Business Driven Information Systems

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DEDICATION

To Tony, Hannah, Sophie, and Gus

What do you always remember?

That I Love You!

That I'm Proud of You!

Paige

To my colleagues, Jill, David, Hans, Don, Dick, Paul, KED, Dan, Paige, and Deborah with respect. You are an exceptional group of professionals and friends. Thank you very much for making Daniels a wonderful place to park my bike.

Amy

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PREFACE

Business Driven Information Systems discusses various business initiatives first and how technology supports those initiatives second. The premise for this unique approach is that business initiatives should drive technology choices. Every discussion first addresses the business needs and then addresses the technology that supports those needs. This text provides the foundation that will enable students to achieve excellence in business, whether they major in operations management, manufacturing, sales, marketing, finance, human resources, accounting, or virtually any other business discipline. Business Driven Information Systems is designed to give students the ability to understand how information technology can be a point of strength for an organization.

Common business goals associated with information technology projects include reducing costs, improving pro-

ductivity, improving customer satisfaction and loyalty, creating competitive advantages, streamlining supply chains, global expansion, and so on. Achieving these results is not easy. Implementing a new accounting system or marketing plan is not likely to generate long-term growth or reduce costs across an entire organization. Businesses must undertake enterprisewide initiatives to achieve broad general business goals such as reducing costs. Information technology plays a critical role in deploying such initiatives by facilitating communication and increasing business intelligence. Any individual anticipating a successful career in business whether it is in accounting, finance, human resources, or operation management must understand the basics of information technology which can be found in this text.

FORMAT, FEATURES, AND HIGHLIGHTS

Business Driven Information Systems is state-of-the-art in its discussions, presents concepts in an easy-to-understand format, and allows students to be active participants in learning. The dynamic nature of information technology requires all students, more specifically business students, to be aware of both current and emerging technologies. Students are facing complex subjects and need a clear, concise explanation to be able to understand and use the concepts throughout their careers. By engaging students with numerous case studies, exercises, projects, and questions that enforce concepts, *Business Driven Information Systems* creates a unique learning experience for both faculty and students.

- **Audience.** *Business Driven Information Systems* is designed for use in undergraduate or introductory MBA courses in Management Information Systems, which are required in many Business Administration or Management programs as part of the common body of knowledge for all business majors.

- **Logical Layout.** Students and faculty will find the text well organized with the topics flowing logically from one chapter to the next. The definition of each term is provided before it is covered in the chapter and an extensive glossary is included at the back of the text. Each chapter offers a comprehensive opening case study, introduction, learning outcomes, closing case studies, key terms, and making business decision questions. The plug-ins follow the same pedagogical elements with the exception of the exclusion of opening case and closing case studies.

- **Thorough Explanations.** Complete coverage is provided for each topic that is introduced. Explanations are written so that students can understand the ideas presented and relate them to other concepts.

- **Solid Theoretical Base.** The text relies on current theory and practice of information systems as they relate to the business environment. Current academic and professional journals cited throughout the text are found in the

Notes at the end of the book—a roadmap for additional, pertinent readings that can be the basis for learning beyond the scope of the chapters or plug-ins.

■ **Material to Encourage Discussion.** All chapters contain a diverse selection of case studies and individual and group problem-solving activities as they relate to the use of information technology in business. Three comprehensive cases at the end of each chapter reinforce content. These cases encourage students to consider what concepts have been presented and then apply those concepts to a situation they might find in an organization. Different people in an organization can view the same facts from different points of view and the cases will force students to consider some of those views.

■ **Flexibility in Teaching and Learning.** While most textbooks that are "text only" leave faculty on their own when it comes to choosing cases, *Business Driven Information Systems* goes much further. Several options are provided to faculty with case selections from a variety of sources including *CIO, Harvard Business Journal, Wired, Forbes, Business 2.0,* and *Time,* to name just a few. Therefore, faculty can use the text alone, the text and a complete selection of cases, or anything in between.

■ **Integrative Themes.** Several integrative themes recur throughout the text which adds integration to the material. Among these themes are value added techniques and methodologies, ethics and social responsibility, globalization, and gaining a competitive advantage. Such topics are essential to gaining a full understanding of the strategies that a business must recognize, formulate, and in turn implement. In addition to addressing these in the chapter material, many illustrations are provided for their relevance to business practice.

WALKTHROUGH

Learning Outcomes and Introduction

Introduction. Located after the Opening Case, the introduction familiarizes students with the overall tone of the chapters. Thematic concepts are also broadly defined.

Learning Outcomes. These outcomes focus on what students should learn and be able to answer upon completion of the chapter or plug-in.

Chapter Opening Case and Opening Case Study Questions

Chapter Opening Case. To enhance student interest, each chapter begins with an opening case study that highlights an organization that has been time-tested and value proven in the business world. This feature serves to fortify concepts with relevant examples of outstanding companies. Discussion of the case is threaded throughout the chapters.

Opening Case Study Questions. Located at the end of each section, poignant questions connect the Chapter Opening Case Study with important chapter concepts.

Projects and Case Studies

Case Studies. This text is packed with 48 case studies illustrating how a variety of prominent organizations and business have successfully implemented many of this text's concepts. All cases are timely and promote critical thinking. Company profiles are especially appealing and relevant to your students, helping to stir classroom discussion and interest. For a full list of cases explored in *Business Driven Information Systems,* turn to the inside back cover.

Apply Your Knowledge. At the end of this text, there is a set of 50 projects aimed at reinforcing the business initiatives explored in this text. These projects help to develop the application and problem-solving skills of your students through challenging and creative business-driven scenarios.

Making Business Decisions. Small scenario-driven projects that help students focus individually on decision making as they relate to the topical elements in the chapters.

End-of-Chapter Elements

Each chapter contains complete pedagogical support in the form of:

Key Terms. With page numbers referencing where they are discussed in the text.

Three Closing Case Studies. Reinforcing importance concepts with prominent examples from businesses and organizations. Discussion Questions follow each case study.

About the Plug-Ins

Located on the student CD that accompanies this text, the overall goal of the plug-ins is to provide an alternative for faculty who find themselves in the situation of having to purchase an extra book to support Microsoft Office. The plug-ins presented here offer integration with the core chapters and provides critical knowledge using essential busi-

ness applications, such as Microsoft Excel, Microsoft Access, and Microsoft FrontPage. Each plug-in uses hands-on tutorials for comprehension and mastery.

End-of-Plug-In Elements

Each plug-in contains complete pedagogical support in the form of:

Plug-In Summary. Revisits the plug-in highlights in summary format.

Making Business Decisions. Small scenario-driven projects that help students focus individually on decision making as they relate to the topical elements in the chapters.

Support and Supplemental Material

Business Driven Information Systems is taking supplements to a whole new level. This text focuses on engaging students, helping instructors, and achieving educational success. All supplement material is created by Paige Baltzan on the author team..

EZ TEST CD-ROM. This computerized package allows instructors to custom design, save, and generate tests. The test program permits instructors to edit, add, or delete questions from the test banks; analyze test results; and organize a database of tests and students results. In addition to the traditional test bank material BDIS offers Excel and Access questions for testing purposes. Each file comes with a Captivate solution file that walks students step-by-step through the solution, which saves instructors valuable time.

ONLINE LEARNING CENTER (www.mhhe.com/baltzan) The McGraw-Hill Higher Education Web site for *Business Driven Information Systems* includes support for students and faculty. All supplements, save the Test Bank, will be available exclusively on the OLC. This will allow the authors to continually update and add to the instructor support materials. The following materials will be available on the OLC:

Instructor's Manual (IM). The IM includes suggestions for designing the course and presenting the material. Each chapter is supported by answers to end-of-chapter questions and problems, and suggestions concerning the discussion topics and cases.

PowerPoint Presentations. A set of PowerPoint slides accompanies each chapter that features bulleted items that provide a lecture outline, plus key figures and tables from the text, and detailed teaching notes on each slide.

This text offers two sets of PowerPoint slides – one for instructors and one for students. The instructor edition comes complete with detailed teaching notes on each slide that offer discussion topics, classroom questions, and lecture points.

Additional Material PowerPoints. *Business Driven Information Systems* also offers PowerPoint slides on additional lecture material. If you want to walk your students through NetFlix' supply chain or Eddie Bauer's customer relationship management there are 10 additional sets of slides focusing on extra material not found in the text.

Sample Syllabi. Several syllabi have been developed according to different course lengths—quarters and semesters, as well as different course concentrations such as a business emphasis or a technology focus.

Classroom Exercises. Choose from over 50 engaging classroom exercises that challenge students to apply the material they are learning. For example, if you are teaching systems development start off the class with the "Skyscraper Activity" where the students build a prototype that takes them through each phase of the systems development life cycle. If you are working on tying information technology to business begin your class with the "Magazine Exercise" where students place Post-It Notes on technology articles in popular business magazines clearly demonstrating that technology is everywhere in business.

Image Library. Text figures and tables, as permission allows, are provided in a format by which they can be imported into PowerPoint for class lectures.

Multiple Data and Solution Files. For appropriate problems, there are multiple data and solution files allowing instructors to assign the same base problem with different data files.

Captivate Files. A complete set of narrated solution files for all Excel, Access, and Web development

projects provide narrated step-by-step detail for each project. These are a great aid to help instructors quickly understand questions and can be posted for students to review, saving instructor time with case reviews.

Cohesion Case. The Broadway Cafe is a running case instructors can use to reinforce core material such as customer relationship management, supply chain management, business intelligence, and decision making. The case has 15 sections that challenge students to develop and expand their grandfather's coffee shop. Students receive hands-on experience in business and learn technology's true value of enabling business.

Project Files. The authors have provided files for all projects that need further support, such as data files.

Internet Links. Throughout the text are Web site addresses where related material can be obtained from the World Wide Web. These Web locations provide valuable information that, when used with the text material, provides a complete, up-to-date coverage of information technology and business..

Apply Your Knowledge

Business Driven Information Systems contains 50 projects that focus on student application of core concepts and tools. All productivity tool projects come with Captivate solution file that walks students step-by-step through the solution, which saves instructors valuable time.

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Business Driven Information Systems

Information Systems in Business

CHAPTER OUTLINE

SECTION 1.1

SECTION 1.2

opening case study

Apple—Merging Technology, Business, and Entertainment

Apple Computer Inc., back from near oblivion, is setting the pace in the digital world with innovation and creativity that had been missing from the company for the past 20 years. Introduction of the iPod, a brilliant merger of technology, business, and entertainment, catapulted Apple back into the mainstream.

Capitalizing on New Trends

In 2000, Steve Jobs was fixated on developing video editing software for the Macintosh. But then he realized millions of people were using computers and CD burners to make audio CDs and to download digital songs called MP3s from illegal online services like Napster. Jobs was worried that he was looking in the wrong direction and had

missed the MP3 bandwagon.

Jobs moved fast. He began by purchasing SoundStep from Jeff Robbin, a 28-year-old software engineer and former Apple employee. SoundStep was developing software that simplified the importing and compression of MP3 songs. Robbin and a couple of other programmers began writing code from scratch and created the first version of iTunes for the Mac in less than four months. This powerful and ingenious database could quickly sort tens of thousands of songs in a multitude of ways and find particular tracks in nanoseconds.

Jobs next challenged the team to make iTunes portable. He envisioned a Walkman-like player that could hold thousands of songs and be taken anywhere. The idea was to modify iTunes and build a tiny new system for what was basically a miniature computer, along with a user interface that could sort and navigate music files with the same sophistication as iTunes on the Mac. The iPod was born nine months later.

Jobs noticed that one last key element was missing, an online store for buying downloadable songs. Such a store would need an e-business infrastructure that could automatically deliver songs and track billing and payments for conceivably millions of purchases. In the spring of 2003, 18 months after the launch of the iPod, Apple's iTunes Music Store opened for business. The company's goal was to sell 1 million songs in the first six months. It hit this goal in six days.

Capitalizing on the iPod

Consumers purchased more than 14 million iPod devices during the 2005 holiday season, allowing Apple to exceed $1 billion in sales through its retail stores. Apple has now sold more than 40 million iPods. The groundbreaking product has transformed Apple from a niche computer maker into the leading purveyor of digital media.

With millions of iPods in the hands of consumers, other companies are noticing the trend and finding ways to capitalize on the product. John Lin created a prototype of a remote control for the iPod. Lin took his prototype to Macworld, where he found success. A few months later, Lin's company had Apple's blessing and a commitment for shelf space in its retail stores. "This is how Apple supports the iPod economy," Lin said.

In the iPod-dominated market, hundreds of companies have been inspired to develop more than 500 accessories—everything from rechargers for the car to $1,500 Fendi bags. Eric Tong, vice president at Belkin, a cable and peripheral manufacturer, believes that 75 percent of all iPod owners purchase at least one accessory— meaning that 30 million accessories have been sold. With most of the products priced between $10 and $200 that puts the iPod economy well over $300 million and perhaps as high as $6 billion. Popular iPod accessories include:

- Altec Lansing Technologies—iPod speakers and recharger dock ($150).

- Belkin—TuneCast mobile FM transmitter ($40).

- Etymotic Research—high-end earphones ($150).

- Griffin Technology—iTrip FM transmitter ($35).

- Kate Spade—Geneva faux-croc mini iPod holder ($55).

- Apple—socks set in six colors, green, purple, blue, orange, pink, and gray ($29).

- Apple—digital camera connector ($29).

Capitalizing on the Future

The latest iPod packs music, audiobooks, podcasts, photos, video, contacts, calendars, games, clocks, and locks in a design up to 45 percent slimmer than the original iPod. It also boasts stamina (up to 20 hours of battery life), generous capacity (30 GB or 60 GB of storage), a great personality (intuitive, customizable menus), and a touch of genius (the Apple Click Wheel). The latest features include:

- **Videos—**Choose from over 2,000 music videos at the iTunes Music Store or purchase ad-free episodes of a favorite ABC or Disney television show and watch them on the go.

- **Podcasts—**The iTunes Podcast Directory features thousands of free podcasts,

or radio-style shows, including favorites from such big names as ABC News, Adam Curry, ESPN, KCRW, and WGBH.

- **Audiobooks—**The digital shelves of the iTunes Music Store are stocked with more than 11,000 audiobooks, including such exclusives as the entire Harry Potter series.

- **Photos—**With storage for up to 25,000 photos, iPod users can view photo slide shows—complete with music—on an iPod or on a TV via the optional video cable.

iPod's Impact on the Music Business

In the digital era, the unbundling of CDs through the purchase of individual tracks lets consumers pay far less to get a few of their favorite songs rather than buying an entire album. Many analysts predicted that the iPod's success coupled with the consumer's ability to choose individual song downloads would lead to increased revenues for music businesses. However, the industry is seeing individual downloads cannibalizing album profits and failing to attract new music sales. "I've still never bought a download," said Eneka Iriondo-Coysh, a 21-year-old graphic-

design student in London who has owned a 10,000 song-capacity iPod for more than two years. "I do it all from my CDs," mostly hip-hop and soul.

The global music industry has been under siege for years amid declining sales. Record companies suffer from piracy, including billions of dollars in lost revenue due to bootlegged CDs. At the same time, music faces new competition for consumer time and money from video games, DVDs, and mobile phones. At traditional record stores, DVDs and games are taking an increasing amount of shelf space, squeezing out CDs. The music download numbers suggest that the iPod's iconic success is not translating into new music sales the way the evolution from vinyl albums to cassettes and then CDs did. For many users, the portable devices are just another way of stocking and listening to music, not an incentive to buy new music.

Global CD sales fell 6.7 percent to $12.4 billion in the first half of 2005, according to the London-based International Federation of the Phonographic Industry. The evidence indicates that digital downloads are not good for the music business.[1]

INTRODUCTION

Information is everywhere. Most organizations value information as a strategic asset. Consider Apple and its iPod, iPod accessories, and iTunes Music Store. Apple's success depends heavily on information about its customers, suppliers, markets, and operations for each of these product lines. For example, Apple must be able to predict the number of people who will purchase an iPod to help estimate iPod accessory and iTunes sales within the next year. Estimating too many buyers will lead Apple to produce an excess of inventory; estimating too few buyers will potentially mean lost sales due to lack of product (resulting in even more lost revenues from iTunes downloads).

Understanding the direct impact information has on an organization's bottom line is crucial to running a successful business. This text focuses on information, business, technology, and the integrated set of activities used to run most organizations. Many of these activities are the hallmarks of business today—supply chain management, customer relationship management, enterprise resource planning, outsourcing, integration, e-business, and others.

section 1.1 INFORMATION SYSTEMS IN BUSINESS

1.1. Describe the functional areas of a business and why they must work together for the business to be successful.

1.2. Explain information technology's role in business and how you measure success.

1.3. Compare management information systems (MIS) and information technology (IT), and define the relationships among people, information technology, and information.

1.4. Compare the responsibilities of a chief information officer (CIO), chief technology officer (CTO), chief security officer (CSO), chief privacy officer (CPO), and chief knowledge officer (CKO).

1.5. Explain the gap between IT and the business, along with the primary reason this gap exists.

INFORMATION TECHNOLOGY'S ROLE IN BUSINESS

Students frequently ask, "Why do we need to study information technology?" The answer is simple: Information technology is everywhere in business. Understanding information technology provides great insight to anyone learning about business.

It is easy to demonstrate information technology's role in business by reviewing a copy of popular business magazines such as *BusinessWeek, Fortune, Business 2.0,* or *Fast Company*. Placing a marker (such as a Post-it Note) on each page that contains a technology-related article or advertisement indicates that information technology is everywhere in business (see Figure 1.1). These are *business* magazines, not *technology* magazines, yet they are filled with technology. Students who understand technology have an advantage in business.

These magazine articles typically discuss such topics as databases, customer relationship management, Web services, supply chain management, security, ethics, business intelligence, and so on. They also focus on companies such as Siebel, Oracle, Microsoft, and IBM. This text explores these topics in detail, along with reviewing the associated business opportunities and challenges.

Information Technology's Impact on Business Operations

Figure 1.2 highlights the business functions receiving the greatest benefit from information technology, along with the common business goals associated with information technology projects, according to *CIO* magazine.

Achieving the results outlined in Figure 1.2, such as reducing costs, improving productivity, and generating growth, is not easy. Implementing a new accounting system or marketing plan is not likely to generate long-term growth or reduce costs across an entire organization. Businesses must undertake enterprisewide initiatives to achieve broad general business goals such as reducing costs. Information technology plays a critical role in deploying such initiatives by facilitating communication and increasing business intelligence. For example, e-mail and cell phones allow people across an organization to communicate in new and innovative ways.

FIGURE 1.1

Technology in *Business Week and Fortune*

FIGURE 1.2

Business Benefits and Information Technology Project Goals

   Understanding information technology begins with gaining an understanding of how businesses function and IT's role in creating efficiencies and effectiveness across the organization. Typical businesses operate by functional areas (often called functional silos). Each area undertakes a specific core business function (see Figure 1.3).

FIGURE 1.3

Departmental Structure of a Typical Organization

■ **Accounting** provides quantitative information about the finances of the business including recording, measuring, and describing financial information.
■ **Finance** deals with the strategic financial issues associated with increasing the value of the business, while observing applicable laws and social responsibilities.
■ **Human resources (HR)** includes the policies, plans, and procedures for the effective management of employees (human resources).
■ **Sales** is the function of selling a good or service and focuses on increasing customer sales, which increases company revenues.
■ **Marketing** is the process associated with promoting the sale of goods or services. The marketing department supports the sales department by creating promotions that help sell the company's products.
■ **Operations management** (also called **production management**) includes the methods, tasks, and techniques organizations use to produce goods and services. Transportation (also called logistics) is part of operations management.
■ **Management information systems (MIS)** is the function that plans for, develops,

implements, and maintains IT hardware, software, and the portfolio of applications that people use to support the goals of an organization.

Functional areas are anything but independent in a business. In fact, functional areas are *interdependent* (see Figure 1.4). Sales must rely on information from operations to understand inventory, place orders, calculate transportation costs, and gain insight into product availability based on production schedules. For an organization to succeed, every department or functional area must work together sharing common information and not be a "silo." Information technology can enable departments to more efficiently and effectively perform their business operations.

FIGURE 1.4

Marketing Working with Other Organizational Departments

Individuals anticipating a successful career in business, whether it is in accounting, finance, human resources, or operation management, must understand information technology including:

- Information technology basics.
- Roles and responsibilities in information technology.
- Measuring information technology's success.

INFORMATION TECHNOLOGY BASICS

Information technology (IT) is any computer-based tool that people use to work with information and support the information and information-processing needs of an organization. Information technology can be an important enabler of business success and innovation. This is not to say that IT *equals* business success and innovation or that IT *represents* business success and innovation. Information technology is most useful when it leverages the talents of people. Information technology in and of itself is not useful unless the right people know how to use and manage it effectively.

Management information systems is a business function just as marketing, finance, operations, and human resources management are business functions. Formally defined, *management information systems (MIS)* is the function that plans for, develops, implements, and maintains IT hardware, software, and applications that people use to support the goals of an organization. To perform the MIS function effectively, almost all organizations today, particularly large and medium-sized ones, have an internal IT department, often called Information Technology (IT),

Information Systems (IS), or Management Information Systems (MIS). When beginning to learn about information technology it is important to understand:

- Information
- IT resources
- IT cultures

Information

It is important to distinguish between data and information. **Data** are raw facts that describe the characteristics of an event. Characteristics for a sales event could include the date, item number, item description, quantity ordered, customer name, and shipping details. **Information** is data converted into a meaningful and useful context. Information from sales events could include best-selling item, worst-

selling item, best customer, and worst customer.

IT Resources

The plans and goals of the IT department must align with the plans and goals of the organization. Information technology can enable an organization to increase efficiency in manufacturing, retain key customers, seek out new sources of supply, and introduce effective financial management.

It is not always easy for managers to make the right choices when using IT to support (and often drive) business initiatives. Most managers understand their business initiatives well, but are often at a loss when it comes to knowing how to use and manage IT effectively in support of those initiatives. Managers who understand what IT is, and what IT can and cannot do, are in the best position for success. In essence,

- *People* use
- *information technology* to work with
- *information* (see Figure 1.5).

Those three key resources—people, information, and information technology (in that order of priority)—are inextricably linked. If one fails, they all fail. Most important, if one fails, then chances are the business will fail.

IT Cultures

An organization's culture plays a large role in determining how successfully it will share information. Culture will influence the way people use information (their information behavior) and will reflect the importance that company

leaders attribute to the use of information in achieving success or avoiding failure. Four common information-sharing cultures exist in organizations today: information-functional, information-sharing, information-inquiring, and information-discovery (see Figure 1.6).[2]

FIGURE 1.5

The Relationship among People, Information, and Information Technology

FIGURE 1.6

Different Information Cultures Found in Organizations

Organizational Information Cultures	
Information-Functional Culture	Employees use information as a means of exercising influence or power over others. For example, a manager in sales refuses to share information with marketing. This causes marketing to need the sales manager's input each time a new sales strategy is developed.
Information-Sharing Culture	Employees across departments trust each other to use information (especially about problems and failures) to improve performance.
Information-Inquiring Culture	Employees across departments search for information to better understand the future and align themselves with current trends and new directions.
Information-Discovery Culture	Employees across departments are open to new insights about crisis and radical changes and seek ways to create competitive advantages.

An organization's IT culture can directly affect its ability to compete in the global market. If an organization operates with an information-functional culture, it will have a great degree of difficulty operating. Getting products to market quickly and creating a view of its end-to-end (or entire) business from sales to billing will be a challenge. If an organization operates with an information-discovery culture it will be able to get products to market quickly

and easily see a 360-degree view of its entire organization. Employees will be able to use this view to better understand the market and create new products that offer a competitive advantage.

ROLES AND RESPONSIBILITIES IN INFORMATION TECHNOLOGY

Information technology is a relatively new functional area, having been around formally in most organizations only for about 40 years. Job titles, roles, and responsibilities often differ from organization to organization. Nonetheless, clear trends are developing toward elevating some IT positions within an organization to the strategic level.

Most organizations maintain positions such as chief executive officer (CEO), chief financial officer (CFO), and chief operations officer (COO) at the strategic level. Recently there are more IT-related strategic positions such as chief information officer (CIO), chief technology officer (CTO), chief security officer (CSO), chief privacy officer (CPO), and chief knowledge officer (CKO).

J. Greg Hanson is proud to be the first CIO of the U.S. Senate. Contrary to some perceptions, the technology found in the Senate is quite good, according to Hanson. Hanson's responsibilities include creating the Senate's technology vision, leading the IT department, and deploying the IT infrastructure. Hanson must work with everyone from the 137 network administrators to the senators themselves to ensure that everything is operating smoothly.[3]

The *chief information officer (CIO)* is responsible for (1) overseeing all uses of information technology and (2) ensuring the strategic alignment of IT with business goals and objectives. The CIO often reports directly to the CEO (see Figure 1.7 for average CIO compensation). CIOs must possess a solid understanding of every aspect of an organization coupled with tremendous insight into the capability of IT. Broad roles of a CIO include:

■ *Manager*—ensure the delivery of all IT projects, on time and within budget.

■ *Leader*—ensure the strategic vision of IT is in line with the strategic vision of the organization.

■ *Communicator*—advocate and communicate the IT strategy by building and maintaining strong executive relationships.

FIGURE 1.7

Average CIO Compensation by Industry

Industry	Average CIO Compensation
Wholesale/Retail/Distribution	$243,304

Finance	$210,547
Insurance	$197,697
Manufacturing	$190,250
Medical/Dental/Health Care	$171,032
Government	$118,359
Education	$93,750

FIGURE 1.8

What Concerns CIOs the Most?

CIO's Concerns	Percentage
Enchancing customer satisfaction	94%
Security	92
Technology evaluation	89
Budgeting	87
Staffing	83
ROI analysis	66
Building new applications	64
Outsourcing hosting	45

Although CIO is considered a position within IT, CIOs must be concerned with more than just IT. According to a recent survey (see Figure 1.8), most CIOs ranked "enhancing customer satisfaction" ahead of their concerns for any specific aspect of IT. We should applaud CIOs who possess the broad business view that customer satisfaction is more crucial and critical than specific aspects of IT.

The *chief technology officer (CTO)* is responsible for ensuring the throughput, speed, accuracy, availability, and reliability of an organization's information technology. CTOs have direct responsibility for ensuring the efficiency of IT systems throughout the organization. Most CTOs possess well-rounded knowledge of all aspects of IT, including hardware, software, and telecommunications. CTO's typically report to the CIO. The role of CTO is similar to CIO, except that CIO must take on the additional responsibility of ensuring that IT aligns with the organization's strategic initiatives.

The *chief security officer (CSO)* is responsible for ensuring the security of IT systems and developing strategies and IT safeguards against attacks from hackers and viruses. The role of a CSO has been elevated in recent years because of the number of attacks from hackers and viruses. Most CSOs possess detailed knowledge of networks and telecommunications because hackers and viruses usually find their way into IT systems through networked computers.

The *chief privacy officer (CPO)* is responsible for ensuring the ethical and legal use of information within an organization. CPOs are the newest senior executive position in IT. Recently, 150 of the Fortune 500 companies added the CPO position to their list of senior executives. Many CPOs are lawyers by training, enabling them to understand the often complex legal issues surrounding the use of information.

The *chief knowledge officer (CKO)* is responsible for collecting, maintaining, and distributing the organization's knowledge. The CKO designs programs and systems that make it easy for people to reuse knowledge. These systems create repositories of organizational documents, methodologies, tools, and practices, and they establish methods for filtering the information. The CKO must continuously encourage employee contributions to keep the systems up-to-date. The CKO can contribute directly to the organization's bottom line by reducing the learning curve for new employees or employees taking on new roles.

In 1998, Danny Shaw became the first CKO at Children's Hospital in Boston. His initial task was to unite information from disparate systems to enable analysis of both the efficiency and effectiveness of the hospital's care. Shaw started by building a series of small, integrated information systems that quickly demonstrated value. He then gradually built on those successes, creating a knowledge-enabled organization one layer at a time. Shaw's information systems have enabled administrative and clinical operational analyses.[4]

All the above IT positions and responsibilities are critical to an organization's success. While many organizations may not have a different individual for each of these positions, they must have leaders taking responsibility for all

these areas of concern. The individuals responsible for enterprisewide IT and IT-related issues must provide guidance and support to the organization's employees. Figure 1.9 displays the personal skills pivotal for success in an executive IT role.

The Gap Between Business Personnel and IT Personnel

One of the greatest challenges today is effective communication between business personnel and IT personnel. Figure 1.9 clearly demonstrates the importance of communication for IT executives. Business personnel possess expertise in functional areas such as marketing, accounting, sales, and so forth. IT personnel have the technological expertise. Unfortunately, a communications gap often exists between the two. Business personnel have their own vocabularies based on their experience and expertise. IT personnel have their own vocabularies consisting of acronyms and technical terms. Effective communication between business and IT personnel should be a two-way street with each side making the effort to understand each other (including written and oral communication).

Improving Communication   Business personnel must seek to increase their understanding of IT. Although they do not need to know every technical detail, it is beneficial to understand what IT can and cannot accomplish. Business managers and leaders should read business-oriented IT magazines, such as *InformationWeek* and *CIO*, to increase their IT knowledge.

At the same time, an organization must develop strategies for integrating its IT personnel into the various business functions. Too often, IT personnel are left out of strategy meetings because of the belief they do not understand the business so they will not add any value. That is a dangerous position to take. IT personnel must understand the business if the organization is going to determine which technologies can benefit (or hurt) the business. With a little effort to communicate, IT personnel might provide information on the functionality available in an information system, which could add tremendous value to a meeting about how to improve customer service. Working together, business and IT personnel have the potential to create competitive advantages, reduce costs, and streamline business processes.

FIGURE 1.9

Skills Pivotal for Success in Executive IT Roles

It is the CIO's responsibility to ensure effective communications between business and IT personnel. While the CIO assumes the responsibility on an enterprisewide level, it is each employee's responsibility to communicate effectively on a personal level.

MEASURING INFORMATION TECHNOLOGY'S SUCCESS

To offer detailed information to all layers of management, General Electric Co. (GE) invested $1.5 billion in employee time, hardware, software, and other technologies to implement a real-time operations monitoring system. GE's executives use the new system to monitor sales, inventory, and savings across the company's 13 global business operations every 15 minutes. This allows GE to respond to changes, reduce cycle times, and improve risk management on an hourly basis instead of waiting for monthly or quarterly reports. GE estimates the $1.5 billion investment will provide a 33 percent return over five years.[5]

IT professionals know how to install and maintain information systems. Business professionals know how to run a successful business. But how does a company decide if an information system helps make a business successful?

The answer lies in the metrics. Designing metrics requires an expertise that neither IT nor business professionals usually possess. Metrics are about neither technology nor business strategy. The questions that arise in metrics design are almost philosophical: How do you define success? How do you apply quantifiable measures to business processes, especially qualitative ones such as customer service? What kind of information best reflects progress, or the lack of it?

Key performance indicators (KPIs) are the measures that are tied to business drivers. Metrics are the detailed measures that feed those KPIs. Performance metrics fall into a nebulous area of business intelligence that is neither technology- nor business-centered, but this area requires input from both IT and business professionals to find success. Cisco Systems implemented a cross-departmental council to create metrics for improving business process operations. The council developed metrics to evaluate the efficiency of Cisco's online order processing and discovered that due to errors, more than 70 percent of online orders required manual input and were unable to be automatically routed to manufacturing. By changing the process and adding new information systems, within six months the company doubled the percentage of orders that went directly to manufacturing.[6]

Efficiency and Effectiveness Metrics

Organizations spend enormous sums of money on IT to compete in today's fast-paced business environment. Some organizations spend up to 50 percent of their total capital expenditures on IT. To justify these expenditures, an organization must measure the payoff of these investments, their impact on business performance, and the overall business value gained.

Efficiency and effectiveness metrics are two primary types of IT metrics. *Efficiency IT metrics* measure the performance of the IT system itself such as throughput, speed, and availability. *Effectiveness IT metrics* measure the impact IT has on business processes and activities including customer satisfaction, conversion rates, and sell-through increases. Peter Drucker offers a helpful distinction between efficiency and effectiveness. Drucker states that managers "Do things right" and/or "Do the right things." Doing things right addresses efficiency—getting the most from each resource. Doing the right things addresses effectiveness—setting the right goals and objectives and ensuring they are accomplished.[7]

Efficiency focuses on the extent to which an organization is using its resources in an optimal way, while effectiveness focuses on how well an organization is achieving its goals and objectives. The two—efficiency and effectiveness—are definitely interrelated. However, success in one area does not necessarily imply success in the other.

Benchmarking—Baseline Metrics

Regardless of what is measured, how it is measured, and whether it is for the sake of efficiency or effectiveness, there must be *benchmarks*, or baseline values the system seeks to attain. *Benchmarking* is a process of continuously measuring system results, comparing those results to optimal system performance (benchmark values), and identifying steps and procedures to improve system performance.

Consider online government services (e-government) as an illustration of bench-marking efficiency IT metrics and effectiveness IT metrics (see survey results in Figure 1.10). From an effectiveness point of view, Canada ranks number one in terms of e-government satisfaction of its citizens. (The United States ranks third.) The survey, sponsored by Accenture, also included such attributes as customer-service vision, initiatives for identifying services for individual citizen segments, and approaches to offering e-government services through multiple-service delivery channels. These are all benchmarks at which Canada's government excels.[8]

In contrast, the *United Nations Division for Public Economics and Public Administration* ranks Canada sixth in terms of efficiency IT metrics. (The United States ranked first.) This particular ranking, based purely on efficiency IT metrics, includes benchmarks such as the number of computers per 100 citizens, the number of Internet hosts per 10,000 citizens, and the percentage of the citizen online population. Therefore, while Canada lags behind in IT efficiency, it is the premier e-government provider in terms of effectiveness.[9]

Governments hoping to increase their e-government presence would benchmark themselves against these sorts of

efficiency and effectiveness metrics. There is a high degree of correlation between e-government efficiency and effectiveness, although it is not absolute.

The Interrelationship Between Efficiency and Effectiveness IT Metrics

Efficiency IT metrics focus on the technology itself. Figure 1.11 highlights the most common types of efficiency IT metrics.

FIGURE 1.10

E-Government Ranking for Efficiency and Effectiveness

Efficiency	Effectiveness
1. United States (3.11)	1. Canada
2. Australia (2.60)	2. Singapore
3. New Zealand (2.59)	3. United States
4. Singapore (2.58)	4. Denmark
5. Norway (2.55)	5. Australia
6. Canada (2.52)	6. Finland
7. United Kingdom (2.52)	7. Hong Kong
8. Netherlands (2.51)	8. United Kingdom
9. Denmark (2.47)	9. Germany
10. Germany (2.46)	10. Ireland

FIGURE 1.11

Common Types of Efficiency IT Metrics

Efficiency IT Metrics

Throughput	The amount of information that can travel through a system at any point in time.
Transaction speed	The amount of time a system takes to perform a transaction.
System availability	The number of hours a system is available for users.
Information accuracy	The extent to which a system generates the correct results when executing the same transaction numerous times.
Web traffic	Includes a host of benchmarks such as the number of page views, the number of unique visitors, and the average time spent viewing a Web page.
Response time	The time it takes to respond to user interactions such as a mouse click.

While these efficiency metrics are important to monitor, they do not always guarantee effectiveness. Effectiveness IT metrics are determined according to an organization's goals, strategies, and objectives. Here, it becomes important to consider the strategy an organization is using, such as a broad cost leadership strategy (Wal-Mart, for example), as well as specific goals and objectives such as increasing new customers by 10 percent or reducing new-product development cycle times to six months. Figure 1.12 displays the broad, general effectiveness IT metrics.

In the private sector, eBay constantly benchmarks its information technology efficiency and effectiveness. In 2005, eBay posted impressive year-end results with revenues increasing 72 percent while earnings grew 125 percent. Maintaining constant Web site availability and optimal throughput performance is critical to eBay's success.[10]

Jupiter Media Metrix ranked eBay as the Web site with the highest visitor volume (efficiency) in 2005 for the fourth year in a row, with an 80 percent growth from the previous year. The auction Web site averaged 8 million unique visitors during each week of the holiday season that year with daily peaks exceeding 12 million visitors. To

ensure constant availability and reliability of its systems, eBay implemented ProactiveNet, a performance measurement and management-tracking tool. The tool allows eBay to monitor its environment against baseline benchmarks, which helps the eBay team keep tight control of its systems. The new system has resulted in improved system availability with a 150 percent increase in productivity as measured by system uptime.[11]

FIGURE 1.12

Common Types of Effectiveness IT Metrics

Effectiveness IT Metrics	
Usability	The ease with which people perform transactions and/or find information. A popular usability metric on the Internet is degrees of freedom, which measures the number of clicks required to find desired information.
Customer satisfaction	Measured by such benchmarks as satisfaction surveys, percentage of existing customers retained, and increases in revenue dollars per customer.
Conversion rates	The n umber of customers an organization "touches" for the first time and persuades to purchase its products or services. This is a popular metric for evaluating the effectiveness of banner, pop-up, and pop-under ads on the Internet.
Financial	Such as return on investment (the earning power of an organization's assets), cost-benefit analysis (the comparison of projected revenues and costs including development, maintenance, fixed, and variable), and break-even analysis (the point at which constant revenues equal ongoing costs).

FIGURE 1.13

The Interrelationships Between Efficiency and Effectiveness

Be sure to consider the issue of security while determining efficiency and effectiveness IT metrics. When an

organization offers its customers the ability to purchase products over the Internet, it must implement the appropriate security. It is actually inefficient for an organization to implement security measures for Internet-based transactions as compared to processing nonsecure transactions. However, an organization will probably have a difficult time attracting new customers and increasing Web-based revenue if it does not implement the necessary security measures. Purely from an efficiency IT metric point of view, security generates some inefficiency. From an organization's business strategy point of view, however, security should lead to increases in effectiveness metrics.

Figure 1.13 depicts the interrelationships between efficiency and effectiveness. Ideally, an organization should operate in the upper right-hand corner of the graph, realizing both significant increases in efficiency and effectiveness. However, operating in the upper left-hand corner (minimal effectiveness with increased efficiency) or the lower right-hand corner (significant effectiveness with minimal efficiency) may be in line with an organization's particular strategies. In general, operating in the lower left-hand corner (minimal efficiency and minimal effectiveness) is not ideal for the operation of any organization.

OPENING CASE QUESTIONS

Apple—Merging Technology, Business, and Entertainment

1. What might have happened to Apple if its top executives had not supported investment in iPods?

2. Formulate a strategy for how Apple can use efficiency IT metrics to improve its business.

3. Formulate a strategy for how Apple can use effectiveness IT metrics to improve its business.

4. Why would it be unethical for Apple to sell its iTunes customer information to other businesses?

5. Evaluate the effects on Apple's business if it failed to secure its customer information and all of it was accidentally posted to an anonymous Web site.

section 1.2 BUSINESS STRATEGY

LEARNING OUTCOMES

1.6. Explain why competitive advantages are typically temporary.

1.7. List and describe each of the five forces in Porter's Five Forces Model.

1.8. Compare Porter's three generic strategies.

1.9. Describe the relationship between business processes and value chain analysis.

IDENTIFYING COMPETITIVE ADVANTAGES

To survive and thrive, an organization must create a competitive advantage. A ***competitive advantage*** is a product or service that an organization's customers place a greater value on than similar offerings from a competitor. Unfortunately, competitive advantages are typically temporary because competitors often seek ways to duplicate the competitive advantage. In turn, organizations must develop a strategy based on a new competitive advantage.

When an organization is the first to market with a competitive advantage, it gains a first-mover advantage. The ***first-mover advantage*** occurs when an organization can significantly impact its market share by being first to market with a competitive advantage. FedEx created a first-mover advantage by creating its customer self-service software, which allows people and organizations to request parcel pickups, print mailing slips, and track parcels online. Other parcel delivery companies quickly began creating their own online services. Today, customer self-service on the Internet is a standard for doing business in the parcel delivery business.

As organizations develop their competitive advantages, they must pay close attention to their competition through environmental scanning. ***Environmental scanning*** is the acquisition and analysis of events and trends in the environment external to an organization. Information technology has the opportunity to play an important role in environmental scanning.

Frito-Lay, a premier provider of snack foods such as Cracker Jacks and Cheetos, does not just send its representatives into grocery stores to stock shelves; they carry handheld computers and record the product offerings, inventory, and even product locations of competitors. Frito-Lay uses this information to gain business intelligence on everything from how well competing products are selling to the strategic placement of its own products.

Organizations use three common tools to analyze and develop competitive advantages: (1) Five Forces Model, (2) three generic strategies, and (3) value chain analysis.

THE FIVE FORCES MODEL—EVALUATING BUSINESS SEGMENTS

Michael Porter's Five Forces Model is a useful tool to aid organizations facing the challenging decision of entering a new industry or industry segment. The ***Five Forces Model*** helps determine the relative attractiveness of an industry and includes:

1. Buyer power.

2. Supplier power.

3. Threat of substitute products or services.

4. Threat of new entrants.

5. Rivalry among existing competitors (see Figure 1.14).

Buyer Power

Buyer power in the Five Forces Model is high when buyers have many choices of whom to buy from and low when their choices are few. To reduce buyer power (and create a competitive advantage), an organization must make it more attractive for customers to buy from it instead of its competition. One of the best IT-based examples is the loyalty programs that many organizations offer.

Loyalty programs reward customers based on the amount of business they do with a particular organization. The travel industry is famous for its loyalty programs such as frequent-flyer programs for airlines and frequent-guest programs for hotels. Keeping track of the activities and accounts of many thousands or millions of customers covered by loyalty programs is not practical without large-scale IT systems. Loyalty programs are a good example of using IT to reduce buyer power; because of the rewards (e.g., free airline tickets, upgrades, or hotel stays) travelers receive, they are more likely to be loyal to or give most of their business to a single organization.

Supplier Power

Supplier power in the Five Forces Model is high when buyers have few choices of whom to buy from and low when their choices are many. Supplier power is the converse of buyer power: A supplier organization in a market will want buyer power to be low. A *supply chain* consists of all parties involved, directly or indirectly, in the procurement of a product or raw material. In a typical supply chain, an organization will probably be both a supplier (to customers) and a customer (of other supplier organizations) (see Figure 1.15).

As a buyer, the organization can create a competitive advantage by locating alternative supply sources. IT-enabled business-to-business (B2B) marketplaces can help. A *business-to-business (B2B) marketplace* is an Internet-based service that brings together many buyers and sellers (discussed in detail in Chapter 3). One important variation of the B2B marketplace is a private exchange. A *private exchange* is a B2B marketplace in which a single buyer posts its needs and then opens the bidding to any supplier who would care to bid. Bidding is typically carried out through a reverse auction. A *reverse auction* is an auction format in which increasingly lower bids are solicited from organizations willing to supply the desired product or service at an increasingly lower price. As the bids get lower and lower, more and more suppliers drop out of the auction. Ultimately, the organization with the lowest bid wins. Internet-based reverse auctions are an excellent example of the way that information technology can reduce

supplier power for an organization and create a competitive advantage.

FIGURE 1.14

Porter's Five Forces Model

FIGURE 1.15

An Organization within the Supply Chain

Threat of Substitute Products or Services

The ***threat of substitute products or services*** in the Five Forces Model is high when there are many alternatives to a product or service and low when there are few alternatives from which to choose. Ideally, an organization would like to be in a market in which there are few substitutes for the products or services it offers. Of course, that is seldom possible today, but an organization can still create a competitive advantage by using switching costs.

Switching costs are costs that can make customers reluctant to switch to another product or service. A switching cost need not have an associated *monetary* cost. Amazon.com offers an example. As customers purchase products at Amazon.com over time, Amazon develops a profile of their shopping and purchasing habits, enabling Amazon to offer products tailored to a particular customer based on the customer's profile. If the customer decides to shop elsewhere, there is an associated switching cost because the new site will not have the profile of the customer's past purchases. In this way, Amazon.com has reduced the threat of substitute products or services by creating a "cost" to the consumer to switch to another online retailer.

The cell phone industry offers another good example of switching costs. Cell phone providers want to keep their customers as long as possible. Many cell phone providers offer their customers free phones or unlimited minutes if they will sign a one- or two-year contract. This creates a switching cost for the customers if they decide to change providers because they will be required to pay a penalty for breaking their contract. Another switching cost for the cell phone customer was losing the actual cell phone number; however, this switching cost has been removed with the implementation of *local number portability (LNP)* or the ability to "port" cell phone numbers to new providers. Within the context of Porter's Five Forces Model, eliminating this switching cost creates a greater threat of substitute products or services for the supplier. That is, customers can now expect to see more new cell phone providers cropping up over the next several years. They will compete on price, quality, and services with the big-name cell phone providers such as AT&T and Verizon because cell phone numbers can be moved from one provider to another. When businesses reduce or eliminate switching costs, the consumer gains more power.

Threat of New Entrants

The *threat of new entrants* in the Five Forces Model is high when it is easy for new competitors to enter a market and low when there are significant entry barriers to entering a market. An entry barrier is a product or service feature that customers have come to expect from organizations in a particular industry and must be offered by an entering organization to compete and survive. For example, a new bank must offer its customers an array of IT-enabled services, including ATM use, online bill paying, and account monitoring. These are significant barriers to entering the banking market. At one time, the first bank to offer such services gained a valuable first-mover advantage, but only temporarily, as other banking competitors developed their own IT systems.

Rivalry Among Existing Competitors

Rivalry among existing competitors in the Five Forces Model is high when competition is fierce in a market and low when competition is more complacent. Although competition is always more intense in some industries than in others, the overall trend is toward increased competition in almost every industry.

The retail grocery industry is intensively competitive. While Kroger, Safeway, and Albertsons in the United States compete in many different ways, essentially they try to beat or match the competition on price. Most of them have loyalty programs that give shoppers special discounts. Customers get lower prices while the store gathers valuable information on buying habits to create pricing strategies. In the future, expect to see grocery stores using wireless technologies to track customer movement throughout the store and match it to products purchased to determine product placement and pricing strategies. Such a system will be IT-based and a huge competitive advantage to the first store to implement it.

Since margins are low in the retail grocery market, grocers build efficiencies into their supply chains, connecting with their suppliers in IT-enabled information partnerships such as the one between Wal-Mart and its suppliers. Communicating with suppliers over telecommunications networks rather than using paper-based systems makes the procurement process faster, cheaper, and more accurate. That equates to lower prices for customers and increased rivalry among existing competitors.

THE THREE GENERIC STRATEGIES—CREATING A BUSINESS FOCUS

Once the relative attractiveness of an industry is determined and an organization decides to enter that market, it must formulate a strategy for entering the new market. An organization can follow Porter's three generic strategies when

entering a new market: (1) broad cost leadership, (2) broad differentiation, or (3) focused strategy. Broad strategies reach a large market segment, while focused strategies target a niche market. A focused strategy concentrates on either cost leadership or differentiation. Trying to be all things to all people, however, is a recipe for disaster, since it is difficult to project a consistent image to the entire marketplace. Porter suggests that an organization is wise to adopt only one of the three generic strategies.

To illustrate the use of the three generic strategies, consider Figure 1.16. The matrix shown demonstrates the relationships among strategies (cost leadership versus differentiation) and market segmentation (broad versus focused).

■ **Hyundai** is following a broad cost leadership strategy. Hyundai offers low-cost vehicles, in each particular model stratification, that appeal to a large audience.

■ **Audi** is pursuing a broad differentiation strategy with its Quattro models available at several price points. Audi's differentiation is safety, and it prices its various Quattro models (higher than Hyundai) to reach a large, stratified audience.

■ **Kia** has a more focused cost leadership strategy. Kia mainly offers low-cost vehicles in the lower levels of model stratification.

■ **Hummer** offers the most focused differentiation strategy of any in the industry (including Mercedes-Benz).

FIGURE 1.16

Porter's Three Generic Strategies in the Auto Industry

VALUE CHAIN ANALYSIS—TARGETING BUSINESS PROCESSES

Once an organization enters a new market using one of Porter's three generic strategies, it must understand, accept, and successfully execute its business strategy. Every aspect of the organization contributes to the success (or failure) of the chosen strategy. The business processes of the organization and the value chain they create play an integral role in strategy execution.

Value Creation

A *business process* is a standardized set of activities that accomplish a specific task, such as processing a customer's order. To evaluate the effectiveness of its business processes, an organization can use Michael Porter's value chain approach. An organization creates value by performing a series of activities that Porter identified as the value chain.

The *value chain* approach views an organization as a series of processes, each of which adds value to the product or service for each customer. To create a competitive advantage, the value chain must enable the organization to provide unique value to its customers. In addition to the firm's own value-creating activities, the firm operates in a value system of vertical activities including those of upstream suppliers and downstream channel members. To achieve a competitive advantage, the firm must perform one or more value-creating activities in a way that creates more overall value than do competitors. Added value is created through lower costs or superior benefits to the consumer (differentiation).

Organizations can add value by offering lower prices or by competing in a distinctive way. Examining the organization as a value chain (actually numerous distinct but inseparable value chains) leads to identifying the important activities that add value for customers and then finding IT systems that support those activities. Figure 1.17 depicts a value chain. Primary value activities, shown at the bottom of the graph, acquire raw materials and manufacture, deliver, market, sell, and provide after-sales services. Support value activities, along the top of the graph, such as firm infrastructure, human resource management, technology development, and procurement, support the primary value activities.

FIGURE 1.17

The Value Chain

The goal is to survey the customers and ask them the extent to which they believe each activity adds value to the product or service. This generates a quantifiable metric, displayed in percentages in Figure 1.17, for how each activity adds value (or reduces value). The competitive advantage decision then is to (1) target high value-adding activities to further enhance their value, (2) target low value-adding activities to increase their value, or (3) perform some combination of the two.

Organizations should attempt to use information technology to add value to both primary and support value activities. One example of a primary value activity facilitated by IT is the development of a marketing campaign management system that could target marketing campaigns more efficiently, thereby reducing marketing costs. The system would also help the organization better pinpoint target market needs, thereby increasing sales. One example of a support value activity facilitated by IT is the development of a human resources system that could more efficiently reward employees based on performance. The system could also identify employees who are at risk of leaving their jobs, allowing the organization to find additional challenges or opportunities that would help retain

these employees and thus reduce turnover costs.

Value chain analysis is a highly useful tool in that it provides hard and fast numbers for evaluating the activities that add value to products and services. An organization can find additional value by analyzing and constructing its value chain in terms of Porter's Five Forces (see Figure 1.18). For example, if an organization wants to decrease its buyer's or customer's power, it can construct its value chain activity of "service after the sale" by offering high levels of quality customer service. This will increase the switching costs for its customers, thereby decreasing their power. Analyzing and constructing its support value activities can help an organization decrease the threat of new entrants. Analyzing and constructing its primary value activities can help an organization decrease the threat of substitute products or services.

A company can implement its selected strategy by means of programs, budgets, and procedures. Implementation involves organization of the firm's resources and motivation of the employees to achieve objectives. How the company implements its chosen strategy can have a significant impact on its success. In a large company, the personnel implementing the strategy are usually different from those formulating the strategy. For this reason, proper communication of the strategy is critical. Failure can result if the strategy is misunderstood or if lower-level managers resist its implementation because they do not understand the process for selecting the particular strategy.

FIGURE 1.18

The Value Chain and Porter's Five Forces

An organization must continually adapt to its competitive environment, which can cause its business strategy to change. To remain successful, an organization should use Porter's Five Forces, the three generic strategies, and value chain analysis to adopt new business strategies.

OPENING CASE QUESTIONS

Apple—Merging Technology, Business, and Entertainment

6. Did Apple gain a competitive advantage from its decision to invest in an online music business?

7. How can Apple use environmental scanning to gain business intelligence?

8. Using Porter's Five Forces Model, analyze Apple's buyer power and supplier power.

9. Which of the three generic strategies is Apple following?

10. Which of Porter's Five Forces did Apple address through its introduction of the iPod?

KEY TERMS

CLOSING CASE ONE

Say "Charge It" with Your Cell Phone

Wireless operators, credit card companies, and retailers are working on a technology that allows customers to purchase items by using their cell phones. For example, a customer could purchase a can of soda by dialing a telephone number on the dispensing machine and have the charge for the soda show up on the customer's cell phone bill. Working prototypes are currently in use in South Korea, Japan, and Europe.

The ability to charge items to a cell phone has significant business potential because credit cards are not nearly as popular in other countries as they are in the United States. In Japan and China, for example, people are much more likely to have a cell phone than a credit card. Japanese consumers use credit cards for only 5.6 percent of their personal spending compared with 33 percent of U.S. consumer spending.

The payoff for credit card companies and cell phone operators from this technology could be enormous. By associating a credit card with a cell phone, banks and credit card companies hope to persuade consumers to buy products, such as soda, with their cell phones instead of pocket change. Of course, they will reap transaction fees for each transaction. Mobile phone operators see the technology as a way to increase traffic on their networks as well as to position cell phones as an even more useful and, thus, essential device for consumers. Retailers envision easier transactions also leading to more sales.

MasterCard International and Nokia are currently testing a cell phone credit card for the U.S. market. The phones have a special chip programmed with the user's credit card information and a radio frequency transmitting circuit.

Consumers can simply tap their phone on a special device at a checkout counter equipped with a receiving device that costs the retailer about $80. Betsy Foran-Owens, vice president for Product Services at MasterCard International, commented that with this technology, "You don't even have to get off your phone to pay. You can just tap this thing down at the register." She also noted, "If you're not going to carry cash around, what are you going to carry? Your mobile phone."

The only players who might not look favorably on the technology are the traditional telephone companies, who must certainly view the technology as just one more threat to their traditional telephone business.[12]

Questions

1. Do you view this technology as a potential threat to traditional telephone companies? If so, what counterstrategies could traditional telephone companies adopt to prepare for this technology?

2. Using Porter's Five Forces describe the barriers to entry and switching costs for this new technology.

3. Which of Porter's three generic strategies is this new technology following?

4. Describe the value chain of using cell phones as a payment method.

5. What types of regulatory issues might occur due to this type of technology?

CLOSING CASE TWO

Innovative Business Managers

BusinessWeek magazine recognized several innovative managers who have demonstrated talent, vision, and the ability to identify excellent opportunities (see Figure 1.19).

Jeffrey Immelt, General Electric (GE)

When Jeffrey Immelt took over as CEO of General Electric, he had big shoes to fill. The former CEO, Jack Welch, had left an unprecedented record as one of the top CEOs of all time. Immelt proved his ability to run the company by creating a customer-driven global culture that spawns innovation and embraces technology. The company was forecasting earnings to increase 17 percent in 2005.

Steven Reinemund, PepsiCo

Steven Reinemund has turned PepsiCo into a $27 billion food and beverage giant. "To be a leader in consumer products, it's critical to have leaders who represent the population we serve," said Reinemund, who created a diverse leadership group that defines the strategic vision for the company. Reinemund also takes a major role in mentoring

and teaching his employees and demands that all senior executives do the same. The payoff: consistent double-digit earnings and solid sales at a time when many of the company's staple products—potato chips and soft drinks—are under attack for fears about childhood obesity and health concerns.

FIGURE 1.19

Innovative Business Managers

Innovative Managers	
Jeffrey Immelt, General Electric (GE)	■ Repositioned GE's portfolio with major acquisitions in health care, entertainment, and commercial finance ■ Created a more diverse, global, and customer-driven culture
Steven Reinemund, PepsiCo	■ Developed strong and diverse leadership that helped PepsiCo tap new markets ■ Attained consistent double-digit growth through product innovation and smart marketing
Steven Spielberg, Jeffrey Katzenberg, and David Geffen, DreamWorks SKG	■ Computer-animated Shrek 2 set a record with a gross of $437 million ■ IPO pulled in $812 million
Robert Nardelli, Home Depot	■ Turned a $46 billion company focused on big stores into a $70 billion chain with urban, suburban, and international outlets ■ Drive for efficiency, such as centralizing purchasing and investing in

	technology, pushed margins above 30 percent
John Henry, Boston Red Sox	■ Broke the most fabled curse in sports, when the Boston Red Sox won the team's first World Championship since 1918 ■ Sold out all 81 home games for the first time in team history
Phil Knight, Nike	■ Transformed a volatile, fad-driven marketing and design icon into a more shareholder-friendly company

Steven Spielberg, Jeffrey Katzenberg, and David Geffen, DreamWorks

DreamWorks, founded 10 years ago by Steven Spielberg, Jeffrey Katzenberg, and David Geffen, suffered through its share of early bombs. Finally, the studio discovered a green ogre named Shrek and quickly became the hottest studio this side of Pixar Animation. DreamWorks Animation turned a $187 million loss in 2003 into a $196 million profit in 2004, with revenues of $1.1 billion. DreamWorks plans to release two animation films per year, each taking almost four years to produce.

Robert Nardelli, Home Depot

Robert Nardelli took several risks when he became CEO of Home Depot. First, he allocated $14 billion into upgrading merchandise, renovating outdated stores, and investing in new technology such as self-checkout lanes and cordless scan guns. Second, Nardelli expanded into Mexico, China, and other regions, tapping the growing homeowner market. Finally, Nardelli bet big on carrying products for aging baby boomers who wanted to spruce up their empty nests. The moves are paying off. The company sits on $3.4 billion in cash. With 2005 revenues headed to $80 billion, Home Depot is the number two U.S. retailer after Wal-Mart.

John Henry, Boston Red Sox

John Henry earned his fortune in the global futures market by developing a proprietary futures-trading system that

consistently produced double-digit returns. Henry's new system, Sabermetrics, helped him reverse the most fabled curse in sports history by leading the Boston Red Sox to the team's first World Championship since 1918. Sabermetrics mines baseball statistics to find undervalued players while avoiding long contracts for aging stars whose performance is likely to decline. With the help of Sabermetrics, Henry built one of the most effective teams in baseball.

Philip Knight, Nike

Philip Knight, who got his start by selling Japanese sneakers from the trunk of his car, built the $12 billion sports behemoth Nike. Knight and his team transformed high-performance sports equipment into high-fashion gear and forever changed the rules of sports marketing with huge endorsement contracts and in-your-face advertising. Then, just as suddenly, Nike lost focus. In early 2000, kids stopped craving the latest sneaker, the company's image took a huge hit from its labor practices, sales slumped, and costs soared.

Thus began Knight's second act. He revamped management and brought in key outsiders to oversee finances and apparel lines. Knight devoted more energy to developing new information systems. Today, Nike's earnings are less volatile and less fad-driven. In 2004, Nike's earnings increased $1 billion.[13]

Questions

1. Choose one of the companies listed above and explain how it could use a chief information officer (CIO), chief technology officer (CTO), and chief privacy officer (CPO) to improve business.

2. Why is it important for all of DreamWork's functional business areas to work together? Provide an example of what might happen if the DreamWorks marketing department failed to work with its sales department.

3. Why is information technology important to an organization like the Boston Red Sox?

4. Which of Porter's Five Forces is most important to Home Depot's business?

5. Which of the three generic strategies is PepsiCo following?

6. Explain the value chain and how a company like GE can use it to improve operations.

CLOSING CASE THREE

The World Is Flat—Thomas Friedman

In his book, *The World is Flat,* Thomas Friedman describes the unplanned cascade of technological and social shifts that effectively leveled the economic world, and "accidentally made Beijing, Bangalore, and Bethesda next-door

neighbors." Chances are good that Bhavya in Bangalore will read your next X-ray, or as Friedman learned first-hand, "Grandma Betty in her bathrobe" will make your JetBlue plane reservation from her Salt Lake City home.

Friedman believes this is Globalization 3.0. "In Globalization 1.0, which began around 1492, the world went from size large to size medium. In Globalization 2.0, the era that introduced us to multinational companies, it went from size medium to size small. And then around 2000 came Globalization 3.0, in which the world went from being small to tiny. There is a difference between being able to make long-distance phone calls cheaper on the Internet and walking around Riyadh with a PDA where you can have all of Google in your pocket. It is a difference in degree that's so enormous it becomes a difference in kind," Friedman stated. Figure 1.20 displays Friedman's list of "flatteners."

Friedman writes these flatteners converged around the year 2000 and "created a flat world: a global, Web-enabled platform for multiple forms of sharing knowledge and work, irrespective of time, distance, geography, and increasingly, language." At the very moment this platform emerged, three huge economies materialized—those of India, China, and the former Soviet Union—"and 3 billion people who were out of the game, walked onto the playing field." A final convergence may determine the fate of the United States in this chapter of globalization. A "political perfect storm," as Friedman describes it—the dot-com bust, the attacks of 9/11, and the Enron scandal— "distract us completely as a country." Just when we need to face the fact of globalization and the need to compete in a new world, "we're looking totally elsewhere."

FIGURE 1.20

Thomas Friedman's 10 Forces That Flattened the World

Friedman's 10 Forces That Flattened the World	
1. Fall of the Berlin Wall	The events of November 9, 1989, tilted the worldwide balance of power toward democracies and free markets.
2. Netscape IPO	The August 9, 1995, offering sparked massive investment in fiber-optic cables.
3. Work flow software	The rise of applications from PayPal to VPNs enabled

	faster, closer coordination among far-flung employees.
4. Open sourcing	Self-organizing communities, such as Linux, launched a collaborative revolution.
5. Outsourcing	Migrating business functions to India saved money *and* a Third World economy.
6. Offshoring	Contract manufacturing elevated China to economic prominence.
7. Supply chaining	Robust networks of suppliers, retailers, and customers increased business efficiency.
8. In-sourcing	Logistics giants took control of customer supply chains, helping mom-and-pop shops go global.
9. Informing	Power searching allowed everyone to use the Internet as a "personal supply chain of knowledge."
10. Wireless	Wireless technologies pumped up collaboration, making it mobile and personal.

Friedman believes that the next great breakthrough in bioscience could come from a 5-year-old who downloads the human genome in Egypt. Bill Gates's view is similar: "20 years ago, would you rather have been a B-student in Poughkeepsie or a genius in Shanghai? Twenty years ago you'd rather be a B-student in Poughkeepsie. Today, it is not even close. You'd much prefer to be the genius in Shanghai because you can now export your talents anywhere in the world."[14]

Questions

1. Do you agree or disagree with Friedman's assessment that the world is flat? Be sure to justify your answer.

2. What are the potential impacts of a flat world for a student performing a job search?

3. What can students do to prepare themselves for competing in a flat world?

4. Identify a current flattener not mentioned on Friedman's list.

MAKING BUSINESS DECISIONS

1. Competitive analysis

Cheryl O'Connell is the owner of a small, high-end retailer of women's clothing called Excelus. Excelus's business has been successful for many years, largely because of Cheryl's ability to anticipate the needs and wants of her loyal customer base and provide them with personalized service. Cheryl does not see any value in IT and does not want to invest any capital in something that will not directly affect her bottom line. Develop a proposal describing the potential IT-enabled competitive opportunities or threats Cheryl might be missing by not embracing IT. Be sure to include a Porter's Five Forces analysis and discuss which one of the three generic strategies Cheryl should pursue.

2. Applying the three generic strategies

This chapter discussed several examples of companies that pursue differentiated strategies so that they are not forced into positions where they must compete solely based on price. In a team, choose an industry and find and compare two companies, one that is competing based on price and another that is pursuing a differentiated strategy enabled by the creative use of IT. Some industries you may want to consider are clothing retailers, grocery stores, airlines, and personal computers. Prepare a presentation for the class on the ways that the company is using IT to help it differentiate and compete against the low-cost provider. Before you begin, spend some class time to make sure each team selects a different industry.

3. Using efficiency and effectiveness metrics

You are the CEO of a 500-bed acute care general hospital. Your internal IT department is responsible for running applications that support both administrative functions (e.g., patient accounting) as well as medical applications (e.g., medical records). You need assurance that your IT department is a high-quality operation in comparison to similar hospitals. What metrics should you ask your CIO to provide to give the assurance you seek? Provide the reasoning behind each suggested metric. Also, determine how the interrelationship between efficiency metrics and effectiveness metrics can drive your business's success.

4. Building Business Relationships

Synergistics Inc. is a start-up company that specializes in helping businesses build successful internal relationships. You have recently been promoted to senior manager of the Business and IT Relationship area.

Sales for your new department have dwindled over the last two years for a variety of reasons including the burst of the technological stock bubble, recent economic conditions, and a poorly communicated business strategy. Your first task on the job is to prepare a report detailing the following:

■ Fundamental reasons for the gap between IT and the business.

■ Strategies you can take to convince the business this is an area that is critical to success.

■ Strategies the business can follow to ensure synergies exist between the two sides.

5. Determining IT Organizational Structures

You are the chief executive officer for a start-up telecommunications company. The company currently has 50 employees and plans to ramp up to 3,000 by the end of the year. Your first task is to determine how you are going to model your organization. You decide to address the IT department's organizational structure first. You need to consider if you want to have a CIO, CPO, CSO, CTO, and CKO and if so, what the reporting structure will look like and why. You also need to determine the responsibilities for each executive position. Once you have compiled this information, put together a presentation describing your IT department's organizational structure.

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Strategic Decision Making

opening case study

Revving Up Sales at Harley-Davidson

There is a mystique associated with a Harley-Davidson motorcycle. No other motorcycle in the world has the look, feel, and sound of a Harley-Davidson. Demand for Harley-Davidson motorcycles outweighs supply even though the company produces 300,000 motorcycles per year, which generates over $4 billion in revenues. Some models have a two-year waiting list.

The company recently won a number of awards including:

- Rated second in *ComputerWorld's* Top 100 Best Places to Work in IT.

- Rated 51st in *Fortune's* 100 Best Companies to Work For.

- Rated first in *Fortune's* 5 Most Admired Companies in the motor vehicles industry.

- Rated first in the Top 10 Sincerest Corporations by the *Harris Interactive Report.*

- Rated second in the Top 10 Overall Corporations by the *Harris Interactive Report.*

Harley-Davidson's Focus on Technology

Harley-Davidson's technology budget of $50 million is more than 2 percent of its revenue, which is far above the manufacturing industry average. More than 50 percent of this budget is devoted to developing new technologies such as sharing information, gaining business intelligence, and enhancing decision making. Harley-Davidson's commitment to technology is paying off, and by using strategic information systems, the company has reduced operating costs by $40 million.

Talon, Harley-Davidson's proprietary dealer management system, is one of its most successful information systems. Talon handles inventory, vehicle registration, warranties, and point-of-sale transactions for all Harley-Davidson dealerships. The system checks dealer inventory, generates parts orders, and analyzes global organization information. Talon gives Harley-Davidson managers a 360-degree view into enterprisewide information that supports strategic goal setting and decision making throughout all levels of the organization.

Building Supplier Relationships

Harley-Davidson understands and values the importance of building strong relationships with its suppliers, and it invests time, energy, and resources into improving company-to-company information systems. To develop these important relation-ships, the company deployed Manugistics, a supply chain management (SCM) system that allows it to do business with suppliers in a collaborative, Web-based environment. The company uses the SCM software to

manage material flows and improve collaboration with key suppliers.

Building Customer Relationships

Each time a customer reaches out to a company, the company has an opportunity to build a trusting relationship with that particular customer. Harley-Davidson realizes that it takes more than just building and selling motorcycles to fulfill the dreams of its customers. For this reason, the company strives to deliver unforgettable experiences along with high-quality products.

Harley-Davidson sells more than $500 million worth of parts and accessories to its loyal followers. Ken Ostermann, Harley-Davidson's manager of electronic commerce and communications, decided the company could increase parts and accessories sales if it could offer the products online. The dilemma facing Ostermann's online strategy was that selling jackets, saddlebags, and T-shirts directly to consumers would bypass Harley-Davidson's 650 dealers, who depend on the high-margin accessories to fuel profits. Ostermann's solution was to build an online store, Harley-Davidson.com, which prompts customers to select a participating Harley-Davidson dealership before placing any online orders. The selected dealership is then responsible for fulfilling the order. The strategy ensures dealers that they will remain the focal point of customers' buying experiences. The company currently receives over 1 million visitors a month to its online store. To guarantee that every customer has a highly satisfying online buying experience, the company asks the dealers to agree to a number of standards including:

- Checking online orders twice daily.
- Shipping online orders within 24 hours.
- Responding to customer inquiries within 24 hours.

Another of Harley-Davidson's customer-centric strategies is its Harley's Owners Group (HOG), which offers an array of events, rides, and benefits to its members. HOG is the largest factory-sponsored motorcycle club in the world with more than 600,000 members and is one of the key drivers helping to build a strong sense of community among Harley-Davidson owners. Harley-Davidson has built a customer following that is extremely loyal, a difficult task to accomplish in any industry.

Harley-Davidson's Corporate Culture

Harley-Davidson employees are the engine behind its outstanding performance and the foundation of the company's overall success. Harley-Davidson believes in a strong sense of corporate ethics and values, and the company's top

five core values serve as a framework for the entire corporation:

- Tell the truth.

- Be fair.

- Keep your promises.

- Respect the individual.

- Encourage intellectual curiosity.

The company credits its core values as the primary reason it won the two prestigious awards from the *Harris Interactive Report*, one of the most respected consumer reviews for corporate sincerity, ethics, and standards. Sticking to strong ethics and values is and will continue to be a top priority for the company and its employees.

To enhance its enterprise further, Harley-Davidson plans to keep taking advantage of new technologies and strategies, including a Web-based approach to accessing information and an enterprisewide system to consolidate procurement at its eight U.S. facilities.[1]

INTRODUCTION

Decision-making and problem-solving abilities are now the most sought-after traits in up-and-coming executives, according to a recent survey of 1,000 executives by Caliper Associates, as reported in *The Wall Street Journal*. To put it mildly, decision makers and problem solvers have limitless career potential.[2]

Decision making and problem solving in today's electronic world encompass large-scale, opportunity-oriented, strategically focused solutions. The traditional "cookbook" approach to decision making simply will not work. This chapter focuses on technology to help make decisions, solve problems, and find new innovative opportunities. The chapter also highlights how to bring people together with the best IT processes and tools in complete, flexible solutions that can seize business opportunities and combat business challenges (see Figure 2.1).

SECTION 2.1   DECISION-MAKING SYSTEMS

LEARNING OUTCOMES

2.1. Explain the difference between transactional information and analytical information. Be sure to provide an example of each.

2.2. Define TPS, DSS, and EIS and explain how an organization can use these systems to make decisions and gain competitive advantages.

2.3. Describe the three quantitative models typically used by decision support systems.

2.4. Describe the relationship between digital dashboards and executive information systems.

2.5. Identify the four types of artificial intelligence systems.

FIGURE 2.1

Examples of Decision Making, Problem Solving, and Opportunity Seizing Information Systems

DECISION MAKING

What is the value of information? The answer to this important question varies. Karsten Solheim would say the value of information is its ability to lower a company's handicap. Solheim, an avid golfer, invented a putter, one with a "ping," that led to a successful golf equipment company and the PING golf clubs. PING Inc., a privately held corporation, was the first to offer customizable golf clubs. The company prides itself on being a just-in-time manufacturer that depends on flexible information systems to make informed production decisions. PING's production systems scan large amounts of information and pull orders that meet certain criteria such as order date (this week), order priority (high), and customer type (Gold). PING then manufactures the appropriate products, allowing it to carry less than 5 percent of inventory in its warehouse. PING depends on its flexible information systems for production decision support and thanks information technology for the explosion of its business over the past decade. [3]

Business is accelerating at a breakneck pace. The more information a business acquires, the more difficult it becomes to make decisions. The amount of information people must understand to make good decisions is growing exponentially. In the past, people could rely on manual processes to make decisions because they had limited amounts of information to process. Today, with massive volumes of available information it is almost impossible for people to make decisions without the aid of information systems. Highly complex decisions—involving far more information than the human brain can comprehend—must be made in increasingly shorter time frames. Figure 2.2 highlights the primary reasons dependence on information systems to make decisions is growing and will continue to grow.

A *model* is a simplified representation or abstraction of reality. Models can calculate risks, understand uncertainty, change variables, and manipulate time. Decision-making information systems work by building models out of organizational information to lend insight into important business issues and opportunities.

Figure 2.3 displays three common types of decision-making information systems used in organizations today—

transaction processing systems, decision support systems, and executive information systems. Each system uses different models to assist in decision making, problem solving, and opportunity capturing.

TRANSACTION PROCESSING SYSTEMS

Transactional information encompasses all of the information contained within a single business process or unit of work, and its primary purpose is to support the performing of daily operational tasks. Examples of transactional information include purchasing stocks, making an airline reservation, or withdrawing cash from an ATM. Organizations use transactional information when performing operational tasks and repetitive decisions such as analyzing daily sales reports to determine how much inventory to carry.

FIGURE 2.2

Primary Reasons for Growth of Decision-Making Information Systems

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Reasons for Growth of Decision-Making Information Systems

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1.   **People need to analyze large amounts of information**—Improvements in technology itself, innovations in communication, and globalization have resulted in a dramatic increase in the alternatives and dimensions people need to consider when making a decision or appraising an opportunity.

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2.   **People must make decisions quickly**—Time is of the essence and people simply do not have time to sift through all the information manually.

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3.   **People must apply sophisticated analysis techniques, such as modeling and forecasting, to make good decisions**—Information systems substantially reduce the time required to perform these sophisticated analysis techniques.

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4.   **People must protect the corporate asset of organizational information**—Information systems offer the security required to ensure organizational information remains safe.

FIGURE 2.3

IT Systems in an Enterprise

Analytical information encompasses all organizational information, and its primary purpose is to support the performing of managerial analysis tasks. Analytical information includes transactional information along with other information such as market and industry information. Examples of analytical information include trends, sales, product statistics, and future growth projections. Managers use analytical information when making important ad hoc decisions such as whether the organization should build a new manufacturing plant or hire additional sales personnel.

The structure of a typical organization is similar to a pyramid. Organizational activities occur at different levels of the pyramid. People in the organization have unique information needs and thus require various sets of IT tools (see Figure 2.4). At the lower levels of the pyramid, people perform daily tasks such as processing transactions. *Online transaction processing (OLTP)* is the capturing of transaction and event information using technology to (1) process the information according to defined business rules, (2) store the information, and (3) update existing information to reflect the new information. During OLTP, the organization must capture every detail of transactions and events. A *transaction processing system (TPS)* is the basic business system that serves the operational level (analysts) in an organization. The most common example of a TPS is an operational accounting system such as a payroll system or an order-entry system.

FIGURE 2.4

Enterprise View of Information and Information Technology

Moving up through the organizational pyramid, people (typically managers) deal less with the details ("finer" information) and more with meaningful aggregations of information ("coarser" information) that help them make broader decisions for the organization. (Granularity means fine and detailed or "coarse" and abstract information.) *Online analytical processing (OLAP)* is the manipulation of information to create business intelligence in support of strategic decision making. *Business intelligence* is a broad, general term describing information that people use to support their decision-making efforts.

DECISION SUPPORT SYSTEMS

At limousine and transportation company BostonCoach, managers must dispatch fleets of hundreds of vehicles as efficiently as possible. BostonCoach requires a real-time dispatching system that considers inventory, customer needs, and soft dimensions such as weather and traffic. Researchers at IBM's Thomas J. Watson Research Center built BostonCoach a mathematical algorithm for a custom dispatch system that combines information about weather,

traffic conditions, driver locations, and customer pickup requests and determines which cars to assign to which customers. The system is so efficient that, after launching it in Atlanta, BostonCoach experienced a 20 percent increase in revenues.[4]

A *decision support system (DSS)*, such as BostonCoach's, models information to support managers and business professionals during the decision-making process. Three quantitative models often used by DSS include:

1. *Sensitivity analysis* is the study of the impact that changes in one (or more) parts of the model have on other parts of the model. Users change the value of one variable repeatedly and observe the resulting changes in other variables.

2. *What-if analysis* checks the impact of a change in an assumption on the proposed solution. For example, "What will happen to the supply chain if a hurricane in South Carolina reduces holding inventory from 30 percent to 10 percent?" Users repeat this analysis until they understand all the effects of various situations. Figure 2.5 displays an example of what-if analysis using Microsoft Excel. The tool is calculating the net effect of a 20 percent increase in sales on the company's bottom line.

FIGURE 2.5

Example of What-If Analysis in Microsoft Excel

FIGURE 2.6

Example of Goal-Seeking Analysis in Microsoft Excel

3. *Goal-seeking analysis* finds the inputs necessary to achieve a goal such as a desired level of output. Instead of observing how changes in a variable affect other variables as in what-if analysis, goal-seeking analysis sets a target value (a goal) for a variable and then repeatedly changes other variables until the target value is achieved. For example, "How many customers are required to purchase a new product to increase gross profits to $5 million?" Figure 2.6 displays a goal-seeking scenario using Microsoft Excel. The model is seeking the monthly mortgage payment needed to pay off the remaining balance in 130 months.

One national insurance company uses DSSs to analyze the amount of risk the company is undertaking when it insures drivers who have a history of driving under the influence of alcohol. The DSS discovered that only 3 percent of married male homeowners in their forties received more than one DUI. The company decided to lower rates for customers falling into this category, which increased its revenue while mitigating its risk.[5]

Figure 2.7 displays how a TPS is used within a DSS. The TPS supplies transaction-based data to the DSS. The

DSS summarizes and aggregates the information from the many different TPS systems, which assists managers in making informed decisions. Burlington Northern and Santa Fe Railroad (BNSF) regularly tests its railroad tracks. Each year hundreds of train derailments result from defective tracks. Using a DSS to schedule train track replacements helped BNSF decrease its rail-caused derailments by 33 percent.[6]

EXECUTIVE INFORMATION SYSTEMS

An *executive information system (EIS)* is a specialized DSS that supports senior-level executives within the organization. An EIS differs from a DSS because an EIS typically contains data from external sources as well as data from internal sources (see Figure 2.8).

Consolidation, drill-down, and slice-and-dice are a few of the capabilities offered in most EISs.

FIGURE 2.7

Interaction Between TPSs and DSSs

■ *Consolidation* involves the aggregation of information and features simple roll-ups to complex groupings of interrelated information. Many organizations track financial information at a regional level and then consolidate the information at a single global level.

■ *Drill-down* enables users to view details, and details of details, of information. Viewing monthly, weekly, daily, or even hourly information represents drill-down capability.

■ *Slice-and-dice* is the ability to look at information from different perspectives. One slice of information could display all product sales during a given promotion. Another slice could display a single product's sales for all promotions.

Digital Dashboards

A common feature of an EIS is a digital dashboard. *Digital dashboards* integrate information from multiple components and tailor the information to individual preferences. Digital dashboards commonly use indicators to help executives quickly identify the status of key information or critical success factors. Following is a list of features included in a dashboard designed for a senior executive of an oil refinery:

■ A hot list of key performance indicators, refreshed every 15 minutes.

■ A running line graph of planned versus actual production for the past 24 hours.

■ A table showing actual versus forecasted product prices and inventories.

■ A list of outstanding alerts and their resolution status.

■ A graph of crude-oil stock market prices.

■ A scroll of headline news from Petroleum Company news, an industry news service.

FIGURE 2.8

Interaction Between TPSs and EISs

Digital dashboards, whether basic or comprehensive, deliver results quickly. As digital dashboards become easier to use, more executives can perform their own analysis without inundating IT personnel with questions and requests for reports. According to an independent study by Nucleus Research, there is a direct correlation between use of digital dashboards and companies' return on investment (ROI). Figure 2.9 and Figure 2.10 display two different digital dashboards from Visual Mining.

EIS systems, such as digital dashboards, allow executives to move beyond reporting to using information to directly impact business performance. Digital dashboards help executives react to information as it becomes available and make decisions, solve problems, and change strategies daily instead of monthly.

Verizon Communications CIO Shaygan Kheradpir tracks 100-plus major IT systems on a single screen called "The Wall of Shaygan." Every 15 seconds, a new set of charts communicating Verizon's performance flashes onto a giant LCD screen in Kheradpir's office. The 44 screen shots cycle continuously, all day long, every day. The dashboard includes more than 300 measures of business performance that fall into one of three categories:

1. **Market pulse**—examples include daily sales numbers, market share, and subscriber turnover.

2. **Customer service**—examples include problems resolved on the first call, call center wait times, and on-time repair calls.

3. **Cost driver**—examples include number of repair trucks in the field, repair jobs completed per day, and call center productivity.

Kheradpir has memorized the screens and can tell at a glance when the lines on the charts are not trending as expected. The system informs him of events such as the percentage of customer calls resolved by voice systems, number of repair trucks in the field, and amount of time to resolve an IT system issue. The dashboard works the same way for 400 managers at every level of Verizon.[7]

FIGURE 2.9

Visual Mining NetCharts Corporate Financial Dashboard

FIGURE 2.10

Artificial Intelligence

Executive information systems are starting to take advantage of artificial intelligence to help executives make strategic decisions. RivalWatch, based in Santa Clara, California, offers a strategic business information service using artificial intelligence that enables organizations to track the product offerings, pricing policies, and promotions of online competitors. Clients can determine the competitors they want to watch and the specific information they wish to gather, ranging from products added, removed, or out of stock to price changes, coupons offered, and special shipping terms. Clients can check each competitor, category, and product either daily, weekly, monthly, or quarterly.

"Competing in the Internet arena is a whole different ballgame than doing business in the traditional brick-and-mortar world because you're competing with the whole world rather than the store down the block or a few miles away," said Phil Lumish, vice president of sales and marketing at RivalWatch.com. "With new products and campaigns being introduced at a breakneck pace, e-businesses need new tools to monitor the competitive environment, and our service is designed specifically to meet that need."[8]

Intelligent systems are various commercial applications of artificial intelligence. *Artificial intelligence (AI)* simulates human intelligence such as the ability to reason and learn. AI systems can learn or understand from experience, make sense of ambiguous or contradictory information, and even use reasoning to solve problems and make decisions effectively. AI systems can perform such tasks as boosting productivity in factories by monitoring equipment and signaling when preventive maintenance is required. The ultimate goal of AI is the ability to build a system that can mimic human intelligence. AI systems are beginning to show up everywhere:

- At Manchester Airport in England, the Hefner AI Robot Cleaner alerts passengers to security and nonsmoking rules while it scrubs up to 65,600 square feet of floor per day. Laser scanners and ultrasonic detectors keep it from colliding with passengers.

- Shell Oil's SmartPump keeps drivers in their cars on cold, wet winter days. It can service any automobile built after 1987 that has been fitted with a special gas cap and a windshield-mounted transponder that tells the robot where to insert the pump.

- Matsushita's courier robot navigates hospital hallways, delivering patient files, X-ray films, and medical supplies.

- The FireFighter AI Robot can extinguish flames at chemical plants and nuclear reactors with water, foam, powder, or inert gas. The robot puts distance between the human operator and the fire.[9]

Examples of AI Systems

AI systems dramatically increase the speed and consistency of decision making, solve problems with incomplete information, and resolve complicated issues that cannot be solved by conventional computing. There are many categories of AI systems; four of the most familiar are: (1) expert systems, (2) neural networks, (3) genetic algorithms, and (4) intelligent agents.

Expert Systems *Expert systems* are computerized advisory programs that imitate the reasoning processes of experts in solving difficult problems. Human expertise is transferred to the expert system, and users can access the expert system for specific advice. Most expert systems reflect expertise from many humans and can therefore perform better analysis than any single expert. Typically, the system includes a knowledge base containing various accumulated experience and a set of rules for applying the knowledge base to each particular situation. The best-known expert systems play chess and assist in medical diagnosis. Expert systems are the most commonly used form of AI in the business arena because they fill the gap when human experts are difficult to find, retain, or too expensive.

Neural Networks A *neural network*, also called an ***artificial neural network***, is a category of AI that attempts to emulate the way the human brain works. The types of decisions for which neural networks are most useful are those that involve pattern or image recognition because a neural network can learn from the information it processes. Neural networks analyze large quantities of information to establish patterns and characteristics in situations where the logic or rules are unknown.

The finance industry is a veteran in neural network technology and has been relying on various forms of it for over two decades. The industry uses neural networks to review loan applications and create patterns or profiles of applications that fall into two categories: approved or denied. One neural network has become the standard for detecting credit card fraud. Since 1992, this technology has slashed fraud by 70 percent for U.S. Bancorp. Now, even small credit unions are required to use the software in order to qualify for debit-card insurance from Credit Union National Association.[10]

Fuzzy logic is a mathematical method of handling imprecise or subjective information. The basic approach is to assign values between 0 and 1 to vague or ambiguous information. The higher the value, the closer it is to 1. The value zero is used to represent nonmembership, and the value one is used to represent membership. For example, fuzzy logic is used in washing machines that determine by themselves how much water to use or how long to wash

(they continue washing until the water is clean). In accounting and finance, fuzzy logic allows people to analyze information with subjective financial values (intangibles such as goodwill) that are very important considerations in economic analysis. Fuzzy logic and neural networks are often combined to express complicated and subjective concepts in a form that makes it possible to simplify the problem and apply rules that are executed with a level of certainty.

Genetic Algorithms   A *genetic algorithm* is an artificial intelligence system that mimics the evolutionary, survival-of-the-fittest process to generate increasingly better solutions to a problem. A genetic algorithm is essentially an optimizing system: It finds the combination of inputs that gives the best outputs.

Genetic algorithms are best suited to decision-making environments in which thousands, or perhaps millions, of solutions are possible. Genetic algorithms can find and evaluate solutions with many more possibilities, faster and more thoroughly than a human. Organizations face decision-making environments for all types of problems that require optimization techniques such as the following:

■ Business executives use genetic algorithms to help them decide which combination of projects a firm should invest in, taking complicated tax considerations into account.

■ Investment companies use genetic algorithms to help in trading decisions.

■ Telecommunication companies use genetic algorithms to determine the optimal configuration of fiber-optic cable in a network that may include as many as 100,000 connection points. The genetic algorithm evaluates millions of cable configurations and selects the one that uses the least amount of cable.[11]

Intelligent Agents   An *intelligent agent* is a special-purpose knowledge-based information system that accomplishes specific tasks on behalf of its users. Intelligent agents use their knowledge base to make decisions and accomplish tasks in a way that fulfills the intentions of a user. Intelligent agents usually have a graphical representation such as "Sherlock Holmes" for an information search agent.

One of the simplest examples of an intelligent agent is a shopping bot. A *shopping bot* is software that will search several retailer Web sites and provide a comparison of each retailer's offerings including price and availability. Increasingly, intelligent agents handle the majority of a company's Internet buying and selling and handle such processes as finding products, bargaining over prices, and executing transactions. Intelligent agents also have the capability to handle all supply chain buying and selling.

Another application for intelligent agents is in environmental scanning and competitive intelligence. For instance,

an intelligent agent can learn the types of competitor information users want to track, continuously scan the Web for it, and alert users when a significant event occurs.

By 2010, some 4 million AI robots are expected to populate homes and businesses, performing everything from pumping gas to delivering mail. According to a new report by the United Nations and the International Federation of Robotics, more than half the AI robots will be toys and the other half will perform services. Bots will deactivate bombs, clean skyscraper windows, and vacuum homes.[12]

Data Mining

Wal-Mart consolidates point-of-sale details from its 3,000 stores and uses AI to transform the information into business intelligence. Data-mining systems sift instantly through the information to uncover patterns and relationships that would elude an army of human researchers. The results enable Wal-Mart to predict sales of every product at each store with uncanny accuracy, translating into huge savings in inventories and maximum payoff from promotional spending.

Data-mining software typically includes many forms of AI such as neural networks and expert systems. Data-mining tools apply algorithms to information sets to uncover inherent trends and patterns in the information, which analysts use to develop new business strategies. Analysts use the output from data-mining tools to build models that, when exposed to new information sets, perform a variety of data analysis functions. The analysts provide business solutions by putting together the analytical techniques and the business problem at hand, which often reveals important new correlations, patterns, and trends in information. A few of the more common forms of data-mining analysis capabilities include cluster analysis, association detection, and statistical analysis. Data mining is covered in detail in Chapter 6.

OPENING CASE QUESTIONS

Revving Up Sales at Harley-Davidson

1. How does Talon help Harley-Davidson employees improve their decision-making capabilities?

2. Identify a few key metrics a Harley-Davidson marketing executive might want to monitor on a digital dashboard.

3. How can Harley-Davidson benefit from using decision support systems in its business?

SECTION 2.2   ENTERPRISE SYSTEMS

LEARNING OUTCOMES

2.6. Describe the four basic components of supply chain management.

2.7. Explain customer relationship management and the benefits it can provide an organization.

2.8. Define enterprise resource planning and explain its importance to an organization.

2.9. Identify how an organization can use business process reengineering to improve its business.

ENTERPRISE SYSTEMS

Trek, a leader in bicycle products and accessories, gained a 30 percent increase in market share by streamlining its information systems. The largest improvement realized from the new systems was the ability to obtain key management information to drive business decisions in line with the company's strategic goals. The system also included a highly successful Web site developed for the 1,400 Trek dealers where they could enter orders, check stock availability, view accounts receivable, and verify credit. Tonja Green, Trek channel manager for North America, stated, "We wanted to give our dealers an easier and quicker way to enter their orders and get information. Every week the number of Web orders increases by 25 to 30 percent due to the new system."[13]

Section 2.2 introduces supply chain management, customer relationship management, business process reengineering, and enterprise resource planning—enterprise systems organizations can use to make decisions and gain competitive advantages.

SUPPLY CHAIN MANAGEMENT

To understand a supply chain, consider a customer purchasing a Trek bike from a dealer. The supply chain begins when a customer places an order for a Trek bike with the dealer. The dealer purchases the bike from the manufacturer, Trek. Trek purchases the raw materials required to make the bike such as metal, packaging, and accessories from different suppliers. The supply chain for Trek encompasses every activity and party involved in the process of fulfilling the order from the customer for the new bike.

Supply chain management (SCM) involves the management of information flows between and among stages in a supply chain to maximize total supply chain effectiveness and profitability. The four basic components of supply chain management include:

1. Supply chain strategy—the strategy for managing all the resources required to meet customer demand for all products and services.

2. **Supply chain partners**—the partners chosen to deliver finished products, raw materials, and services including pricing, delivery, and payment processes along with partner relationship monitoring metrics.

3. **Supply chain operation**—the schedule for production activities including testing, packaging, and preparation for delivery. Measurements for this component include productivity and quality.

4. **Supply chain logistics**—the product delivery processes and elements including orders, warehouses, carriers, defective product returns, and invoicing.

Dozens of steps are required to achieve and carry out each of the above components. SCM software can enable an organization to generate efficiencies within these steps by automating and improving the information flows throughout and among the different supply chain components.

FIGURE 2.11

Supply Chain for a Product Purchased from Wal-Mart

Wal-Mart and Procter & Gamble (P&G) implemented a successful SCM system, which linked Wal-Mart's distribution centers directly to P&G's manufacturing centers. Every time a Wal-Mart customer purchases a P&G product, the system sends a message directly to the factory alerting P&G to restock the product. The system also sends an automatic alert to P&G whenever a product is running low at one of Wal-Mart's distribution centers. This real-time information allows P&G to produce and deliver products to Wal-Mart without having to maintain large inventories in its warehouses. The SCM system saves time, reduces inventory, and decreases order-processing costs for P&G, which P&G passes on to Wal-Mart in the form of discounted prices.[14]

Figure 2.11 diagrams the stages of the SCM system for a customer purchasing a product from Wal-Mart. The diagram demonstrates how the supply chain is dynamic and involves the constant flow of information between the different parties. For example, a customer purchases a product from Wal-Mart and generates order information. Wal-Mart supplies the order information to its warehouse or distributor. The warehouse or distributor transfers the order information to the manufacturer, who provides pricing and availability information to the store and replenishes the product. Partners transfer all payments electronically.

Effective and efficient supply chain management systems can enable an organization to:

- Decrease the power of its buyers.
- Increase its own supplier power.
- Increase switching costs to reduce the threat of substitute products or services.

■ Create entry barriers thereby reducing the threat of new entrants.

■ Increase efficiencies while seeking a competitive advantage through cost leadership (see Figure 2.12).

CUSTOMER RELATIONSHIP MANAGEMENT

Today, most competitors are simply a mouse-click away. The intense competition in today's marketplace forces organizations to switch from sales-focused strategies to customer-focused strategies.

Charles Schwab recouped the cost of a multimillion-dollar customer relationship management system in less than two years. The system, developed by Siebel, allows the brokerage firm to trace each interaction with a customer or prospective customer and then provide services (retirement planning, for instance) to each customer's needs and interests. The system provides Schwab with a complete view of its customers, which it uses to differentiate serious investors from nonserious investors. For example, automated deposits from paychecks are a sign of a serious investor, while stagnant balances signal a nonserious investor. Once Schwab is able to make this determination, the firm allocates its resources accordingly, saving money by not investing time or resources in subsidizing nonserious investors.[15]

FIGURE 2.12

Effective and Efficient Supply Chain Management's Effect on Porter's Five Forces

Customer relationship management (CRM) involves managing all aspects of a customer's relationship with an organization to increase customer loyalty and retention and an organization's profitability. CRM allows an organization to gain insights into customers' shopping and buying behaviors. Kaiser Permanente undertook a CRM strategy to improve and prolong the lives of diabetics. After compiling CRM information on 84,000 diabetic patients, Kaiser found that only 20 percent were getting their eyes checked routinely. (Diabetes is the leading cause of blindness.) As a result, Kaiser is now enforcing rigorous eye-screening programs for diabetics, along with creating support groups for obesity and stress (two more factors that make diabetes even worse). This CRM-based "preventive medicine" approach is saving Kaiser money and, more importantly, improving the health of diabetic patients.[16]

Figure 2.13 provides an overview of a typical CRM system. Customers contact an organization through various means including call centers, Web access, e-mail, faxes, and direct sales. A single customer may access an organization multiple times through many different channels. The CRM system tracks every communication between the customer and the organization and provides access to CRM information across different systems from

accounting to order fulfillment. Understanding all customer communications allows the organization to communicate effectively with each customer. It gives the organization a detailed understanding of each customer's products and services regardless of the customer's preferred communication channel. A customer service representative can easily view detailed account information and history through a CRM system when providing information to a customer such as expected delivery dates, complementary product information, and customer payment and billing information.

CRM Strategy

Eddie Bauer ships 110 million catalogs a year, maintains two Web sites, and has more than 600 retail stores. The company collects information through customer transactions and analyzes the information to determine the best way to market to each individual customer. Eddie Bauer discovered that customers who shop across all three of its distribution channels—catalogs, Web sites, and stores—spend up to five times more than customers who shop through only one channel.

Michael Boyd, director of CRM at Eddie Bauer, stated, "Our experience tells us that CRM is in no way, shape, or form a software application. Fundamentally, it is a business strategy to try to optimize profitability, revenue, and satisfaction at an individual customer level. Everything in an organization, every single process, every single application, is a tool that can be used to serve the CRM goal."[17]

FIGURE 2.13

Customer Relationship Management Overview

It is important to realize that CRM is not just a technology, but also a strategy that an organization must embrace on an enterprise level. Although there are many technical components of CRM, it is actually a process and business goal simply enhanced by technology. Implementing a CRM system can help an organization identify customers and design specific marketing campaigns tailored to each customer, thereby increasing customer spending. A CRM system also allows an organization to treat customers as individuals, gaining important insights into their buying preferences and behaviors and leading to increased sales, greater profitability, and higher rates of customer loyalty.

BUSINESS PROCESS REENGINEERING

A *business process* is a standardized set of activities that accomplish a specific task, such as processing a customer's order. *Business process reengineering (BPR)* is the analysis and redesign of workflow within and between

enterprises. The concept of BPR traces its origins to management theories developed as early as the 19th century. The purpose of BPR is to make all business processes best-in-class. Frederick Taylor suggested in the 1880s that managers could discover the best processes for performing work and reengineer the process to optimize productivity. BPR echoes the classical belief that there is one best way to conduct tasks. In Taylor's time, technology did not allow large companies to design processes in a cross-functional or cross-departmental manner. Specialization was the state-of-the-art method to improve efficiency given the technology of the time.[18]

FIGURE 2.14

Seven Principles of Business Process Reengineering

Seven Principles of Business Process Reengineering
1. Organize around outcomes, not tasks.
2. Identify all the organization's processes and prioritize them in order of redesign urgency.
3. Integrate information processing work into the real work that produces the information.
4. Treat geographically dispersed resources as though they were centralized.
5. Link parallel activities in the workflow instead of just integrating their results.
6. Put the decision point where the work is performed, and build control into the process.
7. Capture information once and at the source.

BPR reached its heyday in the early 1990s when Michael Hammer and James Champy published their best-selling book, *Reengineering the Corporation*. The authors promoted the idea that radical redesign and reorganization of an enterprise (wiping the slate clean) sometimes was necessary to lower costs and increase quality of service and that information technology was the key enabler for that radical change. Hammer and Champy believed that workflow design in most large corporations was based on invalid assumptions about technology, people, and

organizational goals. They suggested seven principles of reengineering to streamline the work process and thereby achieve significant improvement in quality, time management, and cost (see Figure 2.14).[19]

Finding Opportunity Using BPR

Companies frequently strive to improve their business processes by performing tasks faster, cheaper, and better. Figure 2.15 displays different ways to travel the same road. A company could improve the way that it travels the road by moving from foot to horse and then from horse to car. However, true BPR would look at taking a different path. A company could forget about traveling on the same old road and use an airplane to get to its final destination. Companies often follow the same indirect path for doing business, not realizing there might be a different, faster, and more direct way of doing business.

Creating value for the customer is the leading factor for instituting BPR, and information technology often plays an important enabling role. Radical and fundamentally new business processes enabled Progressive Insurance to slash the claims settlement from 31 days to four hours. Typically, car insurance companies follow this standard claims resolution process: The customer gets into an accident, has the car towed, and finds a ride home. The customer then calls the insurance company to begin the claims process, which usually takes over a month (see Figure 2.16).[20]

FIGURE 2.15

Better, Faster, Cheaper, or BPR

FIGURE 2.16

Auto Insurance Claims Processes

Progressive Insurance improved service to its customers by offering a mobile claims process. When a customer has a car accident, he or she calls in the claim on the spot. The Progressive claims adjustor comes to the accident and performs a mobile claims process, surveying the scene and taking digital photographs. The adjustor then offers the customer on-site payment, towing services, and a ride home. (see Figure 2.16).[21]

A true BPR effort does more for a company than simply improve it by performing a process better, faster, and cheaper. Progressive Insurance's BPR effort redefined best practices for its entire industry. Figure 2.17 displays the different types of change an organization can achieve, along with the magnitude of change and the potential business benefit.

FIGURE 2.17

Process Change Spectrum

Pitfalls of BPR

One hazard of BPR is that the company becomes so wrapped up in fighting its own demons that it fails to keep up with its competitors in offering new products or services. While American Express tackled a comprehensive reengineering of its credit card business, MasterCard and Visa introduced a new product—the corporate procurement card. American Express lagged a full year behind before offering its customers the same service.[22]

ENTERPRISE RESOURCE PLANNING

Many organizations fail to maintain consistency across business operations. If a single department, such as sales, decides to implement a new system without considering the other departments, inconsistencies can occur throughout the company. Not all applications are built to talk to each other, and if the sales function suddenly implements a new system that marketing and production cannot use or is inconsistent in the way it handles information, the company's operations become isolated.

Enterprise resource planning systems provide organizations with consistency. ***Enterprise resource planning (ERP)*** integrates all departments and functions throughout an organization into a single IT system (or integrated set of IT systems) so that employees can make decisions by viewing enterprisewide information on all business operations. An ERP system provides a method for effective planning and controlling of all the resources required to take, make, ship, and account for customer orders in a manufacturing, distribution, or service organization. The key word in enterprise resource planning is *enterprise*.

Los Angeles is a city of 3.5 million people, with 44,000 city employees, and a budget of $4 billion. Yet a few years ago each of the departments conducted its own purchasing. That meant 2,000 people in 600 city buildings and 60 ware-houses were ordering material. Some 120,000 purchase orders (POs) and 50,000 checks per year went to more than 7,000 vendors. Inefficiency was rampant.

"There was a lack of financial responsibility in the old system, and people could run up unauthorized expenditures," said Bob Jensen, the city's ERP project manager. Each department maintained its own inventories on different systems. Expense-item mismatches piled up. One department purchased one way, while others preferred a different approach. Mainframe-based systems were isolated. The city chose an ERP system as part of a $22 million project to integrate purchasing and financial reporting across the entire city. The project resulted in cutting the check

processing staff in half, processing POs faster than ever, reducing the number of workers in warehousing by 40 positions, decreasing inventories from $50 million to $15 million, and providing a single point of contact for each vendor. In addition, $5 million a year has been saved in contract consolidation.[23]

ERP Software

The many ERP vendors on the market today each offer different ERP solutions, but the core functions are the same, focusing on financial, accounting, sales, marketing, human resources, operations, and logistics. Vendors differentiate themselves by offering distinct functionality such as CRM and SCM systems.

But many customers find that their chosen ERP solution does not meet expectations. Despite many improvements in the software, failed ERP implementations are still far too common. According to Gartner Inc., the average failure rate for an ERP project is 66 percent. With those results, it is no wonder that some organizations view ERP as a necessary, strategic evil. The key word here though is *necessary.*

Many companies strive to make good financial decisions by making smart investments. The best way to ensure a good investment in ERP is to understand why failure occurs and how to avoid it. The first challenge is that ERP comes in many flavors. Its main purpose is to provide support and automation to a business process. The business world has many different business models with many ERP products available that serve them.

Finding the Right ERP Solution

A good ERP system will be highly reflective of the business process in place at the company. This means the software must perform many different tasks and that makes it complex. Most companies do not carry a high degree of ERP software expertise on their staff, making it easy to choose the wrong package. The key to making an effective purchase is to have solid business processes. Successful ERP projects share three basic attributes:

1. Overall fit
2. Proper business analysis
3. Solid implementation plans[24]

Overall Fit This refers to the degree of gaps that exist between the system and the business process. A well-fitting ERP has no major process gaps and very few minor ones. Think of a new ERP system as a suit. Typically, a customer buys a suit three ways: off the rack, off the rack and tailored to fit, or custom-made.

The way the solution fits the business process will normally determine the client's satisfaction level. Buying ERP

off the rack is the equivalent of buying a canned software package. It fits some well, but not all. The customer can tailor the software so that its processes better line up with company processes. This is a good strategy provided the chosen package supports this. The downside is that it can get very expensive. Choosing a custom system can provide a great fit, but the company must thoroughly understand what it is doing and be able to support the associated financial burden.

Proper Business Analysis   The best way to determine which fit strategy is right is to conduct a thorough business analysis. Successful companies normally spend up to 10 percent of the project budget on a business analysis. A proper analysis must result in a documented list of the business processes at work within the company. This will provide a basic tool that can measure vendor capability.

Solid Implementation Plans   As with the installation of any successful process or machinery, a plan is needed to monitor the quality objectives and timelines. The plan will also employ processes such as workflow analysis and job combination to harvest savings.

A thorough implementation will transfer knowledge to system users. When the project is complete, employees must be capable of using the tools the new system provides. The users must also know what to do in cases when the process fluctuates. Most failed systems result from low-quality implementation. ERP is simply a tool. Tools that people do not know how to use can be as useless as having no tools at all.

OPENING CASE QUESTIONS

Revving Up Sales at Harley-Davidson

4. Evaluate the HOG CRM strategy and recommend an additional benefit Harley-Davidson could provide to its HOG members to increase customer satisfaction.

5. Describe how Harley-Davidson's SCM system, Manugistics, could improve its business operations.

6. Provide a potential illustration of Harley-Davidson's SCM system including all upstream and downstream participants.

KEY TERMS

Analytical information   36

Artificial intelligence   43

Business intelligence   38

CLOSING CASE ONE

Consolidating Touchpoints for Saab

Saab Cars USA imports more than 37,000 Saab sedans, convertibles, and wagons annually and distributes the cars to 220 U.S. dealerships. Saab competes in the premium automotive market, and its primary rivals attract customers through aggressive marketing campaigns, reduced prices, and inexpensive financing. Saab decided that the answer to beating its competition was not to spend capital on additional advertising, but to invest in Siebel Automotive, a customer relationship management system.

Until recently, the company communicated with its customers through three primary channels: (1) dealer network, (2) customer assistance center, (3) lead management center. Traditionally, each channel maintained its own customer database, and this splintered approach to managing customer information caused numerous problems for the company. For example, a prospective customer might receive a direct-mail piece from Saab one week, then an e-mail with an unrelated offer from a third-party marketing vendor the next week. The local dealer might not know of either activity, and therefore might deliver an ineffective pitch when the customer visited the showroom that weekend. Al Fontova, direct marketing manager with Saab Cars USA, stated he had over 3 million customer records and 55 files at three different vendors. Analyzing this information in aggregate was complicated, inefficient, and costly.

Saab required a solution that would provide a consolidated customer view from all three touchpoints. In 2003, Saab implemented the Siebel CRM solution, which provides Saab's call center employees with a 360-degree view of each customer, including prior service-related questions and all the marketing communications they have received. Known internally as "TouchPoint," the Siebel application provides Saab's dealers with a powerful Web-based solution for coordinating sales and marketing activities. These tracking capabilities enable Saab to measure the sales results of specific leads, recommend more efficient selling techniques, and target its leads more precisely in the future. Using Siebel Automotive, Saab received the following benefits:

- Direct marketing costs decreased by 5 percent.
- Lead follow-up increased from 38 percent to 50 percent.
- Customer satisfaction increased from 69 percent to 75 percent.
- Saab gained a single view of its customers across multiple channels.[25]

Questions

1. How has implementing a CRM system enabled Saab to gain a competitive advantage?

2. Estimate the potential impact to Saab's business if it had not implemented a CRM system.

3 What additional benefits could Saab receive from implementing a supply chain management system?

4. Model Saab's supply chain.

5. How is Saab's CRM implementation going to influence its SCM practices?

CLOSING CASE TWO

Made-to-Order Businesses

In the past, customers had two choices for purchasing products: (1) purchase a mass-produced product like a pair of jeans or a candy bar or (2) commission a custom-made item that was perfect but cost a small fortune. Mass customization is a new trend in the retail business. Mass customization hits that sweet spot between harnessing the cost efficiencies of mass production and offering so many options that customers feel the product has been designed just for them. Today, many companies are using strategic information systems to implement mass customization business strategies.

Lands' End

Lands' End built a decision support system that could pinpoint a person's body size by taking just a few measurements and running a series of algorithms. The process begins when the customer answers questions on Lands' End's Web site about everything from waist size to inseam. Lands' End saves the data in its customer relationship management system, which is used for reorders, promotions, and marketing campaigns. The order is then sent to San Francisco where supply chain management software determines which one of five contracted manufacturers should receive the order. The chosen manufacturer then cuts and sews the material and ships the finished garment directly to the customer.

Over 40 percent of Lands' End shoppers prefer a customized garment to the standard-sized equivalent, even though each customized garment costs at least $20 more and takes four weeks to deliver. Customized clothes account for a growing percentage of Lands' End's $511 million online business. Reorder rates for Lands' End custom-clothing buyers are 34 percent higher than for buyers of its standard-sized clothing.

Nike

The original business model for Nike iD concentrated on connecting with consumers and creating customer loyalty.

Nike iD's Web site allows customers to build their own running shoes. The process begins when customers choose from one of seven different styles and orders from numerous color combinations. Dark-pink bottoms, red mesh, bright yellowing lining, purple laces, blue swoosh, and a eucalyptus green accent. Customers can even place eight-character personalized messages on the side. The cost averages about $30 more than buying the regular shoes in a store.

Once Nike receives the custom order, its supply chain management system sends it to one of 15 plants depending on production availability. Customers receive their shoes within four weeks. The program experienced triple-digit growth in just two years.

Stamps.com

Stamps.com made an agreement with the U.S. Postal Service to sell customized stamps. Customers could put pictures of their choice on an actual U.S. postage stamp. Pictures ranged from dogs to fiancées. The response was phenomenal: Within seven weeks Stamps.com processed and sold more than 2 million PhotoStamps at $1 for a first-class stamp.

Thinking about mass customization as a goal changes the way businesses think about their customers. Using supply chain management and customer relationship management to implement mass customization can have a direct impact on a business's bottom line.[26]

Questions

1. What role does supply chain management and customer relationship management play in a mass customization business strategy?

2. How can Lands' End use its CRM system to improve its business?

3. How can Nike use a CRM system to improve its customer relations?

4. Why is Nike's supply chain management system critical to its Nike iD order fulfillment process?

5. Choose one of the examples above and explain how an ERP system could help facilitate the mass customization effort.

6. Choose one of the examples above and explain how the company is attempting to gain a competitive advantage with mass customization.

7. Identify one other business that could benefit from the use of mass customization. Explain why this business

would need customer relationship management and supply chain management systems to implement a mass customization business strategy.

CLOSING CASE THREE

Delta Air Lines Plays Catch-Up

The airline industry has a well-deserved reputation for creative use of IT. American Airlines is known as a leader in using IT to drive its business, and United Airlines is known as a fast follower. Delta Air Lines, while highly regarded as a well-run airline, has been a slow follower in IT. Recently, however, this has changed. In the past few years, Delta has invested more than $1.5 billion in technology, automating everything from gate and boarding tasks to baggage-handling, inventory control, and revenue accounting.

The airline reservation systems introduced by American Airlines and United Airlines, respectively, Sabre and Apollo, were the earliest examples of significant forays into business driven IT in the airline industry. The programs are inventory control systems that sell and manage available seats on upcoming flights. Travel agents received a special computer terminal from the airline when they signed up for the programs. Usually, a travel agent would sign up for one or the other system, but not both. Airline companies that did not have their own reservation systems (Frontier Airlines, for example) could become "co-hosts" on Sabre or Apollo. A fee was charged to co-hosts for the privilege of listing their flights on the reservation systems.

American and United obtained significant competitive advantages as owners of the reservation systems for several reasons. First, the systems were very profitable. Second, they gave American's and United's IT and operations personnel early and valuable experience with online transaction processing (OLTP) systems. Finally, they gave American and United access to information on the sales volumes of their competitors, such as Frontier, because the information was available in the reservation system's database. For example, if American wanted to consider adding a flight from Denver to Chicago, it could simply examine the historical information in the Sabre system to see if there was enough demand for the new route. It could also see what sort of traffic a competitor such as Frontier was generating on the same route in order to pick the best time to schedule a new flight along with the best price. American and United offered the same competitive intelligence information to their co-host airlines, but charged them for it, and often took weeks to provide it to them.

American and United soon realized they had a gold mine of customer-related information available in their

reservation systems. They conceived and rolled out hugely successful frequent-flyer programs, which increased the likelihood that frequent business travelers, their most profitable customers, would fly with them instead of with a competitor. Frequent-flyer programs require sophisticated computer systems to properly account for and manage the flight activity of millions of customers, together with their eligibility for awards—another noteworthy example of business driven IT. Ultimately, frequent-flyer programs became an entry barrier for the industry because all airline companies felt they could not compete for the best customers without having their own frequent-flyer systems.

Follow-on IT Innovations

Yield management systems alter the price of available seats on a flight. The systems operate on a minute-by-minute basis as the date of the flight approaches, depending on the number of seats sold compared to the number expected. This is why an airfare quoted over the phone can be $100 higher if the airfare is quoted again an hour later. Most airlines use yield management systems to sell as many seats as possible at the best price. From the airlines' standpoint, it is better to sell a seat at a lower price than to have a plane take off with a vacant seat. At the same time, airlines want to avoid selling a seat for a price lower than what a passenger is willing to pay. Yield management systems are a great example of solving a business problem with IT because they help business managers maximize the revenue generated by each flight.

American Airlines went so far as to sell some of its systems, such as yield management, to other airlines. When asked why, American's then CIO, Max Hopper, said American might as well recover some of its development costs by selling systems to competitors because eventually competitors would develop their own systems. Besides, Hopper believed that by the time lagging competitors such as Delta figured out how to use the systems, American would have reached the next plateau of IT innovation.

Delta's IT Success

Delta always had a reputation in the industry as a slow follower, being reluctant to give up its paper-based systems for modern IT systems. The company did a turnaround when "CIO for Hire" Charlie Feld, a former Frito-Lay CIO, joined Delta in 1997. Feld quickly addressed some of Delta's most pressing IT issues including projects and people in disarray, departments hiring their own IT consultants to develop systems with no attention given to coordination with other Delta systems, as well as the pending Y2K problem. He established a separate wholly owned subsidiary called Delta Technology, and set out to replace Delta's antiquated IT systems with new applications to run the

airline.

Feld began by building the gate and boarding application along with the supporting technical hardware, software, and network infrastructure. The gate and boarding application was chosen because it was most visible to Delta's 104 million passengers. The new system provided gate agents' information on which passengers had checked in, seat assignments, and standby status, and saved an average of 8 to 10 minutes of gate activity per flight. As Chief Technical Officer (CTO) Dean Compton recalled, "I remember when we put in the systems in Jacksonville. I saw an overbooked wide-body 767—where there is normally a lot of confusion around the gate—boarded by two agents on time and ahead of schedule. I'd seen a similar situation in Salt Lake City where we hadn't put in the technology yet, and they had to use nine agents to board the plane, and it still left late."

Delta Technology continued to roll out applications, but by early 2001, the airline industry began to feel the effects of the economic downturn. Delta's board of directors questioned the need to spend additional funds on IT when the airline was under great pressure to reduce its costs. After Delta Technology executives gave an overview of projects they were working on, Vickie Escarra, the chief marketing officer, spoke up in support of the IT initiatives like the gate and boarding application by saying, "Man, we couldn't have done what we're doing today if it wasn't for the technology." The overview from IT coupled with the endorsement from a satisfied business unit customer convinced the board that the IT projects should proceed. They insisted, however, that all projects be supported and justified by a solid business case analysis with emphasis placed on either lowered operating costs or increased revenues.

After September 11, 2001, when traffic fell off even more, Delta began to postpone projects showing a longer payoff (like new HR systems) and to speed up projects showing a faster payoff (like increasing the number of self-service check-in kiosks and replacing call center technology).

Currently, Delta processes almost 300 million transactions on its IT infrastructure each month. The company installed SAP software for inventory management, but altered the "flight plan" for Delta's new technology platform. "Today, we're working only on projects that pay off in 12 months and have ongoing impact for at least three years—either building revenue or lowering operating costs," said current CIO Curtis Robb. "I see this work going on for another five years. We'll be done when we run out of ideas."

Delta's Problems

Even after making great strides through IT, Delta could not shake financial woes caused by the 9/11 terrorist attacks

and high oil prices. By staving off bankruptcy for a year, the carrier thought it was taking the high road. Unfortunately, it has not worked out that way. Delta CEO Gerald Grinstein stood before 1,700 retirees—men and women whose benefits and pensions will be slashed in Chapter 11 proceedings—and swore he shared their pain. "Bankruptcy is beyond strange," he told them in late 2005 at an Atlanta convention center. "I now know why we fought so hard to avoid it."

It is amazing that his remarks did not spark a riot. After all, Chapter 11 has become a last-resort management tool: a way for airlines to slash labor costs, offload pension obligations, dump unwanted jets, and reemerge as moneymakers. United Airlines, for instance, which exited bankruptcy in early 2006 after more than three years, projected more than $1 billion in profits by 2007. Yet Delta's retirees ended up giving the 73-year-old Grinstein, who outlined the airline's financial straits but made no promises about their benefits, a standing ovation. "That took a lot for [him] to be willing to come over and answer our questions," explains Cathy Cone, a retired flight attendant. While the Delta "family," as its workforce still calls itself, evinces plenty of hostility toward Grinstein's predecessor Leo Mullin, the current management team has avoided most of the blame.

Bankruptcies are notoriously unpredictable, and Delta's is still early in the process. CFO Edward Bastian insists the airline has a leg up on previous legacy carriers in Chapter 11, having entered it "with a transformation plan we've been working on for the past two years." The carrier also has an ace in the hole: GE, the world's biggest aircraft lessor and a major jet-engine maker. Sometimes called the "patron saint of failing airlines," GE knows that liquidations are bad for business. It helped keep US Airways aloft until that carrier finally merged with America West, and it is unlikely to let the third-biggest U.S. carrier disappear. (GE is already the lead provider of Delta's bankruptcy financing.) The real question is whether Delta's management will get its strategy together in time to ensure a post-Chapter 11 existence as a stand-alone carrier or whether Delta will survive only as part of another airline.[27]

Questions

1. What business risks would Delta be taking if it decided not to catch up with industry leaders in using IT to gain a competitive advantage?

2. What competitive advantages can an airline gain by using DSS and EIS?

3. What other industries could potentially benefit from the use of yield management systems?

4. How can American and United use customer information to gain a competitive advantage?

5. What types of metrics would Delta executives want to see in a digital dashboard?

6. How could Delta use supply chain management to improve its operations?

MAKING BUSINESS DECISIONS

1. Making decisions

You are the vice president of human resources for a large consulting company. You are compiling a list of questions that you want each interviewee to answer. The first question on your list is, "How can information technology enhance your ability to make decisions at our organization?" Prepare a one-page report to answer this difficult question.

2. DSS and EIS

Dr. Rosen runs a large dental conglomerate—Teeth Doctors—that staffs more than 700 dentists in six states. Dr. Rosen is interested in purchasing a competitor called Dentix that has 150 dentists in three additional states. Before deciding whether to purchase Dentix,

Dr. Rosen must consider several issues:

- The cost of purchasing Dentix.
- The location of the Dentix offices.
- The current number of customers per dentist, per office, and per state.
- The merger between the two companies.
- The professional reputation of Dentix.
- Other competitors.

Explain how Dr. Rosen and Teeth Doctors can benefit from the use of information systems to make an accurate business decision in regard to the potential purchase of Dentix.

3. SCM, CRM, and ERP

Jamie Ash is interested in applying for a job at a large software vendor. One of the criteria for the job is a detailed understanding of strategic initiatives such as SCM, CRM, and ERP. Jamie has no knowledge of any of these initiatives and cannot even explain what the acronyms mean. Jamie has come to you for help. She would like you to compile a summary of the three initiatives, including an analysis of how the three are similar and how they are

different. Jamie would also like to perform some self-training via the Web so be sure to provide her with several additional links to key Web sites that offer detailed overviews on SCM, CRM, and ERP.

4. Finding information on decision support systems

You are working on the sales team for a small catering company that maintains 75 employees and generates $1 million in revenues per year. The owner, Pam Hetz, wants to understand how she can use decision support systems to help grow her business. Pam has an initial understanding of DSS systems and is interested in learning more about what types are available, how they can be used in a small business, and the cost associated with different DSS systems. In a group, research the Web site www.dssresources.com and compile a presentation that discusses DSS systems in detail. Be sure to answer all Pam's questions on DSS systems in the presentation.

5. Gaining business intelligence from strategic initiatives

You are a new employee in the customer service department at Premier One, a large pet food distributor. The company, founded by several veterinarians, has been in business for three years and focuses on providing nutritious pet food at a low cost. The company currently has 90 employees and operates in seven states. Sales over the past three years have tripled, and the manual systems currently in place are no longer sufficient to run the business. Your first task is to meet with your new team and create a presentation for the president and CEO describing supply chain management, customer relationship management, and enterprise resource planning systems. The presentation should highlight the main benefits Premier One can receive from these strategic initiatives along with any additional added business value that can be gained from the systems.

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E-Business

CHAPTER OUTLINE

SECTION 3.1

Business and the Internet

Disruptive Technology

Evolution of the Internet

Accessing Internet Information

Providing Internet Information

SECTION 3.2

E-Business

E-Business Basics

E-Business Models

Organizational Strategies for E-Business

Measuring E-Business Success

E-Business Benefits and Challenges

New Trends in E-Business: E-Government and M-Commerce

opening case study

Amazon.com—Not Your Average Bookstore

Jeffrey Bezos, CEO and founder of Amazon.com, is running what some people refer to as the "world's biggest bookstore." The story of Bezos's virtual bookstore teaches many lessons about online business. Out of nowhere, this digital bookstore turned an industry upside down. What happened here was more than just creating a Web site. Bezos conceived and implemented an intelligent, global digital business. Its business is its technology; its technology is its business. Shocking traditional value chains in the bookselling industry, Amazon opened thousands

of virtual bookstores in its first few months of operation.

Bezos graduated from Princeton and was the youngest vice president at Banker's Trust in New York. He had to decide if he would stay and receive his 1994 Wall Street bonus or leave and start a business on the Internet. "I tried to imagine being 80 years old, looking back on my life. I knew that I would hardly regret having missed the 1994 Wall Street bonus. But having missed being part of the Internet boom—that would have really hurt," stated Bezos. One evening he compiled a list of 20 products he believed would sell on the Internet. Books, being small-ticket items that are easy and inexpensive to ship, were on the top of the list. It was also apparent that no bookstore could conceivably stock more than a fraction of the 5 million books published annually. Bezos, who had never sold a book in his life, developed a strategic plan for selling books on the Internet. Amazon launched three years later. In the fall of 1994, Amazon filled its first book order—personally packaged by Bezos and his wife.

Amazon's E-Business Strategy

Amazon does not operate any physical stores. All of its sales occur through its Web site. It is consistently pushing the technological envelope in its search to provide a satisfying, personalized experience for its customers. What started as a human-edited list of product suggestions morphed into a sophisticated computer-generated recommendation engine. The company captures the comments and recommendations of buyers for site visitors to read—similar to the friendly salesperson in a store offering advice on which books to buy. The Web site tracks customer traffic, the number of visitors who access the site, how long they stay, what pages they click on, and so forth. The company uses the information to evaluate buying and selling patterns and the success of promotions. Amazon has quickly become a model success story for e-businesses around the globe.

Amazon retains customers with Web site features such as personalized recommendations, online customer reviews, and "1-click ordering"—the creation of a true one-stop shopping establishment where customers can find anything they want to buy online. Through the Amazon.com Auctions, zShops (independent third-party sellers), and more recently the Amazon.com Marketplace (where customers can sell used items), the company is able to offer its customers almost everything.

Shaping Amazon's Future

Amazon released a free Web service that enables its business partners (whom Amazon calls "associates") to interact with its Web site. More specifically, this Web service allows its partners to access catalog data, to create and

populate an Amazon.com shopping cart, and even to initiate the checkout process. In 16 months, the company has inspired 30,000 associates to invent new ways to extend Amazon's visibility on the Internet. With over 30 million customers, Amazon has become a household brand.[1]

INTRODUCTION

One of the biggest forces changing business is the Internet. Technology companies such as Intel and Cisco were among the first to seize the Internet to overhaul their operations. Intel deployed Web-based automation to liberate its 200 salesclerks from tedious order-entry positions. Instead, salesclerks concentrate on customer relationship management functions such as analyzing sales trends and pampering customers. Cisco handles 75 percent of its sales online, and 45 percent of online orders never touch employees' hands. This type of Internet-based ordering has helped Cisco hike productivity by 20 percent over the past two years.[2]

E-business is the conducting of business on the Internet, not only buying and selling, but also serving customers and collaborating with business partners. Organizations realize that putting up simple Web sites for customers, employees, and partners does not create an e-business. E-business Web sites must create a buzz, much as Amazon has done in the bookselling industry. E-business Web sites must be innovative, add value, and provide useful information. In short, the site must build a sense of community and collaboration, eventually becoming the port of entry for business. Understanding e-business begins with understanding:

■ Disruptive technology.

■ Evolution of the Internet.

■ Accessing Internet information.

■ Providing Internet information.

section 3.1 BUSINESS AND THE INTERNET

LEARNING OUTCOMES

3.1. Compare disruptive and sustaining technologies.

3.2. Explain how the Internet caused disruption among businesses.

3.3. Define the relationship between the Internet and the World Wide Web.

3.4. Describe the different methods an organization can use to access information.

3.5. Compare the three different types of service providers.

DISRUPTIVE TECHNOLOGY

Polaroid, founded in 1937, produced the first instant camera in the late 1940s. The Polaroid camera was one of the most exciting technological advances the photo-graphy industry had ever seen. By using a Polaroid camera, customers no longer had to depend on others to develop their pictures. The technology was innovative and the product was high-end. The company eventually went public, becoming one of Wall Street's most prominent enterprises, with its stock trading above $60 in 1997. In 2002, the stock was down to 8 cents and the company declared bankruptcy.[3]

How could a company like Polaroid, which had innovative technology and a captive customer base, go bankrupt? Perhaps company executives failed to use Porter's Five Forces to analyze the threat of substitute products or services. If they had, would they have noticed the two threats, one-hour film processing and digital cameras, that eventually stole Polaroid's market share? Would they have understood that their customers, people who want instant access to their pictures without having a third party involved, would be the first to use one-hour film processing and the first to purchase digital cameras? Could the company have found a way to compete with one-hour film processing and the digital camera to save Polaroid?

Most organizations face the same dilemma as Polaroid—the criteria an organization uses to make business decisions for its present business could possibly create issues for its future business. Essentially, what is best for the current business could ruin it in the long term. Some observers of our business environment have an ominous vision of the future—digital Darwinism. ***Digital Darwinism*** implies that organizations which cannot adapt to the new demands placed on them for surviving in the information age are doomed to extinction.[4]

Disruptive versus Sustaining Technology

A ***disruptive technology*** is a new way of doing things that initially does not meet the needs of existing customers. Disruptive technologies tend to open new markets and destroy old ones. A ***sustaining technology***, on the other hand, produces an improved product customers are eager to buy, such as a faster car or larger hard drive. Sustaining technologies tend to provide us with better, faster, and cheaper products in established markets. Incumbent companies most often lead sustaining technology to market, but virtually never lead in markets opened by disruptive technologies. Figure 3.1 displays companies that are expecting future growth to occur from new investments

(disruptive technology) and companies that are expecting future growth to occur from existing investments (sustaining technology).

Disruptive technologies typically cut into the low end of the marketplace and eventually evolve to displace high-end competitors and their reigning technologies. Sony is a perfect example of a company that entered the low end of the marketplace and eventually evolved to displace its high-end competitors. Sony started as a tiny company that built portable, battery-powered transistor radios people could carry around with them. The sound quality of Sony's transistor radios was poor because the transistor amplifiers were of lower quality than traditional vacuum tubes, which produce a better sound. But, customers were willing to overlook sound quality for the convenience of portability. With the experience and revenue stream from the portables, Sony improved its technology to produce cheap, low-end transistor amplifiers that were suitable for home use and invested those revenues to improve the technology further, which produced better radios.[5]

Figure 3.1

Disruptive versus Sustaining Technology

Fortune 500 Rank	Company	Expected Returns on New Investment	Expected Returns on Existing Investments
53	Dell Computer	78%	22%
47	Johnson & Johnson	66	34
35	Procter & Gamble	62	38
6	General Electric	60	40
77	Lockheed Martin	59	41
1	Wal-Mart	50	50

65	Intel	49	51
49	Pfizer	48	52
9	IBM	46	54
24	Merck	44	56
92	Cisco Systems	42	58
18	Home Depot	37	63
16	Boeing	30	70
11	Verizon	21	79
22	Kroger	13	87
32	Sears Roebuck	8	92
37	AOL Time Warner	8	92
3	General Motors	5	95
81	Phillips Petroleum	3	97

FIGURE 3.2

Companies That Capitalized on Disruptive Technology

Company	Disruptive Technology
Charles Schwab	Online brokerage
Hewlett-Packard	Microprocessor-based computers; ink-jet printers
IBM	Minicomputers; personal computers

Intel	Low-end microprocessors
Intuit	QuickBooks software; TurboTax software; Quicken software
Microsoft	Internet-based computing; operating system software; SQL and Access database software
Oracle	Database software
Quantum	3.5-inch disks
Sony	Transistor-based consumer electronics

The *Innovator's Dilemma*, a book by Clayton M. Christensen, discusses how established companies can take advantage of disruptive technologies without hindering existing relationships with customers, partners, and stakeholders. Xerox, IBM, Sears, and DEC all listened to existing customers, invested aggressively in technology, had their competitive antennae up, and still lost their market-dominant positions. Christensen states that these companies may have placed too much emphasis on satisfying customers' current needs, while neglecting to adopt new disruptive technology that will meet customers' future needs, thus causing the companies to eventually lose market share. Figure 3.2 highlights several companies that launched new businesses by capitalizing on disruptive technologies.[6]

The Internet—Business Disruption

When the Internet was in its early days, no one had any idea how massive it would become. Computer companies did not think it would be a big deal; neither did the phone companies or cable companies. Difficult to access and operate, it seemed likely to remain an arcane tool of the Defense Department and academia. However, the Internet grew, and grew, and grew. It began with a handful of users in the mid-1960s and reached 1 billion by 2005 (see Figure 3.3). Estimates predict there will be more than 3 billion Internet users by 2010. Already, villages in Indonesia and India have Internet access before they have electricity.[7] Figure 3.4 displays several ways the Internet is changing business.

EVOLUTION OF THE INTERNET

During the Cold War in the mid-1960s, the U.S. military decided it needed a bombproof communications system, and thus the concept for the Internet was born. The system would link computers throughout the country, allowing messages to get though even if a large section of the country was destroyed. In the early days, the only linked computers were at government think tanks and a few universities. The Internet was essentially an emergency military communications system operated by the Department of Defense's Advanced Research Project Agency (ARPA) and called ARPANET. Formally defined, the *Internet* is a global public network of computer networks that pass information from one to another using common computer protocols. *Protocols* are standards that specify the format of data as well as the rules to be followed during transmission.

FIGURE 3.3

Worldwide Internet Usage Statistics

Internet Usage Statistics–The Big Picture World Internet Users and Population Statistics					
Region	**Population (2006)**	**% of World Population**	**Internet Users**	**Internet Penetration (% of Population)**	**% of World Usage**	**Usage Growth. 2000–2005**
Africa	915,210,928	14.1%	22,737,500	2.5%	2.2%	403.7%
Asia	3,667,774,066	56.4	364,270,713	9.9	35.7	218.7
Europe	807,289,020	12.4	290,121,957	35.9	28.5	176.1
Middle East	190,084,161	2.9	18,203,500	9.6	1.8	454.2
North	331,473,276	5.1	225,801,42	68.1	22.2	108.9

America			8			
Latin America/Caribbean	553,908,632	8.5	79,033,597	14.3	7.8	337.4
Oceania/Australia	33,956,977	0.5	17,690,762	52.9	1.8	132.2
WORLD TOTAL	**6,499,697,060**	**100%**	**1,017,859,457**	**15.7%**	**100%**	**182%**

FIGURE 3.4

The Internet's Impact on Business

Industry	Business Changes Due to Technology
Travel	Travel site Expedia.com is now the biggest leisure-travel agency, with higher profit margins than even American Express. Thirteen percent of traditional travel agencies closed in 2002 because of their inability to compete with online travel.
Entertainment	The music industry has kept Napster and others from operating, but $35 billion annual online downloads are wrecking the traditional music business. U.S. music unit sales are down 20 percent since 2000. The next big entertainment industry to feel the effects of e-business will be the $67 billion movie business.
Electronics	Using the Internet to link suppliers and customers, Dell dictates industry profits. Its operating margins have risen from 7.3 percent in 2002 to 8 percent in 2003, even as it takes prices to levels where rivals cannot make money.
Financial services	Nearly every public e-finance company left makes money, with online mortgage service Lending

	Tree growing 70 percent a year. Processing online mortgage applications is now 40 percent cheaper for customers.
Retail	Less than 5 percent of retail sales occur online. eBay is on track this year to become one of the nation's top 15 retailers, and Amazon.com will join the top 40. Wal-Mart's e-business strategy is forcing rivals to make heavy investments in technology.
Automobiles	The cost of producing vehicles is down because of SCM and Web-based purchasing. eBay has become the leading U.S. used-car dealer, and most major car sites are profitable.
Education and training	Cisco saved $133 million last year by moving training sessions to the Internet, and the University of Phoenix online college classes please investors.

In time, every university in the United States that had defense-related funding installed ARPANET computers. Gradually, the Internet moved from a military pipeline to a communications tool for scientists. As more scholars came online, system administration transferred from ARPA to the National Science Foundation. Years later, businesses began using the Internet, and the administrative responsibilities were once again transferred. Today, no one party operates the Internet; however, several entities oversee the Internet and set standards including:

■ Internet Engineering Task Force (IETF): The protocol engineering and development arm of the Internet.

■ Internet Architecture Board (IAB): Responsible for defining the overall architecture of the Internet, providing guidance and broad direction to the IETF.

■ Internet Engineering Steering Group (IESG): Responsible for technical management of IETF activities and the Internet standards process.

Evolution of the World Wide Web

People often interchange the terms *Internet* and the *World Wide Web*, but these terms are not synonymous. Throughout the 1960s, 1970s, and 1980s, the Internet was primarily used by the Department of Defense to support activities such as e-mail and transferring files. The Internet was restricted to noncommercial activities, and its users included government employees, researchers, university professors, and students. The World Wide Web changed the purpose and use of the Internet.

The ***World Wide Web (WWW)*** is a global hypertext system that uses the Internet as its transport mechanism.

Hypertext transport protocol (HTTP) is the Internet standard that supports the exchange of information on the WWW. By defining universal resource locators (URLs) and how they can be used to retrieve resources anywhere on the Internet, HTTP enables Web authors to embed hyperlinks in Web documents. HTTP defines the process by which a Web client, called a browser, originates a request for information and sends it to a Web server, a program designed to respond to HTTP requests and provide the desired information. In a hypertext system, users navigate by clicking a hyperlink embedded in the current document. The action displays a second document in the same or a separate browser window. The Web has quickly become the ideal medium for publishing information on the Internet and serves as the platform for the electronic economy. Figure 3.5 displays the reasons for the popularity and growth in the WWW.

The WWW remained primarily text-based until 1991 when two events occurred that would forever change the Web and the amount and quality of information available (see Figure 3.6). First, Tim Berners-Lee built the first Web site on August 6, 1991 (http://info.cern.ch/—the site has been archived). The site provided details about the World Wide Web including how to build a browser and set up a Web server. It also housed the world's first Web directory, since Berners-Lee later maintained a list of other Web sites apart from his own.[8]

FIGURE 3.5

Reasons for World Wide Web Growth

Reasons for Growth of the World Wide Web
■ The microcomputer revolution made it possible for an average person to own a computer.
■ Advancements in networking hardware, software, and media made it possible for business PCs to be inexpensively connected to larger networks.
■ Browser software such as Microsoft's Internet Explorer and Netscape Navigator gave computer users an easy-to-use graphical interface to find, download, and display Web pages.
■ The speed, convenience, and low cost of e-mail have made it an incredibly popular tool

for business and personal communications.
■ Basic Web pages are easy to create and extremely flexible.

FIGURE 3.6

The Internet's Impact on Information

Internet's Impact on Information	
Easy to compile	Searching for information on products, prices, customers, suppliers, and partners is faster and easier when using the Internet.
Increased richness	*Information richness* refers to the depth and breadth of information transferred between customers and businesses. Businesses and customers can collect and track more detailed information when using the Internet.
Increased reach	*Information reach* refers to the number of people a business can communicate with, on a global basis. Businesses can share information with numerous customers all over the world.
Improved content	A key element of the Internet is its ability to provide dynamic relevant content. Buyers need good content descriptions to make informed purchases, and sellers use content to properly market and differentiate themselves from the competition. Content and product description establish the common understanding between both parties to the transaction. As a result, the reach and richness of that content directly affects the transaction.

FIGURE 3.7

File Formats Offered over the WWW

Second, Marc Andreesen developed a new computer program called the NCSA Mosaic (National Center for

Supercomputing Applications at the University of Illinois) and gave it away! The browser made it easier to access the Web sites that had started to appear. Soon Web sites contained more than just text; they also had sound and video files (see Figure 3.7). These pages, written in the hypertext markup language (HTML), have links that allow the user to quickly move from one document to another, even when the documents are stored in different computers. Web browsers read the HTML text and convert it into a Web page.[9]

By eliminating time and distance, the Internet makes it possible to perform business in ways not previously imaginable. The *digital divide* is when those with access to technology have great advantages over those without access to technology. People living in the village of Siroha, India, must bike five miles to find a telephone. For over 700 million rural people living in India, the digital divide was a way of life, until recently. Media Lab Asia sells telephony and e-mail services via a mobile Internet kiosk mounted on a bicycle, which is known as an "info-thelas." The kiosk has an onboard computer equipped with an antenna for Internet service and a specially designed all-day battery. Over 2,000 villages have purchased the kiosk for $1,200, and another 600,000 villages are interested.[10]

ACCESSING INTERNET INFORMATION

Many restaurant and franchise experts believe that Cold Stone Creamery's franchisee intranet is what keeps the company on the fast track. Franchisee owners communicate with other owners through Creamery Talk, the company's intranet-based chat room. Since it launched, Creamery Talk has turned into a franchisee's black book, with tips on everything from storefront design to equipment repair. When one owner's freezer broke recently, a post to the chat room turned up an easy fix involving a $21 motor fan.

Four common tools for accessing Internet information include:

- Intranet
- Extranet
- Portal
- Kiosk

Intranet

An *intranet* is an internalized portion of the Internet, protected from outside access, that allows an organization to provide access to information and application software to only its employees. An intranet is an invaluable tool for presenting organizational information as it provides a central location where employees can find information. It can

host all kinds of company-related information such as benefits, schedules, strategic directions, and employee directories. At many companies, each department has its own Web page on the intranet for departmental information sharing. An intranet is not necessarily open to the external Internet and enables organizations to make internal resources available using familiar Internet clients, such as Web browsers, newsreaders, and e-mail.

Intranet publishing is the ultimate in electronic publishing. Companies realize significant returns on investment (ROI) simply by publishing information, such as employee manuals or telephone directories, on intranets rather than printed media.

Citigroup's Global Corporate and Investment Banking division uses an intranet to provide its entire IT department with access to all IT projects including information on project owners, delivery dates, key resources, budget information, and project metrics. Providing this information via an intranet, or one convenient location, has enabled Citigroup to gain a 15 percent improvement in IT project delivery.[11]

Extranet

An *extranet* is an intranet that is available to strategic allies (such as customers, suppliers, and partners). Many companies are building extranets as they begin to realize the benefit of offering individuals outside the organization access to intranet-based information and application software such as order processing. Having a common area where employees, partners, vendors, and customers access information can be a major competitive advantage for an organization.

Wal-Mart created an extranet for its suppliers, which can view detailed product information at all Wal-Mart locations. Suppliers log on to Wal-Mart's extranet and view metrics on products such as current inventory, orders, forecasts, and marketing campaigns. This helps Wal-Mart's suppliers maintain their supply chains and ensure Wal-Mart never runs out of products.[12]

Portal

Portal is a very generic term for what is in essence a technology that provides access to information. A *portal* is a Web site that offers a broad array of resources and services, such as e-mail, online discussion groups, search engines, and online shopping malls. There are general portals and specialized or niche portals. Leading general portals include Yahoo!, Netscape, Microsoft, and America Online. Examples of niche portals include Garden.com (for gardeners), Fool.com (for investors), and SearchNetworking.com (for network administrators).

Pratt & Whitney, one of the largest aircraft-engine manufacturers in the world, has saved millions of dollars with its field service portal initiative. Pratt & Whitney's sales and service field offices are geographically scattered around the globe and were connected via expensive dedicated lines. The company saved $2.6 million annually by replacing the dedicated lines with high-speed Internet access to its field service portal. Field staff can find information they need in a fraction of the time it took before. The company estimates this change will save another $8 million per year in "process and opportunity" savings.[13]

Kiosk

A *kiosk* is a publicly accessible computer system that has been set up to allow interactive information browsing. In a kiosk, the computer's operating system has been hidden from view, and the program runs in a full-screen mode, which provides a few simple tools for navigation.

Jason Suker walked into the Mazda showroom in Bountiful, Utah, and quickly found what he was looking for in a car dealership—a Web kiosk, one of six stationed around the showroom. Using the Web kiosk, he could track down the latest pricing information from sites like Kelley Blue Book and Edmunds.com. Suker, eyeing a four-year-old limited-edition Miata in mint condition, quickly pulled up the average retail price on Kelley Blue Book. At $16,000, it was $500 more than the dealer's price. Then, on eBay, Suker checked bids for similar models and found they were going for far less. With a sales representative looking over his shoulder to confirm his findings, the skeptical Suker made a lowball offer and expected the worst: endless haggling over price. However, the sales representative, after commending Suker for his research talent, eventually compromised and offered up the Miata for $13,300.

It was an even better deal for Bountiful Mazda. By using a kiosk to help Suker find the bargain price he wanted, the dealership moved a used car (with a higher profit margin than a new model) and opened the door to the unexpected up-sell with a $1,300, 36,000-mile service warranty.[14]

PROVIDING INTERNET INFORMATION

British Airways, the $11.9 billion airline, outsourced the automation of its FAQ (frequently asked questions) Web pages. The airline needed to automatically develop, manage, and post different sets of FAQs for British Airway's loyalty program customers, allowing the company to offer special promotions based on the customer's loyalty program status (gold, silver, bronze). The company outsourced the project to application service provider RightNow

Technologies. The new system is helping British Airways create the right marketing programs for the appropriate customer tier.[15]

There are three common forms of service providers including:

1. Internet service provider (ISP).

2. Online service provider (OSP).

3. Application service provider (ASP).

Internet Service Provider

An *Internet service provider (ISP)* is a company that provides individuals and other companies access to the Internet along with additional related services, such as Web site building. An ISP has the equipment and the telecommunication line access required to have a point of presence on the Internet for different geographic areas. Larger ISPs have their own high-speed leased lines so they are less dependent on telecommunication providers and can deliver better service to their customers. Among the largest national and regional ISPs are AT&T WorldNet, IBM Global Network, MCI, Netcom, UUNet, and PSINet.

Navigating the different options for an ISP can be daunting and confusing. There are more than 7,000 ISPs in the United States; some are large with household names, and others are literally one-person operations. Although Internet access is viewed as a commodity service, in reality features and performance can differ tremendously among ISPs. Figure 3.8 highlights common ISP features.

FIGURE 3.8

Common ISP Services

Common ISP Services
■ **Web hosting.** Housing, serving, and maintaining files for one or more Web sites is a widespread offering.
■ **Hard-disk storage space.** Smaller sites may need only 300 to 500 MB (megabytes) of Web site storage space, whereas other e-business sites may need at least 10 GB (gigabytes) of space or their own dedicated Web server.

- **Availability.** To run an e-business, a site must be accessible to customers 24x7. ISPs maximize the availability of the sites they host using techniques such as load balancing and clustering many servers to reach 100 percent availability.

- **Support.** A big part of turning to an ISP is that there is limited worry about keeping the Web server running. Most ISPs offer 24x7 customer service.

Another member of the ISP family is the *wireless Internet service provider (WISP)*, an ISP that allows subscribers to connect to a server at designated hotspots or access points using a wireless connection. This type of ISP offers access to the Internet and the Web from anywhere within the zone of coverage provided by an antenna. This is usually a region with a radius of one mile. Figure 3.9 displays a brief overview of how this technology works.

One example of a WISP is T-Mobile International, a company that provides access to wireless laptop users in more than 2,000 locations including airports, airline clubs, Starbucks coffeehouses, and Borders Books. A wireless service called T-Mobile HotSpot allows customers to access the Internet and T-Mobile's corporate intranet via a wireless network from convenient locations away from their home or office. T-Mobile International is the first mobile communications company to extend service on both sides of the Atlantic, offering customers the advantage of using their wireless services when traveling worldwide.[16]

FIGURE 3.9

Wireless Access Diagram

Online Service Provider

An *online service provider (OSP)* offers an extensive array of unique services such as its own version of a Web browser. The term *online service provider* helps to distinguish ISPs that offer Internet access and their own online content, such as America Online (AOL), from ISPs that simply connect users directly with the Internet, such as EarthLink. Connecting to the Internet through an OSP is an alternative to connecting through one of the national ISPs, such as AT&T or MCI, or a regional or local ISP.

Application Service Provider

An *application service provider (ASP)* is a company that offers an organization access over the Internet to systems

and related services that would otherwise have to be located in personal or organizational computers. Employing the services of an ASP is essentially outsourcing part of a company's business logic. Hiring an ASP to manage a company's software allows the company to hand over the operation, maintenance, and upgrade responsibilities for a system to the ASP.

FIGURE 3.10

Top ISPs, OSPs, and ASPs

Company	Description	Specialty
Appshop www.appshop.com	Application service provider	Oracle 11i e-business suite applications
BlueStar Solutions www.bluestarsolutions.com	Application service provider	Managing ERP solutions with a focus on SAP
Concur www.concur.com	Internet service provider	Integrates B2B procurement
Corio www.corio.com	Application service provider	Specializes in Oracle applications
Employease www.employease.com	Online service provider	Human resource applications services
Intacct www.intacct.com	Online service provider	Online general ledger service
LivePerson www.liveperson.com	Online service provider	Real-time chat provider
NetLedger www.netledger.com	Online service provider	Web based accounting platform
Outtask www.outtask.com	Application service provider	Integration of budgeting, customer service, sales management, and human resources applications
RightNow www.rightnow.com	Online service provider, Internet service provider	Suite of customer service applications

Salesforce.com www.salesforce.com	Online service provider	Suite of customer service applications
Salesnet www.salesnet.com	Online service provider	Suite of sales force automation products and services
Surebridge www.surebridge.com	Application service provider	High-tech manufacturing, distribution, health care applications
UpShot www.upshot.com	Online service provider	Sales force automation products and services
USi www.usinternetworking.com	Application service provider	Ariba, Siebel, Microsoft, and Oracle customer base

One of the most important agreements between the customer and the ASP is the service level agreement. ***Service level agreements (SLAs)*** define the specific responsibilities of the service provider and set the customer expectations. SLAs include such items as availability, accessibility, performance, maintenance, backup/recovery, upgrades, equipment ownership, software ownership, security, and confidentiality. For example, an SLA might state that the ASP must have the software available and accessible from 7:00 a.m. to 7:00 p.m. Monday through Friday. It might also state that if the system is down for more than 60 minutes, there will be no charge for that day. Most industry analysts agree that the ASP market is growing rapidly. International Data Corporation (IDC) estimates the worldwide ASP market will grow from around $13 billion in 2005 to $23 billion by 2008.[17] Figure 3.10 displays the top ISPs, OSPs, and ASPs.

OPENING CASE QUESTIONS

Amazon.com—Not Your Average Bookstore

1. How has Amazon used technology to revamp the bookselling industry?

2. Is Amazon using disruptive or sustaining technology to run its business?

3. How is Amazon using intranets and extranets to run its business?

4. How could Amazon use kiosks to improve its business?

section 3.2 E-BUSINESS

E-BUSINESS BASICS

In 2003, Tom Anderson and Chris DeWolf started MySpace, a social networking Web site that offers its members information about the independent music scene around the country representing both Internet culture and teenage culture. Musicians sign up for free MySpace home pages where they can post tour dates, songs, and lyrics. Fans sign up for their own Web pages to link to favorite bands and friends. As of February 2006, MySpace was the world's fifth most popular English-language Web site with over 60 million users.[18]

FIGURE 3.11

Overview of Several Industries Using E-Business

One of the biggest benefits of the Internet is its ability to allow organizations to perform business with anyone, anywhere, anytime. *E-commerce* is the buying and selling of goods and services over the Internet. E-commerce refers only to online transactions. *E-business*, derived from the term e-commerce, is the conducting of business on the Internet, not only buying and selling, but also serving customers and collaborating with business partners. The primary difference between e-commerce and e-business is that e-business also refers to online exchanges of information. For example, a manufacturer allowing its suppliers to monitor production schedules or a financial institution allowing its customers to review their banking, credit card, and mortgage accounts.

In the past few years, e-business seems to have permeated every aspect of daily life. Both individuals and organizations have embraced Internet technologies to enhance productivity, maximize convenience, and improve communications globally. From banking to shopping to entertainment, the Internet has become integral to daily life. Figure 3.11 provides examples of a few of the industries using e-business.

E-BUSINESS MODELS

A *e-business model* is an approach to conducting electronic business on the Internet. E-business transactions take place between two major entities—businesses and consumers. All e-business activities happen within the framework of two types of business relationships: (1) the exchange of products and services between businesses (business-to-business, or B2B) and (2) the exchange of products and services with consumers (business-to-consumer, or B2C) (see Figure 3.12).

The primary difference between B2B and B2C are the customers; B2B customers are other businesses while B2C markets to consumers. Overall, B2B relations are more complex and have higher security needs; plus B2B is the dominant e-business force, representing 80 percent of all online business.[19] Figure 3.13 illustrates all the e-business models: Business-to-business, business-to-consumer, consumer-to-consumer, and consumer-to-business.

Business-to-Business (B2B)

Business-to-business (B2B) applies to businesses buying from and selling to each other over the Internet. Online access to data, including expected shipping date, delivery date, and shipping status, provided either by the seller or a third-party provider is widely supported by B2B models. Electronic marketplaces represent a new wave in B2B e-business models. *Electronic marketplaces*, or *e-marketplaces*, are interactive business communities providing a central market where multiple buyers and sellers can engage in e-business activities (see Figure 3.14). They present structures for conducting commercial exchange, consolidating supply chains, and creating new sales channels. Their primary goal is to increase market efficiency by tightening and automating the relationship between buyers and sellers. Existing e-marketplaces allow access to various mechanisms in which to buy and sell almost anything, from services to direct materials.

FIGURE 3.12

Basic E-Business Models

FIGURE 3.13

E-Business Models

FIGURE 3.14

Business-to-Business E-Marketplace Overview

Business-to-Consumer (B2C)

Business-to-consumer (B2C) applies to any business that sells its products or services to consumers over the

Internet. Carfax has been in the vehicle history report business for 20 years with an original customer base of used-car dealers. "The Inter-net was just a new way for us to reach the consumer market," Carfax President Dick Raines said. Carfax spent $20 million on print and TV ads to attract customers to its Web site. Customers can purchase a Carfax report for $14.95 or six days of reports for $19.95. Carfax has now launched a partnership program for small auto dealers' Web sites and a cash-back program offering customers 20 percent of revenues received for their referrals. "We continue to look for more and more ways to add value," Raines said.[20] Common B2C e-business models include e-shops and e-malls.

E-Shop An *e-shop*, sometimes referred to as an *e-store* or *e-tailer*, is a version of a retail store where customers can shop at any hour of the day without leaving their home or office. These online stores sell and support a variety of products and services. The online businesses channeling their goods and services via the Internet only, such as Amazon.com, are called pure plays. The others are an extension of traditional retail outlets that sell online as well as through a traditional physical store. They are generally known as "bricks and clicks" or "click and mortar" organizations, such as the Gap (www.gap.com) and Best Buy (www.bestbuy.com) (see Figure 3.15).

E-Mall An *e-mall* consists of a number of e-shops; it serves as a gateway through which a visitor can access other e-shops. An e-mall may be generalized or specialized depending on the products offered by the e-shops it hosts. Revenues for e-mall operators include membership fees from participating e-shops, advertising, and possibly a fee on each transaction if the e-mall operator also processes payments. E-shops in e-malls benefit from brand reinforcement and increased traffic as visiting one shop on the e-mall often leads to browsing "neighboring" shops. An example of an e-mall is the Arizona e-mall www.1az1.com/shopping.

FIGURE 3.15

Types of Businesses

Business Types	
Brick-and-mortar business	A business that operates in a physical store without an Internet presence.
Pure-play (virtual) business	A business that operates on the Internet only without a physical store. Examples include Amazon.com and

	Expedia.com.
Click-and-mortar business	A business that operates in a physical store and on the Internet. Examples include REI and Barnes and Noble.

FIGURE 3.16

Online Auctions

Online Auctions	
Electronic Auction (e-auction)	Sellers and buyers solicit consecutive bids from each other and prices are determined dynamically.
Forward Auction	An auction that sellers use as a selling channel to many buyers and the highest bid wins.
Reverse Auction	An auction that buyers use to purchase a product or service, selecting the seller with the lowest bid.

FIGURE 3.17

C2C Communities

C2C Communities
■ **Communities of interest**—People interact with each other on specific topics, such as golfing and stamp collecting.
■ **Communities of relations**—People come together to share certain life experiences, such as cancer patients, senior citizens, and car enthusiasts.
■ **Communities of fantasy**—**People participate in** imaginary environments, such as fantasy football teams and playing one-on-one with Michael Jordan.

Consumer-to-Business (C2B)

Consumer-to-business (C2B) applies to any consumer that sells a product or service to a business over the Internet. One example of this e-business model is Priceline.com where bidders (or customers) set their prices for items such as airline tickets or hotel rooms, and a seller decides whether to supply them. The demand for C2B e-business will increase over the next few years due to customer's desire for greater convenience and lower prices.

Consumer-to-Consumer (C2C)

Consumer-to-consumer (C2C) applies to sites primarily offering goods and services to assist consumers interacting with each other over the Internet. eBay, the Internet's most successful C2C online auction Web site, links like-minded buyers and sellers for a small commission. Figure 3.16 displays the different types of online auctions.

C2C online communities, or virtual communities, interact via e-mail groups, Web-based discussion forums, or chat rooms. C2C business models are consumer-driven and opportunities are available to satisfy most consumers' needs, ranging from finding a mortgage to job hunting. They are global swap shops based on customer-centered communication. One C2C community, KazaA, allows users to download MP3 music files, enabling users to exchange files. Figure 3.17 highlights the different types of C2C communities that are thriving on the Internet.

ORGANIZATIONAL STRATEGIES FOR E-BUSINESS

To be successful in e-business, an organization must master the art of electronic relationships. Traditional means of customer acquisition such as advertising, promotions, and public relations are just as important with a Web site. Primary business areas taking advantage of e-business include:

- Marketing/sales
- Financial services
- Procurement
- Customer service
- Intermediaries

Marketing/Sales

Direct selling was the earliest type of e-business and has proven to be a stepping-stone to more complex commerce operations. Successes such as eBay, Barnes and Noble, Dell Inc., and Travelocity have sparked the growth of this segment, proving customer acceptance of e-business direct selling. Marketing and sales departments are initiating some of the most exciting e-business innovations (see Figure 3.18).

Cincinnati's WCPO-TV was a ratings blip in 2002 and is now the number three ABC affiliate in the nation. WCPO-TV credits its success largely to digital billboards that promote different programming depending on the time of day. The billboards are updated directly from a Web site. The station quickly noticed that when current events for the early-evening news were plugged during the afternoon, ratings spiked.

The digital billboards let several companies share one space and can change messages directly from the company's computer. In the morning, a department store can advertise a sale, and in the afternoon, a restaurant can advertise its specials. Eventually customers will be able to buy billboard sign time in hour or minute increments. Current costs to share a digital billboard are $40,000 a month, compared with $10,000 for one standard billboard.[21]

E-business provides an easy way to penetrate a new geographic territory and extend global reach. Large, small, or specialized businesses can use their online sales sites to sell on a worldwide basis with little extra cost. This ability to tap into expanded domestic or even international markets can be an immediate revenue boost to artists, jewelry makers, wineries, and the like, for initial orders and especially for reorders.

The Hotel Gatti (www.hotel-gatti.com) is a small hotel in northern Italy catering primarily to Italian travelers. By introducing its own Web site with English-language options, it significantly extended its geographic reach. Now, at very little cost, the hotel communicates with and takes reservations from potential customers in the United States and other English-speaking countries. The bottom line is that e-business now allows any company to market and sell products globally, regardless of its size.[22]

Financial Services

Financial services Web sites are enjoying rapid growth as they help consumers, businesses, and financial institutions distribute information with greater convenience and richness than is available in other channels. Consumers in e-business markets pay for products and services using a credit card or one of the methods outlined in Figure 3.19. Online business payments differ from online consumer payments because businesses tend to make large purchases (from thousands to millions of dollars) and typically do not pay with a credit card. Businesses make online payments using electronic data interchange (EDI) (see Figure 3.20). Transactions between businesses are complex and typically require a level of system integration between the businesses.

Many organizations are now turning to providers of electronic trading networks for enhanced Internet-based network and messaging services. Electronic trading networks are service providers that manage network services. They support business-to-business integration information exchanges, improved security, guaranteed service levels,

and command center support (see Figure 3.21). As electronic trading networks expand their reach and the number of

Internet businesses continues to grow, so will the need for managed trading services. Using these services allows

organizations to reduce time to market and the overall development, deployment, and maintenance costs associated

with their integration infrastructures.

FIGURE 3.18

Generating Revenue on the Internet through Marketing and Sales Departments

Marketing and Sales E-Business Innovations
■ An *online ad* is a box running across a Web page that is often used to contain advertisements. The banner generally contains a link to the advertiser's Web site. Web-based advertising services can track the number of times users click the banner, generating statistics that enable advertisers to judge whether the advertising fees are worth paying. Banner ads are like living, breathing classified ads.
■ A *pop-up ad* is a small Web page containing an advertisement that appears on the Web page outside of the current Web site loaded in the Web browser. A *pop-under ad* is a form of a pop-up ad that users do not see until they close the current Web browser screen.
■ *Associate programs (affiliate programs)* allow businesses to generate commissions or royalties from an Internet site. For example, a business can sign up as an associate of a major commercial site such as Amazon. The business then sends potential buyers to the Amazon site using a code or banner ad. The business receives a commission when the referred customer makes a purchase on Amazon.
■ *Viral marketing* is a technique that induces Web sites or users to pass on a marketing message to other Web sites or users, creating exponential growth in the message's visibility and effect. One example of successful viral marketing is Hotmail, which promotes its service and its own advertisers' messages in every user's e-mail notes. Viral marketing encourages users of a product or service supplied by an e-business to encourage friends to join. Viral marketing is a word-of-mouth type advertising program.
■ *Mass customization* is the ability of an organization to give its customers the opportunity to tailor its products or

services to the customers' specifications. For example, customers can order M&M's with customized sayings such as "Marry Me."

■ *Personalization* occurs when a Web site can know enough about a person's likes and dislikes that it can fashion offers that are more likely to appeal to that person. Personalization involves tailoring a presentation of an e-business Web site to individuals or groups of customers based on profile information, demographics, or prior transactions. Amazon uses personalization to create a unique portal for each of its customers.

■ A *blog* (the contraction of the phrase "Web log") is a Web site in which items are posted on a regular basis and displayed in reverse chronological order. Like other media, blogs often focus on a particular subject, such as food, politics, or local news. Some blogs function as online diaries. A typical blog combines text, images, and links to other blogs, Web pages, and other media related to its topic. Since its appearance in 1995, blogging has emerged as a popular means of communication, affecting public opinion and mass media around the world.

■ *Real simple syndications (RSS)* is a family of Web feed formats used for Web syndication of programs and content. RSS is used by (among other things) news Web sites, blogs, and podcasting, which allows consumers and journalists to have news constantly fed to them instead of searching for it. In addition to facilitating syndication, RSS allows a Web site's frequent readers to track updates on the site.

■ *Podcasting* is the distribution of audio or video files, such as radio programs or music videos, over the Internet to play on mobile devices and personal computers. Podcasting's essence is about creating content (audio or video) for an audience that wants to listen when they want, where they want, and how they want. Podcasters' Web sites also may offer direct download of their files, but the subscription feed of automatically delivered new content is what distinguishes a podcast from a simple download or real-time streaming. Usually, the podcast features one type of show with new episodes either sporadically or at planned intervals such as daily, weekly, etc.

■ *Search engine optimization (SEO)* is a set of methods aimed at improving the ranking of a Web site in search engine listings. Search engines display different kinds of listings in the search engine results pages (SERPs), including: pay-per-click advertisements, paid inclusion listings, and organic search results. SEO is primarily concerned with

advancing the goals of Web sites by improving the number and position of organic search results for a wide variety of relevant keywords. SEO strategies can increase the number of visitors and the quality of visitors, where quality means visitors who complete the action the site intends (e.g., purchase, sign up, learn something).

SEO, or "white hat SEO," is distinguished from "black hat SEO," or spamdexing, by methods and objectives. *Spamdexing* uses a variety of deceptive techniques in an attempt to manipulate search engine rankings, whereas legitimate SEO focuses on building better sites and using honest methods of promotion. What constitutes an honest, or ethical, method is an issue that has been the subject of numerous debates.

FIGURE 3.19

Types of Online Consumer Payments

Online Consumer Payments	
Financial cybermediary	A *financial cybermediary* is an Internet-based company that facilitates payments over the Internet. PayPal is the best-known example of a financial cybermediary.
Electronic check	An *electronic check* is a mechanism for sending a payment from a checking or savings account. There are many implementations of electronic checks, with the most prominent being online banking.
Electronic bill presentment and payment (EBPP)	An *electronic bill presentment and payment (EBPP)* is a system that sends bills over the Internet and provides an easy-to-use mechanism (such as clicking on a button) to pay the bill. EBPP systems are available through local banks or online services such as Checkfree and Quicken.
Digital wallet	A *digital wallet* is both software and information—the software provides security for the transaction and the

	information includes payment and delivery information (for example, the credit card number and expiration date).

Traders at Vanguard Petroleum Corporation spent most days on the phone, patrolling the market for pricing and volume information in order to strike the best possible deal. The process was slow and tied up traders on one negotiation at a time, making it inherently difficult to stay on top of quickly changing prices. One winter, for example, the weather got cold and stayed cold, causing propane prices to increase dramatically. The price was moving so fast that Vanguard was missing opportunities to buy, sell, and execute deals since it was able to complete only one deal at a time.

To bridge these shortcomings and speed the process, Vanguard became one of the first users of Chalkboard, a commodity markets electronic trading network that is now part of ChemConnect, a B2B e-marketplace. Vanguard uses Chalkboard to put bids and offers in front of hundreds of traders and complete various trades at multiple delivery points simultaneously. Vanguard now completes deals in real-time and is able to access a broader audience of buyers and sellers.[23]

Procurement

Web-based procurement of maintenance, repair, and operations (MRO) supplies is expected to reach more than $200 billion worldwide by the year 2009. ***Main-tenance, repair, and operations (MRO) materials*** (also called ***indirect materials***) are materials necessary for running an organization but do not relate to the company's primary business activities. Typical MRO goods include office supplies (such as pens and paper), equipment, furniture, computers, and replacement parts. In the traditional approach to MRO purchasing, a purchasing manager would receive a paper-based request for materials. The purchasing manager would need to search a variety of paper catalogs to find the right product at the right price. Not surprisingly, the administrative cost for purchasing indirect supplies often exceeded the unit value of the product itself. According to the Organization for Economic Cooperation and Development (OECD), companies with more than $500 million in revenue spend an estimated $75 to $150 to process a single purchase order for MRO supplies.[24]

FIGURE 3.20

Types of Online Business Payments

Online Business Payments
Electronic data interchange (EDI) is a standard format for exchanging business data. One way an organization can use EDI is through a value-added network. A *value-added network (VAN)* is a private network, provided by a third party, for exchanging information through a high-capacity connection. VANs support electronic catalogs (from which orders are placed), EDI-basedtransactions (the actual orders), security measures such as encryption, and EDI mailboxes.
Financial EDI (financial electronic data interchange) is a standard electronic process for B2B market purchase payments. National Cash Management System is an automated clearinghouse that supports the reconciliation of the payments.

FIGURE 3.21

Diagram of an Electronic Trading Network

E-Procurement   *E-procurement* is the B2B purchase and sale of supplies and services over the Internet. The goal of many e-procurement applications is to link organizations directly to preapproved suppliers' catalogs and to process the entire purchasing transaction online. Linking to electronic catalogs significantly reduces the need to check the timeliness and accuracy of supplier information.

An *electronic catalog* presents customers with information about goods and services offered for sale, bid, or auction on the Internet. Some electronic catalogs manage large numbers of individual items, and search capabilities help buyers navigate quickly to the items they want to purchase. Other electronic catalogs emphasize merchandise presentation and special offers, much as a retail store is laid out to encourage impulse or add-on buying. As with other aspects of e-business, it is important to match electronic catalog design and functionality to a company's business goals.

Customer Service

E-business enables customers to help themselves by combining the communications capability of a traditional customer response system with the content richness only the Web can provide—all available and operating 24x7. As a result, conducting business via the Web offers customers the convenience they want while freeing key support

staff to tackle more complex problems. The Web also allows an organization to provide better customer service through e-mail, special messages, and private password-Web access to special areas for top customers.

FIGURE 3.22

Consumer Protection

Issues for Consumer Protection
■ Unsolicited goods and communication
■ Illegal or harmful goods, services, and content
■ Insufficient information about goods or their suppliers
■ Invasion of privacy
■ Cyberfraud

Vanguard manages $690 billion in assets and charges the lowest fees in the industry: 0.26 percent of assets versus an industry average of 0.81 percent. Vanguard keeps fees down by teaching its investors how to better use its Web site. For good reason: A Web log-on costs Vanguard mere pennies, while each call to a service rep is a $9 expense.[25]

Customer service is the business process where the most human contact occurs between a buyer and a seller. Not surprisingly, e-business strategists are finding that customer service via the Web is one of the most challenging and potentially lucrative areas of e-business. The primary issue facing customer service departments using e-business is consumer protection.

Consumer Protection An organization that wants to dominate by using superior customer service as a competitive advantage must not only consider how to service its customers, but also how to protect its customers. Organizations must recognize that many consumers are unfamiliar with their digital choices, and some e-businesses are well aware of these vulnerabilities. For example, 17-year-old Miami high school senior Francis Cornworth offered his "Young Man's Virginity" for sale on eBay. The offer attracted a $10 million phony bid. Diana Duyser of Hollywood, Florida, sold half of a grilled cheese sandwich that resembles the Virgin Mary to the owners of an online casino for $28,000 on eBay. Figure 3.22 highlights the different protection areas for consumers.[26]

Regardless of whether the customers are other businesses or end consumers, one of their greatest concerns is the security level of their financial transactions. This includes all aspects of electronic information, but focuses mainly on the information associated with payments (e.g., a credit card number) and the payments themselves, that is, the "electronic money." An organization must consider such issues as encryption, secure socket layers (SSL), and secure electronic transactions (SET), as explained in Figure 3.23.

FIGURE 3.23

E-Business Security

E-Business Security
Encryption scrambles information into an alternative form that requires a key or password to decrypt the information. Encryption is achieved by scrambling letters, replacing letters, replacing letters with numbers, and other ways.
A *secure socket layer (SSL)* (1) creates a secure and private connection between a client and server computer, (2) encrypts the information, and (3) sends the information over the Internet. SSL is identified by a Web site address that includes an "s" at the end—http**s.**
A *secure electronic transaction (SET)* is a transmission security method that ensures transactions are secure and legitimate. Similar to SSL, SET encrypts information before sending it over the Internet. However, SET also enables customer authentication for credit card transaction. SETs are endorsed by major e-commerce players including MasterCard, American Express, Visa, Netscape, and Microsoft.

FIGURE 3.24

Types of Intermediaries

Type of Intermediary	Description	Example
Internet service providers	Make money selling a service, not a product	Earthlink.com, Comcast.com, AOL.com

Portals	Central hubs for online content	Yahoo.com, MSN.com, Google.com
Content providers	Use the Internet to distribute copyrighted content	wsj.com, cnn.com, espn.com
Online brokers	Intermediaries between buyers and sellers of goods and services	charlesschwab.com, fidelity.com, datek.com
Market makers	Aggregate three services for market participants: a place, rules, and infrastructure	amazon.com, ebay.com, priceline.com
Online service providers	Extensive online array of services	xdrive.com, lawinfo.com
Intelligent agents	Software applications that follow instructions and learn independently	Sidestep.com, WebSeeker.com, iSpyNOW.com
Application service providers	Sell access to Internet-based software applications to other companies	ariba.com, commerceone.com, ibm.com
Infomedianies	Provide specialized information on behalf of producers of goods and	autobytel.com, BizRate.com

	services and their potential customers	

Intermediaries

Intermediaries are agents, software, or businesses that bring buyers and sellers together that provide a trading infrastructure to enhance e-business. With the introduction of e-commerce there was much discussion about disintermediation of middle people/organizations; however, recent developments in e-business have seen more reintermediation. *Reintermediation* refers to using the Internet to reassemble buyers, sellers, and other partners in a traditional supply chain in new ways. Examples include New York-based e-Steel Corp. and Philadelphia-based PetroChemNet Inc. bringing together producers, traders, distributors, and buyers of steel and chemicals, respectively, in Web-based marketplaces. Figure 3.24 lists intermediaries and their functions.

MEASURING E-BUSINESS SUCCESS

Traffic on the Internet retail site for Wal-Mart has grown 66 percent in the last year. The site receives over 500,000 visitors daily (6.5 million per week), downloads 2 million Web pages daily, and averages 60,000 users logged on simultaneously. Wal-Mart's primary concern is maintaining optimal performance for online transactions. A disruption to the Web site directly affects the company's bottom line and customer loyalty. The company monitors and tracks the hardware, software, and network running the company's Web site to ensure high quality of service.[27]

The Yankee Group reports that 66 percent of companies determine Web site success solely by measuring the amount of traffic. Unfortunately, large amounts of Web site traffic does not necessarily indicate large sales. Many Web sites with lots of traffic have minimal sales. The best way to measure a Web site's success is to measure such things as the revenue generated by Web traffic, the number of new customers acquired by Web traffic, any reductions in customer service calls resulting from Web traffic.[28]

FIGURE 3.25

Web Site Effectiveness Metrics

Effectiveness Web Site Metrics
■ *Cookie*—a small file deposited on a hard drive by a Web site containing information

about customers and their Web activities. Cookies allow Web sites to record the comings and goings of customers, usually without their knowledge or consent.

- *Click-through*—a count of the number of people who visit one site and click on an advertisement that takes them to the site of the advertiser. Tracking effectiveness based on click-throughs guarantees exposure to target ads; however, it does not guarantee that the visitor liked the ad, spent any substantial time viewing the ad, or was satisfied with the information contained in the ad.

- A *banner ad*—advertises the products and services of another business, usually another dot-com business. Advertisers can track how often customers click on banner ads resulting in a click-through to their Web site. Often the cost of the banner ad depends on the number of customers who click on the banner ad. Tracking the number of banner ad clicks is one way to understand the effectiveness of the ad on its target audience.

Web Site Metrics

Figure 3.25 displays a few metrics an organization can use to measure Web site effectiveness.

To help understand advertising effectiveness, interactivity measures are tracked and monitored. *Interactivity* measures the visitor interactions with the target ad. Such interaction measures include the duration of time the visitor spends viewing the ad, the number of pages viewed, and even the number of repeat visits to the target ad. Interactivity measures are a giant step forward for advertisers, since traditional advertising methods—newspapers, magazines, radio, and television—provide few ways to track effectiveness metrics. Interactivity metrics measure actual consumer activities, something that was impossible to do in the past, and provide advertisers with tremendous amounts of business intelligence.

FIGURE 3.26

Clickstream Data Metrics

Clickstream Data Metrics

■ The number of page views (i.e., the number of times a particular page has been presented to a visitor).
■ The pattern of Web sites visited, including most frequent exit page and most frequent prior Web site.
■ Length of stay on the Web site.
■ Dates and times of visits.
■ Number of registrations filled out per 100 visitors.
■ Number of abandoned registrations.
■ Demographics of registered visitors.
■ Number of customers with shopping carts.
■ Number of abandoned shopping carts.

The ultimate outcome of any advertisement is a purchase. Tying purchase am-ounts to Web site visits makes it easy to communicate the business value of the Web site. Organizations use metrics to tie revenue amounts and new customer creation numbers directly back to the Web sites or banner ads. Organization can observe through *clickstream data* the exact pattern of a consumer's navigation through a site. Clickstream data can reveal a number of basic data points on how consumers interact with Web sites. Figure 3.26 displays different types of clickstream metrics.

Marc Barach is the co-inventor and chief marketing officer of Ingenio, a start-up company that specializes in connecting people in real-time. When the Internet first emerged, banner ads were the prevalent marketing tools. Next came pay-per-click where the company pays the search engine each time its Web site is accessed from a search. Today 35 percent of online spending occurs through pay-per-clicks. Unfortunately, pay-per-clicks are not suitable for all businesses. Roofers, plumbers, auto repair people, and cosmetic surgeons rarely have Web sites and do not generate business via pay-per-clicks. Barach believes that the next line of Internet advertising will be pay-

per-call, and Ingenio has invested five years and $50 million in building the platform to run the business. Here is how pay-per-call works:

- The user types a keyword into a search engine.

- The search engine passes the keyword to Ingenio.

- Ingenio determines the category and sends back the appropriate merchant's unique, traceable 800 telephone number.

- The 800 number routes through Ingenio's switches, and Ingenio charges the merchant when a customer calls.

  A Jupiter Research study discovered that businesses were willing to pay between $2 and $35 for each call lead.[29]

Figure 3.27 provides definitions of common metrics based on clickstream data. To interpret such data properly, managers try to benchmark against other companies. For instance, consumers seem to visit their preferred Web sites regularly, even checking back to the Web site multiple times during a given session. Consumers tend to become loyal to a small number of Web sites, and they tend to revisit those Web sites a number of times during a particular session.

E-BUSINESS BENEFITS AND CHALLENGES

According to an NUA Internet Survey, the Internet links more than 1 billion people worldwide. Experts predict that global Internet usage will nearly triple between 2006 and 2010, making e-business a more significant factor in the global economy. As e-business improves, organizations will experience benefits and challenges alike. Figure 3.28 details e-business benefits for an organization.

The Internet is forcing organizations to refocus their information systems from the inside out. A growing number of companies are already using the Internet to streamline their business processes, procure materials, sell products, automate customer service, and create new revenue streams. Although the benefits of e-business systems are enticing, developing, deploying, and managing these systems is not always easy. Unfortunately, e-business is not something a business can just go out and buy. Figure 3.29 details the challenges facing e-business.

A key element of e-marketplaces is their ability to provide not only transaction capabilities but also dynamic, relevant content to trading partners. The original e-business Web sites provided shopping cart capabilities built around product catalogs. As a result of the complex e-marketplace that must support existing business processes and systems, content is becoming even more critical for e-marketplaces. Buyers need good content description to make informed purchases, and sellers use content to properly market and differentiate themselves from the competition.

Content and product description establish the common understanding between both parties to the transaction. As a result, the accessibility, usability, accuracy, and richness of that content directly affect the transaction. Figure 3.30 displays the different benefits and challenges of various e-marketplace revenue models.

FIGURE 3.27

Definitions of Web Site Metrics

Visitor	Visitor Metrics
Unidentified visitor	A visitor is an individual who visits a Web site. An "unidentified visitor" means that no information about that visitor is available.
Unique visitor	A unique visitor is one who can be recognized and counted only once within a given period of time. An accurate count of unique visitors is not possible without some form of identification, registration, or authentication.
Session visitor	A session ID is available (e.g., cookie) or inferred by incoming address plus browser type, which allows a visitor's responses to be tracked within a given visit to a Web site.
Tracked visitor	An ID (e.g., cookie) is available which allows a user to be tracked across multiple visits to a Web site. No information, other than a unique identifier, is available for a tracked visitor.
Identified visitor	An ID is available (e.g., cookie or voluntary registration), which allows a user to be tracked across multiple visits to a Web site. Other information (name, demographics, possibly supplied voluntarily by the visitor) can be linked to this ID.
Exposure	**Exposure Metrics**
Page exposures (page-views)	The number of times a particular Web page has been viewed by visitors in a given

	time period, without regard to duplication.
Site exposures	The number of visitor sessions at a Web site in a given time period, without regard to visitor duplication.
Visit	**Visit Metrics**
Stickiness (visit duration time)	The length of time a visitor spends on a Web site. Can be reported as an average in a given time period, without regard to visitor duplication.
Raw visit depth (total Web pages exposure per session)	The total number of pages a visitor is exposed to during a single visit to a Web site. Can be reported as an average or distribution in a given time period, without regard to visitor duplication.
Visit depth (total unique Web pages exposure per session)	The total number of unique pages a visitor is exposed to during a single visit to a Web site. Can be reported as an average or distribution in a given time period, without regard to visitor duplication.
Hit	**Hit Metrics**
Hits	When visitors reach a Web site, their computer sends a request to the site's computer server to begin displaying pages. Each element of a requested page (including graphics, text, interactive items) is recorded by the Web site's server log file as a "hit."
Qualified hits	Exclude less important information recorded in a log file (such as error messages, etc.).

NEW TRENDS IN E-BUSINESS: E-GOVERNMENT AND M-COMMERCE

Recent business models that have arisen to enable organizations to take advantage of the Internet and create value are within e-government. *E-government* involves the use of strategies and technologies to transform government(s) by improving the delivery of services and enhancing the quality of interaction between the citizen-consumer within

all branches of government (refer to Figure 3.31).

FIGURE 3.28

E-Business Benefits

E-Business Benefits	
Highly Accessible	Businesses can operate 24 hours a day, 7 days a week, 365 days a year.
Increased Customer Loyalty	Additional channels to contact, respond to, and access customers helps contribute to customer loyalty.
Improved Information Content	In the past, customers had to order catalogs or travel to a physical facility before they could compare price and product attributes. Electronic catalogs and Web pages present customers with updated information in real-time about goods, services, and prices.
Increased Convenience	E-business automates and improves many of the activities that make up a buying experience.
Increased Global Reach	Business, both small and large, can reach new markets.
Decreased Cost	The cost of conducting business on the Internet is substantially smaller than traditional forms of business communication.

FIGURE 3.29

E-Business Challenges

E-Business Challenges

Protecting Consumers	Consumers must be protected against unsolicited goods and communication, illegal or harmful goods, insufficient information about goods or their suppliers, invasion of privacy, and cyberfraud.
Leveraging Existing Systems	Most companies already use information technology to conduct business in non-Internet environments, such as marketing, order management, billing, inventory, distribution, and customer service. The Internet represents an alternative and complementary way to do business, but it is imperative that e-business systems integrate existing systems in a manner that avoids duplicating functionality and maintains usability, performance, and reliability.
Increasing Liability	E-business exposes suppliers to unknown liabilities because Internet commerce law is vaguely defined and differs from country to country. The Internet and its use in e-business have raised many ethical, social, and political issues, such as identity theft and information manipulation.
Providing Security	The Internet provides universal access, but companies must protect their assets against accidental or malicious misuse. System security, however, must not create prohibitive complexity or reduce flexibility. Customer information also needs to be protected from internal and external misuse. Privacy systems should safeguard the personal information critical to building sites that satisfy customer and business needs. A serious deficiency arises from the use of the Internet as a marketing means. Sixty percent of Internet users do not trust the Internet as a payment channel. Making purchases via the Internet is considered unsafe by many. This issue affects both the business and the consumer. However, with encryption and the development of secure Web sites, security is becoming less of a constraint for e-businesses.
Adhering to Taxation Rules	The Internet is not yet subject to the same level of taxation as traditional businesses. While taxation should not discourage consumers from using electronic purchasing channels, it should not favor Internet purchases over store purchases either. Instead, a tax policy should

	provide a level playing field for traditional retail businesses, mail-order companies, and Internet-based merchants. The Internetmarketplace is rapidly expanding, yet it remains mostly free from traditional forms of taxation. In one recent study, uncollected state and local sales taxes from e-business are projected to exceed $60 billion in 2008.	

FIGURE 3.30

The Benefits and Challenges of Various E-Marketplace Revenue Models

Revenue Models	Advantages	Limitation
Transaction fees	■ Can be directly tied to savings (both process and price savings) ■ Important revenue source when high level of liquidity (transaction volume) is reached	■ If process savings are not completely visible, use of the system is discouraged (incentive to move transactions offline) ■ Transaction fees likely to decrease with time
License fees	■ Creates incentives to do many transactions ■ Customization and back-end integration leads to lock-in of participants	■ Up front fee is a barrier to entry for participants ■ Price differentiation is complicated
Subscription fees	■ Creates incentives to do transactions ■ Price can be differentiated ■ Possibility to build additional revenue from new user groups	■ Fixed fee is a barrier to entry for participants

Fees for value-added services	■ Service offering can be differentiated ■ Price can be differentiated ■ Possibility to build additional revenue from established and new user groups (third parties)	■ Cumbersome process for customers to continually evaluate new services
Advertising fees	■ Well-targeted advertisements can be perceived as value-added content by trading participants ■ Easy to implement	■ Limited revenue potential ■ Overdone or poorly targeted advertisements can be disturbing elements on the Web site

One example of an e-government portal, FirstGov.gov, the official U.S. gateway to all government information, is the catalyst for a growing electronic government. Its powerful search engine and ever-growing collection of topical and customer-focused links connect users to millions of   Web pages, from the federal government, to local and tribal governments, to foreign nations around the world. Figure 3.32 highlights specific e-government models.

FIGURE 3.31

Extended E-Business Models

FIGURE 3.32

E-Government Models

E-Government Models	
Consumer-to-government (C2G)	C2G will mainly constitute the areas where a consumer (or citizen) interacts with the government. It will include areas like elections, when citizens vote for government officials; census, where the consumer provides demographic information to the government;

	taxation, where the consumer is paying taxes to the government.
Government-to-business (G2B)	This model includes all government interaction with business enterprises whether it is procurement of goods and services from suppliers or information regarding legal and business issues that is transmitted electronically.
Government-to-consumer (G2C)	Governments around the world are now dealing with consumers (or citizens) electronically, providing them with updated information. Governments are also processing applications for visas, renewal of passports and driver's licenses, advertising of tender notices, and other services online.
Government-to-government (G2G)	Governments around the world are now dealing with other governments electronically. Still at an inception stage, this e-business model will enhance international trade and information retrieval, for example, on criminal records of new migrants. At the state level, information exchange and processing of transactions online will enable enhanced efficiencies.

M-Commerce

In a few years, Internet-enabled mobile devices will outnumber PCs. *Mobile commerce*, or *m-commerce*, is the ability to purchase goods and services through a wireless Internet-enabled device. The emerging technology behind m-commerce is a mobile device equipped with a Web-ready micro-browser. To take advantage of the m-commerce market potential, handset manufacturers Nokia, Ericsson, Motorola, and Qualcomm are working with telecommunication carriers AT&T Wireless and Sprint to develop smartphones. Using new forms of technology,

smartphones offer fax, e-mail, and phone capabilities all in one, paving the way for m-commerce to be accepted by an increasingly mobile workforce. Figure 3.33 gives a visual overview of m-commerce.

Amazon.com has collaborated with Nokia to pioneer a new territory. With the launch of its Amazon.com Anywhere service, it has become one of the first major online retailers to recognize and do something about the potential of Internet-enabled wireless devices. As content delivery over wireless devices becomes faster, more secure, and scalable, m-commerce will surpass landline e-business (traditional telephony) as the method of choice for digital commerce transactions. According to the research firm Strategy Analytics, the global m-commerce market was expected to be worth more than $200 billion by 2005, with some 350 million customers generating almost 14 billion transactions annually. Additionally, information activities like e-mail, news, and stock quotes will progress to personalized transactions, "one-click" travel reservations, online auctions, and video-conferencing.[30]

Organizations face changes more extensive and far reaching in their implications than anything since the modern industrial revolution occurred in the early 1900s. Technology is a primary force driving these changes. Organizations that want to survive must recognize the immense power of technology, carry out required organizational changes in the face of it, and learn to operate in an entirely different way.

FIGURE 3.33

M-Commerce Technology Overview

OPENING CASE QUESTIONS

Amazon.com—Not Your Average Bookstore

5. What is Amazon's e-business model?

6. How can Amazon use m-commerce to influence its business?

7. Which metrics could Amazon use to assess the efficiency and effectiveness of Amazon's Web site?

8. What are some of the business challenges facing Amazon?

KEY TERMS

Application service provider (ASP)   74

Associate program (affiliate program)   81

Banner ad   86

Blog   81

Brick-and-mortar business   78

CLOSING CASE ONE

eBay—The Ultimate E-Business

Pierre Omidyar was just 28 when he sat down over a long holiday weekend to write the original computer code for what eventually became an Internet super brand—the auction site eBay. Omidyar viewed auctions as a fair mechanism for Internet commerce where sellers could set their minimum prices, and buyers could then determine an item's market value by bidding up to what they were willingly to pay. A novel feedback system could allow buyers and sellers to rate each other, helping minimize fraud by enabling the community to police itself. "I really wanted to give the individual the power to be a producer as well. It was letting the users take responsibility for building the community," Omidyar would later explain.

The site launched on Labor Day, September 4, 1995, under the title of Auction Web, soon to be renamed after the site's domain name—ebay.com (a shortening of Echo Bay, Omidyar's consulting firm). The service was free at first, but started charging to cover Internet service provider costs.

A National Marketplace

Omidyar's auction Web site, eBay.com, took off. It provided something novel that its users craved: an efficient national marketplace with a strong community built on fairness and trust. A photography student looking for a used camera could choose from models across the nation and trust the timely delivery of the product. The owner of a vintage clothing store could sell to collectors nationwide. The community would expose a deceptive or fraudulent user and ban them from the marketplace.

Entrepreneurs in record numbers began setting up shop on eBay. According to a new survey conducted for eBay by ACNielsen International Research, in 2005 more than 724,000 people supported themselves by selling items on eBay, up from 75,000 in 2002. In addition to these professional eBay sellers, another 1.5 million individuals supplement their income by selling on eBay. In the first six months of 2005, Americans sold merchandise worth

about $10.6 billion through eBay.

The stock market value of Omidyar's innovative company grew to $2 billion in just three years, and his site's staying power as an economic engine was evident. Jeffrey Skoll, a Stanford MBA, joined the company in 1996 after the site was already profitable. In March 1998, Meg Whitman took over as president and CEO. In September 1998, eBay launched a successful public offering, making both Omidyar and Skoll billionaires—three years after Omidyar created eBay. As of 2005, Omidyar's 214 million eBay shares were worth about $8 billion.

Collaborating with eBay

This e-business is collaborating with marketplace, payment, and communication companies that add value for its customers.

Marketplace—The U.S. Postal Service

People who sell items on eBay all have one thing in common: They need to ship their goods to their customers. To support this growing economic force, eBay and the U.S. Postal Service created an innovative economic and educational opportunity.

The Postal Service's bread and butter—first-class mail—is beset by rising costs and falling use. E-mail and faxes have reduced the amount of mail sent each day, but the Postal Service still bears the cost of delivering to every business and home, six days a week. Package shipping, however, remains a profitable and booming business, as evidenced by the number and earnings of private shippers in the market.

The Postal Service offers free boxes and heavy-duty envelopes for shippers using overnight or priority mail. To make it easier for those in the vanguard of the new, digital economy, the Postal Service will pick up shipments from the sender, and its Web site sells mailing labels with postage included that can be printed out from a home computer. Over 20 million shipping labels with postage were printed via the eBay/Postal Service link in 2005. Customers can also link to the United Parcel Service site, but eBay does not have a formal relationship with Federal Express.

Payment—PayPal

Founded in 1998, PayPal, an eBay company, enables any individual or business with an e-mail address to securely, easily, and quickly send and receive payments online. PayPal's service builds on the existing financial infrastructure of bank accounts and credit cards and utilizes the world's most advanced proprietary fraud prevention systems to create a safe, global, real-time payment solution.

PayPal has quickly become a global leader in online payment solutions with 96 million account members worldwide. Buyers and sellers on eBay, online retailers, online businesses, as well as traditional off-line businesses are transacting with PayPal, available in 55 countries.

Communication—Skype

Skype, a global Internet communications company, allows people everywhere to make free, unlimited, superior quality voice calls via its innovative peer-to-peer software. Since its launch in August 2003, Skype has been downloaded more than 163 million times in 225 countries and territories. Fifty-four million people are registered to use Skype's free services, with over 3 million simultaneous users on the network at any one time. Skype adds about 150,000 users a day.

In September 2005, eBay acquired Skype for approximately $2.6 billion, anticipating that Skype will streamline and improve communications between buyers and sellers as it is integrated into the eBay marketplace. Buyers will gain an easy way to talk to sellers quickly and get the information they need, and sellers can more easily build relationships. The auction company hopes the acquisition will strengthen its global marketplace and payments platform, while opening several new lines of business and creating significant new opportunities for the company.

Unforeseen Dangers of Collaboration

"Communications is at the heart of e-commerce and community," said Meg Whitman. "By combining the two leading e-commerce franchises, eBay and PayPal, with the leader in Internet voice communications, Skype, we will create an extraordinarily powerful environment for business on the Net."

In October 2005, one month after eBay's acquisition of Skype, a press release discussed two critical flaws in Skype's software, one of which could allow malicious hackers to take control of compromised systems and another that could allow attackers to crash the client software. While fixes for the issues were being addressed, businesses asked their users to refrain from using voice services based on proprietary protocols like Skype while on corporate networks because of network security issues. Perhaps Skype might not be the collaborative tool of choice for eBay.

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Questions

1. eBay is one of the only major Internet "pure plays" to consistently make a profit from its inception. What is eBay's e-business model and why has it been so successful?

2. Other major Web sites, like Amazon.com and Yahoo!, have entered the e-marketplace with far less success than

eBay. How has eBay been able to maintain its dominant position?

3. eBay has long been an e-marketplace for used goods and collectibles. Today, it is increasingly a place where major businesses come to auction their wares. Why would a brand name vendor set up shop on eBay?

4. What are the three different types of online auctions and which one is eBay using?

5. What are the different forms of online payment methods for consumers and business? How might eBay's customer benefit from the different payment methods?

6. Which metrics would you use if you were hired to assess the efficiency and effectiveness of eBay's Web site?

CLOSING CASE TWO

Direct Groceries

In July 2002, FreshDirect made its first delivery. The online grocer, which began in the New York metropolitan area and has expanded slowly and cautiously from Brooklyn to Queens to Manhattan, now has annual revenues of $150 million. The company decided to revamp its IT infrastructure focusing on availability and scalability to support a new, more aggressive growth strategy. In early 2004, FreshDirect hired a new CTO, Myles Trachtenberg, to help expand its business. Trachtenberg led the company through its IT infrastructure revamp, which was completed in September 2004.

The company's growth strategy focuses on using a variety of industry best practices to succeed. "I like to think of us as three types of businesses pulled together," Trachtenberg said. FreshDirect has sought to emulate the e-business success of Amazon.com, the just-in-time manufacturing capabilities of Dell, and the distribution expertise of FedEx. FreshDirect generates 99 percent of its business through its Web site. To differentiate itself in the marketplace, the company concentrates on preparation and delivery of fresh foods, which account for about 70 percent of sales.

When Trachtenberg joined FreshDirect, its infrastructure was running on Sun Microsystems servers. Trachtenberg wanted to update the systems to create an infrastructure that would ensure high availability to meet customer demands for a quick and easy online experience, as well as the scalability to allow FreshDirect to continue to expand. Trachtenberg also wanted to move to an Intel-based system.

Keeping FreshDirect's Web site operational is essential to the company's growth strategy. The Web site must handle over 4,000 orders a day, each with an average of 30 items, which requires the movement of about 1 million items in the warehouse each week.

Before the new IT infrastructure revamp, the average response time on the FreshDirect Web site was about eight seconds. Today, the response time is two seconds during peak demand and one second during low demand periods.

Within its data center, FreshDirect runs SAP enterprise resource planning software and database. Inside the warehouse, each order is disassembled for sorting and packing. The order is first run through a logistics application by RouteSmart Technologies Inc., which uses algorithms to divide orders based on destination, delivery schedules, and capacity.

How rapidly FreshDirect will expand its territory has yet to be determined. "There's still a lot of growth left in the areas we serve now," Trachtenberg said. "In New York City alone, I'd say there's definitely potential for between $300 million and $500 million a year."[32]

Questions

1. What type of technology is FreshDirect using—disruptive or sustaining?

2. How could FreshDirect use a kiosk to improve its business?

3. How could FreshDirect use m-commerce to improve its business?

4. What are the three different types of service providers and which one would FreshDirect use to run its business?

5. What types of information would be contained in FreshDirect's intranet?

6. What types of information would be contained in FreshDirect's extranet?

7. Which metrics would you use if you were hired to assess the efficiency and effectiveness of FreshDirect's Web site?

CLOSING CASE THREE

How Do You Value Friendster?

Jonathan Abrams is keeping quiet about how he is going to generate revenue from his Web site, Friendster, which specializes in social networking. Abrams is a 33-year-old Canadian software developer whose experiences include being laid off by Netscape and then moving from one start-up to another. In 2002, Abrams was unemployed, not doing well financially, and certainly not looking to start another business when he developed the idea for Friendster. He quickly coded a working prototype and watched in amazement as his Web site took off.

The buzz around social networking start-ups has been on the rise. A number of high-end venture capital firms, including Sequoia and Mayfield, have invested more than $40 million into social networking start-ups such as

LinkedIn, Spoke, and Tribe Networks. Friendster received over $13 million in venture capital from Kleiner, Perkins, Caufield, Byers, and Benchmark Capital, which reportedly valued the company at $53 million—a startling figure for a company that had yet to generate even a single dime in revenue.

A year after making its public debut, Friendster was one of the largest social networking Web sites, attracting over 5 million users and receiving more than 50,000 page views per day. The question is how do efficiency metrics, such as Web traffic and page views, turn into cash flow? Everyone is wondering how Friendster is going to begin generating revenue.

The majority of Abrams's competitors make their money by extracting fees from their subscribers. Friendster is going to continue to let its subscribers meet for free but plans to charge them for premium services such as the ability to customize their profile page. The company also has plans to extend beyond social networking to an array of value-added services such as friend-based job referrals and classmate searches. Abrams is also looking into using his high-traffic Web site to tap into the growing Internet advertising market.

Abrams does not appear concerned about generating revenue or about potential competition. "Match.com has been around eight years, has 12 million users, and has spent many millions of dollars on advertising to get them," he said. "We're a year old, we've spent zero dollars on advertising, and in a year or less, we'll be bigger than them—it's a given."

The future of Friendster is uncertain. Google offered to buy Friendster for $30 million even though there are signs, both statistical and anecdotal, that Friendster's popularity may have peaked. [33]

Questions

1. How could you use e-business metrics to place a value on Friendster?

2. Why would a venture capital company value Friendster at $53 million when the company has yet to generate any revenue?

3. Why would Google be interested in buying Friendster for $30 million when the company has yet to generate any revenue?

4. Identify Friendster's e-business model and explain how the company can generate revenue.

5. Explain the e-business benefits and challenges facing Friendster.

MAKING BUSINESS DECISIONS

1. **Leveraging the competitive value of the Internet**

   Physical inventories have always been a major cost component of business. Linking to suppliers in real time dramatically enhances the classic goal of inventory "turn." The Internet provides a multitude of opportunities for radically reducing the costs of designing, manufacturing, and selling goods and services. E-mango.com, a fruit e-marketplace, must take advantage of these opportunities or find itself at a significant competitive disadvantage. Identify the disadvantages that confront E-mango.com if it does not leverage the competitive value of the Internet.

2. **Implementing an e-business model**

   The Genius is a revolutionary mountain bike with full-suspension and shock-adjustable forks that is being marketed via the Internet. The Genius needs an e-business solution that will easily enable internal staff to deliver fresh and relevant product information throughout its Web site. To support its large audience, the company also needs the ability to present information in multiple languages and serve over 1 million page views per month to visitors in North America and Europe. Explain what e-business model you would use to market The Genius on the Internet.

3. **Assessing Internet capabilities**

   Hoover's Rentals is a small privately owned business that rents sports equipment in Denver, Colorado. The company specializes in winter rentals including ski equipment, snowboarding equipment, and snowmobile equipment. Hoover's has been in business for 20 years and, for the first time, it is experiencing a decline in rentals. Brian Hoover, the company's owner, is puzzled by the recent decreases. The snowfall for the last two years has been outstanding, and the ski resorts have opened earlier and closed later than most previous years. Reports say tourism in the Colorado area is up, and the invention of loyalty programs has significantly increased the number of local skiers. Overall, business should be booming. The only reason for the decrease in sales might be the fact that big retailers such as Wal-Mart and Gart Sports are now renting winter sports equipment. Brian would like your team's help in determining how he can use the Internet to help his company increase sales and decrease costs to compete with these big retailers.

4. **Online auction sites**

   You are working for a new Internet start-up company, eMart.com, an online marketplace for the sale of goods and services. The company offers a wide variety of features and services that enable online members to buy and

sell their goods and services quickly and conveniently. The company's mission is to provide a global trading platform where anyone can trade practically anything. Suggest some ways that eMart.com can extend its market reach beyond that of its competitor, eBay.com.

5. **Everybody needs an Internet strategy**

An Internet strategy addresses the reasons businesses want to "go online." "Going online" because it seems like the right thing to do now or because everyone else is doing it is not a good enough reason. A business must decide how it will best utilize the Internet for its particular needs. It must plan for where it wants to go and how best the Internet can help shape that vision. Before developing a strategy a business should spend time on the Internet, see what similar businesses have grown, and what is most feasible, given a particular set of resources. Think of a new online business opportunity and answer the following questions:

1. Why do you want to put your business online?

2. What benefits will going online bring?

3. What effects will being connected to the Internet have on your staff, suppliers, and customers?

6. **Analyzing Web Sites**

Stars Inc. is a large clothing corporation that specializes in reselling clothes worn by celebrities. The company's four Web sites generate 75 percent of its sales. The remaining 25 percent of sales occur directly through the company's warehouse. You have recently been hired as the director of sales. The only information you can find on the success of the four Web sites follows:

Web Site	Classic	Contemporary	New Age	Traditional
Traffic analysis	5,000 hits/day	200 hits/day	10,000 hits/day	1,000 hits/day
Stickiness (average)	20 min.	1 hr.	20 min.	50 min.
Number of	400/day	0/day	5,000/day	200/day

abandoned shopping carts				
Number of unique visitors	2,000/day	100/day	8,000/day	200/day
Number of identified visitors	3,000/day	100/day	2,000/day	800/day
Average revenue per sale	$1,000	$1,000	$50	$1,300

You decide that maintaining four separate Web sites is expensive and adds little business value. You want to propose consolidating to one Web site. Create a report detailing the business value gained by consolidating to a single Web site, along with your recommendation for consolidation. Be sure to include your Web site profitability analysis.

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Ethics and Information Security

CHAPTER OUTLINE

SECTION 4.1

Ethics

Ethics

Information Ethics

Developing Information Management Policies

Ethics in the Workplace

SECTION 4.2

Information Security

Protecting Intellectual Assets

The First Line of Defense—People

The Second Line of Defense—Technology

opening case study

Sarbanes-Oxley: Where Information Technology, Finance, and Ethics Meet

Congress is cleaning up the way companies do business after accounting and governance scandals rocked investor confidence and damaged the reputation of companies large and small. The Sarbanes-Oxley Act (SOX) of 2002 was enacted in response to the high-profile Enron and WorldCom financial scandals to protect shareholders and the public from accounting errors and fraudulent practices by organizations.

Sarbanes-Oxley

One primary component of the SOX is the definition of which records are to be stored and for how long. For

this reason, the legislation not only affects financial departments, but also IT departments whose job it is to store electronic records. SOX states that all business records, including electronic records and electronic messages, "must be saved for not less than five years." The consequences for noncompliance are fines, imprisonment, or both. Three rules of Sarbanes-Oxley affecting the management of electronic records address the following areas:

1. The destruction, alteration, or falsification of records. It states that persons who knowingly alter, destroy, mutilate, conceal, or falsify documents shall be fined or imprisoned for not more than 20 years, or both.

2. The retention period for records storage. Best practices indicate that corporations securely store all business records using the same guidelines set for public accountants. Organizations shall maintain all audit or review work papers for a period of five years from the end of the fiscal period in which the audit or review was concluded.

3. The business records and communications that need to be stored, including electronic communications. IT departments are facing the challenge of creating and maintaining a corporate records archive in a cost-effective fashion that satisfies the requirements put forth by the legislation.

Essentially, any public organization that uses IT as part of its financial business processes must implement IT controls to comply with SOX. The cost of implementing SOX is high at $35 million per year for large companies. William D. Zollars, CEO of Yellow Roadway Corp., the nation's largest trucking firm, said, "It requires an army of people to do the paperwork." Zollars dispatched 200 people to work on SOX compliance, paying more than $9 million for the work—roughly 3 percent of annual profits.

Benefits from Sarbanes-Oxley

Many businesses are promoting the benefits they received from implementing SOX. General Electric Co., which spent about $30 million on SOX compliance, has added controls that boost investors' confidence in the company. United Technologies used SOX to standardize bookkeeping audits in its disparate businesses around the world. The biggest advantage of all, though, may be the greater confidence investors have in financial results.

Some officials believe it will take another two years (around 2008) for companies, auditors, and regulators

to apply the law efficiently. That might appear to be a long time, and it may seem to be expensive; however, it is a small price to pay to help organizations run smoothly and renew investor confidence.

Implementing Sarbanes-Oxley

Ultimately, Sarbanes-Oxley compliance will require a great deal of work among all departments. Compliance starts with running IT as a business and strengthening IT internal controls. The following are a few practices organizations can follow to ensure compliance with the Sarbanes-Oxley Act.

- Overhaul or upgrade financial systems to meet regulatory requirements for more accurate, detailed, and timely filings.

- Examine the control processes within the IT department and apply best practices to comply with the act's goals. For example, segregation of duties within the systems development staff is a widely recognized best practice that helps prevent errors and outright fraud. The people who code program changes should be different from the people who test them, and a separate team should be responsible for changes in production environments.

- Ensure that information system customizations are not overriding controls by working with internal and external auditors. Homegrown financial systems are fraught with potential information-integrity issues. Although leading enterprise resource planning (ERP) systems offer audit-trail functionality, customizations of these systems often bypass those controls.

- Work with the CIO, CEO, CFO, and corporate attorneys to create a document-retention-and-destruction policy that addresses what types of electronic documents should be saved, and for how long.[1]

INTRODUCTION

Ethics and security are two fundamental building blocks for all organizations. In recent years, such events as the Enron and Martha Stewart scandals along with 9/11 have shed new light on the meaning of ethics and security. When the behavior of a few individuals can destroy billion-dollar organizations, the value of ethics and security should be evident.

section 4.1 ETHICS

4.1. Explain the ethical issues surrounding information.

4.2. Identify the differences between an ethical computer use policy and an acceptable use policy.

4.3. Describe the relationship between an e-mail privacy policy and an Internet use policy.

4.4. Explain the effects of spam on an organization.

4.5. Summarize the different monitoring technologies and explain the importance of an employee monitoring policy.

ETHICS

Ian Clarke, the inventor of a file-swapping service called Freenet, decided to leave the United States for the United Kingdom, where copyright laws are more lenient. Wayne Rosso, the inventor of a file-sharing service called Grokster, left the United States for Spain, again saying goodbye to tough U.S. copyright protections. The U.S. copyright laws, designed decades before the invention of the Internet, make file sharing and many other Internet technologies illegal. Although some individuals use file sharing in unethical manners, such as downloading music and movies illegally, file sharing has many positive benefits, such as improving drug research, software development, and the flow of information.[2]

The ethical issues surrounding copyright infringement and intellectual property rights are consuming the e-business world. Advances in technology make it easier for people to copy everything from music to pictures. Technology poses new challenges for our *ethics*—the principles and standards that guide our behavior toward other people. Review Figure 4.1 for an overview of concepts, terms, and ethical issues stemming from advances in technology.

The Securities Exchange Commission (SEC) began inquiries into Enron's accounting practices on October 22, 2001. David Duncan, the Arthur Andersen partner in charge of Enron, instructed his team to begin destroying paper and electronic Enron-related records on October 23, 2001. Kimberly Latham, a subordinate to Duncan, sent instructions on October 24, 2001, to her entire team to follow Duncan's orders and even compiled a list of computer files to delete. Arthur Andersen blames Duncan for destroying thousands of Enron-related documents. Duncan blames the Arthur Andersen attorney, Nancy Temple, for sending him a memo instructing him to destroy files. Temple blames Arthur Andersen's document deletion policies.[3]

FIGURE 4.1

Technology-Related Ethical Issues

Intellectual property	Intangible creative work that is embodied in physical form.
Copyright	The legal protection afforded an expression of an idea, such as a song, video game, and some types of proprietary documents.
Fair use doctrine	In certain situations, it is legal to use copyrighted material.
Pirated software	The unauthorized use, duplication, distribution, or sale of copyrighted software.
Counterfeit software	Software that is manufactured to look like the real thing and sold as such.

FIGURE 4.2

Trust and E-Business

Primary Reasons Privacy Issues Reduce Trust for E-Business

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1. Loss of personal privacy

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2. 37 percent of Internet users are "a lot" more inclined to purchase a product on a Web site that has a privacy policy

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3. Effective privacy and security would convert more Internet users to Internet buyers

Regardless of who is to blame, the bigger issue is that the destruction of files after a federal investigation has begun is both unethical and illegal. A direct corporate order to destroy information currently under federal investigation poses a dilemma for any professional. Comply, and you participate in potentially criminal activities; refuse, and you might find yourself looking for a new job.

Privacy is one of the largest ethical issues facing organizations. *Privacy* is the right to be left alone when you want to be, to have control over your own personal possessions, and not to be observed without your consent. Privacy is related to *confidentiality*, which is the assurance that messages and information are available only to those who are authorized to view them. Some of the most problematic decisions facing organizations lie in the

murky and turbulent waters of privacy. The burden comes from the knowledge that each time employees make a decision regarding issues of privacy, the outcome could potentially sink the company.

Trust between companies, customers, partners, and suppliers is the support structure of e-business. One of the main ingredients in trust is privacy. Privacy continues to be one of the primary barriers to the growth of e-business. People are concerned their privacy will be violated because of interactions on the Web. Unless an organization can effectively address this issue of privacy, its customers, partners, and suppliers might lose trust in the organization, which would hurt its business. Figure 4.2 displays the results from a *CIO* survey as to how privacy issues reduce trust for e-businesses.

INFORMATION ETHICS

Individuals determine how to use information and how information affects them. How individuals behave toward each other, how they handle information and technology, are largely influenced by their ethics. Ethical dilemmas usually arise not in simple, clear-cut situations but out of a clash between competing goals, responsibilities, and loyalties. Inevitably, the decision process has more than one socially acceptable "correct" decision. Figure 4.3 contains examples of ethically questionable or unacceptable uses of information technology.

People make arguments for or against—justify or condemn—the behaviors in Figure 4.3. Unfortunately, there are few hard and fast rules for always determining what is and is not ethical. Knowing the law will not always help because what is legal might not always be ethical, and what might be ethical is not always legal. For example, Joe Reidenberg received an offer for cell phone service from AT&T Wireless. The offer revealed that AT&T Wireless had used Equifax, a credit reporting agency, to identify Joe Reidenberg as a potential customer. Overall, this strategy seemed like good business. Equifax could generate additional revenue by selling information it already owned and AT&T Wireless could identify target markets, thereby increasing response rates to its marketing campaigns.

Unfortunately, the Fair Credit Reporting Act (FCRA) forbids repurposing credit information except when the information is used for "a firm offer of credit or insurance." In other words, the only product that can be sold based on credit information is credit. A representative for Equifax stated, "As long as AT&T Wireless (or any company for that matter) is offering the cell phone service on a credit basis, such as allowing the use of the service before the consumer has to pay, it is in compliance with the FCRA." However, the question remains—is it ethical?[4]

FIGURE 4.3

Ethically Questionable or Unacceptable Information Technology Use

Examples of Questionable Information Technology Use
Individuals copy, use, and distribute software.
Employees search organizational databases for sensitive corporate and personal information.
Organizations collect, buy, and use information without checking the validity or accuracy of the information.
Individuals create and spread viruses that cause trouble for those using and maintaining IT systems.
Individuals hack into computer systems to steal proprietary information.
Employees destroy or steal proprietary organization information such as schematics, sketches, customer lists, and reports.

This is a good example of the ethical dilemmas facing organizations. Because technology is so new and pervasive in unexpected ways, the ethics surrounding information are still being defined. Figure 4.4 displays the four quadrants of ethical and legal behavior. The ideal goal for organizations is to make decisions within quadrant I that are both legal and ethical.

Information Has No Ethics

Jerry Rode, CIO of Saab Cars USA, realized he had a public relations fiasco on his hands when he received an e-mail from an irate customer. Saab had hired four Internet marketing companies to distribute electronic information about Saab's new models to its customers. Saab specified that the marketing campaign be opt-in, implying that it would contact only the people who had agreed to receive promotions and marketing material via e-mail. Unfortunately, one of the marketing companies apparently had a different definition of opt-in and was e-mailing all customers regardless of their opt-in decision.

Rode fired the errant marketing company and immediately developed a formal policy for the use of customer information. "The customer doesn't see ad agencies and contracted marketing firms. They see Saab USA spamming them," Rode said. "Finger-pointing after the fact won't make your customers feel better."[5]

Information has no ethics. Information does not care how it is used. It will not stop itself from spamming customers, sharing itself if it is sensitive or personal, or revealing details to third parties. Information cannot delete or preserve itself. Therefore, it falls on the shoulders of those who own the information to develop ethical guidelines on how to manage the information. Figure 4.5 provides an overview of some of the important laws that individuals must follow when they are attempting to manage and protect information.

FIGURE 4.4

Acting Ethically and Legally Are Not Always the Same

FIGURE 4.5

Established Information-Related Laws

Established Information-Related Laws

Privacy Act—1974	Restricts what information the federal government can collect; allows people to access and correct information on themselves; requires procedures to protect the security of personal information; and forbids the disclosure of name-linked information without permission.
Family Education Rights and Privacy Act—1974	Regulates access to personal education records by government agencies and other third parties and ensures the right of students to see their own records.
Cable Communications Act—1984	Requires written or electronic consent from viewers before cable TV providers can release viewing choices or other personally identifiable information.
Electronic Communications Privacy Act—1986	Allows the reading of communications by a firm and says that employees have no right to privacy when using their companies' computers.
Computer Fraud and Abuse Act—1986	Prohibits unauthorized access to computers used for financial institutions, the U.S. government, or interstate and international trade.
The Bork Bill (officially known as the Video Privacy Protection Act, 1988)	Prohibits the use of video rental information on customers for any purpose other than that of marketing goods and services directly to the customer.
Communications Assistance for Law Enforcement Act—1994	Requires that telecommunications equipment be designed so that authorized government agents are able to intercept all wired and wireless communications being sent or received by any subscriber. The Act also requires that subscriber call-

	identifying information be transmitted to a government when and if required.
Freedom of Information Act— 1967, 1975, 1994, and 1998	Allows any person to examine government records unless it would cause an invasion of privacy. It was amended in 1974 to apply to the FBI, and again in 1994 to allow citizens to monitor government activities and information gathering, and once again in 1998 to access government information on the Internet.
Health Insurance Portability and Accountability Act (HIPPA)—1996	Requires that the health care industry formulate and implement regulations to keep patient information confidential.
Identity Theft and Assumption Deterrence Act—1998	Strengthened the criminal laws governing identity theft making it a federal crime to use or transfer identification belonging to another. It also established a central federal service for victims.
USA Patriot Act—2001 and 2003	Allows law enforcement to get access to almost any information, including library records, video rentals, bookstore purchases, and business records when investigating any act of terrorist or clandestine intelligence activities. In 2003, Patriot II broadened the original law.
Homeland Security Act—2002	Provided new authority to government agencies to mine data on individuals and groups including e-mails and Web site visits; put limits on the information available under the Freedom of Information Act; and gave new powers to government agencies to declare national heath emergencies.
Sarbanes-Oxley Act—2002	Sought to protect investors by improving the accuracy and reliability of corporate disclosures and requires companies to (1) implement extensive and detailed policies to prevent illegal activity within the company, and (2) to respond in a timely manner to investigate illegal activity.

Fair and Accurate Credit Transactions Act—2003	Included provisions for the prevention of identity theft including consumers' right to get a credit report free each year, requiring merchants to leave all but the last five digits of a credit card number off a receipt, and requiring lenders and credit agencies to take action even before a victim knows a crime has occurred when they notice any circumstances that might indicate identity theft.
CAN-Spam Act—2003	Sought to regulate interstate commerce by imposing limitations and penalties on businesses sending unsolicited e-mail to consumers. The law forbids deceptive subject lines, headers, return addresses, etc., as well as the harvesting of e-mail addresses from Web sites. It requires businesses that send spam to maintain a do-not-spam list and to include a postal mailing address in the message.

DEVELOPING INFORMATION MANAGEMENT POLICIES

Treating sensitive corporate information as a valuable resource is good management. Building a corporate culture based on ethical principles that employees can understand and implement is responsible management. In an effort to provide guidelines for ethical information management, *CIO* magazine (along with over 100 CIOs) developed six principles for ethical information management displayed in Figure 4.6.

Organizations should develop written policies establishing employee guidelines, personnel procedures, and organizational rules for information. These policies set employee expectations about the organization's practices and standards and protect the organization from misuse of computer systems and IT resources. If an organization's employees use computers at work, the organization should, at a minimum, implement ePolicies. *ePolicies* are policies and procedures that address the ethical use of computers and Internet usage in the business environment. These policies typically embody the following:

- Ethical computer use policy.
- Information privacy policy.
- Acceptable use policy.
- E-mail privacy policy.
- Internet use policy.
- Anti-spam policy.

Ethical Computer Use Policy

One of the essential steps in creating an ethical corporate culture is establishing an ethical computer use policy. An *ethical computer use policy* contains general principles to guide computer user behavior. For example, the ethical computer use policy might explicitly state that users should refrain from playing computer games during working hours. This policy ensures the users know how to behave at work and the organization has a published standard by which to deal with user infractions. For example, after appropriate warnings, the company may terminate an employee who spends significant amounts of time playing computer games at work.

FIGURE 4.6

CIO Magazine's Six Principles for Ethical Information Management

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Six Principles for Ethical Information Management

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1. Information is a valuable corporate asset and should be managed as such, like cash, facilities, or any other corporate asset.

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2. The CIO is steward of corporate information and is responsible for managing it over its life cycle—from its generation to its appropriate destruction.

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3. The CIO is responsible for controlling access to and use of information, as determined by governmental regulation and corporate policy.

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4. The CIO is responsible for preventing the inappropriate destruction of information.

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5. The CIO is responsible for bringing technological knowledge to the development of information management practices and policies.

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6. The CIO should partner with executive peers to develop and execute the organization's information management policies.

There are variations in how organizations expect their employees to use computers, but in any approach, the overriding principle when seeking appropriate computer use should be informed consent. The users should be

informed of the rules and, by agreeing to use the system on that basis, *consent* to abide by the rules.

An organization should make a conscientious effort to ensure all users are aware of the policy through formal training and other means. If an organization were to have only one ePolicy, it should be an ethical computer use policy since it is the starting point and the umbrella for any other policies the organization might establish.

Information Privacy Policy

Scott Thompson is the executive vice president of Inovant, the company Visa set up to handle its technology. Thompson errs on the side of caution in regard to Visa's information: He bans the use of Visa's customer information for anything outside its intended purpose—billing.

Visa's customer information details how people are spending their money, in which stores, on which days, and even at what time of day. Sales and marketing departments around the country no doubt are salivating at any prospect of gaining access to Visa's databases. "They would love to refine the information into loyalty programs, target markets, or even partnerships with Visa. There are lots of creative people coming up with these ideas. This whole area of information sharing is enormous and growing. For the marketers, the sky's the limit," Thompson said. Privacy specialists along with Thompson developed a strict credit card information policy, which the company follows.

The question now is can Thompson guarantee that unethical use of his information will not occur? Many experts do not believe that he can. In a large majority of cases, the unethical use of information happens not through the malicious scheming of a rogue marketer, but rather unintentionally. For instance, information is collected and stored for some purpose, such as record keeping or billing. Then, a sales or marketing professional figures out another way to use it internally, share it with partners, or sell it to a trusted third party. The information is "unintentionally" used for new purposes. The classic example of this type of unintentional information reuse is the Social Security number, which started simply as a way to identify government retirement benefits and is now used as a sort of universal personal ID, found on everything from drivers' licenses to savings accounts.

An organization that wants to protect its information should develop an information privacy policy. An *information privacy policy* contains general principles regarding information privacy. Figure 4.7 highlights a few guidelines an organization can follow when creating an information privacy policy.

Acceptable Use Policy

An *acceptable use policy (AUP)* is a policy that a user must agree to follow in order to be provided access to a network or to the Internet. *Nonrepudiation* is a contractual stipulation to ensure that e-business participants do not deny (repudiate) their online actions. A nonrepudiation clause is typically contained in an AUP.

Many businesses and educational facilities require employees or students to sign an acceptable use policy before gaining network access. When signing up with an Internet service provider (ISP), each customer is typically presented with an AUP, which states that they agree to adhere to certain stipulations (see Figure 4.8).

E-Mail Privacy Policy

E-mail is so pervasive in organizations that it requires its own specific policy. In a recent survey, 80 percent of professional workers identified e-mail as their preferred means of corporate communications. Trends also show a dramatic increase in the adoption rate of instant messaging (IM) in the workplace. While e-mail and IM are common business communication tools, there are risks associated with using them. For instance, a sent e-mail is stored on at least three or four different computers (see Figure 4.9). Simply deleting an e-mail from one computer does not delete it off the other computers. Companies can mitigate many of the risks of using electronic messaging systems by implementing and adhering to an e-mail privacy policy.[6]

FIGURE 4.7

Organizational Guidelines for Creating an Information Privacy Policy

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Creating an Information Privacy Policy

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1.   **Adoption and implementation of a privacy policy.** An organization engaged in online activities or e-business has a responsibility to adopt and implement a policy for protecting the privacy of personal information. Organizations should also take steps that foster the adoption and implementation of effective online privacy policies by the organizations with which they interact, for instance, by sharing best practices with business partners.

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2.   **Notice and disclosure.** An organization's privacy policy must be easy to find, read, and understand. The policy must clearly state:

- What information is being collected?

- The use of information being collected.

- Possible third-party distribution of that information.

- The choices available to an individual regarding collection, use, and distribution of the collected information.

- A statement of the organization's commitment to information security.

- What steps the organization takes to ensure information quality and access.

3.   Choice and consent. Individuals must be given the opportunity to exercise choice regarding how personal information collected from them online may be used when such use is unrelated to the purpose for which the information was collected. At a minimum, individuals should be given the opportunity to opt out of such use.

4.   Information security. Organizations creating, maintaining, using, or disseminating personal information should take appropriate measures to assure its reliability and should take reasonable precautions to protect it from loss, misuse, or alteration.

5.   Information quality and access. Organizations should establish appropriate processes or mechanisms so that inaccuracies in material personal information, such as account or contact information, may be corrected. Other procedures to assure information quality may include use of reliable sources, collection methods, appropriate consumer access, and protection against accidental or unauthorized alteration.

FIGURE 4.8

Acceptable Use Policy Stipulations

Acceptable Use Policy Stipulations

1.   Not using the service as part of violating any law.

2.	Not attempting to break the security of any computer network or user.

3.	Not posting commercial messages to groups without prior permission.

4.	Not performing any nonrepudiation.

5.	Not attempting to send junk e-mail or spam to anyone who does not want to receive it.

6.	Not attempting to mail bomb a site. A *mail bomb* is sending a massive amount of e-mail to a specific person or system resulting in filling up the recipient's disk space, which, in some cases, may be too much for the server to handle and may cause the server to stop functioning.

One of the major problems with e-mail is the user's expectations of privacy. To a large extent, this exception is based on the false assumption that e-mail privacy protection exists somehow analogous to that of U.S. first-class mail. This is simply not true.

FIGURE 4.9

E-Mail Is Stored on Multiple Computers

Generally, the organization that owns the e-mail system can operate the system as openly or as privately as it wishes. That means that if the organization wants to read everyone's e-mail, it can do so. If it chooses not to read any, that is allowable too. Hence, it is up to the organization to decide how much, if any, e-mail it is going to read. Then, when it decides, it must inform the users, so that they can consent to this level of intrusion. In other words, an *e-mail privacy policy* details the extent to which e-mail messages may be read by others.

Organizations must create an e-mail privacy policy. Figure 4.10 displays a few of the key stipulations generally contained in an e-mail privacy policy.

Internet Use Policy

Similar to e-mail, the Internet has some unique aspects that make it a good candidate for its own policy. These include the large amounts of computing resources that Internet users can expend, thus making it essential that such use be legitimate. In addition, the Internet contains numerous materials that some believe are offensive and, hence,

some regulation is required. An ***Internet use policy*** contains general principles to guide the proper use of the Internet. Figure 4.11 lists a few important stipulations that might be included in an Internet use policy.

FIGURE 4.10

E-Mail Privacy Policy Stipulations

E-Mail Privacy Policy Stipulations
1.   The policy should be complementary to the ethical computer use policy.
2.   It defines who legitimate e-mail users are.
3.   It explains the backup procedure so users will know that at some point, even if a message is deleted from their computer, it will still be on the backup tapes.
4.   It describes the legitimate grounds for reading someone's e-mail and the process required before such action can be taken.
5.   It informs that the organization has no control of e-mail once it is transmitted outside the organization.
6.   It explains what will happen if the user severs his or her connection with the organization.
7.   It asks employees to be careful when making organizational files and documents available to others.

FIGURE 4.11

Internet Use Policy Stipulations

Internet Use Policy Stipulations
1.   The policy should describe available Internet services because not all Internet sites allow users to access all services.

2.	The policy should define the organization's position on the purpose of Internet access and what restrictions, if any, are placed on that access.
3.	The policy should complement the ethical computer use policy.
4.	The policy should describe user responsibility for citing sources, properly handling offensive material, and protecting the organization's good name.
5.	The policy should clearly state the ramifications if the policy is violated.

Anti-Spam Policy

Chief technology officer (CTO) of the law firm Fenwick and West, Matt Kesner reduced incoming spam by 99 percent and found himself a corporate hero. Before the spam reduction, the law firm's partners (whose time is worth $350 to $600 an hour) found themselves spending hours each day sifting through 300 to 500 spam messages. The spam blocking engineered by Kesner traps between 5,000 and 7,000 messages a day.[7]

Spam is unsolicited e-mail. An ***anti-spam policy*** simply states that e-mail users will not send unsolicited e-mails (or spam). Spam plagues all levels of employees within an organization from receptionists to CEOs. Estimates indicate that spam accounts for 40 percent to 60 percent of most organizations' e-mail traffic. Ferris Research says spam cost U.S. businesses over $10 billion in 2005, and Nucleus Research stated that companies forfeit $874 per employee annually in lost productivity from spam alone. Spam clogs e-mail systems and siphons IT resources away from legitimate business projects.[8]

It is difficult to write anti-spam policies, laws, or software because there is no such thing as a universal litmus test for spam. One person's spam is another person's newsletter. End users have to be involved in deciding what spam is because what is unwanted can vary widely not just from one company to the next, but from one person to the next. What looks like spam to the rest of the world could be essential business communications for certain employees.

John Zarb, CIO of Libbey, a manufacturer of glassware, china, and flatware, tested Guenivere (a virus and subject-line filter) and SpamAssassin (an open source spam filter). He had to shut them off after 10 days because they were rejecting important legitimate e-mails. As Zarb quickly discovered, once an organization starts filtering e-mail, it runs the risk of blocking legitimate e-mails that look like spam. Avoiding an unacceptable level of "false

positives" requires a delicate balancing act. The IT team tweaked the spam filters and today, the filters block about 70 percent of Libbey's spam, and Zarb said the "false positive" rate is far lower, but still not zero. Figure 4.12 highlights a few methods an organization can follow to prevent spam.

FIGURE 4.12

Spam Prevention Tips

Spam Prevention Tips

- **Disguise e-mail addresses posted in a public electronic place.** When posting an e-mail address in a public place, disguise the address through simple means such as replacing "jsmith@domain.com" with "jsmith at domain dot com." This prevents spam from recognizing the e-mail address.

- **Opt out of member directories that may place an e-mail address online.** Choose not to participate in any activities that place e-mail addresses online. If an e-mail address is placed online be sure it is disguised in some way.

- **Use a filter.** Many ISPs and free e-mail services now provide spam filtering. While filters are not perfect, they can cut down tremendously on the amount of spam a user receives.

ETHICS IN THE WORKPLACE

Concern is growing among employees that infractions of corporate policies—even accidental ones—will be a cause for disciplinary action. The Whitehouse.gov Internet site displays the U.S. president's official Web site and updates on bill signings and new policies. Whitehouse.com, however, leads to a trashy site that capitalizes on its famous name. A simple mistype from .gov to .com could potentially cost someone her or his job if the company has a termination policy for viewing illicit Web sites. Monitoring employees is one of the largest issues facing CIOs when they are developing information management policies.

Legal precedents that hold businesses financially responsible for their employees' actions drives the decision of whether to monitor what employees do on company time with corporate resources. Increasingly, employee

monitoring is not a choice; it is a risk-management obligation. Michael Soden, CEO of the Bank of Ireland, issued a mandate stating that company employees could not surf illicit Web sites with company equipment. Next, he hired Hewlett-Packard to run the IT department. A Hewlett-Packard employee soon discovered illicit Web sites on Soden's computer. Soden resigned.[9]

A recent survey of workplace monitoring and surveillance practices by the American Management Association (AMA) and the ePolicy Institute showed the degree to which companies are turning to monitoring:

- 82 percent of the study's 1,627 respondents acknowledged conducting some form of electronic monitoring or physical surveillance.
- 63 percent of the companies stated that they monitor Internet connections.
- 47 percent acknowledged storing and reviewing employee e-mail messages.[10]

Monitoring Technologies

Many employees use their company's high-speed Internet access to shop, browse, and surf the Web. Fifty-nine percent of all 2004 Web purchases in the United States were made from the workplace, according to ComScore Networks. Vault.com determined that 47 percent of employees spend at least half an hour a day surfing the Web.[11]

This research indicates that managers should monitor what their employees are doing with their Web access. Most managers do not want their employees conducting personal business during working hours. For these reasons many organizations have increasingly taken the Big Brother approach to Web monitoring with software that tracks Internet usage and even allows the boss to read employees' e-mail. Figure 4.13 highlights a few reasons the effects of employee monitoring are worse than the lost productivity from employee Web surfing.

This is the thinking at SAS Institute, a private software company consistently ranked in the top 10 on many "Best Places to Work" surveys. SAS does not monitor its employees' Web usage. The company asks its employees to use company resources responsibly, but does not mind if they occasionally check sports scores or use the Web for shopping.

FIGURE 4.13

Employee Monitoring Effects

Employee Monitoring Effects

1. Employee absenteeism is on the rise, almost doubling in 2004 to 21 percent. The lesson here might be that more employees are missing work to take care of personal business. Perhaps losing a few minutes here or there—or even a couple of hours—is cheaper than losing entire days.

2. Studies indicate that electronic monitoring results in lower job satisfaction, in part because people begin to believe the quantity of their work is more important than the quality.

3. Electronic monitoring also induces what psychologists call "psychological reactance": the tendency to rebel against constraints. If you tell your employees they cannot shop, they cannot use corporate networks for personal business, and they cannot make personal phone calls, then their desire to do all these things will likely increase.

Many management gurus advocate that organizations whose corporate cultures are based on trust are more successful than those whose corporate cultures are based on distrust. Before an organization implements monitoring technology it should ask itself, "What does this say about how the organization feels about its employees?" If the organization really does not trust its employees, then perhaps it should find new ones. If an organization does trust its employees, then it might want to treat them accordingly. An organization that follows its employees' every keystroke is unwittingly undermining the relationships with its employees.[12]

Information technology monitoring is tracking people's activities by such measures as number of keystrokes, error rate, and number of transactions processed. Figure 4.14 displays different types of monitoring technologies currently available.

Employee Monitoring Policies

The best path for an organization planning to engage in employee monitoring is open communication surrounding the issue. A recent survey discovered that communication about monitoring issues is weak for most organizations. One in five companies did not even have an acceptable use policy and one in four companies did not have an Internet use policy. Companies that did have policies usually tucked them into the rarely probed recesses of the employee handbook, and then the policies tended to be of the vague and legal jargon variety: "XYZ company

reserves the right to monitor or review any information stored or transmitted on its equipment." Reserving the right to monitor is materially different from clearly stating that the company does monitor, listing what is tracked, describing what is looked for, and detailing the consequences for violations.

An organization must formulate the right monitoring policies and put them into practice. Employee monitoring policies explicitly state how, when, and where the company monitors its employees. CSOs that are explicit about what the company does in the way of monitoring and the reasons for it, along with actively educating their employees about what unacceptable behavior looks like, will find that employees not only acclimate quickly to a policy, but also reduce the CSO's burden by policing themselves. Figure 4.15 displays several common stipulations an organization can follow when creating an employee monitoring policy.

FIGURE 4.14

Monitoring Technologies

Common Monitoring Technologies

Key logger, or key trapper, software	A program that, when installed on a computer, records every keystroke and mouse click.
Hardware key logger	A hardware device that captures keystrokes on their journey from the keyboard to the motherboard.
Cookie	A small file deposited on a hard drive by a Web site containing information about customers and their Web activities. Cookies allow Web sites to record the comings and goings of customers, usually without their knowledge or consent.
Adware	Software that generates ads that install themselves on a computer when a person downloads some other program from the Internet.
Spyware	Software that comes hidden in free downloadable software and

(sneakware *or* *stealthware)*	tracks online movements, mines the information stored on a computer, or uses a computer's CPU and storage for some task the user knows nothing about.
Web log	Consists of one line of information for every visitor to a Web site and is usually stored on a Web server.
Clickstream	Records information about a customer during a Web surfing session such as what Web sites were visited, how long the visit was, what ads were viewed, and what was purchased.

FIGURE 4.15

Employee Monitoring Policy Stipulations

Employee Monitoring Policy Stipulations

1.	Be as specific as possible.
2.	Always enforce the policy.
3.	Enforce the policy in the same way for everyone.
4.	Expressly communicate that the company reserves the right to monitor all employees.
5.	Specifically state when monitoring will be performed.
6.	Specifically state what will be monitored (e-mail, IM, Internet, network activity, etc.).
7.	Describe the types of information that will be collected.
8.	State the consequences for violating the policy.

9. State all provisions that allow for updates to the policy.

10. Specify the scope and manner of monitoring for any information system.

11. When appropriate, obtain a written receipt acknowledging that each party has received, read, and understood the monitoring policies.

OPENING CASE QUESTIONS

Sarbanes-Oxley: Where Information Technology, Finance, and Ethics Meet

1. Define the relationship between ethics and the Sarbanes-Oxley Act.

2. Why is records management an area of concern for the entire organization and not just the IT department?

3. Identify two policies an organization can implement to achieve Sarbanes-Oxley compliance.

4. What ethical dilemmas are being solved by implementing Sarbanes-Oxley?

5. What is the biggest ethical roadblock for organizations attempting to achieve Sarbanes-Oxley compliance?

section 4.2 INFORMATION SECURITY

LEARNING OUTCOMES

4.6. Describe the relationship between information security policies and an information security plan.

4.7. Summarize the five steps to creating an information security plan.

4.8. Provide an example of each of the three primary information security areas: (1) authentication and authorization, (2) prevention and resistance, and (3) detection and response.

4.9. Describe the relationships and differences between hackers and viruses.

PROTECTING INTELLECTUAL ASSETS

Organizational information is intellectual capital. Just as organizations protect their assets—keeping their money in an insured bank or providing a safe working environment for employees—they must also protect their intellectual capital. An organization's intellectual capital includes everything from its patents to its transactional and analytical information. With security breaches on the rise and computer hackers everywhere, an organization must put in place strong security measures to survive.

The Health Insurance Portability and Accountability Act (HIPAA) protects the privacy and security of personal

health records and has the potential to impact every business in the United States. HIPAA affects all companies that use electronic data interchange (EDI) to communicate personal health records. HIPAA requires health care organizations to develop, implement, and maintain appropriate security measures when sending electronic health information. Most important, these organizations must document and keep current records detailing how they are performing security measures for all transmissions of health information. On April 21, 2005, security rules for HIPAA became enforceable by law.

According to recent Gartner polls, less than 10 percent of all health care organizations have begun to implement the security policies and procedures required by HIPAA. The Health Information Management Society estimates that 70 percent of all health care providers failed to meet the April 2005 deadline for privacy rule compliance. Health care organizations need to start taking HIPAA regulations seriously since noncompliance can result in substantial fines and even imprisonment.[13]

Beyond the health care industry, all businesses must understand the importance of information security, even if it is not enforceable by law. **Information security** is a broad term encompassing the protection of information from accidental or intentional misuse by persons inside or outside an organization. Figure 4.16 displays the typical size of an organization's information security budget relative to the organization's overall IT budget from the CSI/FBI 2004 Computer Crime and Security Survey. Forty-six percent of respondents indicated that their organization spent between 1 and 5 percent of the total IT budget on security. Only 16 percent indicated that their organization spent less than 1 percent of the IT budget on security.

Figure 4.17 displays the spending per employee on computer security broken down by both public and private industries. The highest average computer security investment per employee was found in the transportation industry.[14]

FIGURE 4.16

Organization's Security Budget

FIGURE 4.17

Security Spending per Employee

Security is perhaps the most fundamental and critical of all the technologies/disciplines an organization must have squarely in place to execute its business strategy. Without solid security processes and procedures, none of the other technologies can develop business advantages.

THE FIRST LINE OF DEFENSE—PEOPLE

With current advances in technologies and business strategies such as CRM, organizations are able to determine valuable information such as who are the top 20 percent of the customers that produce 80 percent of all revenues. Most organizations view this type of information as valuable intellectual capital, and they are implementing security measures to prevent the information from walking out the door or falling into the wrong hands. Enterprises can implement information security lines of defense through people first and through technology second.

Adding to the complexity of information security is the fact that organizations must enable employees, customers, and partners to access information electronically to be successful in this electronic world. Doing business electronically automatically creates tremendous information security risks for organizations. Surprisingly, the biggest issue surrounding information security is not a technical issue, but a people issue.

The CSI/FBI Computer Crime and Security Survey reported that 38 percent of respondents indicated security incidents originated within the enterprise. *Insiders* are legitimate users who purposely or accidentally misuse their access to the environment and cause some kind of business-affecting incident. Most information security breaches result from people misusing an organization's information either advertently or inadvertently. For example, many individuals freely give up their passwords or write them on sticky notes next to their computers, leaving the door wide open to intruders.[15]

The director of information security at a large health care company discovered how easy it was to create an information security breach when she hired outside auditors to test her company's security awareness. In one instance, auditors found that staff members testing a new system had accidentally exposed the network to outside hackers. In another, auditors were able to obtain the passwords of 16 employees when the auditors posed as support staff; hackers frequently use such "social engineering" to obtain passwords. *Social engineering* is using one's social skills to trick people into revealing access credentials or other information valuable to the attacker. Dumpster diving, or looking through people's trash, is another way social engineering hackers obtain information.[16]

Information security policies identify the rules required to maintain information security. An *information security plan* details how an organization will implement the information security policies. Figure 4.18 is an example of the University of Denver's Information Security Plan.

The first line of defense an organization should follow is to create an information security plan detailing the various information security policies. A detailed information security plan can alleviate people-based information

security issues. Figure 4.19 displays the five steps for creating an information security plan.

FIGURE 4.18

Sample Information Security Plan

Interim Information Security Plan

This Information Security Plan ("Plan") describes the University of Denver's safeguards to protect information and data in compliance ("Protected Information") with the Financial Services Modernization Act of 1999, also known as the Gramm Leach Bliley Act, 15 U.S.C. Section 6801. These safeguards are provided to:

- Ensure the security and confidentiality of Protected Information;
- Protect against anticipated threats or hazards to the security or integrity of such information; and
- Protect against unauthorized access to or use of Protected Information that could result in substantial harm or inconvenience to any customer.

This Information Security Plan also provides for mechanisms to:

- Identify and assess the risks that may threaten Protected Information maintained by the University of Denver;
- Develop written policies and procedures to manage and control these risks;
- Implement and review the plan; and
- Adjust the plan to reflect changes in technology, the sensitivity of covered data and information and internal or external threats to information security.

Identification and Assessment of Risks to Customer Information

The University of Denver recognizes that it has both internal and external risks. These risks include, but are not limited to:

- Unauthorized access of Protected Information by someone other than the owner of the covered data and information

- Compromised system security as a result of system access by an unauthorized person

- Interception of data during transmission

- Loss of data integrity

- Physical loss of data in a disaster

- Errors introduced into the system

- Corruption of data or systems

- Unauthorized access of covered data and information by employees

- Unauthorized requests for covered data and information

- Unauthorized access through hardcopy files or reports

- Unauthorized transfer of covered data and information through third parties

The University of Denver recognizes that this may not be a complete list of the risks associated with the protection of Protected Information. Since technology growth is not static, new risks are created regularly. Accordingly, the Information Technology Department and the Office of Student Affairs will actively participate with and seek advice from an advisory committee made up of university representatives for identification of new risks. The University of Denver believes current safeguards used by the Information Technology Department are reasonable and, in light of current risk assessments are sufficient to provide security and confidentiality to Protected Information maintained by the University.

Information Security Plan Coordinators

The University CIO and the Vice President for Student Affairs, in consultation with an

advisory committee, have been appointed as the coordinators of this Plan. They are responsible for assessing the risks associated with unauthorized transfers of covered data and information and implementing procedures to minimize those risks to the University of Denver.

Design and Implementation of Safeguards Program

Employee Management and Training

During employee orientation, each new employee in departments that handle Protected Information will receive proper training on the importance of confidentiality of Protected Information.

Physical Security

The University of Denver has addressed the physical security of Protected Information by limiting access to only those employees who have a business reason to know such information.

Information Systems

The University of Denver has policies governing the use of electronic resources and firewall and wireless policies. The University of Denver will take reasonable and appropriate steps consistent with current technological developments to make sure that all Protected Information is secure and to safeguard the integrity of records in storage and transmission. The University of Denver will develop a plan to ensure that all electronic Protected Information is encrypted in transit.

Selection of Appropriate Service Providers

Due to the specialized expertise needed to design, implement, and service new technologies, vendors may be needed to provide resources that the University of Denver determines not to provide on its own. In the process of choosing a service provider that will maintain or regularly access Protected Information, the evaluation process shall include the ability of the service provider to safeguard Protected Information. Contracts with service providers may include the following provisions:

■ A stipulation that the Protected Information will be held in strict confidence and accessed only for the explicit business purpose of the contract;

■ An assurance from the contract partner that the partner will protect the Protected Information it receives.

Continuing Evaluation and Adjustment

This Information Security Plan will be subject to periodic review and adjustment, especially when due to the constantly changing technology and evolving risks. The Coordinators, in consultation with the Office of General Counsel, will review the standards set forth in this policy and recommend updates and revisions as necessary. It may be necessary to adjust the plan to reflect changes in technology, the sensitivity of student/customer data and internal or external threats to information security.

FIGURE 4.19

Creating an Information Security Plan

Five Steps for Creating an Information Security Plan

1. Develop the information security policies	Identify who is responsible and accountable for designing and implementing the organization's information security policies. Simple, yet highly effective types of information security policies include requiring users to log off of their systems before leaving for lunches or meetings, never sharing passwords with anyone,

	and changing personal passwords every 60 days. The chief security officer (CSO) will typically be responsible for designing these information security policies.
2. Communicate the information security policies	Train all employees on the policies and establish clear expectations for following the policies. For example, let all employees know that they will receive a formal reprimand for leaving a computer unsecured.
3. Identify critical information assets and risks	Require the use of user IDs, passwords, and antivirus software on all systems. Ensure any systems that contain links to external networks have the appropriate technical protections such as firewalls or intrusion detection software. A *firewall* is hardware and/or software that guards a private network by analyzing the information leaving and entering the network. *Intrusion detection software (IDS)* searches out patterns in information and network traffic to indicate attacks and quickly responds to prevent any harm.
4. Test and reevaluate risks	Continually perform security reviews, audits, background checks, and security assessments.
5. Obtain stakeholder support	Gain the approval and support of the information security polices from the board of directors and all stakeholders.

Figure 4.20 provides the top 10 questions from Ernst & Young that managers should ask to ensure their information is secure.

FIGURE 4.20

Top 10 Questions Managers Should Ask Regarding Information Security

1. Does our Board of Directors recognize information security is a board level issue that cannot be left to the IT department alone?

2. Is there clear accountability for information security in our organization?

3. Do our Board members articulate an agreed-upon set of threats and critical assets? How often do we review and update these?

4. How much is spent on information security and what is it being spent on?

5. What is the impact on the organization of a serious security incident?

6. Does our organization view information security as an enabler? (For example, by implementing effective security, could we enable our organization to increase business over the Internet?)

7. What is the risk to our business of getting a reputation for low information security?

8. What steps have we taken to ensure that third parties will not compromise the security of our organization?

9. How do we obtain independent assurance that information security is managed effectively in our organization?

10. How do we measure the effectiveness of our information security activities?

THE SECOND LINE OF DEFENSE—TECHNOLOGY

Arkansas State University (ASU) recently completed a major network upgrade that brought gigabit-speed network capacity to every dorm room and office on its campus. The university was concerned that the new network would be

a tempting playground for hackers. To reduce its fear, the university installed intrusion detection software (IDS) from Cisco Systems to stay on top of security and potential network abuses. Whenever the IDS spots a potential security threat, such as a virus or a hacker, it alerts the central management system. The system automatically pages the IT staff, who deal with the attack by shutting off access to the system, identifying the hacker's location, and calling campus security.[17]

Once an organization has protected its intellectual capital by arming its people with a detailed information security plan, it can begin to focus its efforts on deploying the right types of information security technologies such as the IDS installed at Arkansas State.

International Data Corp. estimated worldwide spending on IT security software, hardware, and services would top $35 billion in 2004. Organizations can deploy numerous technologies to prevent information security breaches. When determining which types of technologies to invest in, it helps to understand the three primary information security areas:

1. Authentication and authorization.

2. Prevention and resistance.

3. Detection and response.[18]

Authentication and Authorization

Authentication is a method for confirming users' identities. Once a system determines the authentication of a user, it can then determine the access privileges (or authorization) for that user. *Authorization* is the process of giving someone permission to do or have something. In multiple-user computer systems, user access or authorization determines such things as file access, hours of access, and amount of allocated storage space. Authentication and authorization techniques are broken down into three categories, and the most secure type involves a combination of all three:

1. Something the user knows such as a user ID and password.

2. Something the user has such as a smart card or token.

3. Something that is part of the user such as a fingerprint or voice signature.

Something the User Knows Such As a User ID and Password   The first type of authentication, using something the user knows, is the most common way to identify individual users and typically consists of a unique user ID and password. However, this is actually one of the most *ineffective* ways for determining authentication because

passwords are not secure. All it typically takes to crack a password is enough time. More than 50 percent of help-desk calls are password related, which can cost an organization significant money, and passwords are vulnerable to being coaxed out of somebody by a social engineer.

Identity theft is the forging of someone's identity for the purpose of fraud. The fraud is often financial fraud, to apply for and use credit cards in the victim's name or to apply for a loan. Figure 4.21 displays several examples of identity theft.

Phishing is a common way to steal identities online. ***Phishing*** is a technique to gain personal information for the purpose of identity theft, usually by means of fraudulent e-mail. One way to accomplish phishing is to send out e-mail messages that look as though they came from legitimate businesses such as AOL, MSN, or Amazon. The messages appear to be genuine with official-looking formats and logos. These e-mails typically ask for verification of important information like passwords and account numbers. The reason given is often that this personal information is required for accounting or auditing purposes. Since the e-mails look authentic, up to one in five recipients respond with the information, and subsequently becomes a victim of identity theft and other fraud. Figure 4.22 displays the amount of money lost to identity thefts based on stolen passwords, among other things.

FIGURE 4.21

Examples of Identity Theft

Identity Theft Examples

An 82-year-old woman in Fort Worth, Texas, discovered that her identity had been stolen when the woman using her name was involved in a four-car collision. For 18 months, she kept getting notices of lawsuits and overdue medical bills that were really meant for someone else. It took seven years for her to get her financial good name restored after the identity thief charged over $100,000 on her 12 fraudulently acquired credit cards.

A 42-year-old retired Army captain in Rocky Hill, Connecticut, found that an identity thief had spent $260,000 buying goods and services that included two trucks, a Harley-Davidson motorcycle, and a time-share vacation home in South Carolina. The victim discovered his problem only when his retirement pay was garnished to pay the

outstanding bills.

In New York, members of a pickpocket ring forged the driver's licenses of their victims within hours of snatching the women's purses. Stealing a purse typically results in around $200, if not less. But stealing the person's identity can net on average between $4,000 and $10,000.

A crime gang took out $8 million worth of second mortgages on victims' homes. It turned out the source of all the instances of identity theft came from a car dealership.

The largest identity-theft scam to date in U.S. history was broken up by police in 2002 when they discovered that three men had downloaded credit reports using stolen passwords and sold them to criminals on the street for $60 each. Many millions of dollars were stolen from people in all 50 states.

Something the User Has Such As a Smart Card or Token   The second type of authentication, using something that the user has, offers a much more effective way to identify individuals than a user ID and password. Tokens and smart cards are two of the primary forms of this type of authentication. *Tokens* are small electronic devices that change user passwords automatically. The user enters his or her user ID and token-displayed password to gain access to the network. A *smart card* is a device that is around the same size as a credit card, containing embedded technologies that can store information and small amounts of software to perform some limited processing. Smart cards can act as identification instruments, a form of digital cash, or a data storage device with the ability to store an entire medical record.

Something That Is Part of the User Such As a Fingerprint or Voice Signature   The third kind of authentication, using something that is part of the user, is by far the best and most effective way to manage authentication. *Biometrics* (narrowly defined) is the identification of a user based on a physical characteristic, such as a fingerprint, iris, face, voice, or handwriting. Unfortunately, biometric authentication can be costly and intrusive. For example, iris scans are expensive and considered intrusive by most people. Fingerprint authentication is less intrusive and inexpensive but is also not 100 percent accurate.

Prevention and Resistance

Prevention and resistance technologies stop intruders from accessing intellectual capital. A division of Sony Inc., Sony Pictures Entertainment (SPE), defends itself from attacks by using an intrusion detection system to detect new attacks as they occur. SPE develops and distributes a wide variety of products including movies, television, videos, and DVDs. A compromise to SPE security could result in costing the company valuable intellectual capital as well as millions of dollars and months of time. The company needed an advanced threat management solution that would take fewer resources to maintain and require limited resources to track and respond to suspicious network activity. The company installed an advanced intrusion detection system allowing it to monitor all of its network activity including any potential security breaches.[19]

FIGURE 4.22

Identity Theft Losses by 2005 (billions of dollars)

The cost of downtime or network operation failures can be devastating to any business. For example, eBay experienced a 22-hour outage in June 2000 that caused the company's market cap to plunge an incredible $5.7 billion. Downtime costs for businesses can vary from $100 to $1 million per hour. An organization must prepare for and anticipate these types of outages resulting most commonly from hackers and viruses. Technologies available to help prevent and build resistance to attacks include content filtering, encryption, and firewalls. [20]

Content Filtering

Content filtering occurs when organizations use software that filters content to prevent the transmission of unauthorized information. Organizations can use content filtering technologies to filter e-mail and prevent e-mails containing sensitive information from transmitting, whether the transmission was malicious or accidental. It can also filter e-mails and prevent any suspicious files from transmitting such as potential virus-infected files. E-mail content filtering can also filter for spam, a form of unsolicited e-mail. Estimates predict organizational losses from spam will be about $198 billion by 2007 (see Figure 4.23).[21]

FIGURE 4.23

Corporate Losses Caused by Spam, Worldwide (2003 and 2007 in billions)

Encryption

Encryption scrambles information into an alternative form that requires a key or password to decrypt the information. If there is an information security breach and the information was encrypted, the person stealing the

information will be unable to read it. Encryption can switch the order of characters, replace characters with other characters, insert or remove characters, or use a mathematical formula to convert the information into some sort of code. Companies that transmit sensitive customer information over the Internet, such as credit card numbers, frequently use encryption.

Some encryption technologies use multiple keys like public key encryption. ***Public key encryption (PKE)*** is an encryption system that uses two keys: a public key that everyone can have and a private key for only the recipient (see Figure 4.24). When implementing security using multiple keys, the organization provides the public key to all of its customers (end consumers and other businesses). The customers use the public key to encrypt their information and send it along the Internet. When it arrives at its destination, the organization would use the private key to unscramble the encrypted information.

Firewalls

One of the most common defenses for preventing a security breach is a firewall. A ***firewall*** is hardware and/or software that guards a private network by analyzing the information leaving and entering the network. Firewalls examine each message that wants entrance to the network. Unless the message has the correct markings, the firewall prevents it from entering the network. Firewalls can even detect computers communicating with the Internet without approval. As Figure 4.25 illustrates, organizations typically place a firewall between a server and the Internet.

FIGURE 4.24

Public Key Encryption (PKE) System

FIGURE 4.25

Sample Firewall Architecture Connecting Systems Located in Chicago, New York, and Boston

Detection and Response

The final area where organizations can allocate resources is in detection and response technologies. If prevention and resistance strategies fail and there is a security breach, an organization can use detection and response technologies to mitigate the damage. The most common type of defense within detection and response technologies is antivirus software.

A single worm can cause massive damage. In August 2003, the "Blaster worm" infected over 50,000 computers worldwide and was one of the worst outbreaks of the year. Jeffrey Lee Parson, 18, was arrested by U.S. cyber

investigators for unleashing the damaging worm on the Internet. The worm replicated itself repeatedly, eating up computer capacity, but did not damage information or programs. The worm generated so much traffic that it brought entire networks down.

The FBI used the latest technologies and code analysis to find the source of the worm. Prosecutors said that Microsoft suffered financial losses that significantly exceeded $5,000, the statutory threshold in most hacker cases. Parson, charged with intentionally causing or attempting to cause damage to a computer, was sentenced to 18 months in prison, three years of supervised release, and 100 hours of community service. "What you've done is a terrible thing. Aside from injuring people and their computers, you shook the foundation of technology," U.S. District Judge Marsha Pechman told Parson.

"With this arrest, we want to deliver a message to cyber-hackers here and around the world," said U.S. Attorney John McKay in Seattle. "Let there be no mistake about it, cyber-hacking is a crime. We will investigate, arrest, and prosecute cyber-hackers."[22]

Typically, people equate viruses (the malicious software) with hackers (the people). While not all types of hackers create viruses, many do. Figure 4.26 provides an overview of the most common types of hackers and viruses.

Some of the most damaging forms of security threats to e-business sites include malicious code, hoaxes, spoofing, and sniffers (see Figure 4.27).

FIGURE 4.26

Hackers and Viruses

Hackers—**people very knowledgeable about computers who use their knowledge to invade other people's computers.**

- *White-hat hackers*—work at the request of the system owners to find system vulnerabilities and plug the holes.
- *Black-hat hackers*—break into other people's computer systems and may just look around or may steal and destroy information.
- *Hactivists*—have philosophical and political reasons for breaking into systems and will often deface the Web site as a protest.

- *Script kiddies* or *script bunnies*—find hacking code on the Internet and click-and-point their way into systems to cause damage or spread viruses.

- *Cracker*—a hacker with criminal intent.

- *Cyberterrorists*—seek to cause harm to people or to destroy critical systems or information and use the Internet as a weapon of mass destruction.

Viruses—software written with malicious intent to cause annoyance or damage.

- *Worm*—a type of virus that spreads itself, not only from file to file, but also from computer to computer. The primary difference between a virus and a worm is that a virus must attach to something, such as an executable file, in order to spread. Worms do not need to attach to anything to spread and can tunnel themselves into computers.

- *Denial-of-service attack (DoS)*—floods a Web site with so many requests for service that it slows down or crashes the site.

- *Distributed denial-of-service attack (DDoS)*—attacks from multiple computers that flood a Web site with so many requests for service that it slows down or crashes. A common type is the Ping of Death, in which thousands of computers try to access a Web site at the same time, overloading it and shutting it down.

- *Trojan-horse virus*—hides inside other software, usually as an attachment or a downloadable file.

- *Backdoor programs*—viruses that open a way into the network for future attacks.

- *Polymorphic viruses and worms*—change their form as they propagate.

Implementing information security lines of defense through people first and through technology second is the best way for an organization to protect its vital intellectual capital. The first line of defense is securing intellectual capital by creating an information security plan detailing the various information security policies. The second line of defense is investing in technology to help secure information through authentication and authorization, prevention and resistance, and detection and response.

FIGURE 4.27

Security Threats to E-Business

Elevation of privilege is a process by which a user misleads a system into granting unauthorized rights, usually for the purpose of compromising or destroying the system. For example, an attacker might log onto a network by using a guest account, and then exploit a weakness in the software that lets the attacker change the guest privileges to administrative privileges.

Hoaxes attack computer systems by transmitting a virus hoax, with a real virus attached. By masking the attack in a seemingly legitimate message, unsuspecting users more readily distribute the message and send the attack on to their co-workers and friends, infecting many users along the way.

Malicious code includes a variety of threats such as viruses, worms, and Trojan horses.

Spoofing is the forging of the return address on an e-mail so that the e-mail message appears to come from someone other than the actual sender. This is not a virus but rather a way by which virus authors conceal their identities as they send out viruses.

Spyware is software that comes hidden in free downloadable software and tracks online movements, mines the information stored on a computer, or uses a computer's CPU and storage for some task the user knows nothing about. According to the National Cyber Security Alliance, 91 percent of the study had spyware on their computers that can cause extremely slow performance, excessive pop-up ads, or hijacked home pages.

A *sniffer* is a program or device that can monitor data traveling over a network. Sniffers can show all the data being transmitted over a network, including passwords and sensitive information. Sniffers tend to be a favorite weapon in the hacker's arsenal.

Packet tampering consists of altering the contents of packets as they travel over the Internet or altering data on computer disks after penetrating a network. For example, an attacker might place a tap on a network line to intercept packets as they leave the computer. The attacker could eavesdrop or alter the information as it leaves the network.

OPENING CASE QUESTIONS

Sarbanes-Oxley: Where Information Technology, Finance, and Ethics Meet

6. What information security dilemmas are being solved by implementing Sarbanes-Oxley?

7. How can Sarbanes-Oxley help protect a company's information security?

8. What impact does implementing Sarbanes-Oxley have on information security in a small business?

9. What is the biggest information security roadblock for organizations attempting to achieve Sarbanes-Oxley compliance?

KEY TERMS

Acceptable use policy (AUP) 109

Adware 114

Anti-spam policy 112

Authentication 121

Authorization 121

Backdoor program 126

Biometrics 122

Black-hat hacker 126

Clickstream 114

Confidentiality 105

Content filtering 123

Cookie 114

Copyright 104

Counterfeit software 104

Cracker 126

CLOSING CASE ONE

Banks Banking on Security

Bank of America, Commerce Bancorp, PNC Financial Services Group, and Wachovia were victims of a crime where a person tried to obtain customer data and sell it to law firms and debt-collection agencies. New Jersey police seized 13 computers from the alleged mastermind with 670,000 account numbers and balances. There is no indication the data were used for identity theft, but it highlights how increasingly difficult it is to protect information against such schemes as the market value of personal information grows. In the past, banks were wary of the cost or

customer backlash from adopting network security technologies. Today, banks are beefing up network security as more customers begin to view security as a key factor when choosing a bank.

Bank of America

Bank of America is moving toward a stronger authentication process for its 13 million online customers. Bank of America's new SiteKey service is designed to thwart scams in which customers think they are entering data on the bank's Web site, when they are actually on a thief's site built to steal data. This occurs when a worm tells a computer to reroute the bank's URL into a browser to another site that looks exactly like the banks.

SiteKey offers two-factor authentication. When enrolling in SiteKey, a customer picks an image from a library and writes a brief phrase. Each time the customer signs on, the image and phrase are displayed, indicating that the bank recognizes the computer the customer is using and letting the customer know that they are in fact at the bank's official Web site. The customer then enters a password and proceeds. When signing on from a different computer than usual the customer must answer one of three prearranged questions.

Wells Fargo & Company

"Out-of-wallet" questions contain information that is not found on a driver's license or ATM card. Wells Fargo is implementing a security strategy that operates based on "out-of-wallet" questions as a second factor for network password enrollment and maintenance. It is also offering network security hardware such as key fobs that change passwords every 60 seconds, and launching a two-factor authentication pilot in which small businesses making electronic funds transfers will need a key fob to complete transactions.

E-Trade Financial Corporation

E-Trade Financial Corporation provides customers with account balances exceeding $50,000 a free Digital Security ID for network authentication. The device displays a new six-digit code every 60 seconds, which the customer must use to log on. Accounts under $50,000 can purchase the Digital Security ID device for $25.

Barclay's Bank

Barclay's Bank instituted online-transfer delays of between several hours and one day. The delays, which apply the first time a transfer is attempted between two accounts, are intended to give the bank time to detect suspicious activity, such as a large number of transfers from multiple accounts into a single account. The online-transfer delay was adopted in response to a wave of phishing incidents in which thieves transferred funds from victims' bank

accounts into accounts owned by "mules." Mules are people who open bank accounts based on an e-mail solicitations, usually under the guise of a business proposal. From the mule accounts, the thieves withdraw cash, open credit cards, or otherwise loot the account.

Barclay's also offers account monitoring of customer's actions to compare them with historical profile data to detect unusual behavior. For instance, the service would alert the bank to contact the customer if the customer normally logs on from England and suddenly logs on from New York and performs 20 transactions.[23]

Questions

1. What reason would a bank have for not wanting to adopt an online-transfer delay policy?

2. What are the two primary lines of security defense and why are they important to financial institutions?

3. Explain the differences between the types of security offered by the banks in the case. Which bank would you open an account with and why?

4. What additional types of security, not mentioned in the case above, would you recommend a bank implement?

5. Identify three policies a bank should implement to help it improve information security.

6. Describe monitoring policies along with the best way for a bank to implement monitoring technologies.

CLOSING CASE TWO

Hacker Hunters

Hacker hunters are the new breed of crime fighter. They employ the same methodology used to fight organized crime in the 1980s—informants and the cyberworld equivalent of wiretaps. Daniel Larking, a 20-year veteran who runs the FBI's Internet Crime Complaint Center, taps online service providers to help track down criminal hackers. Leads supplied by the FBI and eBay helped Romanian police round up 11 members of a gang that set up fake eBay accounts and auctioned off cell phones, laptops, and cameras they never intended to deliver.

On October 26, 2004, the FBI unleashed Operation Firewall, targeting the ShadowCrew, a gang whose members were schooled in identity theft, bank account pillage, and selling illegal goods on the Internet. ShadowCrew's 4,000 gang members lived in a dozen countries and across the United States. For months, agents had been watching their every move through a clandestine gateway into their Web site, shadowcrew.com. One member turned informant and called a group meeting, ensuring the members would be at home on their computers during a certain time, when the Secret Service issued orders to move in on the gang. The move was synchronized around the globe to prevent gang

members from warning each other via instant messages. Twenty-eight gang members in eight states and six countries were arrested, most still at their computers. Authorities seized dozens of computers and found 1.7 million credit card numbers and more than 18 million e-mail accounts.

ShadowCrew's Operations

The alleged ringleaders of ShadowCrew included Andres Mantovani, 23, a part-time community college student in Arizona, and David Appleyard, 45, a former New Jersey mortgage broker. Mantovani and Appleyard allegedly were administrators in charge of running the Web site and recruiting members. The site created a marketplace for over 4,000 gang members who bought and sold hot information and merchandise. The Web site was open for business 24 hours a day, but since most of the members held jobs, the busiest time was from 10 p.m. to 2 a.m. on Sundays. Hundreds of gang members would meet online to trade credit card information, passports, and even equipment to make fake identity documents. Platinum credit cards cost more than gold ones and discounts were offered for package deals. One member known as "Scarface" sold 115,695 stolen credit card numbers in a single trade. Overall, the gang made more than $4 million in credit card purchases over two years. ShadowCrew was equivalent to an eBay for the underworld. The site even posted crime tips on how to use stolen credit cards and fake IDs at big retailers.

The gang stole credit card numbers and other valuable information through clever tricks. One of the favorites was sending millions of phishing e-mails—messages that appeared to be from legitimate companies such as Yahoo!— designed to steal passwords and credit card numbers. The gang also hacked into corporate databases to steal account data. According to sources familiar with the investigation, the gang cracked the networks of 12 unidentified companies that were not even aware their systems had been breached.

Police Operations

Brian Nagel, an assistant director at the Secret Service, coordinated the effort to track the ShadowCrew. Allies included Britain's national high-tech crimes unit, the Royal Canadian Mounted Police, and the Bulgarian Interior Ministry. Authorities turned one of the high-ranking members of the gang into a snitch and had the man help the Secret Service set up a new electronic doorway for ShadowCrew members to enter their Web site. The snitch spread the word that the new gateway was a more secure way to the Web site. It was the first-ever tap of a private computer network. "We became shadowcrew.com," Nagel said. Mantovani and Appleyard were slated for trail in late 2005.

Authorities anticipated using case evidence to make additional arrests.[24]

Questions

1. What types of technology could big retailers use to prevent identity thieves from purchasing merchandise?

2. What can organizations do to protect themselves from hackers looking to steal account data?

3. Authorities frequently tap online service providers to track down hackers. Do you think it is ethical for authorities to tap an online service provider and read people's e-mail? Why or why not?

4. Do you think it was ethical for authorities to use one of the high-ranking officials to trap other gang members? Why or why not?

5. In a team, research the Internet and find the best ways to protect yourself from identity theft.

CLOSING CASE THREE

Thinking Like the Enemy

David and Barry Kaufman, the founders of the Intense School, recently added several security courses, including the five-day "Professional Hacking Boot Camp" and "Social Engineering in Two Days."

Information technology departments must know how to protect organizational information. Therefore, organizations must teach their IT personnel how to protect their systems, especially in light of the many new government regulations, such as the Health Insurance Portability and Accountability Act (HIPPA), that demand secure systems. The concept of sending IT professionals to a hacking school seems counterintuitive; it is somewhat similar to sending accountants to an Embezzling 101 course. The Intense School does not strive to breed the next generation of hackers, however, but to teach its students how to be "ethical" hackers: to use their skills to build better locks, and to understand the minds of those who would attempt to crack them.

The main philosophy of the security courses at the Intense School is simply "To know thy enemy." In fact, one of the teachers at the Intense School is none other than Kevin Mitnick, the famous hacker who was imprisoned from 1995 to 2000. Teaching security from the hacker's perspective, as Mitnick does, is more difficult than teaching hacking itself. A hacker just needs to know one way into a system, David Kaufman noted, but a security professional needs to know all of the system's vulnerabilities. The two courses analyze those vulnerabilities from different perspectives.

The hacking course, which costs $3,500, teaches ways to protect against the mischief typically associated with

hackers: worming through computer systems through vulnerabilities that are susceptible to technical, or computer-based, attacks. Mitnick's $1,950 social engineering course, by contrast, teaches the more frightening art of worming through the vulnerabilities of the people using and maintaining systems—getting passwords and access through duplicity, not technology. People that take this class, or read Mitnick's book, *The Art of Deception*, never again think of passwords or the trash bin the same way.

So how does the Intense School teach hacking? With sessions on dumpster diving (the unsavory practice of looking for passwords and other bits of information on discarded papers), with field trips to case target systems, and with practice runs at the company's in-house "target range," a network of computers set up to thwart and educate students.

One feature of the Intense School that raises a few questions is that the school does not check on morals at the door: Anyone paying the tuition can attend the school. Given the potential danger that an unchecked graduate of a hacking school could represent, it is surprising that the FBI does not collect the names of the graduates. But perhaps it gets them anyhow—several governmental agencies have sent students to the school.[25]

Questions

1. How could an organization benefit from attending one of the courses offered at the Intense School?

2. What are the two primary lines of security defense and how can organizational employees use the information taught by the Intense School when drafting an information security plan?

3. Determine the differences between the two primary courses offered at the Intense School, "Professional Hacking Boot Camp" and "Social Engineering in Two Days." Which course is more important for organizational employees to attend?

4. If your employer sent you to take a course at the Intense School, which one would you choose and why?

5. What are the ethical dilemmas involved with having such a course offered by a private company?

MAKING BUSINESS DECISIONS

1. Firewall decisions

You are the CEO of Inverness Investments, a medium-sized venture capital firm that specializes in investing in high-tech companies. The company receives over 30,000 e-mail messages per year. On average, there are two viruses and three successful hackings against the company each year, which result in losses to the company of

about $250,000 per year. Currently, the company has antivirus software installed but does not have any firewalls.

Your CIO is suggesting implementing 10 firewalls for a total cost of $80,000. The estimated life of each firewall is about three years. The chances of hackers breaking into the system with the firewalls installed are about 3 percent. Annual maintenance costs on the firewalls is estimated around $15,000. Create an argument for or against supporting your CIO's recommendation to purchase the firewalls. Are there any considerations in addition to finances?

2. **Preventing identity theft**

The FBI states that identity theft is one of the fastest-growing crimes. If you are a victim of identity theft, your financial reputation can be ruined, making it impossible for you to cash a check or receive a bank loan. Learning how to avoid identity theft can be a valuable activity. Research the following Web sites and draft a document stating the best ways to prevent identity theft.

■ The Federal Trade Commission Consumer Information on ID theft at www.consumer.gov/idtheft.

■ The Office of the Comptroller of the Currency at www.occ.treas.gov/chcktfd.idassume.htm.

■ The Office of the Inspector General at www.ssa.gov/oig/when.htm.

■ U.S. Department of Justice at www.usdoj.gov/criminal/fraud/idtheft.html.

3. **Discussing the three areas of information security**

Great Granola Inc. is a small business operating out of northern California. The company specializes in selling homemade granola, and its primary sales vehicle is through its Web site. The company is growing exponentially and expects its revenues to triple this year to $12 million. The company also expects to hire 60 additional employees to support its growing number of customers. Joan Martin, the CEO, is aware that if her competitors discover the recipe for her granola, or who her primary customers are, it could easily ruin her business. Joan has hired you to draft a document discussing the different areas of information security, along with your recommendations for providing a secure e-business environment.

4. **Information privacy**

A study by the Annenberg Public Policy Center at the University of Pennsylvania shows that 95 percent of people who use the Internet at home think they should have a legal right to know everything about the information that Web sites collect from them. Research also shows that 57 percent of home Internet users incorrectly believe that when a Web site has an information privacy policy it will not share personal information

with other Web sites or companies. In fact, the research found that after showing the users how companies track, extract, and share Web site information to make money, 85 percent found the methods unacceptable, even for a highly valued site. Write a short paper arguing for or against an organization's right to use and distribute personal information gathered from its Web site.

5. **Spying on e-mail**

   Technology advances now allow individuals to monitor computers that they do not even have physical access. New types of software can capture an individual's incoming and outgoing e-mail and then immediately forward that e-mail to another person. For example, if you are at work and your child is home from school and she receives an e-mail from John at 3:00 pm, at 3:01 pm you will receive a copy of that e-mail sent to your e-mail address. A few minutes later, if she replies to John's e-mail, within seconds you will again receive a copy of what she sent to John. Describe two scenarios (other than the above) for the use of this type of software: (1) where the use would be ethical, (2) where the use would be unethical.

6. **Stealing software**

   The software industry fights against pirated software on a daily basis. The major centers of software piracy are in places like Russia and China where salaries and disposable income are comparatively low. People in developing and economically depressed countries will fall behind the industrialized world technologically if they cannot afford access to new generations of software. Considering this, is it reasonable to blame someone for using pirated software when it could potentially cost him or her two months' salary to purchase a legal copy? Create an argument for or against the following statement: "Individuals who are economically less fortunate should be allowed access to software free of charge in order to ensure that they are provided with an equal technological advantage."

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IT Architectures

CHAPTER OUTLINE

SECTION 5.1

Hardware and Software Basics

Hardware Basics

Computer Categories

Software Basics

SECTION 5.2

Managing Enterprise Architectures

Enterprise Architectures

Information Architecture

Infrastructure Architecture

Application Architecture

opening case study

Electronic Breaking Points

What happens when someone accidentally spills a cup of hot coffee on a laptop, puts a USB memory key in a washing machine, or drops an iPod in the sand? How much abuse can electronic products take and keep on working? *PC World* tested several products to determine their breaking points.[1]

Laptop

A Gateway laptop was placed in a shoulder bag and smashed into several doors and walls. It was also dropped off a six-foot-high bookcase to simulate a drop from an airplane's overhead bin. Finally, it was knocked off a desk onto a carpeted floor without the bag. After all the abuse, the Gateway consistently rebooted and recog-

nized the wireless network; however, the battery did become slightly dislodged and the optical drive opened.

Severe physical damage was caused when the laptop was dropped onto a hardwood floor. The laptop's screen cracked, and the black plastic molding above the keyboard cracked. Plastic splinters littered the floor, and the optical drive refused to open.

Spilling coffee in a travel-size mug onto the keyboard caused a slight sizzle, after which the Gateway's blue light winked out. The machine was quickly turned off, the battery removed, the liquid drained, the keys mopped, and the unit set aside. Unfortunately, the laptop never recovered.

Smart Phone

The PalmOne Treo 600 smart phone was stepped on, buried in the sand, bounced around in a car, and dropped off a desk onto carpeted and hardwood floors. Even though the Treo 600 was not protected by a shock-absorbent case or plastic screen cover, there were no signs of failure. Repeatedly knocking it off the desk onto a carpeted floor also left it undamaged, although the unit did turn off on several occasions.

The desk-to-hardwood-floor test produced scratches but nothing else. If dropped when in phone mode, the Treo automatically turned off. If an application was running—the calculator, for example—the device stayed on and the data remained on the screen, though a mysterious extra numeral nine appeared every time it was dropped.

MP3 Player

A 6 GB silver iPod Mini went for a bouncy car ride, was dropped on wet grass and dry pavement, was knocked off a desk onto carpeted and hardwood floors, and was finally dropped in dry sand. Bouncing inside the car caused a couple of skips. Drops on soft wet grass and carpet had no ill effect. Dropping it from the car seat to the curb and off a desk onto a hardwood floor produced a few nicks and caused songs to skip and the device to shut down repeatedly. Still, all the unit's features continued to work after the abuse, and songs played.

However, the Mini did not like the beach. Without the benefit of a protective case or plastic display covering on the unit, sand became wedged under the scroll wheel, affecting all controls. Feature settings could be seen and highlighted, but the crunching sand prevented the Mini from launching them. The unit turned on but

could not turn off until the iPod's automatic shutdown feature took over.

Memory Stick

Lexar claims that its JumpDrive Sport 256 MB USB 2.0 Flash Drive is "built for the rugged life." A rubber cap protects the device, absorbing shock from any drops. For these experiments, the device was used without its cap. It was dropped, stepped on, buried in the sand, and knocked off a desk onto a hardwood floor. It also took a spin through the washing machine and dryer and was even run over by a car.

There is truth in advertising. Neither water, heat, sand, nor car could keep the memory stick from its appointed storage rounds. The car did squeeze the metal USB connector tip a tad tighter, but the device was still able to make contact with the USB port, and it worked perfectly.

Memory Card

The SanDisk SD 64 MB memory card is easy to misplace, but not easy to break. It was swatted off a desk onto a hardwood floor, dropped, stepped on, and buried in the sand. It also underwent a two-rinse cycle in the wash in a jeans pocket and then tumbled in the dryer for an hour on a high-heat setting. The SanDisk memory card aced every torture test.

For tips on how to protect electronic products, review Figure 5.1.

FIGURE 5.1

How to Protect Electronic Products

Protecting Electronic Products
Bag it. Place your products in a cushioned case or shock-absorbent travel bag. The secret is to make sure it has plenty of padding.
Get protection. Almost every technology manufacturer offers some type of warranty and equipment-replacement program. For example, Sprint provides the PCS Total Equipment Protection service, which costs $5 per month and covers loss, theft, and accidental damage to a cell phone.
Clean up spills. Try these tips to bring a laptop and data back from the dead after a spill.

1. **Disconnect the battery.** The faster the battery is disconnected the less likely components will burn out.

2. **Empty it.** Turn over the device and pour out as much liquid as possible.

3. **Open it up.** Remove the optical drive and keyboard. This can be tricky, so check the user manual for instructions. Once open, use a towel to soak up as much liquid as possible. According to Herman De Hoop, Hewlett-Packard's technical marketing manager, you can even use a hair dryer set on cool (not hot) to dry the liquid.

4. **Leave it alone.** Let the device sit for at least 12 to 24 hours. Robert Enochs, IBM's worldwide product manager for the ThinkPad Series, warns that you should not turn the device on until all the liquid is gone and it is completely dry.

5. **Plug and pray.** Reassemble the device, and if it powers up, copy off important data, and then call the manufacturer. Even if the unit works, a professional cleaning is recommended.

6. **Enter a recovery program.** For an average price of $900, enlist the help of data recovery services like DriveSavers to rescue data from drowned hard disks.

INTRODUCTION

Managers need to determine what types of hardware and software will satisfy their current and future business needs, the right time to buy the equipment, and how to protect their IT investments. This does not imply that managers need to be experts in all areas of technology; however, building a basic understanding of hardware and software can help them make the right IT investment choices.

Information technology (IT) is any computer-based tool that people use to work with information and support the information and information-processing needs of an organization. Information technology can be composed of the Internet, a personal computer, a cell phone that can access the Web, a personal digital assistant, or presentation software. All of these technologies help to perform specific information processing tasks. There are two basic categories of information technology: hardware and software. *Hardware* consists of the physical devices associated with a computer system. *Software* is the set of instructions that the hardware executes to carry out specific tasks. Software, such as Microsoft Excel, and various hardware devices, such as a keyboard and a monitor, interact to create a spreadsheet or a graph. This chapter covers the basics of computer hardware and software including terminology,

characteristics, and the associated managerial responsibilities for building a solid enterprise architecture.

SECTION 5.1 **HARDWARE AND SOFTWARE BASICS**

LEARNING OUTCOMES

5.1. Describe the six major categories of hardware and provide an example of each.

5.2. Identify the different computer categories and explain their potential business uses.

5.3. Explain the difference between primary and secondary storage.

5.4. List the common input, output, storage, and communication devices.

5.5. Describe the eight categories of computers by size.

5.6. Define the relationship between operating system software and utility software.

HARDWARE BASICS

In many industries, exploiting computer hardware is key to gaining a competitive advantage. Frito-Lay gained a competitive advantage by using handheld devices to track the strategic placement and sale of items in convenience stores. Sales representatives could track sale price, competitor information, the number of items sold, and item location in the store all from their handheld device.[2]

A *computer* is an electronic device operating under the control of instructions stored in its own memory that can accept, manipulate, and store data. A computer system consists of six hardware components (see Figure 5.2). Figure 5.3 displays how these components work together to form a computer system.

Central Processing Unit

The dominant manufacturers of CPUs today include Intel (with its Celeron and Pentium lines for personal computers) and Advanced Micro Devices (AMD) (with its Athlon series). AMD was initially dismissed as a company that simply cloned current chips, producing processors that mimic the features and capabilities of those from industry leader Intel. However, over the past few years, AMD has begun introducing innovative CPUs that are forcing Intel into the unfamiliar position of reacting to competition. AMD led the way in transforming the processor market by creating chips that handle 64 bits of data at a time, up from 32 bits. It also broke new territory when it became the first provider of dual-core processors for the server market. Hector Ruiz, chairman and CEO of AMD, stated, "In our position there is only one thing we can do: Stay close to our customers and end users, understand what they need and want, and then simply out-innovate the competition. Innovation is at the center of our ability to succeed. We

cannot win by just copying the competition."[3]

FIGURE 5.2

Hardware Components of a Computer System

Six Hardware Components

Central processing unit (CPU)	The actual hardware that interprets and executes the program (software) instructions and coordinates how all the other hardware devices work together.
Primary storage	The computer's main memory, which consists of the random access memory (RAM), cache memory, and the read-only memory (ROM) that is directly accessible to the central processing unit (CPU).
Secondary storage	Equipment designed to store large volumes of data for long-term storage (e.g., diskette, hard drive, memory card, CD).
Input devices	Equipment used to capture information and commands (e.g., keyboard, scanner).
Output devices	Equipment used to see, hear, or otherwise accept the results of information processing requests (e.g., monitor, printer).
Communication devices	Equipment used to send information and receive it from one location to another (e.g., modem).

FIGURE 5.3

How the Hardware Components Work Together

The *central processing unit (CPU)* (or *microprocessor*) is the actual hardware that interprets and executes the program (software) instructions and coordinates how all the other hardware devices work together. The CPU is built on a small flake of silicon and can contain the equivalent of several million transistors. CPUs are unquestionably one of the 20th century's greatest technological advances.

A CPU contains two primary parts: control unit and arithmetic/logic unit. The *control unit* interprets software in-

structions and literally tells the other hardware devices what to do, based on the software instructions. The ***arithmetic-logic unit (ALU)*** performs all arithmetic operations (for example, addition and subtraction) and all logic operations (such as sorting and comparing numbers). The control unit and ALU perform different functions. The control unit obtains instructions from the software. It then interprets the instructions, decides which tasks other devices perform, and finally tells each device to perform the task. The ALU responds to the control unit and does whatever it dictates, performing either arithmetic or logic operations.

The number of CPU cycles per second determines how fast a CPU carries out the software instructions; more cycles per second means faster processing, and faster CPUs cost more than their slower counterparts. CPU speed is usually quoted in megahertz and gigahertz. ***Megahertz (MHz)*** is the number of millions of CPU cycles per second. ***Gigahertz (GHz)*** is the number of billions of CPU cycles per second. Figure 5.4 displays the factors that determine CPU speed.

Advances in CPU Design Chip makers are pressing more functionality into CPU technology. Most CPUs are ***complex instruction set computer (CISC) chips,*** which is a type of CPU that can recognize as many as 100 or more instructions, enough to carry out most computations directly. ***Reduced instruction set computer (RISC) chips*** limit the number of instructions the CPU can execute to increase processing speed. The idea of RISC is to reduce the instruction set to the bare minimum, emphasizing the instructions used most of the time and optimizing them for the fastest possible execution. An RISC processor runs faster than a CISC processor.

FIGURE 5.4

Factors That Determine CPU Speed

CPU Speed Factors

Clock speed—the speed of the internal clock of a CPU that sets the pace at which operations proceed within the computer's internal processing circuitry. Clock speed is measured in megahertz (MHz) and gigahertz (GHz). Faster clock speeds bring noticeable gains in microprocessor-intensive tasks, such as recalculating a spreadsheet.

Word length—number of bits (0s and 1s) that can be processed by the CPU at any one time. Computers work in terms of bits and bytes using electrical pulses that have two

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states: on and off. A *binary digit (bit)* is the smallest unit of information that a computer can process. A bit can be either a 1 (on) or a 0 (off). A group of eight bits represents one natural language character and is called a *byte*.

Bus width—the size of the internal electrical pathway along which signals are sent from one part of the computer to another. A wider bus can move more data, hence faster processing.

Chip line width—the distance between transistors on a chip. The shorter the chip line width the faster the chip since more transistors can be placed on a chip and the data and instructions travel short distances during processing.

FIGURE 5.5

Chip Advancements by Manufacturer

Chip Advancements

AMD: Security, virtualization, and advanced power-management technology.

IBM: Cryptography for additional security and floating point capability for faster graphics processing.

Intel: Cryptography for additional security, hardware-assisted virtualization, and Active Management Technology for asset tracking, patching, and software updates.

Sun Microsystems: Cryptography for additional security, increased speed for data transmission and receipt, and the ability to run 32 computations simultaneously.

In the next few years, better performance, systems management capabilities, virtualization, security, and features to help track computer assets will be built directly into the CPU (see Figure 5.5). *Virtualization* is a protected memory space created by the CPU allowing the computer to create virtual machines. Each virtual machine can run its own programs isolated from other machines.

Primary Storage

Primary storage is the computer's main memory, which consists of the random access memory (RAM), cache memory, and the read-only memory (ROM) that is directly accessible to the CPU.

Random Access Memory

Random access memory (RAM) is the computer's primary working memory, in which program instructions and data are stored so that they can be accessed directly by the CPU via the processor's high-speed external data bus.

RAM is often called read/write memory. In RAM, the CPU can write and read data. Most programs set aside a portion of RAM as a temporary workspace for data so that one can modify (rewrite) as needed until the data is ready for printing or storage on secondary storage media, such as a hard drive or memory key. RAM does not retain its contents when the power to the computer is switched off, hence individuals should save their work frequently. When the computer is turned off, everything in RAM is wiped clean. *Volatility* refers to RAM's complete loss of stored information if power is interrupted. RAM is volatile and its contents are lost when the computer's electric supply fails.

Cache Memory   *Cache memory* is a small unit of ultra-fast memory that is used to store recently accessed or frequently accessed data so that the CPU does not have to retrieve this data from slower memory circuits such as RAM. Cache memory that is built directly into the CPU's circuits is called primary cache. Cache memory contained on an external circuit is called secondary cache.

Read-Only Memory (ROM)   *Read-only memory (ROM)* is the portion of a computer's primary storage that does not lose its contents when one switches off the power. ROM contains essential system programs that neither the user nor the computer can erase. Since the computer's internal memory is blank during start-up, the computer cannot perform any functions unless given start-up instructions. These instructions are stored in ROM.

Flash memory is a special type of rewriteable read-only memory (ROM) that is compact and portable. *Memory cards* contain high-capacity storage that holds data such as captured images, music, or text files. Memory cards are removable; when one is full the user can insert an additional card. Subsequently, the data can be downloaded from the card to a computer. The card can then be erased and used again. Memory cards are typically used in digital devices such as cameras, cellular phones, and personal digital assistants (PDA). *Memory sticks* provide nonvolatile memory for a range of portable devices including computers, digital cameras, MP3 players, and PDAs.

Secondary Storage

Storage is a hot area in the business arena as organizations struggle to make sense of exploding volumes of data.

Storage sales grew more than 16 percent to nearly $8 billion in 2004, according to IDC market research. ***Secondary storage*** consists of equipment designed to store large volumes of data for long-term storage. Secondary storage devices are nonvolatile and do not lose their contents when the computer is turned off. Some storage devices, such as a hard disk, offer easy update capabilities and a large storage capacity. Others, such as CD-ROMs, offer limited update capabilities but possess large storage capacities.

Storage capacity is expressed in bytes, with megabytes being the most common. A ***megabyte (MB*** or ***M*** or ***Meg)*** is roughly 1 million bytes. Therefore, a computer with 256 MB of RAM translates into the RAM being able to hold roughly 256 million characters of data and software instructions. A ***gigabyte (GB)*** is roughly 1 billion bytes. A ***terabyte (TB)*** is roughly 1 trillion bytes (refer to Figure 5.6).

Most standard desktops have a hard drive with storage capacity in excess of 80 GB. Hard drives for large organizational computer systems can hold in excess of 100 TB of information. For example, a typical double-spaced page of pure text is roughly 2,000 characters. Therefore, a 40 GB (40 gigabyte or 40 billion characters) hard drive can hold approximately 20 million pages of text.

FIGURE 5.6

Binary Terms

Term	Size
Kilobyte (KB)	1,024 Bytes
Megabyte (MB)	1,024 KB 1,048,576 Bytes
Gigabyte (GB)	1,024 MB (10^9 bytes)
Terabyte (TB)	1,024 GB (10^{12} bytes) 1 TB = Printing of 1 TB would require 50,000 trees to be made into paper and printed
Petabyte (PB)	1,024 TB (10^{15} bytes)

	200 PB = All production of digital magnetic tape in 1995
Exabyte (EB)	1,024 PB (10^{18} bytes)
	2 EB = total volume of information generated worldwide annually
	5 EB = all words ever spoken by human beings

Common storage devices include:

■ Magnetic medium

■ Optical medium

Magnetic medium   *Magnetic medium* is a secondary storage medium that uses magnetic techniques to store and retrieve data on disks or tapes coated with magnetically sensitive materials. Like iron filings on a sheet of waxed paper, these materials are reoriented when a magnetic field passes over them. During write operations, the read/write heads emit a magnetic field that orients the magnetic materials on the disk or tape to represent encoded data. During read operations, the read/write heads sense the encoded data on the medium.

One of the first forms of magnetic medium developed was magnetic tape. *Magnetic tape* is an older secondary storage medium that uses a strip of thin plastic coated with a magnetically sensitive recording medium. The most popular type of magnetic medium is a hard drive. A *hard drive* is a secondary storage medium that uses several rigid disks coated with a magnetically sensitive material and housed together with the recording heads in a hermetically sealed mechanism. Hard drive performance is measured in terms of access time, seek time, rotational speed, and data transfer rate.

Optical Medium   Optical medium is a secondary storage medium for computers on which information is stored at extremely high density in the form of tiny pits. The presence or absence of pits is read by a tightly focused laser beam. Optical medium types include:

■ **Compact disk-read-only memory (CD-ROM) drive—**an optical drive designed to read the data encoded on CD-ROMs and to transfer this data to a computer.

■ **Compact disk-read-write (CD-RW) drive—**an optical drive that enables users to erase existing data and to write new data repeatedly to a CD-RW.

■ **Digital video disk (DVD)—**a CD-ROM format capable of storing up to a maximum of 17 GB of data; enough for a full-length feature movie.

- **DVD-ROM drive**—a read-only drive designed to read the data encoded on a DVD and transfer the data to a computer.

- **Digital video disk-read/write (DVD-RW)**—a standard for DVD discs and player/recorder mechanisms that enables users to record in the DVD format.

CD-ROMs and DVDs offer an increasingly economical medium for storing data and programs. The overall trend in secondary storage is toward more direct-access methods, higher capacity with lower costs, and increased portability.

Input Devices

An *input device* is equipment used to capture information and commands. A keyboard is used to type in information, and a mouse is used to point and click on buttons and icons. Numerous input devices are available in many different environments, some of which have applications that are more suitable in a personal setting than a business setting. A keyboard, mouse, and scanner are the most common forms of input devices (see Figures 5.7 and 5.8).

FIGURE 5.7

Manual Input Devices

Manual Input Devices
Joystick—widely used as an alternative to the keyboard for computer games and some professional applications, such as computer-aided design.
Keyboard—provides a set of alphabetic, numeric, punctuation, symbol, and control keys.
Microphone—captures sounds such as a voice for voice-recognition software.
Mouse—one or more control buttons housed in a palm-sized case and designed so that one can move it about on the table next to the keyboard.
Pointing stick—causes the pointer to move on the screen by applying directional pressure (popular on notebooks and PDAs).
Touch screen—allows the use of a finger to point at and touch a particular function to perform.
Touchpad—a form of a stationary mouse on which the movement of a finger causes the pointer on the screen to move.

FIGURE 5.8

Automated Input Devices

Automated Input Devices
Bar code scanner—captures information that exists in the form of vertical bars whose width and distance apart determine a number.
Digital camera—captures still images or video as a series of 1s and 0s.
Magnetic ink character reader—reads magnetic ink numbers printed on checks that identify the bank, checking account, and check number.
Optical-character recognition—converts text into digital format for computer input.
Optical-mark recognition (OMR)—detects the presence or absence of a mark in a pre-determined place (popular for multiple-choice exams).
Point-of-sale (POS)—captures information at the point of a transaction, typically in a retail environment.
Radio frequency identification (RFID)—uses active or passive tags in the form of chips or smart labels that can store unique identifiers and relay this information to electronic readers.

New forms of input devices allow people to exercise and play video games at the same time. The Kilowatt Sport from Powergrid Fitness lets people combine strength training with their favorite video games. Players can choose any PlayStation or Xbox game that uses a joystick to run the elliptical trainer. After loading the game, participants stand on a platform while pushing and pulling a resistance rod in all directions to control what happens in the game. The varied movement targets muscle groups on the chest, arms, shoulders, abdomen, and back. The machine's display shows information such as pounds lifted and current resistance level, and players can use one-touch adjustment to vary the degree of difficulty.[4]

Another new input device is a stationary bicycle. A computer design team of graduate and undergraduate students

at MIT built the Cyclescore, an integrated video game and bicycle. The MIT students tested current games on the market but found users would stop pedaling to concentrate on the game. To engage users, the team is designing games that interact with the experience of exercise itself, for example, monitoring heart rate and adjusting the difficulty of the game according to the user's bicycling capabilities. In one game, the player must pedal to make a hot-air balloon float over mountains, while collecting coins and shooting at random targets.[5]

FIGURE 5.9

Output Devices

Output Devices

Cathode-ray tube (CRT)—a vacuum tube that uses an electron gun (cathode) to emit a beam of electrons that illuminates phosphors on a screen as the beam sweeps across the screen repeatedly. A monitor is often called a CRT.

Liquid crystal display (LCDs)—a low-powered display technology used in laptop computers where rod-shaped crystal molecules change their orientation when an electrical current flows through them.

Laser printer—a printer that forms images using an electrostatic process, the same way a photocopier works.

Ink-jet printer—a printer that makes images by forcing ink droplets through nozzles.

Plotter—a printer that uses computer-directed pens for creating high-quality images, blueprints, schematics, etc.

Output Devices

An *output device* is equipment used to see, hear, or otherwise accept the results of information processing requests. Among output devices, printers and monitors are the most common; however, speakers and plotters (special printers that draw output on a page) are widely used (see Figure 5.9). In addition, output devices are responsible for converting computer-stored information into a form that can be understood.

A new output device based on sensor technology aims to translate American Sign Language (ASL) into speech, enabling the millions of people who use ASL to better communicate with those who do not know the rapid gesturing system. The AcceleGlove is a glove lined on the inside with sensors embedded in rings. The sensors, called accelerometers, measure acceleration and can categorize and translate finger and hand movements. Additional, interconnected attachments for the elbow and shoulder capture ASL signs that are made with full arm motion. When users wear the glove while signing ASL, algorithms in the glove's software translate the hand gestures into words. The translations can be relayed through speech synthesizers or read on a PDA-size computer screen. Inventor Jose L. Hernandez-Rebollar started with a single glove that could translate only the ASL alphabet. Now, the device employs two gloves that contain a 1,000-word vocabulary.[6]

Other new output devices are being developed every day. Needapresent.com, a British company, has developed a vibrating USB massage ball, which plugs into a computer's USB port to generate a warm massage for sore body parts during those long evenings spent coding software or writing papers. Needapresent.com also makes a coffee cup warmer that plugs into the USB port.[7]

FIGURE 5.10

Comparing Modems

Carrier Technology	Description	Speed	Comments
Dial-up Access	On demand access using a modem and regular telephone line (POT).	2400 bps to 56 Kbps	■ Cheap but slow.
Cable	Special cable modem and cable line required.	512 Kbps to 20 Mbps	■ Must have existing cable access in area. ■ Bandwidth is shared.
DSL Digital Subscriber Line	This technology uses the unused digital portion of a regular copper telephone line to	128 Kbps to 8 Mbps	■ Doesn't interfere with normal telephone use. ■ Bandwidth is dedicated.

	transmit and receive information. A special modem and adapter card are required.		■ Must be within 5 km (3.1 miles) of telephone company switch.
Wireless (LMCS)	Access is gained by connection to a high speed cellular like local multipoint communications system (LMCS) network via wireless transmitter/receiver.	30 Mbps or more	■ Can be used for high speed data, broadcast TV and wireless telephone service.
Satellite	Newer versions have two-way satellite access, removing need for phone line.	6 Mbps or more	■ Bandwidth is not shared. ■ Some connections require an existing Internet service account. ■ Setup fees can range from $500–$1000.

Communication

Devices

A *communication device* is equipment used to send information and receive it from one location to another. A telephone modem connects a computer to a phone line in order to access another computer. The computer works in terms of digital signals, while a standard telephone line works with analog signals. Each digital signal represents a bit (either 0 or 1). The modem must convert the digital signals of a computer into analog signals so they can be sent across the telephone line. At the other end, another modem translates the analog signals into digital signals, which can then be used by the other computer. Figure 5.10 displays the different types of modems.

COMPUTER CATEGORIES

Supercomputers today can hit processing capabilities of well over 200 teraflops—the equivalent of everyone on earth performing 35,000 calculations per second (see Figure 5.11). For the past 20 years, federally funded super-

computing research has given birth to some of the computer industry's most significant technology breakthroughs including:

FIGURE 5.11

Supercomputer

- Clustering, which allows companies to chain together thousands of PCs to build mass-market systems.

- Parallel processing, which provides the ability to run two or more tasks simultaneously and is viewed as the chip industry's future.

- Mosaic browser, which morphed into Netscape and made the Web a household name.

Federally funded supercomputers have also advanced some of the country's most dynamic industries, including advanced manufacturing, gene research in the life sciences, and real-time financial-market modeling.[8]

Computers come in different shapes, sizes, and colors. Some are small enough to carry around, while others are the size of a telephone booth. Size does not always correlate to power, speed, and price (see Figure 5.12).

MIT's Media Lab is developing a laptop that it will sell for $100 each to government agencies around the world for distribution to millions of underprivileged schoolchildren. Using a simplified sales model and reengineering the device helped MIT reach the $100 price point. Almost half the price of a current laptop comprises marketing, sales, distribution, and profit. Of the remaining costs, the display panel and backlight account for roughly half while the rest covers the operating system. The low-cost laptop will use a display system that costs less than $25, a 500 MHz processor from AMD, a wireless LAN connection, 1 GB of storage, and the Linux operating system. The machine will automatically connect with others. China and Brazil have already ordered 3 million and 1 million laptops, respectively. MIT's goal is to produce around 150 million laptops per year.[9]

SOFTWARE BASICS

Hardware is only as good as the software that runs it. Over the years, the cost of hardware has decreased while the complexity and cost of software have increased. Some large software applications, such as customer relationship management systems, contain millions of lines of code, take years to develop, and cost millions of dollars. The two main types of software are system software and application software.

System Software

System software controls how the various technology tools work together along with the application software. Sys-

tem software includes both operating system software and utility software.

FIGURE 5.12

Computer Categories

Computer Category	Description	Size
Personal digital assistant (PDA)	A small handheld computer that performs simple tasks such as taking notes, scheduling appointments, and maintaining an address book and a calendar. The PDA screen is touch-sensitive, allowing a user to write directly on the screen, capturing what is written.	Fits in a person's hand
Laptop	A fully functional computer designed to be carried around and run on battery power. Laptops come equipped with all of the technology that a personal desktop computer has, yet weigh as little as two pounds.	Similar to a textbook
Tablet	A pen-based computer that provides the screen capabilities of a PDA with the functional capabilities of a laptop or desktop computer. Similar to PDAs, tablet PCs use a writing pen or stylus to write notes on the screen and touch the screen to perform functions such as clicking on a link while visiting a Web site.	Similar to a textbook
Desktop	Available with a horizontal system box (the box is where the CPU, RAM, and storage devices are held) with a monitor on top, or a vertical system box (called a tower) usually placed on the floor within a work area.	Fits on a desk
Workstation	Similar to a desktop but has more powerful mathematical	Fits on a desk

	and graphics processing capabilities and can perform more complicated tasks in less time. Typically used for software development, Web development, engineering, and e-business tools.	
Minicomputer (mid-range computer)	Designed to meet the computing needs of several people simultaneously in a small to medium-size business environment. A common type of minicomputer is a server and is used for managing internal company networks and Web sites. Minicomputers are more powerful than desktop computers but also cost more, ranging in price from $5,000 to several hundred thousand dollars.	Ranges from fitting on a desk to the size of a filing cabinet
Mainframe computer	Designed to meet the computing needs of hundreds of people in a large business environment. Mainframe computers are a step up in size, power, capability, and cost from minicomputers. Mainframes can cost in excess of $1 million. With processing speeds greater than 1 trillion instructions per second (compared to a typical desktop that can process about 2.5 billion instructions per second), mainframes can easily handle the processing requests of hundreds of people simultaneously.	Similar to a refrigerator
Supercomputer	The fastest, most powerful, and most expensive type of computer. Organizations such as NASA that are heavily involved in research and number crunching employ supercomputers because of the speed with which they can process information. Other large, customer-oriented businesses	Similar to a car

	such as General Motors and AT&T employ supercomputers just to handle customer information and transaction processing.	

FIGURE 5.13

Operating System Software

Operating System Software

Linux	An open source operating system that provides a rich environment for high-end workstations and network servers. Open source refers to any program whose source code is made available for use or modification as users or other developers see fit.
Mac OS X	The operating system of Macintosh computers.
Microsoft Windows	Generic name for the various operating systems in the Microsoft Windows family, including Microsoft Windows CE, Microsoft Windows 98, Microsoft Windows ME, Microsoft Windows 2000, Microsoft Windows XP, Microsoft Windows NT, and Microsoft Windows Server 2003.
MS-DOS	The standard, single-user operating system of IBM and IBM-compatible computers, introduced in 1981. MS-DOS is a command-line operating system that requires the user to enter commands, arguments, and syntax.
UNIX	A 32-bit multitasking and multiuser operating system that originated at AT&T's Bell Laboratories and is now used on a wide variety of computers, from mainframes to PDAs.

Operating System Software   Linus Torvalds, a shy Finnish programmer, may seem an unlikely choice to be one of the world's top managers. However, Linux, the software project he created while a university student, is now one of the most powerful influences on the computer world. Linux is an operating system built by volunteers and distributed for free and has become one of the primary competitors to Microsoft. Torvalds coordinates Linux development with a few dozen volunteer assistants and more than 1,000 programmers scattered around the globe. They con-

tribute code for the kernel—or core piece—of Linux. He also sets the rules for dozens of technology companies that have lined up behind Linux, including IBM, Dell, Hewlett-Packard, and Intel.

While basic versions of Linux are available for free, Linux is having a considerable financial impact. According to market researcher IDC, the total market for Linux devices and software will increase from $11 billion in 2004 to $35.7 billion by 2008.[10]

Operating system software controls the application software and manages how the hardware devices work together. When using Excel to create and print a graph, the operating system software controls the process, ensures that a printer is attached and has paper, and sends the graph to the printer along with instructions on how to print it.

Operating system software also supports a variety of useful features, one of which is multitasking. ***Multitasking*** allows more than one piece of software to be used at a time. Multitasking is used when creating a graph in Excel and simultaneously printing a word processing document. With multitasking, both pieces of application software are operating at the same time. There are different types of operating system software for personal environments and for organizational environments (see Figure 5.13).

Utility Software   *Utility software* provides additional functionality to the operating system. Utility software includes antivirus software, screen savers, and anti-spam software. Figure 5.14 displays a few types of available utility software.

Application Software

Application software is used for specific information processing needs, including payroll, customer relationship management, project management, training, and many others. Application software is used to solve specific problems or perform specific tasks. From an organizational perspective, payroll software, collaborative software such as videoconferencing (within groupware), and inventory management software are all examples of application software (see Figure 5.15).

FIGURE 5.14

Utility Software

Types of Utility Software	
Crash-proof	Helps save information if a computer crashes.

Disk image for data re-covery	Relieves the burden of reinstalling and tweaking scores of applications if a hard drive crashes or becomes irretrievably corrupted.
Disk optimization	Organizes information on a hard disk in the most efficient way.
Encrypt data	Protects confidential information from unauthorized eyes. Programs such as BestCrypt simply and effectively apply one of several powerful encryption schemes to hard drive information. Users unlock the information by entering a password in the BestCrypt control panel. The program can also secure information on rewritable optical disks or any other storage media assigned a drive letter.
File and data recovery	Retrieves accidental deletion of photos or documents in Windows XP by utilities such as Free Undelete, which searches designated hard drive deletion areas for recognizable data.
Text protect	In Microsoft Word, prevents users from typing over existing text after accidentally hitting the Insert key. Launch the Insert Toggle Key program, and the PC will beep whenever a user presses the Insert key.
Preventative security	Through programs such as Window Washer, erases file histories, browser cookies, cache contents, and other crumbs that applications and Windows leave on a hard drive.
Spyware	Removes any software that employs a user's Internet connection in the background without the user's knowledge or explicit permission.
Uninstaller	Can remove software that is no longer needed.

OPENING CASE QUESTIONS

Electronic Breaking Points

1. Identify the six hardware categories and place each product listed in the case in its appropriate category.

2. Describe the CPU and identify which products would use a CPU.

3. Describe the relationship between memory sticks and laptops. How can a user employ one to help protect information loss from the other?

4. What different types of software might each of the products listed in the case use?

section 5.2 MANAGING ENTERPRISE ARCHITECTURES

LEARNING OUTCOMES

5.7. Explain the three components of an enterprise architecture.

5.8. Describe how an organization can implement a solid information architecture.

5.9. List and describe the five *ilities* in an infrastructure architecture.

5.10. Compare Web services and open systems.

FIGURE 5.15

Application Software

Types of Application Software

Browser	Enables the user to navigate the World Wide Web. The two leading browsers are Netscape Navigator and Microsoft Internet Explorer.
Communication	Turns a computer into a terminal for transmitting data to and receiving data from distant computers through the telephone system.
Data management	Provides the tools for data retrieval, modification, deletion, and insertion; for example, Access, MySQL, and Oracle.
Desktop publishing	Transforms a computer into a desktop publishing workstation. Leading packages include Adobe FrameMaker, Adobe PageMaker, and QuarkXpress.
E-mail	Provides e-mail services for computer users, including receiving mail, sending mail, and storing messages. Leading e-mail software includes Microsoft Outlook, Microsoft Outlook Express, and Eudora.

Groupware	Increases the cooperation and joint productivity of small groups of co-workers.
Presentation graphics	Creates and enhances charts and graphs so that they are visually appealing and easily understood by an audience. A full-features presentation graphics package such as Lotus Freelance Graphics or Microsoft PowerPoint includes facilities for making a wide variety of charts and graphs and for adding titles, legends, and explanatory text anywhere in the chart or graph.
Programming	Possesses an artificial language consisting of a fixed vocabulary and a set of rules (called syntax) that programmers use to write computer programs. Leading programming languages include Java, C ++, C#, and .NET.
Spreadsheet	Simulates an accountant's worksheet onscreen and lets users embed hidden formulas that perform calculations on the visible data. Many spreadsheet programs also include powerful graphics and presentation capabilities to create attractive products. The leading spreadsheet application is Microsoft Excel.
Word processing	Transforms a computer into a tool for creating, editing, proofreading, formatting, and printing documents. Leading word processing applications include Microsoft Word and WordPerfect.

ENTERPRISE ARCHITECTURES

A 66-hour failure of an FBI database that performed background checks on gun buyers was long enough to allow criminals to buy guns. The database failed at 1:00 p.m. on a Thursday and was not restored until 7:30 a.m. Sunday. The FBI must complete a gun check within three days; if it fails to do so, a merchant is free to make the sale. During this outage, any gun checks that were in progress were not finished, allowing merchants to complete those gun sales at their own discretion.[11]

To support the volume and complexity of today's user and application requirements, information technology needs to take a fresh approach to enterprise architectures by constructing smarter, more flexible environments that protect from system failures and crashes. *Enterprise architectures* include the plans for how an organization will

build, deploy, use, and share its data, processes, and IT assets. A unified enterprise architecture will standardize enterprisewide hardware and software systems, with tighter links to the business strategy. A solid enterprise architecture can decrease costs, increase standardization, promote reuse of IT assets, and speed development of new systems. The end result being that the right enterprise architecture can make IT cheaper, strategic, and more responsive. The primary business goals of enterprise architectures are displayed in Figure 5.16.

Enterprise architectures are never static; they continually change. Organizations use enterprise architects to help manage change. An *enterprise architect (EA)* is a person grounded in technology, fluent in business, a patient diplomat, and provides the important bridge between IT and the business. An EA is expensive and generally receives a salary upward of $150,000 per year. T-Mobile International's enterprise architects review projects to ensure they are soundly designed, meet the business objectives, and fit in with the overall enterprise architecture. One T-Mobile project was to create software that would let subscribers customize the ring sounds on their cell phones. The project group assumed it would have to create most of the software from scratch. However, T-Mobile's EAs found software already written elsewhere at T-Mobile that could be reused to create the new application. The reuse reduced the development cycle time by eight months, and the new application was available in less than six weeks.[12]

FIGURE 5.16

Primary Business Goals of Enterprise Architectures

FIGURE 5.17

Three Components of Enterprise Architecture

Companies that have created solid enterprise architectures, such as T-Mobile, are reaping huge rewards in savings, flexibility, and business alignment. Basic enterprise architectures contain three components (see Figure 5.17).

1. *Information architecture* identifies where and how important information, like customer records, is maintained and secured.

2. *Infrastructure architecture* includes the hardware, software, and telecommunications equipment that, when combined, provide the underlying foundation to support the organization's goals.

3. *Application architecture* determines how applications integrate and relate to each other.

INFORMATION ARCHITECTURE

Information architecture identifies where and how important information, like customer records, is maintained and secured. A single backup or restore failure can cost an organization more than time and money; some data cannot be

recreated, and the business intelligence lost from that data can be tremendous. Chief information officers should have enough confidence that they could walk around and randomly pull out cables to prove that the systems are safe. The CIO should also be secure enough to perform this test during peak business hours. If the thought of this test makes the CIO cringe, then the organization's customers should be cringing also. Three primary areas an enterprise information architecture should focus on are:

1. Backup and recovery

2. Disaster recovery

3. Information security

Backup and Recovery

Each year businesses lose time and money because of system crashes and failures. One way to minimize the damage of a system crash is to have a backup and recovery strategy in place. A *backup* is an exact copy of a system's information. *Recovery* is the ability to get a system up and running in the event of a system crash or failure and includes restoring the information backup. Many different types of backup and recovery media are available, including redundant storage servers, tapes, disks, and even CDs and DVDs. All the different types of backup and recovery media are reliable; their primary differences are the speed and associated costs.

A chain of more than 4,000 franchise locations, 7-Eleven Taiwan uploads backup and recovery information from its central location to all its chain locations daily. The company implemented a new technology solution by Digital Fountain that could quickly and reliably download and upload backup and recovery information to all its stores. In addition, when a connection fails during the download or upload, the technology automatically resumes the download without having to start over, saving valuable time.[13]

Organizations should choose a backup and recovery strategy that is in line with its business goals. If the organization deals with large volumes of critical information, it will require daily backups, perhaps even hourly backups, to storage servers. If the organization deals with small amounts of noncritical information, then it might require only weekly backups to tapes, CDs, or DVDs. Deciding how often to back up information and what media to use is a critical business decision. If an organization decides to back up on a weekly basis, then it is taking the risk that, if a total system crash occurs, it could lose a week's worth of work. If this risk is acceptable, then a weekly backup strategy will work. If this risk is unacceptable, then the organization needs to move to a daily backup strategy. Some organizations find the risk of losing a day's worth of work too high and move to an hourly backup strategy.

Two techniques used to help in case of system failure are fault tolerance and failover. ***Fault tolerance*** is a computer system designed that in the event a component fails, a backup component or procedure can immediately take its place with no loss of service. Fault tolerance can be provided with software, or embedded in hardware, or provided by some combination. ***Failover*** is a backup operational mode in which the functions of a computer component (such as a processor, server, network, or database) are assumed by secondary system components when the primary component becomes unavailable through either failure or scheduled downtime. A failover procedure involves automatically offloading tasks to a standby system component so that the procedure is as seamless as possible to the end user. Used to make systems more fault tolerant, failover is typically an integral part of mission-critical systems that must be constantly available.

FIGURE 5.18

Financial Institutions' Worldwide Spending on Disaster Recovery

Disaster Recovery

A northern Ohio power company, FirstEnergy, missed signs that there were potential problems in its portion of North America's electrical grid. The events that followed left an estimated 50 million people in the Northeast and Canada in the dark. The failings are laid out in the widely reported findings of a joint U.S./Canada task force that investigated the causes of the blackout and recommended what to do to avoid big-scale outages in the future. The report detailed many procedures or best practices including:

- Mind the enterprise architectures.
- Monitor the quality of computer networks that provide data on power suppliers and demand.
- Make sure the networks can be restored quickly in the case of downtime.
- Set up disaster recovery plans.
- Provide adequate staff training, including verbal communication protocols "so that operators are aware of any IT-related problems that may be affecting their situational awareness of the power grid."[14]

Disasters such as power outages, floods, and even harmful hacking strike businesses every day. Organizations must develop a disaster recovery plan to prepare for such occurrences. A ***disaster recovery plan*** is a detailed process for recovering information or an IT system in the event of a catastrophic disaster such as a fire or flood. Spending on disaster recovery is rising worldwide among financial institutions (see Figure 5.18)

A comprehensive disaster recovery plan takes into consideration the location of the backup information. Many

organizations store backup information in an off-site facility. StorageTek specializes in providing off-site information storage and disaster recovery solutions. A comprehensive disaster recovery plan also foresees the possibility that not only the computer equipment but also the building where employees work may be destroyed. A ***hot site*** is a separate and fully equipped facility where the company can move immediately after a disaster and resume business. A ***cold site*** is a separate facility that does not have any computer equipment, but is a place where employees can move after a disaster.

A ***disaster recovery cost curve*** charts (1) the cost to the organization of the unavailability of information and technology and (2) the cost to the organization of recovering from a disaster over time. Figure 5.19 displays a disaster recovery cost curve and shows that where the two lines intersect is the best recovery plan in terms of cost and time. Creating an organization's disaster recovery cost curve is no small task. It must consider the cost of losing information and technology within each department or functional area, and the cost of losing information and technology across the whole enterprise. During the first few hours of a disaster, those costs will be low but become increasingly higher over time. With those costs in hand, an organization must then determine the costs of recovery. Cost of recovery during the first few hours of a disaster is exceedingly high and diminishes over time.

FIGURE 5.19

The Disaster Recovery Cost Curve

Marshall & Swift, which provides property valuation services, may be located in sunny Los Angeles, but the company barely averted a major disaster when Hurricane Charley ripped through southwest Florida in 2004. Many of the nation's largest insurance companies rely on Marshall & Swift's 200-plus servers to process claims and calculate the costs of rebuilding commercial and residential properties. Within one month of the Florida hurricane, the number of claims jumped from 20,000 to a whopping 180,000. This sudden surge in server utilization could have spelled disaster.

Fortunately, Marshall & Swift used an application performance management solution called ProactiveNet that identifies when an application or system is operating outside of its normal parameters and pinpoints the most likely source of the problem. ProactiveNet alerted the company's IT department to an improper balance of application, Web, and database servers. Some servers were being under-- utilized while others were being overburdened, thereby causing degradations in overall system performance. Marshall & Swift quickly began monitoring the usage patterns of each server and moved certain servers to ensure that all requests were processed in a timely matter.[15]

Information Security

Security professionals are under increasing pressure to do the job right and cost-effectively as networks extend beyond organizations to remote users, partners, and customers, and to cell phones, PDAs, and other mobile devices. Regulatory requirements to safeguard data have increased. Concerns about identity theft are at an all-time high. Hacking and other unauthorized access contribute to the approximately 10 million instances of identity theft each year, according to the Federal Trade Commission. A good information architecture includes a strong information security plan, along with managing user access and up-to-date antivirus software and patches.[16]

Managing User Access   Managing user access to information is a critical piece of the information architecture. Passwords may still be the weakest link in the security chain. At Vitas Healthcare Corporation, with a workforce of 6,000 and operations across 15 states, authorized employees enter as many as a half-dozen passwords a day to access multiple systems. While it is important to maintain password discipline to secure customers' health care data, maintaining and managing the situation creates a drag on the IT department. "Our help desk spends 30 percent of their time on password management and provisioning," said John Sandbrook, senior IT director.

The company began using Fischer International Corporation's Identity Management Suite to manage passwords and comply with data-access regulations such as the Sarbanes-Oxley Act. The ID-management product includes automated audit, reporting, and compliance capabilities, plus a common platform for password management, provisioning, and self-service. With the software, Vitas can enforce stronger passwords with seven, eight, or nine characters, numbers, and capital letters that frequently change. The company anticipates curbing help-desk password time by 50 percent.[17]

Up-to-Date Antivirus Software and Patches   There is little doubt that security is a top priority for business managers, regardless of the size of their company. Among Fortune 500 companies, more than 80 percent of those surveyed described updating security procedures, tools, and services as a key business priority. That desire holds true for small, midsize, or large companies and for IT managers and corporate managers.

The main focus for most managers is preventing hackers, spammers, and other malcontents from entering their networks, and nearly two-thirds are looking to enhance their network-security-management, intrusion-detection, content-filtering, and anti-spam software. More than half also plan to upgrade their encryption software.[18]

Microsoft issues patches for its software on the second Tuesday of every month. These patches must be downloaded and installed on all systems across the entire enterprise if the company wants to keep its systems pro-

tected. At OMD, a media buying and planning subsidiary of Omnicom Group Inc., the network administrator had to manually install critical patches on all 100 servers, taking more than a week to deploy the patch across the company. Now, OMD uses automated installation software for patches and upgrades. The company purchased Altiris Management Suite for Dell servers, which let it move ahead with applying patches without taking down entire systems and balancing patch-deployment timing among servers so that all departments were not down at once during a patch install. Given everything else that security professionals need to think about, automated installation software is a welcome relief.[19]

INFRASTRUCTURE ARCHITECTURE

Gartner Inc. estimates that the typical Web application goes down 170 hours per year. At Illinois-based online brokerage OptionsXpress, application performance problems can have a serious impact on livelihoods. Nearly 7,000 options traders visit the OptionsXpress Web site at any given time, completing nearly 20,000 transactions a day. With all this online traffic, the brokerage's IT administrators were always up against the clock when recreating troublesome applications offline in the development environment. The company struggled to unlock the mystery behind a troublesome trading application that was forcing traders to resubmit orders. Some times the application would just die and then restart itself for no apparent reason.[20]

Infrastructure architecture includes the hardware, software, and telecommunications equipment that, when combined, provide the underlying foundation to support the organization's goals. As an organization changes, its systems must be able to change to support its operations. If an organization grows by 50 percent in a single year, its systems must be able to handle a 50 percent growth rate. Systems that cannot adapt to organizational changes can severely hinder the organization's ability to operate. The future of an organization depends on its ability to meet its partners and customers on their terms, at their pace, any time of the day, in any geographic location. The following are the five primary characteristics of a solid infrastructure architecture:

1. Flexibility

2. Scalability

3. Reliability

4. Availability

5. Performance

Flexibility

Organizations must watch today's business, as well as tomorrow's, when designing and building systems. Systems must be flexible enough to meet all types of business changes. For example, a system might be designed to include the ability to handle multiple currencies and languages, even though the company is not currently performing business in other countries. When the company starts growing and performing business in new countries, the system will already have the flexibility to handle multiple currencies and languages. If the company failed to recognize that its business would someday be global, it would need to redesign all its systems to handle multiple currencies and languages, not easy once systems are up and running.

Scalability

Estimating organizational growth is a challenging task. Growth can occur in a number of different forms including more customers and product lines and expansion into new markets. *Scalability* refers to how well a system can adapt to increased demands. A number of factors can create organizational growth including market, industry, and economy factors. If an organization grows faster than anticipated, it might experience all types of performance degradations, ranging from running out of disk space to a slowdown in transaction speeds. Anticipating expected—and unexpected—growth is key to building scalable systems that can support that growth.

MSNBC's Web site typically received moderate traffic. On September 11, 2001, the site was inundated with more than 91 million page views as its customers were trying to find out information about the terrorist attacks. Fortunately, MSNBC had anticipated this type of surging demand and built adaptable systems accordingly, allowing it to handle the increased page view requests.[21]

Capacity planning determines the future IT infrastructure requirements for new equipment and additional network capacity. Performing a capacity plan is one way to ensure the IT infrastructure is scalable. It is cheaper for an organization to implement an IT infrastructure that considers capacity growth at the beginning of a system launch than to try to upgrade equipment and networks after the system has been implemented. Not having enough capacity leads to performance issues and hinders the ability of knowledge workers to perform their jobs. If 100 workers are using the Internet to perform their jobs and the company purchases bandwidth that is too small and the network capacity is too small, the workers will spend a great deal of time just waiting to get information from the Internet. Waiting for an Internet site to return information is not very productive.

A computer glitch caused Delta Air Lines subsidiary Comair to cancel 1,100 flights Christmas Day 2004. The problem occurred when snowstorms caused the airline to ground flights, and the resulting quagmire overwhelmed its aging crew-scheduling system, causing further cancellations. Delta's crew-scheduling system is being replaced by one that can scale to handle more transaction.[22]

Reliability

Reliability ensures all systems are functioning correctly and providing accurate information. Reliability is another term for accuracy when discussing the correctness of systems within the context of efficiency IT metrics. Inaccurate information processing occurs for many reasons, from the incorrect entry of data to information corruption. Unreliable information puts the organization at risk when making decisions based on the information.

Availability

Availability (an efficiency IT metric) addresses when systems can be accessed by users. *High availability* refers to a system or component that is continuously operational for a desirably long length of time. Availability is typically measured relative to "100 percent operational" or "never failing." A widely held but difficult-to-achieve standard of availability for a system or product is known as "five 9s" (99.999 percent) availability.

Some companies have systems available 24x7 to support business operations and global customer and employee needs. With the emergence of the Web, companies expect systems to operate around the clock. A customer who finds that a Web site closes at 9:00 p.m. is not going to be a customer long.

Systems, however, must come down for maintenance, upgrades, and fixes. One challenge organizations face is determining when to schedule system downtime if the system is expected to operate continually. Exacerbating the negative impact of scheduled system downtime is the global nature of business. Scheduling maintenance during the evening might seem like a great idea, but the evening in one city is the morning somewhere else in the world, and global employees may not be able to perform their jobs if the system is down. Many organizations overcome this problem by having redundant systems, allowing the organization to take one system down by switching over to a redundant, or duplicate, system.

Performance

Performance measures how quickly a system performs a certain process or transaction (in terms of efficiency IT metrics of both speed and throughput). Not having enough performance capacity can have a devastating, negative

impact on a business. A customer will wait only a few seconds for a Web site to return a request before giving up and moving on to another Web site. To ensure adaptable systems performance, capacity planning helps an organization determine future IT infrastructure requirements for new equipment and additional network capacity. It is cheaper for an organization to design and implement an IT infrastructure that envisions performance capacity growth than to update all the equipment after the system is already operational.

Abercrombie & Fitch (A&F) uses the Internet to market its distinctive image of being a fashion trendsetter to one of its largest customer segments, college students. The company designed its enterprise architecture with the help of IBM, which ensured www.abercrombie.com paralleled the same sleek but simple design of A&F Quarterly, the company's flagship magazine. Abercrombie & Fitch knew that its Web site had to be accessible, available, reliable, and scalable to meet the demands of its young customers. Young customers tend to be Internet savvy, and their purchasing habits vary from customers who only shop for sale items at midnight to customers who know exactly what they want immediately. The highly successful Web site gives customers not only an opportunity to shop online, but also a taste of the Abercrombie & Fitch lifestyle through downloadable MP3s, calendars, and desktop accessories.[23]

APPLICATION ARCHITECTURE

Gartner Inc. research indicates that application problems are the single largest source of downtime, causing 40 percent of annual downtime hours and 32 percent of average downtime costs. *Application architecture* determines how applications integrate and relate to each other. Advances in integration technology—primarily Web services and open systems—are providing new ways for designing more agile, more responsive enterprise architectures that provide the kind of value businesses need. With these new architectures, IT can build new business capabilities faster, cheaper, and in a vocabulary the business can understand.[24]

Web Services

Web services promise to be the next major frontier in computing. *Web services* contain a repertoire of Web-based data and procedural resources that use shared protocols and standards permitting different applications to share data and services. The major application of Web services is the integration among different applications. Before Web services, organizations had trouble with interoperability. *Interoperability* is the capability of two or more computer systems to share data and resources, even though they are made by different manufacturers. If a supply chain management (SCM) system can talk to (share information with) a customer relationship management (CRM) system,

interoperability exists between the two systems. The traditional way that organizations achieved interoperability was to build integrations. Now, an organization can use Web services to perform the same task.

Verizon's massive enterprise architecture includes three different companies, GTE, Bell Atlantic, and Nynex, each with its own complex systems. To find a customer record in any of the three companies' systems, Verizon turns to its search engine, called Spider. Spider is Verizon's version of Google, and it's helping Verizon's business to thrive.

Spider contains a vital customer information Web service that encapsulates Verizon's business rules, which help it to access the correct data repository when looking for customer information. Whenever a new system is built that needs to link to customer information, all the developer has to do is reuse the Web service that will link to the customer records. Because Verizon has the Web service in place as part of its enterprise architecture, development teams can build new applications within a month, as opposed to six months.[25]

Web services encompass all the technologies that are used to transmit and process information on and across a network, most specifically the Internet. It is easiest to think of an individual Web service as software that performs a specific task, with that task being made available to any user who needs its service. For example, a "Deposit" Web service for a banking system might allow customers to perform the task of depositing money to their accounts. The Web service could be used by a bank teller, by the customer at an ATM, and/or by the customer performing an online transaction through a Web browser.

The "Deposit" Web service demonstrates one of the great advantages of using the Web service model to develop applications. Developers do not have to reinvent the wheel every time they need to incorporate new functionality. A Web service is really a piece of reusable software code. A software developer can quickly build a new application by using many of these pieces of reusable code. The two primary parts of Web services are events and services.

Events   Events are the eyes and ears of the business expressed in technology—they detect threats and opportunities and alert those who can act on the information. Pioneered by telecommunication and financial services companies, this involves using IT systems to monitor a business process for events that matter—a stock-out in the warehouse or an especially large charge on a consumer's credit card—and automatically alert the people best equipped to handle the issue. For example, a credit monitoring system automatically alerts a credit supervisor and shuts down an account when the system processes a $7,000 charge on a credit card with a $6,000 limit.

Services   Services are more like software products than they are coding projects. They must appeal to a broad au-

dience, and they need to be reusable if they are going to have an impact on productivity. Early forms of services were defined at too low a level in the architecture to interest the business, such as simple "Print" and "Save" services. The new services are being defined at a higher level; they describe such things as "Credit Check," "Customer Information," and "Process Payment." These services describe a valuable business process. For example, "Credit Check" has value not just for programmers who want to use that code in another application, but also for businesspeople who want to use it across multiple products—say, auto loans and mortgages—or across multiple business.

The trick to building services is finding the right level of granularity. T-Mobile builds services starting at the highest level and then works its way down to lower levels, helping to ensure it does not build services that no one uses. The company first built a "Send Message" Web service and then built a "Send SMS Message" Web service that sends messages in special formats to different devices such as cell phones and pagers.

Lydian Trust's enterprise architects designed a Web service called "Get Credit" that is used by several different business units for loan applications. "Get Credit" seeks out credit ratings over the Internet from the major credit bureaus. One day, one of the credit bureaus' Web servers crashed, and Lydian Trust's "Get Credit" Web service could not make a connection. Since the connection to the server was loosely linked, the system did not know what to do. "Get Credit" was not built to make more than one call. So, while it waited for a response, hundreds of loan applications sat idle.

Lydian Trust's loan officers had to work overnight to ensure that all of the applications were completed within 24 hours as promised by the company. Fortunately, Lydian Trust's customers never felt the pain; however, its employees did. Systems must be designed to deal with the existence of certain events, or the lack of an event, in a way that does not interrupt the overall business. The "Get Credit" Web service has been modified to include an automatic e-mail alert to a supervisor whenever the Web service encounters a delay.[26]

Open Systems

Microsoft Internet Explorer's share of the Web browser market has dipped below 90 percent because of Mozilla's Firefox, an open source Web browser. According to WebSideStory, which has been tracking the Firefox versus Internet Explorer numbers, the Mozilla-made open source browser had captured 5 percent of the U.S. market in January 2005, an increase of almost a full percentage point in a month. Firefox claimed more than 25 million copies of the browser had been downloaded in its first 15 weeks of release.[27]

An **open system** is a broad, general term that describes nonproprietary IT hardware and software made available

by the standards and procedures by which their products work, making it easier to integrate them. Amazon.com embraced open source technology converting from Sun's proprietary operating system to Linux. The switch to an open source operating system, such as Linux, is simplifying the process by which Amazon.com associates can build links to Amazon.com applications into their Web sites.[28]

The designs of open systems allow for information sharing. In the past, different systems were independent of each other and operated as individual islands of control. The sharing of information was accomplished through software drivers and devices that routed data allowing information to be translated and shared between systems. Although this method is still widely used, its limited capability and added cost are not an effective solution for most organizations. Another drawback to the stand-alone system is it can communicate only with components developed by a single manufacturer. The proprietary nature of these systems usually results in costly repair, maintenance, and expansion because of a lack of competitive forces. On the other hand, open system integration is designed to:

■ Allow systems to seamlessly share information. The sharing of information reduces the total number of devices, resulting in an overall decrease in cost.

■ Capitalize on enterprise architectures. This avoids installing several independent systems, which creates duplication of devices.

■ Eliminate proprietary systems and promote competitive pricing. Often a sole-source vendor can demand its price and may even provide the customer with less than satisfactory service. Utilization of open systems allows users to purchase systems competitively.

OPENING CASE QUESTIONS

Electronic Breaking Points

5. How can an organization use an information architecture to protect its IT investment in electronic devices outlined in the case?

6. How can an organization use the devices mentioned in the case to protect information security?

7. Identify the five *ilities* and rank them in order of importance for a laptop (1 highest, 5 lowest).

8. Describe how a "Customer Phone Number" Web service could be used by one of the products outlined in the case.

KEY TERMS

Application architecture 140

CLOSING CASE ONE

Chicago Tribune's Server Consolidation a Success

The *Chicago Tribune* is the seventh-largest newspaper in the country. Overhauling its data center and consolidating servers was a difficult task; however, the payoff was tremendous. The *Chicago Tribune* successfully moved its critical applications from a mishmash of mainframes and older Sun Microsystems servers to a new dual-site enterprise architecture, which has resulted in lower costs and increased reliability throughout the company.

The paper's new enterprise architecture clustered its servers over a two-mile distance, lighting up a 1 Gbps dark-fiber link—an optical fiber that is in place but not yet being used—between two data centers. This architecture lets the newspaper spread the processing load between the servers while improving redundancy and options for disaster recovery.The transfer to the new architecture was not smooth. A small piece of software written for the transition contained a coding error that caused the *Tribune*'s editorial applications to experience intermittent processing failures. As a result, the paper was forced to delay delivery to about 40 percent of its 680,000 readers and cut 24 pages from a Monday edition, costing the newspaper nearly $1 million in advertising revenue.

After editorial applications were stabilized, the *Tribune* proceeded to migrate applications for operations—the physical production and printing of the newspaper—and circulation to the new enterprise architecture. "As we gradually took applications off the mainframe, we realized that we were incurring very high costs in maintaining underutilized mainframes at two different locations," said Darko Dejanovic, vice president and CTO of the Tribune Co., which owns the *Chicago Tribune*, the *Los Angeles Times*, Long Island's *Newsday*, and about a dozen other metropolitan newspapers. "By moving from two locations to one, we've achieved several million dollars in cost savings. There's no question that server consolidation was the right move for us.

"The Tribune Co. is excited about its new enterprise architecture and is now looking to consolidate software across its newspapers. Currently, each newspaper maintains its own applications for classified advertising and billing, which means the parent company must support about 10 billing packages and the same number of classified-ad programs.The Tribune Co. has found that most of the business processes can be standardized. So far, it has standardized about 95 percent of classified-ad processes and about 90 percent of advertising-sales processes. Over the next

three years, the Tribune Co. will replace the disparate billing and ad applications across the company with a single package that will be used by all business units. The different newspapers will not necessarily share the same data, but they will have the same processes and the same systems for accessing them. Over time, that will allow some of the call centers to handle calls for multiple newspapers; East Coast centers will handle the early-morning calls and West Coast centers the late-day and evening calls.

The Tribune Co. is looking at a few additional projects including the implementation of hardware that will allow its individual applications to run on partial CPUs, freeing up processor power and making more efficient use of disk space.[29]

Questions

1. Review the five characteristics of infrastructure architecture and rank them in order of their potential impact on the Tribune Co.'s business.

2. What is the disaster recovery cost curve? Where should the Tribune Co. operate on the curve?

3. Define backups and recovery. What are the risks to the Tribune Co.'s business if it fails to implement an adequate backup plan?

4. Why is a scalable and highly available enterprise architecture critical to the Tribune Co.'s current operations and future growth?

5. Identify the need for information security at the Tribune Co.

6. How could the Tribune Co. use a "Classified Ad" Web service across its different businesses?

CLOSING CASE TWO

UPS in the Computer Repair Business

When people think of UPS they usually think of brown delivery trucks and employees in shorts dropping off and picking up packages. This image is about to change. UPS has now entered the laptop repair business. Toshiba is handing over its entire laptop repair operation to UPS Supply Chain Solutions, the shipper's $2.4 billion logistics outsourcing division. Toshiba's decision to allow a shipping company to fix its laptops might appear odd to many individuals. However, when you understand that the primary challenge of computer repair is more logistical than technical—Toshiba's business decision seems brilliant. "Moving a unit around and getting replacement parts consumes most of the time," explains Mark Simons, general manager at Toshiba's digital products division. "The actual

service only takes about an hour."

UPS will send broken Toshiba laptops to its facility in Louisville, Kentucky, where UPS engineers will diagnose and repair defects. Consumers will notice an immediate change: In the past, repairs could take weeks, depending on whether Toshiba needed components from Japan. Since the UPS repair site is adjacent to its air hub, customers should get their machines back, as good as new, in just a matter of days. UPS has been servicing Lexmark and Hewlett-Packard printers since 1996 and has been performing initial inspections on laptops being returned to Toshiba since 1999.

The expanded Toshiba relationship is another step in UPS's strategy to broaden its business beyond package delivery into commerce services. The company already works with clients to manage inventory, ordering, and custom processes. It recently introduced a service to dispose of unwanted electrical devices. To take on laptop repair, UPS put 50 technicians through a Toshiba-certified training course.[30]

Questions

1. Do you think UPS's entrance into the laptop repair business was a good business decision? Why or why not?

2. Identify the different types of hardware UPS technicians might be working on when fixing laptops.

3. Assume you are a technician working at UPS. Explain to a customer the different types of memory and why only certain types of data are lost during a computer failure. Also identify a potential backup strategy you can suggest to the customer.

4. Assume you are a technician working at UPS. Explain to a customer the different types of software found in a typical laptop.

CLOSING CASE THREE

Fear the Penguin

Linux has proved itself the most revolutionary software of the past decade. Spending on Linux was expected to reach $280 million by 2006. Linus Torvalds, who wrote the kernel (the core) of the Linux operating system at age 21, posted the operating system on the Internet and invited other programmers to improve his code and users to download his operating system for free. Since then, tens of thousands of people have, making Linux perhaps the single largest collaborative project in the planet's history.

Today, Linux, if not its penguin mascot, is everywhere. You can find Linux inside a boggling array of computers,

machines, and devices. Linux is robust enough to run the world's most powerful supercomputers, yet sleek and versatile enough to run inside consumer items like TiVo, cell phones, and handheld portable devices. Even more impressive than Linux's increasing prevalence in living rooms and pockets is its growth in the market for corporate computers. According to a recent poll by CIO.com, 39 percent of IT managers agreed that Linux would dominate corporate systems by 2007.

Since its introduction in 1991, no other operating system in history has spread as quickly across such a broad range of systems as Linux, and it has finally achieved critical mass. According to studies by market research firm IDC, Linux is the fastest-growing server operating system, with shipments expected to grow by 34 percent per year over the next four years. With its innovative open source approach, strong security, reliability, and scalability, Linux can help companies achieve the agility they need to respond to changing consumer needs and stay ahead of the game.

Thanks to its unique open source development process, Linux is reliable and secure. A "meritocracy," a team specifically selected for their competence by the technical developer community, governs the entire development process. Each line of code that makes up the Linux kernel is extensively tested and maintained for a variety of different platforms and application scenarios.

This open collaborative approach means the Linux code base continually hardens and improves itself. If vulnerabilities appear, they get the immediate attention of experts from around the world, who quickly resolve the problems. According to Security Portal, which tracks vendor response times, it takes an average of 12 days to patch a Linux bug compared to an average of three months for some proprietary platforms. With the core resilience and reliability of Linux, businesses can minimize downtime, which directly increases their bottom line.

The Spread of Open Systems

Businesses and governments are opting for open source operating systems like Linux instead of Windows. One attendee at the Linux Desktop Consortium in 2004 was Dr. Martin Echt, a cardiologist from Albany, New York. Dr. Echt, chief operating officer of Capital Cardiology Associates, an eight-office practice, discussed his decision to shift his business from Microsoft's Windows to Linux. Dr. Echt is not your typical computer geek or Linux supporter, and he is not the only one switching to Linux.

The State Council in China has mandated that all ministries install the local flavor of Linux, dubbed Red Flag, on their PCs. In Spain, the government has installed a Linux operating system that incorporates the regional dialect.

The city of Munich, despite a personal visit from Microsoft CEO Steve Ballmer, is converting its 14,000 PCs from Windows to Linux.

"It's open season for open source," declared Walter Raizner, general manager of IBM Germany. One of the biggest corporate backers of Linux, IBM has more than 75 government customers worldwide, including agencies in France, Spain, Britain, Australia, Mexico, the United States, and Japan.

The move toward Linux varies for each country or company. For Dr. Echt, it was a question of lower price and long-term flexibility. In China, the government claimed national security as a reason to move to open source code because it permitted engineers to make sure there were no security leaks and no spyware installed on its computers. In Munich, the move was largely political. Regardless of the reason, the market is shifting toward Linux.

Microsoft versus Linux

Bill Gates has openly stated that Linux is not a threat to Microsoft. According to IDC analysts, Microsoft's operating systems ship with 93.8 percent of all desktops worldwide. Ted Schadler, IDC research principal analyst, states that despite the push of lower cost Linux players into the market, Microsoft will maintain its desktop market share for the following three reasons:

1. Linux adds features to its applications that most computer users have already come to expect.

2. Linux applications might not be compatible with Microsoft applications such as Microsoft Word or Microsoft Excel.

3. Microsoft continues to innovate, and the latest version of Office is beginning to integrate word processing and spreadsheet software to corporate databases and other applications.

The Future of Linux

IDC analyst Al Gillen predicts that an open source operating system will not enjoy explosive growth on the desktop for at least six or eight years. Still, even Gillen cannot deny that Linux's penetration continues to rise, with an estimated 18 million users. Linux's market share has increased from 1.5 percent at the end of 2000 to 4.2 percent at the beginning of 2004. According to IDC, by the end of 2005 it was expected to have surpassed Apple's Mac OS, which has 2.9 percent of the market, as the second most popular operating system. Gartner Dataquest estimates Linux's server market share will grow seven times faster than Windows.[31]

Questions

1. How does Linux differ from traditional software?

2. Should Microsoft consider Linux a threat? Why or why not?

3. How is open source software a potential trend shaping organizations?

4. How can you use Linux as an emerging technology to gain a competitive advantage?

5. Research the Internet and discover potential ways that open source software might revolutionize business in the future.

MAKING BUSINESS DECISIONS

1. Purchasing a computer

Dell is considered the fastest company on earth and specializes in computer customization. Connect to Dell's Web site at www.dell.com. Go to the portion of Dell's site that allows you to customize either a laptop or a desktop computer. First, choose an already prepared system and note its price and capability in terms of CPU speed, RAM size, monitor quality, and storage capacity. Now, customize that system to increase CPU speed, add more RAM, increase monitor size and quality, and add more storage capacity. What is the difference in price between the two? Which system is more in your price range? Which system has the speed and capacity you need?

2. Web-enabled cell phones

When categorizing computers by size for personal needs, we focused on PDAs, laptops, and desktop computers. Other variations include Web-enabled cell phones that include instant text messaging and Web computers. For this project, you will need a group of four people, which you will then split into two groups of two. Have the first group research Web-enabled cell phones, their capabilities and costs. Have that group make a purchase recommendation based on price and capability. Have the second group do the same for Web computers. What is your vision of the future? Will we ever get rid of clunky laptops and desktops in favor of more portable and cheaper devices such as Web-enabled cell phones and Web computers? Why or why not?

3. Small business computers

Many different types of computers are available for small businesses. Use the Internet to find three different vendors of laptops or notebooks that are good for small businesses. Find the most expensive and the least expensive that the vendor offers and create a table comparing the different computers based on the following:

■ CPU

- ■ Memory

- ■ Hard drive

- ■ Optical drive

- ■ Operating system

- ■ Utility software

- ■ Application software

- ■ Support plan

Determine which computer you would recommend for a small business looking for an inexpensive laptop. Determine which computer you would recommend for a small business looking for an expensive laptop.

4. **Planning for disaster recovery**

You are the new senior analyst in the IT department at Beltz, a large snack food manufacturing company. The company is located on the beautiful shoreline in Charleston, North Carolina. The company's location is one of its best and also worst features. The weather and surroundings are beautiful, but the threat of hurricanes and other natural disasters is high. Compile a disaster recovery plan that will minimize any risks involved with a natural disaster.

5. **Comparing backup and recovery systems**

Research the Internet to find three different vendors of backup and recovery systems. Compare and contrast the three systems and determine which one you would recommend if you were installing a backup and recovery system for a medium-sized business with 3,500 employees that maintains information on the stock market. Compile your findings in a presentation that you can give to your class that details the three systems' strengths and weaknesses, along with your recommendation.

6. **Ranking the** *–ilities*

In a group, review the list of IT infrastructure qualities and rank them in order of their impact on an organization's success. Use a rating system of 1 to 7, where 1 indicates the biggest impact and 7 indicates the least impact.

IT Infrastructure Qualities	Business Impact
Availability	

Accessibility	
Reliability	
Scalability	
Flexibility	
Performance	
Capacity Planning	

7. Designing an enterprise architecture

Components of a solid enterprise architecture include everything from documentation to business concepts to software and hardware. Deciding which components to implement and how to implement them can be a challenge. New IT components are released daily, and business needs continually change. An enterprise architecture that meets your organization's needs today may not meet those needs tomorrow. Building an enterprise architecture that is scalable, flexible, available, accessible, and reliable is key to your organization's success.

You are the enterprise architect (EA) for a large clothing company called Xedous. You are responsible for developing the initial enterprise architecture. Create a list of questions you will need answered to develop your architecture. Below is an example of a few of the questions you might ask.

- What are the company's growth expectations?
- Will systems be able to handle additional users?
- How long will information be stored in the systems?
- How much customer history must be stored?
- What are the organization's business hours?
- What are the organization's backup requirements?

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Databases and Data Warehouses

CHAPTER OUTLINE

opening case study

Searching for Revenue—Google

Google founders Sergey Brin and Larry Page recently made *Forbes* magazine's list of world billionaires. Google, famous for its highly successful search engine, experienced a 850 percent revenue growth in 2005.

How Google Works

Figure 6.1 displays the life of an average Google query. The Web server sends the query to the index servers. The

content inside the index server is similar to the index at the back of a book; it tells which pages contain the words that match any particular query term. Then the query travels to the document servers, which actually retrieve the stored documents and generate snippets to describe each search result. Finally, the search engine returns the results to the user. All these activities occur within a fraction of a second.

Google consists of three distinct parts:

1. The Web crawler, known as Googlebot, finds and retrieves Web pages and passes them to the Google indexer. Googlebot functions much like a Web browser. It sends a request for a Web page to a Web server, downloads the entire page, and then hands it off to Google's indexer. Googlebot can request thousands of different Web pages simultaneously.

FIGURE 6.1

Sample Google Architecture

2. The indexer indexes every word on each page and stores the resulting index of words in a huge database. This index is sorted alphabetically by search term, with each index entry storing a list of documents in which the term appears and the location within the text where it occurs. Indexing the full text of Web pages allows Google to go beyond simply matching single search terms. Google gives more priority to pages that have search terms near each other and in the same order as the query. Google can also match multi-word phrases and sentences.

3. The query processor compares the search query to the index and recommends the documents that it considers most relevant. Google considers more than a hundred factors in determining which documents are most relevant to a query, including the popularity of the page, the position and size of the search terms within the page, and the proximity of the search terms to one another. The query processor has several parts, including the user interface (search box), the "engine" that evaluates queries and matches them to relevant documents, and the results for-matter.

Selling Words

Google's primary line of business is its search engine; however, the company does not generate revenue from people using its site to search the Internet. It generates revenue from the marketers and advertisers that are paying to place their ads on the site.

Around 200 million times each day, people from all over the world access Google to perform searches. AdWords, a part of the Google site, allows advertisers to bid on common search terms. The advertisers simply enter in the

keywords they want to bid on and the maximum amounts they want to pay per click, per day. Google then determines a price and a search ranking for those keywords based on how much other advertisers are willing to pay for the same terms. Pricing for keywords can range from 5 cents to $3 a click. A general search term like *tropical vacation* costs less than a more specific term like *Hawaiian vacation*. Whoever bids the most for a term appears in a sponsored advertisement link either at the top or along the side of the search-results page.

Paid search is the ultimate in targeted advertising because consumers type in exactly what they want. One of the primary advantages of paid search Web programs such as AdWords is that customers do not find it annoying, as is the problem with some forms of Web advertising such as banner ads and pop-up ads. According to the Interactive Advertising Bureau, overall industry revenues from paid search surpassed banner ads in the third quarter of 2003.

"A big percentage of queries we get are commercial in nature," said Salar Kamangar, Google's director of product management. "It is a marketplace where the advertisers tell us about themselves by telling us how much each lead is worth. They have an incentive to bid how much they really want to pay, because if they underbid, their competitors will get more traffic." Kamangar came up with the AdWords concept and oversees that part of the business. AdWords accounts for the vast majority of Google's annual revenue, and the company has over 150,000 advertisers in its paid-search program, up from zero in 2002.

Expanding Google

Google has a secret weapon working for its research and development department—hackers. Hackers actually develop many of the new and unique ways to expand Google. The company elicits hacker ideas through its application program interface (API), a large piece of the Google code. The API enables developers to build applications around the Google search engine. By making the API freely available, Google has inspired a community of programmers that are extending Google's capabilities. "It's working," said Nelson Minar, who runs the API effort. "We get clever hacks, educational uses, and wacky stuff. We love to see people do creative things with our product." A few of the successful developed applications include:

> **Banana Slug,** www.bananaslug.com. For customers who hit a dead end with Google search, the site adds a random word to search text that generates surprising results.

Cookin' with Google, www.researchbuzz.org. Enter in the ingredients that are in the fridge and the site returns potential recipes for those ingredients.

Google Alert, www.googlealert.com. Google Alert automatically searches the Web for information on a topic and returns the results by e-mail.

RateMyProfessors.com, www.ratemyprofessors.com. The goal of this site was to create a place where students could rank their teachers. However, too many jokesters typing in false professor names such as "Professor Harry Leg" and "Professor Ima Dog" left the information on the site questionable. The developers turned to the Google API to create an automatic verification tool. If Google finds enough mentions in conjunction with a professor or university then it considers the information valid and posts it to the Web site.

Froogle, www.froogle.com. Google launched a beta version of a new shopping search tool called "Froogle" that the company claims is the most comprehensive product search engine available. Froogle has 15 product categories in its directory. Similar to the Google Directory, customers can view products either by using a keyword search or by drilling down through a particular category and its subcategories.

Stopping Google

As part of its Google Print Library Project, the company is working to scan all or parts of the book collections of the University of Michigan, Harvard University, Stanford University, the New York Public Library, and Oxford University. It intends to make those texts searchable on Google and to sell advertisements on the Web pages.

The Authors Guild filed a lawsuit against search engine Google, alleging that its scanning and digitizing of library books constitutes a "massive" copyright infringement. "This is a plain and brazen violation of copyright law," Nick Taylor, president of the New York-based Authors Guild, said in a statement about the lawsuit, which is seeking class action status. "It's not up to Google or anyone other than the authors, the rightful owners of these copyrights,

to decide whether and how their works will be copied."

In response, Google defended the program in a company blog posting. "We regret that this group chose to sue us over a program that will make millions of books more discoverable to the world—especially since any copyright holder can exclude their books from the program," wrote Susan Wojcicki, vice president of product management. "Google respects copyright. The use we make of all the books we scan through the Library Project is fully consistent with both the fair use doctrine under U.S. copyright law and the principles underlying copyright law itself, which allow everything from parodies to excerpts in book reviews."[1]

INTRODUCTION

Information is powerful. Information is useful in telling an organization how its current operations are performing and estimating and strategizing how future operations might perform. New perspectives open up when people have the right information and know how to use it. The ability to understand, digest, analyze, and filter information is key to success for any professional in any industry. This chapter demonstrates the value an organization can uncover and create by learning how to manage, access, and analyze organizational information.

It is important to distinguish between data and information. *Data* are raw facts that describe the characteristics of an event. Characteristics for a sales event could include the date, item number, item description, quantity ordered, customer name, and shipping details. *Information* is data converted into a meaningful and useful context. Information from sales events could include best-selling item, worst-selling item, best customer, and worst customer.

section 6.1   DATABASE FUNDAMENTALS

LEARNING OUTCOMES

6.1. List, describe, and provide an example of each of the five characteristics of high quality information.

6.2. Define the relationship between a database and a database management system.

6.3. Describe the advantages an organization can gain by using a database.

6.4. Define the fundamental concepts of the relational database model.

6.5. Describe the role and purpose of a database management system and list the four components of a database management system.

6.6. Describe the two primary methods for integrating information across multiple databases.

UNDERSTANDING INFORMATION

Google recently reported a 200 percent increase in sales of its new Enterprise Search Appliance tool. Companies use the tool to search corporate information for answers to customer questions and to fulfill sales orders. Hundreds of Google's customers, including Xerox, Nextel Communications, Procter & Gamble, and Boeing, are using the tool. The ability to search, analyze, and comprehend information is vital for any organization's success. The incredible growth in sales of the Enterprise Search Appliance tool is a strong indicator that businesses desire technologies that help organize and provide access to information.[2]

When addressing a significant business issue, employees must be able to obtain and analyze all the relevant information so they can make the best decision possible. Organizational information comes at different levels, formats, and "granularities." *Information granularity* refers to the extent of detail within the information (fine and detailed or coarse and abstract information). On one end of the spectrum is coarse granularity, or highly summarized information. At the other end is fine granularity, or information that contains a great amount of detail. If employees are using a supply chain management (SCM) system to make decisions, they might find their suppliers send information in different formats and granularities, and at different levels. One supplier might send detailed information in a spreadsheet, another supplier might send summary information in a Word document, and still another might send aggregate information from a database. Employees must be able to correlate the different levels, formats, and granularities of information when making decisions.

Successfully collecting, compiling, sorting, and finally analyzing information from multiple levels, in varied formats, exhibiting different granularities can provide tremendous insight into how an organization is performing. Taking a hard look at organizational information can yield exciting and unexpected results such as potential new markets, new ways of reaching customers, and even new ways of doing business. Figure 6.2 displays the different types of information found in organizations.

FIGURE 6.2

Levels, Formats, and Granularities of Organizational Information

Information Types	Range	Examples

Information Levels	Individual	Individual knowledge, goals, and strategies
	Department	Departmental goals, revenues, expenses, processes, and strategies
	Enterprise	Enterprisewide revenues, expenses, processes, and strategies
Information Formats	Document	Letters, memos, faxes, e-mails, reports, marketing materials, and training materials
	Presentation	Product, strategy, process, financial, customer, and competitor presentations
	Spreadsheet	Sales, marketing, industry, financial, competitor, customer, and order spreadsheets
	Database	Customer, employee, sales, order, supplier, and manufacturer databases
Information Granularities	Detail (Fine)	Reports for each salesperson, product, and part

	Summary	Reports for all sales personnel, all products, and all parts
	Aggregate (Coarse)	Reports across departments, organizations, and companies

Samsung Electronics took a detailed look at over 10,000 reports from its resellers to identify "lost deals" or orders lost to competitors. The analysis yielded the enlightening result that 80 percent of lost sales occurred in a single business unit, the health care industry. Furthermore, Samsung was able to identify that 40 percent of its lost sales in the health care industry were going to one particular competitor. Before performing the analysis, Samsung was heading into its market blind. Armed with this valuable information, Samsung is changing its selling strategy in the health care industry by implementing a new strategy to work more closely with hardware vendors to win back lost sales.[3]

Not all companies are successful at managing information. Staples, the office-supplies superstore, opened its first store in 1986 with state-of-the-art technology. The company experienced rapid growth and soon found itself overwhelmed with the resulting volumes of information. The state-of-the-art technology quickly became obsolete and the company was unable to obtain any insight into its massive volumes of information. A simple query such as identifying the customers who purchased a computer, but not software or peripherals, took hours. Some of the queries required several days to complete and by the time the managers received answers to their queries it was too late.[4]

Information Quality

Westpac Financial Services (WFS), one of the four major banks in Australia, serves millions of customers from its many core systems, each with its own database. The databases maintain information and provide users with easy access to the stored information. Unfortunately, the company failed to develop information-capturing standards; one system had a field to capture e-mail addresses while another system did not, which led to inconsistent organizational information. Duplicate customer information among the different systems was another major issue, and the company continually found itself sending conflicting or competing messages to customers from different operations of the bank. A customer could also have multiple accounts within the company, one representing a life insurance policy

and one representing a credit card. WFS had no way to identify that the two different customer accounts were for the same customer.

FIGURE 6.3

Characteristics of High-Quality Information

Characteristics of High-Quality Information	
Accuracy	Are all the values correct? For example, is the name spelled correctly? Is the dollar amount recorded properly?
Completeness	Are any of the values missing? For example, is the address complete including street, city, state, and zip code?
Consistency	Is aggregate or summary information in agreement with detailed information? For example, do all total fields equal the true total of the individual fields?
Uniqueness	Is each transaction, entity, and event represented only once in the information? For example, are there any duplicate customers?
Timeliness	Is the information current with respect to the business requirements? For example, is information updated weekly, daily, or hourly?

WFS had to solve its information quality problems immediately if it was to remain competitive. The company purchased NADIS (Name & Address Information Integrity Software), a software solution that filters customer information and highlights missing, inaccurate, and redundant information. Customer service ratings are on the rise for WFS now that the company can operate its business with a single and comprehensive view of each of its customers.[5]

Business decisions are only as good as the quality of the information used to make the decisions. Figure 6.3 reviews five characteristics common to high-quality information: accuracy, completeness, consistency, uniqueness, and timeliness. Figure 6.4 displays these issues in a sample information set.

FIGURE 6.4

Examples of Low-Quality Information

Figure 6.4 highlights several issues with low-quality information including:

1. The first issue is *missing* information. The customer's first name is missing. (See 1 in Figure 6.4.)

2. The second issue is *incomplete* information since the street address contains only a number and not a street name.

3. The third issue is a probable *duplication* of information since the only slight difference between the two customers is the spelling of the last name. Similar street addresses and phone numbers make this likely.

4. The fourth issue is potential *wrong* information because the customer's phone and fax numbers are the same. Some customers might have the same number for phone and fax line, but the fact that the customer also has this number in the e-mail address field is suspicious.

5. The fifth issue is definitely an example of *inaccurate* information since a phone number is located in the e-mail address field.

6. The sixth issue is *incomplete* information since there is not a valid area code for the phone and fax numbers.

Recognizing how quality issues occur will allow organizations to begin to correct them. The four primary sources of low-quality information are:

1. Online customers intentionally enter inaccurate information to protect their privacy.

2. Information from different systems have different information entry standards and formats.

3. Call center operators enter abbreviated or erroneous information by accident or to save time.

4. Third party and external information contain inconsistencies, inaccuracies, and errors.[6]

Addressing the above sources of information inaccuracies will significantly improve the quality of organizational information and the value extracted from the information.

Understanding the Costs of Poor Information   Using the wrong information can lead to making the wrong decision. Making the wrong decision can cost time, money, and even reputations. Every business decision is only as good as the information used to make the decision. Bad information can cause serious business ramifications such as:

■ Inability to accurately track customers, which directly affects strategic initiatives such as customer relationship management and supply chain management.

■ Difficulty identifying the organization's most valuable customers.

■ Inability to identify selling opportunities and wasted revenue from marketing to nonexistent customers and non-

deliverable mail.

- Difficulty tracking revenue because of inaccurate invoices.

- Inability to build strong relationships with customers, which increases their buyer power.

Understanding the Benefits of Good Information High-quality information can significantly improve the chances of making a good decision and directly increase an organization's bottom line. Lillian Vernon Corp., a catalog company, used Web analytics to discover that men preferred to shop at Lillian Vernon's Web site instead of looking through its paper catalog. Based on this information, the company began placing male products more prominently on its Web site and soon realized a 15 percent growth in sales to men.[7]

Another company discovered that Phoenix, Arizona, is not a good place to sell golf clubs, even with its high number of golf courses. An analysis revealed that typical golfers in Phoenix are either tourists or conventioneers. These golfers usually bring their clubs with them while visiting Phoenix. The analysis further revealed that two of the best places to sell golf clubs in the United States are Rochester, New York, and Detroit, Michigan.[8]

There are numerous examples of companies that have used their high-quality information to make solid strategic business decisions. Quality information does not automatically guarantee that every decision made is going to be a good one, since people ultimately make decisions. But such information ensures that the basis of the decisions is accurate. The success of the organization depends on appreciating and leveraging the true value of timely and quality information.

DATABASE FUNDAMENTALS

Like any resource, an organization must manage information properly. That is, an organization must:

1. Determine what information it requires.

2. Acquire that information.

3. Organize the information in a meaningful fashion.

4. Assure the information's quality.

5. Provide software tools so that employees throughout the organization can access the information they require.

At the very heart of most—if not all—management information systems is a database and a database management system. A ***database*** maintains information about various types of objects (inventory), events (transactions), people (employees), and places (warehouses). A ***database management system (DBMS)*** is software through which users and application programs interact with a database. Think of it this way: A DBMS is to a database as word

processing software is to a document or as spreadsheet software is to a spreadsheet. One is the information and the other is the software people use to manipulate the information.

The primary task of a database is to store and organize every piece of information related to transactions (for instance, the sale of a product) and business events (such as the hiring of a new employee). As such, databases store a tremendous amount of detailed information. The primary task of a DBMS then is to allow users to create, access, and use information stored in a database.

All kinds of information, from e-mails and contact information to financial information and sales records, are stored in databases. There are many different models for organizing information in a database, including the hierarchical database, network database, and the most prevalent—the relational database model. In a *hierarchical database model*, information is organized into a tree-like structure that allows repeating information using parent/child relationships, in such a way that it cannot have too many relationships. Hierarchical structures were widely used in the first mainframe database management systems. However, owing to their restrictions, hierarchical structures often cannot be used to relate to structures that exist in the real world. The *network database model* is a flexible way of representing objects and their relationships. Where the hierarchical model structures information as a tree of records, with each record having one parent record and many children, the network model allows each record to have multiple parent and child records, forming a lattice structure. The *relational database model* is a type of database that stores information in the form of logically related two-dimensional tables. This text focuses on the relational database model.

DATABASE ADVANTAGES

From a business perspective, databases offer many advantages, including:

- Increased flexibility.
- Increased scalability and performance.
- Reduced redundancy.
- Increased integrity (quality).
- Increased security.

Increased Flexibility

Databases tend to mirror business structures, and a good database can handle changes quickly and easily, just as any

good business needs to be able to handle changes quickly and easily. Equally important, databases provide flexibility in allowing each user to access the information in whatever way best suits his or her needs.

The distinction between logical and physical views is important in understanding flexible database user views. The *physical view* of information deals with the physical storage of information on a storage device such as a hard disk. The *logical view* of information focuses on how users logically access information to meet their particular business needs. This separation of logical and physical views is what allows each user to access database information differently. That is, while a database has only one physical view, it can easily support multiple logical views. One user might want a customer report presented in alphabetical format, in which case last name should appear before first name. Another user might want customer names appearing as first name and then last name. Both are easily achievable, but different logical views of the same physical information.

Increased Scalability and Performance

The official Web site of The American Family Immigration History Center, www.ellisisland.org, generated over 2.5 billion hits in its first year of operation. The site offers easy access to immigration information about people who entered America through the Port of New York and Ellis Island between 1892 and 1924. The database contains over 25 million passenger names correlated to 3.5 million images of ships' manifests.[9]

Only a database could "scale" to handle the massive volumes of information and the large numbers of users required for the successful launch of the Ellis Island Web site. *Scalability* refers to how well a system can adapt to increased demands. *Performance* measures how quickly a system performs a certain process or transaction. Some organizations, such as eBay, must be able to support hundreds or thousands of online users including employees, partners, customers, and suppliers, who all want to access and share information. Databases today scale to exceptional levels, allowing all types of users and programs to perform information processing and information-searching tasks.

Reduced Redundancy

Redundancy is the duplication of information, or storing the same information in multiple places. Redundant information occurs because organizations frequently capture and store the same information in multiple locations. The primary problem with redundant information is it is often inconsistent, which makes it difficult to determine which values are the most current or most accurate. Not having correct information is confusing and frustrating for em-

ployees and disruptive to an organization. One primary goal of a database is to eliminate information redundancy by recording each piece of information in only one place in the database. Eliminating information redundancy saves space, makes performing updates easier, and improves quality.

Increased Integrity (Quality)

Information integrity is a measure of the quality of information. Within a database environment, *integrity constraints* are rules that help ensure the quality of information. Integrity constraints are defined and built into the database. The database (more appropriately, the database management system) ensures that users can never violate these constraints. There are two types of integrity constraints: (1) relational integrity constraints and (2) business-critical integrity constraints.

Relational integrity constraints are rules that enforce basic and fundamental information constraints. For example, a referential integrity constraint would not allow someone to create an order for a nonexistent customer, provide a markup percentage that was negative, or order zero pounds of raw materials from a supplier.

Business-critical integrity constraints enforce business rules vital to an organization's success and often require more insight and knowledge than relational integrity constraints. Consider a supplier of fresh produce to large grocery chains such as Safeway. The supplier might implement a business-critical integrity constraint stating that no produce returns are accepted after 15 days past delivery. That would make sense because of the chance of spoilage of the produce. These types of integrity constraints tend to mirror the very rules by which an organization achieves success.

The specification and enforcement of integrity constraints produce higher-quality information that will provide better support for business decisions. Organizations that establish specific procedures for developing integrity constraints typically see a decline in information error rates and an increase in the use of organizational information.

Increased Security

Information is an organizational asset. Like any asset, an organization must protect its information from unauthorized users or misuse. As systems become increasingly complex and more available over the Internet, security becomes an even bigger issue. Databases offer many security features including passwords, access levels, and access controls.

Passwords provide authentication of the user who is gaining access to the system. Access levels determine who

has access to the different types of information, and access controls determine what type of access they have to the information. Customer service representatives might need read-only access to customer order information so they can answer customer order inquiries; they might not have or need the authority to change or delete order information. Managers might require access to employee files, but they should have access only to their own employees' files, not the employee files for the entire company. Various security features of databases ensure that individuals have only certain types of access to certain types of information.

Databases can increase personal security as well as information security. Since 1995, the Chicago Police Department (CPD) has relied on a crime-fighting system called Citizen and Law Enforcement Analysis and Reporting (CLEAR). CLEAR electronically streamlines the way detectives enter and access critical information to help them solve crimes, analyze crime patterns, and ultimately promote security in a proactive manner. The CPD enters 650,000 new criminal cases and 500,000 new arrests into CLEAR each year.[10]

RELATIONAL DATABASE FUNDAMENTALS

The relational database model is a type of database that stores information in the form of logically related two-dimensional tables. Consider how the Coca-Cola Bottling Company of Egypt (TCCBCE) implemented an inventory-tracking database to improve order accuracy by 27 percent, decrease order response time by 66 percent, and increase sales by 20 percent. With over 7,400 employees, TCCBCE owns and operates 11 bottling plants and 29 sales and distribution centers, making it one of the largest companies in Egypt.

Traditionally, the company sent distribution trucks to each customer's premises to take orders and deliver stock. Many problems were associated with this process including numerous information entry errors, which caused order-fulfillment time to take an average of three days. To remedy the situation, Coca-Cola decided to create presales teams equipped with handheld devices to visit customers and take orders electronically. On returning to the office, the teams synchronized orders with the company's inventory-tracking database to ensure automated processing and rapid dispatch of accurate orders to customers.[11]

Entities, Entity Classes, and Attributes

Figure 6.5 illustrates the primary concepts of the relational database model—entities, entity classes, attributes, keys, and relationships. An *entity* is a person, place, thing, transaction, or event about which information is stored. An *entity class* (often called a table) is a collection of similar entities. The entity classes of interest in Figure 6.5 are

CUSTOMER, ORDER, ORDER LINE, PRODUCT, and DISTRIBUTOR. Notice that each entity class (the collection of similar entities) is stored in a different two-dimensional table. *Attributes*, also called fields or columns, are characteristics or properties of an entity class. In Figure 6.5, the attributes for CUSTOMER include *Customer ID, Customer Name, Contact Name,* and *Phone*. Attributes for PRODUCT include *Product ID, Product Description,* and Price. Each specific entity in an entity class (e.g., Dave's Sub Shop in the CUSTOMER table) occupies one row in its respective table. The columns in the table contain the attributes.

Keys and Relationships

To manage and organize various entity classes within the relational database model, developers must identify primary keys and foreign keys and use them to create logical relationships. A *primary key* is a field (or group of fields) that uniquely identifies a given entity in a table. In CUSTOMER, the *Customer ID* uniquely identifies each entity (customer) in the table and is the primary key. Primary keys are important because they provide a way of distinguishing each entity in a table.

A *foreign key* in the relational database model is a primary key of one table that appears as an attribute in another table and acts to provide a logical relationship between the two tables. Consider Hawkins Shipping, one of the distributors appearing in the DISTRIBUTOR table. Its primary key, *Distributor ID,* is DEN8001. Notice that *Distributor ID* also appears as an attribute in the ORDER table. This establishes the fact that Hawkins Shipping (*Distributor ID* DEN8001) was responsible for delivering orders 34561 and 34562 to the appropriate customer(s). Therefore, *Distributor ID* in the ORDER table creates a logical relationship (who shipped what order) between ORDER and DISTRIBUTOR.

DATABASE MANAGEMENT SYSTEMS

Ford's European plant manufactures more than 5,000 vehicles a day and sells them in over 100 countries. Every component of every model must conform to complex European standards, including passenger safety standards and pedestrian and environmental protection standards. These standards govern each stage of Ford's manufacturing process from design to final production. The company needs to obtain many thousands of different approvals each year to comply with the standards. Overlooking just one means the company cannot sell the finished vehicle, which brings the production line to a standstill and could potentially cost Ford up to 1 million euros per day. Ford built the Homologation Timing System (HTS), based on a relational database, to help it track and analyze these standards.

The reliability and high performance of the HTS have helped Ford substantially reduce its compliance risk.[12]

As displayed in Figure 6.6, a user can directly interact with a database using different types of technology tools such as views and report generators. Users can also interact with a database by using application programs such as accounting, marketing, and manufacturing applications.

Austrian Federal Railways maintains its entire railway system—which includes over 5,849 kilometers of track, 5,993 bridges and viaducts, 240 tunnels, and 6,768 crossings—with an Oracle database. Multiple applications run on the database including accounting, order processing, and geographic applications that pinpoint railway equipment locations. The database contains over 80 billion characters and supports more than 1,200 users. Many organizations use databases similar to Austrian Federal Railways' to manage large amounts of information.[13]

FIGURE 6.5

Potential Relational Database for Coca-Cola Bottling Company of Egypt

FIGURE 6.6

User Interaction with a Database and DBMS

A DBMS is composed of four primary components—data definition, data manipulation, application generation, and data administration (see Figure 6.7).

Data Definition Component

The *data definition component* of a DBMS helps create and maintain the data dictionary and the structure of the database. The *data dictionary* is a file that stores definitions of information types, identifies the primary and foreign keys, and maintains the relationships among the tables. The data dictionary essentially defines the logical properties of the information that the database contains. Figure 6.8 displays typical logical properties of information.

All the logical properties shown in Figure 6.8 are important, and they vary depending on the type of information. A typical address field might have a *Type* logical property of alphanumeric, meaning that the field can accept numbers, letters, and special characters. This would be an example of a relational integrity constraint. The validation rule requiring that a discount cannot exceed 100 percent is an example of a business-critical integrity constraint.

FIGURE 6.7

Four Components of a Database Management System

FIGURE 6.8

Logical Field Properties in a Database

Logical Property	Example
Field name	Name of field such as *Customer ID* or *Product ID*
Type	Alphanumeric, numeric, date, time, currency, etc.
Form	Each phone number must have the area code (XXX) XXX-XXXX
Default value	The default value for area code is (303)
Validation rule	A discount cannot exceed 100 percent
Entry rule	The field must have a valid entry—no blanks are allowed
Duplicate rule	Duplicate information is not allowed

The data dictionary is an important part of the DBMS because users can consult the dictionary to determine the different types of information. The data dictionary also supplies users with vital information when creating reports such as column names and information formats.

Data Manipulation Component

Of the four DBMS components, users probably spend the most time working with data manipulation. The ***data manipulation component*** allows users to create, read, update, and delete information in a database. A DBMS contains a variety of data manipulation tools including views, report generators, query-by-example tools, and structured query language.

FIGURE 6.9

Sample Report Using Microsoft Access

A *view* allows users to see the contents of a database, make any required changes, perform simple sorting, and query the database to find the location of specific information. ***Report generators*** allow users to define formats for reports along with what information they want to see in the report (see Figure 6.9).

Most often, users will create queries to access information in a database. A query is simply a question, such as "How many customers live in California?" ***Query-by-example (QBE)*** tools allow users to graphically design the

answers to specific questions. Figure 6.10 displays Microsoft's Access QBE tool with a query asking which customers have ordered which products. Using a QBE, a user can design this query by asking the DBMS to pull all of the product descriptions for each order for every customer. Figure 6.11 displays the results to this query.

Structured query language (SQL) is a standardized fourth-generation query language found in most DBMSs. SQL performs the same function as QBE, except that the user must type statements instead of pointing, clicking, and dragging in a graphical environment. The basic form of an SQL statement is SELECT……FROM ……WHERE. Figure 6.12 displays the corresponding SQL statement required to perform the query from Figure 6.10. To write queries in SQL, users typically need some formal training and a solid technical background. Fortunately, QBE tools and their drag-and-drop design features allow nonprogrammers to quickly and easily design complex queries without knowing SQL.

FIGURE 6.10

Sample QBE Using Microsoft Access

FIGURE 6.11

Results to the QBE in Figure 6.10

Application Generation and Data Administration Components

For the most part, users will be focusing on data manipulation tools to build views, reports, and queries. IT specialists primarily use the application generation and data administration components. Even though most users will probably not be using these components, it is still important they understand what they are and the functions they support.

The *application generation component* includes tools for creating visually appealing and easy-to-use applications. IT specialists use application generation components to build programs for users to enter and manipulate information with an interface specific to their application needs. Consider a manager involved in the management of an organization's supply chain. Using the application generation component, an IT specialist could build a supply chain management application software tool for the manager that would contain various menu options including add a supplier, order from a supplier, check the status of an order, and so on. This application would be easier and more intuitive for the manager to use on a consistent basis than requiring the manager to use views, report generators, and QBE tools.

FIGURE 6.12

SQL Version of the QBE Query in Figure 6.10

The **_data administration component_** provides tools for managing the overall database environment by providing facilities for backup, recovery, security, and performance. Again, IT specialists directly interact with the data administration component.

Most organizations have several strategic-level IT positions—CIO (chief information officer), CTO (chief technology officer), CSO (chief security officer), CPO (chief privacy officer), and CKO (chief knowledge officer). People in these positions oversee the use of the data administration component. The CPO is responsible for ensuring the ethical and legal use of information. Therefore, he or she would direct the use of the security features of the data administration component, implement policies and procedures concerning who has access to different types of information, and control what functions they can perform on that information (read-only, update, delete). The CTO is responsible for ensuring the efficiency of IT systems and would direct the use of the backup, recovery, and performance features of the data administration component.

INTEGRATING DATA AMONG MULTIPLE DATABASES

Until the 1990s, each department in the United Kingdom's Ministry of Defense (MOD) and army headquarters had its own systems, each system had its own database, and sharing information among the departments was difficult. Manually inputting the same information multiple times into the different systems was also time-consuming and inefficient. In many cases, management could not even compile the information it required to answer questions and make decisions.

The army solved the problem by integrating its systems, or building connections between its many databases. These integrations allow the army's multiple systems to automatically communicate by passing information between the databases, eliminating the need for manual information entry into multiple systems because after entering the information once, the integrations sent the information immediately to all other databases. The integrations not only enable the different departments to share information, but have also dramatically increased the quality of the information. The army can now generate reports detailing its state of readiness and other vital issues, nearly impossible tasks before building the integrations among the separate systems.[14]

An **_integration_** allows separate systems to communicate directly with each other. Similar to the UK's army, an organization will maintain multiple systems, with each system having its own database. Without integrations, an organization will (1) spend considerable time entering the same information in multiple systems and (2) suffer from

the low quality and inconsistency typically embedded in redundant information. While most integrations do not eliminate all redundant information, they can ensure the consistency of it across multiple systems.

An organization can choose from two integration methods. The first is to create forward and backward integrations that link processes (and their underlying databases) in the value chain. A *forward integration* takes information entered into a given system and sends it automatically to all downstream systems and processes. A *backward integration* takes information entered into a given system and sends it automatically to all upstream systems and processes.

Figure 6.13 demonstrates how this method works across the systems or processes of sales, order entry, order fulfillment, and billing. In the order entry system, for example, an employee can update the information for a customer. That information, via the integrations, would be sent upstream to the sales system and downstream to the order fulfillment and billing systems.

FIGURE 6.13

A Forward and Backward Customer Information Integration Example

Ideally, an organization wants to build both forward and backward integrations, which provide the flexibility to create, update, and delete information in any of the systems. However, integrations are expensive and difficult to build and maintain and most organizations build only forward integrations (sales through billing in Figure 6.13). Building only forward integrations implies that a change in the initial system (sales) will result in changes occurring in all the other systems. Integration of information is not possible for any changes occurring outside the initial system, which again can result in inconsistent organizational information. To address this issue, organizations can enforce business rules that all systems, other than the initial system, have read-only access to the integrated information. This will require users to change information in the initial system only, which will always trigger the integration and ensure that organizational information does not get out of sync.

The second integration method builds a central repository for a particular type of information. Figure 6.14 provides an example of customer information integrated using this method across four different systems in an organization. Users can create, update, and delete customer information only in the central customer database. As users perform these tasks on the central customer database, integrations automatically send the new and/or updated customer information to the other systems. The other systems limit users to read-only access of the customer information stored in them. Again, this method does not eliminate redundancy, but it does ensure consistency of the information

among multiple systems.

FIGURE 6.14

Integrating Customer Information among Databases

OPENING CASE QUESTIONS

Searching for Revenue—Google

1. How did the Web site RateMyProfessors.com solve its problem of low-quality information?

2. Review the five common characteristics of high-quality information and rank them in order of importance to Google's business.

3. What would be the ramifications to Google's business if the search information it presented to its customers was of low quality?

4. Describe the different types of database. Why should Google use a relational database?

5. Identify the different types of entities, entity classes, attributes, keys, and relationships that might be stored in Google's AdWords relational database.

section 6.2   DATA WAREHOUSE FUNDAMENTALS

LEARNING OUTCOMES

6.7. Describe the roles and purposes of data warehouses and data marts in an organization.

6.8 Compare the multidimensional nature of data warehouses (and data marts) with two-dimensional nature of databases.

6.9. Identify the importance of ensuring cleanliness of information throughout an organization.

6.10. Explain the relationship between business intelligence and a data warehouse.

ACCESSING ORGANIZATIONAL INFORMATION

Applebee's Neighborhood Grill & Bar posts annual sales in excess of $3.2 billion and is actively using information from its data warehouse to increase sales and cut costs. The company gathers daily information for the previous day's sales into its data warehouse from 1,500 restaurants located in 49 states and seven countries.

Understanding regional preferences, such as patrons in Texas preferring steaks more than patrons in New England, allows the company to meet its corporate strategy of being a neighborhood grill appealing to local tastes. The

company has found tremendous value in its data warehouse by being able to make business decisions about customers' regional needs. The company also uses data warehouse information to perform the following:

- Base its labor budgets on actual number of guests served per hour.

- Develop promotional sale item analysis to help avoid losses from overstocking or understocking inventory.

- Determine theoretical and actual costs of food and the use of ingredients. [15]

HISTORY OF DATA WAREHOUSING

In the 1990s as organizations began to need more timely information about their business, they found that traditional operational information systems were too cumbersome to provide relevant information efficiently and quickly. Operational systems typically include accounting, order entry, customer service, and sales and are not appropriate for business analysis for the following reasons:

- Information from other operational applications is not included.

- Operational systems are not integrated, or not available in one place.

- Operational information is mainly current—does not include the history that is required to make good decisions.

- Operational information frequently has quality issues (errors)— the information needs to be cleansed.

- Without information history, it is difficult to tell how and why things change over time.

- Operational systems are not designed for analysis and decision support.

During the latter half of the 20th century, the numbers and types of databases increased. Many large businesses found themselves with information scattered across multiple platforms and variations of technology, making it almost impossible for any one individual to use information from multiple sources. Completing reporting requests across operational systems could take days or weeks using antiquated reporting tools that were designed more or less to execute the business rather than run the business. From this idea, the data warehouse was born as a place where relevant information could be held for completing strategic reports for management. The key here is the word *strategic* as most executives were less concerned with the day-to-day operations than they were with a more overall look at the model and business functions.

A key idea within data warehousing is to take information from multiple platforms/technologies (as varied as spreadsheets, databases, and word files) and place them in a common location that uses a common querying tool. In this way operational databases could be held on whatever system was most efficient for the operational business, while the reporting/strategic information could be held in a common location using a common language. Data ware-

houses take this a step further by giving the information itself commonality by defining what each term means and keeping it standard. An example of this would be gender, which can be referred to in many ways (Male, Female, M/F, 1/0), but should be standardized on a data warehouse with one common way of referring to each sex (M/F).

This design makes decision support more readily available without affecting day-to-day operations. One aspect of a data warehouse that should be stressed is that it is *not* a location for *all* a business's information, but rather a location for information that is interesting, or information that will assist decision makers in making strategic decisions relative to the organization's overall mission.

Data warehousing is about extending the transformation of data into information. Data warehouses offer strategic level, external, integrated, and historical information so businesses can make projections, identify trends, and decide key business issues. The data warehouse collects and stores integrated sets of historical information from multiple operational systems and feeds them to one or more data marts. It may also provide end-user access to support enterprisewide views of information.

DATA WAREHOUSE FUNDAMENTALS

A *data warehouse* is a logical collection of information—gathered from many different operational databases—that supports business analysis activities and decision-making tasks. The primary purpose of a data warehouse is to aggregate information throughout an organization into a single repository in such a way that employees can make decisions and undertake business analysis activities. Therefore, while databases store the details of all transactions (for instance, the sale of a product) and events (hiring a new employee), data warehouses store that same information but in an aggregated form more suited to supporting decision-making tasks. Aggregation, in this instance, can include totals, counts, averages, and the like.

The data warehouse modeled in Figure 6.15 compiles information from internal databases or transactional/operational databases and external databases through *extraction, transformation, and loading (ETL)*, which is a process that extracts information from internal and external databases, transforms the information using a common set of enterprise definitions, and loads the information into a data warehouse. The data warehouse then sends subsets of the information to data marts. A *data mart* contains a subset of data warehouse information. To distinguish between data warehouses and data marts, think of data warehouses as having a more organizational focus and data marts having focused information subsets particular to the needs of a given business unit such as finance or production and operations.

Lands' End created an organizationwide data warehouse so all its employees could access organizational information. Lands' End soon discovered that there could be "too much of a good thing." Many of its employees would not use the data warehouse because it was simply too big, too complicated, and had too much irrelevant information. Lands' End knew there was valuable information in its data warehouse, and it had to find a way for its employees to easily access the information. Data marts were the perfect solution to the company's information overload problem. Once the employees began using the data marts, they were ecstatic at the wealth of information. Data marts were a huge success for Lands' End.[16]

Multidimensional Analysis

A relational database contains information in a series of two-dimensional tables. In a data warehouse and data mart, information is multidimensional, meaning it contains layers of columns and rows. For this reason, most data warehouses and data marts are *multidimensional databases*. A *dimension* is a particular attribute of information. Each layer in a data warehouse or data mart represents information according to an additional dimension. A ***cube*** is the common term for the representation of multidimensional information. Figure 6.16 displays a cube (cube a) that represents store information (the layers), product information (the rows), and promotion information (the columns).

FIGURE 6.15

Model of a Typical Data Warehouse

FIGURE 6.16

A Cube of Information for Performing a Multidimensional Analysis on Three Stores for Five Products and Four Promotions

Once a cube of information is created, users can begin to slice-and-dice the cube to drill down into the information. The second cube (cube b) in Figure 6.16 displays a slice representing promotion II information for all products at all stores. The third cube (cube c) in Figure 6.16 displays only information for promotion III, product B, at store 2. By using multidimensional analysis, users can analyze information in a number of ways and with any number of dimensions. Users might want to add dimensions of information to a current analysis including product category, region, and even forecasted versus actual weather. The true value of a data warehouse is its ability to provide multidimensional analysis that allows users to gain insights into their information.

Data warehouses and data marts are ideal for off-loading some of the querying against a database. For example, querying a database to obtain an average of sales for product B at store 2 while promotion III is under way might

create a considerable processing burden for a database, essentially slowing down the time it takes another person to enter a new sale into the same database. If an organization performs numerous queries against a database (or multiple databases), aggregating that information into a data warehouse will be beneficial.

Information Cleansing or Scrubbing

Maintaining quality information in a data warehouse or data mart is extremely important. The Data Warehousing Institute estimates that low-quality information costs U.S. businesses $600 billion annually. That number may seem high, but it is not. If an organization is using a data warehouse or data mart to allocate dollars across advertising strategies, low-quality information will definitely have a negative impact on its ability to make the right decision.[17]

To increase the quality of organizational information and thus the effectiveness of decision making, businesses must formulate a strategy to keep information clean. This is the concept of *information cleansing or scrubbing,* a process that weeds out and fixes or discards inconsistent, incorrect, or incomplete information.

FIGURE 6.17

Contact Information in Operational Systems

Specialized software tools exist that use sophisticated algorithms to parse, standardize, correct, match, and consolidate data warehouse information. This is vitally important because data warehouses often contain information from several different databases, some of which can be external to the organization. In a data warehouse, information cleansing occurs first during the ETL process and second on the information once it is in the data warehouse. Companies can choose information cleansing software from several different vendors including Oracle, SAS, Ascential Software, and Group 1 Software. Ideally, scrubbed information is error-free and consistent.

Dr Pepper/Seven Up, Inc., was able to integrate its myriad databases in a data warehouse (and subsequently data marts) in less than two months, giving the company access to consolidated, clean information. Approximately 600 people in the company regularly use the data marts to analyze and track beverage sales across multiple dimensions, including various distribution routes such as bottle/can sales, fountain food-service sales, premier distributor sales, and chain and national accounts. The company is now performing in-depth analysis of up-to-date sales information that is clean and error-free.[18]

Looking at customer information highlights why information cleansing is necessary. Customer information exists in several operational systems. In each system all details of this customer information could change from the customer ID to contact information (see Figure 6.17). Determining which contact information is accurate and correct

for this customer depends on the business process that is being executed.

Figure 6.18 displays a customer name entered differently in multiple operational systems. Information cleansing allows an organization to fix these types of inconsistencies and cleans the information in the data warehouse. Figure 6.19 displays the typical events that occur during information cleansing.

FIGURE 6.18

Standardizing Customer Name from Operational Systems

FIGURE 6.19

Information Cleansing Activities

Achieving perfect information is almost impossible. The more complete and accurate an organization wants its information to be, the more it costs (see Figure 6.20). The trade-off for perfect information lies in accuracy versus completeness. Accurate information means it is correct, while complete information means there are no blanks. A birth date of 2/31/10 is an example of complete but inaccurate information (February 31 does not exist). An address containing Denver, Colorado, without a ZIP code is an example of incomplete information that is accurate. For their information, most organizations determine a percentage high enough to make good decisions at a reasonable cost, such as 85 percent accurate and 65 percent complete.

BUSINESS INTELLIGENCE

Business intelligence (BI) is information that people use to support their decision-making efforts. An early reference to business intelligence occurs in Sun Tzu's book titled *The Art of War*. Sun Tzu claims that to succeed in war, one should have full knowledge of one's own strengths and weaknesses and full knowledge of the enemy's strengths and weaknesses. Lack of either one might result in defeat. A certain school of thought draws parallels between the challenges in business and those of war, specifically:

FIGURE 6.20

Accurate and Complete Information

■ Collecting information.

■ Discerning patterns and meaning in the information.

■ Responding to the resultant information.

Before the start of the information age in the late 20th century, businesses sometimes collected information from nonautomated sources. Businesses then lacked the computing resources to properly analyze the information and

often made commercial decisions based primarily on intuition.

As businesses started automating more and more systems, more and more information became available. However, collection remained a challenge due to a lack of infrastructure for information exchange or to incompatibilities between systems. Reports sometimes took months to generate. Such reports allowed informed long-term strategic decision making. However, short-term tactical decision making continued to rely on intuition.

In modern businesses, increasing standards, automation, and technologies have led to vast amounts of available information. Data warehouse technologies have set up repositories to store this information. Improved ETL have increased the speedy collecting of information. Business intelligence has now become the art of sifting through large amounts of data, extracting information, and turning that information into actionable knowledge.

Enabling Business Intelligence

Competitive organizations accumulate business intelligence to gain sustainable competitive advantage, and they may regard such intelligence as a valuable core competence in some instances. The principal BI enablers are technology, people, and corporate culture.

Technology   Even the smallest company with BI software can do sophisticated analyses today that were unavailable to the largest organizations a generation ago. The largest companies today can create enterprisewide BI systems that compute and monitor metrics on virtually every variable important for managing the company. How is this possible? The answer is technology—the most significant enabler of business intelligence.

People   Understanding the role of people in BI allows organizations to systematically create insight and turn these insights into actions. Organizations can improve their decision making by having the right people making the decisions. This usually means a manager who is in the field and close to the customer rather than an analyst rich in information but poor in experience. In recent years "business intelligence for the masses" has been an important trend, and many organizations have made great strides in providing sophisticated yet simple analytical tools and information to a much larger user population than previously possible.

Culture   A key responsibility of executives is to shape and manage corporate culture. The extent to which the BI attitude flourishes in an organization depends in large part on the organization's culture. Perhaps the most important step an organization can take to encourage BI is to measure the performance of the organization against a set of key indicators. The actions of publishing what the organization thinks are the most important indicators, measuring these indicators, and analyzing the results to guide improvement display a strong commitment to BI throughout the or-

ganization.

DATA MINING

Ruf Strategic Solutions helps organizations employ statistical approaches within a large data warehouse to identify customer segments that display common traits. Marketers can then target these segments with specially designed products and promotions. ***Data mining*** is the process of analyzing data to extract information not offered by the raw data alone. Data mining can also begin at a summary information level (coarse granularity) and progress through increasing levels of detail (drilling down), or the reverse (drilling up).[19]

FIGURE 6.21

Data-Mining Tools Investment Forecast

*In millions of dollars

To perform data mining, users need data-mining tools. ***Data-mining tools*** use a variety of techniques to find patterns and relationships in large volumes of information and infer rules from them that predict future behavior and guide decision making. Data-mining tools for data warehouses and data marts include query tools, reporting tools, multidimensional analysis tools, statistical tools, and intelligent agents.

Sega of America, one of the largest publishers of video games, uses a data warehouse and statistical tools to distribute its advertising budget of more than $50 million a year. With its data warehouse, product line specialists and marketing strategists "drill" into trends of each retail store chain. Their goal is to find buying trends that help them determine which advertising strategies are working best and how to reallocate advertising resources by media, territory, and time. Figure 6.21 displays the average organizational spending on data-mining tools over the next few years.[20]

Data-mining tools apply algorithms to information sets to uncover inherent trends and patterns in the information, which analysts use to develop new business strategies. Analysts use the output from data-mining tools to build models that, when exposed to new information sets, perform a variety of information analysis functions. The analysts provide business solutions by putting together the analytical techniques and the business problem at hand, which often reveals important new correlations, patterns, and trends. The more common forms of data-mining analysis capabilities include cluster analysis, association detection, and statistical analysis.

Cluster Analysis

Cluster analysis is a technique used to divide an information set into mutually exclusive groups such that the members of each group are as close together as possible to one another and the different groups are as far apart as possible. Cluster analysis is frequently used to segment customer information for customer relationship management systems to help organizations identify customers with similar behavioral traits, such as clusters of best customers or one-time customers. Cluster analysis also has the ability to uncover naturally occurring patterns in information.

Such data-mining tools that "understand" human language are finding unexpected applications in medicine. IBM and the Mayo Clinic unearthed hidden patterns in medical records, discovering that infant leukemia has three distinct clusters, each of which probably benefits from tailored treatments. Caroline A. Kovac, general manager of IBM Life Sciences, expects that mining the records of cancer patients for clustering patterns will turn up clues pointing the way to "tremendous strides in curing cancer."[21]

Association Detection

Maytag Corporation, a $4.3 billion home and commercial appliance manufacturer, employs hundreds of R&D engineers, data analysts, quality assurance specialists, and customer service personnel who all work together to ensure that each generation of appliances is better than the previous generation. Maytag is an example of an organization that is gaining business intelligence with association detection data-mining tools.

Association detection reveals the degree to which variables are related and the nature and frequency of these relationships in the information. Maytag's warranty analysis tool, for instance, uses statistical analysis to automatically detect potential issues, provide quick and easy access to reports, and perform multidimensional analysis on all warranty information. This association detection data-mining tool enables Maytag's managers to take proactive measures to control product defects even before most of its customers are aware of the defect. The tool also allows Maytag personnel to devote more time to value-added tasks such as ensuring high quality on all products rather than waiting for or manually analyzing monthly reports.[22]

Many people refer to association detection algorithms as *association rule generators* because they create rules to determine the likelihood of events occurring together at a particular time or following each other in a logical progression. Percentages usually reflect the patterns of these events, for example, "55 percent of the time, events A and B occurred together," or "80 percent of the time that items A and B occurred together, they were followed by item C within three days."

One of the most common forms of association detection analysis is market basket analysis. *Market basket analy-*

sis analyzes such items as Web sites and checkout scanner information to detect customers' buying behavior and predict future behavior by identifying affinities among customers' choices of products and services (see Figure 6.22). Market basket analysis is frequently used to develop marketing campaigns for cross-selling products and services (especially in banking, insurance, and finance) and for inventory control, shelf-product placement, and other retail and marketing applications.

Statistical Analysis

Statistical analysis performs such functions as information correlations, distributions, calculations, and variance analysis, just to name a few. Data-mining tools offer knowledge workers a wide range of powerful statistical capabilities so they can quickly build a variety of statistical models, examine the models' assumptions and validity, and compare and contrast the various models to determine the best one for a particular business issue.

FIGURE 6.22

Market Basket Analysis

Kraft is the producer of instantly recognizable food brands such as Oreo, Ritz, DiGiorno, and Kool-Aid. The company implemented two data-mining applications to assure consistent flavor, color, aroma, texture, and appearance for all of its food lines. One application analyzed product consistency and the other analyzed process variation reduction (PVR).

The product consistency tool SENECA (Sensory and Experimental Collection Application) gathers and analyzes information by assigning precise definitions and numerical scales to such qualities as chewy, sweet, crunchy, and creamy. SENECA then builds models, histories, forecasts, and trends based on consumer testing and evaluates potential product improvements and changes.

The PVR tool ensures consistent flavor, color, aroma, texture, and appearance for every Kraft product since even small changes in the baking process can result in huge disparities in taste. Evaluating every manufacturing procedure, from recipe instructions to cookie dough shapes and sizes, the PVR tool has the potential to generate significant cost savings for each product. Using these types of data-mining techniques for quality control and cluster analysis makes sure that the billions of Kraft products that reach consumers annually will continue to taste great with every bite.[23]

Forecasting is a common form of statistical analysis. Formally defined, *forecasts* are predictions made on the basis of time-series information. ***Time-series information*** is time-stamped information collected at a particular fre-

quency. Examples of time-series information include Web visits per hour, sales per month, and calls per day. Forecasting data-mining tools allow users to manipulate the time series for forecasting activities. When discovering trends and seasonal variations in transactional information, use a time-series forecast to change the transactional information by units of time, such as transforming weekly information into monthly or seasonal information or hourly information into daily information. Companies base production, investment, and staffing decisions on a host of economic and market indicators in this manner. Forecasting models allow organizations to take into account all sorts of variables when making decisions.

Nestlé Italiana is part of the multinational giant Nestlé Group and currently dominates Italy's food industry. The company improved sales forecasting by 25 percent with its data-mining forecasting solution that enables the company's managers to make objective decisions based on facts instead of subjective decisions based on intuition. Determining sales forecasts for seasonal confectionery products is a crucial and challenging task. During Easter, Nestlé Italiana has only four weeks to market, deliver, and sell its seasonal products. The Christmas time frame is a little longer, lasting from six to eight weeks, while other holidays such as Valentine's Day and Mother's Day have shorter time frames of about one week.

The company's data-mining solution gathers, organizes, and analyzes massive volumes of information to produce powerful models that identify trends and predict confectionery sales. The business intelligence created is based on five years of historical information and identifies what is important and what is not important. Nestlé Italiana's sophisticated data-mining tool predicted Mother's Day sales forecasts that were 90 percent accurate. The company has benefited from a 40 percent reduction in inventory and a 50 percent reduction in order changes, all due to its forecasting tool. Determining sales forecasts for seasonal confectionery products is now an area in which Nestlé Italiana excels.[24]

Today, vendors such as Business Objects, Cognos, and SAS offer complete data-mining decision-making solutions. Moving forward, these companies plan to add more predictive analytical capabilities to their products. Their goal is to give companies more "what-if" scenario capabilities based on internal and external information.

OPENING CASE QUESTIONS

Searching for Revenue—Google

6. How could Google use a data warehouse to improve its business operations?

7. Why would Google need to scrub and cleanse the information in its data warehouse?

8. Identify a data mart that Google's marketing and sales department might use to track and analyze its AdWords revenue.

KEY TERMS

CLOSING CASE ONE

Fishing for Quality

The Alaska Department of Fish and Game requires high-quality information to manage the state's natural resources, specifically to increase fishing yields, while ensuring the future of many species. Using fish counts, the department makes daily decisions as to which districts will be open or closed to commercial fishing. If the department receives

low-quality information from fish counts, then either too many fish escape or too many are caught. Allowing too many salmon to swim upstream could deprive fishermen of their livelihoods. Allowing too many to be caught before they swim upstream to spawn could diminish fish populations—yielding devastating effects for years to come.

Because of the incredible size of Alaskan fisheries, the Commercial Fisheries Division's decisions have global impact. Its information is relied upon by individual fishermen who want to know the best places to fish, by corporations around the world that need information on which to base business strategies for seafood processing and marketing, by researchers, and by legislators. With so much at stake, the Division of Commercial Fisheries set out to improve the quality of its information by implementing a system that can gather the information from remote parts of the state and analyze it quickly to determine the daily outcomes.

Originally, the department captured information in spreadsheets that were e-mailed from station to station before being entered into the system. There was no central information set to work from, and more often than not, the information was low quality. Decisions were based on inaccurate and, because of delays in posting, untimely information.

With the implementation of an Oracle database, the department significantly improved the quality and timeliness of its information. Each time a commercial fishing boat within Alaska's jurisdiction unloads at a processing plant, the catch is weighed and details of the catch, such as species caught, weight, and quantity, are recorded on a fish ticket. This information is entered into the new system. To gather fish escapement information from remote areas, field workers positioned in towers scan rivers to visibly count fish. This information is radioed in the next morning.

Information from fish processed the previous day is keyed in by 10:00 a.m., and one hour later, the managers and fisheries across the state have all the information they require to make accurate decisions. They then announce on the radio and on their Web site, which receives more that 3,000 hits on an average day, whether or not fishermen can fish that day.

Fisheries are now managed with timely, centralized, and accurate information. Web pages summarize daily catches for certain areas, like Bristol Bay, whose annual sockeye salmon season, which lasts only a few weeks, is closely monitored by fish processors worldwide. With the enormous quantities of fish caught, salmon fisheries worldwide adjust their production levels based on the results of the annual Bristol Bay sockeye salmon season. This is just one reason why producing fast, quality information is critical to managing Alaska's natural resources.[25]

Questions

1. Explain the importance of high-quality information for the Alaska Department of Fish and Game.

2. Review the five common characteristics of quality information and rank them in order of importance for the Alaska Department of Fish and Game.

3. How could data warehouses and data marts be used to help the Alaska Department of Fish and Game improve the efficiency and effectiveness of its operations?

4. What two data marts might the Alaska Department of Fish and Game want to build to help it analyze its operational performance?

5. Do the managers at the Alaska Department of Fish and Game actually have all of the information they require to make an accurate decision? Explain the statement "it is never possible to have all of the information required to make the best decision possible."

CLOSING CASE TWO

Mining the Data Warehouse

According to a Merrill Lynch survey in 2006, business intelligence software and data-mining tools were at the top of CIOs' technology spending list. Following are a few examples of how companies are using data warehousing and data-mining tools to gain valuable business intelligence.

Ben & Jerry's

These days, when we all scream for ice cream, Ben & Jerry's cuts through the din by using integrated query, reporting, and online analytical processing technology from BI software vendor Business Objects. Through an Oracle database and with BI from Business Objects, Ben & Jerry's tracks the ingredients and life of each pint. If a consumer calls in with a complaint, the consumer affairs staff matches the pint with which supplier's milk, eggs, cherries, or whatever did not meet the organization's near-obsession with quality.

The BI tools let Ben & Jerry's officials access, analyze, and act on customer information collected by the sales, finance, purchasing, and quality-assurance departments. The company can determine what milk customers prefer in the making of the ice cream. The technology helped Ben & Jerry's track more than 12,500 consumer contacts in 2005. The information ranged from comments about the ingredients used in ice cream to queries about social causes supported by the company.

California Pizza Kitchen

California Pizza Kitchen (CPK) is a leading casual dining chain in the premium pizza segment with a recognized consumer brand and an established, loyal customer base. Founded in 1985, there are currently more than 130 full-service restaurants in over 26 states, the District of Columbia, and five foreign countries.

Before implementing its BI tool, Cognos, CPK used spreadsheets to plan and track its financial statements and line items. The finance team had difficulty managing the volumes of information, complex calculations, and constant changes to the spreadsheets. It took several weeks of two people working full time to obtain one version of the financial statements and future forecast. In addition, the team was limited by the software's inability to link cells and calculations across multiple spreadsheets, so updating other areas of corporate records became a time-consuming task. With Cognos, quarterly forecasting cycles have been reduced from eight days to two days. The finance team can now spend more time reviewing the results rather than collecting and entering the information.

Noodles & Company

Noodles & Company has more than 70 restaurants throughout Colorado, Illinois, Maryland, Michigan, Minnesota, Texas, Utah, Virginia, and Wisconsin. The company recently purchased Cognos BI tools to help implement reporting standards and communicate real-time operational information to field management throughout the United States.

Before implementing the first phase of the Cognos solution, IT and finance professionals spent days compiling report requests from numerous departments including sales and marketing, human resources, and real estate. Since completing phase one, operational Cognos reports are being accessed on a daily basis through the Noodles & Company Web site. This provides users with a single, 360-degree view of the business and consistent reporting throughout the enterprise.

Noodles & Company users benefit from the flexible query and reporting capabilities, allowing them to see patterns in the information to leverage new business opportunities. Cognos tools can pull information directly from a broad array of relational, operational, and other systems.[26]

Questions

1. How is Ben & Jerry's using BI tools to remain successful and competitive in a saturated market?

2. Why is information cleansing critical to California Pizza Kitchen's BI tools success?

3. Why is 100 percent accurate and complete information impossible for Noodles & Company to obtain?

4. Describe how each of the companies above is using BI from its data warehouse to gain a competitive advantage.

CLOSING CASE THREE

Harrah's—Gambling Big on Technology

The large investment made by Harrah's Entertainment Inc. in its information technology strategy has been tremendously successful. The results of Harrah's investment include:

- 10 percent annual increase in customer visits.

- 33 percent increase in gross market revenue.

- Yearly profits of over $208 million.

- Highest three-year ROI (return on investment) in the industry.

- A network that links over 42,000 gaming machines in 26 casinos across 12 states.

- Rated number six of the 100 best places to work in IT for 2003 by *ComputerWorld* magazine.

- Recipient of 2000 Leadership in Data Warehousing Award from the Data Warehousing Institute (TDWI), the premier association for data warehousing.

The casino industry is highly competitive (rivalry among existing competitors is fierce). Bill Harrah was a man ahead of his time when he opened his first bingo parlor in 1937 with the commitment of getting to know each one of his customers. In 1984, Phil Satre, president and CEO of Harrah's, continued that commitment to customers. In search of its competitive advantage, Harrah's invested in an enterprisewide technology infrastructure to maintain Bill Harrah's original conviction: "Serve your customers well and they will be loyal."

Harrah's Commitment to Customers

Harrah's recently implemented its patented Total Rewards^{TM} program to help build strong relationships with its customers. The program rewards customers for their loyalty by tracking their gaming habits across its 26 properties and currently maintains information on over 19 million customers, information the company uses to analyze, predict, and maximize each customer's value.

One major reason for the company's success is Harrah's implementation of a service-oriented strategy. Total Rewards allows Harrah's to give every customer the appropriate amount of personal attention, whether it's leaving sweets in the hotel room or offering free meals. Total Rewards works by providing each customer with an account and a corresponding card that the player swipes each time he or she plays a casino game. The program collects information on the amount of time the customers gamble, their total winnings and losses, and their betting strategies.

Customers earn points based on the amount of time they spend gambling, which they can then exchange for comps such as free dinners, hotel rooms, tickets to shows, and even cash.

Total Rewards helps employees determine which level of service to provide each customer. When a customer makes a reservation at Harrah's, the service representative taking the call can view the customer's detailed information including the customer's loyalty level, games typically played, past winnings and losses, and potential net worth. If the service representative notices that the customer has a Diamond loyalty level, the service representative knows that customer should never have to wait in line and always receive free upgrades to the most expensive rooms.

"Almost everything we do in marketing and decision making is influenced by technology," says Gary Loveman, Harrah's chief operating officer. "The prevailing wisdom in this business is that the attractiveness of property drives customers. Our approach is different. We stimulate demand by knowing our customers. For example, if one of our customers always vacations at Harrah's in April, they will receive a promotion in February redeemable for a free weekend in April."

Gaining Business Intelligence with a Data Warehouse

Over 90 million customers visit Harrah's each year, and tracking a customer base larger than the population of Australia is a challenge. To tackle this challenge Harrah's began developing a system called WINet (Winner's Data Network). WINet links all Harrah's properties, allowing the company to collect and share customer information on an enterprisewide basis. WINet collects customer information from all the company transactions, game machines, and hotel management and reservations systems and places the information in a central data warehouse. Information in the data warehouse includes both customer and gaming information recorded in hourly increments. The marketing department uses the data warehouse to analyze customer information for patterns and insights, which allows it to create individualized marketing programs for each customer based on spending habits. Most important, the data warehouse allows the company to make business decisions based on information, not intuition.

Casinos traditionally treat customers as though they belong to a single property, typically the place the customer most frequently visits. Harrah's was the first casino to realize the potential of rewarding customers for visiting more than one property. Today, Harrah's has found that customers who visit more than one of its properties represent the fastest growing revenue segment. In the first two years of the Total Rewards program, the company received a $100 million increase in revenue from customers who gambled at more than one casino.

Harrah's also uses business intelligence to determine gaming machine performance. Using the data warehouse, Harrah's examines the performance and cost structure of each individual gaming machine. The company can quickly identify games that do not deliver optimal operational performance and can make a decision to move or replace the games. The capability to assess the performance of each individual slot machine has provided Harrah's with savings in the tens of millions of dollars. CIO Tim Stanley stated, "As we leverage more data from our data warehouse and increase the use and sophistication of our decision science analytical tools, we expect to have many new ways to improve customer loyalty and satisfaction, drive greater revenues, and decrease our costs as part of our ongoing focus on achieving sustainable profitability and success."

Security and Privacy

Some customers have concerns about Harrah's information collection strategy since they want to keep their gambling information private. The good news for these customers is that casinos are actually required to be more mindful of privacy concerns than most companies. For example, casinos cannot send marketing material to any underage persons. To adhere to strict government regulations, casinos must ensure that the correct information security and restrictions are in place. Many other companies actually make a great deal of money by selling customer information. Harrah's will not be joining in this trend since its customer information is one of its primary competitive advantages.

The Future of Harrah's

Harrah's current systems support approximately $140,000 in revenue per hour (that's almost $25 million weekly). In the future, Harrah's hopes to become device-independent by allowing employees to access the company's data warehouse via PDAs, handheld computers, and even cell phones. "Managing relationships with customers is incredibly important to the health of our business," Stanley says. "We will apply whatever technology we can to do that."[27]

Questions

1. Identify the effects poor information might have on Harrah's service-oriented business strategy.

2. How does Harrah's use database technologies to implement its service-oriented strategy?

3. Harrah's was one of the first casino companies to find value in offering rewards to customers who visit multiple Harrah's locations. Describe the effects on the company if it did not build any integrations among the databases

located at each of its casinos. How could Harrah's use distributed databases or a data warehouse to synchronize customer information?

5. Estimate the potential impact to Harrah's business if there is a security breach in its customer information.

6. Identify three different types of data marts Harrah's might want to build to help it analyze its operational performance.

7. What might occur if Harrah's fails to clean or scrub its information before loading it into its data warehouse?

8. Describe cluster analysis, association detection, and statistical analysis and explain how Harrah's could use each one to gain insights into its business.

MAKING BUSINESS DECISIONS

1. **Explaining relational databases**

   You have been hired by Vision, a start-up recreational equipment company. Your manager, Holly Henningson, is unfamiliar with databases and their associated business value. Holly has asked you to create a report detailing the basics of databases. Holly would also like you to provide a detailed explanation of relational databases along with their associated business advantages.

2. **Entities and attributes**

   Martex Inc. is a manufacturer of athletic equipment, and its primary lines of business

   include running, tennis, golf, swimming, basketball, and aerobics equipment. Martex currently supplies four primary vendors including Sam's Sports, Total Effort, The Underline, and Maximum Workout. Martex wants to build a database to help it organize its products. In a group, identify the different types of entities, entity classes, attributes, keys and relationships Martex will want to consider when designing its database.

3. **Integrating information**

   You are currently working for the Public Transportation Department of Chatfield. The department controls all forms of public transportation including buses, subways, and trains. Each department has about 300 employees and maintains its own accounting, inventory, purchasing, and human resource systems. Generating reports across departments is a difficult task and usually involves gathering and correlating the information from the many different systems. It typically takes about two weeks to generate the quarterly balance sheets and profit and loss statements. Your team has been asked to compile a report recommending what the Public Transportation Department of Chatfield can do to alleviate its information and system issues. Be sure that your report addresses the

various reasons departmental reports are presently difficult to obtain as well as how you plan to solve this problem.

4. **Information timeliness**

Information timeliness is a major consideration for all organizations. Organizations need to decide the frequency of backups and the frequency of updates to a data warehouse. In a team, describe the timeliness requirements for backups and updates to a data warehouse for each of the following:

- Weather tracking systems.

- Car dealership inventories.

- Vehicle tire sales forecasts.

- Interest rates.

- Restaurant inventories.

- Grocery store inventories.

5. **Improving information quality**

HangUps Corporation designs and distributes closet organization structures. The company operates five systems—order entry, sales, inventory management, shipping, and billing. The company has severe information quality issues including missing, inaccurate, redundant, and incomplete information. The company wants to implement a data warehouse containing information from the five different systems to help maintain a single customer view, drive business decisions, and perform multidimensional analysis. Identify how the organization can improve its information quality when it begins designing and building its data warehouse.

6. **Determining information quality issues**

Real People is a magazine geared toward working individuals that provides articles and advice on everything from car maintenance to family planning. Real People is currently experiencing problems with its magazine distribution list. Over 30 percent of the magazines mailed are returned because of incorrect address information, and each month it receives numerous calls from angry customers complaining that they have not yet received their magazines. Below is a sample of Real People's customer information. Create a report detailing all of the issues with the information, potential causes of the information issues, and solutions the company can follow to correct the situation.

ID	First Name	Middle Initial	Last Name	Street	City	State	Zip Code
433	M	J	Jones	13 Denver	Denver	CO	87654
434	Margaret	J	Jones	13 First Ave.	Denver	CO	87654
434	Brian	F	Hoover	Lake Ave.	Columbus	OH	87654
435	Nick	H	Schweitzer	65 Apple Lane	San Francisco	OH	65664
436	Richard	A		567 55th St.	New York	CA	98763
437	Alana	B	Smith	121 Tenny Dr.	Buffalo	NY	142234
438	Trevor	D	Darrian	90 Fresrdestil	Dallas	TX	74532

7. **Mining the data warehouse**

Alana Smith is a senior buyer for a large wholesaler that sells different types of arts and crafts to greeting card stores such as Hallmark. Alana's latest marketing strategy is to send all of her customers a new line of handmade picture frames from Russia. All of Alana's information supports her decision for the new line. Her analysis predicts that the frames should sell an average of 10 to 15 per store, per day. Alana is excited about the new line and is positive it will be a success.

One month later Alana learns that the frames are selling 50 percent below expectations and averaging between five to eight frames sold daily in each store. Alana decides to access the company's data warehouse information to determine why sales are below expectations. Identify several different dimensions of information that Alana will want to analyze to help her decide what is causing the problems with the picture frame sales.

8. **Cleansing information**

You are working for BI, a start-up business intelligence consulting company. You have a new client that is interested in hiring BI to clean up its information. To determine how good your work is, the client would like your analysis of the following spreadsheet.

CUST ID	First Name	Last Name	Address	City	State	ZIP	Phone	Last Order Date
233620	Christopher	Lee	12421 W Olympic Blvd	Los Angeles	CA	75080-1100	(972)680-7848	4/18/2002
233621	Bruce	Brandwen	268 W 44th St	New York	PA	10036-3906	(212)471-6077	5/3/2002
233622	Glr	Johnson	4100 E Dry Creek Rd	Littleton	CO	80122-3729	(303)712-5461	5/6/2002
233623	Dave	Owens	466 Commerce Rd	Staunton	VA	24401-4432	(540)851-0362	3/19/2002
233624	John	Coulbourn	124 Action St	Maynard	MA	1754	(978)987-0100	4/24/2002
233629	Dan	Gagliardo	2875 Union Rd	Cheektowaga	NY	14227-1461	(716)558-8191	5/4/2002
23362	Damanceee	Allen	1633 Broadway	New York	NY	10019-6708	(212)708-1576	
233630	Michael	Peretz	235 E 45th St	New York	NY	10017-3305	(212)210-1340	4/30/2002
233631	Jody	Veeder	440 Science Dr	Madison	WI	53711-1064	(608)238-9690 X227	3/27/2002
233632	Michael	Kehrer	3015 SSE Loop	Tyler	TX	75701	(903)579	4/28/

			323				-3229	
233633	Erin	Yoon	3500 Carillon Pt	Kirkland	WA	98033-7354	(425)897-7221	3/25/2002
233634	Madeline	Shefferly	4100 E Dry Creek Rd	Littleton	CO	80122-3729	(303)486-3949	3/33/2002
233635	Steven	Conduit	1332 Enterprise Dr	West Chester	PA	19380-5970	(610)692-5900	4/27/2002
233636	Joseph	Kovach	1332 Enterprise Dr	West Chester	PA	19380-5970	(610)692-5900	4/28/2002
233637	Richard	Jordan	1700 N	Philadelphia	PA	19131-4728	(215)581-6770	3/19/2002
233638	Scott	Miko-lajczyk	1655 Crofton Blvd	Crofton	MD	21114-1387	(410)729-8155	4/28/2002
233639	Susan	Shragg	1875 Century Park E	Los Angeles	CA	90067-2501	(310)785-0511	4/29/2002
233640	Rob	Ponto	29777 Tele-graph Rd	Southfield	MI	48034-1303	(810)204-4724	5/5/2002
233642	Lauren	Butler	1211 Avenue Of The Americas	New York	NY	10036-8701	(212)852-7494	4/22/2002
233643	Christopher	Lee	12421 W Olym-pic Blvd	Los Angeles	CA	90064-1022	(310)689-2577	3/25/2002

233644	Michelle	Decker	6922 Hollywood Blvd	Hollywood	CA	90028-6117	(323)817-4655	5/8/2002
233647	Natalia	Galeano	1211 Avenue Of The Americas	New York	NY	10036-8701	(646)728-6911	4/23/2002
233648	Bobbie	Orchard	4201 Congress St	Charlotte	NC	28209-4617	(704)557-2444	5/11/2002
233650	Ben	Konfino	1111 Stewart Ave	Bethpage	NY	11714-3533	(516)803-1406	3/19/2002
233651	Lenee	Santana	1050 Techwood Dr NW	Atlanta	GA	30318-KKRR	(404)885-2000	3/22/2002
233652	Lauren	Monks	7700 Wisconsin Ave	Bethesda	MD	20814-3578	(301)771-4772	3/19/2005
233653	Mark	Woolley	10950 Washington Blvd	Culver City	CA	90232-4026	(310)202-2900	4/20/2002
233654	Stan	Matthews	1235 W St NE	Washington	DC	20018-1107	(202)608-2000	3/25/2002

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CHAPTER 7

Networks, Telecommunications, and Wireless Computing

opening case study

The Digital Hospital

For years, health care has missed the huge benefits that information technology has bestowed upon the rest of the economy. During the 1990s, productivity in health care services declined, according to estimates from Economy.com Inc. That is a huge underachievement in a decade of strong gains from the overall economy. This is

beginning to change as hospitals, along with insurers and the government, are stepping up their IT investments. Hospitals are finally discarding their clumsy, sluggish first-generation networks and are beginning to install laptops, software, and Internet technologies.

Hackensack University Medical Center in Hackensack, New Jersey, is one of the nation's most aggressive technology adopters, investing $72 million in IT projects since 1998. The IT investments are paying off for the hospital with patient mortality rates decreasing—down 16 percent in four years—and quality of care and productivity increasing. The most important piece of Hackensack's digital initiatives is the networked software that acts as the hospital's central nervous system. Using wireless laptops, nurses log in to the system to record patient information and progress. Doctors tap into the network via wireless devices to order prescriptions and lab tests. Everything is linked, from the automated pharmacy to the X-ray lab, eliminating the need for faxes, phone calls, and other administrative hassles. Figure 7.1 displays the hospital's IT systems development projects.

Health care spending accounts for 15 percent of the U.S. economy, or $1.7 trillion. It is so gargantuan that any efficiency gains will affect the overall economy. Dr. David Brailer, President George W. Bush's point man on health IT initiatives, predicts that IT investments will lead to $140 billion a year in cost savings by 2014. More important than saving money is saving lives. Poor information kills some 7,000 Americans each year just by missing drug-interaction problems, according to the National Academy of Sciences Institute of Medicine. Hospital errors result in 100,000 deaths annually. Early evidence indicates that proper technology can reduce this amount. Hospitals using electronic prescription systems have seen 80 percent fewer prescription errors.[1]

FIGURE 7.1

Hospital IT Systems Development Projects

Hackensack University Medical Center IT's Projects
■ Patients can use 37-inch plasma TVs in their rooms to surf the Internet for information about their medical conditions. They can also take interactive classes about their condition and find out how to take care of themselves after discharge.
■ From virtually anywhere in the world, physicians can make their hospital rounds with the help of a life-size robot, Mr. Rounder. Using laptops with joysticks and

Web links, doctors drive the robot around the hospital to confer by remote video with patients and other doctors. When a blizzard prevented Dr. Garth Ballantynes from reaching the hospital, he used Mr. Rounder to make his rounds from his home 82 miles away.

■ Pocket-sized PCs that hook wirelessly into the hospital's network allow doctors the freedom to place pharmacy orders and pull up medical records from anywhere in the hospital.

■ Nurses use wireless laptops to record patients' vitals signs, symptoms and medications. Doctors can sign into the same central system from the laptops to order prescriptions and lab tests and read their patient's progress.

■ The hospital's internal Web site stores all of its medical images. Doctors can view crystal-clear digital versions of their patients' X-rays, MRIs, and CT scans from any computer in or out of the hospital.

■ A giant robot named Robbie, equipped with arms, reads prescriptions entered into the hospital's computer system and then grabs medications stored on pegs on the wall. The pills are then dropped into containers that are marked for each patient.

INTRODUCTION

Telecommunication systems enable the transmission of data over public or private networks. A *network* is a communications, data exchange, and resource-sharing system created by linking two or more computers and establishing standards, or protocols, so that they can work together. Telecommunication systems and networks are traditionally complicated and historically inefficient. However, businesses can benefit from today's modern network infrastructures that provide reliable global reach to employees and customers. Businesses around the world are moving to network infrastructure solutions that allow greater choice in how they go to market—solutions with global reach. These alternatives include wireless, voice-over internet protocol (VoIP), and radio-frequency identification (RFID). This chapter takes a detailed look at key telecommunication, network, and wireless

technologies being integrated into businesses around the world.

SECTION 7.1 **NETWORKS AND TELECOMMUNCIATIONS**

LEARNING OUTCOMES

7.1. Compare LANs, WANs, and MANs.

7.2. List and describe the four components that differentiate networks.

7.3. Compare the two types of network architectures.

7.4. Explain topology and the different types found in networks.

7.5. Describe TCP/IP along with its primary purpose.

7.6. Identify the different media types found in networks.

NETWORK BASICS

Music is the hottest new product line at ubiquitous coffee retailer Starbucks. In Starbucks stores, customers can burn CDs while sipping coffee, thanks to the company's own online music library and increasingly sophisticated in-store network. Networks range from small two-computer networks to the biggest network of all, the Internet. A network provides two principle benefits: the ability to communicate and the ability to share. E-mail is the most popular form of network communication. Figure 7.2 highlights the three different types of networks, and Figure 7.3 graphically depicts each network type.

Networks are differentiated by the following:

■ Architecture—peer-to-peer, client/server.

■ Topology—bus, star, ring, hybrid, wireless.

■ Protocols—Ethernet, Transmission Control Protocol/Internet Protocol (TCP/IP).

■ Media—coaxial, twisted-pair, fiber-optic.

ARCHITECTURE

The two primary types of network architectures are: peer-to-peer networks and client/server networks.

Peer-to-Peer Networks

A *peer-to-peer (P2P) network* is any network without a central file server and in which all computers in the network have access to the public files located on all other workstations, as illustrated in Figure 7.4. Each networked computer can allow other computers to access its files and use connected printers while it is in use as a workstation

without the aid of a server.

FIGURE 7.2

Network Types

Network Types	
Local area network (LAN)	A computer network that uses cables or radio signals to link two or more computers within a geographically limited area, generally one building or a group of buildings. A networked office building, school, or home usually contains a single LAN. The linked computers are called workstations.
Wide area network (WAN)	A computer network that provides data communication services for business in geographically dispersed areas (such as across a country or around the world). The Internet is a WAN that spans the world.
Metropolitan area network (MAN)	A computer network that provides connectivity in a geographic area or region larger than that covered by a local area network, but smaller than the area covered by a wide area network. A college or business may have a MAN that joins the different LANs across its campus.

FIGURE 7.3

LAN, WAN, and MAN

FIGURE 7.4

Peer-to-Peer (P2P) Networks

While Napster may be the most widely known example of a P2P implementation, it may also be one of the most narrowly focused since the Napster model takes advantage of only one of the many capabilities of P2P computing: file sharing. The technology has far broader capabilities, including the sharing of processing, memory, and storage, and the supporting of collaboration among vast numbers of distributed computers. Peer-to-peer computing enables immediate interaction among people and computer systems.

Client/Server Networks

A *client* is a computer that is designed to request information from a server. A *server* is a computer that is dedicated to providing information in response to external requests. A *client/server network* is a model for applications in which the bulk of the back-end processing, such as performing a physical search of a database, takes place on a server, while the front-end processing, which involves communicating with the users, is handled by the clients (see Figure 7.5). A *network operating system (NOS)* is the operating system that runs a network, steering information between computers and managing security and users. The client/server model has become one of the central ideas of network computing. Most business applications written today use the client/server model.

A fundamental part of client/server architecture is packet-switching. *Packet-switching* occurs when the sending computer divides a message into a number of efficiently sized units called packets, each of which contains the address of the destination computer. Each packet is sent on the network and intercepted by routers. A *router* is an intelligent connecting device that examines each packet of data it receives and then decides which way to send it onward toward its destination. The packets arrive at their intended destination, although some may have actually traveled by different physical paths, and the receiving computer assembles the packets and delivers the message to the appropriate application. The number of network routers being installed by businesses worldwide is booming (see Figure 7.6).

Eva Chen, CIO at Trend Micro, built a router that helps prevent worms and viruses from entering networks. The problem with most existing antivirus software is that it starts working after a destructive sequence of code is identified, meaning it starts doing its job only after the virus or worm has been unleashed inside the network. Chen's router, the Network VirusWall, sits on the edge of a corporate network, scanning data packets and detaining those that might contain viruses or worms. Any suspicious packets are compared with up-to-the-second information from Trend Micro's virus-tracking command center. Viruses and worms are then deleted and refused entry to the network, allowing the company to perform a preemptive strike.[2]

FIGURE 7.5

Client/Server Network

FIGURE 7.6

Worldwide Router Growth

TOPOLOGY

Networks are assembled according to certain rules. Cables, for example, have to be a certain length; each cable strand can support only a certain amount of network traffic. A ***network topology*** refers to the geometric arrangement of the actual physical organization of the computers (and other network devices) in a network. Topologies vary depending on cost and functionality. Figure 7.7 highlights the five common topologies used in networks, and Figure 7.8 displays each topology.

FIGURE 7.7

Five Network Topologies

Network Topologies	
Bus	All devices are connected to a central cable, called the bus or backbone. Bus networks are relatively inexpensive and easy to install for small networks.
Star	All devices are connected to a central device, called a hub. Star networks are relatively easy to install and manage, but bottlenecks can occur because all data must pass through the hub.
Ring	All devices are connected to one another in the shape of a closed loop, so that each device is connected directly to two other devices, one on either side of it. Ring topologies are relatively expensive and difficult to install, but they offer high bandwidth and can span large distances.
Hybrid	Groups of star-configured workstations are connected to a linear bus backbone cable, combining the characteristics of the bus and star

	topologies.
Wireless	Devices are connected by a receiver/transmitter to a special network interface card that transmits signals between a computer and a server, all within an acceptable transmission range.

FIGURE 7.8

Network Topologies

PROTOCOLS

A *protocol* is a standard that specifies the format of data as well as the rules to be followed during transmission. Simply put, for one computer (or computer program) to talk to another computer (or computer program) they must both be talking the same language, and this language is called a protocol.

A protocol is based on an agreed-upon and established standard, and this way all manufacturers of hardware and software that are using the protocol do so in a similar fashion to allow for interoperability. *Interoperability* is the capability of two or more computer systems to share data and resources, even though they are made by different manufacturers. The most popular network protocols used are Ethernet and Transmission Control Protocol/Internet Protocol (TCP/IP).

Ethernet

Ethernet is a physical and data layer technology for LAN networking (see Figure 7.9). Ethernet is the most widely installed LAN access method, originally developed by Xerox and then developed further by Xerox, Digital Equipment Corporation, and Intel. When it first began to be widely deployed in the 1980s, Ethernet supported a maximum theoretical data transfer rate of 10 megabits per second (Mbps). More recently, Fast Ethernet has extended traditional Ethernet technology to 100 Mbps peak, and Gigabit Ethernet technology extends performance up to 1,000 Mbps.

Ethernet has survived as the major LAN technology—it is currently used for approximately 85 percent of the world's LAN-connected PCs and workstations—because its protocol has the following characteristics:

- Is easy to understand, implement, manage, and maintain.
- Allows low-cost network implementations.

- Provides extensive flexibility for network installation.

- Guarantees successful interconnection and operation of standards-compliant products, regardless of manufacturer.

FIGURE 7.9

Ethernet Protocol

FIGURE 7.10

TCP/IP Four-Layer Reference Model

Transmission Control Protocol/Internet Protocol

The most common telecommunication protocol is Transmission Control Protocol/Internet Protocol (TCP/IP), which was originally developed by the Department of Defense to connect a system of computer networks that became known as the Internet. *Transmission Control Protocol/Internet Protocol (TCP/IP)* provides the technical foundation for the public Internet as well as for large numbers of private networks. The key achievement of TCP/IP is its flexibility with respect to lower-level protocols. TCP/IP uses a special transmission method that maximizes data transfer and automatically adjusts to slower devices and other delays encountered on a network. Although more than 100 protocols make up the entire TCP/IP protocol suite, the two most important of these are TCP and IP. **TCP** provides transport functions, ensuring, among other things, that the amount of data received is the same as the amount transmitted. **IP** provides the addressing and routing mechanism that acts as a postmaster. Figure 7.10 displays TCP/IP's four-layer reference model:

- Application layer—serves as the window for users and application processes to access network services.

- Transport layer—handles end-to-end packet transportation.

- Internet layer—formats the data into packets, adds a header containing the packet sequence and the address of the receiving device, and specifies the services required from the network.

- Network interface layer—places data packets on the network for transmission.

The TCP/IP suite of applications includes five protocols—file transfer, simple mail transfer, telnet, hypertext transfer, and simple network management (see Figure 7.11).

Another communication reference model is the seven-layer Open System Interconnection (OSI) reference model. Figure 7.12 show the OSI model's seven layers.

The lower layers (1 to 3) represent local communications, while the upper layers (4 to 7) represent end-to-end

communications. Each layer contributes protocol functions that are necessary to establish and maintain the error-free exchange of information between network users.

For many years, users thought the OSI model would replace TCP/IP as the preferred technique for connecting multivendor networks. But the slow pace of OSI standards as well as the expense of implementing complex OSI software and having products certified for OSI interoperability will preclude this from happening.

FIGURE 7.11

TCP/IP Applications

TCP/IP Applications	
File Transfer Protocol (FTP)	Allows files containing text, programs, graphics, numerical data, and so on to be downloaded off or uploaded onto a network.
Simple Mail Transfer Protocol (SMTP)	TCP/IP's own messaging system for e-mail.
Telnet Protocol	Provides terminal emulation that allows a personal computer or workstation to act as a terminal, or access device, for a server.
Hypertext Transfer Protocol (HTTP)	Allows Web browsers and servers to send and receive Web pages.
Simple Network Management Protocol (SNMP)	Allows the management of networked nodes to be managed from a single point.

FIGURE 7.12

Open System Interconnection Model

OSI Model

7. Application
6. Presentation
5. Session
4. Transport
3. Network
2. Data Link
1. Physical

Voice over IP (VoIP)   Originally, phone calls made over the Internet had a reputation of offering poor call quality, lame user interfaces, and low call-completion rates. With new and improved technology and IT infrastructures, Internet phone calls now offer similar quality to traditional telephone calls. Today, many consumers are making phone calls over the Internet by using voice over Internet protocol (VoIP). *Voice over IP (VoIP)* uses TCP/IP technology to transmit voice calls over long-distance telephone lines. In fact, VoIP transmits over 10 percent of all phone calls in the United States and this number is growing exponentially.

VoIP and e-mail work in similar ways. The user sends a call over the Internet in packets of audio data tagged with the same destination. VoIP reassembles the packets once they arrive at their final destination.

Numerous vendors offer VoIP services; however, the service works differently depending on the vendor's IT infrastructure. The start-up Skype pairs P2P (peer-to-peer) technology with a PC's sound card to create a voice service, which the client can use to call other Skype users. Unfortunately, the user can talk only to other Skype users. Vonage lets the user place calls to any person who has a mobile or landline (regular telephone) number. Vonage sends the call over a cable via a digital-to-analog converter. A few providers even offer an adapter for a traditional handset that plugs into a broadband modem. All of these vendors are providing VoIP, but the service and its features can vary significantly.

The telecom industry expects great benefits from combining VoIP with emerging standards that allow for easier development, interoperability among systems, and application integration. This is a big change for an industry that relies on proprietary systems to keep customers paying for upgrades and new features. The VoIP and open-standards

combo should produce more choices, lower prices, and new applications.

FIGURE 7.13

Typical Telephone Start-up Costs for a 1,000-Person Office

Telephone System	Typical Telecom System	IP-Based System	Peerio
Requirements	■ Phones ■ Private branch exchange (PBX) ■ Voice switches ■ Dedicated voice network	■ Phones ■ IP PBX ■ Existing data network ■ Gateway	■ Phones ■ PC ■ Existing data network ■ Gateway
Total Cost	$1,000,000	$500,000	$100,000

Writing voice applications may never be as common as writing computer applications. But the spread of VoIP will make it easier to manage applications and add capabilities to the voice feature set. In a decade, the telecom network "will be like getting water out of the tap," predicts Stef van Aarle, vice president of marketing and strategy at Lucent Worldwide Services. "The only time you think of it will be when it doesn't work. And software is the glue that makes it all easy to use."

Upstarts like Vonage and Skype are bringing VoIP to the masses. But a bigger opportunity lurks in the $2 billion corporate phone market. New York-based start-up Popular Telephony is offering a new VoIP technology that dramatically cuts corporate phone costs while letting workers take their office phones anywhere. Its secret: peer-to-peer software called Peerio that is built right into handsets.

CEO Dmitry Goroshevsky founded the company three years ago to bring PC economics to the office telephone system. A traditional workplace setup requires a dedicated voice network and a private branch exchange, or PBX, to connect to the outside world and can cost up to $1 million (see Figure 7.13). Cisco has been selling an IP PBX, which uses a data network for voice calls. But Popular Telephony eliminates pricey hardware. Using an ordinary PC, network administrators assign an extension to each phone. Peerio-enabled handsets, which will be sold through

discount retailers and office supply stores, plug directly into a company's data network, where calls are routed through a gateway and then out. Since Peerio is based on Internet protocol, office workers can use their phones wherever there is a broadband connection. And though companies pay the usual rates to call conventional landline and mobile phone numbers, ringing up other Peerio and VoIP users will not cost a dime. A handful of licensees are manufacturing the phones.[3]

MEDIA

Network transmission media refers to the various types of media used to carry the signal between computers. When information is sent across the network, it is converted into electrical signals. These signals are generated as electromagnetic waves (analog signaling) or as a sequence of voltage pulses (digital signaling). To be sent from one location to another, a signal must travel along a physical path. The physical path that is used to carry a signal between a signal transmitter and a signal receiver is called the transmission media. The two types of transmission media are wire (guided) and wireless (unguided).

Wire Media

Wire media are transmission material manufactured so that signals will be confined to a narrow path and will behave predictably. The three most commonly used types of guided media are (see Figure 7.14):

■ Twisted-pair wiring

■ Coaxial cable

■ Fiber-optic cable

FIGURE 7.14

Twisted-Pair, Coaxial Cable, and Fiber-Optic

Twisted-Pair Wiring   *Twisted-pair wiring* refers to a type of cable composed of four (or more) copper wires twisted around each other within a plastic sheath. The wires are twisted to reduce outside electrical interference. Twisted-pair cables come in shielded and unshielded varieties. Shielded cables have a metal shield encasing the wires that acts as a ground for electromagnetic interference. Unshielded twisted-pair (UTP) is the most popular and is generally the best option for LAN networks. The quality of UTP may vary from telephone-grade wire to high-speed cable. The cable has four pairs of wires inside the jacket. Each pair is twisted with a different number of twists per inch to help eliminate interference from adjacent pairs and other electrical devices. The RJ-45 connectors on

twisted-pair cables resemble large telephone connectors.

Coaxial Cable *Coaxial cable* is cable that can carry a wide range of frequencies with low signal loss. It consists of a metallic shield with a single wire placed along the center of a shield and isolated from the shield by an insulator. This type of cable is referred to as coaxial because it contains one copper wire (or physical data channel) that carries the signal and is surrounded by another concentric physical channel consisting of a wire mesh. The outer channel serves as a ground for electrical interference. Because of this grounding feature, several coaxial cables can be placed within a single conduit or sheath without significant loss of data integrity.

Fiber-Optic Cable *Fiber optic* (or *optical fiber*) refers to the technology associated with the transmission of information as light impulses along a glass wire or fiber. The 10Base-FL and 100Base-FX optical fiber cable are the same types of cable used by most telephone companies for long-distance service. Optical fiber cable can transmit data over long distances with little loss in data integrity. In addition, because data are transferred as a pulse of light, optical fiber is not subject to interference. The light pulses travel through a glass wire or fiber encased in an insulating sheath.

Optical fiber's increased maximum effective distance comes at a price. Optical fiber is more fragile than wire, difficult to split, and labor intensive to install. For these reasons, optical fiber is used primarily to transmit data over extended distances where the hardware required to relay the data signal on less expensive media would exceed the cost of optical fiber installation. It is also used where large amounts of data need to be transmitted on a regular basis.

Wireless Media

Wireless media are natural parts of the Earth's environment that can be used as physical paths to carry electrical signals. The atmosphere and outer space are examples of wireless media that are commonly used to carry signals. These media can carry such electromagnetic signals as microwave, infrared light waves, and radio waves.

Network signals are transmitted through all media as a type of waveform. When transmitted through wire and cable, the signal is an electrical waveform. When transmitted through fiber-optic cable, the signal is a light wave, either visible or infrared light. When transmitted through the Earth's atmosphere, the signal can take the form of waves in the radio spectrum, including microwaves, infrared, or visible light.

Recent advances in radio hardware technology have produced significant advancements in wireless networking devices: the cellular telephone, wireless modems, and wireless LANs. These devices use technology that in some cases has been around for decades but until recently was too impractical or expensive for widespread use.

E-BUSINESS NETWORKS

To set up an e-business even a decade ago would have required an individual organization to assume the burden of developing the entire network infrastructure. Today, industry-leading companies have developed Internet-based products and services to handle many aspects of customer and supplier interactions. "In today's retail market, you cannot be a credible national retailer without having a robust Web site," says Dennis Bowman, senior vice president and CIO of Circuit City, who adds that customers now expect seamless retailing just as they expect stores that are clean and well stocked. For this reason, retailers are working furiously to integrate their e-business sites with their inventory and point-of-sale (POS) systems so that they can accept in-store returns of merchandise bought online and allow customers to buy on the Web and pick up in the store.

Some companies, such as Best Buy, Circuit City, Office Depot, and Sears, already have their physical and online stores integrated. These companies have been the fast movers because they already had an area in their stores for merchandise pickup (usually for big, bulky items like TVs and appliances), and because long before the Web they had systems and processes in place that facilitated the transfer of a sale from one store to another. Other retailers are partially integrated. Ann Taylor, Bed Bath & Beyond, Eddie Bauer, Linens 'n' Things, Macy's, REI, Target, The Gap, and others let customers return but not pick up online-ordered merchandise in stores. To take on the challenge of e-business integration, an organization needs a secure and reliable IT infrastructure for mission-critical systems (see Figure 7.15)

A ***virtual private network (VPN)*** is a way to use the public telecommunication infrastructure (e.g., Internet) to provide secure access to an organization's network (see Figure 7.16). A ***valued-added network (VAN)*** is a private network, provided by a third party, for exchanging information through a high-capacity connection. To date, organizations engaging in e-business have relied largely on VPNs, VANs, and other dedicated links handling electronic data interchange transactions. These traditional solutions are still deployed in the market and for many companies will likely hold a strategic role for years to come. However, conventional technologies present significant challenges:

FIGURE 7.15

E-Business Network Characteristics

E-Business Network Characteristics
■ Provide for the transparent exchange of information with suppliers, trading partners, and customers.
■ Reliably and securely exchange information internally and externally via the Internet or other networks.
■ Allow end-to-end integration and provide message delivery across multiple systems, in particular, databases, clients, and servers.
■ Respond to high demands with scalable processing power and networking capacity.
■ Serve as the integrator and transaction framework for both digital businesses and traditional brick-and-mortar businesses that want to leverage the Internet for any type of business.

FIGURE 7.16

Virtual Private Network Example

■ By handling only limited kinds of business information, these contribute little to a reporting structure intended to provide a comprehensive view of business operations.

■ They offer little support for the real-time business process integration that will be essential in the digital marketplace.

■ Relatively expensive and complex to implement, conventional technologies make it difficult to expand or change networks in response to market shifts.

OPENING CASE QUESTIONS

The Digital Hospital

1. Explain how hospitals are using telecommunication and network technologies to improve their operations.

2. Describe the two different types of network architectures and identify which one Hackensack University Medical Center is using.

3. Explain TCP/IP and the role it plays in Hackensack University Medical Center's IT projects.

4. Identify a new telecommunication or network product that Hackensack University Medical Center could use to improve its operations

section 7.2 WIRELESS COMPUTING

LEARNING OUTCOMES

7.7. Explain how a wireless device helps an organization conduct business anytime, anywhere, anyplace.

7.8. Describe RFID and how it can be used to help make a supply chain more effective.

7.9. List and discuss the key factors inspiring the growth of wireless technologies.

7.10. Describe the business benefits associated with enterprise mobility.

WIRELESS FIDELITY

An hour's drive west of Toronto sits a 120,000-square-foot building where Mike Lazaridis's 20-year dream is coming to life. Seven 125-foot-long assembly lines are stamping out wallet-size BlackBerrys—the wireless handhelds now in the hands of more than 1.3 million users worldwide—at a rate of about 230 an hour. Lazaridis, the co-CEO of Research in Motion (RIM), gave the go-ahead earlier this year to ratchet up plant production from five days a week to seven. Orders are surging, and so RIM's BlackBerry-making machine does not sleep.[4]

Wireless fidelity (wi-fi) is a means of linking computers using infrared or radio signals. Wi-fi is a type of Ethernet, which makes the wireless network a straightforward extension of the wired network. Wireless users can run the same network applications they use on an Ethernet LAN. Wireless communication can be installed using the existing network infrastructure with minimal retraining or system changes. Laptop users can roam throughout their locales while remaining in contact with the network via strategically placed access points that are plugged into the wired network. One of the biggest benefits of using wireless communications is its ability to deliver real-time information.

The Value of Timely Information

The need for timely information can change for each business decision. Some decisions require weekly or monthly information while other decisions require daily information. Timeliness is an aspect of information that depends on the situation. In some industries, information that is a few days or weeks old can be relevant, while in other

industries information that is a few minutes old can be almost worthless. Some organizations, such as 911 centers, stock traders, and banks, require consolidated, up-to-the-second information, 24 hours a day, seven days a week. Other organizations, such as insurance and construction companies, require only daily or even weekly information.

Real-time information means immediate, up-to-date information. *Real-time systems* provide real-time information in response to query requests. Many organizations use real-time systems to exploit key corporate transactional information. In a survey of 700 IT executives by Evans Data Corp., 48 percent of respondents said they were already analyzing information in or near real-time, and another 25 percent reported plans to add real-time systems.[5]

Real-time systems provide valuable information for supporting corporate strategies such as customer relationship management. Bell Mobility Inc., Canada's largest wireless carrier, staffs over 550 customer service representatives and uses E.piphany Inc.'s Real-Time tool to make the right customer offers at the right time without having to rely on guesswork. The results from the first month after implementation of the Real-Time tool are displayed in Figure 7.17.[6]

The growing demand for real-time information stems from organizations' need to make faster and more effective decisions, keep smaller inventories, operate more efficiently, and track performance more carefully. Nevertheless, timeliness is relative. Organizations need fresh, timely information to make good decisions. Information also needs to be timely in the sense that it meets employees' needs, but no more. If employees can absorb information only on an hourly or daily basis, there is no need to gather real-time information in smaller increments.

FIGURE 7.17

Results from Bell Mobility's Real-Time Tool

Bell Mobility's Real-Time Tool Results
■ 18 percent increase in sales per hour
■ 16 percent increase in total inbound marketing revenue
■ 75 percent decrease in total time to create and deploy a new marketing campaign

MBIA Insurance Corp. uses overnight updates to feed its real-time systems. Employees use this information to make daily risk decisions for mortgages, insurance policies, and other services. The company found that overnight

updates were sufficient, as long as users could gain immediate access to the information they needed to make business decisions during the day.[7]

Most people request real-time information without understanding one of the biggest pitfalls associated with real-time information—continual change. Imagine the following scenario: Three managers meet at the end of the day to discuss a business problem. Each manager has gathered information at different times during the day to create a picture of the situation. Each manager's picture may be different because of this time discrepancy. Their views on the business problem may not match since the information they are basing their analysis on is continually changing. This approach may not speed up decision making, and may actually slow it down.

Organizations must evaluate the timeliness of the information required for each business decision. Organizations do not want to find themselves using real-time information to make a bad decision faster.

BUSINESS DRIVERS FOR WIRELESS TECHNOLOGIES

United Parcel Service and FedEx have been using wireless technologies for years, making it possible for information about dispatching and deliveries to travel between couriers and central stations. FedEx's famous tracking system, which can find a package's location from its tracking number, uses a wireless courier-management system.

The terms *mobile* and *wireless* are often used synonymously, but actually denote two different technologies. *Mobile technology* means the technology can travel with the user, but it is not necessarily in real-time; users can download software, e-mail messages, and Web pages onto their personal digital assistant (PDA), laptop, or other mobile device for portable reading or reference. Information collected while on the road can be synchronized with a PC or corporate server.

Wireless technology, on the other hand, gives users a live (Internet) connection via satellite or radio transmitters. International Data Corporation forecasts that by 2010 nearly two-thirds of handheld devices will include integrated wireless networking. For instance, newly announced PDAs integrate phones, text messaging, Web browsers, and organizers. Figure 7.18 displays the factors inspiring the growth of wireless technologies.[8]

State government agencies, such as transportation departments, use wireless devices to collect field information, tracking inventory, reporting times, monitoring logistics, and completing forms—all from a mobile environment. The transportation industry is using wireless devices to help determine current locations and alternate driving routes.

FIGURE 7.18

Wireless Drivers

Drivers of Wireless Technology Growth	
Universal access to information and applications	People are mobile and have more access to information than ever before, but they still need to get to the point where they can access all information anytime, anywhere, anyplace.
The automation of business processes	Wireless technologies have the ability to centralize critical information and eliminate redundant processes.
User convenience, timeliness, and ability to conduct business 24x7x365	People delayed in airports no longer have to feel cut off from the world or their office. Through wireless tools and wireless solutions such as a BlackBerry RIM device, they can access their information anytime, anywhere, anyplace.

FIGURE 7.19

U. S. Wireless Device Users

Number of U.S. Users	Wireless Device Technology
Less than 15,000	Smart phones
4,000,000	Web-enabled (WAP) phones
65,000,000	Digital cell phones

FIGURE 7.20

Wireless Technologies Changing Business

Wireless Devices Changing Business

■ **Wireless local area network (wLAN):** uses radio waves rather than wires to transmit information across a local area network.

■ **Cellular phones and pagers:** provide connectivity for portable and mobile applications, both personal and business.

■ **Cordless computer peripherals:** connect wirelessly to a computer, such as a cordless mouse, keyboard, and printer.

■ **Satellite television:** allows viewers in almost any location to select from hundreds of channels.

■ **WiMax wireless broadband:** enables wireless networks to extend as far as 30 miles and transfer information, voice, and video at faster speeds than cable. It is perfect for Internet service providers (ISPs) that want to expand into sparsely populated areas, where the cost of bringing in cable wiring or DSL is too high.

■ **Security sensor:** alerts customers to break-ins and errant pop flies. Its dual sensors record vibration and acoustic disturbances—a shattered window—to help avoid false alarms.

Wireless technology is rapidly evolving and is playing an increasing role in the lives of people throughout the world. The final key factor driving the increased use of wireless devices is the sheer number of U.S. wireless device users (see Figure 7.19). With such a large market, businesses simply must embrace wireless technologies or be left behind.

Wireless technologies are transforming how we live, work, and play. Handheld devices continue to offer additional functionality, and cellular networks are advancing rapidly in their increased speed and throughput abilities. These enabling technologies fuel widespread adoption and creation of new and innovative ways to perform business. The big changes that will re-create workplaces, industries, and organizations are coming from wireless technologies. Figure 7.20 displays a few common examples of wireless technologies that are changing our world.

ADVANTAGES OF ENTERPRISE MOBILITY

Organizations have realized that while the value of electronic corporate information can be nearly limitless, it is worth nothing if employees cannot access it. Work does not always get done at an office desk, and the ability to connect remote workers to the information they require to perform their job provides benefits to an organization.

Wireless laptops facilitate emergency room registration so doctors can start working on the patients as soon as the medics wheel them into the hospital. High-end tractors equipped with wireless sensors help farmers monitor everything from the weather to the amount of seed released. Tractors that break down automatically e-mail the service department with the information for the repair. Roaming ticket sellers armed with wi-fi-enabled devices and belt-mounted printers shorten the wait at the front gate at theme parks such as Universal Studios. Figure 7.21 lists the wireless technologies influencing business mobility, which are described in detail in the following section.

FIGURE 7.21

Wireless Technologies Influencing Business Mobility

Wireless Technlogies Influencing Business Mobility
■ **Bluetooth:** creating a niche market for traditionally cabled devices.
■ **Radio frequency identification tags (RFID):** possessing the potential to reinvent the supply chain. Wal-Mart's suppliers must now use the tags for pallets and cases of merchandise.
■ **Satellite:** changing the way television and radio stations operate. Plus, global positioning systems (GPS) allow drivers of cars and trucks, captains of boats and ships, backpackers, hikers, skiers, and pilots of aircraft to ascertain their location anywhere on Earth.

FIGURE 7.22

Bluetooth Virtual Keyboard

Beams of light, which detect the user's movements, make up this virtual keyboard. It can be integrated into mobile phones, laptops, tablet PCs, or even sterile medical environments.

Bluetooth

One challenge to wireless devices is their size. Everyone wants their mobile devices to be small, but many people also curse the tiny, cryptic keyboards that manufacturers squeeze into smart phones and PDAs. The laws of physics have proved a significant barrier to solving this problem, but VKB Inc.'s Bluetooth Virtual Keyboard offers a possible solution (see Figure 7.22). VKB's technology uses a red laser to

illuminate a virtual keyboard outline on any surface. Despite its futuristic look, the laser is really just a visual guide to where users put their fingers. A separate illumination and sensor module invisibly tracks when and where each finger touches the surface, translating that into keystrokes or other commands.[9]

Bluetooth is an omnidirectional wireless technology that provides limited-range voice and data transmission over the unlicensed 2.4-GHz frequency band, allowing connections with a wide variety of fixed and portable devices that normally would have to be cabled together. Bluetooth headsets allow users to cut the cord and make calls even while their cell phones are tucked away in a briefcase. Wireless Bluetooth printing allows users of a Bluetooth-enabled PDA or laptop to connect to any printer via a Bluetooth adapter connected to the printer's parallel port.

Since Bluetooth's development in 1994 by the Swedish telecommunications company Ericsson, more than 1,800 companies worldwide have signed on to build products to the wireless specification and promote the new technology in the marketplace. The engineers at Ericsson code-named the new wireless technology Bluetooth to honor a 10th-century Viking King, Harald Bluetooth, who is credited with uniting Denmark and bringing order to the country.

Bluetooth capability is enabled in a device by means of an embedded Bluetooth chip and supporting software. Although Bluetooth is slower than competing wireless LAN technologies, the Bluetooth chip enables Bluetooth networking to be built into a wide range of devices—even small devices such as cellular phones and PDAs. Bluetooth's maximum range is 30 feet, limiting it to gadget-to-gadget communication. There are more than 1,000 Bluetooth products on the market, with 10 more introduced each week.

Radio Frequency Identification (RFID)

Radio frequency identification (RFID) technologies use active or passive tags in the form of chips or smart labels that can store unique identifiers and relay this information to electronic readers. At Starbucks, good service is nearly as important as good coffee to customer loyalty. But when a delivery person comes knocking on the back door to drop off muffins, it means employees may need to leave their countertop posts, jeopardizing customer service. To help solve the problem, Starbucks is considering using radio frequency identification technology as part of a

proposed plan to let its 40,000 suppliers drop off pastries, milk, coffee beans, and other supplies at night, after stores have closed. This solution solves one problem while causing another: How does Starbucks ensure that delivery people do not walk out with as much stuff as they dropped off?

To solve the problem, the company will distribute to its suppliers cards with RFID chips that give delivery people access to stores at night, while recording who is coming and going. *RFID tags* contain a microchip and an antenna, and typically work by transmitting a serial number via radio waves to an electronic reader, which confirms the identity of a person or object bearing the tag.

RFID technology is finally coming into its own. Wal-Mart, the nation's largest retailer, asked suppliers to attach RFID tags to product shipment pallets by the end of 2005 to automate tracking. However, drawbacks to RFID technology, including its high cost and concerns about consumer privacy, must be overcome before it finds widespread use. Figure 7.23 displays the three components of RFID, and Figure 7.24 shows how tracking with RFID tags is expected to work in the supply chain.

As many as 10,000 radio frequency identification tags are taking to the skies, affixed to everything from airline seats to brakes, as part of the Airbus A380, a 550-seat jet scheduled to begin service in 2006. The tags will contain serial numbers, codes, and maintenance history that should make it easier to track, fix, and replace parts. Not to be outdone, Boeing is using tags on many of the parts in its upcoming 7E7 Dreamliner, a smaller commercial jet that is set to fly in 2007 and be in service by 2008.

FIGURE 7.23

Three RFID Components

FIGURE 7.24

RFID in the Supply Chain.

These initiatives are not the first use of RFID in the airline industry, but they represent aggressive plans to further leverage the real-time and detail capabilities of RFID. In 2000, Boeing began equipping all its tools and toolboxes with RFID tags. Similarly, Airbus began tagging its ground equipment and tools soon after.[10]

Integrating RFID and Software Integrating RFID with enterprise software is expected to change the way companies manage maintenance, combat theft, and even augment Sarbanes-Oxley Act IT initiatives. Oracle and SAP have begun adding RFID capability to their enterprise application suites. Oracle's RFID and Sensor-Based Services analyze and respond to data from RFID so the information can be integrated with Oracle's applications.

RFID tags are evolving, too, and the advances will provide more granular information to enterprise software. Today's tags can store an electronic product code. In time, tags could hold more information, making them portable mini-databases.

The possibilities of RFID are endless. Delta Air Lines recently completed a pilot project that used baggage tags incorporating RFID chips instead of the standard bar codes. With RFID readers installed at counters and key sorting locations, not a single duffel was misplaced. The system worked so well that Delta intends to roll it out nationwide in 2007.[11]

Satellite

Microwave transmitters, especially satellite systems, are commonly used to transmit network signals over great distances. A microwave transmitter uses the atmosphere (or outer space) as the transmission medium to send the signal to a microwave receiver. The microwave receiver then either relays the signal to another microwave transmitter or translates the signal to some other form, such as digital impulses, as illustrated in Figure 7.25. Originally, this technology was used almost exclusively for satellite and long-range communication. Recently, however, developments in cellular technology allow complete wireless access to networks, intranets, and the Internet via microwave transmission.

FIGURE 7.25

Satellite Microwave Link

XM Satellite Radio made a tech-savvy decision when it decided to develop the chipsets for XM's radios in-house rather than outsourcing the job. The move allowed the XM service to launch faster and better, giving the company a lead over its archrival, Sirius Satellite Radio. Both companies are growing quickly. Satellite radio is big business, and Sirius recently signed a contract with Howard Stern for $500 million over five years.[12]

Global Positioning System (GPS)

The Department of Defense installed more than 30 satellites in space over the equator to help the military identify positions on Earth. In 1993, the Defense Department made this global positioning technology available for commercial use to anyone who has a GPS. A *global positioning system (GPS)* is a device that determines current latitude, longitude, speed, and direction of movement. GPS devices have special microprocessors that analyze satellite signals. Sirf Technology specializes in building GPS microprocessors and charges about $13 per device to

put its GPS chipset in phones, electronics, and car navigation systems. Since going public in 2004, Sirf Technology has seen revenue climb 60 percent to $117 million with net profits of $30.7 million. With new federal regulation forcing wireless operators to include GPS in their phones and networking equipment, chip demand is sure to explode.[13]

The market for GPS services has grown to over $5 billion with expectations for demand to double over the next few years. Tracking, navigation, and hardware promise to be multibillion-dollar markets by 2010. UPS plans to outfit 75,000 drivers with GPS-enabled handhelds to help them reach destinations more efficiently. The handhelds will also trigger e-mail alerts if a company vehicle speeds or ventures into unauthorized areas. Steve Wozniak, Apple co-founder, started a company in 2002 named Wheels of Zeus that combines GPS data with local wireless networking. The technology helps parents keep tabs on their children or can alert IT managers when company-owned computers leave the premises. Zingo, in the United Kingdom, uses GPS-enabled cars and text messaging to help subscribers hail cabs.

A *geographic information system (GIS)* is designed to work with information that can be shown on a map. Companies that deal in transportation use GISs combined with database and GPS technology. Airlines and shipping companies can plot routes with up-to-the-second information on the location of all their transport vehicles. Hospitals can keep track of where personnel are located by using a GIS and sensors in the ceiling that pick up the transmission of badges worn by hospital staff.

Automobiles have GPSs linked to maps that display in a screen on the dashboard driving directions and exact location of the vehicle. GM offers the OnStar system, which sends a continuous stream of information to the OnStar center about the car's exact location. The new OnStar Vehicle Diagnostics automatically performs hundreds of diagnostic checks on four key operating systems—the engine/transmission, antilock brakes, air bags, and OnStar systems—in GM vehicles. The vehicle is programmed to send the results via e-mail to the owner each month. The unique e-mail report also provides maintenance reminders based on the current odometer reading, remaining engine oil life, and other relevant ownership information.[14]

Some cell phone providers equip their phones with GPS chips that enable users to be located to within a geographical location about the size of a tennis court. This allows emergency services such as 911 to find a cell phone user. Marketers are monitoring cell phone GPS development, hoping to be able to call potential customers when they are walking past their store to let them know of a special sale.[15]

THE FUTURE OF WIRELESS

One of the strangest Internet innovations in recent history was Microsoft's toilet project. It was a widely reported weird-news item in the spring of 2003, later revealed to be a hoax, and even later to be confirmed by Microsoft as an actual project, albeit a defunct one. The gist of the story was that Microsoft U.K. wanted to create a portable toilet, the iLoo, with a built-in high-speed Internet connection, wireless keyboard, and height-adjustable plasma monitor—a contraption, so they said, that would appeal to the British market.

Now it seems that the restroom and the Internet are converging yet again. A *hotspot* consists of one or more access points positioned on a ceiling, wall, or other strategic spot in a public place to provide maximum wireless coverage for a specific area. Users in range of the hotspot can then access the Internet from their wireless device. The latest front in the wireless hotspot movement is the interstate rest area. "I know it sounds strange at first, but when you think about it, rest areas are a great fit for wi-fi," said Mark Wheeler, CEO of I Spot Networks, a wireless Internet service provider. Wheeler noted that highway travelers often actively seek out an Internet connection because the Internet has become so integral to 21st century life.

Working in conjunction with state transportation departments, I Spot Networks is rolling out hotspots along interstates in Iowa, Missouri, and Nebraska. The company also targets more conventional hotspot locations, such as hotels and coffee shops, but it believes that heavily traveled interstate corridors are an overlooked hotspot opportunity.

Analysts predict that more than 120 million U.S. consumers will use wireless devices for Internet access by 2008. Overall, there will be more than 1.4 billion wireless subscribers by the end of 2010, with about 500 million of those using wireless Internet access. The growth of the wireless market will drive the development of new wireless technology, which in turn will create a larger market for Bluetooth connectivity, which allows wireless handheld devices, personal computers, and laptops to work together. Analysts expect Bluetooth shipments to rise from fewer than 1 million in 2001 to 3 billion in 2010.[16]

Gartner Inc. predicts that the future will belong to "The Real-Time Enterprise," the organization that thrives in uncertain times because it can detect sooner and respond faster. Wireless technologies clearly play a major role in increasing an organization's agility.

Wireless access to corporate e-mail systems, often the primary catalyst to an organization's first significant venture into wireless technology, has become the focus of much attention. E-mail is the foremost communication

system in most organizations, surpassing voice mail in importance and interest (see Figure 7.26).[17]

FIGURE 7.26

Current Mobile Phone Users' Applications Interest

Application	Western Europe	Eastern Europe	United States
On 6-point interest scale, 6 = high interest, and 1 = low interest:			
E-mail	4.5	4.7	4.3
Payment authorization/enablement	3.4	3.8	3.0
Banking/trading online	3.5	3.4	3.2
Shopping/reservations	3.0	3.1	2.9
Interactive games	2.0	2.2	2.4

Organizations are fast approaching the point where they will have the technical wireless infrastructure to support an always-on connection that will let users roam seamlessly from Starbucks, to a customer site, to conference rooms, and even to a comfortable chair in front of the TV at home.

OPENING CASE QUESTIONS

The Digital Hospital

5. Why is real-time information important to hospitals?

6. How is Hackensack University Medical Center using wireless technology to improve its operations?

7. Identify three wireless technologies that are changing the way businesses operate and explain how hospitals can use these technologies to improve their operations.

KEY TERMS

Bluetooth 230

Client 217

Client/server network 217

CLOSING CASE ONE

Tracking Students

The grade school that required students to wear radio frequency identification (RFID) tags that can track their every move has ended the program because the company that developed the technology pulled out. "I'm disappointed; that's about all I can say at this point," stated Earnie Graham, the superintendent and principal of Brittan Elementary School. "I think I let my staff down."

The tags, developed by Sutter-based technology company InCom Corp., were introduced in January 2005. Each student was required to wear identification cards around their necks with their picture, name, grade, and a wireless transmitter that beamed their ID number to a teacher's handheld computer when the child passed under an antenna posted above a classroom door. The system was imposed, without parental input, by the school as a way to simplify attendance-taking and potentially reduce vandalism and improve student safety. "I'm not convinced it's over," parent Dawn Cantrall, who filed a complaint with the American Civil Liberties Union, told the (Marysville) *Appeal-Democrat.* "I'm happy for now that kids are not being tagged, but I'm still fighting to keep it out of our school system. It has to stop here."

While many parents criticized the tags for violating privacy and possibly endangering children's health, some parents supported the plan. "Technology scares some people; it's a fear of the unknown," parent Mary Brower told the newspaper. "Any kind of new technology has the potential for misuse, but I feel confident the school is not going to misuse it."[18]

Questions

1. Explain the fundamentals of RFID and how it is being used to track students.

2. Describe the ethical dilemmas involved with tracking students with RFID.

3. Identify two types of wireless business opportunities schools could take advantage of to help improve operations.

4. How could RFID help schools deal with potential security issues?

5. Develop a Bluetooth, GPS, or satellite product that schools could use to improve operations.

6. Determine a way that schools could use RFID tags without violating privacy rights.

CLOSING CASE TWO

UPS versus FedEx: Head-to-Head on Wireless

Federal Express and United Parcel Service are always seeking a competitive edge over one another. And as the two companies are encroaching on each other's primary businesses (UPS on overnight delivery and FedEx on ground delivery), they are concurrently stepping up their wireless deployments as well. The reason: operational efficiency— a critical business requirement aimed at shaving costs, increasing reach, and doing more with the same resources.

Their approaches to deploying wireless technologies over the past 15 years have been markedly different; FedEx has led the way with cutting-edge applications, while UPS has been slower and more deliberate. FedEx deploys new technologies as soon as it can justify the cost and demonstrate improved efficiencies and customer benefit. UPS refreshes its technology base roughly every five to seven years, when it rolls out a unified system in stages that it synchronizes with the life span of the older system. But the goal is the same for both companies: to use next-generation wireless technologies to better manage the delivery of millions of packages that flow through dozens of sorting facilities every day.

The two companies are exploiting new wireless technologies in their differing attempts at aiding the two main components of their operations: pickup/delivery and packaging/sorting. Both are also looking ahead to potential applications of radio frequency identification and GPS wireless technologies.

	UPS	FedEx
Main hub:	Louisville, Kentucky	Memphis, Tennessee
Total packages handled each day:	13.6 million	5 million
Number of air deliveries daily:	2 million	3.1 million
Wireless devices in field:	90,000	80,000

Wireless devices in sorting facilities:	55,000	70,000
Wireless access points:	9,000	5,000

Seeking New Benefits from Wireless

In addition to their major package-scanning retooling efforts, FedEx and UPS continue to investigate what business benefits they might gain from other wireless technologies. Two have gained particular attention: RFID tags, which could replace bar code scanners, and GPS, which can precisely locate field units.

As UPS and FedEx are showing, wireless technology provides the medium through which dynamic exchange happens. Interconnectedness allows drivers to talk, computers to interact, and businesses to work together. Whether it is wireless routing or fueling of trucks, it is all happening dynamically. Although few companies have the scale of UPS and FedEx, they can adopt many of the wireless technologies scaled to their size, and use devices and network components that fit their operations.[19]

Questions

1. Explain the fundamentals of wireless fidelity.

2. Describe the differences between UPS and FedEx's use of wi-fi.

3. Identify two types of wireless business opportunities the companies could use to gain a competitive advantage.

4. How could RFID help the companies deal with potential security issues?

5. Develop a Bluetooth, GPS, or satellite product that the parcel delivery business could use to improve efficiencies.

CLOSING CASE THREE

Watching Where You Step—Prada

Prada estimates its sales per year at $22 million. The luxury retailer recently spent millions on IT for its futuristic "epicenter" store, but the flashy technology turned into a high-priced hassle. The company will need to generate annual sales of $75 million by 2007 to turn a profit on its new high-tech investment.

When Prada opened its $40 million Manhattan flagship, architect Rem Koolhaas promised a radically new shopping experience. He kept the promise—though not quite according to plan. Customers were soon enduring hordes of tourists, neglected technology, and the occasional thrill of being stuck in experimental dressing rooms. A

few of the problems associated with the store:

- Fickle fitting rooms. Doors that turn from clear to opaque confuse shoppers and frequently fail to open on cue.

- Failed RFID. Touchscreens meant to spring to life when items are placed in the RFID "closets" are often just blank.

- Pointless personal digital assistants (PDA). Salesclerks let the handheld devices gather dust and instead check the stockroom for inventory.

- Neglected network. A lag between sales and inventory systems makes the wireless network nearly irrelevant.

This was not exactly the vision for the high-end boutique when it debuted its new high-tech store. Instead, the 22,000-square-foot SoHo shop was to be the first of four "epicenter" stores around the world that would combine cutting-edge architecture and 21st century technology to revolutionize the luxury shopping experience. Prada poured roughly 25 percent of the store's budget into IT, including a wireless network to link every item to an Oracle inventory database in real time using radio frequency identification (RFID) tags on the clothes. The staff would roam the floor armed with PDAs to check whether items were in stock, and customers could do the same through touchscreens in the dressing rooms.

However, most of the flashy technology today sits idle, abandoned by employees who never quite embraced the technology. On top of that, many gadgets, such as automated dressing-room doors and touchscreens, are either malfunctioning or ignored. Packed with experimental technology, the clear-glass dressing-room doors were designed to open and close automatically at the tap of a foot pedal, then turn opaque when a second pedal sent an electric current through the glass. Inside, an RFID-aware rack would recognize a customer's selections and display them on a touchscreen linked to the inventory system.

In practice, the process was hardly that smooth. Many shoppers never quite understood the pedals and disrobed in full view, thinking the door had turned opaque. That is no longer a problem, since the staff usually leaves the glass opaque, but often the doors are stuck. Some of the chambers are open only to VIP customers during peak traffic times.

With the smart closets and handhelds out of commission, the wireless network in the store is nearly irrelevant, despite its considerable expense. As Prada's debt reportedly climbed to around $1 billion in late 2001, the company shelved plans for the fourth epicenter store, in San Francisco. A second store opened in Tokyo in 2003 to great acclaim, albeit with different architects in a different market. Though that store incorporates similar cutting-edge

concepts, architect Jacques Herzog emphasized that avant-garde retail plays well only in Japan. "This building is clearly a building for Tokyo," he told *The New York Times*. "It couldn't be somewhere else."

The multimillion-dollar technology is starting to look more like technology for technology's sake than an enhancement of the shopping experience, and the store's failings have prompted Prada to reevaluate its epicenter strategy.[20]

Questions

1. Would you consider Prada's use of technology cutting-edge? Why or why not?

2. Prada's attempt to use RFID to check inventory in real time failed because of the staff's refusal to use the system. What could Prada have done to make the implementation of RFID successful?

3. Identify an additional strategic use of RFID for Prada's high-tech store.

4. What should Prada do differently when designing its next store to ensure its success?

5. Identify a new use of wireless technology for Prada's next store.

MAKING BUSINESS DECISIONS

1. Wireless fitness

Sandifer's Fitness Club is located in beautiful South Carolina. Rosie Sandifer has owned and operated the club for 20 years. The club has three outdoor pools, two indoor pools, 10 racquetball courts, 10 tennis courts, an indoor and outdoor track, along with a four-story exercise equipment and massage therapy building. Rosie has hired you as a summer intern specializing in information technology. The extent of Rosie's current technology includes a few PCs in the accounting department and two PCs with Internet access for the rest of the staff. Your first assignment is to create a report detailing networks and wireless technologies. The report should explain how the club could gain a business advantage by implementing a wireless network. If Rosie likes your report, she will hire you as the full-time employee in charge of information technology. Be sure to include all of the different uses for wireless devices the club could implement to improve its operations.

2. Secure access

Organizations that have traditionally maintained private, closed systems have begun to look at the potential of the Internet as a ready-made network resource. The Internet is inexpensive and globally pervasive: Every phone jack is a potential connection. However, the Internet lacks security. What obstacles must organizations overcome to

allow secure network connections?

3. **Integrating wireless worlds**

Tele-Messaging is a next-generation integrated Internet and wireless messaging service that offers services to ISPs, telecommunications carriers, and portal companies. According to Tele-Messaging's research, the primary reason that 90 percent of the people go online is for e-mail. However, the challenge for Tele-Messaging is how to successfully attract and retain these customers. Customers want more than free calls to sign up and are looking for a host of additional services with whiz-bang technology to give them the information they want, when they want it, anywhere, and in the method most convenient to them. List the infrastructures needed to deliver the technology with the necessary reliability, availability, and scalability demanded by Tele-Messaging's customers.

4. **Communicating with instant messages**

You are working for a new start-up magazine, *Jabber Inc.,* developed for information professionals that provides articles, product reviews, case studies, evaluation, and informed opinions. You need to collaborate on news items and projects, and exchange data with a variety of colleagues inside and outside the *Jabber Inc.* walls. You know that many companies are now embracing the instant messaging technology. Prepare a brief report for the CIO that will explain the reasons IM is not just a teenage fad, but also a valuable communications tool that is central to everyday business.

5. **Rolling out with networks**

As organizations begin to realize the benefits of adding a wireless component to their network, they must understand how to leverage this emerging technology. Wireless solutions have come to the forefront for many organizations with the rollout of more standard, cost-effective, and secure wireless protocols. With wireless networks, increased business agility may be realized by continuous data access and synchronization. However, with the increased flexibility come many challenges. Develop a report detailing the benefits an organization could obtain by implementing wireless technology. Also, include the challenges that a wireless network presents along with recommendations for any solutions.

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Supply Chain Management

CHAPTER OUTLINE

SECTION 8.1

Supply Chain Fundamentals

Basics of Supply Chain

Information Technology's Role in the Supply Chain

Supply Chain Management Success Factors

SCM Success Stories

SECTION 8.2

Applying a Supply Chain Design

Using Information Technology to Drive the Supply Chain

Facilities Driver

Inventory Driver

Transportation Driver

Information Driver

Applying a Supply Chain Design

Future Supply Chain Trends

opening case study

Dell's Famous Supply Chain

Speed is at the core of everything Dell does. Dell assembles nearly 80,000 computers every 24 hours. The computer manufacturer has done more than any other company when it comes to tweaking its supply chain. About 10 years ago, Dell carried 20 to 25 days of inventory in a sprawling network of warehouses. Today, Dell does not have a single warehouse and carries only two hours of inventory in its factories and a maximum of

just 72 hours across its entire operation. Dell's vast, global supply chain is in constant overdrive, making the company one of the fastest, most hyperefficient organizations on the planet.

Disaster Occurs

In 2002, a 10-day labor lockout shut down 29 West Coast ports extending from Los Angeles to Seattle, idled 10,000 union dockworkers, and blocked hundreds of cargo ships from unloading raw materials and finished goods. The port closings paralyzed global supply chains and ultimately cost U.S. consumers and businesses billions of dollars.

Analysts expected Dell, with its just-in-time manufacturing model, would be especially hard hit when parts failed to reach its two U.S.-based factories. Without warehouses filled with motherboards and hard drives the world's largest PC maker would simply find itself with nothing to sell within a matter of days. Dell knew all too well that its ultra-lean, high-speed business model left it vulnerable to just such a situation. "When a labor problem or an earthquake or a SARS epidemic breaks out, we've got to react quicker than anyone else," said Dick Hunter, the company's supply chain expert. "There's no other choice. We know these things are going to happen; we must move fast to fix them. We just can't tolerate any kind of delay."

Fortunately, the same culture of speed and flexibility that seems to put Dell at the mercy of disruptions also helps it deal with them. Dell was in constant, round-the-clock communication with its parts makers in Taiwan, China, and Malaysia and its U.S.-based shipping partners. Hunter dispatched a "tiger team" of 10 logistics specialists to Long Beach, California, and other ports; they worked with Dell's carrying and freight-forwarding networks to assemble a contingency plan.

When the tiger team confirmed that the closings were all but certain, Dell moved into high gear. It chartered 18 airplanes (747s) from UPS, Northwest Airlines, and China Airlines. A 747 holds the equivalent of 10 tractor-trailers—enough parts to manufacture 10,000 PCs. The bidding for the planes grew fierce, running as high as $1 million for a one-way flight from Asia to the West Coast. Dell got in the bidding early and kept costs around $500,000 per plane. Dell also worked with its Asia-based suppliers to ensure that its parts were always at the Shanghai and Taipei airports in time for its returning charters to land, reload, refuel, and take off. The company was consistently able to get its planes to the United States and back within 33 hours, which kept

its costs down and its supply chain moving.

Meanwhile, Dell had people on the ground in every major harbor. In Asia, the freight specialists saw to it that Dell's parts were the last to be loaded onto each cargo ship so they would be unloaded first when the ship hit the West Coast. The biggest test came when the ports reopened and companies scrambled to sort through the backed-up mess of thousands of containers. Hunter's tiger team had anticipated this logistical nightmare. Even though Dell had PC components in hundreds of containers on 50 ships, it knew the exact moment when each component cycled through the harbor, and it was among the first to unload its parts and speed them to its factories in Austin, Texas, and Nashville, Tennessee. In the end, Dell did the impossible: It survived a 10-day supply chain blackout with roughly 72 hours of inventory without delaying a single customer order.

The aftershocks of the port closings reverberated for weeks. Many companies began to question the wisdom of running so lean in an uncertain world, and demand for warehouse space soared as they piled up buffer inventory to insure against labor unrest, natural disasters, and terrorist attacks.

Building a "Dell-like" Supply Chain

Dell's ultimate competitive weapon is speed, which gives the technical giant's bottom line a real boost. Figure 8.1 displays a five-point plan for building a fast supply chain—direct from Dell.[1]

FIGURE 8.1

How to Build a Dell-Like Supply Chain

Dell-Like Supply Chain Plan
1.   **The supply chain starts with the customer.** By cutting out retailers and selling directly to its customers, Dell is in a far better position to forecast real customer demand.
2.   **Replace inventory with information.** To operate with close to zero inventory, Dell communicates constantly with its suppliers. It sends out status updates three times a day from its assembly plants; every week it updates its quarterly demand forecasts. By making communication its highest priority, Dell

ensures the lowest possible inventory.

3.   **If you cannot measure it, you cannot manage it.** Dell knows what works because it measures everything from days in inventory to the time it takes to build a PC. As Dell slashed those numbers, it got more efficient.

4.   **Complexity slows you down.** Dell cut the number of its core PC suppliers from several hundred to about 25. It standardized critical PC components, which streamlined its manufacturing. Dell got faster by making things simpler.

5.   **Create a watershed mind-set.** Dell is not content with incremental improvement; it demands massive change. Each year, it wants its Austin-based PC-assembly plant—already very fast—to improve production by 30 percent. "You don't get a big result if you do not challenge people with big goals," Dell CEO Kevin Rollins said.

INTRODUCTION

Companies that excel in supply chain operations perform better in almost every financial measure of success, according to a report from Boston-based AMR Research Inc. When supply chain excellence improves operations, companies experience a 5 percent higher profit margin, 15 percent less inventory, 17 percent stronger "perfect order" ratings, and 35 percent shorter cycle times than their competitors. "The basis of competition for winning companies in today's economy is supply chain superiority," said Kevin O'Marah, vice president of research at AMR Research. "These companies understand that value chain performance translates to productivity and market-share leadership. They also understand that supply chain leadership means more than just low costs and efficiency: It requires a superior ability to shape and respond to shifts in demand with innovative products and services."[2]

Collecting, analyzing, and distributing transactional information to all relevant parties, supply chain management (SCM) systems help all the different entities in the supply chain work together more effectively. SCM systems provide dynamic holistic views of organizations. Users can "drill down" into detailed analyses of supply chain activities to find valuable information on the organizational operations. This chapter explores the details of supply

chain management.

section 8.1 SUPPLY CHAIN FUNDAMENTALS

LEARNING OUTCOMES

8.1 List and describe the five components of a typical supply chain.

8.2 Define the relationship between information technology and the supply chain.

8.3 Identify the factors driving supply chain management.

8.4 Summarize the best practices for implementing a successful supply chain management system.

BASICS OF SUPPLY CHAIN

The average company spends nearly half of every dollar it earns on production needs—goods and services it needs from external suppliers to keep producing. A *supply chain* consists of all parties involved, directly or indirectly, in the procurement of a product or raw material. *Supply chain management (SCM)* involves the management of information flows between and among stages in a supply chain to maximize total supply chain effectiveness and profitability.

In the past, companies focused primarily on manufacturing and quality improvements within their four walls; now their efforts extend beyond those walls to influence the entire supply chain including customers, customers' customers, suppliers, and suppliers' suppliers. Today's supply chain is a complex web of suppliers, assemblers, logistic firms, sales/marketing channels, and other business partners linked primarily through information networks and contractual relationships. SCM systems enhance and manage the relationships. The supply chain has three main links (see Figure 8.2):

1. Materials flow from suppliers and their upstream suppliers at all levels.

2. Transformation of materials into semifinished and finished products—the organization's own production processes.

3. Distribution of products to customers and their downstream customers at all levels.

Organizations must embrace technologies that can effectively manage and oversee their supply chains. SCM is becoming increasingly important in creating organizational efficiencies and competitive advantages. Best Buy checks inventory levels at each of its 750 stores in North America as often as every half hour with its SCM system,

taking much of the guesswork out of inventory replenishment. Supply chain management improves ways for companies to find the raw components they need to make a product or service, manufacture that product or service, and deliver it to customers. Figure 8.3 highlights the five basic components of supply chain management.[3]

FIGURE 8.2

A Typical Supply Chain

Technology advances in the five SCM components have significantly improved companies' forecasting and business operations. Businesses today have access to modeling and simulation tools, algorithms, and applications that can combine information from multiple sources to build forecasts for days, weeks, and months in advance. Better forecasts for tomorrow result in better preparedness today.

Mattel Inc. spent the past several years investing heavily in software and processes that simplify its supply chain, cut costs, and shorten cycle times. Using supply chain management strategies, the company cut weeks out of the time it takes to design, produce, and ship everything from Barbies to Hot Wheels. Mattel installed optimization software that measures, tweaks, and validates the operations of its seven distribution centers, seven manufacturing plants, and other facilities that make up its vast worldwide supply chain. Mattel improved forecasting from monthly to weekly. The company no longer produces more inventory than stores require and delivers inventory upon request. Mattel's supply chain moves quickly to make precise forecasts that help the company meet demand.[4]

INFORMATION TECHNOLOGY'S ROLE IN THE SUPPLY CHAIN

As companies evolve into extended organizations, the roles of supply chain participants are changing. It is now common for suppliers to be involved in product development and for distributors to act as consultants in brand marketing. The notion of virtually seamless information links within and between organizations is an essential element of integrated supply chains.

Information technology's primary role in SCM is creating the integrations or tight process and information linkages between functions within a firm—such as marketing, sales, finance, manufacturing, and distribution—and between firms, which allow the smooth, synchronized flow of both information and product between customers, suppliers, and transportation providers across the supply chain. Information technology integrates planning, decision-making processes, business operating processes, and information sharing for business performance management (see Figure 8.4). Considerable evidence shows that this type of supply chain integration results in superior supply chain capabilities and profits.[5]

FIGURE 8.3

The Five Basic Supply Chain Management Components

Adaptec, Inc., of California manufactures semiconductors and markets them to the world's leading PC, server, and end-user markets through more than 115 distributors and thousands of value-added resellers worldwide. Adaptec designs and manufactures products at various third-party locations around the world. The company uses supply chain integration software over the Internet to synchronize planning. Adaptec personnel at the company's geographically dispersed locations communicate in real time and exchange designs, test results, and production and shipment information. Internet-based supply chain collaboration software helped the company reduce inventory levels and lead times.[6]

FIGURE 8.4

The Integrated Supply Chain

Although people have been talking about the integrated supply chain for a long time, it has only been recently that advances in information technology have made it possible to bring the idea to life and truly integrate the supply chain. Visibility, consumer behavior, competition, and speed are a few of the changes resulting from advances in information technology that are driving supply chains (see Figure 8.5).

FIGURE 8.5

Factors Driving Supply Chain Management

Visibility

Supply chain visibility is the ability to view all areas up and down the supply chain. Making the change to supply chains requires a comprehensive strategy buoyed by information technology. Organizations can use technology tools that help them integrate upstream and downstream, with both customers and suppliers.

To make a supply chain work most effectively, organizations must create visibility in real time. Organizations must know about customer events triggered downstream, but so must their suppliers and their suppliers' suppliers. Without this information, partners throughout the supply chain can experience a bullwhip effect, in which disruptions intensify throughout the chain. The ***bullwhip effect*** occurs when distorted product demand information passes from one entity to the next throughout the supply chain. The misinformation regarding a slight rise in demand for a product could cause different members in the supply chain to stockpile inventory. These changes ripple throughout the supply chain, magnifying the issue and creating excess inventory and costs.

Today, information technology allows additional visibility in the supply chain. Electronic information flows allow managers to view their suppliers' and customers' supply chains. Some organizations have completely changed the dynamics of their industries because of the competitive advantage gained from high visibility in the supply chain. Dell is the obvious example. The company's ability to get product to the customer and the impact of the economics have clearly changed the nature of competition and caused others to emulate this model.

Consumer Behavior

The behavior of customers has changed the way businesses compete. Customers will leave if a company does not continually meet their expectations. They are more demanding because they have information readily available, they know exactly what they want, and they know when and how they want it. ***Demand planning software*** generates demand forecasts using statistical tools and forecasting techniques. Companies can respond faster and more effectively to consumer demands through supply chain enhancements such as demand planning software. Once an organization understands customer demand and its effect on the supply chain it can begin to estimate the impact that its supply chain will have on its customers and ultimately the organization's performance. The payoff for a successful demand planning strategy can be tremendous. A study by Peter J. Metz, executive directory of the MIT Center for e-business, found that companies have achieved impressive bottom-line results from managing demand in their supply chains, averaging a 50 percent reduction in inventory and a 40 percent increase in timely deliveries.[7]

Competition

Supply chain management software can be broken down into (1) supply chain planning software and (2) supply chain execution software. Both increase a company's ability to compete. ***Supply chain planning (SCP) software*** uses advanced mathematical algorithms to improve the flow and efficiency of the supply chain while reducing inventory. SCP depends entirely on information for its accuracy. An organization cannot expect the SCP output to be accurate unless correct and up-to-date information regarding customer orders, sales information, manufacturing capacity, and delivery capability is entered into the system.

An organization's supply chain encompasses the facilities where raw materials, intermediate products, and finished goods are acquired, transformed, stored, and sold. These facilities are connected by transportation links, where materials and products flow. Ideally, the supply chain consists of multiple organizations that function as efficiently and effectively as a single organization, with full information visibility. ***Supply chain execution (SCE)***

software automates the different steps and stages of the supply chain. This could be as simple as electronically routing orders from a manufacturer to a supplier. Figure 8.6 details how SCP and SCE software correlate to the supply chain.

FIGURE 8.6

Supply Chain Planning and Supply Chain Execution Software's Correlation to the Supply Chain

General Motors, Ford, and DaimlerChrysler made history when the three automotive giants began working together to create a unified supply chain planning/execution system that all three companies and their suppliers could leverage. Gary Lapidus, Goldman Sachs Group's senior analyst, estimated that Newco, the name of the joint venture, will have a potential market capitalization of between $30 billion and $40 billion once it goes public, with annual revenues of around $3 billion.

The combined automotive giants' purchasing power is tremendous with GM spending $85 billion per year, Ford spending $80 billion, and DaimlerChrysler spending $73 billion. The ultimate goal of Newco is to process automotive production, from ordering materials and forecasting demand to making cars directly to consumer specifications through the Web. The automotive giants understand the impact strategic supply chain planning and execution can have on their competition.[8]

Speed

During the past decade, competition has focused on speed. New forms of servers, telecommunications, wireless applications, and software are enabling companies to perform activities that were once never thought possible. These systems raise the accuracy, frequency, and speed of communication between suppliers and customers, as well as between internal users. Another aspect of speed is the company's ability to satisfy continually changing customer requirements efficiently, accurately, and quickly. Timely and accurate information is more critical to businesses than ever before. Figure 8.7 displays the three factors fostering this change.

SUPPLY CHAIN MANAGEMENT SUCCESS FACTORS

To succeed in today's competitive markets, companies must align their supply chains with the demands of the markets they serve. Supply chain performance is now a distinct competitive advantage for companies proficient in the SCM area. Perdue Farms excels at decision making based on its supply chain management system. Perdue Farms moves roughly 1 million turkeys, each within 24 hours of processing, to reach holiday tables across the nation

yearly. The task is no longer as complicated as it was before Perdue Farms invested $20 million in SCM technology.

SCM makes Perdue more adept at delivering the right number of turkeys, to the right customers, at the right time.[9]

FIGURE 8.7

Factors Fostering Speed

Three Factors Fostering Speed
1.　　Pleasing customers has become something of a corporate obsession. Serving the customer in the best, most efficient, and most effective manner has become critical, and information about issues such as order status, product availability, delivery schedules, and invoices has become a necessary part of the total customer service experience.
2.　　Information is crucial to managers' abilities to reduce inventory and human resource requirements to a competitive level.
3.　　Information flows are essential to strategic planning for and deployment of resources.

FIGURE 8.8

Seven Principles of Supply Chain Management

Seven Principles of Supply Chain Management
1.　　Segment customers by service needs, regardless of industry, and then tailor services to those particular segments.
2.　　Customize the logistics network and focus intensively on the service requirements and on the profitability of the preidentified customer segments.
3.　　Listen to signals of market demand and plan accordingly. Planning must span the entire chain to detect signals of changing demand.

4.	Differentiate products closer to the customer, since companies can no longer afford to holdinventory to compensate for poor demand forecasting.
5.	Strategically manage sources of supply, by working with key suppliers to reduce overall costsof owning materials and services.
6.	Develop a supply chain information technology strategy that supports different levels of decision making and provides a clear view (visibility) of the flow of products, services, and information.
7.	Adopt performance evaluation measures that apply to every link in the supply chain and measure true profitability at every stage.

To achieve success such as reducing operating costs, improving asset productivity, and compressing order cycle time, an organization should follow the seven principles of supply chain management outlined in Figure 8.8.

These seven principles run counter to previous built-in functional thinking of how companies organize, operate, and serve customers. Old concepts of supply chains are typified by discrete manufacturing, linear structure, and a focus on buy-sell transactions ("I buy from my suppliers, I sell to my customers"). Because the traditional supply chain is spread out linearly, some suppliers are removed from the end customer. Collaboration adds the value of visibility for these companies. They benefit by knowing immediately what is being transacted at the customer end of the supply chain (the end customer's activities are visible to them). Instead of waiting days or weeks (or months) for the information to flow upstream through the supply chain, with all the potential pitfalls of erroneous or missing information, suppliers can react in near real-time to fluctuations in end-customer demand.

Dell Inc. offers one of the best examples of an extremely successful SCM system. Dell's highly efficient build-to-order business model enables it to deliver customized computer systems quickly. As part of the company's continual effort to improve its supply chain processes, Dell deploys supply chain tools to provide global views of forecasted product demand and materials requirements, as well as improved factory scheduling and inventory management.

Organizations should study industry best practices to improve their chances of successful implementation of SCM systems. The following are keys to SCM success.

Make the Sale to Suppliers

The hardest part of any SCM system is its complexity because a large part of the system extends beyond the company's walls. Not only will the people in the organization need to change the way they work, but also the people from each supplier that is added to the network must change. Be sure suppliers are on board with the benefits that the SCM system will provide.

Wean Employees Off Traditional Business Practices

Operations people typically deal with phone calls, faxes, and orders scrawled on paper and will most likely want to keep it that way. Unfortunately, an organization cannot disconnect the telephones and fax machines just because it is implementing a supply chain management system. If the organization cannot convince people that using the software will be worth their time, they will easily find ways to work around it, which will quickly decrease the chances of success for the SCM system.

Ensure the SCM System Supports the Organizational Goals

It is important to select SCM software that gives organizations an advantage in the areas most crucial to their business success. If the organizational goals support highly efficient strategies, be sure the supply chain design has the same goals.

Deploy in Incremental Phases and Measure and Communicate Success

Design the deployment of the SCM system in incremental phases. For instance, instead of installing a complete supply chain management system across the company and all suppliers at once, start by getting it working with a few key suppliers, and then move on to the other suppliers. Along the way, make sure each step is adding value through improvements in the supply chain's performance. While a big-picture perspective is vital to SCM success, the incremental approach means the SCM system should be implemented in digestible bites, and also measured for success one step at a time.

Be Future Oriented

The supply chain design must anticipate the future state of the business. Because the SCM system likely will last for many more years than originally planned, managers need to explore how flexible the systems will be when (not if) changes are required in the future. The key is to be certain that the software will meet future needs, not only current needs.[10]

SCM SUCCESS STORIES

Figure 8.9 depicts the top reasons more and more executives are turning to SCM to manage their extended enterprises. Figure 8.10 lists several companies using supply chain management to drive operations.

Apple Computer initially distributed its business operations over 16 legacy applications. Apple quickly realized that it needed a new business model centered around an integrated supply chain to drive performance efficiencies. Apple devised an implementation strategy that focused on specific SCM functions—finance, sales, distribution, and manufacturing—that would most significantly help its business. The company decided to deploy leading-edge functionality with a new business model that provided:

FIGURE 8.9

Top Reasons Executives Use SCM to Manage Extended Enterprises.

FIGURE 8.10

Companies Using Supply Chain Management Technologies to Drive Operations

Companies Using Supply Chain To Drive Operations	
Dell	Business grows 17 percent per year with a $40 billion revenue base.
Nokia	Supply chain best practices are turning ideas into profitable businesses.
Procter & Gamble	Consumer-driven supply chain is the defining architecture for large consumer companies. Best practices in product innovation and supply chain effectiveness are tops.
IBM	Hardware supply chain product-development processes overhauled to the tune of 70 percent better, faster, and cheaper.
Wal-Mart Stores	Everyday low prices define the customer demand driving Wal-Mart's partner integrated supply chain.
Toyota Motor	Lean is one of the top three best practices associated with benchmarked supply chain excellence.

The Home Depot	Cutting-edge supply chain management improved logistics and innovative services.
Best Buy	SCM has radically thinned inventories and delivered enviable business positions.
Marks & Spencer	A pioneer in the use of radio frequency identification (RFID) in stores, Marks& Spencer manages to grow and stay lean.

■ Build-to-order and configure-to-order manufacturing capabilities.

■ Web-enabled configure-to-order order entry and order status for customers buying directly from Apple at Apple.com.

■ Real-time credit card authorization.

■ Available-to-promise and rules-based allocations.

■ Integration to advanced planning systems.

Since its SCM system went live, Apple Computer has experienced substantial benefits in many areas including measurable improvements in its manufacturing processes, a decrease by 60 percent in its build-to-order and configure-to-order cycle times, and the ability to process more than 6,000 orders daily.[11]

OPENING CASE QUESTIONS

Dell's Famous Supply Chain

1. How might Dell use each of the five basic SCM components?

2. How has Dell influenced visibility, consumer behavior, competition, and speed through the use of IT

in its supply chain?

3. Explain the seven principles of SCM in reference to Dell's business model.

section 8.2 APPLYING A SUPPLY CHAIN DESIGN

LEARNING OUTCOMES

8.5 List and describe the four drivers of supply chain management.

8.6 Explain supply chain management strategies focused on efficiency.

8.7 Explain supply chain management strategies focused on effectiveness.

USING INFORMATION TECHNOLOGY TO DRIVE THE SUPPLY CHAIN

This section takes a detailed look at how an organization can create a supply chain strategy focusing on efficiency and effectiveness. *Efficiency IT metrics* measure the performance of the IT system including throughput, speed, and availability. *Effectiveness IT metrics* measure the impact IT has on business processes and activities including customer satisfaction, conversion rates, and sell-through increases. An organization's goals and strategic objectives should determine its overall supply chain management strategy. The SCM strategy in turn determines how the supply chain will perform with respect to efficiency and effectiveness. The four primary drivers of supply chain management are:

1. Facilities

2. Inventory

3. Transportation

4. Information

An organization can use information technology to influence these four drivers in varying measure to push it toward either a supply chain strategy focusing on efficiency or a supply chain strategy focusing on effectiveness. The organization must decide on the trade-off it desires between efficiency and effectiveness for each driver. The selected combined impact of the various drivers then determines the efficiency and effectiveness of the entire supply chain. Figure 8.11 provides an overview of the four supply chain drivers in terms of their effect on overall efficiency and effectiveness.

FACILITIES DRIVER

A facility processes or transforms inventory into another product or it stores the inventory before shipping it to the next facility. Toyota is an example of a company that stresses *effectiveness* in its facilities. Toyota's goal is to open a facility in every major market where it does business. These local facilities protect the company from currency fluctuations and trade barriers and thus are more effective for Toyota's customers. An organization should consider three primary components when determining its facilities strategy:

FIGURE 8.11

Analyzing the Design of a Supply Chain in Terms of Efficiency and Effectiveness

1. Location

2. Capacity

3. Operational design

Location

An organization must determine where it will locate its facilities, an important decision that constitutes a large part of its supply chain strategy. Two primary options when determining facilities location are: (1) centralize the location to gain economies of scale, which increases efficiency, or (2) decentralize the locations to be closer to the customers, which increases effectiveness.

A company can gain economies of scale when it centralizes its facilities. However, this cost reduction decreases the company's effectiveness, since many of its customers may be located far away from the facility. The opposite is also true; having a number of different facilities located closer to customers reduces efficiency because of the increased costs associated with the additional facilities. Many other factors will influence location decisions including facility costs, employee expense, exchange rates, tax effects, and so on.

UPS uses package flow SCM systems at each of its locations. The custom-built software combines operations research and mapping technology to optimize the way boxes are loaded and delivered. The goal is to use the package flow software to cut the distance that delivery trucks travel by more than 100 million miles each year. The project will also help UPS streamline the profitability of each of its facility locations.

Capacity

Demand planning SCM software can help an organization determine capacity. An organization must determine the performance capacity level for each of its facilities. If it decides a facility will have a large amount of excess capacity, which provides the flexibility to respond to wide swings in demand, then it is choosing an effectiveness strategy. Excess capacity, however, costs money and can therefore decrease efficiency.

FIGURE 8.12

The Facilities Driver's Effect on Efficiency and Effectiveness

Operational Design

An organization must determine if it wants a product focus or a functional focus for its facilities operational design. If it chooses a product focus design, it is anticipating that the facility will produce only a certain type of product. All

operations, including fabrication and assembly, will focus on developing a single type of product. This strategy allows the facility to become highly efficient in producing a single product.

If it chooses a functional design, the facility will perform a specific function (e.g., fabrication only or assembly only) on many different products. This strategy allows the facility to become more effective since it can use a single process on many different types of products (see Figure 8.12).

INVENTORY DRIVER

For most of business history, inventory has been a form of security. A warehouse bulging with components, or a distribution center packed with finished products, meant that even when a customer forecast went wildly awry, there would still be enough supply on hand to meet demand. Ever since the 1980s, when General Motors began adopting Toyota's pioneering methods in lean manufacturing, fast companies have delayered, reengineered, and scrubbed the waste from their assembly lines and supply chains by slashing lead time and stripping inventory and spare capacity from their operations.

Dillard's department store's competitive strategy is to appeal to higher-end customers who are willing to pay a premium to obtain products immediately. Dillard's carries large amounts of inventory to ensure products are always available for its customers. In return, its customers are willing to pay extra for their products.[12]

Companies require inventory to offset any discrepancies between supply and demand, but inventory is a major cost in any supply chain. Inventory's impact on a company's effectiveness versus efficiency can be enormous. Effectiveness results from more inventory, and efficiency results from less inventory. If a company's strategy requires a high level of customer effectiveness, then the company will locate large amounts of inventory in many facilities close to its customers, such as Dillard's strategy demands. If a company's strategy requires a high level of efficiency, the strategy of a low-cost producer, for instance, then the company will maintain low levels of inventory in a single strategic location.

Inventory management and control software provides control and visibility to the status of individual items maintained in inventory. The software maintains inventory record accuracy, generates material requirements for all purchased items, and analyzes inventory performance. Inventory management and control software provides the supply chain with information from a variety of sources including:

- Current inventory and order status.
- Cost accounting.

- Sales forecasts and customer orders.

- Manufacturing capacity.

- New-product introductions.

Inventory management and control software provides an organization with information when making decisions about two primary inventory strategies including:

1. Cycle inventory

2. Safety inventory

Cycle Inventory

Cycle inventory is the average amount of inventory held to satisfy customer demands between inventory deliveries. A company can follow either of two approaches regarding cycle inventory. The first approach is to hold a large amount of cycle inventory and receive inventory deliveries only once a month. The second approach is to hold a small amount of inventory and receive orders weekly or even daily. The trade-off is the cost comparison between holding larger lots of inventory for an effective supply chain and ordering products frequently for an efficient supply chain.

Safety Inventory

Safety inventory is extra inventory held in the event demand exceeds supply. For example, a toy store might hold safety inventory for the Christmas season. The risk a company faces when making a decision in favor of safety inventory is that in addition to the cost of holding it, if it holds too much, some of its products may go unsold and it may have to discount them—after the Christmas season, in the toy store example. However, if it holds too little inventory it may lose sales and risk losing customers. The company must decide if it wants to risk the expense of carrying too much inventory or to risk losing sales and customers (see Figure 8.13).

FIGURE 8.13

The Inventory Driver's Effect on Efficiency and Effectiveness

TRANSPORTATION DRIVER

Organizations use IT-enabled supply chain management systems that use quantitative analysis, decision support systems, and intelligent systems for configuring shipping plans. FedEx's entire business strategy focuses on its customers' need for highly effective transportation methods. Any company that uses FedEx to transport a package is

focusing primarily on a safe and timely delivery and not on the cost of delivery. Many businesses even locate their facilities near FedEx hubs so that they can quickly transport inventory overnight to their customers.

An organization can use many different methods of transportation to move its inventories between the different stages in the supply chain. Like the other supply chain drivers, transportation cost has a large impact either way on effectiveness and efficiency. If an organization focuses on a highly effective supply chain, then it can use transportation to increase the price of its products by using faster, more costly transportation methods. If the focus is a highly efficient supply chain, the organization can use transportation to decrease the price of its products by using slower, less costly transportation methods. Two primary facets of transportation an organization should consider when determining its strategy are:

1. Method of transportation

2. Transportation route

Method of Transportation

An organization must decide how it wants to move its inventory through the supply chain. There are six basic methods of transportation: truck, rail, ship, air, pipeline, and electronic. The primary differences between these methods are the speed of delivery and price of delivery. An organization might choose an expensive method of transportation to ensure speedy delivery if it is focusing on a highly effective supply chain. On the other hand, it might choose an inexpensive method of transportation if it is focusing on a highly efficient supply chain. Some organizations will use a *global inventory management system* that provides the ability to locate, track, and predict the movement of every component or material anywhere upstream or downstream in the supply chain. So regardless of the chosen method of transportation, the organization can find its inventory anywhere in the supply chain.

Transportation Route

An organization will also need to choose the transportation route for its products. Two supply chain software modules can aid in this decision. *Transportation planning software* tracks and analyzes the movement of materials and products to ensure the delivery of materials and finished goods at the right time, the right place, and the lowest cost. *Distribution management software* coordinates the process of transporting materials from a manufacturer to distribution centers to the final customer. Transportation route directly affects the speed and cost of delivery. An organization will use these software modules to help it decide if it wants to use an effectiveness route and ship its

products directly to its customers, or use an efficiency route and ship its products to a distributor that ships the products to customers (see Figure 8.14).

INFORMATION DRIVER

Information is a driver whose importance has grown as companies use it to become both more efficient and more effective. An organization must decide what information is most valuable in efficiently reducing costs or in improving effectiveness. This decision will vary depending on a company's strategy and the design and organization of the supply chain. Two things to consider about information in the supply chain are:

1. Information sharing.

2. Push verses pull information strategy.

FIGURE 8.14

The Transportation Driver's Effect on Efficiency and Effectiveness

Information Sharing

An organization must determine what information it wants to share with its partners throughout the stages of the supply chain. Information sharing is a difficult decision since most organizations do not want their partners to gain insight into strategic or competitive information. However, they do need to share information so they can coordinate supply chain activities such as providing suppliers with inventory order levels to meet production forecasts. Building trusting relationships is one way to begin to understand how much information supply chain partners require.

If an organization chooses an efficiency focus for information sharing, then it will freely share lots of information to increase the speed and decrease the costs of supply chain processing. If an organization chooses an effectiveness focus for information sharing, then it will share only selected information with certain individuals, which will decrease the speed and increase the costs of supply chain processing.

Push versus Pull Information Strategy

In a *push technology* environment, organizations send information. In a *pull technology* environment, organizations receive or request information. An organization must decide how it is going to share information with its partners. It might decide that it wants to push information out to partners by taking on the responsibility of sending information to them. On the other hand, it might decide that it wants its partners to take on the responsibility of getting information by having them directly access the information from the systems and pull the information they require.

Again, an organization must determine how much it trusts its partners when deciding on a push versus pull information-sharing strategy. Using a push information-sharing strategy is more effective because the organization has control over exactly what information is shared and when the information is shared. However, a push strategy is less efficient because there are costs associated with sending information such as computer equipment, applications, time, resources, and so forth.

Using a pull information-sharing strategy is more efficient since the organization does not have to undertake the costs associated with sending information. However, the pull strategy is less effective since the organization has no control over when the information is pulled. For example, if the company needs inventory there is no guarantee that the suppliers will pick up the information. Hence, an organization could find itself in trouble if its partners forget to obtain the information and fail to deliver the required products (see Figure 8.15).

FIGURE 8.15

The Information Driver's Effect on Efficiency and Effectiveness

APPLYING A SUPPLY CHAIN DESIGN

Figure 8.16 displays Wal-Mart's supply chain management design and how it correlates to its competitive strategy to be a reliable, low-cost retailer for a wide variety of mass consumption goods. Wal-Mart's supply chain emphasizes efficiency, but also maintains an adequate level of effectiveness.

- **Facilities focus**—efficiency: Wal-Mart maintains few warehouses and will build a new warehouse only when demand is high enough to justify one.

- **Inventory focus**—efficiency: Wal-Mart ships directly to its stores from the manufacturer. This significantly lowers inventory levels because stores maintain inventory, not stores and warehouses.

- **Transportation focus**—effectiveness: Wal-Mart maintains its own fleet of trucks. The benefits in terms of overall supply chain efficiency justify the expense of maintaining its own trucks because effective transportation allows Wal-Mart to keep low levels of inventory.

- **Information focus**—efficiency: Wal-Mart invests heavily in technology and the flow of information throughout its entire supply chain. Wal-Mart pushes inventory information all the way back up the supply chain to its suppliers who then manufacture only enough inventories to meet demand. The cost to build the information flows between its supply chain partners has been tremendous. However, the result of this investment is a highly successful and efficient supply chain.[13]

FUTURE SUPPLY CHAIN TRENDS

A television commercial shows a man in a uniform quietly moving through a family home. The man replaces the empty cereal box with a full one just before a hungry child opens the cabinet. He then opens a new sack of dog food as the hungry bulldog eyes him warily, and finally hands a full bottle of shampoo to the man in the shower who had just run out. The next wave in supply chain management will be home-based supply chain fulfillment.

Walgreens is differentiating itself from other national chains by marketing itself as the family's just-in-time supplier. Consumers today are becoming incredibly comfortable with the idea of going online to purchase products when they want, how they want, and at the price they want. Walgreens is developing custom Web sites for each household that allow families to order electronically and then at their convenience go to the store to pick up their goods at a special self-service counter or the drive-through window. Walgreens is making a promise that goes beyond low prices and customer service and extends right into the home.[14]

FIGURE 8.16

Wal-Mart's Supply Chain Management Drivers

The functionality in supply chain management systems is becoming more and more sophisticated as supply chain management matures. Now and in the future, the next stages of SCM will incorporate more functions such as marketing, customer service, and product development. This will be achieved through more advanced communication networks, adoption of more user-friendly decision support systems, and availability of shared information to all participants in the supply chain. SCM is an ongoing development as technology makes it possible to acquire information ever more accurately and frequently from all over the world, and introduces new tools to aid in the analytical processes that deal with the supply chain's growing complexity.

According to Forrester Research, Inc., U.S. firms will spend $35 billion over the next five years to improve business processes that monitor, manage, and optimize their extended supply chains. Figure 8.17 displays the fastest growing SCM components that can have the greatest potential impact on an organization's bottom line.[15]

New technologies are also going to improve the supply chain. Radio frequency identification (RFID) technologies use active or passive tags in the form of chips or smart labels that can store unique identifiers and relay this information to electronic readers. RFID will become an effective tool for tracking and monitoring inventory movement in a real-time SCM environment. The real-time information will provide managers with an instant and accurate view of inventories within the supply chain.

FIGURE 8.17

Fast Growth SCM Components

Growing SCM Components	
Supply chain event management (SCEM)	Enables an organization to react more quickly to resolve supply chain issues. SCEM software increases real-time information sharing among supply chain partners and decreases their response time to unplanned events. SCEM demand will skyrocket as more and more organizations begin to discover the benefits of real-time supply chain monitoring.
Selling chain management	Applies technology to the activities in the order life cycle from inquiry to sale.
Collaborative engineering	Allows an organization to reduce the cost and time required during the design process of a product.
Collaborative demand planning	Helps organizations reduce their investment in inventory, while improving customer satisfaction through product availability.

Using current SCM systems, the RFID will check the inventory status and then trigger the replenishment process. Organizations using RFIDs will be able to quickly and accurately provide current inventory levels (in real-time) at any point in the supply chain. Reducing inventory levels to their reorder points allows electronic regeneration of replenishment orders. With quick and accurate information about inventories, the use of safety stock levels guarding against uncertainty can also be reduced. Hence, the potential benefits of RFIDs include a reduction of human intervention (or required labor) and holding fewer inventories, which nets a reduction in operating costs.

SCM applications have always been expensive, costing between $1 million and $10 million. As the industry matures and competition increases, vendors will continue adapting their pricing models to attract midsize and

smaller companies.[16]

OPENING CASE QUESTIONS

Dell's Famous Supply Chain

4. Identify the four primary drivers of SCM and explain how Dell uses each one to gain efficiency or effectiveness in its supply chain.

5. Choose one of the fast growth SCM components and explain how Dell can use it to increase business operations.

6. What is RFID and how could Dell use the technology to improve its supply chain?

KEY TERMS

Bullwhip effect 250

Collaborative demand planning 263

Collaborative engineering 263

Cycle inventory 258

Demand planning software 250

Distribution management software 259

Effectiveness IT metrics 255

Efficiency IT metrics 255

Global inventory management system 259

Inventory management and control software 258

Logistics 248

Pull technology 260

Push technology 260

Safety inventory 250

Selling chain management 246

Supply chain 246

Supply chain event management (SCEM) 263

Supply chain execution (SCE) software 250

Supply chain management (SCM) 246

CLOSING CASE ONE

BudNet

Every time a six-pack moves off the shelf, Anheuser-Busch's top-secret nationwide data network, BudNet, knows. BudNet is Anheuser-Busch's secret weapon and one of the reasons that Anheuser's share (by volume) of the $74.4 billion U.S. beer market inched up to 50.1 percent from 48.9 percent in a single year.

Dereck Gurden, a sales representative for Sierra Beverage, one of about 700 U.S. distributors that work for Anheuser-Busch, manages an 800-square-mile territory in California's Central Valley. His customers include 7-Eleven, Buy N Save, and dozens of liquor marts and restaurants. When Gurden enters one of his customers' stores he already knows what products are selling, which campaigns are successful, and what needs to be done to help the customer's business.

When entering a store, Gurden checks his handheld PC, which displays vital store information. "First I'll scroll through and check the accounts receivable, make sure everything's current," he says. "Then it'll show me an inventory screen with a four-week history. I can get past sales, package placements—facts and numbers on how much of the sales they did when they had a display in a certain location." Gurden also walks around the store and inputs competitor information into his PC relating to product displays, pricing strategies, and promotions.

How BudNet Works

Information is entered into BudNet nightly from several thousand beer distributors and sales representatives. The information allows Anheuser-Busch managers to constantly adjust production and fine-tune marketing campaigns. The system works as follows:

1. Sales representatives collect new orders and track competitors' marketing efforts on PDAs and laptops.
2. Distributors compile the information and transmit it daily to Anheuser corporate headquarters.
3. Anheuser brand managers analyze the information and make decisions for distributors.
4. Distributors log on to BudNet to get the latest intelligence.
5. Sales representatives rearrange displays and rotate stock based on the recommendations.

Anheuser-Busch uses BudNet's information to constantly change marketing strategies, to design promotions to suit the ethnic makeup of its markets, and as early warning radar that detects where rivals might have an edge. "If Anheuser-Busch loses shelf space in a store in Clarksville, Tennessee, they know it right away," says Joe Thompson, president of Independent Beverage Group, a research and consulting firm. "They're better at this game than anyone, even Coca-Cola."

According to dozens of analysts, beer-industry veterans, and distributor executives, Anheuser has made a deadly accurate science out of determining what beer lovers are buying, as well as when, where, and why. The last time you bought a six-pack of Bud Light at the corner store, Anheuser servers most likely recorded what you paid, when that beer was brewed, whether you purchased it warm or chilled, and whether you could have gotten a better deal down the street. BudNet has not just added efficiency into the beer supply chain; it is changing the dynamics of the industry.[17]

Questions

1. How can an SCM system help a distributor such as Anheuser-Busch make its supply chain more effective and efficient?

2. SCM is experiencing explosive growth. Explain why this statement is true using BudNet as an example.

3. Evaluate BudNet's effect on each of the five factors that are driving SCM success.

4. List and describe the components of a typical supply chain along with its ability to help Budweiser make effective decisions.

CLOSING CASE TWO

Listerine's Journey

When you use Listerine antiseptic mouthwash, you are experiencing the last step in a complex supply chain spanning several continents and requiring months of coordination by countless businesses and individuals. The resources involved in getting a single bottle of Listerine to a consumer are unbelievable. As raw material transforms into finished product, what will be Listerine travels around the globe and through multiple supply chains and information systems.

The Journey Begins

A farmer in Australia is harvesting a crop of eucalyptus for eucalyptol, the oil found in its leathery leaves. The

farmer sells the crop to an Australian processing company, which spends about four weeks extracting the eucalyptol from the eucalyptus.

Meanwhile, in New Jersey, Warner-Lambert (WL) partners with a distributor to buy the oil from the Australian company and transport it to WL's Listerine manufacturing and distribution facility in Lititz, Pennsylvania. The load will arrive at Lititz about three months after the harvest.

At the same time, in Saudi Arabia, a government-owned operation is drilling deep under the desert for the natural gas that will yield the synthetic alcohol that gives Listerine its 43-proof punch. Union Carbide Corp. ships the gas via tanker to a refinery in Texas, which purifies it and converts it into ethanol. The ethanol is loaded onto another tanker, and then transported from Texas through the Gulf of Mexico to New Jersey, where it is transferred to storage tanks and transported via truck or rail to WL's plant. A single shipment of ethanol takes about six to eight weeks to get from Saudi Arabia to Lititz.

SPI Polyols Inc., a manufacturer of ingredients for the confectionery, pharmaceutical, and oral-care industries, buys corn syrup from farmers in the Midwest. SPI converts the corn syrup into sorbitol solution, which sweetens and adds bulk to the Cool Mint Listerine. The syrup is shipped to SPI's New Castle, Delaware, facility for processing and then delivered on a tank wagon to Lititz. The whole process, from the time the corn is harvested to when it is converted into sorbitol, takes about a month.

By now the ethanol, eucalyptol, and sorbitol have all arrived at WL's plant in Lititz, where employees test them, along with the menthol, citric acid, and other ingredients that make up Listerine, for quality assurance before authorizing storage in tanks. To mix the ingredients, flow meters turn on valves at each tank and measure out the right proportions, according to the Cool Mint formula developed by WL R&D in 1990. (The original amber mouthwash was developed in 1879.)

Next, the Listerine flows through a pipe to fillers along the packaging line. The fillers dispense the product into bottles delivered continuously from a nearby plastics company for just-in-time manufacturing. The bottles are capped, labeled, and fitted with tamper-resistant safety bands, then placed in shipping boxes that each hold one dozen 500-milliliter bottles. During this process, machines automatically check for skewed labels, missing safety bands, and other problems. The entire production cycle, from the delivery via pipe of the Listerine liquid to the point where bottles are boxed and ready to go, takes a matter of minutes. The line can produce about 300 bottles per minute—a far cry from the 80 to 100 bottles that the line produced per minute before 1994.

Each box travels on a conveyor belt to the palletizer, which organizes and shrink-wraps the boxes into 100-case pallets. Stickers with identifying bar codes are affixed to the pallets. Drivers forklift the pallets to the distribution center, located in the same Lititz facility, from which the boxes are shipped around the world.

Finally, the journey is completed when a customer purchases a bottle of Listerine at a local drugstore or grocery store. In a few days, the store will place an order for a replacement bottle of Listerine. And so begins the cycle again.[18]

Questions

1. Summarize SCM and describe Warner-Lambert's supply chain strategy. Diagram the SCM components.

2. Detail Warner-Lambert's facilities strategy.

3. Detail Warner-Lambert's inventory strategy.

4. What would happen to Warner-Lambert's business if a natural disaster in Saudi Arabia depletes its natural gas resources?

5. Assess the impact to Warner-Lambert's business if the majority of the eucalyptus crop was destroyed in a natural disaster.

6. Detail Warner-Lambert's information strategy.

CLOSING CASE THREE

How Levi's Got Its Jeans into Wal-Mart

People around the world recognize Levi's as an American icon, the cool jeans worn by movie stars James Dean and Marilyn Monroe. For one reason or another, however, the company failed to keep up with the fast-changing tastes of American teenagers. In particular, it missed the trend to baggy jeans that caught hold in the mid-1990s. Sales plummeted from $7.1 billion in 1996 to $4.1 billion in 2003, and Levi's U.S. market share dropped from 18.7 percent in 1997 to 12 percent in 2003, a huge decline of almost one-third in both dollars and market share.

Analyzing and Responding to What Happened

Competition hit Levi Strauss on both the high and low ends. Fashion-conscious buyers were drawn to high-priced brands like Blue Cult, Juicy, and Seven, which had more fashion cachet than Levi's. On the low end, parents were buying Wrangler and Lee jeans for their kids because on average they cost about $10 less than Levi's Red Tab brand. Wrangler and Lee were also the brands they found at discount retailers such as Wal-Mart, Target, and T. J.

Maxx. David Bergen, Levi's chief information officer (CIO), described the company as "getting squeezed," and "caught in the jaws of death."

Levi Strauss's new CEO, Philip A. Marineau, came to the company from PepsiCo in 1999, a year after he helped PepsiCo surpass Coca-Cola in sales for the first time. Marineau recruited Bergen in 2000 from Carstation.com. Marineau quickly realized that turning Levi Strauss around would entail manufacturing, marketing, and distributing jeans that customers demanded, particularly customers at the low end where the mass market was located.

Bergen was eager to join Marineau's team because of his background in clothing, retailing, and manufacturing with companies such as The Gap and Esprit de Corps in the 1980s. He knew that Marineau's plan to anticipate customer wants would require up-to-date IT applications such as data warehousing, data mining, and customer relationship management (CRM) systems. He also knew that selling to mass market retailers would require upgrades to the supply chain management (SCM) systems, and he understood that globalization would necessitate standardized enterprise resource planning (ERP) systems. Overall, it was a challenge any ambitious CIO would covet. After all, designing and installing IT systems that drive and achieve key business initiatives is what it is all about.

Joining Wal-Mart

Wal-Mart was a pioneer in supply chain management systems, having learned early on that driving costs out of the supply chain would let it offer products to customers at the lowest possible prices, while at the same time assuring that products the customers demanded were always on the stores' shelves. Becoming one of Wal-Mart's 30,000 suppliers is not easy. Wal-Mart insists that its suppliers do business using up-to-date IT systems to manage the supply chain—not just the supply chain between Wal-Mart and its suppliers, but the supply chains between the suppliers and their suppliers as well. Wal-Mart has strict supply chain management system requirements that its business partners must meet.

Wal-Mart's requirements presented Levi Strauss with a serious hurdle to overcome because its supply chain management systems were in bad shape. Levi Strauss executives did not even have access to key information required to track where its products were moving in the supply chain. For example, they did not know how many pairs of jeans were in the factory awaiting shipment, how many were somewhere en route, or how many had just been unloaded at a customer's warehouse. According to Greg Hammann, Levi's U.S. chief customer officer, "Our supply chain could not deliver the services Wal-Mart expected."

Bergen created a cross-functional team of key managers from IT, finance, and sales to transform Levi Strauss's systems to meet Wal-Mart's requirements. Their recommendations included network upgrades, modifications to ordering and logistics applications, and data warehouse improvements, among others. Although Bergen realized that about half the changes required to current IT systems to accommodate the state-of-the-art demands of Wal-Mart would be a waste of resources since these systems were being replaced by a new SAP enterprise software system over the next five years, Levi Strauss could not wait for the SAP installation if it wanted Wal-Mart's business now, so it decided to move forward with the changes to the current systems.

The successful transformation of its supply chain management system allowed the company to collaborate with Wal-Mart. The company introduced its new signature line at Wal-Mart, which sells for around $23 and has fewer details in the finish than Levi's other lines, no trademark pocket stitching or red tab, for example. Wal-Mart wants big-name brands to lure more affluent customers into its stores, while still maintaining the low price points all Wal-Mart customers have come to expect. Wal-Mart Senior Vice President Lois Mikita noted that Wal-Mart "continues to tailor its selection to meet the needs of customers from a cross section of income levels and lifestyles." She also stated she is impressed with the level of detail Levi Strauss has put into its systems transformation efforts to "make the execution of this new launch 100 percent."

Achieving Business Success Through IT

Bergen's changes were a success and the percentage of products delivered on time quickly rose from 65 percent to 95 percent primarily because of the updated supply chain management system. Levi's total sales were also up in the third and fourth quarters of 2003, for the first time since 1996. NPD Group's Fashionworld is a research group that tracks apparel and footwear market trends. In 2003, Levi's appeared on NPD Fashionworld's top 10 list of brands preferred by young women, ending an absence of several years. Marshall Cohen, a senior industry analyst at NPD Fashionworld, noted that Levi's "hadn't been close to that for a while. Teens hadn't gravitated toward Levi's in years. That was incredible. A lot of that has to do with having the right style in the right place at the right time." The improved systems, Cohen noted, also helped the company get the right sizes to the right stores.

Another highly successful IT system implemented by Levi Strauss is a digital dashboard that executives can display on their PC screens. The dashboard lets an executive see the status of a product as it moves from the factory floor to distribution centers to retail stores. For example, the dashboard can display how Levi's 501 jeans are selling at an individual Kohl's store compared to forecasted sales. "When I first got here I didn't see anything," Hammann

said. "Now I can drill down to the product level."

The digital dashboard alerts executives to trends that under the previous systems would have taken weeks to detect. For example, in 2003 Levi Strauss started to ship Dockers Stain Defender pants. Expected sales for the pants were around 2 million pairs. The digital dashboard quickly notified key executives that the trousers were selling around 2.5 million pairs. This information enabled them to adjust production upward in time to ship more pants, meet the increased demand, and avoid lost sales. Levi Strauss also uses the systems to control supply during key seasonal sales periods such as back-to-school and Christmas.

"If I look overconfident, I'm not," Bergen said. "I'm very nervous about this change. When we trip, we have to stand up real quick and get back on the horse, as they say." As if to reinforce Bergen's point, Gib Carey, a supply chain analyst at Bain, noted, "The place where companies do fail is when they aren't bringing anything new to Wal-Mart. Wal-Mart is constantly looking at 'How can I get the same product I am selling today at a lower price somewhere else?'"[19]

Questions

1. How did Levi Strauss achieve business success through the use of supply chain management?

2. What might have happened to Levi's if its top executives had not supported investments in SCM?

3. David Bergen, Levi's CIO, put together a cross-functional team of key managers from IT, finance, and sales to transform Levi's systems to meet Wal-Mart's requirements. Analyze the relationships between these three business areas and SCM systems. How can an SCM system help support these three critical business areas?

4. Describe the five basic SCM components in reference to Wal-Mart's business model.

5. Explain RFID and provide an example of how Levi's could use the technology to increase its business operations.

MAKING BUSINESS DECISIONS

1. Analyzing Dell's supply chain management system

Dell's supply chain strategy is legendary. Essentially, if you want to build a successful SCM system your best bet is to model your SCM system after Dell's. In a team, research Dell's supply chain management strategy on the Web and create a report discussing any new SCM updates and strategies the company is currently using that were not discussed in this text. Be sure to include a graphical presentation of Dell's current supply chain model.

2. **Focusing on facilities**

Focus is a large distributor of films and is owned and operated by Lauren O'Connell. The company has been in business for more than 50 years and distributes motion pictures to theaters all over the United States and Canada. Focus is in the middle of a supply chain overhaul and is currently deciding its supply chain strategy. Lauren has asked you to create a report discussing the company's options for its facilities including location, capacity, and operational design. The report should include two primary focuses: one on efficiency and one on effectiveness.

3. **Investing in inventory**

Poppa's Toy Store Inc. has more then 150 stores in 38 states. The chain has been owned and operated for the last 30 years by CEO Taylor Coombe. Taylor has been reading reports on supply chain management and is particularly interested in updating the company's current supply chain. It is the beginning of April and Taylor wants a new SCM system up and running before the Christmas season starts in November. Taylor is particularly interested in demand planning and forecasting for the entire company's inventory during its busiest season—Christmas. Taylor has asked you to create a report discussing the company's options for its inventory management strategy including cycle and safety inventory. The report should include two primary focuses: one on efficiency and one on effectiveness.

4. **Increasing information**

Galina's is a high-end auction house located in New York City. Galina's specializes in selling jewelry, art, and antique furniture primarily from estate sales. The owner, Galina Bucrya, would like to begin offering certain items for auction over the Internet. Galina is unfamiliar with the Internet and not quite sure how to pursue her new business strategy. You are working for Information Inc., a small business consulting company that specializes in e-business strategies. Galina has hired you to help her create her supply chain e-business strategy. Compile a report describing supply chain management, the potential benefits her company can receive from an SCM strategy, your recommendation for an efficient or effective SCM strategy, and your views on the future of SCM.

5. **Increasing revenues with SCM**

Cold Cream is one of the premier beauty supply stores in the metro New York area. People come from all over to sample the store's unique creams, lotions, makeup, and perfumes. The company receives its products from manufacturers around the globe. The company would like to implement an SCM system to help it better

understand its customers and their purchasing habits. Create a report summarizing SCM systems and explain how an SCM system can directly influence Cold Cream's revenues.

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Customer Relationship Management

CHAPTER OUTLINE

SECTION 9.1

Customer Relationship Management

Business Benefits of CRM

CRM Basics

Using Information Technology to Drive Operational CRM

Using Information Technology to Drive Analytical CRM

SECTION 9.2

Customer Relationship Management Strategies

Customer Relationship Management's Explosive Growth

Customer Relationship Management Success Factors

Current Trends: SRM, PRM, and ERM

Future CRM Trends

opening case study

Customer First Awards

Profitable Player Award: Progressive

Fast Company granted Progressive the coveted Profitable Player Customer First Award. Imagine walking into a Circuit City prepared to buy an expensive digital camera and being told you could get it cheaper at Best Buy. Sound crazy? If a customer shopping for car insurance calls Progressive, that is what happens. For years, the company has handed out rivals' rates to potential customers. In 2002, it began scrolling competitors' rates—even when its own were higher—across its Web site.

It is a bold piece of Progressive's plan to foster long-term customer loyalty. Progressive may lose some custom-

ers who opt for lower rates, but CEO Glenn Renwick thinks transparency will keep the rest around. "We hope it establishes a feeling of trust for the company," he said.

Renwick seems to be getting his wish. The third-largest auto insurer in the United States, Progressive has averaged an awe-inducing 75 percent annual profit growth since 2001. Progressive continues to roll out still more customer-focused services, including a test program that lets drivers exchange a totaled vehicle for another of the same or better make, year, and mileage (Progressive does the shopping).

Progressive has long emphasized innovations that transform the customer experience and the efficiency of its operations. Its 2,900-plus immediate response vehicles (IRVs), which the company pioneered 10 years ago, are sent to accident sites or customers' homes to assess damage and in some cases pay claims immediately. Renwick says the IRVs—mobile offices for Progressive's claim representatives—were designed in part to help the customer's "emotional EKG." Reps arrive in the IRVs and quickly take care of the details so the accident victim can get back on the road as soon as possible. But the IRVs are more than just reassuring perks for stressed-out drivers. They save Progressive money by reducing costs of vehicle storage and rental cars on the 10,000 or so claims it handles in a typical day.

This results in happier customers like Dave Meisburger, whose wife was in a car accident a few years ago. Within four hours of her initial call to Progressive, an adjustor had been to their Mobile, Alabama, home, assessed the damage, and cut them a check, right in the driveway. Now Meisburger says he will never leave Progressive. "They could double their rate, and I wouldn't care. Their customer service means more to me than anything," he said.

More recently, Progressive has launched and expanded its Concierge Level claims-service facilities, now available in 18 metropolitan areas. Clients bring in their damaged cars, get a beeper and a rental car, and are notified when repairs are done. In addition to saving the customer time and energy, the centers help streamline communications among Progressive, the customer, and the body shop, increasing productivity of inspections and repairs.

"We're a company that has thought about claims continuously," Renwick said. "Rather than believing that there's one breakthrough that gets you to a new utopia of customer service, we're continuously trying to improve."

High-Tech Achiever Award: Mini USA

Fast Company granted Mini the coveted High-Tech Achiever Customer First Award. Before Angela DiFabio bought her Mini Cooper, she had been dreaming about it for a year. The Philadelphia-based Accenture consultant spent un-

told hours on Mini's Web site, playing with dozens of possibilities before coming up with the perfect combination: A chili-pepper-red exterior, white racing stripes on the hood, and a custom rally badge bar on the grill.

When DiFabio placed her order with her dealer, the same build-your-own tool—and all the price and product details it provided—left her feeling as if she were getting a fair deal. "He even used the site to order my car," she said. "That made me feel like I was getting the same information that he was, that I wasn't missing something."

While she waited for her Mini to arrive, DiFabio logged on to Mini's Web site every day, this time using its "Where's My Baby?" tracking tool to follow her car, like an expensive FedEx package, from the factory in Britain to its delivery. "I think most places you go to for a car, if you order one it's just a big black hole," DiFabio said. "To be able to check the process made the wait exciting. It definitely gave me a feeling of control in the process."

Being in control. Not missing anything. Making the wait, if there must be one, exciting. It's how every customer wants the service experience to be. And it is what Mini USA, whose customers must usually wait two to three months for their cars, is using technology to do. The Web site does more than just provide information or sell products or services. It keeps customers engaged, and when they are more engaged, they are usually happier, too. "Our ultimate goal was to make waiting fun," said Kerri Martin, Mini USA's marketing manager.

Mini's technology is not groundbreaking; however, it makes an impact on the customer experience because of how it is integrated with the brand: It is fun and makes users feel like part of the clan. Many car Web sites have build-your-own tools, but few are as customizable as Mini's, where the choices are endless and the on-screen car image changes to your specifications. The tracking service, which is unusual, acknowledges and soothes customers' anxiety and impatience—and perhaps stretches the nervous-parent metaphor a bit. In the "scheduled for production" phase, for example, the tracking tool assures them that their Mini "will begin to move through the 'birth canal' at our Oxford plant. Rest well knowing that your baby is in the best of hands."

The challenge for Mini is meeting the high expectations of such eager customers. Critics note that some dealerships are not as integrated with their Web site as they should be. And when expectant Mini owners, who it turns out are a fretful bunch, found a way to track their cars through independent shipping companies, some customers were upset that Mini's tool was not updated as quickly as the information they were finding on their own. To try to adjust these customers' expectations, Mini added an online video that explains everything that has to happen in the port and why its online tool might be slower than the independent data. It has not appeased everyone, but it has helped soothe some anxiety.

Some of Mini's technology is just for fun: Stay on the Mini site too long, and a pop-up window tells you to "save your retinas for the road." Owners are e-mailed birthday cards when their Mini is a year old and sent notices when new features are available on the site. DiFabio looks forward to these messages. "E-mails I get from other companies feel more like an ad. This feels more like a club," she said.[1]

INTRODUCTION

Customer relationship management (CRM) involves managing all aspects of a customer's relationship with an organization to increase customer loyalty and retention and an organization's profitability. As organizations begin to migrate from the traditional product-focused organization toward customer-driven organizations, they are recognizing their customers as experts, not just revenue generators. Organizations are quickly realizing that without customers, they simply would not exist and it is critical they do everything they can to ensure their customers' satisfaction. In an age when product differentiation is difficult, CRM is one of the most valuable assets a company can acquire. The sooner a company embraces CRM the better off it will be and the harder it will be for competitors to steal loyal and devoted customers.

section 9.1 CUSTOMER RELATIONSHIP MANAGEMENT

LEARNING OUTCOMES

9.1. Compare operational and analytical customer relationship management.

9.2. Explain the formula an organization can use to find its most valuable customers.

9.3. Describe and differentiate the CRM technologies used by sales departments and customer service departments.

9.4. Describe and differentiate the CRM technologies used by marketing departments and sales departments.

BUSINESS BENEFITS OF CRM

1-800-Flowers.com achieved operational excellence by building customer intimacy to continue to improve profits and business growth. The company turned brand loyalty into brand relationships by using the vast amounts of information it collected to understand customers' needs and expectations. The floral delivery company adopted SAS Enterprise Miner to analyze the information in its CRM systems. Enterprise Miner sifts through information to reveal trends, explain outcomes, and predict results so that businesses can increase response rates and quickly identify their profitable customers. With the help of Enterprise Miner, 1-800-Flowers.com is continuing to thrive with reve-

nues averaging 17 percent annual increases in revenue.[2]

CRM is a business philosophy based on the premise that those organizations that understand the needs of individual customers are best positioned to achieve sustainable competitive advantage in the future. Many aspects of CRM are not new to organizations; CRM is simply performing current business better. Placing customers at the forefront of all thinking and decision making requires significant operational and technology changes.

A customer strategy starts with understanding who the company's customers are and how the company can meet strategic goals. *The New York Times* understands this and has spent the past decade researching core customers to find similarities among groups of readers in cities outside the New York metropolitan area. Its goal is to understand how to appeal to those groups and make *The New York Times* a national newspaper, expanding its circulation and the reach it offers to advertisers. *The New York Times* is growing in a relatively flat publishing market and has achieved a customer retention rate of 94 percent in an industry that averages roughly 60 percent.[3]

As the business world increasingly shifts from product focus to customer focus, most organizations recognize that treating existing customers well is the best source of profitable and sustainable revenue growth. In the age of e-business, however, an organization is challenged more than ever before to satisfy its customers. Figure 9.1 displays the benefits derived by an organization from a CRM strategy.

FIGURE 9.1

CRM Benefits

CRM Benefits
Provide better customer service
Improve call center efficiency
Cross-sell products more effectively
Help sales staff close deals faster
Simplify marketing and sales processes
Discover new customers

Increase customer revenues

The National Basketball Association's New York Knicks are becoming better than ever at communicating with their fans. Thanks to a CRM solution, New York Knicks' management now knows which season-ticket holders like which players, what kind of merchandise they buy, and where they buy it. Management is finally able to send out fully integrated e-mail campaigns that do not overlap with other marketing efforts.[4]

CRM BASICS

An organization can find its most valuable customers by using a formula that industry insiders call RFM—**R**ecency, **F**requency, and **M**onetary value. In other words, an organization must track:

- How recently a customer purchased items (recency).
- How frequently a customer purchases items (frequency).
- How much a customer spends on each purchase (monetary value).

Once a company has gathered this initial CRM information, it can compile it to identify patterns and create marketing campaigns, sales promotions, and services to increase business. For example, if Ms. Smith buys only at the height of the season, then the company should send her a special offer during the off-season. If Mr. Jones always buys software but never computers, then the company should offer him free software with the purchase of a new computer.

The CRM technologies discussed in this chapter can help organizations find answers to RFM and other tough questions, such as who are their best customers and which of their products are the most profitable.

The Evolution of CRM

Knowing the customer, especially knowing the profitability of individual customers, is highly lucrative in the financial services industry. Its high transactional nature has always afforded the financial services industry more access to customer information than other industries have, but it has embraced CRM technologies only recently.

Barclays Bank is a leading financial services company operating in more than 70 countries. In the United Kingdom, Barclays has over 10 million personal customers and about 9.3 million credit cards in circulation, and it serves 500,000 small business customers. Barclays decided to invest in CRM technologies to help it gain valuable insights into its business and customers.

With the new CRM system, Barclays' managers are better able to predict the financial behavior of individual customers and assess whether a customer is likely to pay back a loan in full and within the agreed-upon time period. This helps Barclays manage its profitability with greater precision because it can charge its customers a more appropriate rate of interest based on the results of the customer's risk assessment. Barclays also uses a sophisticated customer segmentation system to identify groups of profitable customers, both on a corporate and personal level, which it can then target for new financial products. One of the most valuable pieces of information Barclays discovered was that about 50 percent of its customers are nonprofitable and that less than 30 percent of its customers provide 90 percent of its profits.[5]

FIGURE 9.2

Evolution of CRM

There are three phases in the evolution of CRM: (1) reporting, (2) analyzing, and (3) predicting. ***CRM reporting technologies*** help organizations identify their customers across other applications. ***CRM analysis technologies*** help organizations segment their customers into categories such as best and worst customers. ***CRM predicting technologies*** help organizations make predictions regarding customer behavior such as which customers are at risk of leaving (see Figure 9.2).

Both operational and analytical CRM technologies can assist in customer reporting (identification), customer analysis (segmentation), and customer prediction. Figure 9.3 highlights a few of the important questions an organization can answer using CRM technologies.

FIGURE 9.3

Reporting, Analyzing, and Predicting Examples

REPORTING "Asking What Happened"	ANALYZING "Asking Why It Happened"	PREDICTING "Asking What Will Happen"
What is the total revenue by customer?	Why did sales not meet forecasts?	What customers are at risk of leaving?
How many units did we manufacture?	Why was production so low?	What products will the customer buy?

Where did we sell the most products?	Why did we not sell as many units as last year?	Who are the best candidates for a mailing?
What were total sales by product?	Who are our customers?	What is the best way to reach the customer?
How many customers did we serve?	Why was customer revenue so high?	What is the lifetime profit-ability of a customer?
What are our inventory levels?	Why are inventory levels so low?	What transactions might be fradulent?

FIGURE 9.4

Operational CRM and Analytical CRM

Operational and Analytical CRM

Joe Guyaux knows the best way to win customers is to improve service. Under his leadership and with the help of Siebel CRM, the PNC retail banking team increased new consumer checking customers by 19 percent in one year. Over the past year, PNC retained 21 percent more of its consumer checking households as well as improved customer satisfaction by 9 percent.[6]

The two primary components of a CRM strategy are operational CRM and analytical CRM. ***Operational CRM*** supports traditional transactional processing for day-to-day front-office operations or systems that deal directly with the customers. ***Analytical CRM*** supports back-office operations and strategic analysis and includes all systems that do not deal directly with the customers. The primary difference between operational CRM and analytical CRM is the direct interaction between the organization and its customers. Figure 9.4 provides an overview of operational CRM and analytical CRM.

USING INFORMATION TECHNOLOGY TO DRIVE OPERATIONAL CRM

Figure 9.5 displays the different technologies marketing, sales, and customer service departments can use to perform operational CRM.

FIGURE 9.5

Operational CRM Technologies for Sales, Marketing, and Customer Service Departments

Operational CRM Technologies		
Marketing	**Sales**	**Customer Service**
1. List generator	1. Sales management	1. Contact center
2. Campaign management	2. Contact management	2. Web-based self-service
3. Cross-selling and up-selling	3. Opportunity management	3. Call scripting

Marketing and Operational CRM

Companies are no longer trying to sell one product to as many customers as possible; instead, they are trying to sell one customer as many products as possible. Marketing departments are able to transform to this new way of doing business by using CRM technologies that allow them to gather and analyze customer information to deploy successful marketing campaigns. In fact, a marketing campaign's success is directly proportional to the organization's ability to gather and analyze the right information. The three primary operational CRM technologies a marketing department can implement to increase customer satisfaction are:

1. List generator.

2. Campaign management.

3. Cross-selling and up-selling.

List Generator   *List generators* compile customer information from a variety of sources and segment the information for different marketing campaigns. Information sources include Web site visits, Web site questionnaires, online and off-line surveys, flyers, toll-free numbers, current customer lists, and so on. After compiling the customer list, an organization can use criteria to filter and sort the list for potential customers. Filter and sort criteria can include such things as household income, education level, and age. List generators provide the marketing department with a solid understanding of the type of customer it needs to target for marketing campaigns.

Campaign Management   *Campaign management systems* guide users through marketing campaigns performing such tasks as campaign definition, planning, scheduling, segmentation, and success analysis. These advanced sys-

tems can even calculate quantifiable results for return on investment (ROI) for each campaign and track the results in order to analyze and understand how the company can fine-tune future campaigns.

Cross-Selling and Up-Selling   Two key sales strategies a marketing campaign can deploy are cross-selling and up-selling. *Cross-selling* is selling additional products or services to a customer. *Up-selling* is increasing the value of the sale. For example, McDonald's performs cross-selling by asking customers if they would like an apple pie with their meal. McDonald's performs up-selling by asking customers if they would like to super-size their meals. CRM systems offer marketing departments all kinds of information about their customers and their products, which can help them identify cross-selling and up-selling marketing campaigns.

The California State Automobile Association (CSAA) had to take advantage of its ability to promote and cross-sell CSAA automotive, insurance, and travel services to beat its competition. Accomplishing this task was easy once the company implemented E.piphany's CRM system. The system integrated information from all of CSAA's separate databases, making it immediately available to all employees through a Web-based browser. Employees could quickly glance at a customer's profile and determine which services the customer currently had and which services the customer might want to purchase based on her or his needs as projected by the software.[7]

Sales and Operational CRM

Siebel, one of the largest providers of CRM software, had 33,000 subscribers in January 2005. Salesforce.com, provider of on-demand Web-based customer relationship management software, added 40,000 subscribers during the first three months of 2005, more than all of Siebel's subscribers. Salesforce.com's total number of subscribers is over 300,000. Merrill Lynch, one of the biggest customers in the sales force market, signed on for 5,000 subscriptions for its global private client division, making the brokerage firm Salesforce.com's largest customer. Salesforce.com's new product, Customforce, includes tools for adding data analysis capabilities, spreadsheet-style mathematical formulas, business processes, and forecasting models.[8]

Sales departments were the first to begin developing CRM systems. Sales departments had two primary reasons to track customer sales information electronically. First, sales representatives were struggling with the overwhelming amount of customer account information they were required to maintain and track. Second, companies were struggling with the issue that much of their vital customer and sales information remained in the heads of their sales representatives. One of the first CRM components built to help address these issues was the sales force automation component. *Sales force automation (SFA)* is a system that automatically tracks all of the steps in the sales process.

SFA products focus on increasing customer satisfaction, building customer relationships, and improving product sales by tracking all sales information.

Serving several million guests each year, Vail Resorts Inc. maintains dozens of systems across all seven of its properties. These systems perform numerous tasks including recording lift ticket, lodging, restaurant, conference, retail, and ski rental sales. Since a significant percentage of the company's revenue results from repeat guests, building stronger, more profitable relationships with its loyal customers is Vail Resorts first priority.

To improve its customer service and marketing campaign success, Vail deployed the Ascential CRM system, which integrated the customer information from its many disparate systems. The CRM system is providing Vail Resorts with a detailed level of customer insight, which helps the company personalize its guest offerings and promotions. By using a CRM system that integrates information from across all of its resorts and business lines, the company can determine what, where, and how its guests behave across all of its properties. For example, the company can now offer discounts on lift ticket and ski rentals for customers staying in its resorts. The three primary operational CRM technologies a sales department can implement to increase customer satisfaction are:

1. Sales management CRM systems.

2. Contact management CRM systems.

3. Opportunity management CRM systems.[9]

Sales Management CRM Systems   Figure 9.6 depicts the typical sales process, which begins with an opportunity and ends with billing the customer for the sale. Leads and potential customers are the lifeblood of all sales organizations, whether the products they are peddling are computers, clothing, or cars. How the leads are handled can make the difference between revenue growth or decline. *Sales management CRM systems* automate each phase of the sales process, helping individual sales representatives coordinate and organize all of their accounts. Features include calendars to help plan customer meetings, alarm reminders signaling important tasks, customizable multimedia presentations, and document generation. These systems even have the ability to provide an analysis of the sales cycle and calculate how each individual sales representative is performing during the sales process.

Contact Management CRM Systems   A *contact management CRM system* maintains customer contact information and identifies prospective customers for future sales. Contact management systems include such features as maintaining organizational charts, detailed customer notes, and supplemental sales information. For example, a contact management system can take an incoming telephone number and display the caller's name along with notes

detailing previous conversations. This allows the sales representative to answer the telephone and say, "Hi Sue, how is your new laptop working? How was your vacation to Florida?" without receiving any reminders of such details first from the customer. The customer feels valued since the sales associate knows her name and even remembers details of their last conversation!

FIGURE 9.6

Overview of the Sales Process

A \$16 billion technology company, 3M is a leader in health care, safety, electronics, telecommunications, office, and consumer markets. The company began to focus on streamlining and unifying its sales processes with the primary goals of better customer segmentation and more reliable lead generation and qualification. To achieve these goals the company implemented a CRM system and soon found itself receiving the following benefits:

- Cutting the time it takes to familiarize sales professionals with new territories by 33 percent.

- Increasing management's visibility of the sales process.

- Decreasing the time it takes to qualify leads and assign sales opportunities by 40 percent.

One of the more successful campaigns driven by the CRM system allowed 3M to deliver direct mail to targeted government agencies and emergency services in response to the anthrax attacks in 2002. All inquiries to the mail campaign were automatically assigned to a sales representative who followed up with a quote. In little more than a week, the company had received orders for 35,000 respirator masks.[10]

Opportunity Management CRM Systems   *Opportunity management CRM systems* target sales opportunities by finding new customers or companies for future sales. Opportunity management systems determine potential customers and competitors and define selling efforts including budgets and schedules. Advanced opportunity management systems can even calculate the probability of a sale, which can save sales representatives significant time and money when attempting to find new customers. The primary difference between contact management and opportunity management is that contact management deals with existing customers and opportunity management deals with new customers. Figure 9.7 displays six CRM pointers a sales representative can use to increase prospective customers.

FIGURE 9.7

CRM Pointers for Gaining Prospective Customers

CRM Pointers for Gaining Prospective Customers

1. Get their attention	If you have a good prospect, chances are that he or she receives dozens of offers from similar companies. Be sure your first contact is professional and gets your customer's attention.
2. Value their time	When you ask for a meeting, you are asking for the most valuable thing a busy person has—time. Many companies have had great success by offering high-value gifts in exchange for a meeting with a representative. Just be careful because some organizations frown on expensive gifts. Instead, offer these prospective customers a report that can help them perform their jobs more effectively.
3. Overdeliver	If your letter offered a free DVD in exchange for a meeting, bring a box of microwave popcorn along with the movie. Little gestures like these tell customers that you not only keep your word, but also can be counted on to overdeliver.
4. Contact frequently	Find new and creative ways to contact your prospective customers frequently. Starting a newsletter and sending out a series of industry updates are excellent ways to keep in contact and provide value.
5. Generate a trustworthy mailing list	If you are buying a mailing list from a third party be sure that the contacts are genuine prospects, especially if you are offering an expensive gift. Be sure that the people you are meeting have the power to authorize a sale.
6. Follow up	One of the most powerful prospecting tools is a simple thank-you note. Letting people know that their time was appreciated

	may even lead to additional referrals.

Customer Service and Operational CRM

Andy Taylor became president of Enterprise, his father's $76 million rental-car company, in 1980. Today, it is the largest in North America, with $7 billion in revenue. How has he kept customer service a priority? By quantifying it. Enterprise surveys 1.7 million customers a year. If a branch's satisfaction scores are low, employees, even vice presidents, cannot be promoted. The result is self-propagating. Seeking better scores, managers make better hires. And because Enterprise promotes almost solely from within, nearly every executive—including Taylor, who started out washing cars—has a frontline understanding of what it takes to keep customers happy. "The company would never have gotten that 100-fold growth without Andy's knack for putting systems and processes in place so you can deliver consistent service," said Sandy Rogers, senior vice president of corporate strategy.

Sales and marketing are the primary departments that interact directly with customers before a sale. Most companies recognize the importance of building strong relationships during the marketing and sales efforts; however, many fail to realize the importance of continuing to build these relationships after the sale is complete. It is actually more important to build postsale relationships if the company wants to ensure customer loyalty and satisfaction. The best way to implement postsale CRM strategies is through the customer service department.

One of the primary reasons a company loses customers is bad customer service experiences. Providing outstanding customer service is a difficult task, and many CRM technologies are available to assist organizations with this important activity. For example, by rolling out Lotus Instant Messaging to its customers, Avnet Computer Marketing has established an efficient, direct route to push valuable information and updates out to its customers. The company uses Lotus Instant Messaging to provide real-time answers to customer questions by listing its support specialists' status by different colors on its Web site: green if they are available, red if they are not, or blue if they are out of the office. The customer simply clicks on a name to begin instant messaging or a chat session to get quick answers to questions.[11]

Before access to Lotus Instant Messaging, customers had to wait in "1-800" call queues or for e-mail responses for answers. The new system has increased customer satisfaction along with tremendous savings from fewer long-distance phone charges. Avnet also estimates that Lotus Instant Messaging saves each of its 650 employees 5 to 10

minutes a day. The three primary operational CRM technologies a customer service department can implement to increase customer satisfaction are:

1. Contact center.

2. Web-based self-service.

3. Call scripting.

Contact Center   Knowledge-management software, which helps call centers put consistent answers at customer-service representative's fingertips, is often long on promise and short on delivery. The problem? Representatives have to take time out from answering calls to input things they have learned—putting the "knowledge" in knowledge management.

Brad Cleveland, who heads the Incoming Calls Management Institute, said, "Software is just a tool. It doesn't do any good unless people across the organization are using it to its potential." Sharp Electronics is making it happen. Sharp's frontline representatives built the system from scratch. And as Sharp rolled out its network over the past four years, representatives' compensation and promotions were tied directly to the system's use. As a result, the customer call experience at Sharp has improved dramatically: The proportion of problems resolved by a single call has soared from 76 percent to 94 percent since 2000.

A *contact center* (or *call center*) is where customer service representatives (CSRs) answer customer inquiries and respond to problems through a number of different customer touchpoints. A contact center is one of the best assets a customer-driven organization can have because maintaining a high level of customer support is critical to obtaining and retaining customers. Numerous systems are available to help an organization automate its contact centers. Figure 9.8 highlights a few of the features available in contact center systems.

Contact centers also track customer call history along with problem resolutions—information critical for providing a comprehensive customer view to the CSR. CSRs who can quickly comprehend and understand all of a customer's products and issues provide tremendous value to the customer and the organization. Nothing makes frustrated customers happier than not having to explain their problems to yet another CSR.

New emotion-detection software called Perform, created by Nice Systems, is designed to help companies improve customer service by identifying callers who are upset. When an elderly man distressed over high medical premiums hung up during his phone call to the Wisconsin Physician Services Insurance Corporation's call center, an IT system detected the customer's exasperation and automatically e-mailed a supervisor. The supervisor listened to a

digital recording of the conversation, called the customer, and suggested ways to lower the premium. The system uses algorithms to determine a baseline of emotion during the first 5 to 10 seconds of a call, any deviation from the baseline triggers an alert.[12]

FIGURE 9.8

Common Features Included in Contact Centers

Common Features Included in Contact Centers	
Automatic call distribution	A phone switch routes inbound calls to available agents.
Interactive voice response (IVR)	Directs customers to use touch-tone phones or keywords to navigate or provide information.
Predictive dialing	Automatically dials outbound calls and when someone answers, the call is forwarded to an available agent.

Web-Based Self-Service *Web-based self-service systems* allow customers to use the Web to find answers to their questions or solutions to their problems. FedEx uses Web-based self-service systems to allow customers to track their own packages without having to talk to a CSR. FedEx customers can simply log on to FedEx's Web site and enter their tracking number. The Web site quickly displays the exact location of the package and the estimated delivery time.

Another great feature of Web-based self-service is click-to-talk buttons. Click-to-talk buttons allow customers to click on a button and talk with a CSR via the Internet. Powerful customer-driven features like these add tremendous value to any organization by providing customers with real-time information without having to contact company representatives. [13]

Call Scripting Being a CSR is not an easy task, especially when the CSR is dealing with detailed technical products or services. *Call scripting systems* access organizational databases that track similar issues or questions and automatically generate the details for the CSR who can then relay them to the customer. The system can even provide a list of questions that the CSR can ask the customer to determine the potential problem and resolution. This feature helps CSRs answer difficult questions quickly while also presenting a uniform image so two different customers do not receive two different answers.

Documedics is a health care consulting company that provides reimbursement information about pharmaceutical products to patients and health care professionals. The company currently supports inquiries for 12 pharmaceutical companies and receives over 30,000 customer calls per month. Originally, the company had a data file for each patient and for each pharmaceutical company. This inefficient process resulted in the potential for a single patient to have up to 12 different information files if the patient was a client of all 12 pharmaceutical companies. To answer customer questions, a CSR had to download each customer file, causing tremendous inefficiencies and confusion. The company implemented a CRM system with a call scripting feature to alleviate the problem and provide its CSRs with a comprehensive view of every customer, regardless of the pharmaceutical company. The company anticipated 20 percent annual growth primarily because of the successful implementation of its new system.[14]

USING INFORMATION TECHNOLOGY TO DRIVE ANALYTICAL CRM

Maturing analytical CRM and behavioral modeling technologies are helping numerous organizations move beyond legacy benefits such as enhanced customer service and retention to systems that can truly improve business profitability. Unlike operational CRM that automates call centers and sales forces with the aim of enhancing customer transactions, analytical CRM solutions are designed to dig deep into a company's historical customer information and expose patterns of behavior on which a company can capitalize. Analytical CRM is primarily used to enhance and support decision making and works by identifying patterns in customer information collected from the various operational CRM systems.

For many organizations, the power of analytical CRM solutions provides tremendous managerial opportunities. Depending on the specific solution, analytical CRM tools can slice-and-dice customer information to create made-to-order views of customer value, spending, product affinities, percentile profiles, and segmentations. Modeling tools can identify opportunities for cross-selling, up-selling, and expanding customer relationships.

Personalization occurs when a Web site can know enough about a person's likes and dislikes that it can fashion offers that are more likely to appeal to that person. Many organizations are now utilizing CRM to create customer rules and templates that marketers can use to personalize customer messages.

The information produced by analytical CRM solutions can help companies make decisions about how to handle customers based on the value of each and every one. Analytical CRM can help reveal information about which customers are worth investing in, which should be serviced at an average level, and which should not be invested in at all.

Data gained from customers can also reveal information about employees. Wachovia Bank surveys customers—25,000 every month—for feedback on their service experience. It asks about individual employees and uses those answers in one-on-one staff coaching. A recent 20-minute coaching session at a Manhattan branch made clear how this feedback—each customer surveyed rates 33 employee behaviors—can improve service. The branch manager urged an employee to focus on sincerity rather than on mere friendliness, to "sharpen her antenna" so she would listen to customers more intuitively, and to slow down rather than hurry up. That focus on careful, sincere, intuitive service has paid off: Wachovia has held the top score among banks in the American Customer Satisfaction Index since 2001.[15]

Analytical CRM relies heavily on data warehousing technologies and business intelligence to glean insights into customer behavior. These systems quickly aggregate, analyze, and disseminate customer information throughout an organization. Figure 9.9 displays a few examples of the kind of information insights analytical CRM can help an organization gain.

UPS's data-intensive environment is supported by the largest IBM DB2 database in the world, consisting of 236 terabytes of data related to its analytical CRM tool. The shipping company's goal is to create one-to-one customer relationships, and it is using Quantum View tools that allow it to let customers tailor views of such things as shipment history and receive notices when a package arrives or is delayed. UPS has built more than 500 customer relationship management applications that run off of its data warehouse.[16]

FIGURE 9.9

Analytical CRM Information Examples

Analytical CRM Information Examples	
1. Give customers more of what they want	Analytical CRM can help an organization go beyond the typical "Dear Mr. Smith" salutation. An organization can use its analytical CRM information to make its communications more personable. For example, if it knows a customer's shoe size and preferred brand it can notify the customer that there is a pair of size 12 shoes set aside to try on the next time the customer vis-

	its the store.
2. Find new customers similar to the best customers	Analytical CRM might determine that an organization does a lot of business with women 35 to 45 years old who drive SUVs and live within 30 miles of a certain location. The company can then find a mailing list that highlights this type of customer for potential new sales.
3. Find out what the organization does best	Analytical CRM can determine what an organization does better than its competitors. For example, if a restaurant caters more breakfasts to midsized companies than its competition does, it can purchase a specialized mailing list of midsized companies in the area and send them a mailing that features the breakfast catering specials.
4. Beat competitors to the punch	Analytical CRM can determine sales trends allowing an organization to offer the best customers deals before the competition has a chance to. For example, a clothing store might determine its best customers for outdoor apparel and send them an offer to attend a private sale right before the competition runs its outdoor apparel sale.
5. Reactivate inactive customers	Analytical CRM can highlight customers who have not done any business with the organization in a while. The organization can then send them a personalized letter along with a discount coupon. It will remind them of the company and may help spark a renewed relationship.
6. Let customers know	Analytical CRM can determine what customers want and need,

they matter	so an organization can contact them with this information. Anything from a private sale to a reminder that the car is due for a tune-up is excellent customer service.

Data warehouses are providing businesses with information about their customers and products that was previously impossible to locate, and the resulting payback can be tremendous. Organizations are now relying on business intelligence to provide them with hard facts that can determine everything from which type of marketing and sales campaign to launch, to which customers to target, at what time. Using CRM along with business intelligence allows organizations to make better, more informed decisions and to reap amazing unforeseen rewards.

Sears, Roebuck and Company is the third-largest U.S. retailer. Over the past two decades there has been a well-publicized encroachment by discount mass merchandisers. Even though Sears does not know exactly "who" its customers are (by name and address) since many customers use cash or non-Sears credit cards, it can still benefit from analytical CRM technologies. Sears uses these technologies to determine what its generic customers prefer to buy and when they buy it, which enables the company to predict what they will buy. Using analytical CRM, Sears can view each day's sales by region, district, store, product line, and individual item. Sears can now monitor the precise impact of advertising, weather, and other factors on sales of specific items. For the first time, Sears can even group together, or "cluster," widely divergent types of items. For example, merchandisers can track sales of a store display marked "Gifts under $25" that might include sweatshirts, screwdrivers, and other unrelated items. The advertising department can then follow the sales of "Gifts under $25" to determine which products to place in its newspaper advertisements.[17]

OPENING CASE QUESTIONS

Customer First Awards

1. Summarize the evolution of CRM and provide an example of a reporting, analyzing, and predicting question Progressive might ask its customers.

2. How could Progressive's marketing department use CRM technology to improve its operations?

3. How could Mini's sales department use CRM technology to improve its operations?

4. How could Progressive and Mini's customer service departments use CRM technology to improve their operations?

5. Define analytical CRM and its importance to companies like Progressive and Mini.

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section 9.2   CUSTOMER RELATIONSHIP MANAGEMENT STRATEGIES

LEARNING OUTCOMES

9.5. Identify the primary forces driving the explosive growth of customer relationship management.

9.6. Summarize the best practices for implementing a successful customer relationship management system.

9.7. Compare customer relationship management, supplier relationship management, partner relationship management, and employee relationship management.

CUSTOMER RELATIONSHIP MANAGEMENT'S EXPLOSIVE GROWTH

Brother International Corporation experienced skyrocketing growth in its sales of multifunction centers, fax machines, printers, and labeling systems in the late 1990s. Along with skyrocketing sales growth came a tremendous increase in customer service calls. When Brother failed to answer the phone fast enough, product returns started to increase. The company responded by increasing call center capacity, and the rate of returns began to drop. However, Dennis Upton, CIO of Brother International, observed that all the company was doing was answering the phone. He quickly realized that the company was losing a world of valuable market intelligence (business intelligence) about existing customers from all those telephone calls. The company decided to deploy SAP's CRM solution. The 1.8 million calls Brother handled dropped to 1.57 million, which reduced call center staff from 180 agents to 160 agents. Since customer demographic information is now stored and displayed on the agent's screen based on the incoming telephone number, the company has reduced call duration by an average of one minute, saving the company $600,000 per year.[18]

In the context of increasing business competition and mature markets, it is easier than ever for informed and demanding customers to defect since they are just a click away from migrating to an alternative. When customers buy on the Internet, they see, and they steer, entire value chains. The Internet is a "looking glass," a two-way mirror, and its field of vision is the entire value chain. While the Internet cannot totally replace the phone and face-to-face communication with customers, it can strengthen these interactions at all customer touchpoints. Customer Web interactions become conversations, interactive dialogs with shared knowledge, not just business transactions. Web-based customer care can actually become the focal point of customer relationship management and provide break-

through benefits for both the enterprise and its customers, substantially reducing costs while improving service.

According to an AMR Research survey of more than 500 businesses in 14 key vertical markets, half of all current CRM spending is by manufacturers. Current users are allocating 20 percent of their IT budgets to CRM solutions. Those who have not invested in CRM may soon come on board: Of the respondents in the study who are not currently using CRM, roughly one-third plan to implement these types of technology solutions within the next year. Figure 9.10 shows the top CRM business drivers, and Figure 9.11 displays the forecasts for CRM spending over the next few years..

FIGURE 9.10

CRM Business Drivers

When you are dealing with sick customers, flexibility is key. That is why Walgreens has made healthy investments in customer service over the past 30 years, originating the drive-through pharmacy and pioneering a network for refilling prescriptions at any location. It should come as no surprise that Walgreens credited much of its growth to an increased investment in customer service. The company has developed new software that can print prescription labels in 14 languages and large-type labels for older patrons. Besides investing in customer-friendly technology, the 103-year-old chain is not forgetting the human touch. Walgreens spends more on payroll on stores where performance is below average, increasing the clerk-to-customer ratio; and it recently launched an online training program for all employees. With 19 straight quarters of double-digit earnings growth, the prescription appears to be working.[19]

FIGURE 9.11

Forecasts for CRM Spending ($ billions)

CUSTOMER RELATIONSHIP MANAGEMENT SUCCESS FACTORS

When a "lucky ambassador" greets a Harrah's guest at a video-poker machine by name, wishes her a happy birthday, and offers free tickets to a show, luck has nothing to do with it. The moment customers insert their loyalty card into a slot machine, the casino giant's $30 million-plus CRM system reveals every move they have ever made at any of its 28 properties. "If you start to have a really unfortunate visit, you start to think, 'Man, that place is really just bad luck,' " said Gary Loveman, Harrah's president and CEO. "If we see that coming, we can intervene" with perks to soothe the pain of gambling losses. While many companies struggle to employ CRM successfully, gathering massive amounts of data without using it to benefit customers, Harrah's is building on its mastery. In the future, its slot machines will spout real-time monetary credits and dinner coupons using new customer-recognition software

and hardware, leaving even its losing customers feeling a little luckier.

CRM solutions make organizational business processes more intelligent. Organizations achieve this by understanding customer behavior and preferences, then realigning product and service offerings and related communications to make sure they are synchronized with customer needs and preferences. If an organization is implementing a CRM system, it should study the industry best practices to help ensure a successful implementation (see Figure 9.12).

CRM is critical to business success. CRM is the key competitive strategy to stay focused on customer needs and to integrate a customer-centric approach throughout an organization. CRM can acquire enterprisewide knowledge about customers and improve the business processes that deliver value to an organization's customers, suppliers, and employees. Using the analytical capabilities of CRM can help a company anticipate customer needs and proactively serve customers in ways that build relationships, create loyalty, and enhance bottom lines.

FIGURE 9.12

CRM Industry Best Practices

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1. Clearly Communicate the CRM Strategy—Boise Office Solutions recently spent $25 million implementing a successful CRM system. One of the primary reasons for the system's success was that Boise started with a clear business objective for the system: to provide customers with greater economic value. Only after establishing the business objective did Boise Office Solutions invest in CRM technology to help meet the goal. Ensuring that all departments and employees understand exactly what CRM means and how it will add value to the organization is critical. Research by Gartner Dataquest indicates that enterprises that attain success with CRM have interested and committed senior executives who set goals for what CRM should achieve, match CRM strategies with corporate objectives, and tie the measurement process to both goals and strategies.

2. Define Information Needs and Flows—People who perform successful CRM implementations have a clear understanding of how information flows in and out of their organization. Chances are information comes into the organization in many different

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forms over many different touch points.

3. **Build an Integrated View of the Customer**—Essential to a CRM strategy is choosing the correct CRM system that can support organizational requirements. The system must have the corresponding functional breadth and depth to support strategic goals. Do not forget to take into account the system's infrastructure including ease of integration to current systems, discussed in greater detail later in this unit.

4. **Implement in Iterations**—Implement the CRM system in manageable pieces—in other words avoid the "big bang" implementation approach. It is easier to manage, measure, and track the design, building, and deployment of the CRM system when it is delivered in pieces. Most important, this allows the organization to find out early if the implementation is headed for failure and thus either kill the project and save wasted resources or change direction to a more successful path.

5. **Scalability for Organizational Growth**—Make certain that the CRM system meets the organization's future needs as well as its current needs. Estimating future needs is by far one of the hardest parts of any project. Understanding how the organization is going to grow, predicting how technology is going to change, and anticipating how customers are going to evolve are very difficult challenges. Taking the time to answer some tough questions up front will ensure the organization grows into, instead of out of, its CRM system.

CURRENT TRENDS: SRM, PRM, AND ERM

Organizations are discovering a wave of other key business areas where it is beneficial to take advantage of building strong relationships. These emerging areas include supplier relationship management (SRM), partner relationship management (PRM), and employee relationship management (ERM).

Supplier Relationship Management

Supplier relationship management (SRM) focuses on keeping suppliers satisfied by evaluating and categorizing

suppliers for different projects, which optimizes supplier selection. SRM applications help companies analyze vendors based on a number of key variables including strategy, business goals, prices, and markets. The company can then determine the best supplier to collaborate with and can work on developing strong relationships with that supplier. The partners can then work together to streamline processes, outsource services, and provide products that they could not provide individually.

With the merger of the Bank of Halifax and Bank of Scotland, the new company, HBOS, implemented an SRM system to provide consistent information to its suppliers. The system integrates procurement information from the separate Bank of Halifax and Bank of Scotland operational systems, generating a single repository of management information for consistent reporting and analysis. Other benefits HBOS derived from the SRM solution include:

- A single consolidated view of all suppliers.
- Consistent, detailed management information allowing multiple views for every executive.
- Elimination of duplicate suppliers.[20]

Partner Relationship Management

Organizations have begun to realize the importance of building relationships with partners, dealers, and resellers. *Partner relationship management (PRM)* focuses on keeping vendors satisfied by managing alliance partner and reseller relationships that provide customers with the optimal sales channel. PRM's business strategy is to select and manage partners to optimize their long-term value to an organization. In effect, it means picking the right partners, working with them to help them be successful in dealing with mutual customers, and ensuring that partners and the ultimate end customers are satisfied and successful. Many of the features of a PRM application include real-time product information on availability, marketing materials, contracts, order details, and pricing, inventory, and shipping information.

PRM is one of the smaller segments of CRM that has superb potential. PRM grew from a $500 million business to a $1 billion business in under four years. This is a direct reflection of the growing interdependency of organizations in the new economy. The primary benefits of PRM include:

- Expanded market coverage.
- Offerings of specialized products and services.
- Broadened range of offerings and a more complete solution.

Employee Relationship Management

Jim Sinegal runs Costco, one of the largest wholesale club chains, but there are two things he does not discount: employee benefits and customer service. Average hourly wages trounce those of rival Sam's Club, and 86 percent of workers have health insurance (versus a reported 47 percent at Sam's). Sinegal is not just being nice. Happy employees, he believes, make for happier customers. Low prices (he caps per-item profits at 14 percent) and a generous return policy certainly help. Although Wall Street has long been arguing for smaller benefits, a stingier return policy, and bigger profits, Sinegal sides with customers and staff. "We're trying to run Costco in a fashion that is not just going to satisfy our shareholders this year or this month," he said, "but next year and on into the future."[21]

Employee relationship management (ERM) provides employees with a subset of CRM applications available through a Web browser. Many of the ERM applications assist the employee in dealing with customers by providing detailed information on company products, services, and customer orders.

At Rackspace, a San Antonio-based Web-hosting company, customer focus borders on the obsessive. Joey Parsons, 24, won the Straightjacket Award, the most coveted employee distinction at Rackspace. The award recognizes the employee who best lives up to the Rackspace motto of delivering "fanatical support," a dedication to customers that is so intense it borders on the loony. Rackspace motivates its staff by treating each team as a separate business, which is responsible for its own profits and losses and has its own ERM Web site. Each month, employees can earn bonuses of up to 20 percent of their monthly base salaries depending on the performance of their units by both financial and customer-centric measurements such as customer turnover, customer expansion, and customer referrals. Daily reports are available through the team's ERM Web site.[22]

FUTURE CRM TRENDS

CRM revenue forecast for 2008 is $11.5 billion. In the future, CRM applications will continue to change from employee-only tools to tools used by suppliers, partners, and even customers. Providing a consistent view of customers and delivering timely and accurate customer information to all departments across an organization will continue to be the major goal of CRM initiatives.

As technology advances (intranet, Internet, extranet, wireless), CRM will remain a major strategic focus for companies, particularly in industries whose product is difficult to differentiate. Some companies approach this problem by moving to a low-cost producer strategy. CRM will be an alternative way to pursue a differentiation strategy with

a nondifferentiable product.

CRM applications will continue to adapt wireless capabilities supporting mobile sales and mobile customers. Sales professionals will be able to access e-mail, order details, corporate information, inventory status, and opportunity information all from a PDA in their car or on a plane. Real-time interaction with human CSRs over the Internet will continue to increase.

CRM suites will also incorporate PRM and SRM modules as enterprises seek to take advantage of these initiatives. Automating interactions with distributors, resellers, and suppliers will enhance the corporation's ability to deliver a quality experience to its customers.

OPENING CASE QUESTIONS

Customer First Awards

6. How might Progressive's business model change if it decreased its investments in CRM technologies?

7. How might Mini's business model change if it decreased its investments in CRM technologies?

8. Describe the CRM industry best practices and explain how Progressive is using each.

9. Explain SRM and how Mini could use it to improve its business.

10. Explain ERM and how Progressive could use it to improve its business.

KEY TERMS

Analytical CRM 280

Automatic call distribution 285

Call scripting system 286

Campaign management system 281

Contact center (call center) 285

Contact management CRM system 282

CRM analysis technology 279

CRM predicting technology 279

CRM reporting technology 279

Cross-selling 281

Customer relationship management (CRM) 277

Employee relationship management (ERM) 292

CLOSING CASE ONE

Fighting Cancer with Information

"The mission of the American Cancer Society (ACS) is to cure cancer and relieve the pain and suffering caused by this insidious disease," said Zachary Patterson, chief information officer, ACS.

The ACS is a nationwide voluntary health organization dedicated to eliminating cancer as a major health problem by supporting research, education, advocacy, and volunteer service. Headquartered in Atlanta, Georgia, with 17 divisions and more than 3,400 local offices throughout the United States, the ACS represents the largest source of private nonprofit cancer research funds in the United States.

To support its mission, the ACS must perform exceptionally well in three key areas. First, it must be able to provide its constituents—more than 2 million volunteers, patients, and donors—with the best information available regarding the prevention, detection, and treatment of cancer. Second, ACS must be able to demonstrate that it acts responsibly with the funds entrusted to it by the public. "Among other things, that means being able to provide exceptional service when someone calls our call center with a question about mammography screening or our latest antismoking campaign," said Terry Music, national vice president for Information Delivery at the ACS. Third, ACS must be able to secure donations of time and money from its constituent base. Its success in this area is directly re-

lated to providing excellent information and service, as well as having an integrated view of its relationship with constituents. "To succeed, we need to understand the full extent of each constituent's relationship with us so we can determine where there might be opportunities to expand that relationship," Music said.

The ACS was experiencing many challenges with its current information. "Our call center agents did not know, for example, if a caller was both a donor and a volunteer, or if a caller was volunteering for the society in multiple ways," he said. "This splintered view made it challenging for American Cancer Society representatives to deliver personalized service and make informed recommendations regarding other opportunities within the society that might interest a caller."

The ACS chose to implement a customer relationship management solution to solve its information issues. Critical to the CRM system's success was consolidating information from various databases across the organization to provide a single view of constituents and all information required to serve them. After an evaluation process that included participation from individuals across the organization, the ACS chose Siebel Systems as its CRM solution provider. The society wanted to work with a company that could address both its immediate needs with a best-in-class e-business solution and its future requirements.

The Siebel Call Center is specifically designed for the next generation of contact centers, enabling organizations to provide world-class customer service, generate increased revenue, and create a closed-loop information flow seamlessly over multichannel sales, marketing, and customer service operations. Siebel Call Center empowers agents at every level by providing up-to-the-minute information and in-depth customer and product knowledge. This approach enables quick and accurate problem resolution and generates greater relationship opportunities. The ACS has received numerous benefits from the system including:

- Increased constituent satisfaction and loyalty by supporting personalized interactions between constituents and cancer information specialists.

- Improved productivity of cancer information specialists by consolidating all information required to serve constituents into a single view.

- Increased donations of time and money by helping call center agents identify callers who are likely to be interested in expanding their relationship with the ACS.[23]

Questions

1. How could the ACS's marketing department use operational CRM to strengthen its relationships with its cus-

tomers?

2. How could the ACS's customer service department use operational CRM to strengthen its relationships with its customers?

3. Review all of the operational CRM technologies and determine which one would add the greatest value to ACS's business.

4. Describe the benefits ACS could gain from using analytical CRM.

5. Summarize SRM and describe how ACS could use it to increase efficiency in its business.

CLOSING CASE TWO

Calling All Canadians

With multiple communication channels available and so many CRM failures, many companies are concluding that the best method for providing customer service is good old-fashioned customer service provided by a real live person. At the same time that companies consider outsourcing their customer service departments to other countries in order to save money, many worry about foreign accents as well as time-zone issues related to offshore outsourcing.

Canada has become one of the primary targets for outsourcing customer service centers by U.S. companies. Not only are accent and time-zone issues nonexistent, but companies also receive a favorable exchange rate. The Bank of Canada estimates that over the past five years, the currency exchange rate between the United States and Canada favors Americans by 44 percent. For every dollar an American business spends in Canada, it receives over a dollar and a half in goods and services.

Additional factors that make Canada even more attractive include a high Canadian unemployment rate estimated at 7.5 percent in 2003, while the U.S. unemployment rate was 5.9 percent. Canadians also have high education rates with 63 percent of Canadians over the age of 15 being high school graduates. The country's predominantly rural population and strong work ethic along with a declining industrial base have made call center outsourcing an attractive solution for Canada, too.

Canada has been a leader in the call center industry for over a decade. Since the early 1990s, "the Canadian call center industry has grown at an annual rate of 20 percent," according to Steve Demmings, president of Site Selection Canada of Winnipeg, Manitoba. Site Selection Canada promotes and assists site selection for American and Canadian firms. Demmings estimated there are 14,000 call centers in Canada with six or more agents employing 500,000

people, contributing about $36 billion (Canadian) in annual salaries.

In 1994, two Canadian provinces—Manitoba and New Brunswick—made a concerted effort to develop a local call center industry, recognizing the area's high unemployment with little native industry, Demmings said. The other provinces soon followed. Then the call center industry "made a big move" to bring educational institutions on board. "Many colleges have set up call center training programs," Demmings reported. The result has been an established industry with an excellent skilled labor pool. "American companies come up here to go shopping and we need to have the tableware on the table," Demmings said.

What is important to outsourcing buyers is that many Canadian call center customer service representatives have made it their career. Consequently, there is a much lower turnover rate for call centers than in the United States. Demmings reported the CSR turnover rate in the Province of Ontario was 18.3 percent last year. Compare that to the United States, where call center staffing can be a problem. Christopher Fletcher, vice president and research director of CRM for the Aberdeen Group, stated, "It is tough to find people to staff a call center. Turnover ranges from 25 percent to 50 percent annually or above. The skill sets of the people you have available are often equivalent to McDonald's."[24]

Questions

1. What are the two different types of CRM and how can they be used to help an organization gain a competitive advantage?

2. Explain how a contact center (or call center) can help an organization achieve its CRM goals.

3. Describe three ways an organization can perform CRM functions over the Internet.

4. How will outsourcing contact centers (call centers) to Canada change as future CRM technologies replace current CRM technologies?

CLOSING CASE THREE

The Ritz-Carlton—Specializing in Customers

Bill Kapner, CEO of financial software provider Bigdough, checked into the Ritz-Carlton in Palm Beach, Florida. Before introducing himself, he was greeted—by name—at the front desk. Then a reception clerk asked, "Will you be having sushi tonight?" The interesting thing about these conversations is that Kapner never mentioned his fondness for Japanese cuisine. "I was wowed," he said.

Ritz-Carlton is the only service company to have won the prestigious Malcolm Baldrige National Quality Award twice—in 1992 and 1999. Companies worldwide strive to be "the Ritz-Carlton" of their industries. In 2000, the company launched the Ritz-Carlton Leadership Center, where anyone can study the brand's cult of customer service for $2,000. The center has addressed topics such as "talent benchmarking" and "empowerment using customer recognition to boost loyalty" for more than 800 companies, including Starbucks, Microsoft, and Coca-Cola. The following six steps can be followed and implemented by any company to become the Ritz-Carlton of its industry:

1. **Make customer service an elite club.** Ritz-Carlton has devised a rigorous interview process to identify the positive team players who, according to in-house statistics, become top performers. Executives believe that the company is effective not only in picking great talent, but also in conveying the message that working at Ritz-Carlton is a privilege.

2. **Once you have the right people, indoctrinate them.** Ritz-Carlton spends about $5,000 to train each new hire. It begins with a two-day introduction to company values (it is all about the service) along with a 21-day course focused on job responsibilities, such as a bellman's 28 steps to greeting a guest: "A warm and sincere greeting. Use the guest's name, if and when possible." Tracy Butler Hamilton, a retired bond trader who has stayed at a Ritz-Carlton in Atlanta several times, recalls that the hotel's bartenders remembered not only her name, but also the name and favorite drink of her brother, who would sometimes visit. "He wasn't even staying at the hotel," Hamilton said.

3. **Treat staffers the way they should treat customers.** The Ritz-Carlton motto—"We are ladies and gentlemen serving ladies and gentlemen"—might sound corny, but it is taken seriously. The company celebrates not just employee birthdays, but also employment anniversaries. Regardless of position, every staff member can spend as much as $2,000 without management approval to resolve a guest's problem. Employees say the exemption lets them make a personal impact on a guest's experience, resulting in higher job satisfaction. The median annual nonmanagement turnover rate at luxury hotels is 44 percent; at Ritz-Carlton, it is only 25 percent.

4. **Offer "memorable" service.** "What others call complaints," said John Timmerman, vice president for quality and productivity, "we call opportunities." A tired euphemism elsewhere, the idea is truly embraced at Ritz-Carlton. In one case, an administrative assistant at Ritz-Carlton Philadelphia overheard a guest lamenting that he had forgotten to pack formal shoes and would have to wear hiking boots to an important meeting; early the next morning, she delivered to the awestruck man a new pair in his size and favorite color. (In a more intimate ex-

ample, a housekeeper recently traded shoes with a woman who needed a different pair.)

5. **Talk about values and stoke enthusiasm.** Every day at the chain's 57 hotels, all 25,000 Ritz-Carlton employees participate in a 15-minute "lineup" to talk about one of the basics. The ritual makes Ritz-Carlton one of the few large companies that set aside time for a daily discussion of core values.

6. **Eschew technology, except where it improves service.** Other hotels may be experimenting with automated check-in kiosks, but not Ritz-Carlton. "Not in a million years," said Vivian Deuschl, the company's vice president for public relations. "We will not replace human service with machines." But porters and doormen wear headsets, so when they spot your name on luggage tags, they can radio the information to the front desk. In addition, an in-house database called the Customer Loyalty Anticipation Satisfaction System stores guest preferences, such as whether an individual likes Seagram's ginger ale or Canada Dry. The software also alerts front-desk clerks when a guest who has stayed at other Ritz-Carltons has a habit of inquiring about the best sushi in town.[25]

Questions

1. What are the two different types of CRM and how has the Ritz-Carlton used them to become a world-class customer-service business?

2. Which of the Ritz-Carlton six steps of customer service is the most important for its business?

3. Rank the Ritz-Carlton's six steps of customer service in order of greatest to least importance in a CRM strategy for an online bookselling business such as Amazon.com.

4. Describe three ways the Ritz-Carlton can extend its customer reach by performing CRM functions over the Internet.

5. What benefits could the Ritz-Carlton gain from using analytical CRM?

6. Explain ERM and describe how the Ritz-Carlton could use it to increase efficiency in its business.

MAKING BUSINESS DECISIONS

1. Customer relationship management strategies

On average, it costs an organization six times more to sell to a new customer than to sell to an existing customer. As the co-owner of a medium-sized luggage distributor, you have recently been notified that sales for the past three months have decreased by an average of 17 percent. The reasons for the decline in sales are numerous, in-

cluding a poor economy, people's aversion to travel because of the terrorist attacks, and some negative publicity your company received regarding a defective product line. In a group, explain how implementing a CRM system can help you understand and combat the decline in sales. Be sure to justify why a CRM system is important to your business and its future growth.

2. Comparing CRM vendors

As a team, search the Internet for at least one recent and authoritative article that compares or ranks customer relationship management systems. Select two packages from the list and compare their functions and features as described in the article(s) you found as well as on each company's Web site. Find references in the literature where companies that are using each package have reported their experiences, both good and bad. Draw on any other comparisons you can find. Prepare a presentation for delivery in class on the strengths and weaknesses of each package, which one you favor, and why.

3. Searching for employee loyalty

You are the CEO of Razz, a start-up Web-based search company, which is planning to compete directly with Google. The company had an exceptional first year and is currently receiving over 500,000 hits a day from customers all over the world. You have hired 250 people in the last four months, doubling the size of your organization. With so many new employees starting so quickly you are concerned about how your company's culture will evolve and whether your employees are receiving enough attention. You are already familiar with customer relationship management and how CRM systems can help an organization create strong customer relationships. However, you are unfamiliar with employee relationship management and you are wondering what ERM systems might be able to offer your employees and your company. Research the Web, create a report detailing features and functions of ERM systems, and determine what value will be added to your organization if you decide to implement an ERM solution.

4. Employee relationship management

All new employees at the Shinaberry Inn & Spa wear bathing suits during orientation to experience the spa's exfoliating showers and hot mineral baths. At the Shinaberry San Francisco, new employees get the same penthouse champagne toast the hotel uses to woo meeting planners. And at many properties, employees arriving for their first day have their cars parked by the valet or get vouchers for a free night's stay. This innovative orientation program, which lets employees experience what guests experience began two years ago after focus groups

pointed to empathy as a service differentiator. As a result, the company added empathy to the attributes for which it screens and a training program that involves listening to recorded guest phone calls. Even its discounted employee travel program gives employees yet another way to understand the guest experience. Design an ERM system that would help Shinaberry further its employee-centered culture. The ERM system must consider all employee needs.

5. Increasing revenues with CRM

Cold Cream is one of the premier beauty supply stores in the metro New York area. People come from all over to sample the store's unique creams, lotions, makeup, and perfumes. The store is four stories high with each department located on a separate floor. The company would like to implement a CRM system to help it better understand its customers and their purchasing habits. Create a report summarizing CRM systems and detail how such a system can directly influence Cold Cream's revenues.

6. Driving Up Profits with Successful Campaigns (or Driving Down?)

The Butterfly Café is a local hotspot located in downtown San Francisco and offers specialty coffee, teas, and organic fruits and vegetables. The café holds a number of events to attract customers such as live music venues, poetry readings, book clubs, charity events, and local artist's night. A listing of all participants attending each event is tracked in the café's database. The café uses the information for marketing campaigns and offers customers who attend multiple events additional discounts. A marketing database company, InTheKnow.com, has offered to pay The Butterfly Café a substantial amount of money for access to its customer database, which it will then sell to other local businesses. The owner of the Butterfly Café, Mary Conzachi, has come to you for advice. Mary is not sure if her customers would appreciate her selling their personal information and how it might affect her business. However, the amount of money InTheKnow.com is offering is enough to finance her much needed new patio for the back of the café. InTheKnow.com has promised Mary that the sale will be completely confidential. What should Mary do?

7. Supporting Customers

Creative.com is an e-business that sells craft materials and supplies over the Internet. You have just started as the vice president of customer service, and you have a team of 45 customer service representatives. Currently, the only form of customer service is the 1-800 number and the company is receiving a tremendous number of calls regarding products, orders, and shipping information. The average wait time for a customer to speak to a cus-

tomer service representative is 35 minutes. Orders are being cancelled and Creative.com is losing business due to its lack of customer service. Create a strategy to revamp the customer service center at Creative.com and get the company back on track.

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CHAPTER 10

Enterprise Resource Planning and Collaboration Systems

CHAPTER OUTLINE

SECTION 10.1

Enterprise Resource Planning

SECTION 10.2

Collaboration Systems

opening case study

Campus ERP

When Stefanie Fillers returned to college she needed to log in to the school's new online registration system to make certain that the courses she was taking would allow her to graduate. She also wanted to waive her participation in her college's health insurance plan. When the system crashed the day before classes began, Fillers, a senior, was annoyed. But at least she knew where her classes were—unlike most first-year students.

Several colleges around the country have experienced problems with nonfunctioning Web portals that prevented students from finding out where their classes were. At one college, financial aid was denied to 3,000 students by a buggy new ERP system, even though they had already received loan commitments. The college provided short-term loans for the cash-strapped students while the IT department and financial aid administrators scrambled to fix the complex system.

Disastrous ERP implementations have given more than a few colleges' black eyes. These recent campus meltdowns illustrate how the growing reliance on expensive ERP systems has created nightmare scenarios for some colleges. In every case, the new systems were designed to centralize business processes in what historically has been a hodgepodge of discrete legacy systems. College administrators are drawn to ERP systems offering integrated views of finance, HR, student records, financial aid, and more.

ERP implementations are difficult, even in very top-down corporate environments. Getting them to work in colleges, which are essentially a conglomeration of decentralized fiefdoms, has been nearly impossible. Staff members in the largely autonomous departments do not like the one-size-fits-all strategy of an ERP implementation. Plus, these nonprofit organizations generally lack the talent and financial resources to create and manage a robust enterprise system. Representatives from Oracle, which dominates the higher education market for ERP, say that much of the problem results from the inexperience of college IT departments and their tendency to rush implementations and inadequately test the new systems.

Standardizing at Stanford

Stanford University bought into the late 1990s enterprise software pitch and never slowed down its implementation engine. "In hindsight, we tried to do too much in too little time," said Randy Livingston, Stanford's vice president of business affairs and CFO.

Starting in 2001, Stanford implemented student administration systems, PeopleSoft HR, Oracle financials, and several other ancillary applications. Years later, users still complain that they have lower productivity with the new systems than with the previous ones, which were supported by a highly customized mainframe. Users also have had difficulty accessing critical information on a timely basis. Livingston said many transactions, such as initiating a purchase requisition or requesting a reimbursement, now take longer for users than with the prior legacy system.

Stanford has also not realized any of the projected savings the vendors promised. "We are finding that the new ERP applications cost considerably more to support than our legacy applications," Livingston said. He does not know how much it will cost to get the enterprise systems working at acceptable user levels.

Stanford's IT department is still trying to get campuswide buy-in for the enterprise applications, which have necessitated new ways of doing business, which leads to nonuse of the new systems and costly customizations to keep all users satisfied. For example, Stanford's law school operates on a semester schedule, while the other six schools operate on a trimester schedule. "This means that every aspect of the student administration system needs to be configured differently for the law school," Livingston said. Within the schools, some faculty members are paid a 12-month salary; other schools pay by 9 months, 10 months, or 11 months. "The standard HR payroll system is not designed to handle all these unusual pay schedules," Livingston said.

To resolve the issues, Livingston has reorganized the IT department, which he hopes will be better able to manage the enterprise projects going forward. He also created a separate administrative systems group that reports directly to him, with responsibility for development, integration, and support of the major ERP systems.

The hurdles Stanford and other colleges face with ERP systems are largely cultural ones. For instance, lean staffs and tight budgets at most university campuses usually lead to a lack of proper training and systems testing. At Stanford, plenty of training was offered, but many users did not take it, Livingston said. He has set up new training programs, including a group of trainers who sit side by side with users to help them learn how to do complex tasks; periodic user group meetings; Web site and e-mail lists that offer more help; and expert users embedded in the various departments who aid their colleagues.

Stanford's IT was still struggling with integrating the enterprise systems when the newly launched People-Soft Web portal (called Axess) crashed in 2004. Axess could not handle the load of all the returning students trying to log in to the untested Web-based system at the same time, Livingston said. Stanford was able to fix those problems relatively quickly, but Livingston and his staff continue to struggle with the enterprise projects. The university's departments remain "highly suspicious and resistant" of his efforts to standardize and centralize business processes, Livingston said.[1]

INTRODUCTION

Enterprise resource planning (ERP) integrates all departments and functions throughout an organization into a single IT system (or integrated set of IT systems) so that employees can make decisions by viewing enterprisewide information on all business operations.

SAP, the leading ERP vendor, boasts 20,000 installations and 10 million users worldwide. These figures represent only 30 percent of the overall ERP market. Figure 10.1 highlights a few reasons ERP solutions have proven to be such a powerful force.

ERP as a business concept resounds as a powerful internal information management nirvana: Everyone involved in sourcing, producing, and delivering the company's product works with the same information, which eliminates redundancies, reduces wasted time, and removes misinformation.

section 10.1 ENTERPRISE RESOURCE PLANNING

LEARNING OUTCOMES

10.1 Compare core enterprise resource planning components and extended enterprise resource planning components.

10.2 Describe the three primary components found in core enterprise resource planning systems.

10.3 Describe the four primary components found in extended enterprise resource planning systems.

10.4 Explain the business value of integrating supply chain management, customer relationship management, and enterprise resource planning systems.

ENTERPRISE RESOURCE PLANNING

Turner Industries grew from $300 million in sales to $800 million in sales in less than 10 years thanks to the implementation of an ERP system. Ranked number 369 on the Forbes 500 list of privately held companies, Turner Indus-

tries is a leading industrial services firm. Turner Industries develops and deploys advanced software applications designed to maximize the productivity of its 25,000 employees and construction equipment valued at more than $100 million.

The company considers the biggest challenges in the industrial services industry to be completing projects on time, within budget, while fulfilling customers' expectations. To meet these challenges the company invested in an ERP system and named the project Interplan. Interplan won Constructech's Vision award for software innovation in the heavy construction industry. Interplan runs all of Turner's construction, turnaround, shutdown, and maintenance projects and is so adept at estimating and planning jobs that Turner Industries typically achieves higher profit margins on projects that use Interplan. As the ERP solution makes the company more profitable, the company can pass on the cost savings to its customers, giving the company an incredible competitive advantage.[2]

FIGURE 10.1

Reasons ERP Systems Are Powerful Organizational Tools

Reasons ERP Systems Are Powerful Organizational Tools
ERP is a logical solution to the mess of incompatible applications that had sprung up in most businesses.
ERP addresses the need for global information sharing and reporting.
ERP is used to avoid the pain and expense of fixing legacy systems.

A common problem facing organizations is maintaining consistency across its business operations. If a single department, such as sales, decides to implement a new system without considering the other departments, it can cause inconsistencies throughout the company. A common problem occurs when one system saves (or fails to save) information that is not in other company systems. For example, a new sales system does not have a field to save e-mail addresses and the rest of the company's systems save e-mail addresses. Not all applications are built to talk to each other and if sales suddenly implements a new system that marketing and production cannot use or is inconsistent in the way it handles information, the company becomes siloed in its operations.

Enterprise resource planning systems provide organizations with consistency. An ERP system provides a method for the effective planning and controlling of all the resources required to take, make, ship, and account for customer orders in a manufacturing, distribution, or service organization. The key word in enterprise resource planning is *enterprise.*

Los Angeles is a city of 3.5 million, with 44,000 city employees, and a budget of $4 billion. Yet a few years ago

each of the departments conducted its own purchasing. That meant 2,000 people in 600 city buildings and 60 warehouses ordering material. Some 120,000 purchase orders (POs) and 50,000 checks per year went to more than 7,000 vendors. Inefficiency was rampant.

"There was a lack of financial responsibility in the old system, and people could run up unauthorized expenditures," said Bob Jensen, the city's ERP project manager. Each department maintained its own inventories on different systems. Expense-item mismatches piled up. One department purchased one way, others preferred a different approach. Their mainframe-based systems were isolated. The city chose an ERP system as part of a $22 million project to integrate purchasing and financial reporting across the entire city. The project resulted in cutting the check-processing staff in half, processing POs faster than ever, reducing the number of workers in warehousing by 40 positions, decreasing inventories from $50 million to $15 million, and providing a single point of contact for each vendor. In addition, $5 million a year has been saved in contract consolidation.[3]

CORE AND EXTENDED ERP COMPONENTS

Figure 10.2 provides an example of an ERP system with its core and extended components. *Core ERP components* are the traditional components included in most ERP systems and they primarily focus on internal operations. *Extended ERP components* are the extra components that meet the organizational needs not covered by the core components and primarily focus on external operations.

CORE ERP COMPONENTS

The three most common core ERP components focusing on internal operations are:

1. Accounting and finance.
2. Production and materials management.
3. Human resources.

Accounting and Finance ERP Components

Deeley Harley-Davidson Canada, the exclusive Canadian distributor of Harley- Davidson motorcycles, has improved inventory, turnaround time, margins, and customer satisfaction—all with the implementation of a financial ERP system. The system has opened up the power of information to the company and is helping it make strategic decisions when it still has the time to change things. The ERP system provides the company with ways to manage inventory, turnaround time, and utilize warehouse space more effectively.[4]

FIGURE 10.2

Core ERP Components and Extended ERP Components

Accounting and finance ERP components manage accounting data and financial processes within the enterprise with functions such as general ledger, accounts payable, accounts receivable, budgeting, and asset management. One of the most useful features included in an ERP accounting/finance component is its credit-management feature. Most organizations manage their relationships with customers by setting credit limits, or a limit on how much a customer can owe at any one time. The company then monitors the credit limit whenever the customer places a new order or sends in a payment. ERP financial systems help to correlate customer orders with customer account balances determining credit availability. Another great feature is the ability to perform product profitability analysis. ERP financial components are the backbone behind product profitability analysis and allow companies to perform all types of advanced profitability modeling techniques.

Production and Materials Management ERP Components

One of the main functions of an ERP system is streamlining the production planning process. *Production and materials management ERP components* handle the various aspects of production planning and execution such as demand forecasting, production scheduling, job cost accounting, and quality control. Companies typically produce multiple products, each of which has many different parts. Production lines, consisting of machines and employees, build the different types of products. The company must then define sales forecasting for each product to determine production schedules and materials purchasing. Figure 10.3 displays the typical ERP production planning process. The process begins with forecasting sales in order to plan operations. A detailed production schedule is developed if the product is produced, and a materials requirement plan is completed if the product is purchased.

FIGURE 10.3

The Production Planning Process

Grupo Farmanova Intermed, located in Costa Rica, is a pharmaceutical marketing and distribution company that markets nearly 2,500 products to about 500 customers in Central and South America. The company identified a need for software that could unify product logistics management in a single country. It decided to deploy PeopleSoft financial and distribution ERP components allowing the company to improve customer data management, increase confidence among internal and external users, and coordinate the logistics of inventory. With the new software the company enhanced its capabilities for handling, distributing, and marketing its pharmaceuticals.[5]

Human Resources ERP Components

Human resources ERP components track employee information including payroll, benefits, compensation, and performance assessment, and assure compliance with the legal requirements of multiple jurisdictions and tax authorities. Human resources components even offer features that allow the organization to perform detailed analysis on its employees to determine such things as the identification of individuals who are likely to leave the company unless additional compensation or benefits are provided. These components can also identify which employees are using which resources, such as online training and long-distance telephone services. They can also help determine whether the most talented people are working for those business units with the highest priority—or where they would have the greatest impact on profit.

EXTENDED ERP COMPONENTS

Extended ERP components are the extra components that meet the organizational needs not covered by the core components and primarily focus on external operations. Many of the numerous extended ERP components are Internet-enabled and require interaction with customers, suppliers, and business partners outside the organization. The four most common extended ERP components are:

1. Business intelligence.

2. Customer relationship management.

3. Supply chain management.

4. E-business.

Business Intelligence Components

ERP systems offer powerful tools that measure and control organizational operations. Many organizations have found that these valuable tools can be enhanced to provide even greater value through the addition of powerful business intelligence systems. *Business intelligence* describes information that people use to support their decision-making efforts. The business intelligence components of ERP systems typically collect information used throughout the organization (including data used in many other ERP components), organize it, and apply analytical tools to assist managers with decisions. Data warehouses are one of the most popular extensions to ERP systems, with over two-thirds of U.S. manufacturers adopting or planning such systems.[6]

Customer Relationship Management Components

ERP vendors are expanding their functionality to provide services formerly supplied by customer relationship management (CRM) vendors such as PeopleSoft and Siebel. ***Customer relationship management (CRM)*** involves managing all aspects of a customer's relationship with an organization to increase customer loyalty and retention and an organization's profitability. CRM components provide an integrated view of customer data and interactions allowing organizations to work more effectively with customers and be more responsive to their needs. CRM components typically include contact centers, sales force automation, and marketing functions. These improve the customer experience while identifying a company's most (and least) valuable customers for better allocation of resources.

Supply Chain Management Components

ERP vendors are expanding their functionality to provide services formerly supplied by supply chain management vendors such as i2 Technologies and Manugistics. ***Supply chain management (SCM)*** involves the management of information flows between and among stages in a supply chain to maximize total supply chain effectiveness and profitability. SCM components help an organization plan, schedule, control, and optimize the supply chain from its acquisition of raw materials to the receipt of finished goods by customers.

E-Business Components

The original focus of ERP systems was the internal organization. In other words, ERP systems are not fundamentally ready for the external world of e-business. The newest and most exciting extended ERP components are the e-business components. ***E-business*** means conducting business on the Internet, not only buying and selling, but also serving customers and collaborating with business partners. Two of the primary features of e-business components are e-logistics and e-procurement. ***E-logistics*** manages the transportation and storage of goods. ***E-procurement*** is the business-to-business (B2B) purchase and sale of supplies and services over the Internet.

E-business and ERP complement each other by allowing companies to establish a Web presence and fulfill orders expeditiously. A common mistake made by many businesses is deploying a Web presence before the integration of back-office systems or an ERP system. For example, one large toy manufacturer announced less than a week before Christmas that it would be unable to fulfill any of its Web orders. The company had all the toys in the warehouse, but it could not organize the basic order processing function to get the toys delivered to the consumers on time.

Customers and suppliers are now demanding access to ERP information including order status, inventory levels, and invoice reconciliation. Plus, the customers and partners want all this information in a simplified format available

through a Web site. This is a difficult task to accomplish because most ERP systems are full of technical jargon, which is why employee training is one of the hidden costs associated with ERP implementations. Removing the jargon to accommodate untrained customers and partners is one of the more difficult tasks when Web-enabling an ERP system. To accommodate the growing needs of the e-business world, ERP vendors need to build two new channels of access into the ERP system information—one channel for customers (B2C) and one channel for businesses, suppliers, and partners (B2B).[7]

ERP VENDOR OVERVIEW

Companies that are successful in the digital economy understand that current business designs and models are insufficient to meet the challenges of doing business in the e-business era. A close look at such leading companies as Amazon.com, Dell, and Cisco will provide insight into a new kind of business model that focuses on having a finely tuned integration of business, technology, and process. These companies frequently use technology to streamline supply chain operations, improve customer loyalty, gain visibility into enterprisewide information, and ultimately drive profit growth. To thrive in the e-business world, organizations must structurally transform their internal architectures. They must integrate their disparate systems into a potent e-business infrastructure.

Applications such as SCM, CRM, and ERP are the backbone of e-business. Integration of these applications is the key to success for many companies. Integration allows the unlocking of information to make it available to any user, anywhere, anytime. Figure 10.4 displays the top three ERP vendors until December 2004 when Oracle bought PeopleSoft for $10 billion, after a takeover battle that lasted for 18 months. Figure 10.5 displays the new vendor overview.

The vendors highlighted in Figure 10.5 offer CRM and SCM modules. However, these modules are not as functional or flexible as the modules offered by industry leaders of SCM and CRM such as Siebel and i2 technologies, as depicted in Figure 10.6 and Figure 10.7. As a result, organizations face the challenge of integrating their new e-business systems with their preexisting applications and other vendor products.

FIGURE 10.4

ERP Vendor Overview (before December 31, 2004)

	Vendor		
Component	**PeopleSoft**	**Oracle**	**SAP**

Customer relationship management	X		X
Supply chain management	X	X	X
Financial management	X	X	X
Human resource management	X	X	X
Service automation	X		
Supplier relationship management	X		X
Enterprise performance management	X		
Business intelligence		X	
Learning management		X	
Order management		X	
Manufacturing		X	
Marketing		X	
Sales		X	

FIGURE 10.5

ERP Vendor Overview (after December 31, 2004)

	Vendor	
Component	Oracle	SAP
Customer relationship management	X	X
Supply chain management	X	X
Financial management	X	X
Human resource management	X	X
Service automation	X	
Supplier relationship management	X	X
Enterprise performance management	X	
Business intelligence	X	
Learning management	X	

Order management	X	
Manufacturing	X	
Marketing	X	
Sales	X	

FIGURE 10.6

SCM Market Overview

FIGURE 10.7

CRM Market Overview

ERP SOFTWARE

There are many different ERP vendors on the market today, each offering different ERP solutions. The core ERP functions for each vendor are the same and focus on financial, accounting, sales, marketing, human resource, operations, and logistics. ERP vendors differentiate themselves by offering unique functionality such as CRM and SCM systems.

Many customers find that their chosen ERP solution does not meet their expectations. Despite many improvements in the software, the industry itself is well aware that failed ERP implementations are still far too common. According to Gartner Research, the average failure rate for an ERP project is 66 percent. It is no wonder that some manufacturers view ERP as a necessary, strategic evil. The key word here though is *necessary*.

Many companies strive to make good financial decisions by making smart investments. The best way to ensure a good investment in ERP is to understand why failure occurs and how to avoid it. The first challenge is that ERP is a product that comes in many flavors. Its main purpose is to provide support and automation to a business process. The business world has many different business models, and there are just as many ERP products available that serve them.

Finding the Right ERP Solution

A good ERP system will be highly reflective of the business process in place at the company. This means that the software must perform many different tasks and that makes it complex. Most companies do not carry a high degree of ERP software expertise on their staff and do not understand ERP to the degree they should, and this makes it easy to choose the wrong package. The key to making an effective purchase is to have solid business processes. Success-

ful ERP projects share three basic attributes:

1. Overall fit.

2. Proper business analysis.

3. Solid implementation plans.[8]

Overall Fit This refers to the degree of gaps that exist between the system and the business process. A well-fitting ERP has no major process gaps and very few minor ones. Think of a new ERP system as a suit. Typically, a customer buys a suit three ways:

1. Off the rack.

2. Off the rack and tailor it to fit.

3. Custom made.

The way the solution fits the business process will normally determine the satisfaction level of the client. Buying ERP off the rack is the equivalent of buying a canned software package. It fits some well, but some not at all. That is why a customer can tailor a suit so that it fits better. Modifications can be made to the software so that its processes line up better with the company processes. This is a good strategy, provided the chosen package supports this. The downside is that it can get very expensive. Finally, the custom system can provide a great fit, but the company must thoroughly understand what it is doing and be able to support the heavy financial burden associated with a custom-build.

Proper Business Analysis The best way to determine which fit strategy is right is to conduct a thorough business analysis. Successful companies normally spend up to 10 percent of the project budget on a business analysis. A proper analysis must result in a documented list of the business processes at work within the company. This will provide a basic tool that can measure vendor capability.

Solid Implementation Plans Like the installation of any successful process or piece of machinery, a plan is needed to monitor the quality objectives and timelines. It will also employ processes like workflow analysis and job combination to harvest savings.

A thorough implementation will transfer knowledge to the system users. When the project is complete the users of the new system must be capable of using the tools it provides. The users must also know what to do in cases when the process fluctuates. The majority of failed systems are the result of poor-quality implementation. It is important to remember that ERP is simply a tool. Tools that people do not know how to use can be as useless as having no tools

at all.

ERP BENEFITS AND RISKS (COST)

There is no guarantee of success for an ERP system. ERPs focus on how a corporation operates internally, and optimizing these operations takes significant time and energy. According to Meta Group, it takes the average company 8 to 18 months to see any benefits from an ERP system. The good news is that the average savings from new ERP systems are $1.6 million per year. Figure 10.8 displays a list of the five most common benefits an organization can expect to achieve from a successful ERP implementation.[9]

Along with understanding the benefits an organization can gain from an ERP system, it is just as important to understand the primary risk associated with an ERP implementation—cost. ERP systems do not come cheap. Meta Group studied total cost of ownership (TCO) for an ERP system. The study included hardware, software, professional services, and internal staff costs. Sixty-three companies were surveyed ranging in size from small to large over a variety of industries. The average TCO was $15 million (highest $300 million and lowest $400,000). The price tag for an ERP system can easily start in the multiple millions of dollars and implementation can take an average of 23 months. Figure 10.9 displays a few of the costs associated with an ERP system.

THE CONNECTED CORPORATION—INTEGRATING SCM, CRM, AND ERP

Most organizations today have no choice but to piece their applications together since no one vendor can respond to every organizational need; hence, customers purchase applications from multiple vendors. As a result, large companies usually have multiple applications that are not designed to work together, and find themselves having to integrate business solutions. For example, a single organization might choose its CRM components from Siebel, SCM components from i2, financial components and human resources components from Oracle. Figure 10.10 displays the general audience and purpose for each of the applications that have to be integrated.

FIGURE 10.8

Common Benefits Received from ERP Systems

Common ERP Benefits
1. Integrate financial information: To understand an organization's overall performance, managers must have a single financial view.
2. Integrate customer order information: With all customer order information in a single systemit is

easier to coordinate manufacturing, inventory, and shipping to send a common message tocustomers regarding order status.
3. Standardize and speed up manufacturing processes: ERP systems provide standard methodsfor manufacturing companies to use when automating steps in the manufacturing process.Standardizing manufacturing processes across an organization saves time, increasesproduction, and reduces head count.
4. Reduce inventory: With improved visibility in the order fulfillment process, an organization can reduce inventories and streamline deliveries to its customers.
5. Standardize human resource information: ERPs provide a unified method for tracking employees' time, as well as communicating HR benefits and services.

FIGURE 10.9

Associated ERP Risk (Cost)

Associated ERP Risk (Cost)
Software cost: Purchasing the software.
Consulting fees: Hiring external experts to help implement the system correctly.
Process rework: Redefining processes in order to ensure the company is using the most efficient and effective processes.
Customization: If the software package does not meet all of the company's needs, it may be required to customize the software.
Integration and testing: Ensuring all software products, including disparate systems not part of the ERP system, are working together or are integrated. Testing the ERP system includes testing all integrations.
Training: Training all new users.

> **Data warehouse integration and data conversion:** Moving data from an old system into the new ERP system.

FIGURE 10.10

Primary Users and Business Benefits of Strategic Initiatives

Effectively managing the transformation to an integrated enterprise will be critical to the success of the 21st century organization. The key to an integrated enterprise is the integration of the disparate IT applications. An integrated enterprise infuses support areas, such as finance and human resources, with a strong customer orientation. Integrations are achieved using *middleware*—several different types of software that sit in the middle of and provide connectivity between two or more software applications. Middleware translates information between disparate systems. *Enterprise application integration (EAI) middleware* represents a new approach to middleware by packaging together commonly used functionality, such as providing prebuilt links to popular enterprise applications, which reduces the time necessary to develop solutions that integrate applications from multiple vendors. A few leading vendors of EAI middleware include Active Software, Vitria Technology, and Extricity.

FIGURE 10.11

Integration between SCM, CRM, and ERP Applications

Figure 10.11 displays the data points where these applications integrate and illustrates the underlying premise of e-business architecture infrastructure design: Companies run on interdependent applications. If one application of the company does not function well, the entire customer value delivery system is affected. The world-class enterprises of tomorrow must be built on the foundation of world-class applications implemented today.

The heart of an ERP system is a central database that collects information from and feeds information into all the ERP system's individual application components (called modules), supporting diverse business functions such as accounting, manufacturing, marketing, and human resources. When a user enters or updates information in one module, it is immediately and automatically updated throughout the entire system, as illustrated in Figure 10.12.

FIGURE 10.12

ERP Integration Flow

FIGURE 10.13

ERP Process Flow

ERP automates business processes such as order fulfillment—taking an order from a customer, shipping the purchase, and then billing for it. With an ERP system, when a customer service representative takes an order from a customer, he or she has all the information necessary to complete the order (the customer's credit rating and order history, the company's inventory levels, and the delivery schedule). Everyone else in the company sees the same information and has access to the database that holds the customer's new order. When one department finishes with the order, it is automatically routed via the ERP system to the next department. To find out where the order is at any point, a user need only log in to the ERP system and track it down, as illustrated in Figure 10.13. The order process moves like a bolt of lightning through the organization, and customers get their orders faster and with fewer errors than ever before. ERP can apply that same magic to the other major business processes, such as employee benefits or financial reporting.

To qualify as a true ERP solution, the system not only must integrate various organization processes, but also must be:

- **Flexible**—An ERP system should be flexible in order to respond to the changing needs of an enterprise.

- **Modular and open**—An ERP system has to have an open system architecture, meaning that any module can be interfaced with or detached whenever required without affecting the other modules. The system should support multiple hardware platforms for organizations that have a heterogeneous collection of systems. It must also support third-party add-on components.

- **Comprehensive**—An ERP system should be able to support a variety of organizational functions and must be suitable for a wide range of business organizations.

- **Beyond the company**—An ERP system must not be confined to organizational boundaries but rather support online connectivity to business partners or customers.

Companies are expecting e-business to increase profitability, create competitive differentiation, and support innovative business practices. To achieve these goals, companies must evolve through distinct stages, from integrated processes to truly synchronized inter-enterprise communities. Getting e-business applications based on different technologies and with differing business models and data models to work together is a key issue for 21st century organizations.

THE FUTURE OF ERP

ERP places new demands not only on support and delivery information technology, but also on the way business

processes have to be designed, implemented, monitored, and maintained. For example, several persons in different locations and with different hardware and software resources may simultaneously initiate a purchase process for the same product but with different selection criteria. Reliability, efficiency, and scalability are among the features that have to be embedded in e-business processes in ERP systems. Despite the rapid growth in the number of ERP installations, conducting ERP operations is still challenging.

Understanding the many different types of core and extended ERP components can help an organization determine which components will add the most value. The two biggest vendors in the ERP market are Oracle (which purchased PeopleSoft in 2004) and SAP. Figure 10.14 is an overview of a few of the components offered by each ERP vendor.

FIGURE 10.14

ERP Vendor Components

	PeopleSoft (Purchased by Oracle)
Component	**Description**
Application Integration	Integrate PeopleSoft and non-PeopleSoft applications at all levels with Portal Solutions, AppConnect, and Data Warehousing and Analytic Solutions.
Customer Relationship Management	Get immediate, seamless integration among customer, financial, supply chain, and employeemanagement systems.
Enterprise Performance Management	Enable customers, suppliers, and employees to connect to set goals, develop plans, and measure progress with our integrated, scalable applications.
Financial Management	Get the power to compete in the business world with a comprehensive suite of pure Internet financial applications.
Human Capital Management (including Human Resources Management Solutions)	Manage and mobilize a unified, global workforce, and align workforce contribution with business objectives.
Service Automation	Optimize project investments, reduce project delivery costs, and maxi-

	mize resources to increaseutilization and value to your organization.
Supplier RelationshipManagement	Manage all aspects of supplier relationships including indirect and direct goods, as well as services procurement.
Supply Chain Management	Take advantage of solutions that promote business-to-business interaction throughout the supply chain, from customer to supplier.
	Oracle
Component	**Description**
Oracle Financials	Financial applications manage the flow of cash and assets into, out of, and within your enterprise: tracking thousands of transactions, setting fiscal goals for various departments, and allowing youto project future financial health as you record today's profits.
Oracle Human Resources Management	Oracle Human Resources Management System (HRMS) empowers businesses with the tools to find, extract, and analyze data related to human capital. This intelligence readies a company to rapidlydeploy the best resources for maximum employee productivity, satisfaction, and retention.
Oracle Intelligence	Oracle Daily Business Intelligence accesses and shares unified information and analysis across theenterprise with a single definition of customers, suppliers, employees, and products.
Oracle LearningManagement	Oracle Learning Management (Oracle iLearning, Oracle Training Management, and Oracle Human Resources Management System) provides a complete infrastructure that lets organizations manage, deliver, and track training, in both online and classroom environments.
Oracle Supply Chain Management	Oracle Supply Chain Management lets organizations gain global visibility, automate internal processes, and readily collaborate with suppliers, customers, and partners.
Oracle Manufacturing	Oracle Manufacturing optimizes production capacity beginning with

	raw materials through final products.
Oracle Order Management	Oracle's support of the complete fulfillment process from order to cash.
Oracle Marketing	Oracle Marketing drives profit by intelligently marketing to the most profitable customers. By leveraging a single repository of customer information, marketing professionals can better target and personalize their campaigns, and refine them in real time with powerful analytical tools.
Oracle Projects	To consistently deliver on time and on budget, an organization must fine-tune execution, align globalorganization with projects, and assign the right resources to the most important initiatives at the right time.
Oracle Sales	Oracle Sales allows an organization to learn more about its entire business to identify and targetprofitable opportunities.
	SAP
Component	**Description**
mySAP™ CustomerRelationship Management	The fully integrated CRM solution that facilitates world-class service across all customer touchpoints.
mySAP™ Financials	The leading solution for operational, analytical, and collaborative financial management.
mySAP™ Human Resources (mySAP HR)	The HR resource that helps more than 7,800 organizations worldwide maximize their return on capital.
mySAP™ Marketplace	An online marketplace solution that allows your company to buy, sell, and conduct business aroundthe clock and around the world.
mySAP™ Product Lifecycle Management	The collaborative solution that helps designers, engineers, and suppliers achieve new levels of innovation.
mySAP™ Supplier Relationship Management	Covers the full supply cycle—from strategic sourcing for lower costs to faster process cycles.
mySAP™ Supply Chain Management	Gives an organization the power to dramatically improve its planning,

	responsiveness, and execution.suppliers, customers, and partners.

In the future, the line between ERP, SCM, and CRM will continue to blur as ERP vendors broaden the functionality of their product suites and redefine the packaging of their products. ERP vendors with comprehensive but modular components will dominate the next high-growth phase of the enterprise applications market. Since core functionality is virtually the same for all vendors, a vendor's success will primarily depend upon how quickly it incorporates other kinds of functionality such as the Internet, interface, and wireless technology.

Internet

The adoption of the Internet is one of the single most important forces reshaping the architecture and functionality of ERP systems and is responsible for the most important new developments in ERP. The Internet serves as a basis for extending ERP's traditional vision of integrating data and processes across an organization's functional departments to include sharing data and processes among multiple enterprises.

Interface

Most ERP suites offer a customizable browser that allows each employee to configure his or her own view of the system. A manager can also customize each employee's views of the system. This feature allows managers to control access to highly sensitive information such as payroll and performance appraisals. The same customizable browser will be used in the future to allow customers and partners to see only select ERP information via the Internet.

Wireless Technology

Wireless technologies provide a means for users with handheld devices, such as PDAs and Web-enabled telephones, to connect to and interact with ERP systems. Most large ERP vendors will acquire smaller companies that specialize in wireless access. If they fail to do so, they will need to develop their own expertise in this area to build wireless access packages.

Wireless technologies will enable users to carry out the same transactions from their mobile devices as they used to do from any fixed device. Being able to buy and sell goods and services over mobile devices is an important step toward achieving the anywhere-anytime paradigm. In the future, location and time will no longer constrain organizations from completing their operations.

OPENING CASE QUESTIONS

Campus ERP

1. How could core ERP components help improve business operations at your college?

2. How could extended ERP components help improve business operations at your college?

3. How can integrating SCM, CRM, and ERP help improve business operations at your college?

4. Review the different components in Figure 10.14. Which component would you recommend your college implement if it decided to purchase an ERP component?

section 10.2   COLLABORATION SYSTEMS

LEARNING OUTCOMES

10.5.   Identify the different ways in which companies collaborate using technology.

10.6.   Compare the different categories of collaboration technologies.

10.7.   Define the fundamental concepts of a knowledge management system.

10.8.   Provide an example of a content management system along with its business purpose.

10.9.   Evaluate the advantages of using a workflow management system.

10.10. Explain how groupware can benefit a business.

TEAMS, PARTNERSHIPS, AND ALLIANCES

To be successful—and avoid being eliminated by the competition—an organization must constantly undertake new initiatives, address both minor and major problems, and capitalize on significant opportunities. To support these activities, an organization often will create and utilize teams, partnerships, and alliances because the expertise needed is beyond the scope of a single individual or organization. These teams, partnerships, and alliances can be formed internally among a company's employees or externally with other organizations (see Figure 10.15).

FIGURE 10.15

Teams, Partnerships, and Alliances Within and External to an Organization

Businesses of all sizes and in all markets have witnessed the benefits of leveraging their IT assets to create competitive advantage. Whereas information technology efforts in the past were aimed at increasing operational efficiency, the advent and proliferation of network-based computing (the Internet being the most visible, but not only, example) has enabled organizations to build systems with which all sorts of communities can interact. The ultimate

result will allow organizations to do business with customers, business partners, suppliers, governments and regulatory agencies, and any other community relevant to their particular operation or activity.

In the same way that organizations use internal teams, they are increasingly forming alliances and partnerships with other organizations. The *core competency* of an organization is its key strength, a business function that it does better than any of its competitors. Apple Computer is highly regarded for its strength in product design, while Accenture's core competency is the design and installation of information systems. A *core competency strategy* is one in which an organization chooses to focus specifically on what it does best (its core competency) and forms partnerships and alliances with other specialist organizations to handle nonstrategic business processes. Strategic alliances enable businesses to gain competitive advantages through access to a partner's resources, including markets, technologies, and people. Teaming up with another business adds complementary resources and capabilities, enabling participants to grow and expand more quickly and efficiently, especially fast-growing companies that rely heavily on outsourcing many areas of their business to extend their technical and operational resources. In the outsourcing process, they save time and boost productivity by not having to develop their own systems from scratch. They are then free to concentrate on innovation and their core business.

Information technology makes such business partnerships and alliances easier to establish and manage. An *information partnership* occurs when two or more organizations cooperate by integrating their IT systems, thereby providing customers with the best of what each can offer. The advent of the Internet has greatly increased the opportunity for IT-enabled business partnerships and alliances. Amazon developed a profitable business segment by providing e-business outsourcing services to other retailers that use Amazon's Web site software. Some well-known retailers partnering with Amazon include Marshall Fields, Office Depot, and Target.[10]

COLLABORATION SYSTEMS

Heineken USA has shortened its inventory cycle time for beer production and distribution from three months to four weeks. By using its collaborative system to forecast demand and expedite shipping, the company has dramatically cut inventory levels and shipping costs while increasing sales.

Over the past few years most business processes have changed on various dimensions (e.g., flexibility, interconnectivity, coordination style, autonomy) because of market conditions and organizational models. Frequently, information is located within physically separated systems as more and more organizations spread their reach globally. This creates a need for a software infrastructure that enables collaboration systems.

A *collaboration system* is an IT-based set of tools that supports the work of teams by facilitating the sharing and flow of information. Collaboration solves specific business tasks such as telecommuting, online meetings, deploying applications, and remote project and sales management (see Figure 10.16).

Collaboration systems allow people, teams, and organizations to leverage and build upon the ideas and talents of staff, suppliers, customers, and business partners. It involves a unique set of business challenges that:

■ Include complex interactions between people who may be in different locations and desire to work across function and discipline areas.

■ Require flexibility in work process and the ability to involve others quickly and easily.

■ Call for creating and sharing information rapidly and effortlessly within a team.

Most organizations collaborate with other companies in some capacity. Consider the supplier-customer relationship, which can be thought of in terms of a continuous life cycle of engagement, transaction, fulfillment, and service activities. Rarely do companies excel in all four life cycle areas, either from a business process or from a technology-enabled aspect. Successful organizations identify and invest in their core competencies, and outsource or collaborate for those competencies that are not core to them. Collaboration systems fall into one of two categories:

1. *Unstructured collaboration* (sometimes referred to as *information collaboration*) includes document exchange, shared whiteboards, discussion forums, and e-mail. These functions can improve personal productivity, reducing the time spent searching for information or chasing answers.

FIGURE 10.16

Collaborative Business Areas

2. *Structured collaboration* (or *process collaboration*) involves shared participation in business processes, such as workflow, in which knowledge is hard-coded as rules. This is beneficial in terms of improving automation and the routing of information.

Regardless of location or format—be it unstructured or structured—relevant accurate information must be readily and consistently available to those who need it anytime, anywhere, and on any device. The integration of IT systems enables an organization to provide employees, partners, customers, and suppliers with the ability to access, find, analyze, manage, and collaborate on content. The collaboration can be done across a wide variety of formats, languages, and platforms. Figure 10.17 illustrates many of the typical collaborative functions within most organizations.

Lockheed Martin Aeronautics Company's ability to share complex project information across an extended supply chain in real time was key in its successful bid of a $19 billion Department of Defense (DoD) contract to build 21 supersonic stealth fighters. New government procurement rules require defense contractors to communicate effectively to ensure that deadlines are met, costs are controlled, and projects are managed throughout the life cycle of the contract.[11]

In anticipation of the contract, the Fort Worth, Texas, unit of Lockheed Martin Corporation developed a real-time collaboration system that can tie together its partners, suppliers, and DoD customers via the Internet. The platform lets participants collectively work on product design and engineering tasks as well as supply chain and life cycle management issues. Lockheed will host all transactions and own the project information. The platform will let DoD and Lockheed project managers track the daily progress of the project in real time. This is the first major DoD project with such a requirement. The contract, awarded to the Lockheed unit and partners Northrop Grumman Corp. and BAE Systems, is the first installment in what could amount to a $200 billion program for 3,000 jet fighters over 40 years. The strengths of the collaboration process lie with the integration of many systems, namely:

- Knowledge management systems
- Content management systems
- Workflow management systems
- Groupware systems

FIGURE 10.17

Typical Collaborative Business Functions

Function	Collaborator(s)	Business Function(s)
Planning and forecasting	Supplier, Customer	Real-time information sharing (forecastinformation and sales information)
Product design	Supplier, Customer	Document exchange, computer-aideddesign (CAD)
Strategic sourcing	Supplier	Negotiation, supplier performance management

Component compatibility testing	Supplier	Component compatibility
Pricing	Supplier, Customer	Pricing in supply chain
Marketing	Supplier, Customer	Joint/coop marketing campaigns, branding
Sales	Customer	Shared leads, presentations, configurationand quotes
Make-to-order	Customer	Requirements, capabilities, contract terms
Order processing	Supplier, Customer	Order solution
Fulfillment: Logisticsand service	Supplier, Customer	Coordination of distribution
International trade logistics	Customer	Document exchange, import/export documents
Payment	Customer	Order receipt, invoicing
Customer service/support	Supplier, Customer	Shared/split customer support

KNOWLEDGE MANAGEMENT

Knowledge management (KM) involves capturing, classifying, evaluating, retrieving, and sharing information assets in a way that provides context for effective decisions and actions. It is best to think of KM in the broadest context. Succinctly put, KM is the process through which organizations generate value from their intellectual and knowledge-based assets. Most often, generating value from such assets involves codifying what employees, partners, and customers know, and sharing that information among employees, departments, and even with other companies to devise best practices. It is important to note that the definition says nothing about technology; while KM is often facilitated by IT, technology by itself is not KM.

Think of a golf caddie as a simplified example of a knowledge worker. Good caddies do more than carry clubs

and track down wayward balls. When asked, a good caddie will give advice to golfers, such as, "The wind makes the ninth hole play 15 yards longer." Accurate advice may lead to a bigger tip at the end of the day. The golfer, having derived a benefit from the caddie's advice, may be more likely to play that course again. If a good caddie is willing to share what he knows with other caddies, then they all may eventually earn bigger tips. How would KM work to make this happen? The caddie master may decide to reward caddies for sharing their knowledge by offering them credits for pro shop merchandise. Once the best advice is collected, the course manager would publish the information in notebooks (or make it available on PDAs) and distribute them to all the caddies. The end result of a well-designed KM program is that everyone wins. In this case, caddies get bigger tips and deals on merchandise, golfers play better because they benefit from the collective experience of caddies, and the course owners win because better scores lead to repeat business.

KM in Business

KM has assumed greater urgency in American business over the past few years as millions of baby boomers prepare to retire. When they punch out for the last time, the knowledge they gleaned about their jobs, companies, and industries during their long careers will walk out with them—unless companies take measures to retain their insights. In addition, CIOs who have entered into outsourcing agreements must address the thorny issue of transferring the knowledge of their full-time staff members, who are losing their jobs because of an outsourcing deal, to the outsourcer's employees.

KNOWLEDGE MANAGEMENT SYSTEMS

Knowledge can be a real competitive advantage for an organization. Information technology can distribute an organization's knowledge base by interconnecting people and digitally gathering their expertise. The primary objective of knowledge management is to be sure that a company's knowledge of facts, sources of information, and solutions are readily available to all employees whenever it is needed.

Such knowledge management requires that organizations go well beyond providing information contained in spreadsheets, databases, and documents. It must include expert information that typically resides in people's heads. A *knowledge management system (KMS)* supports the capturing, organization, and dissemination of knowledge (i.e., know-how) throughout an organization. It is up to the organization to determine what information qualifies as knowledge.

Explicit and Tacit Knowledge

Not all information is valuable. Individual companies must determine what information qualifies as intellectual and knowledge-based assets. In general, intellectual and knowledge-based assets fall into one of two categories: explicit or tacit. As a rule, *explicit knowledge* consists of anything that can be documented, archived, and codified, often with the help of IT. Examples of explicit knowledge are assets such as patents, trademarks, business plans, marketing research, and customer lists.

Tacit knowledge is the knowledge contained in people's heads. The challenge inherent in tacit knowledge is figuring out how to recognize, generate, share, and manage knowledge that resides in people's heads. While information technology in the form of e-mail, instant messaging, and related technologies can help facilitate the dissemination of tacit knowledge, identifying it in the first place can be a major obstacle. Shadowing and joint problem solving are two best practices for transferring or re-creating tacit knowledge inside an organization.

Shadowing With *shadowing,* less experienced staff observe more experienced staff to learn how their more experienced counterparts approach their work. Dorothy Leonard and Walter Swap, two knowledge management experts, stress the importance of having the protégé discuss his or her observations with the expert to deepen the dialog and crystallize the knowledge transfer.

Joint Problem Solving Another sound approach is *joint problem solving* by expert and novice. Because people are often unaware of how they approach problems or do their work and therefore cannot automatically generate step-by-step instructions for doing whatever they do, having a novice and expert work together on a project will bring the expert's approach to light. The difference between shadowing and joint problem solving is that shadowing is more passive. With joint problem solving, the expert and the novice work hand in hand on a task.[12]

Information is of little use unless it is analyzed and made available to the right people, at the right place, and at the right time. To get the most value from intellectual assets, knowledge must be shared. An effective KMS system should help do one or more of the following:

■ Foster innovation by encouraging the free flow of ideas.

■ Improve customer service by streamlining response time.

■ Boost revenues by getting products and services to market faster.

■ Enhance employee retention rates by recognizing the value of employees' knowledge.

■ Streamline operations and reduce costs by eliminating redundant or unnecessary processes.

A creative approach to knowledge management can result in improved efficiency, higher productivity, and increased revenues in practically any business function. Figure 10.18 indicates the reasons organizations launch KMS.

Software is helping ChevronTexaco Corporation improve how it manages the assets in oil fields by enabling employees in multiple disciplines to easily access and share the information they need to make decisions. ChevronTexaco teams of 10 to 30 people are responsible for managing the assets, such as the drilling equipment, pipelines, and facilities, for a particular oil field. Within each team, earth scientists and various engineers with expertise in production, reservoir, and facilities work together to keep the oil field up and running. Each member of the asset team needs to communicate with other members to make decisions based on the collection and analysis of huge amounts of information from various departments. Individual team members can look at information from the perspective of their own department.

This has helped ChevronTexaco achieve a 30 percent productivity gain, a 50 percent improvement in safety performance, and more than $2 billion in operating cost reductions. Through KMSs, ChevronTexaco has restructured its gasoline retailing business and now drills oil and gas wells faster and cheaper.[13]

FIGURE 10.18

Key Reasons Organizations Launch Knowledge Management Systems

Not every organization matches ChevronTexaco's success with KM. Numerous KM projects have failed over the past few years, generating an unwillingness to undertake—or even address—KM issues among many organizations. However, KM is an effective tool if it is tied directly to discrete business needs and opportunities. Beginning with targeted projects that deliver value quickly, companies can achieve the success that has proved elusive with many big-bang approaches. Successful KM projects typically focus on creating value in a specific process area, or even just for a certain type of transaction. Companies should start with one job at a time—preferably the most knowledge-oriented one—and build KM into a job function in a way that actually helps employees do their work better and faster, then expand to the next most knowledge-intensive job, and so on. Celebrating even small success with KM will help build a base of credibility and support for future KM projects.

KM Technologies

KM is not a purely technology-based concept. Organizations that implement a centralized database system, electronic message board, Web portal, or any other collaborative tool in the hope that they have established a KMS are wasting both their time and money.

Although tools don't make a KMS, such a system does need tools, from standard, off-the-shelf e-mail packages to sophisticated collaboration tools designed specifically to support community building and identity. Generally, KMS tools fall into one or more of the following categories:

■ Knowledge repositories (databases).

■ Expertise tools.

■ E-learning applications.

■ Discussion and chat technologies.

■ Search and data mining tools.

KM and Social Networking

Companies that have been frustrated by traditional KM efforts are increasingly looking for ways to find out how knowledge flows through their organization, and social networking analysis can show them just that. *Social net-working analysis (SNA)* is a process of mapping a group's contacts (whether personal or professional) to identify who knows whom and who works with whom. In enterprises, it provides a clear picture of how far-flung employees and divisions work together and can help identify key experts in the organization who possess the knowledge needed to, say, solve a complicated programming problem or launch a new product.

M&M maker Mars used SNA to identify how knowledge flows through its organizations, who holds influence, who gives the best advice, and how employees share information. The Canadian government's central IT unit used SNA to establish which skills it needed to retain and develop, and to determine who, among the 40 percent of the workforce that was due to retire within five years, had the most important knowledge and experience to begin trans-ferring to others.[14]

SNA is not a replacement for traditional KM tools such as knowledge databases or portals, but it can provide companies with a starting point for how best to proceed with KM initiatives. As a component to a larger KM strat-egy, SNA can help companies identify key leaders and then set up a mechanism, such as communities of practice, so that those leaders can pass on their knowledge to colleagues. To identify experts in their organizations, companies can use software programs that track e-mail and other kinds of electronic communication.[15]

CONTENT MANAGEMENT SYSTEMS

A *content management system* provides tools to manage the creation, storage, editing, and publication of informa-

tion in a collaborative environment. As a Web site grows in size and complexity, the business must establish procedures to ensure that things run smoothly. At a certain point, it makes sense to automate this process and use a content management system to manage this effectively. The content management system marketplace is complex, incorporating document management, digital asset management, and Web content management. Figure 10.19 highlights the three primary types of content management systems. Figure 10.20 lists the major content management system vendors.

Content management software is helping BMW Group Switzerland accelerate personalized, real-time information about products, services, prices, and events to its dealers countrywide. BMW uses a process that allows dealers to specify what information is seen by which employee, as well as to deliver marketing materials solely to members of the sales department, and technical specifications and support documents only to mechanics. That enhanced personalization eliminates the chance that information is sent to the wrong dealership or to the wrong individual, which provides higher quality customer service. The content management software also enables nontechnical employees to create pages using predefined layout templates, simplifying the Web publishing process. More than 500 people use the solution daily, and all employees are able to publish information without calling on IT specialists, while maintaining the look and feel of the BMW brand.[16]

FIGURE 10.19

Common Types of Content Management Systems

Common Types of Content Management Systems	
Document management system (DMS)	DMS—Supports the electronic capturing, storage, distribution,archiving, and accessing of documents. A DMS optimizes the use of documents within an organization independent of any publishingmedium (for example, the Web). A DMS provides a document repository with information about other information. The system tracks theeditorial history of each document and its relationships with other documents. A variety of search and navigation methods are available to make document retrieval easy. A DMS manages highly structured and regulated content, such as pharma-

	ceutical documentation.
Digital asset management system (DAM)	DAM—Though similar to document management, DAM generally works with binary rather than text files, such as multimedia file types. DAM places emphasis on allowing file manipulation and conversion, for example, converting GIF files to JPEG.
Web content management system (WCM)	WCM—Adds an additional layer to document and digital assetmanagement that enables publishing content both to intranets and to public Web sites. In addition to maintaining the content itself, WCM systems often integrate content with online processes like e-business systems.

FIGURE 10.20

Major Content Management Systems Vendors

Vendors	Strengths	Weaknesses	Costs
Documentum www.documentum.com	Document and digital asset management	Personalizationfeatures not as strong as competitors	Major components start at less than $100,000
FatWire www.fatwire.com	Web content management	May not scale tosupport thousands of users	SPARK, $25,000; Update Engine, $70,000 and up
InterWoven www.interwoven.com	Collaboration, enterprise content management	Requires significant customization	InterWoven 5 Platform, $50,000; average cost for a new customer, $250,000
Percussion www.percussion.com	Web content management	May not scale to support thousands of users	Rhythmyx ContentManager, about $150,000

Stellent www.stellent.com	Document conversion to Web-ready formats	Engineering for very large implementations with thousands of users	Content andCollaboration Servers, $50,000 to $250,000 each
Vignette www.vignette.com	Personalization	Document management and library services are not as robust as others	V6 Multisite Content Manager, $200,000 and up; V6 Content Suite, $450,000 and up

WORKFLOW MANAGEMENT SYSTEMS

A *workflow* defines all the steps or business rules, from beginning to end, required for a business process. Therefore, *workflow management systems* facilitate the automation and management of business processes and control the movement of work through the business process. Work activities can be performed in series or in parallel and involve people and automated computer systems. In addition, many workflow management systems allow the opportunity to measure and analyze the execution of the process because workflow systems allow the flow of work between individuals and/or departments to be defined and tracked. Workflow software helps automate a range of business tasks and electronically route the right information to the right people at the right time. Users are notified of pending work, and managers can observe status and route approvals through the system quickly.

There are two primary types of workflow systems: messaging-based and database-based. *Messaging-based work-flow systems* send work assignments through an e-mail system. The workflow system automatically tracks the order for the work to be assigned and, each time a step is completed, the system automatically sends the work to the next individual in line. For example, each time a team member completes a piece of the project, the system would automatically send the document to the next team member.

Database-based workflow systems store documents in a central location and automatically ask the team members to access the document when it is their turn to edit the document. Project documentation is stored in a central location and team members are notified by the system when it is their turn to log in and work on their portion of the project.

Either type of workflow system helps to present information in a unified format, improves teamwork by providing automated process support, and allows team members to communicate and collaborate within a unified envi-

ronment. Figure 10.21 lists some typical features associated with workflow management systems.

FIGURE 10.21

Workflow Management Systems Features

Workflow Feature	Description
Process definition tool	A graphical or textual tool for defining a business process. Each activity within the process is associated with a person or a computer application. Rules are created to determine how the activities progress across the workflow and which controls are in place to govern each activity.
Simulation, prototyping, and piloting	Some systems allow workflow simulation or create prototype and/or pilot versions of a particular workflow to test systems on a limited basisbefore going into production.
Task initiation and control	The business process defined above is initiated and the appropriateresources (either human and/or IT related) are scheduled and/orengaged to complete each activity as the process progresses.
Rules-based decision making	Rules are created for each step to determine how workflow-relatedinformation is to be processed, routed, tracked, and controlled. As anexample, one rule might generate e-mail notifications when a condition has been met. Another rule might implement conditional routing ofdocuments and tasks based on the content of fields.
Document routing	In simple systems, this is accomplished by passing a file or folder from one recipient to another (e.g., an e-mail attachment). In sophisticated systems, document routing is completed by checking the documents in and out of a central repository. Both systems might allow for "redlining" of the documents so that each person in the process can add their own comments

	without affecting the original document.
Applications to view and manipulate information	Word-processors, spreadsheets, and production systems are used to allow workers to create, update, and view information.
Work list	Current tasks are quickly identified along with such things as a due date, goal date, and priority by using work lists. In some systems, ananticipated workload is displayed as well. These systems analyze where jobs are in the workflow and how long each step should take, and then estimate when various tasks will reach a worker's desk.
Task automation	Computerized tasks are automatically invoked. These might include such things as letter writing, e-mail notices, or execution of productionsystems. Task automation often requires customization of the basicworkflow product.
Event notification	Employees can be notified when certain milestones occur or whenworkload increases.
Process monitoring	The workflow system can provide an organization with valuableinformation on current workload, future workload, bottlenecks (current or potential), turn-around time, or missed deadlines.
Tracking and logging of activities	Information about each step can be logged. This might include such things as start and completion times, worker(s) assigned to the task, and key status fields. Later, this information can be used to analyze theprocess or to provide evidence that certain tasks were in fact completed.

New York City was experiencing a record number of claims, ranging from injuries resulting from slips on sidewalks to medical malpractice at city hospitals. The city processes over 30,000 claims and incurs $250 million in claim costs annually. Claims are generally filed with the Comptroller's Office, which investigates them and offers to

settle meritorious claims. The New York City Comptroller's Office, with the assistance of its consultants Xerox and Universal Systems Inc., utilized a workflow management system to enhance revenues and decrease operating costs. With the implementation of the Omnibus Automated Image Storage Information System (OAISIS) for processing contracts and claims, New York City will save over $20 million.

Numerous city organizations were involved in the workflow management system, including Bureau of Law and Adjustment, Office of Contracts/Administration, Management and Accounting Systems, and Bureau of Information Systems.

In supporting all these New York City organizations, the system performs many functions that were previously labor-intensive and detracted from the quality and efficiency of investigations. The workflow management system screens claims to determine accordance with statutory requirements. Acknowledgment letters are generated automatically, with little or no resource allocation involved in assignment of claims or routing of claims to specific work locations. Status letters are automatically generated by the system for certain claim types, thus allowing the Comptroller's Office to keep claimants informed two months, five months, and one year from the date of their filing. All this is done automatically by the workflow management system.

Workflow management systems allow management to schedule individual systematic claim reviews without disrupting the investigation. Management can also see the entire claim process graphically and determine bottlenecks. Deployment of additional resources to needed areas occurs without a management analysis of a particular process problem.

GROUPWARE SYSTEMS

Groupware is software that supports team interaction and dynamics including calendaring, scheduling, and videoconferencing. Organizations can use this technology to communicate, cooperate, coordinate, solve problems, compete, or negotiate. While traditional technologies like the telephone qualify as groupware, the term refers to a specific class of technologies relying on modern computer networks, such as e-mail, newsgroups, videophones, and chat rooms. Groupware systems fall along two primary categories (see Figure 10.22):

1. Users of the groupware are working together at the same time (real-time or synchronous groupware) or different times (asynchronous groupware).

2. Users are working together in the same place (co-located or face-to-face) or in different places (non-co-located or distance).

The groupware concept integrates various systems and functionalities into a common set of services or a single (client) application. In addition, groupware can represent a wide range of systems and methods of integration. Figure 10.23 displays the advantages groupware systems offer an organization over single-user systems.

Lotus Notes is one of the world's leading software solutions for collaboration that combines messaging, groupware, and the Internet. The structure of Notes allows it to track, route, and manage documents. Systems that lend themselves to Notes involve tracking, routing, approval, document management, and organization.

Toyota developed an intranet system to promote information sharing within the company and to raise productivity. Unfortunately, the company's conventional e-mail system became overloaded, generating problems. Users did not receive incoming messages and were not able to send messages. Individual departments had introduced their own e-mail systems, which were not always compatible. Messages to other mail systems, including those outside the company, experienced delays. To deal with these difficulties, Toyota's information systems department reviewed the e-mail system and restructured it so that e-mail, now recognized as an important communication tool, is utilized more effectively in business transactions.[17]

FIGURE 10.22

Groupware Systems

FIGURE 10.23

Groupware Advantages

Groupware System Advantages
Facilitating communication (faster, easier, clearer, more persuasive)
Enabling telecommuting
Reducing travel costs
Sharing expertise
Forming groups with common interests where it would not be possible to gather a sufficient number of people face-to-face

Saving time and cost in coordinating group work
Facilitating group problem solving

COLLABORATION TRENDS

E-mail is by far the dominant collaboration application, but real-time collaboration tools like instant messaging are creating a new communication dynamic within organizations. *Instant messaging* (sometimes called *IM* or *IMing*) is a type of communications service that enables someone to create a kind of private chat room with another individual in order to communicate in real-time over the Internet. In 1992, AOL deployed IM to the consumer market, allowing users to communicate with other IMers through a buddy list. Most of the popular instant messaging programs provide a variety of features, such as:

■ Web links: Share links to favorite Web sites.

■ Images: Look at an image stored on someone else's computer.

■ Sounds: Play sounds.

■ Files: Share files by sending them directly to another IMer.

■ Talk: Use the Internet instead of a phone to talk.

■ Streaming content: Receive real-time or near-real-time stock quotes and news.

■ Instant messages: Receive immediate text messages.

Commercial vendors such as AOL and Microsoft offer free instant messaging tools. Real-time collaboration, such as instant messaging, live Web conferencing, and screen or document sharing, creates an environment for decision making. AOL, Microsoft's MSN, and Yahoo! have begun to sell enterprise versions of their instant messaging services that match the capabilities of business-oriented products like IBM's Lotus Sametime. Figure 10.24 demonstrates the IM application presence within IT systems.

FIGURE 10.24

Instant Messaging Application

IBM Lotus software has released new versions of its real-time collaboration platform, IBM Lotus Instant Messaging and IBM Lotus Web Conferencing, plus its mobile counterpart, IBM Lotus Instant Messaging Everyplace. These built-for-business products let an organization offer presence awareness, secure instant messaging, and Web conferencing. The products give employees instant access to colleagues and company information regardless of

time, place, or device.

The bigger issue in collaboration for organizations is cultural. Collaboration brings teams of people together from different regions, departments, and even companies—people who bring different skills, perceptions, and capabilities. A formal collaboration strategy helps create the right environment as well as the right systems for team members.

OPENING CASE QUESTIONS

Campus ERP

5. How can a college campus achieve business success through the use of collaboration tools?

6. How can your college use knowledge management systems to improve operations?

7. How can your college use content management systems to improve operations?

8. How can a team of college students use a workflow management system to complete a group project?

9. If your college wanted to implement a groupware system, what would be its primary purpose?

KEY TERMS

CLOSING CASE ONE

DreamWorks Animation Collaboration

Hewlett-Packard (HP) and DreamWorks Animation SKG were the first to introduce a collaboration studio for simulating face-to-face business meetings across long distances. Vyomesh Joshi, executive vice president at HP, and Jeffrey Katzenberg, CEO of DreamWorks, officially unveiled the HP Halo Collaboration Studio in New York City in 2005. Halo enables people in different locations to communicate in a vivid, face-to-face environment in real time. Whether across a country or across the ocean, users can see and hear one another's physical and emotional reactions to conversation and information.

By giving participants the remarkable sense that they are in the same room, the Halo Collaboration Studio is already transforming the way businesses such as PepsiCo, Advanced Micro Devices, and DreamWorks communicate across the globe. Halo significantly increases team effectiveness, provides faster decision-making capabilities, and decreases the need for travel.

"The HP Halo Collaboration Studio enables remote teams to work together in a setting so lifelike that participants feel as though they are in the same room," Joshi said. "To create this experience, HP is harnessing its expertise in color science, imaging, and networking in this new category of innovation. It is something we believe will not only disrupt the traditional videoconferencing market, but will also change the way people work in a global market."

Early in the production of the animated film *Shrek 2,* DreamWorks realized a significant return on investment using the Halo technology. By connecting its California teams in Glendale and Redwood City, DreamWorks was able to speed up many aspects of the production.

"In 2002, while we were producing *Shrek 2*, we realized that DreamWorks needed face-to-face collaboration between key creative talent in different locations," Katzenberg said. "We weren't satisfied with the available videoconferencing systems, so we designed a collaboration solution that would fulfill our needs. HP took the system and turned it into Halo, which is now the only solution on the market that allows this kind of effective communication."

Halo Connection

To connect via Halo, organizations purchase at least two Halo rooms set up for six people each. Three plasma displays in each room enable participants to see those they are collaborating with in life-size images. The rooms come equipped with studio-quality audio and lighting, and participants use a simple on-screen user interface to begin collaborating with just a few mouse clicks.

An intricate software control system ensures Halo rooms work easily and seamlessly together. The control system also provides precise image and color calibration, so participants see each other as they appear in real life. A dedicated HP Halo Video Exchange Network provides a high-bandwidth experience with imperceptible delays between Halo studios worldwide.

To ensure a 24x7 connection and eliminate the need for enterprises to manage the operation and maintenance of a Halo room, services offered include network operations and management, remote diagnostics and calibration, concierge, equipment warranty, and ongoing service and repair.

Participants can easily share documents and data directly from their notebook PCs with individuals in other

rooms using a collaboration screen mounted above the plasma displays. The rooms also contain a high-magnification camera that enables individuals to zoom in on objects on a table, revealing the finest of details and color shading, and a phone that opens a conference call line to those not in one of the Halo rooms.

"We believe there is a personal connection that comes with Halo that just clearly doesn't come from any other kind of technology we've used in the past," said Steve Reinemund, CEO of PepsiCo. "Halo is one of the best investments we've made to improve the effectiveness of our business and work/life balance for our people."[18]

Questions

1. How can companies use Halo to increase their business efficiency?

2. Explain how a company like PepsiCo can use Halo to gain a competitive advantage in its industry.

3. How can knowledge management be increased by using a product such as Halo?

4. Why would a company like DreamWorks, that is not IT focused, be interested in collaboration technology?

5. What are a few of the security issues surrounding this type of technology?

CLOSING CASE TWO

Improving Highway Safety Through Collaboration

Information on traffic-related deaths and accidents are two to three years out of date in some states, making it difficult to devise new safety regulations, rebuild unsafe roads, develop safer automobiles, and improve emergency services. Systems used by federal, state, and local agencies to collect and share information need to be overhauled, and the U.S. Department of Transportation's National Highway Traffic Safety Administration said it would ask Congress for $300 million over the next six years to upgrade them.

The goal is to eliminate antiquated paper-based reporting systems and implement a nationwide initiative to automate and synchronize the collection and sharing of information. The information will include vehicle-related injuries, associated health care costs, safety stops, driver licenses, vehicle registration, and adjudicated violations.

Safer Driving

Federal highway safety officials want $300 million to finance:

■ Wireless communications equipment to facilitate electronic information collection and transmission during traffic safety stops.

■ Real-time information transfer and editing processes to update driver's license or vehicle registration informa-

tion from traffic stops or crash sites.

- Centralized access to query all traffic record databases.

- Standardized search capabilities on common queries and information transmission using XML formats.

Few states have the capability to capture and transmit traffic record and crash information electronically, and those that do are limited, according to Joseph Carra, director of the National Center for Statistics and Analysis at the highway safety agency. "Today, the information is written and stored in files. It's a paper process. The files are sent to the state office, whose clerks input the information into proprietary computer systems. And there it sits," he said.

Collaborating

Better information will save lives and money, says the federal highway safety administration. About 43,220 people were killed on the nation's highways in 2003, and another 2.9 million suffered serious injuries. Traffic accidents in 2000, the latest year for which information is available, cost the U.S. economy about $230 billion, the agency says.

The wide-ranging proposal calls for standardized formats to improve information sharing among various government agencies and private groups, more sophisticated sensors in cars and along highways to gather detailed information on crashes, and wireless handheld devices to let police officers check for outstanding warrants on drivers, among other ideas. Federal funding will encourage states to adopt federal standards. Many states, suffering from a slow economy and declining tax revenues, have not been able to fund upgrades themselves. Some, however, have projects under way.

Revamping Texas

Texas is about halfway done with an IT project to build a crash-records information system, a joint initiative between its Department of Public Safety and the Texas Department of Transportation. When completed, police officers will be able to file accident reports via the Web, and other state agencies will be able to electronically link their systems with it and share information.

Texas has been working on the crash-records system for several years. The state has a $9.9 million contract with IBM to build an information warehouse using a DB2 Universal Database, WebSphere Application Server, Tivoli Storage Manager, and MQ-Series, its message-queuing product. IBM says Florida, Arizona, and New Mexico are considering similar systems.

The Texas system is replacing a decades-old one that is "archaic and in need of many changes," said Carol Raw-

son, deputy division director for the traffic operations division with the state transportation department. The old system requires time-consuming manual entry of around 850,000 accident forms a year, as well as manual cross-checking and validation to ensure the information is correct. Because the process took so long, the state's accident information is backlogged some 30 months. "This is all about safety," Rawson said. "The way you tell if a road is safe is you look at accident information. So that information is critical."[19]

Questions

1. How are collaboration tools helping to save lives in Texas?

2. How could a police department use groupware to help with collaboration on accident reports?

3. Describe how a police department could use workflow systems to help with accident reports and health-care-related issues.

4. What would be the impact on lives if a state fails to implement collaboration tools to help track and analyze highway accidents?

5. How could police departments use wireless technologies to operate more efficiently and effectively?

6. What ethical issues surrounding wireless technologies should police departments understand?

CLOSING CASE THREE

Saving Costs at Costco

For Costco Wholesale to provide quality, brand-name merchandise at substantially lower prices, it must communicate quickly and effectively with thousands of vendors. The company cannot afford slow response times when accessing purchase orders, debit memos, or invoices; unsatisfactory image quality; or indirect access to transaction documents. Costco began the search for a technology that could handle its growing volume of paper, microfilm, and microfiche. The company processes 30,000 documents per day and has more than 75 million documents scanned in total.

Costco chose Stellent Imaging and Business Process Management because of its open architecture, competitive price, and multiple features, which provided a rapid return on investment. Costco worked with ImageSource, Inc., a Stellent solution provider, on design and implementation.

With Stellent, Costco processes about 6.7 million documents per year. Imaged documents can be accessed in seconds. Costco also gained easy storage and quick retrieval of information and integration of workflow processes with

computer data. Faster payment processing and easier transaction storage and retrieval improved service to warehouse, depot, and vendor customers. Faster document retrieval times and quicker problem resolution led to increased vendor satisfaction. Costco recouped the cost of the Stellent solution in just 11 months of operation and saved $7 million in labor and payment term discounts. Today, 750 of Costco's 2,000 corporate office employees use the Stellent system including:

- The accounts payable group accesses invoices related to expense and merchandise functions.

- The accounting department scans and stores capital expenditure and fixed asset documents, which can be accessed by the facilities department.

- Costco's legal department uses Stellent to process and store vendor maintenance and setup agreements and other documents.

- The tax department improved its audit process now that it can randomly review a sampling of historical transaction documents.

- Regional offices can also quickly access vendor invoices and rebate documents via a Web browser.[20]

Questions

1. Identify content management and document management and explain how Costco is using them to improve business operations.

2. Provide an example of a few of the documents that Costco must maintain electronically.

3. How might other Costco departments benefit from a document management system?

4. The Stellent Imaging and Business Process Management solution allowed Costco to grow as a company without increasing expenses. Identify another business that could benefit from the Stellent Imaging and Business Process Management solution.

MAKING BUSINESS DECISIONS

1. Implementing an ERP system

Blue Dog Inc. is a leading manufacturer in the high-end sunglasses industry, reaching record revenue levels of over $250 million last year. Blue Dog is currently deciding on the possibility of implementing an ERP system to help decrease production costs and increase inventory control. Many of the executives are nervous about making such a large investment in an ERP system due to its low success rates. As a senior manager at Blue Dog Inc. you

have been asked to compile a list of the potential benefits and risks associated with implementing an ERP system along with your recommendations for the steps the company can take to ensure a successful implementation.

2. **Most popular ERP component**

Mackenzie Coombe is currently thinking about implementing an ERP solution in her online music company, The Burford Beat. The company is generating over $12 million in revenues and is growing by 150 percent a year. Create a one-page document explaining the advantages and disadvantages of ERP systems, why ERP systems include CRM and SCM components, and why the most popular ERP component in today's marketplace is the accounting and finance core component.

3. **Value-added ERP**

Pirate's Pizza is a large pizza chain that operates 700 franchises in 15 states. The company is currently contemplating implementing a new ERP system, which is expected to cost $7 million and take 18 months to implement. Once the system is completed, it is expected to generate $12 million a year in decreased costs and increased revenues. You are working in the finance department for the company and your boss has asked you to compile a report detailing the different financial metrics you can use to assess the business value of the new ERP system. Once your report is completed, the company will make a decision about purchasing the ERP system.

4. **Collaboration on intranets**

MyIntranet.com is a worldwide leader providing online intranet solutions. The MyIntranet.com online collaboration tool is a solution for small businesses and groups inside larger organizations that need to organize information, share files and documents, coordinate calendars, and enable efficient collaboration, all in a secure, browser-based environment. MyIntranet.com has just added conferencing and group scheduling features to its suite of hosted collaboration software. Explain why infrastructure integration is critical to the suite of applications to function within this environment.

5. **Gaining efficiency with collaboration**

During the past year, you have been working for a manufacturing firm to help improve its supply chain management by implementing enterprise resource planning and supply chain management systems. For efficiency gains, you are recommending that the manufacturing firm should be turning toward collaborative systems. The firm has a need to share intelligent plans and forecasts with supply chain partners, reduce inventory levels, improve working capital, and reduce manufacturing changeovers. Given the technologies presented to you in this unit, what

type of system(s) would you recommend to facilitate your firm's future needs?

6. Increasing revenues with ERP

Cold Cream is one of the premier beauty supply stores in the metro New York area. People come from all over to sample the store's unique creams, lotions, makeup, and perfumes. The company receives its products from manufacturers around the globe. The company would like to implement an ERP system to help it better understand its customers and their purchasing habits. Create a report summarizing ERP systems and explain how an ERP system can directly influence Cold Cream's revenues.

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Systems Development

CHAPTER OUTLINE

SECTION 11.1

Developing Enterprise Applications

Developing Software

The Systems Development Life Cycle (SDLC)

Software Development Methodologies

Developing Successful Software

SECTION 11.2

The Systems Development Life Cycle (SDLC)

Systems Development Life Cycle

Phase 1: Planning

Phase 2: Analysis

Phase 3: Design

Phase 4: Development

Phase 5: Testing

Phase 6: Implementation

Phase 7: Maintenance

Software Problems Are Business Problems

opening case study

HP's Software Problems

With IT projects, pessimism—otherwise known as contingency planning—is the only way to keep small technology problems from becoming full-blown business disasters. Christina Hanger had little reason to be pessi-

mistic in May 2004, when she was moving one of Hewlett-Packard's biggest North American divisions onto a centralized ERP system from SAP. As the leader of an IT consolidation project rooted in HP's acquisition of Compaq two years earlier, Hanger, HP senior vice president of Americas operations and IT, had an unbroken record of success migrating five product groups within the two former companies onto one of two SAP systems.

Hanger had every reason to believe that the sixth would go well too. Even so, she knew to be prepared for problems. At approximately $7.5 billion in annual revenue, the division involved with this latest project, Industry Standard Servers (ISS), is much larger than any of the others that Hanger had migrated to SAP to that point. Hanger took the contingency plan that her team had developed for the other five migrations and adjusted it to accommodate the ISS division's larger sales volume. She planned for three weeks of IT snafus, mostly focused on what might happen as a result of tweaking a legacy order-entry system to work with the new SAP system. The contingency plan addressed business impacts too. HP banked three weeks' worth of extra servers and took over an empty portion of an HP factory in Omaha to stand by for any overflow of orders that needed special configurations (for example, an unusual component or software combination) and could not be stockpiled ahead of time.

"We had a series of small problems, none of which individually would have been too much to handle. But together they created the perfect storm," stated Gilles Bouchard, CIO and executive vice president of global operations. Starting when the system went live at the beginning of June and continuing throughout the rest of the month, as many as 20 percent of customer orders for servers stopped dead in their tracks between the legacy order-entry system and the SAP system. As IT problems go, this was not too big: Some data modeling issues between the legacy system and the SAP system prevented the SAP system from processing some orders for customized products. These programming errors were fixed within four or five weeks. However, Hanger and her business colleagues from the ISS division who were on the project steering committee never envisioned the degree to which these programming glitches would affect the business.

Orders began to backlog quickly, and HP did not have enough manual workarounds to keep servers flowing fast enough to meet customer demand. Angry customers picked up the phone and called HP—or worse, com-

petitors Dell and IBM. In a commodity market such as servers, customer loyalty is built upon a company's ability to configure products to order and get them delivered on time. HP could do neither for much of the summer. In a third-quarter conference call on August 12, HP Chairman and CEO Carly Fiorina pegged the financial impact at $160 million: a $120 million order backlog that resulted in $40 million in lost revenue. That is more than the cost of the project itself, which AMR Research estimates to be $30 million.

The headlines all claimed an IT disaster, but in fact, HP's disaster resulted from a few relatively small problems in IT that snowballed into a much bigger problem for the business: the inability to cope with the order backlog. This was a disaster that could have been prevented—not by trying to eliminate every possibility for error in a major IT system migration, which is virtually impossible, but by taking a much broader view of the impact that these projects can have on a company's supply chain.[1]

INTRODUCTION

Organizations must learn how to build and implement systems to remain competitive. Software that is built correctly can support agile organizations and can transform as the organization and its business transforms. Software that effectively meets employee needs will help an organization become more productive and enhance decision making. Software that does not meet employee needs may have a damaging effect on productivity and can even cause a business to fail. Employee involvement along with using the right implementation methodology when developing software is critical to the success of an organization.

section 11.1 DEVELOPING ENTERPRISE APPLICATIONS

LEARNING OUTCOMES

11.1. Identify the business benefits associated with successful software development.

11.2. Describe the seven phases of the systems development life cycle.

11.3. Summarize the different software development methodologies.

11.4. Define the relationship between the systems development life cycle and software development methodologies.

11.5. Compare the waterfall methodology and the agile methodology.

DEVELOPING SOFTWARE

Nike's SCM system failure, which spun out of control to the tune of $400 million, is legendary. Nike blamed the system failure on its SCM vendor, i2 Technologies. Nike states that i2 Technologies' demand and supply planning module created serious inventory problems. The i2 deployment, part of a multimillion-dollar e-business upgrade, caused Nike CEO Philip Knight to famously say, "This is what we get for our $400 million?" The SCM vendor saw its stock plummet with the Nike disaster, along with its reputation. Katrina Roche, i2's chief marketing officer, asserted that Nike failed to use the vendor's implementation methodology and templates, which contributed to the problem.[2]

Software development problems often lead to high-profile disasters. Hershey's glitch in its ERP implementation made the front page of *The Wall Street Journal* and cost the company millions. Hershey said computer problems with its SAP software system created a backlog of orders, causing slower deliveries, and resulting in lower earnings. Statistics released in 2006 by the National Research Council show that U.S. companies spent $250 billion in 2005 to repair damage caused by software defects.[3]

If software does not work, the organization will not work. Traditional business risk models typically ignored software development, largely because most organizations considered the impact from software and software development on the business to be minor. In the digital age, however, software success, or failure, can lead directly to business success, or failure. Almost every large organization in the world relies on software, either to drive its business operations or to make its products work. As organizations' reliance on software grows, so do the business-related consequences of software successes and failures as displayed in Figure 11.1.

Business-Related Consequences of Software Success and Failure
Increase or decrease revenues—Organizations have the ability to directly increase profits by implementing successful IT systems. Organizations can also lose millions when software fails or key information is stolen or compromised. Nike's poorly designed supply chain management software delayed orders, increased excess inventories, and caused earnings to fall 24 percent below expectations.
Repair or damage to brand reputation—Technologies such as CRM can directly enhance a company's brand reputation. Software can also severely damage a company's

reputation if it fails to work as advertised or has security vulnerabilities that affect its customers' trust.

H&R Block customers were furious when the company accidentally placed its customers' passwords and Social Security numbers on its Web site.

Prevent or incur liabilities—Technology such as CAT scans, MRIs, and mammograms can save lives. Faulty technology used in airplanes, automobiles, pacemakers, or nuclear reactors can cause massive damage, injury, or death.

The parent company of bankrupt pharmaceutical distributor FoxMeyer sued SAP for $500 million over ERP software failure that allegedly crippled its operations.

Increase or decrease productivity—CRM and SCM software can directly increase a company's productivity. Large losses in productivity can also occur when software malfunctions or crashes.

The Standish Group estimates that defective software code accounted for 45 percent of computer-system downtime and cost U.S. companies $100 billion in lost productivity in 2003 alone.[4]

The lucrative advantages of successful software implementations provide significant incentives to manage software development risks. However, according to the Chaos report from the Standish Group, a Massachusetts-based consultancy, more than half the software development projects undertaken in the United States come in late or over budget and the majority of successful projects maintain fewer features and functions than originally specified. Organizations also cancel around 33 percent of these projects during development. Understanding the basics of software development, or the systems development life cycle, will help organizations avoid potential software development pitfalls and ensure that software development efforts are successful.[5]

FIGURE 11.1

Business-Related Consequences of Software Success and Failure

THE SYSTEMS DEVELOPMENT LIFE CYCLE (SDLC)

Information systems are the support infrastructure that helps an organization change quickly when adapting to shift-

ing business environments and markets. Many factors must come together to develop successful software. This chapter focuses on the *systems development life cycle (SDLC)*, also known as the "software life cycle" or the "application life cycle," which is the overall process for developing information systems from planning and analysis through implementation and maintenance (see Figure 11.2).

1. **Planning:** The *planning phase* involves establishing a high-level plan of the intended project and determining project goals. Planning is the first and most critical phase of any systems development effort an organization undertakes, regardless of whether the effort is to develop a system that allows customers to order products over the Internet, determine the best logistical structure for warehouses around the world, or develop a strategic information alliance with another organization. Organizations must carefully plan the activities (and determine why they are necessary) to be successful.

FIGURE 11.2

The Systems Development Life Cycle

2. **Analysis:** The *analysis phase* involves analyzing end-user business requirements and refining project goals into defined functions and operations of the intended system. *Business requirements* are the detailed set of business requests that the system must meet in order to be successful. The analysis phase is obviously critical. A good start is essential and the organization must spend as much time, energy, and resources as necessary to perform a detailed, accurate analysis.

3. **Design:** The *design phase* involves describing the desired features and operations of the system including screen layouts, business rules, process diagrams, pseudo code, and other documentation.

4. **Development:** The *development phase* involves taking all of the detailed design documents from the design phase and transforming them into the actual system. In this phase the project transitions from preliminary designs to the actual physical implementation.

5. **Testing:** The *testing phase* involves bringing all the project pieces together into a special testing environment to test for errors, bugs, and interoperability and verify that the system meets all of the business requirements defined in the analysis phase.

6. **Implementation:** The *implementation phase* involves placing the system into production so users can begin to perform actual business operations with the system.

7. **Maintenance:** Maintaining the system is the final sequential phase of any systems development effort. The *main-*

tenance phase involves performing changes, corrections, additions, and upgrades to ensure the system continues to meet the business goals. This phase continues for the life of the system because the system must change as the business evolves and its needs change, demanding constant monitoring, supporting the new system with frequent minor changes (for example, new reports or information capturing), and reviewing the system to be sure it is moving the organization toward its strategic goals.

SOFTWARE DEVELOPMENT METHODOLOGIES

Today, systems are so large and complex that teams of architects, analysts, developers, testers, and users must work together to create the millions of lines of custom-written code that drive enterprises. For this reason, developers have created a number of different systems development life cycle methodologies including *waterfall, rapid application development (RAD), extreme programming*, and *agile*. The oldest of these, and the best known, is the waterfall methodology: a sequence of phases in which the output of each phase becomes the input for the next (see Figure 11.3).

Waterfall Methodology

The traditional **waterfall methodology** is a sequential, activity-based process in which each phase in the SDLC is performed sequentially from planning through implementation and maintenance. The waterfall methodology is one of the oldest software development methods and has been around for more than 30 years. The success rate for software development projects that follow this approach is only about 1 in 10. One primary reason for such a low success rate is that the waterfall methodology does not sufficiently consider the level of uncertainty in new projects and the creativity required to complete software development projects in several aspects (see Figure 11.4).

FIGURE 11.3

The Traditional Waterfall Methodology

Issues Related to the Waterfall Methodology	
The business problem	Any flaws in accurately defining and articulating the business problem in terms of what the business users actually require flow onward to the next phase.

The plan	Managing costs, resources, and time constraints is difficult in the waterfall sequence. What happens to the schedule if a programmer quits? How will a schedule delay in a specific phase impact the total cost of the project? Unexpected contingencies may sabotage the plan.
The solution	The waterfall methodology is problematic in that it assumes users can specify all business requirements in advance. Defining the appropriate IT infrastructure that is flexible, scalable, and reliable is a challenge. The final IT infrastructure solution must meet not only current but also future needs in terms of time, cost, feasibility, and flexibility. Vision is inevitably limited at the head of the waterfall.

FIGURE 11.4

Issues Related to the Waterfall Methodology

Unfortunately, business requirements change as the business changes, which calls for considerable feedback and iterative consultation for all business requirements. Essentially, software is "soft" and it must be easily changed and manipulated to meet the changing dynamics of an organization. As people's understanding of the business problems evolve, so must the software. For this reason, it is counterproductive to define all requirements precisely upfront since, by the time the software goes into production, which can be several months or even years after completing the initial analysis phase, chances are the business problems have changed as well as the business.

Rapid Application Development Methodology (RAD)

In response to the faster pace of business, rapid application development has become a popular route for accelerating systems development. ***Rapid application development (RAD)*** (also called ***rapid prototyping***) ***methodology*** emphasizes extensive user involvement in the rapid and evolutionary construction of working prototypes of a system to accelerate the systems development process. Figure 11.5 displays the fundamentals of RAD.

FIGURE 11.5

Fundamentals of RAD

Fundamentals of RAD
Focus initially on creating a prototype that looks and acts like the desired system.
Actively involve system users in the analysis, design, and development phases.
Accelerate collecting the business requirements through an interactive and iterative construction approach.

A *prototype* is a smaller-scale representation or working model of the users' requirements or a proposed design for an information system. The prototype is an essential part of the analysis phase when using the RAD methodology.

PHH Vehicle Management Services, a Baltimore fleet-management company with over 750,000 vehicles, wanted to build an enterprise application that opened the entire vehicle information database to customers over the Internet. To build the application quickly, the company abandoned the traditional waterfall approach. Instead, a team of 30 developers began prototyping the Internet application, and the company's customers evaluated each prototype for immediate feedback. The development team released new prototypes that incorporated the customers' feedback every six weeks. The PHH Interactive Vehicle application went into production seven months after the initial work began. Over 20,000 customers, using a common browser, can now access the PHH Interactive site at any time from anywhere in the world to review their accounts, analyze billing information, and order vehicles.[6]

Extreme Programming Methodology

Extreme programming (XP) methodology breaks a project into tiny phases, and developers cannot continue on to the next phase until the first phase is complete. The primary difference between the waterfall and XP methodologies is that XP divides its phases into iterations with user feedback. The waterfall approach develops the entire system, whereas XP develops the system in iterations (see Figure 11.6). XP is a lot like a jigsaw puzzle; there are many small pieces. Individually the pieces make no sense, but when they are combined (again and again) an organization can gain visibility into the entire new system.

Microsoft Corporation developed Internet Explorer and Netscape Communications Corporation developed Communicator using extreme programming. Both companies did a nightly compilation (called a build) of the entire pro-

ject, bringing together all the current components. They established release dates and expended considerable effort to involve customers in each release. The extreme programming approach allowed both Microsoft and Netscape to manage millions of lines of code as specifications changed and evolved over time. Most important, both companies frequently held user design reviews and strategy sessions to solicit and incorporate user feedback.[7]

XP is a significant departure from traditional software development methodologies, and many organizations in different industries have developed successful software using it. One reason for XP's success is its stress on customer satisfaction. XP empowers developers to respond to changing customer and business requirements, even late in the systems development life cycle, and XP emphasizes teamwork. Managers, customers, and developers are all part of a team dedicated to delivering quality software. XP implements a simple, yet effective way to enable groupware-style development. The XP methodology promotes quickly being able to respond to changing requirements and technology.

FIGURE 11.6

The Iterative Approach

The Agile Alliance Manifesto
Early and continuous delivery of valuable software will satisfy the customer.
Changing requirements, even late in development, are welcome.
Businesspeople and developers must work together daily throughout the project.
Projects should be built around motivated individuals. Give them the environment and support they need, and trust them to get the job done.
The best architectures, requirements, and designs emerge from self-organizing teams.
At regular intervals, the team should reflect on how to become more effective, then tune and adjust its behavior accordingly.

FIGURE 11.7

The Agile Alliance Manifesto

Agile Methodology

The *agile methodology*, a form of XP, aims for customer satisfaction through early and continuous delivery of useful software components. Agile is similar to XP but with less focus on team coding and more on limiting project scope. An agile project sets a minimum number of requirements and turns them into a deliverable product. Agile means what it sounds like: fast and efficient; small and nimble; lower cost; fewer features; shorter projects.

The Agile Alliance is a group of software developers whose mission is to improve software development processes and whose manifesto is displayed in Figure 11.7.

DEVELOPING SUCCESSFUL SOFTWARE

The Gartner Research estimates that 65 percent of agile projects are successful. This success rate is extraordinary compared to the 10 percent success rate of waterfall projects. The following are the primary principles an organization should follow for successful agile software development.[8]

Slash the Budget

Small budgets force developers and users to focus on the essentials. Small budgets also make it easier to kill a failing project. For example, imagine that a project that has already cost $20 million is going down the tubes. With that much invested, it is tempting to invest another $5 million to rescue it rather than take a huge loss. All too often, the system fails and the company ends up with an even bigger loss.

Jim Johnson, chairman of the Standish Group, says he forced the CIO of one Fortune 500 company to set a $100,000 ceiling on all software development projects. There were no exceptions to this business rule without approval from the CIO and CEO. Johnson claims the company's project success rate went from 0 percent to 50 percent.[9]

If It Doesn't Work, Kill It

Bring all key stakeholders together at the beginning of a project and as it progresses bring them together again to evaluate the software. Is it doing what the business wants and, more important, requires? Eliminate any software that is not meeting business expectations. This is called triage, and it's "the perfect place to kill a software project," said Pat Morgan, senior program manager at Compaq's Enterprise Storage Group. He holds monthly triage sessions and says they can be brutal. "At one [meeting], engineering talked about a cool process they were working on to transfer information between GUIs. No one in the room needed it. We killed it right there. In our environment, you can burn

a couple of million dollars in a month only to realize what you're doing isn't useful."[10]

Keep Requirements to a Minimum

Start each project with what the software must absolutely do. Do not start with a list of everything the software should do. Every software project traditionally starts with a requirements document that will often have hundreds or thousands of business requirements. The Standish Group estimates that only 7 percent of the business requirements are needed for any given application. Keeping requirements to a minimum also means that scope creep and feature creep must be closely monitored. *Scope creep* occurs when the scope of the project increases. *Feature creep* occurs when developers add extra features that were not part of the initial requirements. Both scope creep and feature creep are major reasons software development fails.[11]

Test and Deliver Frequently

As often as once a week, and not less than once a month, complete a part of the project or a piece of software. The part must be working and it must be bug-free. Then have the customers test and approve it. This is the agile methodology's most radical departure from traditional development. In some traditional software projects, the customers did not see any working parts or pieces for years.

Assign Non-IT Executives to Software Projects

Non-IT executives should coordinate with the technical project manager, test iterations to make sure they are meeting user needs, and act as liaisons between executives and IT. Having the business side involved full-time will bring project ownership and a desire to succeed to all parties involved. SpreeRide, a Salt Lake City market research outfit, used the agile methodology to set up its company's Web site. The project required several business executives designated full-time. The company believes this is one of the primary reasons that the project was successfully deployed in less than three months.[12]

OPENING CASE QUESTIONS

HP's Software Problems

1. Identify the business benefits associated with successful software development for HP.

2. Which of the seven phases of the systems development life cycle is most important to HP?

3. Which of the seven phases of the systems development life cycle is least important to HP?

4. Which of the different software development methodologies should HP use to implement successful systems?

5. Explain what might happen if HP used the waterfall methodology to develop its ERP system.

section 11.2 **SYSTEMS DEVELOPMENT LIFE CYCLE (SDLC)**

LEARNING OUTCOMES

11.6.   Summarize the activities associated with the planning phase in the SDLC.

11.7.   Summarize the activities associated with the analysis phase in the SDLC.

11.8.   Summarize the activities associated with the design phase in the SDLC.

11.9.   Summarize the activities associated with the development phase in the SDLC.

11.10.   Summarize the activities associated with the testing phase in the SDLC.

11.11.   Summarize the activities associated with the implementation phase in the SDLC.

11.12.   Summarize the activities associated with the maintenance phase in the SDLC.

SYSTEMS DEVELOPMENT LIFE CYCLE

The systems development life cycle is the foundation for all systems development methodologies, and there are literally hundreds of different activities associated with each phase in the SDLC. Typical activities include determining budgets, gathering system requirements, and writing detailed user documentation. The activities performed during each systems development project will vary. This section takes a detailed look at a few of the more common activities performed during the systems development life cycle, along with common issues facing software development projects (see Figures 11.8 and 11.9).

PHASE 1: PLANNING

The *planning phase* involves establishing a high-level plan of the intended project and determining project goals. The three primary activities involved in the planning phase are:

1. Identify and select the system for development.

2. Assess project feasibility.

3. Develop the project plan.

FIGURE 11.8

The Systems Development Life Cycle

FIGURE 11.9

Common Activities Performed During Systems Development

Identify and Select the System for Development

Systems are successful only when they solve the right problem or take advantage of the right opportunity. Systems development focuses on either solving a problem or taking advantage of an opportunity. Determining which systems are required to support the strategic goals of an organization is one of the primary activities performed during the planning phase. Typically, employees generate proposals to build new information systems when they are having a difficult time performing their jobs. Unfortunately, most organizations have limited resources and cannot afford to develop all proposed information systems. Therefore, they look to critical success factors to help determine which systems to build.

A *critical success factor (CSF)* is a factor that is critical to an organization's success. To determine which system to develop, an organization tracks all the proposed systems and prioritizes them by business impact or critical success factors. This allows the business to prioritize which problems require immediate attention and which problems can wait. Figure 11.10 displays possible evaluation criteria for determining which projects to develop.

Evaluation Criteria	Description
Value chain analysis	The value chain determines the extent to which the new system will add value to the organization. Systems with greater value are given priority over systems with less value.
Strategic alignment	Projects that are in line with the organization's strategic goals and objectives are given priority over projects not in line with the organization's strategic goals and objectives.
Cost/benefit analysis	A cost/benefit analysis determines which projects offer the organization the greatest benefits with the least amount of cost.
Resource avail-	Determine the amount and type of resources required to complete

ability	the project and determine if the organization has these resources available.
Project size, duration, and difficulty	Determine the number of individuals, amount of time, and technical difficulty of the project.

FIGURE 11.10

Evaluation Criteria for Determining Software Development Projects

Assess Project Feasibility

A *feasibility study* determines if the proposed solution is feasible and achievable from a financial, technical, and organizational standpoint. Typically, an organization will define several alternative solutions that it can pursue to solve a given problem. A feasibility study is used to determine if the proposed solution is achievable, given the organization's resources and constraints in regard to technology, economics, organizational factors, and legal and ethical considerations. Figure 11.11 displays the different types of feasibility studies an organization can perform.

Develop the Project Plan

Developing a project plan is one of the final activities performed during the planning phase and it is one of the hardest and most important activities. The project plan is the guiding force behind on-time delivery of a complete and successful system. It logs and tracks every single activity performed during the project. If an activity is missed, or takes longer than expected to complete, the project plan must be updated to reflect these changes. Updating the project plan must be performed in every subsequent phase during the systems development effort.

Types of Feasibility Studies	
Economic feasibility study (often called a **cost-benefit analysis**)	Identifies the financial benefits and costs associated with the systems development project.
Legal and contractual feasibility study	Examines all potential legal and contractual ramifications of the proposed system.

Operational feasibility study	Examines the likelihood that the project will attain its desired objectives.
Schedule feasibility study	Assesses the likelihood that all potential time frames and completion dates will be met.
Technical feasibility study	Determines the organization's ability to build and integrate the proposed system.

FIGURE 11.11

Different Types of Feasibility Studies

PHASE 2: ANALYSIS

The *analysis phase* involves analyzing end-user business requirements and refining project goals into defined functions and operations of the intended system. The three primary activities involved in the analysis phase are:

1. Gather business requirements.

2. Create process diagrams.

3. Perform a buy versus build analysis.

Gather Business Requirements

Business requirements are the detailed set of business requests that the system must meet to be successful. At this point, there is little or no concern with any implementation or reference to technical details. For example, the types of technology used to build the system, such as an Oracle database or the Java programming language, are not yet defined. The only focus is on gathering the true business requirements for the system. A sample business requirement might state, "The system must track all customer sales by product, region, and sales representative." This requirement states what the system must do from the business perspective, giving no details or information on how the system is going to meet this requirement.

Gathering business requirements is basically conducting an investigation in which users identify all the organization's business needs and take measurements of these needs. Figure 11.12 displays different methods organizations use to gather business requirements.

The *requirements definition document* contains the final set of business requirements, prioritized in order of

business importance. The system users review the requirements definition document and determine if they will sign off on the business requirements. **Sign-off** is the system users' actual signatures indicating they approve all of the business requirements. One of the first major milestones on the project plan is usually the users' sign-off on business requirements.

A large data storage company implemented a project called Python whose purpose was to control all the company's information systems. Seven years, tens of millions of dollars, and 35 programmers later, Python was canceled. At the end of the project, Python had over 1,800 business requirements of which 900 came from engineering and were written in order to make the other 900 customer requirements work. By the time the project was canceled, it was unclear what the primary goals, objectives, and needs of the project were. Management should have realized Python's issues when the project's requirements phase dragged on, bulged, and took years to complete. The sheer number of requirements should have raised a red flag.[13]

Create Process Diagrams

Once a business analyst takes a detailed look at how an organization performs its work and its processes, the analyst can recommend ways to improve these processes to make them more efficient and effective. **Process modeling** involves graphically representing the processes that capture, manipulate, store, and distribute information between a system and its environment. One of the most common diagrams used in process modeling is the data flow diagram. A **data flow diagram (DFD)** illustrates the movement of information between external entities and the processes and data stores within the system (see Figure 11.13). Process models and data flow diagrams establish the specifications of the system. **Computer-aided software engineering (CASE)** tools are software suites that automate systems analysis, design, and development. Process models and data flow diagrams can provide the basis for the automatic generation of the system if they are developed using a CASE tool.

Methods for Gathering Business Requirements
Perform a *joint application development (JAD)* session where employees meet, sometimes for several days, to define or review the business requirements for the system.
Interview individuals to determine current operations and current issues.

Compile questionnaires to survey employees to discover issues.
Make observations to determine how current operations are performed.
Review business documents to discover reports, policies, and how information is used throughout the organization.

FIGURE 11.12

Methods for Gathering Business Requirements

FIGURE 11.13

Sample Data Flow Diagram

Perform a Buy versus Build Analysis

An organization faces two primary choices when deciding to develop an information system: (1) it can buy the information system from a vendor or (2) it can build the system itself. ***Commercial off-the-shelf (COTS)*** software is a software package or solution that is purchased to support one or more business functions and information systems. Most customer relationship management, supply chain management, and enterprise resource planning solutions are COTS. Typically, a cost-benefit analysis forms the basis of the buy versus build decision. Figure 11.14 displays a few questions an organization must consider when contemplating the buy versus build decision.

Buy versus Build Decision Questions
Do any currently available products fit the organization's needs?
Are unavailable features important enough to warrant the expense of in-house development?
Can the organization customize or modify an existing COTS to fit its needs?
Is there a justification to purchase or develop based on the cost of acquisition?

FIGURE 11.14

Buy versus Build Decision Questions

Three Key Factors in Buy versus Build Decisions	
1. Time to market	If time to market is a priority, then purchasing a good base technology and potentially building on to it will likely yield results faster than starting from scratch.
2. Availability of corporate resources	The buy versus build decision is a bit more complex to make when considering the availability of corporate resources. Typically, the costs to an organization to buy systems such as SCM, CRM, and ERP are extremely high. These costs can be so high—in the multiple millions of dollars—that acquiring these technologies might make the entire concept economically unfeasible. Building these systems, however, can also be extremely expensive, take indefinite amounts of time, and constrain resources.
3. Corporate core competencies	The more an organization wants to build a technical core competency, the less likely it will want to buy.

FIGURE 11.15

Key Factorsin Buy versus Build Decisions

Three key factors an organization should also consider when contemplating the buy versus build decision are: (1) time to market, (2) corporate resources, and (3) core competencies (see Figure 11.15). Weighing the complex relationship between each of these three variables will help an organization make the right choice.

When making the all-important buy versus build decision consider when the product must be available, how many resources are available, and how the organization's core competencies affect the product. If these questions can be definitely answered either yes or no, then the answer is easy. However, most organizations cannot answer these questions with a solid yes or no. Most organizations need to make a trade-off between the lower cost of buying a system and the need for a system that meets all of their requirements. Finding a system to buy that meets all an organization's unique business requirements is next to impossible.

PHASE 3: DESIGN

The *design phase* involves describing the desired features and operations of the system including screen layouts, business rules, process diagrams, pseudo code, and other documentation. The two primary activities involved in the design phase are:

1. Design the IT infrastructure.

2. Design system models.

Design the IT Infrastructure

The system must be supported by a solid IT infrastructure or chances are the system will crash, malfunction, or not perform as expected. The IT infrastructure must meet the organization's needs in terms of time, cost, technical feasibility, and flexibility. Most systems run on a computer network with each employee having a client and the application running on a server. During this phase, the IT specialists recommend what types of clients and servers to buy including memory and storage requirements, along with software recommendations. An organization typically explores several different IT infrastructures that must meet current as well as future system needs. For example, databases must be large enough to hold the current volume of customers plus all new customers that the organization expects to gain over the next several years (see Figure 11.16).

Design System Models

Modeling is the activity of drawing a graphical representation of a design. An organization should model everything it builds including reports, programs, and databases. Many different types of modeling activities are performed during the design phase including:

■ The *graphical user interface (GUI)* is the interface to an information system. GUI screen design is the ability to model the information system screens for an entire system using icons, buttons, menus, and submenus.

■ *Data models* represent a formal way to express data relationships to a database management system (DBMS).

■ *Entity relationship diagram (ERD)* is a technique for documenting the relationships between entities in a database environment (see Figure 11.17).

FIGURE 11.16

Sample IT Infrastructure

PHASE 4: DEVELOPMENT

The *development phase* involves taking all of the detailed design documents from the design phase and transforming them into the actual system. The two primary activities involved in the development phase are:

1. Develop the IT infrastructure.

2. Develop the database and programs.

Develop the IT Infrastructure

The platform upon which the system will operate must be built before building the actual system. In the design phase, an organization creates a blueprint of the proposed IT infrastructure displaying the design of the software, hardware, and telecommunication equipment. In the development phase, the organization purchases and implements the required equipment to support the IT infrastructure.

Most new systems require new hardware and software. It may be as simple as adding memory to a client or as complex as setting up a wide area network across several states.

FIGURE 11.17

Sample Entity Relationship Diagram

Develop the Database and Programs

Once the IT infrastructure is built, the organization can begin to create the database and write the programs required for the system. IT specialists perform these functions and it may take months or even years to design and create all the needed elements to complete the system.

PHASE 5: TESTING

According to a report issued in June 2003 by the National Institute of Standards and Technology (NIST), defective software costs the U.S. economy an estimated $59.5 billion each year. Of that total, software users incurred 64 percent of the costs and software developers 36 percent. NIST suggests that improvements in testing could reduce this cost by about a third, or $22.5 billion, but that unfortunately testing improvements would not eliminate all software errors.[14]

The *testing phase* involves bringing all the project pieces together into a special testing environment to test for errors, bugs, and interoperability, in order to verify that the system meets all the business requirements defined in the analysis phase. The two primary activities involved in the testing phase are:

1. Write the test conditions.

2. Perform the system testing.

Write the Test Conditions

Testing is critical. An organization must have excellent test conditions to perform an exhaustive test. ***Test conditions*** are the detailed steps the system must perform along with the expected results of each step. Figure 11.18 displays several test conditions for testing user log-on functionality in a system. The tester will execute each test condition and compare the expected results with the actual results in order to verify that the system functions correctly. Notice in Figure 11.18 how each test condition is extremely detailed and states the expected results that should occur when executing each test condition. Each time the actual result is different from the expected result, a "bug" is generated and the system goes back to development for a bug fix.

Test condition 6 in Figure 11.18 displays a different actual result than the expected result because the system failed to allow the user to log on. After this test condition fails, it is obvious that the system is not functioning correctly and it must be sent back to development for a bug fix.

Test Condition Number	Date Tested	Tester	Test Condition	Expected Result	Actual Result	Pass /Fail
1	1/1/05	Emily Hickman	Click on System Start Button	Main Menu appears	Same as expected result	Pass
2	1/1/05	Emily Hickman	Click on Logon Button in Main Menu	Logon Screen appears asking for Username and Password	Same as expected result	Pass
3	1/1/05	Emily	Type Emily	Emily Hickman	Same as	Pass

		Hick-man	Hickman in the User Name Field	appears in the User Name Field	expected result	
4	1/1/05	Emily Hick-man	Type Zahara 123 in the password field	XXXXXXXXX appears in the pass-word field	Same as expected result	Pass
5	1/1/05	Emily Hick-man	Click on O.K. button	User logon request is sent to database and user name and password are veri-fied	Same as ex-pected result	Pass
6	1/1/05	Emily Hick-man	Click on Start	User name and password are ac-cepted and the sys-tem main menu ap-pears	Screen ap-peared stating logon failed and username and password were incorrect	Fail

FIGURE 11.18

Sample Test Conditions

FIGURE 11.19

Types of Tests Performed During the Testing Phase

Types of Tests Performed During the Testing Phase	
Application (or system) test-ing	Verifies that all units of code work together and the total system satisfies all of its functional and operational re-

	quirements.
Backup and recovery testing	Tests the ability of an application to be restarted after failure.
Documentation testing	Verifies that the instruction guides are helpful and accurate.
Integration testing	Exposes faults in the integration of software components or software units.
Regression testing	Determines if a functional improvement or repair to the system has affected the other functional aspects of the software.
Unit testing	Tests each unit of code as soon as the unit is complete to expose faults in the unit regardless of its interaction with other units.
User acceptance testing (UAT)	Determines whether a system satisfies its acceptance criteria, enabling the customer to decide whether or not to accept a system.

A typical system development effort has hundreds or thousands of test conditions. Every single test condition must be executed to verify that the system performs as expected. Writing all the test conditions and performing the actual testing of the software takes a tremendous amount of time and energy. Testing is critical to the successful development of any system.

Perform the System Testing

System developers must perform many different types of testing to ensure that the system works as expected. Figure 11.19 displays the more common types of tests performed during the testing phase.

PHASE 6: IMPLEMENTATION

The *implementation phase* involves placing the system into production so users can begin to perform actual business operations with the system. The three primary activities involved in the implementation phase are:

1. Write detailed user documentation.

2. Determine implementation method.

3. Provide training for the system users.

Write Detailed User Documentation

System users require *user documentation* that highlights how to use the system. This is the type of documentation that is typically provided along with the new system. System users find it extremely frustrating to have a new system without documentation.

Determine Implementation Method

An organization must choose the right implementation method to ensure a successful system implementation. There are four primary implementation methods an organization can use (see Figure 11.20).

Primary Implementation Methods	
1. Parallel implementation	Using both the old and new systems until it is evident that the new system performs correctly.
2. Phased implementation	Implementing the new system in phases (e.g., accounts receivables then accounts payable) until it is evident that the new system performs correctly and then implementing the remaining phases of the new system.
3. Pilot implementation	Having only a small group of people use the new system until it is evident that the new system performs correctly and then adding the remaining people to the new system.
4. Plunge implementation	Discarding the old system completely and immediately using the new system.

FIGURE 11.20

Primary Implementation Methods

Provide Training for the System Users

An organization must provide training for the system users. The two most popular types of training are online training and workshop training. **Online training** runs over the Internet or off a CD-ROM. System users perform the training at any time, on their own computers, at their own pace. This type of training is convenient for system users because they can set their own schedule for the training. **Workshop training** is set in a classroom-type environment and led by an instructor. Workshop training is recommended for difficult systems where the system users require one-on-one time with an individual instructor.

PHASE 7: MAINTENANCE

The **maintenance phase** involves performing changes, corrections, additions, and upgrades to ensure the system continues to meet the business goals. Once a system is in place, it must change as the organization changes. The three primary activities involved in the maintenance phase are:

1. Build a help desk to support the system users.

2. Perform system maintenance.

3. Provide an environment to support system changes.

Build a Help Desk to Support the System Users

A **help desk** is a group of people who respond to internal system user questions. Typically, internal system users have a phone number for the help desk they call whenever they have issues or questions about the system. Staffing a help desk that answers internal user questions is an excellent way to provide comprehensive support for new systems.

Perform System Maintenance

Maintenance is fixing or enhancing an information system. Many different types of maintenance must be performed on the system to ensure it continues to operate as expected. These include:

■ **Adaptive maintenance**—making changes to increase system functionality to meet new business requirements.

■ **Corrective maintenance**—making changes to repair system defects.

■ **Perfective maintenance**—making changes to enhance the system and improve such things as processing per-

formance and usability.

■ **Preventive maintenance**—making changes to reduce the chance of future system failures.

Provide an Environment to Support System Changes

As changes arise in the business environment, an organization must react to those changes by assessing the impact on the system. It might well be that the system needs to adjust to meet the ever-changing needs of the business environment. If so, an organization must modify its systems to support the business environment.

A *change management system* includes a collection of procedures to document a change request and define the steps necessary to consider the change based on the expected impact of the change. Most change management systems require that a change request form be initiated by one or more project stakeholders (users, customers, analysts, developers). Ideally, these change requests are reviewed by a *change control board (CCB)* responsible for approving or rejecting all change requests. The CCB's composition typically includes a representative for each business area that has a stake in the project. The CCB's decision to accept or reject each change is based on an impact analysis of the change. For example, if one department wants to implement a change to the software that will increase both deployment time and cost, then the other business owners need to agree that the change is valid and that it warrants the extended time frame and increased budget.

SOFTWARE PROBLEMS ARE BUSINESS PROBLEMS

Only 28 percent of projects are developed within budget and delivered on time and as promised, says a Standish Group report. The primary reasons for project failure are:

■ Unclear or missing business requirements.

■ Skipping SDLC phases.

■ Failure to manage project scope.

■ Failure to manage project plan.

■ Changing technology.[15]

Unclear or Missing Business Requirements

The most common reason systems fail is because the business requirements are either missing or incorrectly gathered during the analysis phase. The business requirements drive the entire system. If they are not accurate or complete, the system will not be successful.

It is important to discuss the relationship between the SDLC and the cost for the organization to fix errors. An error found during the analysis and design phase is relatively inexpensive to fix. All that is typically required is a change to a Word document. However, exactly the same error found during the testing or implementation phase is going to cost the organization an enormous amount to fix because it has to change the actual system. Figure 11.21 displays how the cost to fix an error grows exponentially the later the error is found in the SDLC.

Skipping SDLC Phases

The first thing individuals tend to do when a project falls behind schedule is to start skipping phases in the SDLC. For example, if a project is three weeks behind in the development phase, the project manager might decide to cut testing down from six weeks to three weeks. Obviously, it is impossible to perform all the testing in half the time. Failing to test the system will lead to unfound errors, and chances are high that the system will fail. It is critical that an organization perform all phases in the SDLC during every project. Skipping any of the phases is sure to lead to system failure.

FIGURE 11.21

The Cost of Finding Errors

Failure to Manage Project Scope

As the project progresses, the project manager must track the status of each activity and adjust the project plan if an activity is added or taking longer than expected. Scope creep occurs when the scope of the project increases. Feature creep occurs when developers add extra features that were not part of the initial requirements. Scope creep and feature creep are difficult to manage and can easily cause a project to fall behind schedule.

Failure to Manage Project Plan

Managing the project plan is one of the biggest challenges during systems development. The project plan is the road map the organization follows during the development of the system. Developing the initial project plan is the easiest part of the project manager's job. Managing and revising the project plan is the hard part. The project plan is a living document since it changes almost daily on any project. Failing to monitor, revise, and update the project plan can lead to project failure.

Changing Technology

Many real-world projects have hundreds of business requirements, take years to complete, and cost millions of dol-

lars. Gordon Moore, co-founder of Intel Corporation, observed in 1965 that chip density doubles every 18 months. This observation, known as Moore's law, simply means that memory sizes, processor power, and so on, all follow the same pattern and roughly double in capacity every 18 months. As Moore's law states, technology changes at an incredibly fast pace; therefore, it is possible to have to revise an entire project plan in the middle of a project as a result of a change in technology. Technology changes so fast that it is almost impossible to deliver an information system without feeling the pain of changing technology.

OPENING CASE QUESTIONS

HP's Software Problems

6. Describe the different types of feasibility studies and explain how HP could use a technical feasibility study to avoid software development failure.

7. Review the buy versus build decision and explain why HP chose to buy its ERP system.

8. Why is testing critical to HP's software development process?

9. Identify the primary reasons for software project failure and explain which ones HP experienced on its ERP build.

KEY TERMS

Agile methodology 347

Analysis phase 344

Business requirement 344

Change control board (CCB) 360

Change management system 360

Commercial off-the shelf (COTS) 353

Computer-aided software engineering (CASE) 353

Critical success factor (CSF) 350

Data flow diagram (DFD) 353

Data model 355

Design phase 344

Development phase 344

Entity relationship diagram (ERD) 355

CLOSING CASE ONE

Disaster at Denver International Airport

One good way to learn how to develop successful systems is to review past failures. One of the most infamous sys-

tem failures is Denver International Airport's (DIA) baggage system. When the automated baggage system design for DIA was introduced, it was hailed as the savior of modern airport design. The design relied on a network of 300 computers to route bags and 4,000 telecars to carry luggage across 21 miles of track. Laser scanners were to read bar-coded luggage tags, while advanced scanners tracked the movement of toboggan-like baggage carts.

When DIA finally opened its doors for reporters to witness its revolutionary baggage handling system the scene was rather unpleasant. Bags were chewed up, lost, and misrouted in what has since became a legendary systems nightmare.

One of the biggest mistakes made in the baggage handling system fiasco was that not enough time was allowed to properly develop the system. In the beginning of the project, DIA assumed it was the responsibility of individual airlines to find their own way of moving the baggage from the plane to the baggage claim area. The automated baggage system was not involved in the initial planning of the DIA project. By the time the developers of DIA decided to create an integrated baggage system, the time frame for designing and implementing such a complex and huge system was not possible.

Another common mistake that occurred during the project was that the airlines kept changing their business requirements. This caused numerous issues including the implementation of power supplies that were not properly updated for the revised system design, which caused overloaded motors and mechanical failures. Besides the power supplies design problem, the optical sensors did not read the bar codes correctly, causing issues with baggage routing.

Finally, BAE, the company that designed and implemented the automated baggage system for DIA, had never created a baggage system of this size before. BAE had created a similar system in an airport in Munich, Germany, where the scope was much smaller. Essentially, the baggage system had an inadequate IT infrastructure since it was designed for a much smaller system.

DIA simply could not open without a functional baggage system so the city had no choice but to delay the opening date for over 16 months, costing taxpayers roughly $1 million per day, which totaled around $500 million.[16]

Questions

1. One of the problems with DIA's baggage system was inadequate testing. What types of tests could DIA have used to help ensure its baggage system's success?

2. Evaluate the different implementation approaches. Which one would have most significantly increased the

chances of the project's success?

3. Explain the cost of finding errors. How could more time spent in the analysis and design phase have saved Colorado taxpayers hundreds of millions of dollars?

4. Why could BAE not take an existing IT infrastructure and simply increase its scale and expect it to work?

CLOSING CASE TWO

Reducing Ambiguity in Business Requirements

The number one reason projects fail is bad business requirements. Business requirements are considered "bad" because of ambiguity or insufficient involvement of end users during analysis and design.

A requirement is unambiguous if it has the same interpretation for all parties. Different interpretations by different participants will usually result in unmet expectations. Here is an example of an ambiguous requirement and an example of an unambiguous requirement:

■ Ambiguous requirement: The financial report must show profits in local and U.S. currencies.

■ Unambiguous requirement: The financial report must show profits in local and U.S. currencies using the exchange rate printed in *The Wall Street Journal* for the last business day of the period being reported.

Ambiguity is impossible to prevent completely because it is introduced into requirements in natural ways. For example:

■ Requirements can contain technical implications that are obvious to the IT developers but not to the customers.

■ Requirements can contain business implications that are obvious to the customer but not to the IT developers.

■ Requirements may contain everyday words whose meanings are "obvious" to everyone, yet different for everyone.

■ Requirements are reflections of detailed explanations that may have included multiple events, multiple perspectives, verbal rephrasing, emotion, iterative refinement, selective emphasis, and body language—none of which are captured in the written statements.

Tips for Reviewing Business Requirements

When reviewing business requirements always look for the following words to help dramatically reduce ambiguity:

■ *And* and *or* have well-defined meanings and ought to be completely unambiguous, yet they are often understood only informally and interpreted inconsistently. For example, consider the statement "The alarm must ring if but-

ton T is pressed and if button F is pressed." This statement may be intended to mean that to ring the alarm, both buttons must be pressed or it may be intended to mean that either one can be pressed. A statement like this should never appear in a requirement because the potential for misinterpretation is too great. A preferable approach is to be very explicit, for example, "The alarm must ring if both buttons T and F are pressed simultaneously. The alarm should not ring in any other circumstance."

■ *Always* might really mean "most of the time," in which case it should be made more explicit. For example, the statement "We always run reports A and B together" could be challenged with "In other words, there is never any circumstance where you would run A without B and B without A?" If you build a system with an "always" requirement, then you are actually building the system to never run report A without report B. If a user suddenly wants report B without report A, you will need to make significant system changes.

■ *Never* might mean rarely, in which case it should be made more explicit. For example, the statement "We never run reports A and B in the same month" could be challenged with, "So that means that if I see that A has been run, I can be absolutely certain that no one will want to run B." Again, if you build a system that supports a "never" requirement, then the system users can never perform that requirement. For example, the system would never allow a user to run reports A and B in the same month, no matter what the circumstances.

■ Boundary conditions are statements about the line between true and false and do and do not. These statements may or may not be meant to include end points. For example, "We want to use method X when there are up to 10 pages, but method Y otherwise." If you were building this system, would you include page 10 in method X or in method Y? The answer to this question will vary causing an ambiguous business requirement.[17]

Questions

1. Why are ambiguous business requirements the leading cause of system development failures?

2. Why do the words *and* and *or* tend to lead to ambiguous requirements?

3. Research the Web and determine other reasons for "bad" business requirements.

4. What is wrong with the following business requirement: "The system must support employee birthdays since every employee always has a birthday every year."

CLOSING CASE THREE

Gearing Up at REI

Recreational Equipment Inc. (REI) boasts annual revenues between $500 million and $1 billion and more than 10,000 employees. According to Forrester Research, REI is an industry leader for its "best practice" multichannel CRM strategy, which allows customers to seamlessly purchase products at the company's 70 retail stores as well as by telephone, through mail order, and on the Internet.

REI's Internet Strategy

To boost in-store sales, REI developed a comprehensive Internet strategy. In June 2003, REI .com launched free in-store pickup for customers who ordered online. The belief was that people who visit stores to collect their online purchases might spend more money upon seeing the colorful displays of clothing, climbing gear, bikes, and camping equipment.

REI's strategy paid off. "One out of every three people who buy something online will spend an additional $90 in the store when they come to pick something up," said Joan Broughton, REI's vice president of multichannel programs. That tendency translated into a healthy 1 percent increase in store sales. Broughton's motto is "a sale is a sale is a sale—whether online, in stores, or through catalogs." The Internet is not an isolated channel with its own operational metrics or exclusive customer group.

As the Web has matured as a retail channel, consumers have turned to online shopping as an additional place to interact with a retailer rather than as a replacement for existing channels such as stores or catalogs. According to Jupiter Research, while its prediction of $117 billion in online sales for 2008 represents only 5 percent of total retail sales, the company estimates that 30 percent of off-line sales will be influenced by consumers' online research. Essentially, that means retailers will need to leverage their online properties in ways that are synergistic with and complementary to their offline operations.

REI's CRM Strategy

REI.com was one of the first companies to offer a broad selection of outdoor gear plus expert advice and in-depth information about outdoor products and recreation online. The highly successful Web site currently receives over 2.5 million visitors per day, and online sales represent 15 percent of REI's total sales revenue.

REI realized it could provide a consistent and seamless customer experience whether the customer is shopping via its Web site or at its in-store kiosks by consolidating its four disparate database systems into one customer relationship management system. The system integrates multiple sales channels to manage mail orders, in-store special

orders, kiosk operations, and REI Adventures, the company's adventure travel service. This gives the company a complete view of all customers regardless of their shopping preference. In addition to finding items such as back-packs, bicycles, or tents through the system, customers can also research hiking trails, camping guides, and cycling techniques.

The system is providing REI with the confidence it needs to expand customer service, such as the new REI store pickup. REI has also expanded its multichannel philosophy to include services. In February 2004, the company launched an integrated gift registry that allows people to set up lists for gifts that can be purchased in any retail channel. The registry also allows consumers to post messages to other site visitors, seeking information or specific, hard-to-find products. Customers can create a gift registry in several ways: Visit a store and use a kiosk or scan products with a handheld device, call customer service, or visit REI.com. Once a registry is set up, REI sends an e-mail to a designated list of recipients, complete with a link to a personalized registry page. According to Brad Brown, REI's vice president of information services, the registry is a way to expand sales among consumers who do not traditionally shop at REI.

REI's SCM Strategy

REI offers free in-store pickup for online orders as a strategy specifically designed to get people into the stores. To make that strategy as cost-efficient as possible, the company uses the same trucks that restock its stores to fulfill online orders slated for in-store pickup. To do this, REI had to integrate order information from its Web site and replenishment orders from its stores.

Integrating the two types of order information was not complex, Brown said. What was difficult, however, was coordinating fulfillment of both online and replenishment orders because "orders placed on the Web [by customers] are nothing like replenishment orders that stores place," he said. Online orders are picked from the warehouse at the time of the order and then put in a queue until the appropriate truck is loaded, whereas store orders are picked by an automated replenishment system that typically picks orders at one time based on either a weekly or biweekly replenishment schedule.

To make in-store pickup a reality, Brown's group wrote a "promise algorithm" that informs customers of a delivery date when they place an online order. Timing can get tricky when orders are placed the day before a truck is scheduled to depart the warehouse with a store-replenishment delivery. For example, if an online order is placed on a Monday night and a truck is scheduled to depart Tuesday morning, the system promises the customer a pickup

date of a week later, as if the order would be placed on the following week's truck. However, REI will shoot for fulfilling the order that night; if it can do it, REI (and, ultimately, the customer) is happy because the order arrives sooner than was promised.

Creating effective business-to-consumer retail Web sites entails more than simply calculating sales figures; it also involves multiple projects and delivering the functionality that users expect while mitigating risk and change.[18]

Questions

1. What business benefits did REI receive by developing its successful CRM system?

2. Identify the potential issues facing REI if it failed to implement a successful SCM system.

3. List and describe the seven phases of the SDLC and rank them in order of importance to REI's system development efforts.

4. Summarize the different software development methodologies and recommend one for REI to follow.

5. Describe the analysis phase of systems development along with its importance for successful system development efforts for REI.

6. Explain the importance of the testing phase along with three different tests REI should perform on each new system.

MAKING BUSINESS DECISIONS

1. Selecting a systems development methodology

Exus Incorporated is an international billing outsourcing company. Exus currently has revenues of $5 billion, over 3,500 employees, and operations on every continent. You have recently been hired as the CIO. Your first task is to increase the software development project success rate, which is currently at 20 percent. To ensure that future software development projects are successful, you want to standardize the systems development methodology across the entire enterprise. Currently, each project determines which methodology it uses to develop software.

Create a report detailing three additional system development methodologies that were not covered in this text. Compare each of these methodologies to the traditional waterfall approach. Finally, recommend which methodology you want to implement as your organizational standard. Be sure to highlight any potential roadblocks you might encounter when implementing the new standard methodology.

2. **Understanding project failure**

   You are the director of project management for Stello, a global manufacturer of high-end writing instruments. The company sells to primarily high-end customers, and the average price for one of its fine writing instruments is about $350. You are currently implementing a new customer relationship management system and you want to do everything you can to ensure a successful systems development effort. Create a document summarizing the five primary reasons why this project could fail, along with your strategy to eliminate the possibility of system development failure on your project.

3. **Missing phases in the systems development life cycle**

   Hello Inc. is a large concierge service for executives operating in Chicago, San Francisco, and New York. The company performs all kinds of services from dog walking to airport transportation. Your manager, Dan Martello, wants to skip the testing phase during the company's financial ERP implementation. Dan feels that since the system came from a vendor it should work correctly. To meet the project's looming deadline he wants to skip the testing phase. Draft a memo explaining to Dan the importance of following the SDLC and the ramifications to the business if the financial system is not tested.

4. **Refusing to sign off**

   You are the primary client on a large extranet development project. After carefully reviewing the requirements definition document, you are positive that there are missing, ambiguous, inaccurate, and unclear requirements. The project manager is pressuring you for your sign-off since he has already received sign-off from five of your co-workers. If you fail to sign off on the requirements, you are going to put the entire project at risk since the time frame is nonnegotiable. What would you do? Why?

5. **Saving failing systems**

   Crik Candle Company manufactures low-end candles for restaurants. The company generates over $40 million in annual revenues and has more than 300 employees. You are in the middle of a large multimillion-dollar supply chain management implementation. Your project manager has just come to you with the information that the project might fail for the following reasons:

   - Several business requirements were incorrect and the scope has to be doubled.
   - Three developers recently quit.
   - The deadline has been moved up a month.

Develop a list of options that your company can follow to ensure the project remains on schedule and within budget.

6. **Feasibility studies**

John Lancert is the new managing operations director for a large construction company, LMC. John is currently looking for an associate who can help him prioritize the 60 proposed company projects. You are interested in working with John and have decided to apply for the job. John has asked you to compile a report detailing why project prioritization is critical for LMC, along with the different types of feasibility studies you would recommend that LMC use when determining which projects to pursue.

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Project Management and Outsourcing

CHAPTER OUTLINE

SECTION 12.1

Project Management

Project Management

Project Management Fundamentals

Change Management Fundamentals

Risk Management Fundamentals

SECTION 12.2

Outsourcing

Outsourcing

The Outsourcing Phenomenon

Outsourcing Options

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Future Outsourcing Trends

opening case study

Change at Toyota

At Toyota Motor Sales USA's headquarters in Torrance, California, a circular patch of manicured earth separates the IS building and corporate headquarters. A brook winds its way through lush flowers and pine trees, and a terraced path connects the two buildings. For many years, this was about the only thing the two groups shared with each other.

For the business executives at Toyota Motor Sales (TMS) peering across the courtyard at the Data building, the

deep black windows were a symbol of IS's opacity. These executives felt that IS was unresponsive, and they had little clue where the money was going. "One of the complaints was that we spent a lot of money on IT projects, and the business was frequently disappointed with the results," recalled Bob Daly, group vice president of Toyota Customer Services. Daly says badly handled projects, such as a delayed PeopleSoft ERP implementation and a protracted parts inventory initiative, led to finger-pointing between the two factions.

Meanwhile, behind the darkened windows of the Data building, CIO Barbra Cooper's IS staff was buried under the weight of six enterprisewide projects. Called the Big Six, they included a new extranet for Toyota dealers and the PeopleSoft ERP rollout, as well as four new systems for order management, parts forecasting, advanced warranty, and financial document management. Feeling besieged, the IS group made the mistake of not explaining to the business side all the things it was doing and how much it all cost. It was a classic case of mismanaged expectations and fractured alignment.

By late 2002, Cooper realized that if she wanted to win back the respect of the business managers—and remain in her post—she would have to make some radical changes. A conversation with the Toyota Motor Sales CEO, in which he questioned the sharp incline of IS's spending curve, stopped her in her tracks. In her 30 years in IT, Cooper had developed something of a reputation for coming in to clean up other CIO's messes. Now, she had to take a long look in the mirror and fix herself.

Cooper's Path to Success

Cooper could no longer ignore the rumblings from across the courtyard that had worked their way into the rank-and-file business staff. To them, IS had become an unresponsive, bureaucratic machine.

Cooper started soliciting informal feedback from a wide range of businesspeople. What she discovered was an accumulation of "very painful projects for both IT and the business," she said. "Clearly there was not enough communication and education on our part."

In late 2002, Cooper hired an outside consultancy to interview TMS's top 20 executives. She wanted their honest opinions of how IS was doing. The results did not provide all the answers to the ailments, but she certainly saw the trouble spots. "Parts of the survey results were stinging," Cooper said. "But you can't be a CIO and not face that."

Cooper spent many introspective weeks in 2003 formulating her vision for a new IT department. What she developed was a strategy for a decentralized and transparent IS organization that focused all of its energy on the major business segments. In the summer of 2003, she presented her vision to her senior IS staffers. Some of the

managers were excited by the prospect of change; others were less so.

The first thing Cooper did was set up the Toyota Value Action Program, a team of eight staffers responsible for translating her vision into actionable items for the department and her direct reports. Using the survey results and Cooper's direction, the team winnowed the list to 18 initiatives, including increasing employee training and development, gaining cost savings, making process improvements, ridding IS of inefficiencies, and implementing a metrics program. Each initiative got a project owner and a team. Cooper insisted that each initiative have a mechanism to check its success. The most significant initiative called for improved alignment with the business side. At the heart of this new effort would be a revamped Office of the CIO structure—with new roles, reporting lines, and responsibilities.

As part of the rehaul, Cooper took top-flight personnel out of the Data building and embedded them as divisional information officers, or DIOs, in all of the business units. These DIOs are accountable for IT strategy, development, and services, and they sit on the management committees headed by top business executives. The DIOs' goal is to forge relationships with tier-one executives and executives at the vice president level.

The DIOs were not alone. Business operation managers and relationship managers from IS sat alongside the business folks. "I still believe in managing IT centrally, but it was incumbent on us to physically distribute IT into the businesses," Cooper said. "They could provide more local attention while keeping the enterprise vision alive."

Cooper upended the structure of Toyota's IS department in six months in a bid to weave IT functions more closely into the daily business operations. The process was painful: She changed IS employees' jobs, exposed all of IS's shortcomings, and forced her staff into the business offices. Just over a year into the new plan, IS and the business were standing shoulder-to-shoulder when planning and implementing IT projects. And Cooper is still CIO of Toyota Motor Sales.

A Little Kicking and Screaming

Change can be scary for anyone, especially during an upheaval of an entire 400-person IS department. Cooper changed the jobs of 50 percent of her staffers within six months, yet no one left or was let go. Some took on new responsibilities; others took on expanded or new roles. Cooper said some mid- and upper-level staffers were initially uncomfortable with their new roles, but she spent a lot of time fostering a new attitude about the change. "I dragged them into the conversations kicking and screaming," Cooper said. "But I said to them, 'Unless you think of what it means to change on this level, you will never make it happen.'" The key, Cooper said, is that all IS staffers were

brought into the development of the new organization early.[1]

INTRODUCTION

No one would think of building an office complex by turning loose 100 different construction teams to build 100 different rooms, with no single blueprint or agreed-upon vision of the completed structure. Yet this is precisely the situation in which many large organizations find themselves when managing information technology projects. Organizations routinely overschedule their resources (human and otherwise), develop redundant projects, and damage profitability by investing in nonstrategic efforts that do not contribute to the organization's bottom line. Project management offers a strategic framework for coordinating the numerous activities associated with organizational projects.

Business leaders face a rapidly moving and unforgiving global marketplace that will force them to use every possible tool to sustain competitiveness. A good project manager understands not only the fundamentals of project management, but also how to effectively deal with change management and risk management. This chapter explores project management, change management, risk management, and outsourcing in detail.[2]

section 12.1   PROJECT MANAGEMENT

LEARNING OUTCOMES

12.1. Describe the three primary activities performed by a project manager.

12.2. Describe the three common techniques an organization can use to select good projects.

12.3. List and describe the characteristics of a well-defined project plan.

12.4. Explain change management and how an organization can prepare for change.

12.5. Explain risk management and how an organization can mitigate risk.

12.6. Summarize the strategies a project manager can use to ensure a successful project.

PROJECT MANAGEMENT

A *project* is a temporary endeavor undertaken to create a unique product or service. According to the Project Management Institute, *project management* is the application of knowledge, skills, tools, and techniques to project activities in order to meet or exceed stakeholder needs and expectations from a project. *Project management software* specifically supports the long-term and day-to-day management and execution of the steps in a project

(such as building a new warehouse or designing and implementing a new IT system).

Project management is essential to the success of almost every aspect of IT. Without it, projects tend to be delayed, over budget, and often never reach completion. Horizon Blue Cross Blue Shield of New Jersey, a $6 billion-plus health insurance provider, allocated several hundred million dollars to IT over a five-year period to tackle tasks such as consolidating five enterprise software platforms, managing compliance with regulatory offices, and simplifying new product development. These IT initiatives involve hundreds of skilled people working on hundreds of concurrently developing projects. Horizon's executives needed to gain visibility into all projects, subsets of projects, and existing and planned projects collectively. The company considered a rigorous and formalized project management strategy fundamental to the project's success.

Horizon decided to implement IT project management software from Business Engine Inc. to manage its projects. The software collects information through standardized templates created for Microsoft Project, which are stored in an enterprise database, and then fed into Business Engine's analytical tool, called Ben. Each user can then view and manipulate spreadsheets and graphs, share documents, track revisions, and run what-if scenarios in their personalized digital dashboard view. With the help from Business Engine, Horizon is managing IT projects and assets as if they were investments, tracking their performance against business goals, assessing their individual return and value to the company, and helping sort out which projects require greater attention and resources and which require reduced attention and resources. Horizon found itself ahead of schedule on over 70 percent of its IT projects.[3]

FIGURE 12.1

Project Management Interdependent Variables

Figure 12.1 displays the relationships between the three primary variables in any project—(1) time, (2) cost, and (3) scope. These three variables are interdependent. For example, decreasing a project's time frame means either increasing the cost of the project or decreasing the scope of the project to meet the new deadline. Increasing a project's scope means either increasing the project's time frame or increasing the project's cost—or both—to meet the increased scope changes. Project management is the science of making intelligent trade-offs between time, cost, and scope. All three of the factors combined determine a project's quality.

Benjamin Franklin's timeless advice—by failing to prepare, you prepare to fail—especially applies to many of today's software development projects. A recent survey concluded that the failure rate of IT projects is much higher

in organizations that do not exercise disciplined project management. Figure 12.2 displays the top six reasons why IT projects fail according to *Information Week's* research survey of 150 IT managers.

FIGURE 12.2

Why IT Projects Fall Behind Schedule or Fail

FIGURE 12.3

Expected Growth for Project Management Software

A successful project is typically on time, within budget, meets the business's requirements, and fulfills the customer's needs. The Hackett Group, an Atlanta-based consultancy, analyzed its client database (which includes 2,000 companies, including 81 Fortune 100 companies) and discovered:

- Three in 10 major IT projects fail.

- 21 percent of the companies state that they cannot adjust rapidly to market changes.

- One in four validate a business case for IT projects after completion.[4]

Nicolas Dubuc, collaborative project manager at Rhodia Inc., a $6 billion worldwide manufacturer of specialty chemicals, uses Microsoft's software to develop project management templates and methodologies for its 18 divisions. "We're designing a platform for rapid application development that will enhance opportunities for innovation," Dubuc said.

Today, the leaders in the project management software market include Microsoft, Primavera, Oracle, and SAP. Microsoft Project is the core project management tool for many organizations and dominates with more than 8 million users and over 80 percent of the market share. Figure 12.3 displays the expected growth for project management software over the next few years. If an organization wants to deliver successful, high-quality software on time and under budget, it must take advantage of project management software.

PROJECT MANAGEMENT FUNDAMENTALS

Project deliverables are any measurable, tangible, verifiable outcome, result, or item that is produced to complete a project or part of a project. Examples of project deliverables include design documents, testing scripts, and requirements documents. *Project milestones* represent key dates when a certain group of activities must be performed. For example, completing the planning phase might be a project milestone. If a project milestone is missed, then chances are the project is experiencing problems. A *project manager* is an individual who is an expert in project planning and management, defines and develops the project plan, and tracks the plan to ensure all key

project milestones are completed on time. The art and science of project management must coordinate numerous activities as displayed in Figure 12.4. Project managers perform numerous activities, and three of these primary activities are:

FIGURE 12.4

Project Management Roles

1. Choosing strategic projects.

2. Setting the project scope.

3. Managing resources and maintaining the project plan.

Choosing Strategic Projects

Calpine Corp., a large energy producer, uses project management software to look at its IT investments from a business perspective. The company classifies projects in one of three ways: (1) run the business, (2) grow the business, and (3) transform the business. Calpine splits its $100 million in assets accordingly: 60 percent for running the business, 20 percent for growing the business, and 20 percent for transforming the business. Calpine evaluates each of its 30 to 35 active projects for perceived business value against project costs. For the company to pursue a project it must pass a return on investment (ROI) hurdle. A business project must minimally provide two times ROI, and a transformation project must provide five times ROI.[5]

One of the most difficult decisions organizations make is determining the projects in which to invest time, energy, and resources. An organization must identify what it wants to do and how it is going to do it. The "what" part of this question focuses on issues such as justification for the project, definition of the project, and expected results of the project. The "how" part of the question deals with issues such as project approach, project schedule, and analysis of project risks. Determining which projects to focus corporate efforts on is as necessary to projects as each project is to an organization. Figure 12.5 displays the three common techniques an organization can use to select projects.

Before its merger with Hewlett-Packard, Compaq decided to analyze and prioritize its system development projects. Knowing that the CIO wanted to be able to view every project, project management leaders quickly identified and removed nonstrategic projects. At the end of the review process, the company canceled 39 projects, saving the organization $15 million. Most Fortune 100 companies are receiving bottom-line benefits similar to Compaq's from implementing a project management solution.[6]

FIGURE 12.5

Techniques for Choosing Strategic Projects

Techniques for Choosing Strategic Projects
1. **Focus on organizational goals**—Managers are finding tremendous value in choosing projects that align with the organization's goals. Projects that address organizational goals tend to have a higher success rate since they are important to the entire organization.
2. **Categorize projects**—There are various categories that an organization can group projects into to determine a project's priority. One type of categorization includes problem, opportunity, and directives. Problems are undesirable situations that prevent an organization from achieving its goals. Opportunities are chances to improve the organization. Directives are new requirements imposed by management, government, or some other external influence. It is often easier to obtain approval for projects that address problems or directives because the organization must respond to these categories to avoid financial losses.
3. **Perform a financial analysis**—A number of different financial analysis techniques can be performed to help determine a project's priority. A few of these include net present value, return on investment, and payback analysis. These financial analysis techniques help determine the organization's financial expectations for the project.

Organizations also need to choose and prioritize projects in such a way that they can make responsible decisions as to which projects to eliminate. Jim Johnson, chairman of the Standish Group, a Massachusetts-based consultancy, has identified project management as the process that can make the difference in project success. According to Johnson, "Companies need a process for taking a regular look at their projects and deciding, again and again, if the investment is going to pay off. As it stands now, for most companies, projects can take on a life of their own."[7]

An organization must build in continuous self-assessment, which allows earlier termination decisions on failing projects, with the associated cost savings. This frees capital and personnel for dedication to projects that are worth

pursuing. The elimination of a project should be viewed as successful resource management, not as an admission of failure.

Setting the Project Scope

Once an organization defines the projects it wants to pursue, it must set the project scope. ***Project scope*** defines the work that must be completed to deliver a product with the specified features and functions. The project scope statement is important because it specifies clear project boundaries. The project scope typically includes the following:

■ ***Project product***—a description of the characteristics the product or service has undertaken.

■ ***Project objectives***—quantifiable criteria that must be met for the project to be considered a success.

■ ***Project deliverables***—any measurable, tangible, verifiable outcome, result, or item that is produced to complete a project or part of a project.

■ ***Project exclusions***—products, services, or processes that are not specifically a part of the project.

The project objectives are one of the most important areas to define because they are essentially the major elements of the project. When an organization achieves the project objectives, it has accomplished the major goals of the project and the project scope is satisfied. Project objectives must include metrics so that the project's success can be measured. The metrics can include cost, schedule, and quality metrics along with a number of other metrics. Figure 12.6 displays the SMART criteria—useful reminders on how to ensure that the project has created understandable and measurable objectives.

FIGURE 12.6

SMART Criteria for Successful Objective Creation

Managing Resources and Maintaining the Project Plan

Managing people is one of the hardest and most critical efforts a project manager undertakes. How to resolve conflicts within the team and how to balance the needs of the project with the personal/professional needs of the team are a few of the challenges facing project managers. More and more project managers are the main (and sometimes sole) interface with the client during the project. As such, communication, negotiation, marketing, and salesmanship are just as important to the project manager as financial and analytical acumen. There are many times when the people management side of project management made the difference in pulling off a successful project. A

project plan is a formal, approved document that manages and controls project execution. Figure 12.7 displays the characteristics of a well-defined project plan.

The most important part of the plan is communication. The project manager must communicate the plan to every member of the project team and to any key stakeholders and executives. The project plan must also include any project assumptions and be detailed enough to guide the execution of the project. A key to achieving project success is earning consensus and buy-in from all key stakeholders. By including key stakeholders in project plan development, the project manager allows them to have ownership of the plan. This often translates to greater commitment, which in turn results in enhanced motivation and productivity.

The two primary diagrams most frequently used in project planning are PERT and Gantt charts. A ***PERT (Program Evaluation and Review Technique) chart*** is a graphical network model that depicts a project's tasks and the relationships between those tasks. A ***dependency*** is a logical relationship that exists between the project tasks, or between a project task and a milestone. PERT charts define dependency between project tasks before those tasks are scheduled (see Figure 12.8). The boxes in Figure 12.8 represent project tasks, and the project manager can adjust the contents of the boxes to display various project attributes such as schedule and actual start and finish times. The arrows indicate that one task is dependent on the start or completion of another task. The ***critical path*** is a path from the start to the finish that passes through all the tasks that are critical to completing the project in the shortest amount of time. PERT charts frequently display a project's critical path.

FIGURE 12.7

Project Plan Characteristics

Characteristics of a Well-Defined Project Plan
Easy to understand
Easy to read
Communicated to all key participants (key stakeholders)
Appropriate to the project's size, complexity, and criticality

Prepared by the team, rather than by the individual project manager

FIGURE 12.8

PERT Chart Expert, a PERT Chart Example

A *Gantt chart* is a simple bar chart that depicts project tasks against a calendar. In a Gantt chart, tasks are listed vertically and the project's time frame is listed horizontally. A Gantt chart works well for representing the project schedule. It also shows actual progress of tasks against the planned duration. Figure 12.9 displays a software development project using a Gantt chart.

CHANGE MANAGEMENT FUNDAMENTALS

Snap-on, a maker of tools and equipment for specialists such as car mechanics, is successful at managing change. The company recently increased profits by 12 percent while sales were down 6.7 percent. Dennis Leitner, vice president of IT, runs the IT group on a day-to-day basis and leads the implementation of all major software development initiatives. Each software development initiative is managed by both the business and IT. In fact, business resources are on the IT group's payroll, and they spend as much as 80 percent of their time learning what a business unit is doing and how IT can help make it happen. Leitner's role focuses primarily on strategic planning, change management, and setting up metrics to track performance.[8]

Dynamic organizational change is inevitable and an organization must effectively manage change as it evolves. With the numerous challenges and complexities that organizations face in today's rapidly changing environment, effective change management thus becomes a critical core competency. *Change management* is a set of techniques that aid in evolution, composition, and policy management of the design and implementation of a system. Figure 12.10 displays a few of the more common reasons change occurs.

A *change management system* includes a collection of procedures to document a change request and define the steps necessary to consider the change based on the expected impact of the change. Most change management systems require that a change request form be initiated by one or more project stakeholders (systems owners, users, customers, analysts, developers). Ideally, these change requests are considered by a *change control board (CCB)* that is responsible for approving or rejecting all change requests. The CCB's composition typically includes a representative from each business area that has a stake in the project. The CCB's decision to accept or reject each change is based on an impact analysis of the change. For example, if one department wants to implement a change

to the software that will increase both deployment time and cost, then the other business owners need to agree that the change is valid and that it warrants the extended time frame and increased budget.

FIGURE 12.9

Microsoft Project, a Gantt Chart Example

FIGURE 12.10

Common Reasons Why Change Occurs

Common Reasons Change Occurs
1. An omission in defining initial scope
2. A misunderstanding of the initial scope
3. An external event such as government regulations that create new requirements
4. Organizational changes, such as mergers, acquisitions, and partnerships, that create new business problems and opportunities
5. Availability of better technology
6. Shifts in planned technology that force unexpected and significant changes to the business organization, culture, and/or processes
7. The users or management simply wanting the system to do more than they originally requested or agreed to
8. Management reducing the funding for the project or imposing an earlier deadline

FIGURE 12.11

Three Important Guidelines for Effective Change Management

Three Important Guidelines for Effectively Dealing with Change Management

1. Institute change management polices—Create clearly defined policies and procedures that must be followed each time a request for change is received.
2. Anticipate change—View change as an opportunity and embrace it.
3. Seek change—Every 6 to 12 months look for changes that may be windows of opportunity. Review successes and failures to determine if there are any opportunities for innovation.

Preparing for Change

Change is an opportunity, not a threat. Realizing that change is the norm rather than the exception will help an organization stay ahead. Becoming a change leader and accepting the inevitability of change can help ensure that an organization can survive and even thrive in times of change. Figure 12.11 displays the three important guidelines change leaders can follow to make change effective both inside and outside their organizations.

General Electric has successfully tackled change management through an innovative program trademarked "Work Out." Work Out is shorthand for the idea of taking excess work out of the system. The purpose is to eliminate bureaucracy and free people's time for more productive activities. The positive time-saving and productivity-enhancing results of the Work Out change management program include:

■ **Reports**: Teams calculated the time it took to prepare routine reports and compared it with the value generated from the reports. It quickly became apparent that much more effort went into preparing the reports than their comparative value to the recipients warranted. Valuable time was freed when those reports were eliminated or scaled back.

■ **Approvals**: The approval process was questioned and adjusted accordingly. One instance discovered that a simple purchase order request required 12 approval signatures.

■ **Meetings**: Teams evaluated the need for meetings and changed the way they were conducted to take advantage of technologies such as teleconferencing.[9]

Change, whether it comes in the form of a crisis, a market shift, or a technological development, is challenging for all organizations. Successful organizations and successful people learn to anticipate and react appropriately to change.

RISK MANAGEMENT FUNDAMENTALS

Altria Group, Inc., the tobacco and food-products conglomerate, has a well-defined process for choosing projects based on project risk. The company gathers project information such as cash flow, return on investment, interfaces, and regulatory-compliance issues and creates a risk-based score of each project. The company then plots them on a grid with risk on the horizontal axis and value on the vertical axis. Managers then choose projects based on an optimal balance of risk and return.[10]

Project risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on a project objective(s). **Risk management** is the process of proactive and ongoing identification, analysis, and response to risk factors. The best place to address project risk is during the project plan creation. Elements of risk management are outlined in Figure 12.12.

Risks vary throughout a project and in general are more significant at the later phases of a project. Figure 12.13 displays risk factors that may not be immediately obvious and are often the root causes of IT project success or failure.

FIGURE 12.12

Elements of Risk Management

Elements of Risk Management
Risk identification—Determining which risks might affect the project and documenting their characteristics
Qualitative risk analysis—Performing a qualitative analysis of risks and conditions to prioritize their effects on project objectives
Quantitative risk analysis—Measuring the probability and consequences of risks as well as estimating their implications for the project objectives
Risk response planning—Developing procedures and techniques to enhance opportunities and reduce threats to the project's objectives

FIGURE 12.13

Common Project Risk Factors

Common Project Risk Factors
Changing business circumstances that undermine expected benefits
Reluctance to report negative information or to "blow the whistle" on a project
Significant change management issues including resistance to change
The rush to get a project done quickly, often compromising the end result and desired outcome
Executives who are strongly wedded to a project and unwilling to admit that it may have been a mistake
A common tendency in IT projects to overengineer technology solutions, stemming from a belief in the superiority of technical solutions over simpler, people-based solutions
Building the project plan in conjunction with the budget or to validate some basic assumptions about the project's fiscal requirements and business base payback calculations

Mitigating Risk

An organization must devise strategies to reduce or mitigate risk. A wide range of strategies can be applied, with each risk category necessitating different mitigation strategies. When considering risk mitigation, the importance of choice, opportunities, and inexactitude should be kept clearly in mind. Organizations should take several actions at the enterprise level to improve risk management capabilities; these are displayed in Figure 12.14.

FIGURE 12.14

Actions to Improve Risk Management Capabilities

Actions to Improve Risk Management Capabilities

Promote project leadership skills—Hire individuals with strong project management and project leadership skills as well as business management skills. These individuals can be extremely helpful in advisory and steering committee roles as well as coaching roles.

Learn from previous experience—Over many years of collective experiences, organizations have encountered hundreds of large IT projects. Document and revisit development methodologies, software tools, and software development best practices in order to share this vital information across the organization.

Share knowledge—Working in team or group environments tends to yield the most successful projects since individuals can share their unique learning experiences.

Create a project management culture—Orient people from day one on the importance of project management, change management, and risk management. Be sure to measure and reward project management skills and promote individuals based on successful projects.

Audit and tax firm KPMG LLP and software maker SeeCommerce unveiled a service, called SeeRisk, to help companies assess supply chain management risk. SeeRisk helps a company establish common metrics and measure performance against them by identifying operational problems and risks. The SeeRisk system is integrated with operational and transactional systems along with external vendor systems. The goal of the system is to improve revenue as well as reduce costs by increasing visibility of inventory, and by knowing what is on the shelf and what is downstream in production. SeeRisk can calculate the implications that defective components would have on revenue, operating costs, what it would cost to start production over, and ultimately the effect on corporate profitability.[11]

Successful Project Management Strategies

Recreational Equipment, Inc. (REI), needs to consistently develop quality products and decrease the time to deliver them to market. To do that, REI needs to efficiently manage product development processes, projects, and information. The REI Gear and Apparel division takes an integrated project management approach to designing, managing, and tracking its product development projects, while collaborating and managing its workflow. REI's

strategy entails combining Microsoft .NET technology, the Microsoft Office Enterprise Project Management (EPM) Solution, and software based on Microsoft Office Visio 2003 to create an integrated business solution it can use to model as-is business processes, experiment with what-if scenarios, and then convert the optimized processes into detailed project plans.

Project managers can further develop these plans, assign resources divisionwide, manage projects online, and collaborate globally. REI predicts this integrated solution will help it improve its efficiency, consistency, and scalability so it can deliver its products to market more quickly. Figure 12.15 displays the top five successful project management strategies outlined in CIO magazine.

Large IT projects require significant investment of time and resources. Successful software development projects have proven challenging and often elusive, wasting many resources and jeopardizing the goodwill of stakeholders, including customers and employees. Bringing strong, effective project, change, and risk management disciplines to large IT projects is essential to successful organizations. The days when a project manager could just concentrate on bringing a project in on time, on budget, and with agreed-upon deliverables are fading.

FIGURE 12.15

Top Five Successful Project Management Strategies

Top Five Successful Project Management Strategies
1. Define project success criteria. At the beginning of the project, make sure the stakeholders share a common understanding of how they will determine whether the project is successful. Too often, meeting a predetermined schedule is the only apparent success factor, but there are certainly others. Some examples are increasing market share, reaching a specified sales volume or revenue, achieving specific customer satisfaction measures, retiring a high-maintenance legacy system, and achieving a particular transaction processing volume and correctness.
2. Develop a solid project plan. The hard part of developing a plan is the thinking, negotiating, balancing, and communication project managers will have to do to develop a solid and realistic plan. The time they spend analyzing what it will take to solve the

> business problem will reduce the number of changes later in the project.
>
> **3. Divide and conquer.** Break all large tasks into multiple small tasks to provide more accurate estimates, reveal hidden work activities, and allow for more accurate, fine-grained status tracking.
>
> **4. Plan for change.** Things never go precisely as planned on a project; therefore, the budget and schedule should include some contingency buffers at the end of major phases to accommodate change.
>
> **5. Manage project risk.** Failure to identify and control risks will allow the risks to control the project. Be sure to spend significant time during project planning to brainstorm possible risk factors, evaluate their potential threat, and determine the best way to mitigate or prevent them.

OPENING CASE QUESTIONS

Change at Toyota

1. What would be the impact on Toyota's business if it failed to implement a project management solution and managed its projects using a myriad of spreadsheets and Word documents?

2. Why would Opportunity, Resource, and Time & Expense Manager applications be of value to a company like Toyota?

3. Why would Toyota find it important to focus on implementing good project management techniques?

4. Why are project management, change management, and risk management critical to a global company such as Toyota?

5. Why would Toyota find it important to focus on implementing solid risk management techniques?

6. Why would Toyota find it important to focus on implementing solid change management techniques?

7. Describe the ramifications to Toyota's business if it failed to anticipate change.

8. Explain the potential issues facing Toyota if it failed to analyze risk.

section 12.2 OUTSOURCING

OUTSOURCING

More than 400 people from Merrill Lynch, Thomson Financial (a large market data vendor), and a number of other vendors worked feverishly on Merrill Lynch's biggest outsourcing initiative ever. This highly complex $1 billion makeover of its wealth management system is designed to improve the efficiency of Merrill's financial advisers. With the new system, Merrill Lynch advisers can manage more of the assets of their high-net-worth customers.

The new system also represents a major shift in the way Merrill Lynch approaches IT initiatives. In the 1990s, Merrill Lynch developed its previous system, Trusted Global Advisor (TGA), as it did any other major system—it developed it in-house. The thought of outsourcing a critical business system to a vendor was viewed as highly unfavorable by most financial services organizations. Merrill Lynch signed a contract that outsourced much of the responsibility for its new platform to Thomson Financial.[12]

In the high-speed global business environment, an organization needs to maximize its profits, enlarge its market share, and restrain its ever-increasing costs. Businesses need to make every effort to rethink and adopt new processes, especially the prospective resources regarding insourcing and outsourcing.

FIGURE 12.16

Common Departments Outsourced by Organizations

Insourcing (*in-house development*) is a common approach using the professional expertise within an organization to develop and maintain the organization's information technology systems. Insourcing has been instrumental in creating a viable supply of IT professionals and in creating a better quality workforce combining both technical and business skills.

Outsourcing is an arrangement by which one organization provides a service or services for another organization

that chooses not to perform them in-house. In some cases, the entire information technology department is outsourced, including planning and business analysis as well as the installation, management, and servicing of the network and workstations. Outsourcing can range from a large contract under which an organization such as IBM manages IT services for a company such as Xerox, to the practice of hiring contractors and temporary office workers on an individual basis. Figure 12.16 compares the functions companies have outsourced, and Figure 12.17 displays the primary reasons companies outsource.

FIGURE 12.17

Reasons Companies Outsource

Ever since Eastman Kodak announced that it was outsourcing its information systems function in 1988 to IBM, DEC, and Businessland, large organizations have found it acceptable to transfer their IT assets, leases, and staff to outsourcers. In view of the changes in sourcing, the key question now is not "should we outsource IT?" but rather "where and how can we take advantage of the rapidly developing market of IT services providers?" Some of the influential drivers affecting the growth of the outsourcing market include:

- **Core competencies.** Many companies have recently begun to consider outsourcing as a means to fuel revenue growth rather than just a cost-cutting measure. Outsourcing enables an organization to maintain an up-to-date technology infrastructure while freeing it to focus on revenue growth goals by reinvesting cash and human capital in areas offering the greatest return on investment.

- **Financial savings.** It is typically cheaper to hire workers in China and India than similar workers in the United States. Technology is advancing at such an accelerated rate that companies often lack the resources, workforce, or expertise to keep up. It is close to impossible for an IT department to maintain a "best-of-breed" status, especially for small and medium-sized enterprises where cost is a critical factor.

- **Rapid growth.** A company's sustainability depends on both speed to market and ability to react quickly to changes in market conditions. By taking advantage of outsourcing, an organization is able to acquire best practices process expertise. This facilitates the design, building, training, and deployment of business processes or functions.

- **Industry changes.** High levels of reorganization across industries have increased demand for outsourcing to better focus on core competencies. The significant increase in merger and acquisition activity created a sudden need to integrate multiple core and noncore business functions into one business, while the deregulation of the

utilities and telecom industries created a need to ensure compliance with government rules and regulations. Companies in either situation turned to outsourcing so they could better focus on industry changes at hand.

- **The Internet.** The pervasive nature of the Internet as an effective sales channel has allowed clients to become more comfortable with outsourcing. Barriers to entry, such as lack of capital, are dramatically reduced in the world of e-business due to the Internet. New competitors enter the market daily.

- **Globalization.** As markets open worldwide, competition heats up. Companies may engage outsourcing service providers to deliver international services.

THE OUTSOURCING PHENOMENON

The outsourcing market has experienced strong growth over the last several years because of businesses' need to focus on core competencies, Web implementation initiatives, consolidation across industries, and a tight labor pool. The outsourcing of noncore, transaction-based processes has gained significant momentum over the last few years as organizations have become more comfortable with the concept of outsourcing and its advantages.

Organizations elect to outsource for a variety of reasons. Some of these reasons are tactical, while others are strategic. In the past, outsourcing was often used tactically, as a quick-fix, short-term solution to a particular need or problem, that did not form part of an overall business strategy. In recent years, many companies have begun to use strategic outsourcing where an organization works with suppliers in order to make a significant improvement in business performance.

No one would seriously expect an oil company to outsource its exploration and refining functions; pharmaceutical companies probably would not outsource their research and development; and few, if any, major automakers would consider outsourcing their production planning or marketing campaigns. These activities are core to their businesses and often the means for differentiation in the marketplace and a source of competitive advantage. Businesses outsource their noncore functions, such as payroll and IT. By outsourcing IT, most organizations can cut costs, improve service, and focus on their core business. According to research firm IDC, the worldwide IT outsourcing market will reach $230 billion by 2009.[13]

FIGURE 12.18

Outsourcing Opportunities

Industry	Outsourcing Opportunities
Banking and finance	Check and electronic payment processing, credit report issuance, delinquency management, securities, and trades processing
Insurance	Claims reporting and investigation, policy administration, checkprocessing, risk assessment
Telecommunications	Invoice and bill production, transaction processing
Health care	Electronic data interchange, database management, accounting
Transportation	Ticket and order processing
Government	Loan processing, Medicaid processing
Retail	Electronic payment processing

Best Buy Co. Inc. is the number one U.S. specialty retailer for consumer electronics, personal computers, entertainment software, and appliances. Best Buy needed to find a strategic IT partner that could help the company leverage its IT functions in order to meet its business objectives. Best Buy further wanted to integrate its disparate enterprise systems and minimize its operating expenses. Best Buy outsourced these functions to Accenture, a global management consulting, technology services, and outsourcing company. The comprehensive outsourcing relationship that drove Best Buy's transformation produced spectacular results that were measurable in every key area of its business, such as a 20 percent increase in key category revenue that translated into a $25 million profit improvement.[14]

According to PricewaterhouseCoopers' survey of CEOs from 452 of the fastest growing U.S. companies, "Businesses that outsource are growing faster, larger, and more profitably than those that do not. In addition, most of those involved in outsourcing say they are saving money and are highly satisfied with their outsourcing service providers." Figure 12.18 lists common areas for outsourcing opportunities across industries.

Outsourcing Benefits

The many benefits associated with outsourcing include:

■ Increased quality and efficiency of a process, service, or function.

■ Reduced operating expenses.

■ Focusing resources on core profit-generating competencies.

■ Reduced exposure to risks involved with large capital investments.

■ Access to outsourcing service provider's economies of scale.

■ Access to outsourcing services provider's expertise and best-in-class practices.

■ Access to advanced technologies.

■ Increased flexibility with the ability to respond quickly to changing market demands.

■ Avoiding costly outlay of capital funds.

■ Reduced head count and associated overhead expense.

■ Reduced frustration and expense related to hiring and retaining employees in an exceptionally tight job market.

■ Reduced time to market for products or services.

FIGURE 12.19

Outsourcing Models and Cost Savings

OUTSOURCING OPTIONS

In the early 1990s, British Petroleum (BP) began looking at IT outsourcing as a way to radically reduce costs and gain more flexible and higher-quality IT resources that directly improve the overall business. Over the past decade, all companies within the global BP Group have incorporated outsourcing initiatives in their business plans. BP's information technology costs were reduced by 40 percent globally over the first three years of the outsourcing engagement and have continued at a 10 percent reduction year after year, leading to hundreds of millions of dollars in savings to BP.[15]

Information technology outsourcing enables organizations to keep up with market and technology advances— with less strain on human and financial resources and more assurance that the IT infrastructure will keep pace with evolving business priorities (see Figure 12.19). Planning, deploying, and managing IT environments is both a tactical and a strategic challenge that must take into account a company's organizational, industrial, and

technological concerns. The three different forms of outsourcing options are:

1. *Onshore outsourcing* is the process of engaging another company within the same country for services.

2. *Nearshore outsourcing* refers to contracting an outsourcing arrangement with a company in a nearby country. Often this country will share a border with the native country.

3. *Offshore outsourcing* is using organizations from developing countries to write code and develop systems. In offshore outsourcing the country is geographically far away.

OFFSHORE OUTSOURCING

Since the mid-1990s, major U.S. companies have been sending significant portions of their software development work offshore—primarily to vendors in India, but also to vendors in China, Eastern Europe (including Russia), Ireland, Israel, and the Philippines. The big selling point for offshore outsourcing to these countries is "inexpensive good work." A programmer who earns as much as $63,000 per year in the United States is paid as little as $5,000 per year overseas (see Figure 12.20). Companies can easily realize cost savings of 30 percent to 50 percent through offshore outsourcing and still get the same, if not better, quality of service.[16]

Developed and developing countries throughout Europe and Asia offer some IT outsourcing services, but most are hampered to some degree by language, telecommunications infrastructure, or regulatory barriers. The first and largest offshore marketplace is India, whose English-speaking and technologically advanced population have built its IT services business into a $4 billion industry. Infosys, NIIT, Satyam, TCS, and Wipro are among the biggest Indian outsourcing service providers, each with a significant presence in the United States. There are currently three categories of outsourcing countries (see Figure 12.21).

FIGURE 12.20

Typical Salary Ranges for Computer Programmers

Country	Salary Range Per Year
China	$5,000–$9,000
India	6,000–10,000
Philippines	6,500–11,000

Russia	7,000–13,000
Ireland	21,000–28,000
Canada	25,000–50,000
United States	60,000–90,000

FIGURE 12.21

Categories of Outsourcing Countries

1. The leaders—countries that are leading the outsourcing industry.

2. The up-and-comers—countries that are beginning to emerge as solid outsourcing options.

3. The rookies—countries that are just entering the outsourcing industry.

The Leaders

The following countries are leaders in the outsourcing industry:

■ Canada

■ India

■ Ireland

■ Israel

■ Philippines

Expertise	■ Software development/maintenance, contact centers, technical support.
Major Customers	■ Allmerica, Agilent.
Advantages	■ Though labor costs are high, geographic proximity and cultural affinity with the United States make it highly desirable. ■ Contact center turnover is low.

Disadvantage	■ High cost of labor pool, but still less expensive than outsourcing in the United States.

Expertise	■ Software development/maintenance, contact centers, financial processing.
Major Customers	■ Citigroup, GE Capital, American Express.
Advantages	■ India is the leader in business process and IT services outsourcing. ■ Two million English-proficient speakers graduate every year from more than 1,000 colleges that offer information technology education. ■ Strong history of software development. ■ Highly skilled labor pool. ■ Favorable cost structure.
Disadvantages	■ Political instability. ■ Labor costs are rising as demand for IT workers begins to exceed supply. ■ High turnover, particularly in contact centers, is becoming an issue.

Expertise	■ European shared-services centers, software development, contact centers.
Major Customers	■ Intel, Dell, Microsoft.

Advantages	■ Reputation for producing highly skilled IT professionals.
	■ Strong cultural affinity with the United States.
	■ Low political or financial risk.
	■ Solid telecommunications infrastructure.
	■ Strong educational system.
Disadvantage	■ High cost of salaries, however, labor costs are still lower than in the United States.

Expertise	■ Software development/maintenance, packaged software implementation, application integration, security, e-business.
Major Customers	■ Merrill Lynch, Shaw Industries.
Advantages	■ Highly skilled workforce including scientists and engineers from Eastern Europe and Russia.
	■ Excellent educational system.
	■ Hotbed for IT innovation.
Disadvantages	■ Political instability.
	■ Employee safety is a cause for concern.
	■ High cost of IT salaries.

Expertise	■ Accounting, finance, contact centers, human resources.
Major	■ Procter & Gamble, American International Group, Citigroup.

Customers	
Advantages	■ The population boasts a high percentage of English speakers with American accents. ■ Culture dictates aim-to-please attitude. ■ Estimated 15,000 technology students graduate from universities annually.
Disadvantages	■ Filipinos are not nearly as strong in software development and maintenance as other outsourcing countries. ■ Political instability.

The Up-and-Comers

The following countries are up-and-coming in the outsourcing industry:

■ Brazil

■ China

■ Malaysia

■ Mexico

■ Russia

■ South Africa

Expertise	■ Software development/maintenance.
Major Customers	■ General Electric, Goodyear, Xerox.
Advantages	■ Big cost savings from a large supply of IT labor. ■ Brazil is Latin America's largest economy with a strong industrial base. ■ Brazil's national focus is on growing small and midsize businesses,

	including IT services. ■ Affinity with U.S. culture including minimal time zone differences.
Disadvantage	■ Remains on priority watch list of International Intellectual Property Alliance for copyright infractions.

Expertise	■ Transaction processing, low-end software development/maintenance.
Major Customers	■ HSBC Bank, Microsoft.
Advantages	■ Large pool of educated IT workers with broad skill sets. ■ Government provides strong support for IT outsourcing industry. ■ Telecommunications infrastructure is improving. ■ Entry into World Trade Organization winning confidence of foreign investors. ■ Government has established 15 national software industrial parks.
Disadvantages	■ English proficiency low. ■ Workers lack knowledge of Western business culture. ■ Workers lack project management skills. ■ Intellectual property protections weak. ■ Piracy. ■ Red tape and corruption from a highly bureaucratic government.

Expertise	■ Wireless applications.

Major Customers	■ IBM, Shell, DHL, Motorola, Electronic Data Systems Corporation.
Advantages	■ Good business environment with strong government support for IT and communications industries. ■ Workforce has strong global exposure. ■ World-class telecommunications infrastructure. ■ Over half of the 250,000 students in higher education major in scientific or technical disciplines.
Disadvantages	■ Labor costs higher than India. ■ Few suppliers, which limits business choices. ■ Shortage of skilled IT talent.

Expertise	■ Software development, contact centers.
Major Customers	■ AOL Time Warner, General Motors, IBM.
Advantages	■ Solid telecommunications infrastructure. ■ Shares cultural affinity and time zones with the United States. ■ Second-largest U.S. trading partner. ■ Programmers highly proficient on latest technologies, including Sun's J2EE and Microsoft's .NET.
Disadvantages	■ English proficiency low. ■ Government corruption.

Expertise	■ Web design, complex software development, aerospace engineering.
Major Customer	■ Boeing.
Advantages	■ Large number of highly skilled workers with degrees in science, engineering, and math. ■ Strong venue for research and development. ■ Programmers have skills for both cutting-edge projects and working with legacy applications. ■ European-based companies benefit from historic cultural affinity and geographic proximity.
Disadvantages	■ English proficiency not as widespread as in India or the Philippines, making contact centers impractical. ■ Government corruption and red tape. ■ Copyright piracy. ■ Outsourcing industry is fragmented and many firms have 20 programmers or less, making them unattractive to companies with large IT projects. ■ Telecommunications infrastructure needs work.

Expertise	■ Contact centers, e-business, software development, IT security.
Major Customers	■ AIG, Old Mutual, Sage Life, Swissair.
Advantages	■ Time zone compatibility with Europe. ■ English is a native language.

	■ Solid telecommunications infrastructure.
Disadvantages	■ Small pool of IT skilled workers. ■ IT talent tends to emigrate. ■ Crime.

The Rookies

The following countries are just beginning to offer outsourcing and are considered rookies in the industry:

■ Argentina

■ Chile

■ Costa Rica

Expertise	■ Software development/maintenance, contact centers.
Major Customers	■ BankOne, Citibank, Principal Financial Group.
Advantages	■ Low costs resulting from an economic collapse in 2001. ■ Economy began to rebound in 2003, growing more than 8 percent, but unemployment remains high. ■ Large labor pool, including solid base of engineering talent.
Disadvantages	■ Country has yet to reach agreement with creditors on restructuring debt. ■ Foreign investors are cautious.

Expertise	Software development/maintenance.
Major Customer	Compaq.

Advantages	■ Large highly skilled pool of IT talent.
	■ State-of-the-art telecommunications infrastructure.
	■ Good satellite connectivity and digital network.
	■ Government actively supports business process and software development sectors.
	■ Government plans to begin offering English classes to technical workers.
Disadvantages	■ English proficiency lacking.
	■ Slightly higher costs than neighboring countries.

Expertise	■ Contact centers, e-business.
Major Customer	■ Unisys.
Advantages	■ Business-friendly environment.
	■ Highly skilled pool of engineering talent.
	■ Well-educated workforce.
	■ Favorable cost structure.
	■ English and Spanish widely spoken.
Disadvantage	■ Relatively small labor supply.

Expertise	■ Contact centers, e-business, Web hosting, Web design.
Major Customers	■ IBM, Microsoft, Cisco.

Advantages	■ Stable political and economic environment.
	■ Well-established telecommunications infrastructure.
	■ Thriving contact center industry.
	■ Limited supply of domestic labor. To meet demand, the government has eased visa restrictions allowing entry of workers from countries such as Bangladesh.
Disadvantage	■ New Zealand cannot compete on costs with India and the Philippines.

Expertise	■ Software development/maintenance.
Major Customers	■ Dell, Glovia, Sungard.
Advantages	■ Reasonable telecommunications infrastructure.
	■ Cost structure is slightly lower than Malaysia.
Disadvantages	■ Demand for skilled IT labor exceeds supply.
	■ Population is not as educated as in neighboring countries.
	■ English is not widely spoken.

| Expertise | ■ Software development, Web site development. |
| Major Customers | ■ Sears, Roebuck and Company; Target Corporation. |

Advantages	■ History of training highly educated scientists and engineers. (The Soviet Union based the majority of its space and aviation technology work here.) ■ Information technology outsourcing growth predicted to double over the next couple of years.
Disadvantages	■ Unstable political climate. ■ Fears that the country is drifting away from democracy and pro-Western stance.

■ New Zealand

■ Thailand

■ Ukraine

In summary, many countries are racing to participate in the outsourcing phenomenon. When an organization outsources, it needs to analyze all of its options and weigh all of the advantages and disadvantages. When faced with an outsourcing decision, be sure to evaluate the countries on such things as geopolitical risk, English proficiency, and salary cost (see Figure 12.22).

THE CHALLENGES OF OUTSOURCING

Outsourcing comes with several challenges. These arguments are valid and should be considered when a company is thinking about outsourcing. Many challenges can be avoided with proper research on the outsourcing service provider. The challenges include:

■ **Contract length.** Most of the outsourced IT contracts are for a relatively long time period (several years). This is because of the high cost of transferring assets and employees as well as maintaining technological investment. The long time period of the contract causes three particular problems:

1. Difficulties in getting out of a contract if the outsourcing service provider turns out to be unsuitable.

2. Problems in foreseeing what the business will need over the next 5 or 10 years (typical contract lengths), hence creating difficulties in establishing an appropriate contract.

3. Problems in reforming an internal IT department after the contract period is finished.

- **Competitive edge.** Effective and innovative use of IT can give an organization a competitive edge over its rivals. A competitive business advantage provided by an internal IT department that understands the organization and is committed to its goals can be lost in an outsourced arrangement. In an outsourced arrangement, IT staff are striving to achieve the goals and objectives of the outsourcing service provider, which may conflict with those of the organization.

FIGURE 12.22

Outsourcing Options

THE LEADERS			
Country	**Geopolitical Risk**	**English Proficiency**	**Average Programmer Salary**
Canada	Low	Good	>$12K
India	Moderate	Good	$4K–$12K
Ireland	Low	Good	>$12K
Israel	Moderate	Good	>$12K
Philippines	Moderate	Good	$4K–$12K
THE UP-AND-COMERS			
Country	**Geopolitical Risk**	**English Proficiency**	**Average Programmer Salary**
Brazil	Moderate	Poor	$4K–$12K

China	Low	Poor	$4K–$12K
Malaysia	Low	Fair	$4K–$12K
Mexico	Moderate	Poor	>$12K
Russia	Moderate	Poor	$4K–$12K
South Africa	Moderate	Good	>$12K

THE ROOKIES

Country	Geopolitical Risk	English Proficiency	Average Programmer Salary
Argentina	Moderate	Fair	$4K–$12K
Chile	Low	Poor	<$4K
Costa Rica	Moderate	Good	$4K–$12K
New Zealand	Low	Good	>$12K
Thailand	Low	Poor	$4K–$12K
Ukraine	Moderate	Poor	$4K-$12K

■ **Confidentiality.** In some organizations, the information stored in the computer systems is central to the enterprise's success or survival, such as information about pricing policies, product mixing formulas, or sales analysis. Some companies decide against outsourcing for fear of placing confidential information in the hands of the provider, particularly if the outsourcing service provider offers services to companies competing in the same marketplace. Although the organization usually dismisses this threat, claiming it is covered by confidentiality clauses in a contract, the organization must assess the potential risk and costs of a confidentiality breach in

determining the net benefits of an outsourcing agreement.

■ **Scope definition.** Most IT projects suffer from problems associated with defining the scope of the system. The same problem afflicts outsourcing arrangements. Many difficulties result from contractual misunderstandings between the organization and the outsourcing service provider. In such circumstances, the organization believes that the service required is within the contract scope while the service provider is sure it is outside the scope and so is subject to extra fees.

FUTURE OUTSOURCING TRENDS

Companies are getting smarter about outsourcing and about aligning efficiency with core business priorities. As businesses become increasingly networked—global, commoditized, 24x7, and collaborative—outsourcing is becoming less of a cost-saving strategy and more an overall context for business.

Outsourcing is rapidly approaching commodity status, and this will transform the outsourcing value equation from high margins and vendor control into a classic buyers' market with competition driving down margins, adding features and services, and increasing buyer choices. U.S. companies should consider Mexico and Canada for nearshore outsourcing since those countries often provide very competitive pricing. Vendors in these countries can be viable alternatives, such as IBM Global Services (Mexico and Canada), Softtek (Mexico), CGI (Canada), and Keane (Canada).[17]Companies should look for value-based pricing rather than the lowest possible price. The emerging trend of companies using reverse auction bidding to select offshore vendors is a dangerous one; it could result in low prices, but also low value and low customer satisfaction.

Outsourcing IT services and business functions is becoming an increasingly common global practice among organizations looking for competitive advantage. The guiding principle is that noncore and critical activities of an enterprise can be handed over to companies with expertise in those activities, thereby freeing internal resources to focus on enhancing the added-value of the organization's core business. Outsourcing is no longer a simple matter of cutting costs and improving service levels. As more companies consider the benefits of outsourcing their IT functions and their business processes, they will find new ways to create business value. Companies that succeed will find innovative solutions to help drive costs down, select only the problem areas to outsource, and more important, learn to use outsourcing as a strategic weapon.

OPENING CASE QUESTIONS

Change at Toyota

9. How could Toyota benefit from outsourcing?

10. If you had to choose a country to recommend for outsourcing, which country would it be and why?

11. Explain the issues facing Toyota from its internal IT department if it decided to outsource the project management of the development of a new system.

12. What types of ethical issues might Toyota encounter when considering outsourcing?

13. What types of security issues might Toyota encounter when considering outsourcing?

KEY TERMS

CLOSING CASE ONE

Staying on Track—Toronto Transit

Schedules are at the heart of Toronto Transit Commission's (TTC) celebrated transit system, which services over 1 million customers daily. More than 50 large engineering and construction projects are under way to expand, upgrade, and maintain Toronto's transit systems and structures. One such project is the Sheppard project, which consists of constructing the new six-kilometer line north of the city. Sheppard is estimated to take more than five years to complete, with a total cost of $875 million.

TTC's challenge is to keep its 50 individual projects, most of which fall within the $2 million to $100 million price range and span an average of five years, on schedule and under budget. Staying on top of so many multifaceted, multiyear, and often interdependent projects adds additional complexity for the company. TTC uses Primavera Project Planner (P3) to create a single master schedule for all of its engineering and construction projects.

TTC's 50 individual projects average 100 to 150 activities each, with some projects encompassing as many as 500 to 600 activities. "Seeing the big picture is important, not only for the 300 people who work in the Engineering and Construction branch of the TTC, but for the entire 9,000-person organization," said Vince Carroll, head scheduler for the Engineering and Construction branch. "Engineering managers need to see how other projects may impact their own. Materials and procurement managers need to track project progress. Senior managers need to be able to communicate with city government to secure funding. Marketing and public relations people need the latest information to set public expectations. And most important of all," Carroll said, "the operations group needs to stay informed of what is happening so that they can adjust the schedules that run the trains."

Carroll and his team of 25 people create, update, and publish a master schedule that summarizes the individual status of each project, shows the logical links between projects, and provides an integrated overview of all projects. The master schedule helps the team effectively and regularly communicate the status of all projects currently under way throughout the Toronto Transit system.

The master schedule organizes projects according to their location in the capital budget. For example, projects can be organized according to those that have been allotted funding for expansion, state of good repair, legislative reasons, or environmental reasons. Each project is organized by its logical flow—from planning, analysis, design, through the maintenance phase. The final report shows positive and negative balances for each project and a single overview of the status of all the engineering and construction projects. Carroll and his team use PERT charts to create time-scaled logic diagrams and then convert this information to bar charts for presentation purposes in the master schedule. TTC is currently linking its master schedule directly to its payroll system, enabling it to track the number of hours actually worked versus hours planned. [18]

Questions

1. Describe Gantt charts and explain how TTC could use one to communicate project status.

2. Describe PERT charts and explain how TTC could use one to communicate project status.

3. How could TTC use its master schedule to identify change management issues along with potential resolutions?

4. How could TTC use its master schedule to identify risk management issues along with potential resolutions?

CLOSING CASE TWO

Changing Circuits at Circuit City

When Circuit City expanded the big-box warehouse format to consumer electronics retailing in the 1980s, the company was on its way to becoming the place to go for TVs and stereos. By the late 1980s, it had sidestepped its then top competitor, Silo, and it soon put the squeeze on the likes of Tweeter and RadioShack. Circuit City was doing so well in the 1990s that business consultant Jim Collins, in his best seller *Good to Great*, wrote: "From 1982 to 1999, Circuit City generated cumulative stock returns 22 times better than the market, handily beating Intel, Wal-Mart, GE, Hewlett-Packard and Coca-Cola."

Today, Circuit City is in a markedly different position. By 2001, Best Buy had raced past the Richmond, Virginia-based chain, usurping its position as the number one consumer electronics retailer. Best Buy now has 608 stores compared with Circuit City's 599 and nearly $25 billion in revenue to Circuit City's $9.7 billion. Circuit City is ranked by consultancy Retail Forward as the number three seller of consumer electronics, behind Best Buy and Wal-Mart. "Circuit City was the 800-pound gorilla," said Joseph Feldman, a research analyst with the investment bank SG Cowen & Co. However, "they woke up one morning and Best Buy had doubled its size with the same

number of stores."

Catching Best Buy

Circuit City has been trying to catch up to Best Buy, or at least cement its position as a serious contender in consumer electronics retailing. Recently, its top executives announced plans to turn the company into a customer-focused business that delivers a personalized experience to all customers across all its channels (stores, Web, and call centers). Michael Jones, who took over as Circuit City's CIO in January 2004, speaks passionately about the high-profile role technology will play in delivering personalized customer experiences. However, before he can achieve his vision of store associates recognizing customers through their loyalty cards as soon as they enter the store, he has a lot of unglamorous groundwork to lay. Circuit City's strategy hinges on a robust IT infrastructure that makes information readily accessible to decision makers. Everything the company is doing to improve its business—from developing more effective promotions to deciding which products should be displayed at the ends of aisles in stores—hinges on data. "This is heavy analytical work. It's fact-based, data-driven," said Philip Schoonover, Circuit City's new president who was hired in October 2004 from Best Buy.

Circuit City is just starting to invest heavily in the technology needed to act on this strategy. It is upgrading its mostly proprietary point-of-sale (POS) system and building an enterprise data warehouse to replace siloed databases. However, some analysts say Circuit City's turnaround effort has been hampered by a stodgy, overly complacent leadership that lacks vision. Top executives saw the Best Buy locomotive coming but failed to react as it steamed past them. Indeed, some analysts say they doubt Circuit City will ever catch up.

Bottom-Up Changes

As part of its turnaround effort over the past few years, Circuit City has sold all of its noncore businesses to focus on its core: consumer electronics. It also has changed the pay structure for in-store employees, begun relocating stores (it recently closed 19), and hired new management. In addition, the company is finally starting to hone its customer-centric strategy. Circuit City is already improving the customer experience in its stores by, among other things, locating accessories and services close to big-ticket items so that customers can see more quickly what they might need to furnish their home office or outfit a home theater. For example, when a customer is looking at a high-definition television, nearby is a selection of furniture to hold the TV, the cables needed to hook it up, and DirectTV or digital cable service products. Circuit City is also making merchandising decisions based on what is important to

the customer. For example, its stores are beginning to feature products deemed most important to customers on the displays at the ends of aisles. The company is trying to nail the basics of customer service by making sure that items are not out of stock.[19]

Questions

1. Explain why anticipating change would have helped Circuit City remain as an industry leader.

2. Why are project management, change management, and risk management critical to a global company such as Circuit City?

3. Assess the impact on Circuit City's business if it failed to implement change management strategies as it revamped its global organization.

4. What are some of the potential risks facing Circuit City's new business model?

5. Why would Opportunity, Resource, and Time & Expense applications be of value to a company like Circuit City?

6. Why would Circuit City benefit from implementing good risk management and change management techniques?

CLOSING CASE THREE

Outsourcing Brew

Coors Brewing Company, the third-largest brewer in the United States, manufactures and markets more than a dozen varieties of beer and malt beverages in 30 markets around the world. In a rapidly consolidating industry, Coors had a choice: keep growing or be acquired. To create the optimal conditions for growth, the company needed to improve access to information, consolidate systems, and reduce costs.

In less than a decade, Coors Brewing Company had more than doubled in size. Managing that growth became increasingly difficult for the company's internal IT staff. The company wanted to maintain responsibility for the technologies directly related to making and selling beer. Therefore, Coors was looking for a partner with deep industry expertise, mature application experience, and global reach to help revitalize its technology to support its business goals, including bringing new acquisitions online quickly.

The company decided to outsource the day-to-day management of its technical operations, conversion of legacy applications, and systems. Coors outsourced these functions to EDS to create a globally integrated enterprise solution, helping to optimize the supply chain from beginning to end. EDS is an experienced outsourcing services

company with more than 130,000 employees and 2003 revenues of $21.5 billion, ranked 80th on the Fortune 500.

EDS offered Coors an infrastructure "on demand." Coors avoids a huge up-front investment in infrastructure, but is able to access increased capacity when business volumes increase. Now IT costs are predictable, and additional infrastructure is instantly available when the company needs it. Coors also controls costs by using EDS's Best ShoreSM Services, which enables Coors to reduce the cost of applications management by as much as 40 percent through a combination of offshore, nearshore, and local service centers and personnel.

EDS's solutions at Coors deliver much more than lower costs and increased reliability. As EDS assumed control of Coors's help desk, staff increased service levels while identifying patterns that let Coors focus training where it was most needed and kept the company aware of where potential problems lay. Standardizing the company's desktop environment has allowed Coors to get rid of many obsolete applications.

EDS is much more than an information technology outsourcing service provider, it is Coors's business partner. "They work with us on project management and root-cause analysis, which have helped us to add a lot of discipline in our organization," CIO Virginia Guthrie said. With a modernized and efficient information environment taking shape, EDS and Coors have ambitious plans for the future, from improving manufacturing processes to enhancing Coors's global presence. Guthrie said, "What we really want here is for this partnership to be a poster child for how outsourcing partnerships should work." With the help of EDS, Coors was able to:

- Within just 60 days, reduce cost of application maintenance by 70 percent.
- Save more than $1.2 million on project resources related to SAP implementation.
- Reduce applications in use by 48 percent.
- Work to retire 70 percent of legacy systems.[20]

Questions

1. Describe an alternative approach that Coors could have used instead of outsourcing to EDS.

2. What would be the advantages of offshore outsourcing the Coors IT department?

3. What are some other reasons Coors outsourced its information technology functions that were not mentioned in the case?

4. Describe some of the factors causing Coors to be "forced" to outsource its information technology functions.

MAKING BUSINESS DECISIONS

1. **Saving failing systems**

   Signatures Inc. specializes in producing for companies personalized products such as coffee mugs and pens with company logos. The company generates over $40 million in annual revenues and has more than 300 employees. The company is in the middle of a large multimillion-dollar SCM implementation, and it has just hired your Project Management Outsourcing firm to take over the project management efforts. On your first day, your team is told that the project is failing for the following reasons:

   ■ The project is using the traditional waterfall methodology.

   ■ The SDLC was not followed and the developers decided to skip the testing phase.

   ■ A project plan was developed during the analysis phase, but the old project manager never updated or followed the plan.

   ■ In a group determine what your first steps would be to get this project back on track.

2. **Explaining project management**

   Prime Time Inc. is a large consulting company that specializes in outsourcing people with project management capabilities and skills. You are in the middle of an interview for a job with Prime Time. The manager performing the interview asks you to explain why managing a project plan is critical to a project's success. The manager also wants you to explain scope creep and feature creep and your tactics for managing them on a project. Finally, the manager wants you to elaborate on your strategies for delivering successful projects and reducing risks.

3. **Applying project management techniques**

   You have been hired by a medium-sized airline company, Sun Best. Sun Best currently flies over 300 routes in the East. The company is experiencing tremendous issues coordinating its 3,500 pilots, 7,000 flight attendants, and 2,000 daily flights. Determine how Sun Best could use a Gantt chart to help it coordinate pilots, flight attendants, and daily flights. Using Excel, create a sample Gantt chart highlighting the different types of activities and resources Sun Best could track with the tool.

4. **Mitigating risk**

   Alicia Fernandez owns and operates a chain of nine seafood restaurants in the Boston area. Alicia is currently considering purchasing one of her competitors, which would give her an additional six restaurants. Alicia's primary concerns with the purchase are the constantly changing seafood prices and high staff turnover rate in the restaurant industry. Explain to Alicia what risk management is and how she can use it to mitigate the risks for the

potential purchase of her competitor.

5. **The Travel Store**

In 2006, The Travel Store faced a dilemma. The retailer had tripled in size over a three-year period to $1 billion in sales, but it had done so despite operational deficiencies. The company's inability to evolve its business processes as it grew was causing problems. Within a year, sales and profits fell below expectations, and its stock price plummeted from approximately $10 a share to less than $2 a share. The Travel Store is determined to take quick and decisive action to restore profitability and improve its credibility in the marketplace. One of its top priorities is to overhaul its inventory management system in an effort to create optimal levels of inventory to support sales demand. This would prevent higher volume stores from running out of key sale items while also ensuring that lower sales stores would not be burdened with excess inventory that could only be moved at closeout prices. The company would like to outsource this function but is worried about the challenges of transferring the responsibility of this important business function, as well as the issues surrounding confidentiality, and scope definition. Make a list of the competitive advantages outsourcing could give to The Travel Store, along with recommendations for addressing the company's outsourcing concerns.

6. **Software solutions**

Founded in 2003, Gus Software provides innovative search software, Web site demographics, and testing software. All serve as part of its desktop and enterprise resource planning solutions for government, corporate, educational, and consumer markets. Web site publishers, digital media publishers, content managers, document managers, business users, consumers, software companies, and consulting services companies use the Gus solutions. The company is currently thinking about offshore outsourcing its call center functions, e-business strategies, and application development. Describe how Gus could use outsourcing along with the potential advantages it might receive.

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BUSINESS DRIVEN INFORMATION SYSTEMS

GLOSSARY

A

acceptable use policy (AUP)   A policy that a user must agree to follow in order to be provided access to a network or to the Internet.

accounting   Analyzes the transactional information of the business so the owners and investors can make sound economic decisions.

accounting and finance ERP component   Manages accounting data and financial processes within the enterprise with functions such as general ledger, accounts payable, accounts receivable, budgeting, and asset management.

accounting department   Provides quantitative information about the finances of the business including recording, measuring, and describing financial information.

adware   Software that generates ads that install themselves on a computer when a person downloads some other program from the Internet.

agile methodology   A form of XP, aims for customer satisfaction through early and continuous delivery of useful software components.

analysis phase   Analyzing end-user business requirements and refining project goals into defined functions and operations of the intended system.

analytical CRM   Supports back-office operations and strategic analysis and includes all systems that do not deal directly with the customers.

analytical information   Encompasses all organizational information, and its primary purpose is to support the performing of managerial analysis tasks.

anti-spam policy   States that e-mail users will not send unsolicited e-mails (or spam).

application architecture   Determines how applications integrate and relate to each other.

application generation component   Includes tools for creating visually appealing and easy-to-use applications.

application service provider (ASP)   A company that offers an organization access over the Internet to systems and related services that would otherwise have to be located in personal or organizational computers.

application software   Used for specific information processing needs, including payroll, customer relationship management, project management, training, and many others.

arithmetic/logic unit (ALU)   Performs all arithmetic operations (for example, addition and subtraction) and all logic operations (such as sorting and comparing numbers).

artificial intelligence (AI)   Simulates human intelligence such as the ability to reason and learn.

As-Is process model   Represent the current state of the operation that has been mapped, without any specific improvements or changes to existing processes.

asset   Anything owned that has value or earning power.

associates program (affiliate program)   Businesses can generate commissions or royalties from an Internet site.

association detection   Reveals the degree to which variables are related and the nature and frequency of these relationships in the information.

attribute   Characteristics or properties of an entity class.

authentication   A method for confirming users' identities.

authorization   The process of giving someone permission to do or have something.

automatic call distribution   A phone switch routes inbound calls to available agents.

availability   Addresses when systems can be accessed by users.

B

backdoor program   Viruses that open a way into the network for future attacks.

backup   An exact copy of a system's information.

backward integration   Takes information entered into a given system and sends it automatically to all upstream systems and processes.

balance sheet   Gives an accounting picture of property owned by a company and of claims against the property on a specific date.

banner ad   Small ad on one Web site that advertises the products and services of another business, usually another dot-com business.

benchmark   Baseline values the system seeks to attain.

benchmarking   The process of continuously measuring system results, comparing those results to optimal system performance (benchmark values), and identifying steps and procedures to improve system performance.

binary digit (bit)   The smallest unit of information that a computer can process.

biometric   The identification of a user based on a physical characteristic, such as a fingerprint, iris, face, voice, or handwriting.

black-hat hacker   Breaks into other people's computer systems and may just look around or steal and destroy information.

blog   Web site in which items are posted on a regular basis and displayed in reverse chronological order.

Bluetooth   An omnidirectional wireless technology that provides limited-range voice and data transmission over the unlicensed 2.4-GHz frequency band, allowing connections with a wide variety of fixed and portable devices that normally would have to be cabled together.

bookkeeping   The actual recording of the business's transactions, without any analysis of the information.

break-even point   The point at which revenues equal costs.

brick-and-mortar business   A business that operates in a physical store without an Internet presence.

bullwhip effect   Occurs when distorted product demand information passes from one entity to the next throughout the supply chain.

business-critical integrity constraint   Enforces business rules vital to an organization's success and often requires more insight and knowledge than relational integrity constraints.

business facing process   Invisible to the external customer but essential to the effective management of the business and includes goal setting, day-to-day planning, performance feedback, rewards, and resource allocation.

business intelligence   Information that people use to support their decision-making efforts.

business process   A standardized set of activities that accomplish a specific task, such as processing a customer's order.

business process management (BPM)   Integrates all of an organization's business processes to make individual processes more efficient.

business process management tool   Used to create an application that is helpful in designing business process models and also helpful in simulating, optimizing, monitoring, and maintaining various processes that occur within an organization.

business process model   A graphic description of a process, showing the sequence of process tasks, which is developed for a specific purpose and from a selected viewpoint.

business process modeling (or **mapping**)   The activity of creating a detailed flow chart or process map of a work

process showing its inputs, tasks, and activities, in a structured sequence.

business process outsourcing   The contracting of a specific business task, such as payroll, to a third-party service provider.

business process reengineering (BPR)   The analysis and redesign of workflow within and between enterprises.

business requirement   The detailed set of business requests that the system must meet in order to be successful.

business-to-business (B2B)   Applies to businesses buying from and selling to each other over the Internet.

business-to-business (B2B) marketplace   An Internet-based service that brings together many buyers and sellers.

business-to-consumer (B2C)   Applies to any business that sells its products or services to consumers over the Internet.

buyer power   High when buyers have many choices of whom to buy from and low when their choices are few.

byte   Group of eight bits represents one natural language character.

C

cache memory   A small unit of ultra-fast memory that is used to store recently accessed or frequently accessed data so that the CPU does not have to retrieve this data from slower memory circuits such as RAM.

call scripting system   Accesses organizational databases that track similar issues or questions and automatically generate the details for the CSR who can then relay them to the customer.

campaign management system   Guides users through marketing campaigns performing such tasks as campaign definition, planning, scheduling, segmentation, and success analysis.

capacity planning   Determines the future IT infrastructure requirements for new equipment and additional network capacity.

capital   Represents money whose purpose is to make more money, for example, the money used to buy a rental property or a business.

central processing unit (CPU) (or microprocessor)   The actual hardware that interprets and executes the program (software) instructions and coordinates how all the other hardware devices work together.

change control board (CCB)   Responsible for approving or rejecting all change requests.

change management   A set of techniques that aid in evolution, composition, and policy management of the design and implementation of a system.

change management system   Includes a collection of procedures to document a change request and define the steps necessary to consider the change based on the expected impact of the change.

chief information officer (CIO)   Responsible for (1) overseeing all uses of information technology and (2) ensuring the strategic alignment of IT with business goals and objectives.

chief knowledge officer (CKO)   Responsible for collecting, maintaining, and distributing the organization's knowledge.

chief privacy officer (CPO)   Responsible for ensuring the ethical and legal use of information within an organization.

chief security officer (CSO)   Responsible for ensuring the security of IT systems and developing strategies and IT safeguards against attacks from hackers and viruses.

chief technology officer (CTO)   Responsible for ensuring the throughput, speed, accuracy, availability, and reliability of an organization's information technology.

clickstream   Records information about a customer during a Web surfing session such as what Web sites were visited, how long the visit was, what ads were viewed, and what was purchased.

clickstream data   Exact pattern of a consumer's navigation through a site.

click-and-mortar business   A business that operates in a physical store and on the Internet.

click-through   A count of the number of people who visit one site and click on an advertisement that takes them to the site of the advertiser.

click-to-talk   Buttons allow customers to click on a button and talk with a CSR via the Internet.

client   Computer that is designed to request information from a server.

client/server network   A model for applications in which the bulk of the back-end processing, such as performing a physical search of a database, takes place on a server, while the front-end processing, which involves communicating with the users, is handled by the clients.

cluster analysis   A technique used to divide an information set into mutually exclusive groups such that the members of each group are as close together as possible to one another and the different groups are as far apart as possible.

coaxial cable   Cable that can carry a wide range of frequencies with low signal loss.

cold site   A separate facility that does not have any computer equipment, but is a place where employees can

move after a disaster.

collaboration system   An IT-based set of tools that supports the work of teams by facilitating the sharing and flow of information.

collaborative demand planning   Helps organizations reduce their investment in inventory, while improving customer satisfaction through product availability.

collaborative engineering   Allows an organization to reduce the cost and time required during the design process of a product.

commercial off-the-shelf (COTS)   A software package or solution that is purchased to support one or more business functions and information systems.

communication device   Equipment used to send information and receive it from one location to another.

competitive advantage   A product or service that an organization's customers place a greater value on than similar offerings from a competitor.

complex instruction set computer (CISC) chip   Type of CPU that can recognize as many as 100 or more instructions, enough to carry out most computations directly.

computer   Electronic device operating under the control of instructions stored in its own memory that can accept, manipulate, and store data.

computer-aided software engineering (CASE)   Software suites that automate systems analysis, design, and development.

confidentiality   The assurance that messages and information are available only to those who are authorized to view them.

consolidation   Involves the aggregation of information and features simple roll-ups to complex groupings of interrelated information.

consumer-to-business (C2B)   Applies to any consumer that sells a product or service to a business over the Internet.

consumer-to-consumer (C2C)   Applies to sites primarily offering goods and services to assist consumers interacting with each other over the Internet.

contact center (call center)   Customer service representatives (CSRs) answer customer inquiries and respond to problems through a number of different customer touchpoints.

contact management CRM system   Maintains customer contact information and identifies prospective customers for future sales.

content filtering   Occurs when organizations use software that filters content to prevent the transmission of unauthorized information.

content management system   Provides tools to manage the creation, storage, editing, and publication of information in a collaborative environment.

content provider   Companies that use the Internet to distribute copyrighted content, including news, music, games, books, movies, and many other types of information.

continuous process improvement model   Attempts to understand and measure the current process, and make performance improvements accordingly.

control unit   Interprets software instructions and literally tells the other hardware devices what to do, based on the software instructions.

cookie   A small file deposited on a hard drive by a Web site containing information about customers and their Web activities.

copyright   The legal protection afforded an expression of an idea, such as a song, video game, and some types of proprietary documents.

core competency   An organization's key strength or business function that it does better than any of its competitors.

core competency strategy   When an organization chooses to focus specifically on what it does best (its core competency) and forms partnerships and alliances with other specialist organizations to handle nonstrategic business processes.

core ERP component   Traditional components included in most ERP systems and they primarily focus on internal operations.

corporation (also called, **organization, enterprise,** or **business**)   An artificially created legal entity that exists separate and apart from those individuals who created it and carry on its operations.

counterfeit software   Software that is manufactured to look like the real thing and sold as such.

cracker   A hacker with criminal intent.

critical path   A path from the start to the finish that passes through all the tasks that are critical to completing the

project in the shortest amount of time.

critical success factor (CSF) A factor that is critical to an organization's success.

CRM analysis technologies Help organizations segment their customers into categories such as best and worst customers.

CRM predicting technologies Help organizations make predictions regarding customer behavior such as which customers are at risk of leaving.

CRM reporting technologies Help organizations identify their customers across other applications.

cross-selling Selling additional products or services to a customer.

cube The common term for the representation of multidimensional information.

customer facing process Results in a product or service that is received by an organization's external customer.

customer metric Assesses the management of customer relationships by the organization.

customer relationship management (CRM) Involves managing all aspects of a customer's relationship with an organization to increase customer loyalty and retention and an organization's profitability.

cyberterrorist Seeks to cause harm to people or to destroy critical systems or information and use the Internet as a weapon of mass destruction.

cycle inventory The average amount of inventory held to satisfy customer demands between inventory deliveries.

D

data Raw facts that describe the characteristics of an event.

data administration component Provides tools for managing the overall database environment by providing facilities for backup, recovery, security, and performance.

database Maintains information about various types of objects (inventory), events (transactions), people (employees), and places (warehouses).

database management system (DBMS) Software through which users and application programs interact with a database.

database-based workflow system Stores documents in a central location and automatically asks the team members to access the document when it is their turn to edit the document.

data definition component Helps create and maintain the data dictionary and the structure of the database.

data dictionary   A file that stores definitions of information types, identifies the primary and foreign keys, and maintains the relationships among the tables.

data flow diagram (DFD)   Illustrates the movement of information between external entities and the processes and data stores within the system.

data manipulation component   Allows users to create, read, update, and delete information in a database.

data mart   Contains a subset of data warehouse information.

data mining   The process of analyzing data to extract information not offered by the raw data alone.

data-mining tool   Uses a variety of techniques to find patterns and relationships in large volumes of information and infer rules from them that predict future behavior and guide decision making.

data model   A formal way to express data relationships to a database management system (DBMS).

data warehouse   A logical collection of information—gathered from many different operational databases—that supports business analysis activities and decision-making tasks.

decision support system (DSS)   Models information to support managers and business professionals during the decision-making process.

demand planning software   Generates demand forecasts using statistical tools and forecasting techniques.

denial-of-service attack (DoS)   Floods a Web site with so many requests for service that it slows down or crashes the site.

dependency   A logical relationship that exists between the project tasks, or between a project task and a milestone.

design phase   Involves describing the desired features and operations of the system including screen layouts, business rules, process diagrams, pseudo code, and other documentation.

development phase   Involves taking all of the detailed design documents from the design phase and transforming them into the actual system.

digital asset management system (DAM)   Though similar to document management, DAM generally works with binary rather than text files, such as multimedia file types.

digital Darwinism   Organizations that cannot adapt to the new demands placed on them for surviving in the information age are doomed to extinction.

digital dashboard   Integrates information from multiple components and tailors the information to individual

preferences.

digital divide   When those with access to technology have great advantages over those without access to technology.

digital wallet   Both software and information—the software provides security for the transaction and the information includes payment and delivery information (for example, the credit card number and expiration date).

disaster recovery cost curve   Charts (1) the cost to the organization of the unavailability of information and technology and (2) the cost to the organization of recovering from a disaster over time.

disaster recovery plan   A detailed process for recovering information or an IT system in the event of a catastrophic disaster such as a fire or flood.

disruptive technology   A new way of doing things that initially does not meet the needs of existing customers.

distributed denial-of-service attack (DDoS)   Attacks from multiple computers that flood a Web site with so many requests for service that it slows down or crashes.

distribution management software   Coordinates the process of transporting materials from a manufacturer to distribution centers to the final customer.

dividend   A distribution of earnings to shareholders.

document management system (DMS)   Supports the electronic capturing, storage, distribution, archival, and accessing of documents.

drill-down   Enables users to get details, and details of details, of information.

E

e-business   The conducting of business on the Internet, not only buying and selling, but also serving customers and collaborating with business partners.

e-business model   An approach to conducting electronic business on the Internet.

e-commerce   The buying and selling of goods and services over the Internet.

effectiveness IT metric   Measures the impact IT has on business processes and activities including customer satisfaction, conversion rates, and sell-through increases.

efficiency IT metric   Measures the performance of the IT system itself including throughput, speed, and availability.

e-government   Involves the use of strategies and technologies to transform government(s) by improving the delivery of services and enhancing the quality of interaction between the citizen-consumer within all branches of government.

e-logistics   Manages the transportation and storage of goods.

electronic bill presentment and payment (EBPP)   System that sends bills over the Internet and provides an easy-to-use mechanism (such as clicking on a button) to pay the bill.

electronic catalog   Presents customers with information about goods and services offered for sale, bid, or auction on the Internet.

electronic check   Mechanism for sending a payment from a checking or savings account.

electronic data interchange (EDI)   A standard format for exchanging business data.

electronic marketplace, or e-marketplace   Interactive business communities providing a central market space where multiple buyers and suppliers can engage in e-business activities.

electronic tagging   A technique for identifying and tracking assets and individuals via technologies such as radio frequency identification and smart cards.

elevation of privilege   Process by which a user misleads a system into granting unauthorized rights, usually for the purpose of compromising or destroying the system.

e-mail privacy policy   Details the extent to which e-mail messages may be read by others.

e-mall   Consists of a number of e-shops; it serves as a gateway through which a visitor can access other e-shops.

employee monitoring policy   States how, when, and where the company monitors its employees.

employee relationship management (ERM)   Provides employees with a subset of CRM applications available through a Web browser.

encryption   Scrambles information into an alternative form that requires a key or password to decrypt the information.

enterprise application integration (EAI) middleware   Represents a new approach to middleware by packaging together commonly used functionality, such as providing prebuilt links to popular enterprise applications, which reduces the time necessary to develop solutions that integrate applications from multiple vendors.

enterprise architect (EA)   Person grounded in technology, fluent in business, a patient diplomat, and provides the important bridge between IT and the business.

enterprise architecture   Includes the plans for how an organization will build, deploy, use, and share its data, processes, and IT assets.

enterprise resource planning (ERP)   Integrates all departments and functions throughout an organization into a single IT system (or integrated set of IT systems) so that employees can make decisions by viewing enterprisewide information on all business operations.

entity   In the relational database model is a person, place, thing, transaction, or event about which information is stored.

entity class   In the relational database model is a collection of similar entities.

entity-relationship diagram (ERD)   A technique for documenting the relationships between entities in a database environment.

entry barrier   A product or service feature that customers have come to expect from organizations in a particular industry and must be offered by an entering organization to compete and survive.

environmental scanning   The acquisition and analysis of events and trends in the environment external to an organization.

ePolicies   Policies and procedures that address the ethical use of computers and Internet usage in the business environment.

e-procurement   The B2B purchase and sale of supplies and services over the Internet.

e-shop (e-store or **e-tailer)**   A version of a retail store where customers can shop at any hour of the day without leaving their home or office.

ethernet   A physical and data layer technology for LAN networking.

ethical computer use policy   Contains general principles to guide computer user behavior.

ethics   Principles and standards that guide our behavior toward other people.

executive information system (EIS)   A specialized DSS that supports senior level executives within the organization.

expense   Refers to the costs incurred in operating and maintaining a business.

expert system   Computerized advisory programs that imitate the reasoning processes of experts in solving difficult problems.

explicit knowledge   Consists of anything that can be documented, archived, and codified, often with the help of

IT.

extended ERP component   The extra components that meet the organizational needs not covered by the core components and primarily focus on external operations.

extraction, transformation, and loading (ETL)   A process that extracts information from internal and external databases, transforms the information using a common set of enterprise definitions, and loads the information into a data warehouse.

extranet   An intranet that is available to strategic allies (such as customers, suppliers, and partners).

extreme programming (XP) methodology   Breaks a project into tiny phases, and developers cannot continue on to the next phase until the first phase is complete.

F

failover   Backup operational mode in which the functions of a computer component (such as a processor, server, network, or database) are assumed by secondary system components when the primary component becomes unavailable through either failure or scheduled down time.

fair use doctrine   In certain situations, it is legal to use copyrighted material.

fault tolerance   A computer system designed that in the event a component fails, a backup component or procedure can immediately take its place with no loss of service.

feasibility study   Determines if the proposed solution is feasible and achievable from a financial, technical, and organizational standpoint.

feature creep   Occurs when developers add extra features that were not part of the initial requirements.

fiber optic (optical fiber)   The technology associated with the transmission of information as light impulses along a glass wire or fiber.

finance   Deals with the strategic financial issues associated with increasing the value of the business while observing applicable laws and social responsibilities.

financial accounting   Involves preparing financial reports that provide information about the business's performance to external parties such as investors, creditors, and tax authorities.

financial cybermediary   Internet-based company that facilitates payments over the Internet.

financial EDI (financial electronic data interchange)   Standard electronic process for B2B market purchase

payments.

financial quarter   A three-month period (four quarters per year).

financial statement   Written records of the financial status of the business that allow interested parties to evaluate the profitability and solvency of the business.

firewall   Hardware and/or software that guards a private network by analyzing the information leaving and entering the network.

first-mover advantage   An organization can significantly impact its market share by being first to market with a competitive advantage.

Five Forces model   Helps determine the relative attractiveness of an industry.

flash memory   A special type of rewriteable read-only memory (ROM) that is compact and portable.

for profit corporations   Primarily focus on making money and all profits and losses are shared by the business owners.

forecast   Predictions made on the basis of time-series information.

foreign key   A primary key of one table that appears as an attribute in another table and acts to provide a logical relationship between the two tables.

forward integration   Takes information entered into a given system and sends it automatically to all downstream systems and processes.

fuzzy logic   A mathematical method of handling imprecise or subjective information.

G

Gantt chart   A simple bar chart that depicts project tasks against a calendar.

genetic algorithm   An artificial intelligence system that mimics the evolutionary, survival-of-the-fittest process to generate increasingly better solutions to a problem.

geographic information system (GIS)   Designed to work with information that can be shown on a map.

gigabyte (GB)   Roughly 1 billion bytes.

gigahertz (GHz)   The number of billions of CPU cycles per second.

global inventory management system   Provides the ability to locate, track, and predict the movement of every component or material anywhere upstream or downstream in the supply chain.

global positioning system (GPS)   A device that determines current latitude, longitude, speed, and direction of movement.

goal-seeking analysis   Finds the inputs necessary to achieve a goal such as a desired level of output.

graphical user interface (GUI)   The interface to an information system.

groupware   Software that supports team interaction and dynamics including calendaring, scheduling, and video-conferencing.

H

hacker   People very knowledgeable about computers who use their knowledge to invade other people's computers.

hactivist   Person with philosophical and political reasons for breaking into systems and will often deface the Web site as a protest.

hard drive   Secondary storage medium that uses several rigid disks coated with a magnetically sensitive material and housed together with the recording heads in a hermetically sealed mechanism.

hardware   Consists of the physical devices associated with a computer system.

hardware key logger   A hardware device that captures keystrokes on their journey from the keyboard to the motherboard.

help desk   A group of people who respond to internal system user questions.

hierarchical database model   Information is organized into a tree-like structure that allows repeating information using parent/child relationships, in such a way that it cannot have too many relationships.

high availability   Refers to a system or component that is continuously operational for a desirably long length of time.

hoaxes   Attack computer systems by transmitting a virus hoax, with a real virus attached.

hot site   A separate and fully equipped facility where the company can move immediately after a disaster and resume business.

human resource ERP component   Tracks employee information including payroll, benefits, compensation, and performance assessment, and assures compliance with the legal requirements of multiple jurisdictions and tax authorities.

human resources management (HRM)   Includes the policies, plans, and procedures for the effective management of employees (human resources).

hypertext transfer protocol (HTTP)   The Internet standard that supports the exchange of information on the WWW.

I

identity theft   The forging of someone's identity for the purpose of fraud.

implementation phase   Involves placing the system into production so users can begin to perform actual business operations with the system.

income statement (also referred to as earnings report, operating statement, and **profit-and-loss (P&L) statement)**   Reports operating results (revenues minus expenses) for a given time period ending at a specified date.

information   Data converted into a meaningful and useful context.

information accuracy   Extent to which a system generates the correct results when executing the same transaction numerous times.

information architecture   Identifies where and how important information, like customer records, is maintained and secured.

information cleansing or scrubbing   A process that weeds out and fixes or discards inconsistent, incorrect, or incomplete information.

information granularity   Refers to the extent of detail within the information (fine and detailed or "coarse" and abstract information).

information integrity   A measure of the quality of information.

information partnership   Occurs when two or more organizations cooperate by integrating their IT systems, thereby providing customers with the best of what each can offer.

information privacy policy   Contains general principles regarding information privacy.

information reach   Refers to the number of people a business can communicate with, on a global basis.

information richness   Refers to the depth and breadth of information transferred between customers and businesses.

information security   A broad term encompassing the protection of information from accidental or intentional misuse by persons inside or outside an organization.

information security plan   Details how an organization will implement the information security policies.

information security policy   Identifies the rules required to maintain information security.

information technology (IT)   Any computer-based tool that people use to work with information and support the information and information-processing needs of an organization.

information technology monitoring   Tracking people's activities by such measures as number of keystrokes, error rate, and number of transactions processed.

infrastructure architecture   Includes the hardware, software, and telecommunications equipment that, when combined, provide the underlying foundation to support the organization's goals.

input device   Equipment used to capture information and commands.

insider   Legitimate users who purposely or accidentally misuse their access to the environment and cause some kind of business-affecting incident.

insourcing (in-house development)   A common approach using the professional expertise within an organization to develop and maintain the organization's information technology systems.

instant messaging (IM or **IMing)**   A type of communications service that enables someone to create a kind of private chat room with another individual in order to communicate in real-time over the Internet.

integration   Allows separate systems to communicate directly with each other.

integrity constraint   The rules that help ensure the quality of information.

intellectual property   Intangible creative work that is embodied in physical form.

intelligent agent   A special-purpose knowledge-based information system that accomplishes specific tasks on behalf of its users.

intelligent system   Various commercial applications of artificial intelligence.

interactive voice response (IVR)   Directs customers to use touch-tone phones or keywords to navigate or provide information.

interactivity   Measures the visitor interactions with the target ad.

intermediary   Agents, software, or businesses that bring buyers and sellers together that provide a trading infrastructure to enhance e-business.

Internet   A global public network of computer networks that pass information from one to another using common computer protocols.

Internet service provider (ISP)   A company that provides individuals and other companies access to the Internet along with additional related services, such as Web site building.

Internet use policy   Contains general principles to guide the proper use of the Internet.

interoperability   Capability of two or more computer systems to share data and resources, even though they are made by different manufacturers.

intranet   An internalized portion of the Internet, protected from outside access, that allows an organization to provide access to information and application software to only its employees.

intrusion detection software (IDS)   Searches out patterns in information and network traffic to indicate attacks and quickly responds to prevent any harm.

inventory management and control software   Provides control and visibility to the status of individual items maintained in inventory.

IT infrastructure   Includes the hardware, software, and telecommunications equipment that, when combined, provide the underlying foundation to support the organization's goals.

J

joint application development (JAD)   A session where employees meet, sometimes for several days, to define or review the business requirements for the system.

K

key logger, or key trapper, software   A program that, when installed on a computer, records every keystroke and mouse click.

key performance indicator (KPI)   Measures that are tied to business drivers.

kiosk   Publicly accessible computer system that has been set up to allow interactive information browsing.

knowledge management (KM)   Involves capturing, classifying, evaluating, retrieving, and sharing information assets in a way that provides context for effective decisions and actions.

knowledge management system (KMS)   Supports the capturing, organization, and dissemination of knowledge (i.e., know-how) throughout an organization.

L

liability   An obligation to make financial payments.

limited liability   Means that the shareholders are not personally liable for the losses incurred by the corporation.

limited liability corporation (LLC)   A hybrid entity that has the legal protections of a corporation and the ability to be taxed (one time) as a partnership.

limited partnership   Much like a general partnership except for one important fundamental difference; the law protects the limited partner from being responsible for all of the partnership's losses.

list generator   Compiles customer information from a variety of sources and segments the information for different marketing campaigns.

local area network (LAN)   Computer network that uses cables or radio signals to link two or more computers within a geographically limited area, generally one building or a group of buildings.

logical view   Focuses on how users logically access information to meet their particular business needs.

logistics   The set of processes that plans for and controls the efficient and effective transportation and storage of supplies from suppliers to customers.

loss   Occurs when businesses sell products or services for less than they cost to produce.

loyalty program   Rewards customers based on the amount of business they do with a particular organization.

M

magnetic medium   Secondary storage medium that uses magnetic techniques to store and retrieve data on disks or tapes coated with magnetically sensitive materials.

magnetic tape   Older secondary storage medium that uses a strip of thin plastic coated with a magnetically sensitive recording medium.

mail bomb   Sends a massive amount of e-mail to a specific person or system resulting in filling up the recipient's disk space, which, in some cases, may be too much for the server to handle and may cause the server to stop functioning.

maintenance   The fixing or enhancing of an information system.

maintenance phase   Involves performing changes, corrections, additions, and upgrades to ensure the system continues to meet the business goals.

maintenance, repair, and operations (MRO) materials (also called **indirect materials)**   Materials necessary for running an organization but do not relate to the company's primary business activities.

malicious code   Includes a variety of threats such as viruses, worms, and Trojan horses.

management information system (MIS)   The function that plans for, develops, implements, and maintains IT hardware, software, and applications that people use to support the goals of an organization.

managerial accounting   Involves analyzing business operations for internal decision making and does not have to follow any rules issued by standard-setting bodies such as GAAP.

market basket analysis   Analyzes such items as Web sites and checkout scanner information to detect customers' buying behavior and predict future behavior by identifying affinities among customers' choices of products and services.

marketing   The process associated with promoting the sale of goods or services.

marketing communication   Seeks to build product or service awareness and to educate potential consumers on the product or service.

marketing mix   Includes the variables that marketing managers can control in order to best satisfy customers in the target market.

market maker   Intermediaries that aggregate three services for market participants: (1) a place to trade, (2) rules to govern trading, and (3) an infrastructure to support trading.

market segmentation   The division of a market into similar groups of customers.

market share   Calculated by dividing the firm's sales by the total market sales for the entire industry.

mass customization   Ability of an organization to give its customers the opportunity to tailor its products or services to the customers' specifications.

megabyte (MB or M or Meg)   Roughly 1 million bytes.

megahertz (MHz)   The number of millions of CPU cycles per second.

memory card   Contains high-capacity storage that holds data such as captured images, music, or text files.

memory stick   Provides nonvolatile memory for a range of portable devices including computers, digital cameras, MP3 players, and PDAs.

messaging-based workflow system   Sends work assignments through an e-mail system.

metropolitan area network (MAN)   A computer network that provides connectivity in a geographic area or

region larger than that covered by a local area network, but smaller than the area covered by a wide area network.

microwave transmitter   Commonly used to transmit network signals over great distances.

middleware   Different types of software that sit in the middle of and provide connectivity between two or more software applications.

mobile commerce, or **m-commerce**   The ability to purchase goods and services through a wireless Internet-enabled device.

model   A simplified representation or abstraction of reality.

modeling   The activity of drawing a graphical representation of a design.

multisourcing   A combination of professional services, mission-critical support, remote management, and hosting services that are offered to customers in any combination needed.

multitasking   Allows more than one piece of software to be used at a time.

N

nearshore outsourcing   Contracting an outsourcing agreement with a company in a nearby country.

net income   The amount of money remaining after paying taxes.

network   A communications, data exchange, and resource- sharing system created by linking two or more computers and establishing standards, or protocols, so that they can work together.

network database model   A flexible way of representing objects and their relationships.

network operating system (NOS)   The operating system that runs a network, steering information between computers and managing security and users.

network topology   Refers to the geometric arrangement of the actual physical organization of the computers (and other network devices) in a network.

network transmission media   Various types of media used to carry the signal between computers.

neural network (an **artificial neural network)**   A category of AI that attempts to emulate the way the human brain works.

nonrepudiation   A contractual stipulation to ensure that e-business participants do not deny (repudiate) their online actions.

not for profit (or **nonprofit) corporation**   Usually exists to accomplish some charitable, humanitarian, or

educational purpose, and the profits and losses are not shared by the business owners.

O

offshore outsourcing   Using organizations from developing countries to write code and develop systems.

online ad   Box running across a Web page that is often used to contain advertisements.

online analytical processing (OLAP)   The manipulation of information to create business intelligence in support of strategic decision making.

online broker   Intermediaries between buyers and sellers of goods and services.

online service provider (OSP)   Offers an extensive array of unique services such as its own version of a Web browser.

online training   Runs over the Internet or off a CD-ROM.

online transaction processing (OLTP)   The capturing of transaction and event information using technology to (1) process the information according to defined business rules, (2) store the information, and (3) update existing information to reflect the new information.

onshore outsourcing   The process of engaging another company within the same country for services.

open system   A broad, general term that describes nonproprietary IT hardware and software made available by the standards and procedures by which their products work, making it easier to integrate them.

operating system software   Controls the application software and manages how the hardware devices work together.

operational CRM   Supports traditional transactional processing for day-to-day front-office operations or systems that deal directly with the customers.

operations management (also called **production management)**   Includes the methods, tasks, and techniques organizations use to produce goods and services.

opportunity management CRM system   Targets sales opportunities by finding new customers or companies for future sales.

opt-in   Implying that a company will contact only the people who have agreed to receive promotions and marketing material via e-mail.

output device   Equipment used to see, hear, or otherwise accept the results of information processing requests.

outsourcing   An arrangement by which one organization provides a service or services for another organization that chooses not to perform them in-house.

owner's equity   The portion of a company belonging to the owners.

P

packet tampering   Altering the contents of packets as they travel over the Internet or altering data on computer disks after penetrating a network.

packet-switching   Occurs when the sending computer divides a message into a number of efficiently sized units called packets, each of which contains the address of the destination computer.

partner relationship management (PRM)   Focuses on keeping vendors satisfied by managing alliance partner and reseller relationships that provide customers with the optimal sales channel.

partnership   Similar to sole proprietorships, except that this legal structure allows for more than one owner.

partnership agreement   A legal agreement between two or more business partners that outlines core business issues.

peer-to-peer (P2P) network   Any network without a central file server and in which all computers in the network have access to the public files located on all other workstations.

performance   Measures how quickly a system performs a certain process or transaction (in terms of efficiency IT metrics of both speed and throughput).

personalization   Occurs when a Web site can know enough about a person's likes and dislikes that it can fashion offers that are more likely to appeal to that person.

PERT (Program Evaluation and Review Technique) chart   A graphical network model that depicts a project's tasks and the relationships between those tasks.

phishing   Technique to gain personal information for the purpose of identity theft, usually by means of fraudulent e-mail.

physical view   The physical storage of information on a storage device such as a hard disk.

pirated software   The unauthorized use, duplication, distribution, or sale of copyrighted software.

planning phase   Involves establishing a high-level plan of the intended project and determining project goals.

podcasting   Distribution of audio or video files, such as radio programs or music videos, over the Internet to play

on mobile devices and personal computers.

polymorphic virus and worm   Change their form as they propagate.

pop-under ad   Form of a pop-up ad that users do not see until they close the current Web browser screen.

pop-up ad   Small Web page containing an advertisement that appears on the Web page outside of the current Web site loaded in the Web browser.

portal   A Web site that offers a broad array of resources and services, such as e-mail, online discussion groups, search engines, and online shopping malls.

predictive dialing   Automatically dials outbound calls and when someone answers, the call is forwarded to an available agent.

primary key   A field (or group of fields) that uniquely identifies a given entity in a table.

primary storage   Computer's main memory, which consists of the random access memory (RAM), cache memory, and the read-only memory (ROM) that is directly accessible to the CPU.

privacy   The right to be left alone when you want to be, to have control over your own personal possessions, and not to be observed without your consent.

private exchange   A B2B marketplace in which a single buyer posts its need and then opens the bidding to any supplier who would care to bid.

process modeling   Involves graphically representing the processes that capture, manipulate, store, and distribute information between a system and its environment.

product life cycle   Includes the four phases a product progresses through during its life cycle including introduction, growth, maturity, and decline.

production and materials management ERP component   Handles the various aspects of production planning and execution such as demand forecasting, production scheduling, job cost accounting, and quality control.

profit   Occurs when businesses sell products or services for more than they cost to produce.

project   A temporary endeavor undertaken to create a unique product or service.

project deliverable   Any measurable, tangible, verifiable outcome, result, or item that is produced to complete a project or part of a project.

project exclusion   Products, services, or processes that are not specifically a part of the project.

project management   The application of knowledge, skills, tools, and techniques to project activities in order to

meet or exceed stakeholder needs and expectations from a project.

project management software   Supports the long-term and day-to-day management and execution of the steps in a project.

project manager   An individual who is an expert in project planning and management, defines and develops the project plan, and tracks the plan to ensure all key project milestones are completed on time.

project milestone   Represents key dates when a certain group of activities must be performed.

project objective   Quantifiable criteria that must be met for the project to be considered a success.

project plan   A formal, approved document that manages and controls project execution.

project product   A description of the characteristics the product or service has undertaken.

project risk   An uncertain event or condition that, if it occurs, has a positive or negative effect on a project objective(s).

project scope   Defines the work that must be completed to deliver a product with the specified features and functions.

protocol   A standard that specifies the format of data as well as the rules to be followed during transmission.

prototype   A smaller-scale representation or working model of the user's requirements or a proposed design for an information system.

public key encryption (PKE)   Encryption system that uses two keys: a public key that everyone can have and a private key for only the recipient.

pull technology   Organizations receive or request information.

pure-play (virtual) business   A business that operates on the Internet only without a physical store.

push technology   Organizations send information.

Q

query-by-example (QBE) tool   Allows users to graphically design the answers to specific questions.

R

radio frequency identification (RFID)   Technologies using active or passive tags in the form of chips or smart labels that can store unique identifiers and relay this information to electronic readers.

random access memory (RAM)   The computer's primary working memory, in which program instructions and

data are stored so that they can be accessed directly by the CPU via the processor's high-speed external data bus.

rapid application development (RAD) (also called rapid prototyping) methodology   Emphasizes extensive user involvement in the rapid and evolutionary construction of working prototypes of a system to accelerate the systems development process.

read-only memory (ROM)   The portion of a computer's primary storage that does not lose its contents when one switches off the power.

real simple syndication (RSS)   Family of Web feed formats used for Web syndication of programs and content.

real-time information   Immediate, up-to-date information.

real-time system   Provides real-time information in response to query requests.

recovery   The ability to get a system up and running in the event of a system crash or failure and includes restoring the information backup.

reduced instruction set computer (RISC) chip   Limits the number of instructions the CPU can execute to increase processing speed.

redundancy   The duplication of information, or storing the same information in multiple places.

reintermediation   Using the Internet to reassemble buyers, sellers, and other partners in a traditional supply chain in new ways.

relational database model   A type of database that stores information in the form of logically related two-dimensional tables.

relational integrity constraint   The rules that enforce basic and fundamental information-based constraints.

reliability   Ensures all systems are functioning correctly and providing accurate information.

report generator   Allows users to define formats for reports along with what information they want to see in the report.

requirements definition document   Contains the final set of business requirements, prioritized in order of business importance.

response time   The time it takes to respond to user interactions such as a mouse click.

revenue   Refers to the amount earned resulting from the delivery or manufacture of a product or from the rendering of a service.

reverse auction   An auction format in which increasingly lower bids are solicited from organizations willing to

supply the desired product or service at an increasingly lower price.

RFID tag   Contains a microchip and an antenna, and typically works by transmitting a serial number via radio waves to an electronic reader, which confirms the identity of a person or object bearing the tag.

risk management   The process of proactive and ongoing identification, analysis, and response to risk factors.

rivalry among existing competitors   High when competition is fierce in a market and low when competition is more complacent.

router   An intelligent connecting device that examines each packet of data it receives and then decides which way to send it onward toward its destination.

S

safety inventory   Includes extra inventory held in the event demand exceeds supply.

sales   The function of selling a good or service and focuses on increasing customer sales, which increases company revenues.

sales force automation (SFA)   A system that automatically tracks all of the steps in the sales process.

sales management CRM system   Automates each phase of the sales process, helping individual sales representatives coordinate and organize all of their accounts.

scalability   Refers to how well a system can adapt to increased demands.

scope creep   Occurs when the scope of the project increases.

script kiddies or **script bunnies**   Find hacking code on the Internet and click-and-point their way into systems to cause damage or spread viruses.

search engine optimization (SEO)   Set of methods aimed at improving the ranking of a Web site in search engine listings.

secondary storage   Consists of equipment designed to store large volumes of data for long-term storage.

secure electronic transaction (SET)   Transmission security method that ensures transactions are secure and legitimate.

secure socket layer (SSL)   (1) Creates a secure and private connection between a client and server computer, (2) encrypts the information, and (3) sends the information over the Internet.

selling chain management   Applies technology to the activities in the order life cycle from inquiry to sale.

sensitivity analysis   The study of the impact that changes in one (or more) parts of the model have on other parts of the model.

server   Computer that is dedicated to providing information in response to external requests.

service level agreement (SLA)   Defines the specific responsibilities of the service provider and sets the customer expectations.

shareholder   Another term for business owners.

shopping bot   Software that will search several retailer Web sites and provide a comparison of each retailer's offerings including price and availability.

sign-off   The system users' actual signatures indicating they approve all of the business requirements.

slice-and-dice   The ability to look at information from different perspectives.

smart card   A device that is around the same size as a credit card, containing embedded technologies that can store information and small amounts of software to perform some limited processing.

sniffer   A program or device that can monitor data traveling over a network.

social engineering   Using one's social skills to trick people into revealing access credentials or other information valuable to the attacker.

social networking analysis (SNA)   A process of mapping a group's contacts (whether personal or professional) to identify who knows whom and who works with whom.

software   The set of instructions that the hardware executes to carry out specific tasks.

sole proprietorship   A business form in which a single person is the sole owner and is personally responsible for all the profits and losses of the business.

solvency   Represents the ability of the business to pay its bills and service its debt.

source document   Describes the basic transaction data such as its date, purpose, and amount and includes cash receipts, canceled checks, invoices, customer refunds, employee time sheets, etc.

spam   Unsolicited e-mail.

spamdexing   Uses a variety of deceptive techniques in an attempt to manipulate search engine rankings, whereas legitimate search engine optimization focuses on building better sites and using honest methods of promotion.

spoofing   The forging of the return address on an e-mail so that the e-mail message appears to come from

someone other than the actual sender.

spyware Software that comes hidden in free downloadable software and tracks online movements, mines the information stored on a computer, or uses a computer's CPU and storage for some task the user knows nothing about.

statement of cash flow Summarizes sources and uses of cash, indicates whether enough cash is available to carry on routine operations, and offers an analysis of all business transactions, reporting where the firm obtained its cash and how it chose to allocate the cash.

statement of owner's equity (also called the **statement of retained earnings** or **equity statement)** Tracks and communicates changes in the shareholder's earnings.

structured collaboration (or **process collaboration)** Involves shared participation in business processes, such as workflow, in which knowledge is hard coded as rules.

structured query language (SQL) A standardized fourth-generation query language found in most DBMSs.

supplier power High when buyers have few choices of whom to buy from and low when their choices are many.

supplier relationship management (SRM) Focuses on keeping suppliers satisfied by evaluating and categorizing suppliers for different projects, which optimizes supplier selection.

supply chain Consists of all parties involved, directly or indirectly, in the procurement of a product or raw material.

supply chain event management (SCEM) Enables an organization to react more quickly to resolve supply chain issues.

supply chain execution (SCE) software Automates the different steps and stages of the supply chain.

supply chain management (SCM) Involves the management of information flows between and among stages in a supply chain to maximize total supply chain effectiveness and profitability.

supply chain planning (SCP) software Uses advanced mathematical algorithms to improve the flow and efficiency of the supply chain while reducing inventory.

supply chain visibility The ability to view all areas up and down the supply chain.

sustaining technology Produces an improved product customers are eager to buy, such as a faster car or larger hard drive.

switching cost The costs that can make customers reluctant to switch to another product or service.

system availability   Number of hours a system is available for users.

systems development life cycle (SDLC)   The overall process for developing information systems from planning and analysis through implementation and maintenance.

system software   Controls how the various technology tools work together along with the application software.

T

tacit knowledge   The knowledge contained in people's heads.

telecommunication system   Enables the transmission of data over public or private networks.

terabyte (TB)   Roughly 1 trillion bytes.

test condition   The detailed steps the system must perform along with the expected results of each step.

testing phase   Involves bringing all the project pieces together into a special testing environment to test for errors, bugs, and interoperability and verify that the system meets all of the business requirements defined in the analysis phase.

threat of new entrants   High when it is easy for new competitors to enter a market and low when there are significant entry barriers to entering a market.

threat of substitute products or services   High when there are many alternatives to a product or service and low when there are few alternatives from which to choose.

throughput   The amount of information that can travel through a system at any point in time.

time-series information   Time-stamped information collected at a particular frequency.

To-Be process model   Shows the results of applying change improvement opportunities to the current (As-Is) process model.

token   Small electronic devices that change user passwords automatically.

transaction   Exchange or transfer of goods, services, or funds involving two or more people.

transaction processing system   The basic business system that serves the operational level (analysts) in an organization.

transaction speed   Amount of time a system takes to perform a transaction.

transactional information   Encompasses all of the information contained within a single business process or unit of work, and its primary purpose is to support the performing of daily operational tasks.

Transmission Control Protocol/Internet Protocol (TCP/IP)   Provides the technical foundation for the public Internet as well as for large numbers of private networks.

transportation planning software   Tracks and analyzes the movement of materials and products to ensure the delivery of materials and finished goods at the right time, the right place, and the lowest cost.

Trojan-horse virus   Hides inside other software, usually as an attachment or a downloadable file.

twisted-pair wiring   A type of cable composed of four (or more) copper wires twisted around each other within a plastic sheath.

U

unstructured collaboration (or information collaboration)   Includes document exchange, shared whiteboards, discussion forums, and e-mail.

up-selling   Increasing the value of a sale.

user documentation   Highlights how to use the system.

utility software   Provides additional functionality to the operating system.

V

value-added network (VAN)   A private network, provided by a third party, for exchanging information through a high-capacity connection.

value chain   Views an organization as a series of processes, each of which adds value to the product or service for each customer.

view   Allows users to see the contents of a database, make any required changes, perform simple sorting, and query the database to find the location of specific information.

viral marketing   Technique that induces Web sites or users to pass on a marketing message to other Web sites or users, creating exponential growth in the message's visibility and effect.

virtualization   Protected memory space created by the CPU allowing the computer to create virtual machines.

virtual private network (VPN)   A way to use the public telecommunication infrastructure (e.g., Internet) to provide secure access to an organization's network.

virus   Software written with malicious intent to cause annoyance or damage.

voice over IP (VoIP)   Uses TCP/IP technology to transmit voice calls over long-distance telephone lines.

volatility   Refers to RAM's complete loss of stored information if power is interrupted.

W

waterfall methodology   A sequential, activity-based process in which each phase in the SDLC is performed sequentially from planning through implementation and maintenance.

Web-based self-service system   Allows customers to use the Web to find answers to their questions or solutions to their problems.

Web content management system (WCM)   Adds an additional layer to document and digital asset management that enables publishing content both to intranets and to public Web sites.

Web log   Consists of one line of information for every visitor to a Web site and is usually stored on a Web server.

Web service   Contains a repertoire of Web-based data and procedural resources that use shared protocols and standards permitting different applications to share data and services.

Web traffic   Includes a host of benchmarks such as the number of page views, the number of unique visitors, and the average time spent viewing a Web page.

what-if analysis   Checks the impact of a change in an assumption on the proposed solution.

white-hat hacker   Works at the request of the system owners to find system vulnerabilities and plug the holes.

wide area network (WAN)   Computer network that provides data communication services for business in geographically dispersed areas (such as across a country or around the world).

wireless fidelity (wi-fi)   A means of linking computers using infrared or radio signals.

wireless Internet service provider (WISP)   An ISP that allows subscribers to connect to a server at designated hotspots or access points using a wireless connection.

wireless media   Natural parts of the Earth's environment that can be used as physical paths to carry electrical signals.

wire media   Transmission material manufactured so that signals will be confined to a narrow path and will behave predictably.

workflow   Defines all the steps or business rules, from beginning to end, required for a business process.

workflow management system   Facilitates the automation and management of business processes and controls the movement of work through the business process.

workshop training   Set in a classroom-type environment and led by an instructor.

World Wide Web (WWW)   A global hypertext system that uses the Internet as its transport mechanism.

worm   A type of virus that spreads itself, not only from file to file, but also from computer to computer.

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Chapter 1

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NOTES

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THE PLUG-INS

The overall goal of the plug-ins is to provide additional information not covered in the text such as personal productivity using information technology, business basics, and business process. The plug-ins also offer faculty who find themselves in the situation of having to purchase an extra book to support Microsoft Office an all-in-one text. The plug-ins presented here offer integration with the core chapters and provide critical knowledge using essential business applications, such as Microsoft Excel, Microsoft Access, and Microsoft FrontPage using hands-on tutorials for comprehension and mastery. Plug-Ins T1 – T12 are located on the CD that accompanies this text.

Plug-In	Description
T1. Personal Productivity Using IT	Plug-In T1 covers a number of things to do to keep a personal computer running effectively and efficiently. There are 12 topic areas covered in this plug-in. ■ Creating strong passwords ■ Performing good file management ■ Implementing effective backup and recovery strategies ■ Using Zip files ■ Writing professional e-mails ■ Stopping spam ■ Preventing phishing ■ Detecting spyware ■ Restricting instant messaging ■ Increasing PC performance ■ Using anti-virus software ■ Installing a personal firewall
T2. Basic Skills Using Excel	■ Plug-In T2 provides an introduction to the basics of using Microsoft Excel, a spreadsheet program for data management. It is

	designed to show the basics, along with a few fancy features. There are six topic areas covered in this plug-in. ■ Workbooks and worksheets ■ Working with cells and cell data ■ Printing worksheets ■ Formatting worksheets ■ Formulas ■ Working with charts and graphics
T3. Problem Solving Using Excel	Plug-In T3 provides a comprehensive tutorial on how to use a variety of Microsoft Excel functions and features for problem solving. There are five areas covered in this plug-in. ■ Lists ■ Conditional Formatting ■ AutoFilter ■ Subtotals ■ PivotTables
T4. Decision Making Using Excel	Plug-In T4 examines a few of the advanced business analysis tools used in Microsoft Excel that have the capability to identify patterns, trends, rules, and create "what-if" models. There are four topic areas covered in this plug-in. ■ IF ■ Goal Seek ■ Solver ■ Scenario Manager
T5. Designing **Database**	Plug-In T5 provides specific details on how to design relational

Applications	database applications. One of the most efficient and powerful information management computer-based applications is the relational database. There are four topic areas covered in this plug-in. ■ Entities and data relationships ■ Documenting logical data relationships ■ The relational data model ■ Normalization
T6. Basic Skills and Tools Using Access	Plug-In T6 focuses on creating a Microsoft Access database file. One of the most efficient information management, computer-based applications, is Microsoft Access. Access provides a powerful set of tools for creating and maintaining a relational database. There are two topic areas covered in this plug-in. ■ Create a new database file ■ Create and modify tables
T7. Problem Solving Using Access	Plug-In T7 provides a comprehensive tutorial on how to query a database in Microsoft Access. Queries are essential for problem solving; allowing a user to sort information, summarize data (display totals, averages, counts, and so on), display the results of calculations on data, and choose exactly which fields are shown. There are three topic areas covered in this plug-in. ■ Create simple queries using the Simple Query Wizard ■ Advanced queries using calculated fields ■ Format results displayed in calculated fields
T8. Creating Forms and Reports Using Access	Plug-In T8 provides a comprehensive tutorial on entering data in a well-designed form and creating functional reports using Microsoft Access. A form is essential to use for data entry and a report is an

	effective way to present data in a printed format. There are two topic areas covered in this plug-in.
	■ Creating, modifying, and running forms
	■ Creating, modifying, and running reports
T9. Designing Web Pages	Plug-In T9 provides a comprehensive assessment into the functional aspects of Web design. Web sites are beginning to look more alike and to employ the same metaphors and conventions. The Web has now become an everyday tool whose design should not make users think. There are six topic areas in this plug-in.
	■ The World Wide Web
	■ The unknown(s)
	■ The process of Web Design
	■ HTML basics
	■ Web Fonts
	■ Web Graphics
T10. Basic Skills Using FrontPage	Plug-In T10 provides a tour of using FrontPage to create Web pages. FrontPage allows anyone with limited Web page design experience to create, modify, and maintain full-featured, professional-looking pages without having to learn how to code all the functions and features from scratch. There are seven topic areas covered in this plug-in.
	■ Web sites, Web pages, and HTML
	■ Navigation in FrontPage
	■ Building a Web site
	■ Working with graphics
	■ Including hyperlinks
	■ Presenting information in lists and tables

	■ Formatting pages
T11. Business Basics	Plug-in T11 offers an introduction to the basics of business. There are nine topic areas covered in this plug-in. ■ Types of businesses ■ Internal operations of a corporation ■ Accounting ■ Marketing ■ Finance ■ Human resources ■ Management information systems ■ Production/operations ■ Sales
T12. Business Process	Plug-In T12 shows how investment in continuous process improvement, business process reengineering, or business process management is the same as any other technology-related investment. There are five topic areas covered in this plug-in. ■ Examining business processes ■ Business process design ■ Business process improvement ■ Business process management ■ Business process modeling examples

Personal Productivity Using IT

LEARNING OUTCOMES

1. Describe the four steps you can use to create a strong password.

2. Identify three tips you can use to manage your files.

3. Explain why you would use Microsoft's backup and recovery utility.

4. Describe the six common e-mail mistakes.

5. Explain spam and phishing and identify three ways that you can prevent each.

6. Explain the primary uses of spyware and adware.

7. Identify three things you can do to maintain your computer and keep it running smoothly.

8. Explain why you would install anti-virus protection software.

9. Describe the need for a personal firewall.

Introduction

A number of things can be done to keep a personal computer running smoothly and to protect it from such things as spyware and identity theft (see Figure T1.1). A few of these important items are covered in this plug-in, including:

- Creating strong passwords.
- Performing good file management.
- Implementing effective backup and recovery strategies.
- Using Zip files.
- Writing professional e-mails.
- Stopping spam.
- Preventing phishing.
- Detecting spyware.
- Restricting instant messaging.
- Increasing PC performance.

■ Using anti-virus software.

■ Installing a personal firewall.

Creating Strong Passwords

If you have ever lost your wallet or your purse, you know the sense of vulnerability that comes with it. Someone might be walking around with your identification, pretending to be you. If someone stole your passwords, he could do the same thing online. A hacker could be opening new credit card accounts, applying for mortgages, or chatting online disguised as you—and you would not know it until it was too late.

You probably already know not to create passwords using any combination of consecutive numbers or letters such as "12345678," "lmnopqrs," or adjacent letters on your keyboard such as "qwerty." In addition, never use your log-in name, your pet's name, or your birthday, or a word that can be found in the dictionary as a password. Hackers use sophisticated tools that can rapidly guess passwords based on words in the dictionary in different languages, even common words spelled backward.

FIGURE T1.1

Maintaining and Protecting Your Computer

If you use a common word as your password, you might think you are protected if you replace letters of that word with numbers or symbols that look like the letters such as M1cr0$0ft or P@ssw0rd. Unfortunately, hackers know these tricks too. The following are four steps you can use to create strong passwords:

1. Create strong passwords that you can remember.

2. Keep your passwords a secret.

3. Manage your passwords.

4. Monitor your accounts.

CREATE STRONG PASSWORDS THAT YOU CAN REMEMBER

You could come up with a completely random combination of numbers and symbols for a password, but that is not very practical. How would you remember it? Chances are you would write it down and keep it in the top drawer of your desk, and then it is no longer such a great password after all. A strong password is one that is at least eight characters, includes a combination of letters, numbers, and symbols and is easy for you to remember, but difficult for others to guess.

The easiest way to create a strong password that you will not have to write down is to come up with a passphrase. A *passphrase* is a sentence that you can remember, like "My favorite group is Cold Play and my favorite song is Arches." You can make a strong password by using the first letter of each word of the sentence, for example, mfgicpamfsia. However, you can make this password even stronger by using a combination of upper and lowercase letters, numbers, and special characters that look like letters. For example, using the same memorable sentence and a few tricks, your password is now MfGicp&mfsi@.

If you still think that is too hard to remember, you could try a more common phrase, such as "You can't teach an old dog new tricks." If you are using a common phrase make sure to inject at least one number or symbol into the password, such as U(t@0DnT1.

KEEP YOUR PASSWORDS A SECRET

Keeping your passwords safe means keeping them a secret. Do not give them to friends, and do not write them down and keep them at your desk or in an unprotected file on your computer. Your house could get broken into, or, more likely, you may give a friend access to your computer or your desk and that friend may not have the best motives when it comes to your privacy.

Even if you know not to write down your passwords or give them away to friends, you should also be wary when giving them to the Web site where you created the password in the first place. Microsoft, eBay, Amazon, PayPal, or any other reputable company will never ask you to send your password through e-mail. If you receive a request for your password, Social Security number, or other sensitive information via e-mail, notify the company immediately by phone or through the company Web site.

MANAGE YOUR PASSWORDS

The safest password technique is to create a new, strong password for every Web site or log-in that requests one. This is almost as impractical as remembering a long string of random characters. An easier solution is to create a handful of strong passwords and use those at sites you want to keep most secure, such as your bank, brokerage, or bill paying company. Then create another small set of easier to remember passwords that you can use everywhere else.

Remember, a strong password is one you change every few months. Just as you schedule updates, backup software, and clean out old programs, you should also regularly change passwords.

MONITOR YOUR ACCOUNTS

Creating stronger passwords can help protect you against identity theft. However, it does not guarantee that you are protected. If someone does steal your passwords, the faster you catch on and notify authorities, the less damage a hacker can do. Make sure to monitor all your monthly financial statements, and call the appropriate company or bank immediately to report issues. Also, review your credit report each year.

Performing Good File Management

Computer users today work with large numbers of different kinds of files such as documents, spreadsheets, presentations, graphics, and others. Keeping these files organized can be a task in itself. A couple of minutes a few times a day searching for files can add up. The key to minimizing this time is good file management.

The best way to manage files effectively is a lot like managing paper files. They can be organized into folders and then stored in specific locations and recalled quickly when you need them. Just like paper files and folders, if you do not have a good way to organize them, they will get lost and you could spend hours searching for files. Whether you save your files on your computer's hard drive or a shared network location, the tips displayed in Figure T1.2 can help save time and reduce the headaches of searching for files.

Implementing Effective Backup and Recovery Strategies

Tracie Whiteley lost everything in a flash. When she left for work, her home computer was fine. When she came home, all the clocks in the house were blinking 12:00, and her computer was dark. There had been a lightning storm that day. Whiteley, a finance specialist at a large automation technology company, said, "The computer was on when I left for work, and it was not on when I came home. When I tried to start it there was a burning smell and smoke. Everything inside it was fried." Whiteley lost both professional and personal data in that storm. The computer held the only copies of her family's e-mail messages, school projects, finances, and letters. "All our information disappeared," she says. "The computer had to be replaced."

FIGURE T1.2

File Management Tips

Tips for Managing Your Files

1. Use My Documents—To open My Documents in Windows, click **Start**, and then click **My Documents**. My

Documents provides an easy way for you to store your personal documents and perform the following:

- **Find files**—It is easy to access the My Documents folder (and its subfolders) in many different places in Windows including the Start menu, the task pane in Windows Explorer, common File Open and File Save dialog boxes, and other places. (Note: Windows Explorer displays the structure of files and folders on your computer. To open Windows Explorer, click **Start**, point to **All Programs**, point to **Accessories**, and then click **Windows Explorer**.)

- **Back up files**—Keeping all your files in one place is an essential first step in developing a practical backup strategy.

- **Keep files separate from programs**—Separating personal files from program files reduces the risk of accidentally deleting personal files when you install or upgrade programs.

2. **Limit file name length**—Even though Windows allows long file names, it is not always a good idea. Long file names produce cluttered displays. Short file names promote clarity. Let your folders do some of the naming. For example, rather than create a file called **Fall06 MIS2275 Assignment Chapter One.doc**, you can build a file structure similar to the sample below.

3. **Archive completed work**—To keep the My Documents folder from becoming unmanageable, store only files you are currently working on. This reduces the number of files you need to search through and the amount of data you need to back up. Every month or so, move the files you are no longer working on to a different folder or location, preferably not in My Documents. You can archive them on a folder on your desktop (you could even label it Archives) or move them to a backup tape or recordable CD. This limits the size of your My Documents folder, which you should back up frequently.

4. **Use shortcuts instead of multiple copies**—If you need to get to the same file from multiple locations, do not create copies of the file. Create shortcuts to it instead. To create a shortcut, **right-click** on the file and click **Create Shortcut.** You can drop-and-drag the shortcut to other locations. Put a shortcut to My Documents on the desktop.

5. **Use abbreviations**—Keep file names short by using common abbreviations, such as "MTG" for meeting or "ACTG" for accounting. This makes the file names more descriptive, and you can more easily find files through Search if it is necessary. To make it easier to search for documents, name your files and folders with easily found names, such as model numbers, project names, or the project lead in the title.

6. **Use thumbnails**—Search through folders in the Thumbnail view. They are easier to see and you can put a picture or clip art on the folder so that it is more recognizable. For example, a folder that contains information about a product can have a picture of the product, or something else that reminds you of the folder contents. To view your folder list in Thumbnail view, on the My Documents folder, in the toolbar click **View** and then select **Thumbnail**. To put a picture on the folder, **right-click** the folder and click **Properties**. In the Properties dialog box, click the **Customize** tab. In the Folder pictures area, click **Choose Picture**.

7. **Do not save unnecessary files**—Be selective about the files you keep. You probably do not need to keep them all. With e-mail, for example, you rarely need to keep everything you receive.

8. **Use My Recent Documents**—To find a file you just worked on, use My Recent Documents in the Start menu.

You can unintentionally lose information on a computer in many ways—a child playing the keyboard like a piano, a power surge, lightning, a flood, and even equipment failures. If you regularly make backup copies of your files and keep them in a separate place, you can get some, if not all, of your information back if something happens to the originals on your computer.

DETERMINING WHAT TO BACK UP

Deciding what to back up is highly personal. Anything you cannot replace easily should be at the top of your list. The key to a successful backup is getting a copy of your data off your hard drive. Do not try to copy programs like Microsoft Word or Excel; they can be reinstalled from the original CDs you purchased. Likewise, the operating system software—Windows itself and any software provided by your computer manufacturer—can usually be recovered from the installation or "System Restore" CDs that came with the computer. Before you get started, make a checklist of files to back up. This will help you determine what to back up, and give you a reference list in the event you need to retrieve a backed-up file. Here are some file suggestions to get you started:

■ Bank records and other financial information.

■ Digital photographs.

■ Software purchased and downloaded from the Internet.

■ Music purchased and downloaded from the Internet.

■ Personal documents.

■ E-mail address book.

There are several different types of external storage for your backup files including Zip disks, external hard

drives, recordable CDs, DVDs, tape cartridges, and flash drives. You can even upload your data to an Internet-based file storage service such as www.mydocsonline.com.

To find the solution that is best for you, compare the convenience, price, and ease of use offered by each approach. For example, a 100 MB Zip drive costs much less than a tape drive, but a single tape cartridge can hold as much as 300 Zip disks.

HOW TO BACK UP YOUR COMPUTER FILES

A simple backup in Windows XP requires no special software or skills. To copy a file or folder, just right-click on the file or folder and select **Copy** from the pop-up menu that appears. Choose the disk or drive where you want to store the duplicate copy, right-click again and then select **Paste** from the pop-up menu. It is that easy. Be sure to label the backup disks clearly, noting the date and time of the backup. Do not erase the previous backup until you have made a newer one.

You can also copy files in Windows operating systems using a drag-and-drop method—hold down the right mouse button while dragging a file or folder, then select **Copy Here** from the pop-up menu that appears.

Your e-mail messages and address book list can be exported and then backed up along with other personal data. This process varies depending on which e-mail software is used on your computer.

Perform Regular Backups

How often should you back up your data? If you use your computer occasionally, a weekly backup might be enough. If you use your computer every day, a daily backup is a good idea. Whatever backup option you choose, be sure to check that it works. Duplicate a single folder or group of files, and then try to recover those backup files to a different drive or folder. Do not wait until it is too late to find that the restore process does not work.

MICROSOFT'S BACKUP AND RECOVER UTILITY

Microsoft's Backup Utility and Recovery Console are installed by default on Windows XP Professional. However, you can manually install both the Backup Utility and Recovery Console for Windows XP.

Backup Utility

The Backup Utility in Windows XP helps you protect your data if your hard disk fails or files are accidentally erased due to hardware or storage media failure. By using Backup, you can create a duplicate copy of all the data on your hard disk and then archive it on another storage device, such as a hard disk or a tape. If the original data on

your hard disk is accidentally erased or overwritten, or becomes inaccessible because of a computer malfunction, you can easily restore it from the disk or archived copy by using the Restore or Automated System Recovery Wizards. To start Backup or to access Restore and Automated System Recovery:

1. Click **Start** and then click **All Programs**.

2. Select **Accessories**, then **System Tools**, and then **Backup**.

Recovery Console

You can use the Recovery Console to perform many tasks without starting Windows XP, including starting and stopping services, reading and writing information on a local disk drive, and formatting drives. However, you must install the Recovery Console while your computer is still functioning. The Recovery Console feature should be used only by advanced users. Before using the Recovery Console, it is recommended that you back up your information on a tape drive, because your local hard disks might be reformatted—thus erased—as part of the recovery. You can also run the Recovery Console from the Windows XP CD. To install the Recovery Console as a Startup option:

1. Log on to Windows XP as an administrator or as a user with administrator rights. If your computer is connected to a network, network policy settings may prevent you from completing this procedure. If this is the case, contact your network administrator for assistance.

2. Insert the Windows XP CD into your CD-ROM drive. If you are prompted to upgrade to Windows XP, click **No**.

3. From the command prompt—or from the Run command in the Start menu—type the path to the appropriate Winnt32.exe file (on your Windows XP CD), followed by a space and/cmdcons to reference this switch. For example: *e:\i386\winnt32.exe/cmdcons*.

4. Follow the instructions that appear.

   To run the Recovery Console on a computer if Windows XP does not start:

1. Restart your computer, and then choose **Windows Recovery Console** from the list of operating system options.

2. Follow the instructions that appear. Recovery Console displays a command prompt.

3. Make the required changes to your system.

Using Zip Files

Compressing files, folders, and programs decreases their size and reduces the amount of space they use on your hard drives or removable storage devices. Folders that are compressed using the Compressed (zipped) Folders

feature use less drive space and can be transferred to other computers more quickly. You can work with a compressed folder and the files or programs it contains just as you would an uncompressed folder. Once you have created a compressed folder (identified by the zipper on the folder icon), you can compress files, programs, or other folders by dragging them to it. You can open files directly from compressed folders, or you can extract files before opening them. You can run some programs directly from zipped compressed folders, without decompressing them. However, to run programs that are dependent on other files, you must first extract them. Figure T1.3 displays a few of the features in the Windows Compressed (zipped) Folders.

TO CREATE A ZIPPED COMPRESSED FOLDER

1. Click **Start**, and then click **My Computer.**

2. Double-click a drive or folder.

3. On the **File** menu, point to **New**, and then click **Compressed (zipped) Folder**.

4. Type a name for the new folder, and then press **ENTER**.

5. You can also create a zipped compressed folder by right-clicking the desktop, pointing to **New**, and then clicking **Compressed (zipped) Folder**.

6. You can identify compressed folders by the zipper on the folder icon.

TO ADD FILES TO A ZIPPED COMPRESSED FOLDER

1. Open **My Computer**, and then locate the compressed folder.

2. Drag files into the compressed folder to compress them.

FIGURE T1.3

Zip File Features

Features of Windows Zipped Files

You can run some programs directly from compressed folders without decompressing them. You can also open files directly from compressed folders.

Zipped compressed files and folders can be moved to any drive or folder on your computer, the Internet, or your network, and they are compatible with other file compression programs.

Folders compressed using this feature are identified by a zipper icon.

You can protect files in a zipped compressed folder with a password. This protects your data if you save it in a

shared network folder, attach it to an e-mail message, or move it between work and home on floppy disks.

Using Compressed (zipped) Folders will not decrease your computer's performance.

To compress individual files using Compressed (zipped) Folders, create a compressed folder and then move or copy the files to that folder.

TO EXTRACT FILES FROM A ZIPPED COMPRESSED FOLDER

1. Open **My Computer**, and then locate the compressed folder. Do one of the following:

   a. To extract a single file or folder, double-click the compressed folder to open it. Then, drag the file or folder from the compressed folder to a new location.

   b. To extract all files or folders, right-click the compressed folder, and then click **Extract All**. In the Compressed (zipped) Folders Extraction Wizard, specify where you want to store the extracted files.

2. When you extract a file, a compressed version remains in the compressed folder. To delete the compressed version, right-click the file, and then click **Delete**.

3. When you extract a file from a compressed folder that is password-protected, the extracted file is no longer protected.

TO OPEN A ZIPPED COMPRESSED FOLDER

1. You open a compressed folder the same way you open other folders in Windows: Double-click the compressed folder.

2. You can identify compressed folders by the zipper on the folder icon.

3. To view percentages of compression and other file information for a compressed folder, on the **View** menu, click **Details**.

4. When you open or view compressed folders, you cannot use the **Up** or **Back** buttons on the toolbar, or move up or down levels from the folder.

Writing Professional E-Mails

E-mail is almost like talking. We use it so much that we do not always think about it. But there are rules and courtesies, just as there are with verbal conversation. And there are other considerations involved in communicating by written word only. Giving an e-mail additional thought could make your e-mail experience more satisfying and your recipients much happier. Figure T1.4 displays six common e-mail mistakes to avoid.

In addition, be careful about sharing your e-mail or instant message address. Figure T1.5 displays several methods you can use to protect your e-mail address.

NETIQUETTE 101

Surfing the Internet can be fun, useful, and social. But it is important for all new Internet citizens, also called *netizens*, to remember that there are other surfers out there. Like real surfing or any other public activity, there are implied rules of behavior or etiquette to follow. Failing to grasp the netizen ropes could result in more than just missed opportunities—saying the wrong thing at the wrong time could provoke harassment or other problems. The following sections provide a few guidelines that can help you to handle almost any situation in cyberspace.

Using Emoticons

It is often difficult to convey emotion, intent, or tone through text alone, early Internet users invented *emoticons*, which are virtual facial expressions made from basic keyboard characters, like the colon and right parentheses (emoticons lay on their sides at 90 degrees).

FIGURE T1.4

Common E-Mail Mistakes

Six Common E-Mail Mistakes to Avoid

1. **Failing to follow e-mail etiquette—**An old adage states, "You catch more flies with honey than with vinegar."

   Here are a few points to consider:

   - Try not to write or respond to an e-mail when you are angry; wait 24 hours. Calm down. Be reasonable. Have someone else edit your e-mail.

   - Try not to use sarcasm. You may think you are clever, but the recipient will not always agree and might even fail to realize that you are being sarcastic.

   - DO NOT USE ALL UPPERCASE LETTERS. This is the e-mail equivalent of YELLING. Your recipient will not be appreciative. Go easy on the exclamation marks, too. Overuse dulls their effectiveness.

   - Use clear subject lines. That will help people decide whether to read the e-mail now or later.

   - Keep it short. If your e-mail is more than two paragraphs, maybe you should use the telephone.

   - Limit what you forward. Unless the recipient has previously agreed, do not forward poems, jokes, virus warnings, and other things. You are just wasting valuable time and bandwidth.

2. **Attempting anonymity—**If you are sending nasty or inappropriate messages, you might think no one will be able to figure out that the e-mail came from you. After all, you set up a phony Web address. Think again. E-mail contains invisible information about the sender. That information is in the header. All major e-mail programs can display header information. Remember the header if you are tempted to send an anonymous e-mail. You may be less anonymous than you think.

3. **Sending e-mail to the wrong person—**Today's e-mail programs want to make it easy to send e-mail. This means that when you start typing the address of a recipient to whom you have previously sent mail, the "To:" field may already be populated. Be careful. Always double-check that the recipient is the intended one.

4. **Using one e-mail address for everything—**Try to have different e-mail addresses for work and for personal use. Some people have four or more different e-mail addresses: private, public, one for online mailing lists, and another for online shopping. These addresses attract mail for those specific areas. Most e-mail providers will give users a half-dozen e-mail accounts. You can also use addresses on the Web for personal accounts. Both Hotmail and Yahoo! are good choices.

5. **Clicking "Send" too fast—**Reread every e-mail before you send it. E-mails with misspellings and missing words typically end up in the same place: the garbage. Try not to depend on the spell-checker. It will catch misspellings. But if you use "four" instead of "for," or "your" for "you're," it will not tell you. It also is not likely to catch any missing words in a sentence that you inadvertently failed to include. So take a minute and reread your text.

6. **Forgetting the attachment—**This seems obvious, but it happens frequently. When you get ready to send your e-mail, think: "What am I forgetting?"

Here are some examples of commonly used emoticons:

■ :-) Happy or joking.

■ ;-) Winking.

■ :-(Unhappy.

■ :-| Ambivalent.

■ :-o Surprised or concerned.

■ :-x Not saying anything.

■ :-p Sticking out your tongue (usually in fun).

FIGURE T1.5

Protecting Your E-Mail Address

Protecting Your E-Mail Address

Share your primary e-mail address only with people you know. Avoid listing your e-mail address in large Internet directories and job-posting Web sites. Do not even post it on your own Web site (unless you disguise it as described below).

Set up an e-mail address dedicated solely to Web transactions. Consider using a free e-mail service to help keep your primary e-mail address private. When you get too much spam there, simply drop it for a new one.

Create an e-mail name that is tough to crack. Try a combination of letters, numbers, and other characters— Don2Funk9@example.com or J0e_Y0ng@example.com (substituting zero for the letter "O"). Research shows that people with such names get less junk e-mail.

Disguise your e-mail address. When you post your address to a newsgroup, chat room, bulletin board, or other public Web page, add some camouflage such as SairajUdin AT example DOT com. This way, a person can interpret your address, but the automated programs that spammers use often cannot.

Watch out for prechecked boxes. When you buy things online, companies sometimes preselect check boxes to indicate that it is fine to sell or give your e-mail address to responsible parties. Clear the check box if you do not want to be contacted.

Read the privacy policy. When you sign up for Web-based services such as banking, shopping, or a newsletter, carefully read the privacy policy before revealing your e-mail address so you do not unwittingly agree to share confidential information. The privacy policy should outline the terms and circumstances regarding if or how the site will share your information. If a Web site does not post a privacy statement, consider taking your business elsewhere.

Learning Online Acronyms

Another method of streamlining communication is the use of acronyms. Because typing takes longer than speaking, savvy netizens like to reduce common phrases to a few simple letters. Here are some examples of commonly used acronyms:

■ ASAP (As soon as possible).

■ BBL (Be back later).

- BRB (Be right back).

- LOL (Laughing out loud).

- ROFL (Rolling on the floor laughing).

- BTW (By the way).

- OIC (Oh, I see).

- CUL (See you later).

- OTOH (On the other hand).

- GMTA (Great minds think alike).

- IMHO (In my humble opinion).

- RUOK? (Are you OK?).

- TIA (Thanks in advance).

- J/K (Just kidding).

- TTFN (Ta-ta for now).

Stopping Spam

If you send or receive e-mail, you have probably received junk e-mail, also known as *spam*. Unfortunately, spam is not always limited to e-mail. It has spilled over to instant messages (IM) as well and has become enough of a problem for instant messaging spam to warrant its own word, *spim*.

Recent research estimates that 80 percent or more of all e-mail sent these days is spam. An astonishing figure, yet you may see only a tiny portion of that deluge. Many Internet service providers (ISPs) or e-mail programs provide junk e-mail filters that serve as the first line of defense against spam. For example, MSN Hotmail uses patented Microsoft SmartScreen Technology and other tools to keep more than 3.2 billion messages from reaching its customers' e-mail accounts every day.[1]

Sending spam is a lucrative business. It costs spammers next to nothing to send out millions, even billions, of e-mail messages. In addition, consider this: If even a tiny percentage of a hundred million people buy something in response to a junk message, that is a lot of sales! According to a report by the Pew Internet & American Life Project, an independent research organization, five percent of U.S. e-mail users—or 6 million people—said they had ordered a product or service as a result of unsolicited e-mail.[2]

HOW DO SPAMMERS GET E-MAIL ADDRESSES?

Spammers steal, swap, or buy lists of valid e-mail addresses (and the addresses of people who have responded to spam command a premium). Spammers also build their own lists using special software that rapidly generates millions of random e-mail addresses from well-known providers, such as MSN Hotmail and others, and then sends messages to these addresses. Invalid e-mail accounts return e-mail to the sender, so the software very rapidly records which e-mail addresses are active and which are not.

Some spammers also gather or *harvest* addresses from Web sites where people sign up for free offers, enter contests, and so on. Harvesters may also use programs (known as Web bots) that trawl for e-mail addresses anywhere they are posted for all to see—on Internet white pages, job postings, newsgroups, message boards, chat rooms, and even personal Web pages.

HOW TO HANDLE SPAM

Despite your best efforts, you no doubt have received e-mail and instant messages you did not request. Figure T1.6 displays a few things you can do to help stop spam.

Preventing Phishing

A new form of spam e-mail is on the horizon. This spam is more than just unwanted and annoying. It could lead to the theft of credit card numbers, passwords, account information, or other personal data. Thieves use a method known as *phishing* to send e-mail or instant message spam that meticulously imitates messages from reputable, well-known companies, including Microsoft and others. The forged message capitalizes on your trust of the respected brand by enticing you to click a link on a Web page or in a pop-up window. Clicking it could download a virus or lead you to reveal confidential information such as a bank account and Social Security numbers.

WHAT IS PHISHING?

Phishing is a type of deception designed to steal your identity. In phishing scams, scam artists try to get you to disclose valuable personal data, such as credit card numbers, passwords, account data, or other information, by convincing you to provide it under false pretenses. Phishing schemes can be carried out in person or over the phone, and are delivered online through spam e-mail or pop-up windows.

HOW DOES PHISHING WORK?

A phishing scam sent by e-mail may start with con artists who send millions of e-mail messages that appear to come

from popular Web sites or sites that you trust, like your bank or credit card company. The e-mail messages, pop-up windows, and Web sites they link to appear official enough that they deceive many people into believing that they are legitimate. Unsuspecting people too often respond to these requests for their credit card numbers, passwords, account information, or other personal data.

FIGURE T1.6

What to Do With Spam

Tips to Stop Spam

Delete junk e-mail messages without opening them. Sometimes even opening spam can alert spammers.

Do not reply to spam unless you are certain that the message comes from a legitimate source. This includes not responding to such messages that offer an option to "Remove me from your list."

Do not give personal information in an e-mail or instant message. It could be a trick. Most legitimate companies will not ask for personal information by e-mail. If a company you trust, such as your credit card company or bank, appears to ask for personal information, check into it further. Call the company using a number you retrieve yourself from the back of your credit card, bill, phone book, or the like—not a number from the e-mail message. If it is a legitimate request, the company's customer service department should be able to help you.

Think twice before opening attachments or clicking links, even if you know the sender. If you cannot confirm with the sender that an attachment or link is safe, delete the message. (If you must open an attachment that you are less than sure about, save it to your hard disk first so that your anti-virus software can check it before you open it.)

Do not buy anything or give to any charity promoted through spam. Spammers often swap or sell the e-mail addresses of those who have bought from them, so buying something through spam may result in even more spam. Plus, spammers can make their living (and a lucrative one, too) on people's purchases of their offerings. Resist the temptation to buy products through spam, and help to put spammers out of business.

Do not forward chain e-mail messages. Not only do you lose control over who sees your e-mail address, but you also may be furthering a hoax or aiding in the delivery of a virus. Plus, there are reports that spammers start chain letters expressly to gather e-mail addresses. If you do not know whether a message is a hoax or not, a site like Hoaxbusters can help you separate fact from fiction.

WHAT DOES A PHISHING SCAM LOOK LIKE?

As scam artists become more sophisticated, so do their phishing e-mail messages and pop-up windows. They often

include official-looking logos from real organizations and other identifying information taken directly from legitimate Web sites. Figure T1.7 shows what a phishing scam e-mail message might look like.

FIGURE T1.7

Sample Phishing Scam E-Mail Message

If you receive an e-mail message from Microsoft asking you to update your credit card information because of a recent change in Microsoft policy, please do not respond. This is a scam that is designed to steal your money or to install unwanted software on your computer that may have the ability to spy on you while you surf the Internet. Even though it may appear that Microsoft sent these e-mail messages, it did not. Microsoft does not send unsolicited e-mail requesting personal or financial information.

HELP PREVENT IDENTITY THEFT FROM PHISHING SCAMS

Most phishing scams are sent through e-mail. By following the guidelines in Figure T1.8, you can help protect yourself from these tricky scams.

FIGURE T1.8

Preventing Phishing

Tips for Preventing Phishing

Report suspicious e-mail. If you suspect you may have received phishing e-mail designed to steal your identity, report the e-mail to the faked or "spoofed" organization. Contact the organization directly—not through the e-mail you received—and ask for confirmation. If it would make you more comfortable, call the organization's toll-free number (if one exists) and speak to a customer service representative. You should also report the e-mail to the proper authorities including the FBI, the Federal Trade Commission (FTC), and the Anti-phishing Working Group.

Be wary of clicking on links in e-mail messages. Links in phishing e-mail messages often take you directly to phony sites where you could unwittingly transmit personal or financial information to con artists. Avoid clicking on a link in an e-mail message unless you are sure of the destination. Even if the address bar displays the correct Web address, do not risk being fooled. Con artists can display a fake URL in the address bar on your browser.

Type addresses directly into your browser or use your personal bookmarks. If you need to update your account information or change your password, visit the Web site by using your personal bookmark or by typing the URL directly into your browser.

Check the security certificate when you are entering personal or financial information into a Web site. Before

you enter personal or financial information into a Web site, make sure the site is secure. In Internet Explorer, you can do this by checking the yellow lock icon on the status bar as shown below.

If the lock icon is closed, this signifies that the Web site uses encryption to help protect any sensitive, personal information that you enter, such as your credit card number, Social Security number, or payment details. This symbol does not need to appear on every page of a site, only on those pages that request personal information. Unfortunately, even the lock symbol can be faked. To help increase your safety, double-click the lock icon to display the security certificate for the site. The name following **Issued to** should match the name of the site. If the name differs, you may be on a fake site, also called a "spoofed" site. If you are not sure whether a certificate is legitimate, do not enter any personal information. Play it safe and leave.

Do not enter personal or financial information into pop-up windows. One common phishing technique is to launch a fake pop-up window when someone clicks on a link in a phishing e-mail message. To make the pop-up window look more convincing, it may be displayed over a window you trust. Even if the pop-up window looks official or claims to be secure, you should avoid entering sensitive information, because there is no way to check the security certificate. Close pop-up windows by clicking on the red X in the top right corner (a "cancel" button may not work as you would expect).

Detecting Spyware

Spyware is a general term used for software that performs certain behaviors such as advertising, collecting personal information, or changing the configuration of your computer, generally without appropriately obtaining your consent. You might have spyware or other unwanted software on your computer if:

■ You see pop-up advertisements even when you are not on the Web.

■ The page your Web browser first opens to or your browser search settings have changed without your knowledge.

■ You notice a new toolbar in your browser that you didn't want, and find it difficult to get rid of.

■ Your computer takes longer than usual to complete certain tasks.

■ You experience a sudden rise in computer crashes.

Spyware is often associated with software that displays advertisements (called *adware*) or software that tracks personal or sensitive information. That does not mean all software that provides ads or tracks your online activities

is bad. For example, you might sign up for a free music service, but "pay" for the service by agreeing to receive targeted ads. If you understand the terms and agree to them, you may have decided that it is a fair trade-off. You might also agree to let the company track your online activities to determine which ads to show you.

Other kinds of unwanted software will make changes to your computer that can be annoying and can cause your computer to slow down or crash. These programs have the ability to change your Web browser's home page or search page, or add additional components to your browser you do not need or want. These programs also make it very difficult for you to change your settings back to the way you originally had them. These types of unwanted programs are also often called spyware.

The key in all cases is whether or not you (or someone who uses your computer) understand what the software will do and have agreed to install the software on your computer.

Spyware or other unwanted software can get on your system in a number of ways. A common trick is to covertly install the software during the installation of other software you want such as a music or video file-sharing program. Whenever you are installing something on your computer, make sure you carefully read all disclosures, including the license agreement and privacy statement. Sometimes the inclusion of unwanted software in a given software installation is documented, but it may appear at the end of a license agreement or privacy statement.

PREVENTING SPYWARE

Figure T1.9 displays a list of actions that can be taken to help prevent spyware infections.

FIGURE T1.9

Preventing Spyware

Tips for Preventing Spyware

1. Ensure that desktop settings are configured to prompt you whenever a Web site tries to install a new program or Active X control. If possible, configure your browser to reject Active X controls to lessen the likelihood that spyware could be installed on your computer through normal Internet browsing.

2. Keep your desktop systems up-to-date with security patches. Several spyware programs take advantage of known vulnerabilities that, if patched, would limit the spyware's effectiveness.

3. Install and maintain current versions of anti-virus and anti-spyware programs.

4. Expand the risk-assessment process to consider threats from spyware. This ensures that all risks to private information are considered and appropriate steps are taken to mitigate those risks.

5. Install and configure firewalls to monitor all traffic (discussed later in this plug-in).

6. Implement tools to filter out spam and viruses from incoming e-mail. E-mail scanning can limit the likelihood that you could unknowingly infect your computer by viewing or reading e-mail that contains spyware. Filtering outbound e-mail for viruses also gives you an alert that an internal computer is infected.

7. Implement tools to restrict or prevent pop-up windows. This limits the likelihood that spyware will be downloaded through pop-up windows, either automatically or through user error.

HOW TO GET RID OF SPYWARE

Many kinds of unwanted software, including spyware, are designed to be difficult to remove. If you try to uninstall this software like any other program, you might find that the program reappears as soon as you restart your computer. If you are having trouble uninstalling unwanted software, you may need to download a tool to do the job for you. Several companies offer free and low-cost software that will check your computer for spyware and other unwanted software and help you remove it.

Some ISPs include antispyware software in their service packages. Check with your ISP to see if it can recommend or provide a tool. Keep in mind that removing unwanted software with these tools may mean you will no longer be able to use a free program that came with the spyware.

To remove spyware:

1. Download a spyware removal tool (such as Microsoft Windows AntiSpyware).

2. Run the tool to scan your computer for spyware and other unwanted software.

3. Review the files discovered by the tool for spyware and other unwanted software.

4. Select suspicious files for removal by following the tool's instructions.

Restricting Instant Messages

Like e-mail viruses, instant message viruses are malicious or annoying programs that are designed to travel through IM. In most cases, these viruses are spread when a person opens an infected file that was sent in an instant message that appeared to come from a friend. Figure T1.10 provides an example of what an IM virus sent through an infected file might look like.

When unsuspecting people open these files, their computers can become infected with a virus. Because of the virus, their computers may slow down or stop responding, or they may not notice any change. However, the virus

might have installed a covert program on the computer that could damage software, hardware, or important files, and that may include spyware, which can track information entered on a computer.

FIGURE T1.10

Sample IM Virus

A computer infected by a virus may continue to spread the infection by sending copies of the virus to everyone on your IM contact list. A contact list is the collection of IM names (similar to an e-mail address book) that you can store in your IM program. As with most threats on the Internet, you can help keep yourself safe by taking basic precautions. If you know how to avoid e-mail viruses, you will already be familiar with many of the steps highlighted in Figure T1.11 and Figure T1.12.

Increasing PC Performance

To maintain your computer and keep it running smoothly, follow these guidelines:

■ Free disk space.

■ Speed up access to data.

■ Detect and repair disk errors.

FREE DISK SPACE

By freeing disk space, you can improve the performance of your computer. The Disk Cleanup tool, a utility that comes installed with Microsoft Windows, helps free space on your hard disk. The utility identifies files that you can safely delete, and then enables you to choose whether you want to delete some or all of the identified files. You can use the Disk Cleanup Utility to:

FIGURE T1.11

How to Avoid Instant Message Viruses

Steps to Help Avoid Instant Message Viruses

Be careful downloading files in IM. Never open, accept, or download a file in IM from someone you do not know. If the file comes from someone you do know, do not open it unless you know what the file is and you were expecting it. Contact the sender by e-mail, phone, or some other method to confirm that what was sent was not a virus.

Update your Windows software. Visit the Windows Update Web site to scan your computer and install any high-

priority updates that are offered. If you have Automatic Updates enabled, the updates are delivered to you when they are released, but you have to make sure you install them.

Make sure you are using an updated version of your IM software. Using the most up-to-date version of your IM software can better protect your computer against viruses and spyware. If you are using MSN Messenger, install the updated version by visiting the MSN Messenger Web site and clicking the **Download Now!** button.

Use anti-virus software and keep it updated. Anti-virus software can help to detect and remove IM viruses from your computer, but only if you keep the anti-virus software current. If you have purchased a subscription from an anti-virus software company, your anti-virus software may update itself when you are connected to the Internet.

Use anti-spyware software and keep it updated. Some IM viruses may install spyware or other unwanted software on your computer. Anti-spyware software can help to protect your computer from spyware and remove any spyware you may already have.

■ Remove temporary Internet files.

■ Remove downloaded program files (such as Microsoft ActiveX controls and Java applets).

FIGURE T1.12

Safer Instant Messaging

Tips for Safer Instant Messaging

Never give out sensitive personal information, such as your credit card number, Social Security number, or passwords, in an IM conversation.

Only communicate with people on your Contact List or Buddy List.

Never agree to meet a stranger in person whom you have met on IM.

Never accept files or downloads from people you do not know. Never accept files that you were not expecting from people you do know.

Each IM program assigns you a name, not unlike an e-mail address. This name is usually called a screen name. Choose a name that does not give away your personal information. For example, use SassySue instead of DetroitSue.

Just like an e-mail address, do not post your screen name online. People might find it and use it to send you unsolicited IM messages.

Do not send personal or private instant messages at work. Your boss may have a right to view those messages.

Most instant message programs allow you to automatically log on when you start your computer so that you do not have to enter your password every time you want to use the program. If you use a public computer, make sure not to configure your IM program for automatic log-on.

Be careful how you reveal when you are online or not. IM programs allow people on your contact list to see if you are available. However, using this feature may offer people more information about you than you feel comfortable giving. Windows Messenger and MSN Messenger both allow you to control how you appear to people on your contact list.

■ Empty the Recycle Bin.

■ Remove Windows temporary files.

■ Remove optional Windows components that you do not use.

■ Remove installed programs that you no longer use.

(**Note:** Typically, temporary Internet files take the most amount of space because the browser caches each page you visit for faster (later) access.)

FIGURE T1.13

Disk Cleanup Dialog Box

To Use Disk Cleanup

1. Click **Start**, point to **All Programs**, point to **Accessories**, point to **System Tools**, and then click **Disk Cleanup.**

2. If several drives are available, you might be prompted to specify which drive you want to clean.

3. Disk Cleanup calculates the amount of space you will be able to free.

4. In the **Disk Cleanup for** dialog box, scroll through the content of the **Files to delete** list.

5. Choose the files that you want to delete, as displayed in Figure T1.13.

6. Clear the check boxes for files that you do not want to delete, and then click **OK**.

7. When prompted to confirm that you want to delete the specified files, click **Yes**.

8. After a few minutes, the process completes and the Disk Cleanup dialog box closes.

SPEED UP ACCESS TO DATA

Disk fragmentation slows the overall performance of your system. When files are fragmented, the computer must search the hard disk when the file is opened to piece it back together. The response time can be significantly longer.

Disk Defragmenter is a Windows utility that consolidates fragmented files and folders on your computer's hard disk so that each occupies a single space on the disk. With your files stored neatly end-to-end, without fragmentation, reading, and writing to the disk speeds up.

When to Run Disk Defragmenter

In addition to running Disk Defragmenter at regular intervals, optimally monthly, certain events warrant running the utility outside of the normal interval. You should run Disk Defragmenter when:

■ You add a large number of files.

■ Your free disk space nears 15 percent.

■ You install new programs or a new version of Windows.

To Use Disk Defragmenter

1. Click **Start**, point to **All Programs**, point to **Accessories**, point to **System Tools**, and then click **Disk Defragmenter**.

2. Click **Analyze** to start the Disk Defragmenter (see Figure T1.14).

3. In the **Disk Defragmenter** dialog box, click the drives that you want to defragment, and then click the **Analyze** button.

After the disk is analyzed, a dialog box appears, letting you know whether you should defrag the analyzed drives.

Tip: You should analyze a volume before defragmenting it to get an estimate of how long the defragmentation process will take.

4. To defragment the selected drive or drives, click the **Defragment** button.

5. After the defragmentation is complete, Disk Defragmenter displays the results.

6. To display detailed information about the defragmented disk or partition, click **View Report.**

7. To close the **View Report** dialog box, click **Close**.

8. To close the Disk Defragmenter utility, click the **Close** button on the title bar of the window.

DETECT AND REPAIR DISK ERRORS

In addition to running Disk Cleanup and Disk Defragmenter to optimize the performance of your computer, you can check the integrity of the files stored on your hard disk by running the Error Checking utility. As you use your hard drive, it can develop bad sectors. Bad sectors slow down hard disk performance and sometimes make data writing

(such as file saving) difficult, or even impossible. The Error Checking utility scans the hard drive for bad sectors, and scans for file system errors to see whether certain files or folders are misplaced. If you use your computer daily, you should try to run this utility weekly to help prevent data loss.

FIGURE T1.14

Disk Defragmenter Dialog Box

To Run the Error Checking Utility

1. **Important:** Be sure to close all files before running the Error Checking utility.

2. Click **Start**, and then click **My Computer**.

3. In the My Computer window, right-click the hard disk you want to search for bad sectors, and then click **Properties**.

4. In the **Properties** dialog box, click the **Tools** tab.

5. Click the **Check Now** button.

6. In the **Check Disk** dialog box, select the **Scan for and attempt recovery of bad sectors** check box, and then click **Start** (see Figure T1.15).

7. If bad sectors are found, you will be prompted to fix them.

   (Note: Only select the **Automatically fix file system errors** check box if you think that your disk contains bad sectors.)

Using Anti-Virus Software

The Internet is an excellent resource, and no doubt has changed the way most people communicate. Unfortunately the Internet, e-mail in particular, has created an easy medium for the spread of computer viruses, which can cause chaos to whole networks of computers.

FIGURE T1.15

Check Disk Dialog Box

A *virus* is basically a malicious computer program. The effects of viruses differ, some either modify, delete, or steal data, and others may give control of your PC over to their creators via the Internet. One thing they all have in common is that if you get infected and you don't have anti-virus software, you might not know you have it until it is too late.

A *worm* refers to a virus that can replicate and spread by itself over a network (the Internet for instance). These are getting very common and are among the biggest troublemakers on the Internet.

A virus or worm can sit on a computer for months (potentially even years) without doing anything and then be triggered by a certain date and time to do what it has been designed to do. As these viruses and worms become more advanced, the need for anti-virus software has never been so great.

Like its biological equivalent, a computer virus is a program that spreads unwanted and unexpected actions through the insides of a computer. Not all viruses are malicious, but many are written to damage particular types of files, applications, or operating systems.

The results of virus infections vary according to the maliciousness of the author. Many viruses are designed only to spread from file to file and therefore from computer to computer without any serious damage. The only real effect to an end user is loss of credibility when an e-mail to a customer or a friend is rejected by an anti-virus program. But many viruses carry sinister payloads. Some actively destroy files, some overwrite the boot sectors on disks to render computers unbootable, and an increasing number install backdoor programs that allow virus writers to take control of computers remotely. Computers with backdoor software installed are called *zombies* and are often used for computer crime such as distributed denial of service (DDoS) attacks. There are three main types of viruses in circulation: (1) boot sector viruses, (2) macro viruses, and (3) file infecting viruses. Figure T1.16 explains each of these in detail.

ANTI-VIRUS SOFTWARE

Anti-virus (AV) is a term applied to either a single program or a collection of programs that protect a computer system from viruses. Anti-virus software is designed to keep your PC free of computer viruses and worms. It does so by scanning your PC's file system looking for known viruses; if a virus is found, the software will inform you and then take steps to remove the virus threat.

FIGURE T1.16

Types of Viruses

Type of Virus	Definition
Boot sector viruses	The boot sector is the very first sector on a floppy or hard disk. It contains executable code that helps to operate the PC. Because the PC's hard disk boot sector is referred to

	every time the PC powers or "boots" up, and is rewritten whenever you configure or format the setup of the system, it is a vulnerable place for viruses to attack.
	Boot sector viruses are usually spread through the boot sector of floppy disks left in disk drives when systems are rebooted. From there, they infect the boot sector of hard disks, loading themselves into memory each time the system is booted and waiting for an opportunity to write themselves to more disks to spread. This kind of virus can prevent you from being able to boot your hard disk.
Macro viruses	Macro viruses are by far the most common viruses in circulation, accounting for about 75 percent of viruses found "in the wild." These can be obtained through disks, a network, the Internet, or an e-mail attachment.
	Macro viruses do not directly infect programs, but instead, infiltrate the files from applications that use internal macro programming languages, such as Microsoft Excel or Word documents. They are then able to execute commands when the infected file is open, which spreads the virus to other vulnerable documents. In turn, users who share files can also spread the virus to other systems.
File infecting viruses	File infecting viruses infect executable files, such as EXE and COM files. Once the original infected program is run, the virus transfers to your computer's memory and may replicate itself further, spreading the infection. These viruses can be spread beyond the infected system as soon as the infected file or program is passed to another computer.
	The simplest of these viruses work by overwriting part of the program they are infecting. These can thankfully be caught early, because the program rarely continues to work as it should.
	More sophisticated versions hide their presence by saving the program or file's original instructions so that these are executed even after infection. This type may not be noticed until it is too late and enters the attack phase.

Good anti-virus software will automatically check any files being transferred to and from a computer; any anti-

virus software should at least scan attachments of incoming e-mails automatically (even if the option can be turned off).

The intricate details of each anti-virus program vary, but all share the basic responsibility of identifying virus-laden files using *virus signature files*: a unique string of bytes that identifies the virus like a fingerprint. They view patterns in the data and compare them to traits of known viruses captured "in the wild" to determine if a file is infected, and in most cases are able to strip the infection from files, leaving them undamaged. When repairs are not possible, anti-virus programs will quarantine the file to prevent accidental infection, or they can be set up to delete the file immediately.

In the case of new viruses for which no antidote has been created, some anti-virus programs also use heuristic scanning. *Heuristic scanning* allows the anti-virus programs to flag suspicious data structures or unusual virus-like activity even when there is no matching virus definition. If the program sees any funny business, it quarantines the questionable program and broadcasts a warning to you about what the program may be trying to do (such as modify your Windows Registry). The accuracy of such methods is much lower, however, and often a program with this running may err on the side of caution. This can result in confusing false positive results.

If you and the software think the program may be a virus, you can send the quarantined file to the anti-virus vendor, where researchers examine it, determine its signature, name and catalog it, and release its antidote.

Virus Definition Files

Anti-virus software usually works by checking a file for certain patterns of binary code. The patterns used to identify viruses are stored in what is known as a *virus definition file*. When a new virus comes out, the virus definition file needs to be updated to include the new pattern.

The importance of keeping these definition files updated cannot be overstated. Basically, anti-virus software without updated definition files is useless.

Most anti-virus software will update these files automatically (or at least have the option to do so). The update of the definition files is usually achieved by having the software connect via the Internet to the vendor's Web site, and then downloading and installing the latest virus definition files. This is why it is important to purchase anti-virus software from an established company. Imagine you bought anti-virus protection and then six months later the company went bankrupt; you would have nowhere to get your virus definition updates. If you do not have anti-virus software, then check out these anti-virus products from established developers:

FIGURE T1.17

Norton Anti-Virus

■ McAfee VirusScan (www.mcafee.com).

■ Norton Anti-virus (www.symantec.com).

Figure T1.17 displays an example of Norton Anti-virus after it has completed a virus scan of a hard drive.

CELL PHONE VIRUSES

Cabir, the world's first known cell phone virus, was found on the cell phone of a private user in 2004; however, it did not get very far. Cabir infected only a small number of Bluetooth-enabled phones and carried out no malicious action—a group of malware developers created Cabir to prove it could be done. *Malware*, short for malicious software, is designed specifically to damage or disrupt a system, such as a virus. The group's next step was to send it to anti-virus researchers, who began developing a solution to a problem that promises to get a lot worse.

Cell phone viruses are at the threshold of their effectiveness. At present, they cannot spread very far and they don't do much damage, but the future might see cell phone bugs that are as debilitating as computer viruses.

A cell phone virus is basically the same thing as a computer virus—an unwanted executable file that "infects" a device and then copies itself to other devices. However, whereas a computer virus or worm spreads through e-mail attachments and Internet downloads, a cell phone virus or worm spreads via Internet downloads, MMS (multimedia messaging service) attachments, and Bluetooth transfers. The most common type of cell phone infection now occurs when a cell phone downloads an infected file from a PC or the Internet, but phone-to-phone viruses are on the rise.

Current phone-to-phone viruses almost exclusively infect phones running the *Symbian* operating system. The large number of proprietary operating systems in the cell phone world is one of the obstacles to mass infection. Cell phone virus writers have no Windows-level market share to target, so any virus will affect only a small percentage of phones.

Infected files usually show up disguised as applications such as games, security patches, add-on functionalities, and, of course, pornography and free stuff. Infected text messages sometimes steal the subject line from a message you have received from a friend, which increases the likelihood of you opening it, but opening the message is not enough to get infected. You have to choose to open the message attachment and agree to install the program, which is another obstacle to mass infection. The installation obstacles and the methods of spreading limit the amount of damage the current generation of cell phone virus can do.

Installing a Personal Firewall

A *firewall* is a barrier to keep destructive forces away from your property. Its job is similar to a physical firewall that keeps a fire from spreading from one area to the next.

A firewall is simply a program or hardware device that filters the information coming through the Internet connection into a computer. If an incoming packet of information is flagged by the filters, it is not allowed through.

Say that you work at a company with 500 employees. The company has hundreds of computers that are all connected. In addition, the company will have one or more connections to the Internet through something like T1 or T3 lines. Without a firewall, all of those hundreds of computers are directly accessible to anyone on the Internet. An outsider can probe those computers and try to make connections to them. If one employee makes a mistake and leaves a security hole, hackers can get to the machine and exploit the hole.

With a firewall in place, the landscape is much different. A company should place a firewall at every connection to the Internet (for example, at every T1 line coming into the company). The firewall can implement security rules. For example, one of the security rules inside the company might be "out of the 500 computers inside this company, only one of them is permitted to receive public FTP traffic. Allow FTP connections only to that one computer and prevent them on all others."

A company can set up rules like this for FTP servers, Web servers, Telnet servers, and the like. In addition, the company can control how employees connect to Web sites, whether files are allowed to leave the company over the network, and so on. A firewall gives a company tremendous control over how people use the network.

A variety of firewall software applications are available, including ZoneAlarm (www.zonealarm.com), which is free for download. Microsoft has improved the firewall software in Windows XP Service Pack 2, which is turned on by default. However, some computer manufacturers and network administrators might turn it off.

FIGURE T1.18

Windows Firewall Settings

TO OPEN WINDOWS FIREWALL

1. Click **Start** and then click **Control Panel**.

2. Click **Windows Firewall** (see Figure T1.18).

Figure T1.19 displays a list of some things firewalls do and do not do.

FIGURE T1.19

What Windows Firewall Does and Does Not Do

It Does	It Does Not
Help block computer viruses and worms from reaching a computer.	**Detect or disable computer viruses and worms** if they are already on a computer.
Ask for your permission to block or unblock certain connection requests.	**Stop you from opening e-mail with dangerous attachments**.
Create a record (a security log) that records successful and unsuccessful attempts to connect to a computer. This can be useful as a troubleshooting tool.	**Block spam or unsolicited e-mail** from appearing in an e-mail inbox. However, some e-mail programs can help do this.

PLUG-IN SUMMARY

This plug-in covered a number of things to do to keep your personal computer running effectively and efficiently, such as:

■ Creating strong passwords.

■ Performing good file management.

■ Implementing effective backup and recovery strategies.

■ Using Zip files.

■ Writing professional e-mails.

■ Stopping spam.

■ Preventing phishing.

■ Detecting spyware.

■ Restricting instant messaging.

■ Increasing PC performance.

■ Using anti-virus software.

■ Installing a personal firewall.

MAKING BUSINESS DECISIONS

1. Third-Party Backup Utilities

Because of the importance of data backup, numerous companies produce specialized backup software. Backup utilities offer advanced features in the following areas to differentiate it from the Windows Backup utility and from software included with CD and DVD burners:

■ Support for all current media types, including all DVD formats, Zip disks, Pen storage, and so on.

■ Highly specific backup selections, combinations of files and folders in any location.

■ On-the-fly compression of files, to provide reduced file sizes in the backup.

■ Automatic comparisons of data after the backup, taking a number of forms.

■ Support for multi-CD or multi-DVD backups, with a single backup spanning as many discs as necessary.

■ Detailed backup schedulers.

■ Detailed methods of including or excluding file types.

■ Backup from remote computers.

In addition, some backup utilities now include the technology known as *ghost imaging*, or just plain *ghosting*. A ghost image captures the entire hard drive, backing it up to the point where you can restore your entire system from it.

Search the Internet to find different third-party utilities that perform backup, restore, and ghosting. List the features and prices of each.

2. **Spybot Search & Destroy**

Debuting in 2002, Spybot Search & Destroy has gained the reputation as one of the best stand-alone spyware detectors, monitors, and removers in the business. Spybot Search & Destroy is available free, although the Web site (www.safer-networking.org) asks for a donation to defray development costs. Download and install the latest version of Spybot (www.safernetworking.org/en/download/index.html). Run the application to scan for spyware, adware, hijackers, and other malicious software. Installation is simple and fast (although you should create a Restore Point with System Restore before doing so, in case you want to reverse the process). Note how many references to spyware and adware the application finds.

3. **Firewall Utilities**

You have a good range of excellent choices when it comes to firewall protection. In addition to commercial products such as Symantec, McAfee, and Trend Micro, which include firewall protection as part of their security suites or as stand-alone products, Microsoft has a firewall that ships as part of SP1 and SP2.

Perhaps the best known of the stand-alone firewall utilities is ZoneAlarm (www. zonealarm.com), which offers its firewall as a free product as well as a purchasable product, ZoneAlarm Pro, with additional features (including e-mail security).

Other firewall products operate similarly to those already mentioned. Kerio Personal Firewall (www.kerio.com) makes your desktop invisible to outside intruders, blocks pop-up windows and banner ads, and detects a wealth of hacker intrusions. Kerio specializes in enterprise-level products, and its desktop firewall products take advantage of that specialization. Tiny Software (www.tinysoftware.com), recently acquired by industry giant Computer Associates, offers Tiny Firewall, which watches all network activity, establishes intrusion protection as you work, and offers a tool called Track `n' Reverse, which lets you see any changes to your files or your registry and reverse them so that your system is as it was before. Think of this as a kind of System Restore at the microlevel.

Another full-featured product is Sygate Personal Firewall (www.sygate.com), available as a free download for the Standard version or by purchase for the Pro version. Sygate's product offers an especially usable interface and an out-of-the-box configuration that makes it easy for even beginners to get a firewall established.

Download one of the free firewall products mentioned above and try them.

4. Testing Your Setup

How do you know you are actually safe?

- To test your firewall, visit Gibson Research Corporation (www.grc.com) and follow the links to ShieldsUp! This site runs numerous free, fast online tests of common vulnerabilities.

- Another free online tester can be found at www.pcflank.com.

- You can also test your browser's vulnerabilities by using the Browser Security Test (bcheck.scanit.be/bcheck).

- GFi will send a free series of e-mail messages to you with attachments intended to expose holes in your e-mail software (gfi.com/emailsecuritytest).

- Microsoft has a free, heavy-duty Baseline Security Analyzer (www.microsoft.com/technet/security/tools/mbsahome.mspx) available for download. It is intended to detect common security misconfigurations and missing security updates on your computer systems.

5. Scanning from the Web

It is not actually necessary to purchase an anti-virus package if all you want to do is check your PC's current virus situation. Increasingly, anti-virus vendors are offering scanning of your PC directly from their Web sites, a process that tends to take a bit longer than local scanning but which has four major benefits:

1. You can successfully scan a PC that does not have the latest virus definition files installed locally.

2. You are always assured of the most up-to-date virus scan possible.

3. You can scan PCs on which, for whatever reason, you cannot install anti-virus software.

4. You can get a second opinion to see if the results are different from those of your installed anti-virus program.

Go to Trend Micro's Housecall, the online free virus scan corresponding to their PC-cillin product (www.trendmicro.com). You need to agree to a download of an ActiveX control to have the virus-scanning software start; this is one of two apparent strikes against this method of virus checking. Since some of the fear surrounding spyware is precisely the vulnerability of your PC to software placed on your hard drives from outside, it seems counterintuitive from a security standpoint to allow an ActiveX control to install itself on your PC and then allow that control to scan all the files on your system.

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[1] www.microsoft.com/presspass/press/2003/nov03/11-17ComdexAntiSpamPR.mspx, accessed on February 2, 2006.

[2] www.microsoft.com/athome/security/email/aboutspam.mspx, accessed on February 22, 2006.

Basic Skills Using Excel

<< TECHNOLOGY PLUG-IN POINTER

<Go to page xvi in the front of this book for an overview of the technology plug-ins that are on the accompanying CD.

LEARNING OUTCOMES

1. Describe how to open, close, and save an Excel workbook.

2. Explain how to insert and delete an Excel worksheet.

3. Describe how to insert, delete, merge, and split cells in an Excel worksheet.

4. Explain how to set up a worksheet in Excel for printing.

5. Describe how to insert and delete rows and columns in an Excel worksheet.

6. Explain how to create and edit formulas in Excel using the formula bar.

7. Describe how to create a chart using Excel.

Introduction to Excel

Microsoft Excel is a spreadsheet program that enables you to enter, manipulate, calculate, and chart data. An Excel file is referred to as a *workbook*, which is a collection of worksheets. Each *worksheet* is comprised of rows and columns of data that you can perform calculations on. It is these calculations that make Excel such a powerful tool.

You can use Excel for a wide variety of purposes, from calculating payments for a personal loan, to creating a personal budget, to tracking employee sales and calculating bonuses for your business.

This plug-in introduces the basics of using Excel. It is designed to show you the nuts and bolts, along with a few fancy features, to get you off to a good start using the program. However, you should review the CD, *MISource*, which accompanies this text for additional material, animated tutorials, and simulated practice files that go beyond what we cover in the text. Figure T2.1 displays all the tasks and lessons that are provided on the *MISource* CD. This plug-in will focus on the following six areas:

1. Workbooks and worksheets.

2. Working with cells and cell data.

3. Printing worksheets.

4. Formatting worksheets.

5. Formulas.

6. Working with charts and graphics.

FIGURE T2.1

MISource Excel Lessons

MISource CD Microsoft Excel Lessons	
Introduction to Excel	**Printing Worksheets**
■ Introduction to Excel 2003	■ Setting up the page for printing
■ Opening and closing workbooks	■ Setting up margins for printing
■ Creating workbooks	■ Setting up the sheet for printing
■ Using templates	■ Setting and clearing the print area
■ Creating folders for saving workbooks	■ Previewing a print area
■ Saving a workbook in a new format	■ Printing selections, worksheets, and workbooks
■ Using the research tool	
Managing Workbooks	**Analyzing Data**
■ Inserting worksheets	■ Using Autofilter
■ Deleting worksheets	■ Creating and sorting lists
■ Hiding and unhiding worksheets	■ Adding functions to formulas using the Autosum button
■ Moving and copying worksheets	■ Entering formulas
■ Formatting worksheets	■ Creating and editing formulas using the formula bar
■ Splitting and arranging workbooks	■ Entering a range in a formula by dragging
■ Arranging and hiding/unhiding	■ Using absolute and relative references
	■ Using the insert function feature
	■ Creating formulas using the SUM function

	■ Creating formulas using the MIN and MAX functions
	■ Creating formulas using the DATE or NOW function
	■ Creating formulas using the PMT function
	■ Creating formulas using the IF function
Working with Cells and Cell Data	**Working with Charts and Graphics**
■ Inserting cells	■ Creating a chart using the chart wizard
■ Deleting cells	■ Modifying charts
■ Merging and splitting cells	■ Moving a chart
■ Cutting, copying and pasting cells	■ Adding graphics
■ Moving selected cells using drag-and-drop	■ Modifying graphic properties
■ Entering text in cells	■ Positioning graphics
■ Using the fill handle tool editing text in cells	
■ Clearing cell content	
■ Finding and replacing cell content	
■ Using go to	
■ Finding and replacing formatting in cells	
■ Changing the look of cells	
■ Using format painter	
■ Applying number formats	
■ Applying styles	
Formatting Worksheets	**Workgroup Collaboration**
■ Inserting rows and columns	■ Using Web page preview
■ Deleting rows and columns	■ Saving worksheets as Web pages
■ Hiding and unhiding rows and columns	■ Inserting and editing hyperlinks
■ Freezing and unfreezing rows and columns modifying row heights	■ Adding comments
■ Modifying column widths	■ Editing comments

| ■ Changing alignment

■ Applying an autoformat

■ Changing worksheet orientation

■ Adding headers and footers | |

Workbooks and Worksheets

Opening a file retrieves it from storage and displays it on your computer screen. To open an existing workbook:

1. Click the **Open** button on the standard toolbar.

2. The *Open* dialog box appears; make sure the location in the **Look in:** box is correct.

3. Select the **workbook** name in the large list box.

4. Click the **Open** button in the dialog box (see Figure T2.2).

Closing a workbook removes it from your computer screen and stores the last saved version for future use. If you have not saved your latest changes, Excel prevents you from losing work by displaying a dialog box that asks if you want to save the changes you made before closing. You must click one of the three options in the dialog box before Excel will close the workbook.

FIGURE T2.2

Opening a Workbook

To close a workbook and save your latest changes:

1. Click **Close Window** on the menu bar. Be careful not to click the **Close** button above the **Close Window** button; they look the same, but the **Close** button will exit the application.

2. Click **Yes** in the dialog box.

When the Open dialog box appears, the last location you used appears as the default location in the box. If this is not the location of the workbook you want, click the **up one level button** to the right of the Look in: box until the correct location is displayed (you may have to double-click a different folder or drive). Another method is to click the **arrow** to open the drop-down list, which displays different drives. Next, click the desired drive and double-click folders until you see your workbook name in the large list box.

If you have made no changes since the last time you saved the workbook, it will close immediately. If changes

have been made, Excel displays a dialog box asking if you want to save the changes you made before closing. Click **Yes** to save the changes. Click **No** to close the workbook without saving your latest changes. Click **Cancel** to keep the workbook open.

FIGURE T2.3

Workbook Template

CREATING WORKBOOKS USING TEMPLATES

A template is a file with predefined settings that you can use as a starting point for your workbook. An Excel template makes creating a new workbook easy and results in a professional appearance. Some examples of workbook templates are Balance Sheet, Sales Invoice, and Loan Amortization.

   To create a workbook using a template:

1. Click **New …** on the File menu.

2. Click **On my computer …** in the Templates area of the New Workbook task pane.

3. Click the **Spreadsheet Solutions** tab in the Templates dialog box.

4. Click a **template icon** to see a preview in the right pane (see Figure T2.3).

5. Click **OK**.

SAVING A WORKBOOK

Sometimes when you are saving a workbook, you will want to create a new folder, where you can later save other, similar workbooks. You can create this new folder at the same time you save the workbook.

   To create a new folder:

1. Click **Save As …** on the File menu.

2. Click the **Create New Folder** button to the right of the Save in: box.

3. Enter the name for the new folder in the dialog box that appears.

4. Click **OK**.

5. Enter the name for the file in the File name: box.

6. Click the **Save** button.

   You can also use the Save As dialog box to save the workbook with a new name (refer to Figure T2.4):

1. Click **Save As …** on the File menu.

2. Click in the **File name:** box.

3. Type in the new **file name**.

4. Click the **Save** button in the *Save As* dialog box.

FIGURE T2.4

Saving a Workbook

INSERTING AND DELETING WORKSHEETS

When you create a new workbook, it contains three worksheets. However, a workbook can contain as many worksheets as you need.

To add a worksheet:

1. Right-click on any **Sheet tab**.

2. Select **Insert …** from the shortcut menu.

3. To insert a simple worksheet, click the **Worksheet** icon in the dialog box.

4. To insert a formatted worksheet, click the **Spreadsheet Solutions** tab, and click any of the template icons.

5. Click **OK** (see Figure T2.5).

FIGURE T2.5

Inserting a New Worksheet

You can insert more than one worksheet at once. First, select the number of worksheets you want to add. Next, right-click and select **Insert …** Click the **Worksheet icon**, and click **OK**.

Sometimes you may need only one worksheet in your workbook. Limiting the worksheets in your workbook to those that contain information can make your workbook appear organized and professional.

To delete a worksheet:

1. Right-click on a **Sheet tab**.

2. Select **Delete** from the menu.

You can delete more than one worksheet at once. First, select all the sheet tabs you want to remove by holding the **CTRL** key down and clicking on the **Sheet(s) tabs** you wish to delete. Next, **right-click** and select **Delete**. If a worksheet contains data, Excel will display a dialog box, warning that the sheet may contain data and asking if you are sure you want to permanently remove it from your workbook.

Working with Cells and Cell Data

INSERTING AND DELETING CELLS

You may find you want to add some extra space or more information into the middle of your worksheet. To do this, you must insert a new cell. This new cell can be left blank, or you can enter information into the cell. When you insert a new cell, you have the option to shift the existing data to the right or down, allowing you to place the new cell exactly where you want it.

FIGURE T2.6

Inserting a New Cell

To insert a cell:

1. Select **Cells …** from the Insert menu.

2. Click the **Shift cells right** or **Shift cells down** radio button (see Figure T2.6).

3. Click **OK**.

You can customize your workbook and change the layout of data by deleting cells. Deleting cells not only deletes the information and formatting in the cell, but it also shifts the layout of the workbook. By deleting an empty cell, you shift all the surrounding cells as well.

To delete a cell:

1. Select **Delete …** from the Edit menu.

2. Click the **Shift cells left** or **Shift cells up** radio button (see Figure T2.7).

3. Click **OK**.

Pressing the *Delete* key on the keyboard will delete the contents of the cell but not the cell itself.

FIGURE T2.7

Deleting a Cell

MERGING AND SPLITTING CELLS

Merging and splitting cells is one way to control the appearance of your worksheet. Titles of worksheets are typically centered across the top of the columns of information. Excel allows you to merge and center cells to create a title that appears centered in one cell across the top of your workbook. Excel also allows you to reverse this action by splitting the cell. Splitting a cell converts a merged cell back to several cells, with the information displayed in

the uppermost left cell.

FIGURE T2.8

Merging Cells

To center and merge cells:

1. Select the **cells** you want to merge, making sure the text you want centered is in the uppermost left cell.

2. Click the **Merge and Center** button on the Formatting toolbar.

To split merged cells:

1. Select the **merged cell** you want to split into several cells.

2. Click the **Merge and Center** button on the Formatting toolbar (see Figure T2.8).

When you select cells to be merged, Excel will center only the data in the uppermost left cell. All other data will be lost.

CUTTING, COPYING, AND PASTING CELLS

The Cut, Copy, and Paste commands are used to move data and other items within a workbook and between applications. Data that is cut is removed from the document and placed on the Clipboard for later use. The Copy command places a duplicate of the selected data on the Clipboard without changing the workbook. The Paste command is used to insert items from the Clipboard into a workbook.

To cut or copy data within a workbook:

1. Select the **cell** or **cells** you want to cut or copy.

2. Click the appropriate toolbar button:

    a. Cut or

    b. Copy

    c. The cell appears with a flashing dotted line around it.

3. Place the cursor where you want to insert data from the Clipboard.

4. Click the **Paste** toolbar button (see Figure T2.9).

FIGURE T2.9

Copying and Pasting Cells

When you cut or copy items, they are placed on the Clipboard. The Clipboard can store up to 24 items for use in

the current document or any other application. You can view the contents of the Clipboard at any time by opening the **Edit** menu and selecting **Office Clipboard.…** The icons in the Clipboard identify the type of document from which each item originated (Word, Excel, Paint, etc.). A short description of an item will appear when you select it or move the cursor over its icon.

ENTERING TEXT IN CELLS

Without text headers, descriptions, and instructions, your workbook would consist of numbers and formulas without any structure. Adding text headers to your rows and columns creates the structure for you to enter data into your workbook.

To add text to your workbook:

1. Click in the **cell** in which you want to add text.

2. Type the **text**.

3. Click **outside** the cell to accept your entry.

APPLYING NUMBER FORMATS

Formatting your numbers changes the appearance of the data in your worksheet, but does not change its value. The formatted number is displayed in the cell, and the actual value is displayed in the formula bar. Excel provides several numeric formats for you to use in your workbook, including currency, percentage, date, time, and accounting.

To format numbers:

1. Select the **cells** you want to format.

2. Click **Cells …** on the Format menu, and click the **Number** tab.

3. In the **Category:** list, click the format you want to use (see Figure T2.10).

Under each number category, you can choose predefined formatting or create and edit formats of your own.

The Formatting toolbar allows you to add default number styles. Select the cell you want to format, and then do one of the following:

■ To add the default currency style, click the **Currency Style** button.

■ To add the default percent style, click the **Percent Style** button.

■ To add the default comma style, click the **Comma Style** button.

APPLYING STYLES

A style is the combination of effects that can be applied at one time. Styles can include formatting such as character effects, background color, typefaces, and number formatting. Excel comes with predefined styles including Currency, Comma, and Percent styles, but also gives you the ability to create your own styles in the Style dialog box.

To apply a basic style:

1. Select the **cells** you want to format.

2. Click **Style …** on the Format menu.

3. Click the **arrow** next to the Style name box and select the **style** you want (see Figure T2.11).

4. Review the **effects** included in the style (click the **Modify …** button to make any changes to the style).

5. Click **OK**.

FIGURE T2.10

Applying Number Formats

Printing Worksheets

SETTING UP THE PAGE FOR PRINTING

You may find that your worksheet is too wide to print on one sheet of paper, even with landscape orientation. Excel allows you to adjust how your worksheet will print. In the dialog box, you can adjust the scale of your worksheet, making it smaller and forcing it to fit on one page, or you can print your worksheet across multiple pages by changing the *Fit to:* options.

To set up a page to print:

1. Click **Page Setup …** on the File menu.

■ To print your information on one page, adjust the **Scaling** option.

■ To print your information across multiple pages, change the **Fit to:** options.

2. Click the **Print Preview** button to see what your printed worksheet will look like (see Figure T2.12).

FIGURE T2.11

Applying Styles

FIGURE T2.12

Page Setup

SETTING MARGINS FOR PRINTING

Margins are the blank spaces at the top, bottom, left, and right of a printed page. Excel's default margins are typically 1 inch for the top and bottom, and 0.75 inches for the left and right. Using the Page Setup dialog box, you can easily adjust these margins.

To adjust the margins for a document:

1. Click Page **Setup …** on the File menu.

2. Click the **Margins** tab.

3. Click the **arrows** to adjust the top, bottom, left, and right margins.

4. The **Preview** box shows you which part of the page you are changing (See Figure T2.13).

FIGURE T2.13

Setting Up Margins for Printing

The Margins tab also allows you to adjust the placement of the header and footer. Further, you can choose to horizontally and/or vertically center the information on the printed page.

PREVIEWING A PRINT AREA

The *Print Preview* window shows you a reduced version of your worksheet as it will appear when printed. Save time and printing by always checking your layout in Print Preview before you print. Use this view to see how your information fits on each page and to verify such things as placement of page numbers, headers, and column and row labels.

To preview your worksheet before printing it:

1. Click the **Print Preview** button on the standard toolbar.

2. When the Print Preview window opens, scroll the window to view the pages.

3. Notice that the mouse pointer has changed to a magnifying glass. Click on a portion of the document to see it full-size (see Figure T2.14).

4. Click again to reverse the magnification.

5. Click the **Next** and **Previous** buttons to view the pages of your workbook.

6. To return to Normal view, click **Close** on the Print Preview toolbar.

FIGURE T2.14

Previewing a Print Area

You can adjust page breaks, page setup, margins, headers and footers, and other page options from the Print Preview window. You can also print the worksheet from the Print Preview window by clicking the Print button to bring up the Print dialog box.

PRINTING SELECTIONS, WORKSHEETS, AND WORKBOOKS

Printing a print area and printing your worksheet or workbook operate the same way as other Microsoft Office applications. Use the *Print dialog box* to check your print settings before printing. Be sure your printer's name is displayed in the section, and select the number of pages you want to print in the Print range section. Remember, if you have set a Print Area, then only that part of your worksheet will print.

To check your print settings and print:

1. Click **Print …** on the File menu.

2. Verify that the correct printer name is displayed in the Printer section.

3. Verify that **All** is selected in the Page range section (see Figure T2.15).

4. Click **OK**.

In the Print dialog box, you can also specify to print the selection, the entire workbook, or just the active worksheet.

FIGURE T2.15

Preparing to Print

Formatting Worksheets

INSERTING ROWS AND COLUMNS

You may need to add rows or columns of new information into the middle of your workbook.

To insert a row:

1. Place your cursor in a cell in the **row below** where you want the new row.

2. Click **Rows** on the Insert menu.

To insert a column:

1. Place your cursor in a cell in the **column to the right** of where you want the new column.

2. Click **Columns** on the Insert menu (see Figure T2.16).

When you insert a row or column, a smart tag will appear. Click the smart tag to choose formatting options—**Same as left**, **Same as right**, or **Clear Formatting**.

DELETING ROWS AND COLUMNS

When you delete a row or column, you are removing all of those cells from your workbook. Once you have deleted the row or column, it disappears and the rest of the columns and rows move to replace it.

To delete a row or column:

1. Select the **row** or **column** you want to delete.

2. Click **Delete** on the Edit menu (sees Figure T2.17).

Be careful. If you delete a row or column containing data, that data will be lost.

MODIFYING ROW HEIGHTS

When you first enter data in your workbook, Excel automatically sets the rows of your worksheet according to preferences. You may want to make rows a different height from this default setting.

FIGURE T2.16

Inserting a Row or Column

FIGURE T2.17

Delete a Row or Column

To modify row heights:

1. Select the **row** or **rows** you want to change.

2. Drag the **boundary** until the row is the height you want (see Figure T2.18).

If you want to change all the rows in your worksheet to the same height, click the *Select All* button (the gray box above Row 1 and to the left of Column A) and then drag the *boundary* line (this is the physical line that separates each column and row). Double-click the boundary (or select from Row on the Format menu) to make the row automatically fit the contents.

FIGURE T2.18

Modifying Row Heights

MODIFYING COLUMN WIDTHS

When you first enter data in your workbook, Excel automatically sets the widths of the columns. As you type data into multiple columns, you may find that Excel does not display all the text in a cell. You can change the widths of columns in your workbook so that all your information is displayed.

FIGURE T2.19

Modifying Column Widths

To modify column widths:

1. Select the **column** or **columns** you want to change.

2. Drag the **boundary** until the column is the width you want (see Figure T2.19).

To change all the columns in your worksheet to the same width, point to Column on the Format menu, then click **Standard Width …** or click the **Select All** button (the gray box above Row 1 and to the left of Column A) and then drag the boundary. To make the column automatically fit the contents of the selected cell, double-click the **boundary** to the right of the column (or select **AutoFit Selection** from Column on the Format menu).

Formulas

ENTERING FORMULAS

A formula is an equation that performs calculations between cells in a worksheet or table. A formula always begins with an equal sign. A simple formula may contain cell references and operators.

To enter a formula:

1. Click the **cell** in which you want to enter the formula.

2. Type = (an equal sign).

3. Type the **formula**.

4. Click **outside** the cell or press **Enter** (see Figure T2.20).

If a formula has more than one operator, Excel will perform mathematical operations in this order:

■ Exponentiation

■ Multiplication and division

■ Addition and subtraction

Adding parentheses around an operation will override this order, forcing Excel to perform calculations within the

parentheses first.

USING THE FORMULA BAR

To enter a formula in the formula bar:

1. Select the **cell** in which you want to add the formula.

2. In the formula bar, type an **equal sign** (=).

FIGURE T2.20

Entering a Formula

3. Enter the formula (including any functions, operators, references, and/or constants).

4. Click the **Enter Formula** button (see Figure T2.21).

Formulas can be complex equations. Often when you first enter a formula, you will not get the result you intended. This may be because a cell reference has changed, or because the operations are being performed in an undesired order. Use the Formula Bar when you need to edit a formula.

To edit a formula using the Formula Bar:

1. Select the **cell** containing the formula you want to change.

2. Click inside the **Formula Bar**.

3. Click and drag to highlight the **part of the formula** you want to change.

4. Make the changes to the **formula**.

5. Click the **Enter Formula** button.

FIGURE T2.21

Using The Formula Bar

USING ABSOLUTE AND RELATIVE REFERENCES

Cell references can be relative, absolute, or mixed. A *relative reference* is a reference that adjusts to the new location in the worksheet when the formula is copied. An *absolute reference* is a reference whose location remains constant when the formula is copied. A *mixed reference* is a reference that contains both a relative and an absolute reference. Figure T2.22 displays an example of each.

To enter an absolute or relative reference:

1. Type the **name of the cell**.

2. To enter an absolute reference, type a **$, the column name**, **another $**, and **the row name** (e.g., $A$1).

3. To enter a mixed reference, type a **relative reference** and an **absolute reference** in the cell reference.

By default, formulas use relative references. If you want your formula to have an absolute reference, you must change the reference to absolute.

USING THE SUM FUNCTION

The SUM mathematical function is used to add several cells together. Instead of writing a formula with several references separated by a plus sign, you can sum a range of cells. A SUM function looks like this: **=SUM(A3:A6).**

FIGURE T2.22

Using Absolute and Relative References

To use the SUM Function:

1. Select the **cell** in which you want to enter the function.

2. Click the **Insert Function** button (refer back to Figure T2.20).

3. Click **SUM** from the list of **Most Recently Used** or **Math & Trig** functions and click **OK**.

4. Enter the **range of cells** that you want to add.

5. Click **OK** (see Figure T2.23).

FIGURE T2.23

Using the SUM Function

When you click an *argument* box, a description of the argument appears below the description of the function. An *argument* is a name for a value, expression, or cell reference that is passed to the function for its use in calculating an answer. In addition, as you enter arguments, the dialog box will display the results of your formula.

If the SUM function is not in your list of most recently used functions, click the **arrow** next to the **Or select a category:** box, click **Math & Trig**, and select **SUM** from that list of functions.

USING THE MIN AND MAX FUNCTIONS

The *MIN (minimum) statistical function* will give you the smallest value in a range of values. The *MAX (maximum) statistical function* will give you the largest value in a range of values. These functions look like this:

MIN function: =MIN(A3:A6)

MAX function: =MAX(A3:A6)

To use the MIN and MAX functions:

1. Select the **cell** in which you want to enter the function.

2. Click the **Insert Function** button.

3. Click **MIN** or **MAX** from the list of **Most Recently Used** or **Statistical** functions and click **OK**.

4. If necessary, enter the **range of cells**.

5. Click **OK** (see Figure T2.24).

If the MIN or MAX functions are not in your list of most recently used functions, click the **arrow** next to the **Or select a category:** box, click **Statistical**, and select **MIN** or **MAX** from that list of functions.

FIGURE T2.24

Using the MIN and MAX Function

When you click an argument box, a description of the argument appears below the description of the function.

Also, as you enter arguments, the dialog box will display the results of your formula. By default, Excel will enter a range of contiguous cells for you.

USING THE DATE OR NOW FUNCTION

Use the Date & Time function or the NOW function to insert the date and time into your workbook. The date and time will be displayed at all times, but will only be updated when the worksheet is calculated. The NOW function looks like this:

=NOW()

To use the NOW function:

1. Select the **cell** in which you want to enter the function.

2. Click the **Insert Function** button.

3. Click **NOW** from the list of **Most Recently Used** or **Date & Time** functions and click **OK**.

4. The NOW function takes no arguments.

5. Click **OK** (see Figure T2.25).

FIGURE T2.25

Using the NOW() Function

The NOW function uses the computer's system clock to determine the date and time.

Working with Charts and Graphics

CREATING A CHART USING THE CHART WIZARD

A *chart* is a visual representation of data from your workbook. Charts add a visual element to your workbook and help convey the information in a simple, easy to understand manner (see Figure T2.26). The *Chart Wizard* in Excel walks you through the steps of converting the data in your workbook into a chart.

FIGURE T2.26

An Excel Chart

To use the Chart Wizard:

1. Select the **data** you want to display in your chart.

2. Click the **Chart Wizard** button on the Standard toolbar.

3. Select the **chart type** and click **Next**.

4. Select the **data range** for your chart and click **Next**.

5. Add or modify the chart options and click **Next**.

6. Place the **chart**, either in a new worksheet or in an existing worksheet.

7. Click the **Back** button to go back to earlier screens in the wizard and make any adjustments you want.

8. When you are satisfied with your chart, click **Finish**.

The wizard allows you to add titles, legends, labels, and other information to your chart. You can create a chart on its own or as part of a worksheet. To place a chart in its own worksheet, click the **As new sheet in:** option in the Chart Wizard.

MODIFYING CHARTS

When you modify a chart, you can change any of the options that belong to that chart type. Modifying a chart allows you to change the text of the chart and how it appears on the chart. This includes titles, legends, axes, data labels, and data tables (refer to Figure T2.27).

To change chart elements:

1. Select the **chart** you want to modify and select **Chart Options ...** from the Chart menu.

■ Select the **Titles** tab to add or change the title of the chart and the titles for the axes.

■ Select the **Axes** tab to change the display of the axes for the chart.

- Select the **Gridlines** tab to change the display of the gridlines in the chart.

- Select the **Legend** tab to change the position of the legend for the chart.

- Select the **Data** Labels tab to add or remove labels from the chart.

- Select the **Data Table** tab to show the numeric data in the chart.

FIGURE T2.27

Modifying Charts

2. The **Preview** box shows how your chart will look. When you are satisfied with the look of your chart, click **OK**.

Excel offers many different types of charts to display your data and makes it easy to change from one chart type to another.

To change the chart type:

1. Select the **chart** you want to change.

2. Select **Chart Type …** from the Chart menu.

3. Click a **chart type** to see the different chart subtypes.

4. Click a **chart subtype** to select it.

5. Click the **Press and Hold to View Sample** button to see how your data will appear in the chart.

6. Click **OK** to change your chart.

To delete a chart, select the chart and press the **Delete** key or point to **Clear** on the Edit menu and select **All**.

MOVING A CHART

When you create a chart, Excel places the chart in the middle of the worksheet. However, the chart may be covering data that you want to view. You can move a chart by selecting it and then dragging it anywhere on the worksheet.

To move a chart by dragging:

1. Select the **chart** you want to move.

2. Click in the **chart area**.

3. With your left mouse depressed, drag the **chart** to the new location on the worksheet.

4. Release the **mouse button**.

ADDING GRAPHICS

A graphic is a drawing or illustration that can be added to your workbooks. You can add drawing objects such as

AutoShapes from the Drawing toolbar. You can also insert clip art and other graphic files into your workbook. These images are embedded objects, meaning they become part of the new document.

To add a graphic to a workbook:

1. Place your **cursor** where you want the graphic to appear.

2. On the Insert menu, point to **Picture** and select an **option** (refer to Figure T2.28):

    a. Clip Art … opens the Clip Art task pane, allowing you to search hundreds of clips to use in your workbook.

    b. From File … allows you to insert a picture created in another program.

    c. From Scanner or Camera … allows you to insert a picture directly from a scanner or digital camera.

    d. AutoShapes inserts predefined banners, arrows, and callouts as drawing objects.

    e. WordArt … inserts text effects as drawing objects.

    f. Organization Chart inserts a flowchart that you can add text to and modify.

FIGURE T2.28

Adding Graphics

The Clip Art task pane allows you to search for different kinds of clips from many different sources. There are several ways to narrow your search:

■ Click the **Search in:** arrow to limit the search to your files, office files, or Web files.

■ Click the **Results should be:** arrow to specify the exact type of media clip to search for.

■ Click the **Organize clips …** link at the bottom of the task pane to browse through specific collections and organize the clips you use most frequently.

PLUG-IN SUMMARY

Microsoft Excel is a general-purpose electronic spreadsheet used to organize, calculate, and analyze data. The tasks you can perform with Excel range from preparing a simple invoice to managing an accounting ledger for a business.

Six areas in Excel were covered in this plug-in:

1. Workbooks and worksheets.

2. Working with cells and cell data.

3. Printing worksheets.

4. Formatting worksheets.

5. Formulas.

6. Working with charts and graphics.

MAKING BUSINESS DECISIONS

1. Stock Watcher

Mark Martin has created a basic stock watcher worksheet that he uses to report on gains or losses from when he purchased the stock and the last recorded date and price. Mark has given you a snapshot of his spreadsheet (see Figure T2.29) that you can use to recreate this spreadsheet for yourself. Here are some basic steps to follow:

1. Create a new workbook.

2. Enter all the information provided in Figure T2.29.

3. Apply the currency format to the respective columns.

4. The date should be entered as a function. **Hint:** Use the NOW() function.

5. Enter a formula for Gain/Loss (%) column. **Hint:** You should subtract the **Last** column from the **Purchase** column, and then divide by the Purchase column.

6. Format for percent in the Gain/Loss (%) column.

FIGURE T2.29

Stock Watcher Data

FIGURE T2.30

Total Mischief Spreadsheet

2. Total Mischief

Mischief, Inc., is a regional pet toy supplier that tracks its business sales in a spreadsheet. The owner, Lisa Derrick, has provided you with a skeleton worksheet,T2_TotalMischief_Data.xls, with the totals for each quarter by sales region. Lisa needs you to total each column and row, and then provide her with a clustered column chart of each region by quarter. See Figure T2.30 for a sample of what Lisa would like you to do.

3. Recycling Can

For the past 10 years, five Colorado cities have held a recycling contest to see which city does the best job of recycling plastic, glass, and aluminum. Those participating in this year's contest are Arvada, Centennial, Lakewood, Highlands Ranch, and Parker.

To make the contest fair for both large and small cities, the winning city will be the one that recycles the

largest number of cans per capita—the number of cans recycled divided by the number of city residents.

You have been asked to help the coordinator, Jill Slater, to compile the numbers in an Excel worksheet and create the formulas to compute the total recycling by city each month, total recycling for all cities each month, and the per capita recycling value that determines the contest winner. In addition, Jill wants to know a few statistics about the monthly recycling efforts, including the minimum, average, and maximum number of cans recycled. Jill has provided you with sample data, T2_RecyclingCans_Data.xls. Figure T2.31 shows a sample of what Jill would like to see as a completed worksheet.

4. **MusicPlayerz Sales Projections**

MusicPlayerz is a wholesale MP3 distributor headquartered in Morrison, Colorado. Corporate buyers for the retail stores contract with MusicPlayerz to supply and ship MP3s to warehouses scattered throughout the western United States. MusicPlayerz chief procurement officer, Julianne Beekman, oversees the purchase and distribution operations for all divisions from the Morrison office.

FIGURE T2.31

Recycling Can Contest Worksheet

MusicPlayerz also maintains a small Web site from which it sells to consumers. While the online store is not a large part of the revenue stream, it is an essential and growing part of MusicPlayerz's business. Julianne developed a sales report for the coming year, using the previous year's figures as the basis of the projection. Julianne wants to investigate sales predictions based on the assumption that next year's wholesale sales will increase by 10 percent for each product included in the projection.

Julianne has asked you to complete the worksheet she has provided you, T2_MusicPlayerz_Data.xls, for her presentation at the annual board meeting next month. You will have to calculate the following:

■ Projected 2007 sales (this is 10 percent more than 2006 figures)

■ Gross sales (this is the projected 2007 sales times the price)

■ Profit

■ Percent of sales.

Figure T2.32a shows a sample of what Julianne would like to see as a completed worksheet.

FIGURE T2.32

MusicPlayerz Sales Projection Worksheet

Problem Solving Using Excel

LEARNING OUTCOMES

1. Describe how to create and sort a list using Excel.

2. Explain why you would use conditional formatting using Excel.

3. Describe the use of AutoFilter using Excel.

4. Explain how to use the Subtotal command using Excel.

5. Describe the use of a PivotTable using Excel.

Introduction

If you routinely track large amounts of information, such as customer mailing lists, phone lists, product inventories, sales transactions, and so on, you can use the extensive list-management capabilities of Excel to make your job easier.

In this plug-in you will learn how to create a list in a workbook, sort the list based on one or more fields, locate important records by using filters, organize and analyze entries by using subtotals, and create summary information by using pivot tables and pivot charts. The lists that you create will be compatible with Access, and, if you are not already familiar with Access, the techniques that you learn here will give you a head start on learning several database commands and terms. Plug-In T6, "Basic Skills and Tools Using Access," will provide detail on many of the Access database commands and terms.

There are five areas in this plug-in:

1. Lists

2. Conditional Formatting

3. AutoFilter

4. Subtotals

5. PivotTables

Lists

A *list* is a collection of rows and columns of consistently formatted data adhering to somewhat stricter rules than an ordinary worksheet. To build a list that works with all of Excel's list-management commands, you need to follow a few guidelines.

When you create a list, keep the following in mind:

■ Maintain a fixed number of columns (or categories) of information; you can alter the number of rows as you add, delete, or rearrange records to keep your list up to date.

■ Use each column to hold the same type of information.

■ Don't leave blank rows or columns in the list area; you can leave blank cells, if necessary.

■ Make your list the only information in the worksheet so that Excel can more easily recognize the data as a list.

■ Maintain your data's integrity by entering identical information consistently. For example, don't enter an expense category as *Ad* in one row, *Adv* in another, and *Advertising* in a third if all belong to the same classification.

To create a list in Excel, you would follow these steps:

1. Open a new workbook or a new sheet in an existing workbook.

2. Create a column heading for each field in the list, format the headings in bold type, and adjust their alignment.

3. Format the cells below the column headings for the data that you plan to use. This can include number formats (such as currency or date), alignment, or any other formats.

4. Add new records (your data) below the column headings, taking care to be consistent in your use of words and titles so that you can organize related records into groups later. Enter as many rows as you need, making sure that there are no empty rows in your list, not even between the column headings and the first record. See Figure T3.1 for a sample list.

FIGURE T3.1

An Excel List

SORTING ROWS AND COLUMNS

Once your records are organized into a list, you can use several commands on the Data menu to rearrange and analyze the data. The Sort command allows you to arrange the records in a different order based on the values in

one or more columns. You can sort records in ascending or descending order or in a custom order, such as by days of the week, months of the year, or job title.

FIGURE T3.2

Sort Dialog Box

To sort a list based on one column, follow these steps:

1. Select the **SortData** worksheet from the **T3_ProblemSolving_Data.xls** workbook that accompanies this textbook.

2. Click any **cell** in the **Sales Rep** column; you want to use this column as the basis for sorting the list.

3. Click the **Data** button on the standard toolbar, and then select **Sort**. Excel selects all the records in the list and displays a dialog box such as the one in Figure T3.2.

4. The Sort By drop-down list contains the heading for the column you selected.

5. Click the **Ascending** radio button to specify the order to sort by (A to Z, lowest to highest, earliest date to latest).

6. Click **OK** to run the sort. Your screen will look similar to Figure T3.3.

FIGURE T3.3

A Sorted List

SORTING MORE THAN ONE COLUMN

If you have records in your list that have identical entries in the column you are sorting with, you can specify additional sorting criteria to further organize your list.

To sort a list based on two or three columns follow these steps:

1. Click any **cell** in the **Sales Rep** column.

2. Click the **Data** button on the standard toolbar, and then select **Sort**. Excel selects the records in your list and displays the Sort dialog box.

3. Select the **Sales Rep** as the primary field for the sort in the **Sort By** drop-down list. Specify **ascending** order for that column.

4. Click the first **Then By** drop-down list and pick **Magazine** for the sort to further sort any records that have identical entries in the primary field. Specify **ascending** order for the second sort as well.

5. Click the next **Then By** drop-down list and pick **Sale** for the sort. Specify **ascending** order for the third sort as

well. The Sort dialog box should look like Figure T3.4 when you are done.

6. Click **OK** to run the sort.

Figure T3.5 shows how the sort looks based on the options you selected above.

CREATING YOUR OWN CUSTOM SORT ORDER

Excel allows you to create custom sort orders so that you can rearrange lists that do not follow predictable alphanumeric or chronologic patterns. For example, you can create a custom sort order for the regions of the country (West, North, East, South). When you define a custom sort order, it appears in the Options dialog box and is available to all the workbooks on your computer.

FIGURE T3.4

Sort Dialog Box with Multiple Records

FIGURE T3.5

Data Sort Using More Than One Column

To create a custom sort order, follow these steps:

1. Choose **Tools**, **Options**, and then click the **Custom Lists** tab.

2. Click the line **NEW LIST** under **Custom Lists** section and the text pointer appears in the List Entries list box. This is where you will type the items in your custom list.

3. Type **West, North, South, East**, and then click **Add**. You can either separate each value with a comma or type each one on a separate line. The new custom order appears in the Custom Lists list box, as shown in Figure T3.6.

4. Click **OK** to close the Options dialog box.

FIGURE T3.6

Creating a Custom Sort Order

To use a custom sort order, follow these steps:

1. Click any cell in your list.

2. Choose **Data**, **Sort**. Excel selects the records in your list and displays the Sort dialog box.

3. Select the **Region** field, and click on **Ascending** order. You may have to remove any secondary and ternary sort criteria under the Then By sections.

4. Click **Options** to display the Sort Options dialog box, as shown in Figure T3.7.

5. Click the **First Key Sort Order** drop-down list, and click the custom order you created in the step above.

6. Click **OK** to run the sort. Your list appears sorted with the custom criteria you specified.

Creating Conditional Formatting

Excel gives you the ability to add *conditional formatting—*formatting that automatically adjusts depending on the contents of cells—to your worksheet. This means you can highlight important trends in your data, such as the rise in a stock price, a missed milestone, or a sudden spurt in your college expenses, based on conditions you set in advance using the Conditional Formatting dialog box. With this feature, an out-of-the-ordinary number jumps out at anyone who routinely uses the worksheet.

FIGURE T3.7

Sort Options Dialog Box

For example, if a stock in a Gain/Loss column rises by more than 20 percent, you want to display numbers in bold type on a light blue background. In addition, if a stock in the Gain/Loss column falls by more than 20 percent, the number will be displayed in bold type on a solid red background. This is where you want to use conditional formatting.

To create such a conditional format, complete the following steps:

1. If the workbook **T3_ProblemSolving_Data.xls** is closed, open it.

2. Select the worksheet **ConditionalFormatting**.

3. Select the column **Sale**. (Note that each cell can maintain its own, unique conditional formatting, so that you can set up several different conditions.)

4. Choose **Format**, **Conditional Formatting**. The Conditional Formatting dialog box appears, containing several drop-down list boxes.

5. In the first list box, select **Cell Value Is**.

FIGURE T3.8

Conditional Formatting Dialog Box

6. In the second list box, select **Between**.

7. In the first text box, type the number **1000**.

8. In the second text box, type the number **1200**.

9. Click the **Format** button and selected **Bold** style on the Fonts tab and **Light Blue** on the Patterns tab and then click **OK**. The formatting will be used for the cells if the conditional statement you specified in steps 5 through 8 becomes true.

10. Click the **Add** button in the Conditional Formatting dialog box to add another condition to the scenario. The dialog box expands to accept an additional condition. The **Add** button lets you add up to three conditions. The **Delete** button removes conditions you no longer want.

FIGURE T3.9

Conditional Formatting

11. Specify **Greater Than** as the operator you want to use in the second drop-down list box, and then type **1250** in the third list box.

12. Click the **Format** button for Condition 2 and select **Bold** for the font style on the Font tab, and then, using the Patterns tab, select **red** shading. Click **OK**. Figure T3.8 displays the settings for this example.

13. Click **OK** to close the dialog box, and the conditional formatting will be applied to the selected text. If any numbers fall into the ranges you specified, the formatting you specified will be applied. Figure T3.9 shows the conditional formatting you entered for this example.

Using AutoFilter to Find Records

When you want to hide all the records (rows) in your list except those that meet certain criteria, you can use the AutoFilter command on the Filter submenu of the Data menu. The *AutoFilter* command places a drop-down list at the top of each column in your list (in the heading row). To display a particular group of records, select the criteria that you want in one or more of the drop-down lists. For example, to display the sales history for all employees that had $1,000 orders in January, you could select January in the Month column drop-down list and $1,000 in the Sale drop-down list.

To use the AutoFilter command to find records, follow these steps:

1. If the workbook **T3_ProblemSolving_Data.xls** is closed, open it.

2. Select the worksheet **AutoFilter**.

3. Click any cell in the list.

4. Choose **Data**, **Filter**, and then choose **AutoFilter** from the submenu. Each column head now displays a down

arrow.

5. Click the **down arrow** next to the **Region** heading. A list box that contains filter options appears, as shown in Figure T3.10.

If a column in your list contains one or more blank cells, you will also see *(*Blanks*)* and (NonBlanks) options at the bottom of the list. The *(Blanks)* option displays only the records containing an empty cell (blank field) in the filter column, so that you can locate any missing items quickly. The *(NonBlanks)* option displays the opposite—all records that have an entry in the filter column.

6. Click **East** to use for this filter. Excel hides the entries that don't match the criterion you specified and highlights the active filter arrow. Figure T3.11 shows the results of using East as the criterion in the Region column.

You can use more than one filter arrow to further narrow your list, which is useful if your list is many records long. To continue working with AutoFilter but to also redisplay all your records, choose **Data**, **Filter**, **Show All**. Excel displays all your records again. To remove the AutoFilter drop-down lists, unselect the AutoFilter command on the Filter submenu.

FIGURE T3.10

AutoFilter Options

FIGURE T3.11

AutoFilter Output

CREATING A CUSTOM AUTOFILTER

When you want to display a numeric range of data or customize a column filter in other ways, choose Custom from the AutoFilter drop-down list to display the Custom AutoFilter dialog box. The dialog box contains two relational list boxes and two value list boxes that you can use to build a custom range for the filter. For example, you could display all sales greater than $1,000 or all sales between $500 and $800.

To create a custom AutoFilter, follow these steps:

1. Click any cell in the list.

2. If AutoFilter is not already enabled, choose **Data**, **Filter**, and then choose **AutoFilter** from the submenu.

3. Click the arrow next to the heading **Sale** and select **(Custom …)** from the list of choices. The Custom AutoFilter dialog box opens.

4. Click the first relational operator list box and select **is greater than or equal to** and then click the value list box and select **$500**.

5. Click the **And** radio button to indicate that the records must meet both criteria, then specify **is less than or equal to** in the second relational operator list box and select **$800** in the second value list box. Figure T3.12 shows the Custom AutoFilter dialog box with two range criteria specified.

6. Click **OK** to apply the custom AutoFilter. The records selected by the filter are displayed in your worksheet.

Analyzing a List with the Subtotals Command

The *Subtotals* command on the Data menu helps you organize and analyze a list by displaying records in groups and inserting summary information, such as subtotals, averages, maximum values, or minimum values. The Subtotals command can also display a grand total at the top or bottom of your list, letting you quickly add up columns of numbers. As a bonus, Subtotals displays your list in *Outline view* so that you can expand or shrink each section in the list simply by clicking.

FIGURE T3.13

Subtotal Settings

To add subtotals to a list, follow these steps:

1. If the workbook **T3_ProblemSolving_Data.xls** is closed, open it.

2. Select the worksheet **Subtotals**.

3. Arrange the list so that the records for each group are located together. To do this, sort the list by **Region**.

4. Choose **Data**, then select **Subtotals**. Excel opens the Subtotal dialog box and selects the list.

5. In the **At Each Change In** list box, choose **Sales Rep**. Each time this value changes, Excel inserts a row and computes a subtotal for the numeric fields in this group of records.

6. In the **Use Function** list box, choose **SUM**.

7. In the **Add Subtotal To** list box, choose **Sale,** which is the column to use in the subtotal calculation. Figure T3.13 shows the settings for this example.

8. Click **OK** to add the subtotals to the list. You will see a screen similar to the one in Figure T3.14, complete with

subtotals, outlining, and a grand total.

When you use the Subtotals command in Excel to create outlines, you can examine different parts of a list by clicking buttons in the left margin. Click the numbers at the top of the left margin to choose how many levels of data you want to see. Click the plus or minus button to expand or collapse specific subgroups of data.

FIGURE T3.14

Subtotals, Outline, and Grand Total

You can choose the Subtotals command as often as necessary to modify your groupings or calculations. When you are finished using the Subtotals command, click **Remove All** in the Subtotal dialog box.

PivotTables

A powerful built-in data-analysis feature in Excel is the PivotTable. A *PivotTable* analyzes, summarizes, and manipulates data in large lists, databases, worksheets, or other collections. It is called a PivotTable because fields can be moved within the table to create different types of summary lists, providing a "pivot." PivotTables offer flexible and intuitive analysis of data.

Although the data that appear in PivotTables look like any other worksheet data, the data in the data area of the PivotTable cannot be directly entered or changed. The PivotTable is linked to the source data; the output in the cells of the table are read-only data. The formatting (number, alignment, font, etc.) can be changed as well as a variety of computational options such as SUM, AVERAGE, MIN, and MAX.

PIVOTTABLE TERMINOLOGY

Some notable PivotTable terms are:

- **Row field**—Row fields have a row orientation in a PivotTable report and are displayed as row labels. These appear in the ROW area of a PivotTable report layout.
- **Column field**—Column fields have a column orientation in a PivotTable report and are displayed as column labels. These appear in the COLUMN area of a PivotTable report layout.
- **Data field**—Data fields from a list or table contain summary data in a PivotTable, such as numeric data (e.g., statistics, sales amounts). These are summarized in the DATA area of a PivotTable report layout.
- **Page field**—Page fields filter out the data for other items and display one page at a time in a PivotTable report.

BUILDING A PIVOTTABLE

The PivotTable wizard steps through the process of creating a PivotTable, allowing a visual breakdown of the data in the Excel list or database. When the wizard steps are complete, a diagram, such as Figure T3.15, with the labels PAGE, COLUMN, ROW, and DATA appears. The next step is to drag the field buttons onto the PivotTable grid. This step tells Excel about the data needed to be analyzed with a PivotTable.

FIGURE T3.15

The PivotTable, PivotTable Toolbar, and PivotTable Field List

FIGURE T3.16

The PivotTable and PivotChart Wizard—Step 1 of 3 Dialog Box

Using the PivotTable Feature

1. If the workbook **T3_ProblemSolving_Data.xls** is closed, open it.

2. Select the worksheet **PivotTableData**. Click any cell in the list. Now the active cell is within the list, and Excel knows to use the data in the Excel list to create a PivotTable.

3. Select **Data** on the menu bar, then choose **PivotTable and PivotChart Report**. The PivotTable and Pivot Chart Wizard—Step 1 of 3 dialog box opens, as shown in Figure T3.16.

4. In the **Where is the data that you want to analyze?** area, choose **Microsoft Excel list** or **database** if it is not already selected.

5. In the **What kind of report do you want to create?** area, choose **PivotTable**.

6. Click the **Next** button. The PivotTable and PivotChart Wizard—Step 2 of 3 dialog box opens. In the Range box, the range should be **$A$1:$E$97**, which defines the data range to use for the PivotTable. The range must include the column headings in row 1, which will be the names of the fields to drag into the PivotTable.

7. Click the **Next** button. The PivotTable and PivotChart Wizard—Step 3 of 3 dialog box opens. This dialog box is used to tell Excel whether to place the PivotTable on an existing or new worksheet. Select **New Worksheet**.

8. The next step is to design the layout of the PivotTable. Click the **Layout** button. Excel opens the PivotTable and PivotChart Wizard–Layout dialog box, as shown in Figure T3.17.

9. The fields appear on buttons to the right in the dialog box. These currently are the column fields. The four areas you can define to create your PivotTable are ROW, COLUMN, DATA, and PAGE.

10. In the next step, you will drag the field buttons to the areas to define the layout of the PivotTable. For example,

to summarize the values in a field in the body of the table, place the field button in the DATA area. To arrange items in a field in columns with the labels across the top, place the field button in the COLUMN area. To arrange items in a field of rows with labels along the side, place the field button in the ROW area. To show data for one item at a time, one item per page, place the field button in the PAGE area.

FIGURE T3.17

The PivotTable and PivotChart Wizard—Layout Dialog Box

FIGURE T3.18

The PivotTable with Data, PivotTable Toolbar, and PivotTable Field List

11. Drag the **Month** button to the **PAGE** area. The page field operates like the row and column fields but provides a third dimension to the data. It allows another variable to be added to the Pivot Table without necessarily viewing all its values at the same time.

12. Drag the **Sale** button to the **DATA** area. The data field is the variable that the Pivot Table summarizes.

13. Drag the **Region** button to the **COLUMN** area. The column field is another variable used for comparison.

14. Drag the **Magazine** button to the **ROW** area. A row field in a PivotTable is a variable that takes on different values.

15. Click **OK** to return to the PivotTable and PivotChart Wizard—Step 3 of 3 dialog box.

16. Click the **Finish** button. The PivotTable Wizard places the table in the new worksheet called Sheet2, as illustrated in Figure T3.18. In addition, the PivotTable toolbar and the PivotTable Field List should appear.

MODIFYING A PIVOTTABLE VIEW

After a PivotTable is built, modifications can be done at any time. For example, examining the sales for a particular region would mean that the Region field would need to be changed. Use the drop-down list to the right of the field name. Select a region and click OK. Click on the red **!** button on the PivotTable toolbar to refresh the data with the new criteria. The grand total dollar amounts by region are at the bottom of each item, which have been recalculated according to the selected region (or regions).

This report can be used in various ways to analyze the data. For instance, click the PivotTable down arrow button on the PivotTable toolbar, choose PivotTable Wizard, and click the Layout button. Drag the buttons off the diagram and arrange the fields like this:

1. **Magazine** in the **PAGE** area.

2. Month in the **COLUMN** area.

3. Sale in the **DATA** area.

4. Sales Rep in the **ROW** area.

FIGURE T3.19

Rearranged Data in the PivotTable

The completed PivotTable dialog box should look like the one in Figure T3.19. The PivotTable now illustrates the sales by month for each salesperson, along with the total amount for the sales for each sales representative.

PIVOTTABLE TOOLS

There are a number of PivotTable tools that you should be aware of, such as:

- **PivotTable**—Contains commands for working with a PivotTable.

- **Format Report**—Enables the user to format the PivotTable report.

- **Chart Wizard**—Enables the user to create a chart using the data in the PivotTable.

- **Hide Detail**—Hides the detail information in a PivotTable and shows only the totals.

- **Show Detail**—Shows the detail information in a PivotTable.

- **Refresh External Data**—Allows the user to refresh the data in the PivotTable after changes to data are made in the data source.

- **Include Hidden Items in Totals**—Lets the user show the hidden items in the totals.

- **Always Display Items**—Always shows the field item buttons with drop-down arrows in the PivotTable.

- **Field Settings**—Displays the PivotTable Field dialog box so that the user can change computations and their number format.

- **Hide Field List**—Hides and shows the PivotTable Field List window.

BUILDING A PIVOTCHART

A PivotChart is a column chart (by default) that is based on the data in a PivotTable. The chart type can be changed if desired. To build a PivotChart:

1. Click the **Chart Wizard** (see Figure T3.20) on the PivotTable toolbar. Excel will automatically create a new worksheet, labeled Chart 1, and display the current PivotTable information in chart form like Figure T3.21.

FIGURE T3.20

PivotTable Toolbar

FIGURE T3.21

PivotChart

2. Modifications to the PivotChart can be done by selecting the drop-down lists to the right of the field names.

   Note: Whatever changes are selected on the PivotChart are also made to the PivotTable, as the two features are linked dynamically.

PLUG-IN SUMMARY

If you routinely track large amounts of information, you can use several Excel tools for problem solving. A *list* is a table of data stored in a worksheet, organized into columns of fields and rows of records. Excel gives you the ability to add *conditional formatting—*formatting that automatically adjusts depending on the contents of cells—to your worksheet. The *AutoFilter* command places a drop-down list at the top of each column in your list (in the heading row). The *Subtotals* command on the Data menu helps you organize and analyze a list by displaying records in groups and inserting summary information, such as subtotals, averages, maximum values, or minimum values. A *PivotTable* analyzes, summarizes, and manipulates data in large lists, databases, worksheets, or other collections.

MAKING BUSINESS DECISIONS

1. Production Errors

   Established in 2002, t-shirts.com has rapidly become the place to find, order, and save on T-shirts. One huge selling factor is that the company manufactures its own T-shirts. However, the quality manager for the production plant, Kasey Harnish, has noticed an unacceptable number of defective T-shirts being produced. You have been hired to assist Kasey in understanding where the problems are concentrated. He suggests using a PivotTable to perform an analysis and has provided you with a data file, **T3_TshirtProduction_Data.xls**. The following is a brief definition of the information within the data file:

   A. Batch: A unique number that identifies each batch or group of products produced.

   B. Product: A unique number that identifies each product.

   C. Machine: A unique number that identifies each machine on which products are produced.

   D. Employee: A unique number that identifies each employee producing products.

   E. Batch Size: The number of products produced in a given batch.

   F. Num Defect: The number of defective products produced in a given batch.

2. **Coffee Trends**

College chums Hannah Baltzan and Tyler Phillips are working on opening a third espresso drive-through stand in Highlands Ranch, Colorado, called Brewed Awakening. Their original drive-through stand, Jitters, and their second espresso stand, Bean Scene, have done well in their current locations in Englewood, Colorado, five miles away. Since Hannah and Tyler want to start with low overhead, they need assistance analyzing the data from the past year on the different types of coffee and amounts that they sold from both stands. Hannah and Tyler would like a recommendation of the four top sellers to start offering when Brewed Awakening opens. They have provided you with the data file **T3_JittersCoffee_Data.xls** for you to perform the analysis that will support your recommendation.

3. **Filtering SecureIT Data**

SecureIT, Inc., is a small computer security contractor that provides computer security analysis, design, and software implementation for commercial clients. Almost all of SecureIT work requires access to classified material or company confidential documents. Consequently, all of the security personnel have clearances of either Secret or Top Secret. Some have even higher clearances for work that involves so-called black box security work.

While most of the personnel information for SecureIT resides in database systems, a basic employee worksheet is maintained for quick calculations and ad hoc report generation. Because SecureIT is a small company, it can take advantage of Excel's excellent list management facilities to satisfy many of its personnel information management needs. You have been provided with a sample worksheet, **T3_Employee_Data.xls**, to assist SecureIT with producing several worksheet summaries. Here is what is needed:

1. One worksheet that is sorted by last name and hire data.
2. One worksheet that uses a custom sort by department in this order: Marketing, Human Resources, Management, and Engineering.
3. One worksheet that uses a filter to display only those employees in the Engineering department with a clearance of Top Secret (TS).
4. One worksheet that uses a custom filter to display only those employees born between 1960 and 1969 (inclusive).
5. One worksheet that totals the salaries by department and the grand total of all department salaries. This

worksheet should be sorted by department name first.

4. **Filtering RedRocks Consulting Contributions**

RedRocks Consulting is a large computer consulting firm in Denver, Colorado. Don McCubbrey, the CEO and founder of the firm, is well-known for his philanthropic efforts. He believes that many of his employees also contribute to nonprofit organizations and wants to reward them for their efforts while encouraging others to contribute to charities. He started a program in which RedRocks Consulting matches 50 percent of each donation an employee makes to the charity of his or her choice. The only guidelines are that the charity must be a nonprofit organization and the firm's donation per employee may not exceed $500 a year.

Don has started an Excel file, **T3_RedRocks_Data.xls,** to record the firm's donations. Included in this file are the dates the request for a donation was submitted, the employee's name and ID number, the name of the charity, the dollar amount contributed by the firm, and the date the contribution was sent. Don wants you to help him create several worksheets with the following criteria:

1. One worksheet that sorts the list alphabetically by organization and then by employee's last name.

2. One worksheet that totals the contribution made per employee for the month of December.

3. One worksheet that sorts the list by donation value by lowest amount to highest amount.

Decision Making Using Excel

LEARNING OUTCOMES

1. Describe the use of the IF function.

2. Compare the functions of Goal Seek and Solver.

3. List the advantages of using the Scenario Manager.

Introduction

Most of the decision-analysis tools on the market focus on one specific analytical technique, like simulation or decision trees. They may be tailored to a specific industry need, such as insurance claims modeling. Furthermore, the cost of these tools can run into the tens of thousands, even millions, of dollars—such as SAS and Cognos. One integrated set of tools that combines the best analytical methods, can be applied to different problems, and is reasonably priced is Microsoft Excel.

The measure of any business intelligence solution is its ability to derive knowledge from data, as discussed in the core units of this book. This plug-in will examine a few of the advanced business analysis tools that have the capability to identify patterns, trends, and rules and create "what-if" analyses. There are four areas in this plug-in:

1. The IF function is used to conduct conditional tests on values and formulas.

2. The Goal Seek function is used to find an unknown value that produces a desired result.

3. The Solver function is used to calculate an optimum solution based on several variables and constraints.

4. The Scenario Manager function is used to create and evaluate a collection of "what-if" scenarios containing multiple input values.

Creating Formulas Using the IF Function

The IF logical function will return one value if a condition is TRUE and another value if the condition is FALSE. Use the IF function when you want to compare two items in your workbook. The IF function looks like this:

=IF(logical_test,value_if_true, value_if_false)

■ **Logical_test** is any value or expression that can be evaluated to TRUE or FALSE. For example, A10 = 100 is a logical expression; if the value in cell A10 is equal to 100, the expression evaluates to TRUE. Otherwise, the expression evaluates to FALSE. This argument can use any comparison calculation operator.

■ **Value_if_true** is the value that is returned if the logical_test is TRUE. For example, if this argument is the text string "Within budget" and the logical_test argument evaluates to TRUE, then the IF function displays the text "Within budget." **Note:** Value_if_true can be another formula.

■ **Value_if_false** is the value that is returned if the logical_test is FALSE. For example, if this argument is the text string "Over budget" and the logical_test argument evaluates to FALSE, then the IF function displays the text "Over budget." **Note:** Value_if_false can be another formula.

FIGURE T4.1

Logical Operators

Logical operators are used to compare numbers in two or more cells to a constant.	
=	Equal to
<	Less than
>	Greater than
≤	Less than or equal to
≥	Greater than or equal to
≠	Not equal to
NOT	Logical Not
AND	Logical And
OR	Logical Or

To use the IF function follow these steps:

1. Select the cell in which you want to enter the function.

2. Click the **Insert Function** button.

3. Click **IF** from the list of Logical functions and click **OK**.

4. Enter the Logical_test argument. This argument states the condition you want to test for. Use cell references

and/or values with logical operators. Figure T4.1 displays the list of logical operators.

5. Enter the **value_if_true** argument. This is the text string or value that will be displayed if the Logical_test argument is true.

6. Enter the **value_if_false** argument. This is the text string or value that will be displayed if the Logical_test argument is false.

7. Click **OK**.

For example, in a loan analysis worksheet, you want to write a conditional expression that examines the ratio of a loan amount to a purchase price. The logic for solving this is if the ratio is greater than 0.8, then the assessment is $300. Otherwise, the assessment is $0.

To create a conditional expression, complete the following steps:

1. Open the workbook **T4_LoanAnalysis_Data.xls** that accompanies this textbook.

2. Click cell **B14**, the cell that will display Assessment if the ratio of loan amount to purchase price is greater than 0.8—the same criteria for displaying (or not) an assessment fee of $300.

3. Type = **IF (B13 / B4 > 0.8, 300, 0)** and press **Enter**. The cell displays **300** because the loan-to-price ratio is 0.875. Otherwise, nothing is displayed.

When you are unsure of a function and want help writing it, you can use the Insert Function command. Executing the Insert Function command opens a dialog box that lists functions by categories and helps you build the function.

To write an IF function using the Insert Function complete the following steps:

1. Click cell **B16** to make it active.

2. Click **Insert** on the menu bar, and then click **Function** to open the Insert Function dialog box.

3. Click the **Or select a category** list box to display its list of function categories.

4. Click **Logical** in the list of function category choices, click **IF** in the Select a function list box, and then click **OK**. The Function Arguments dialog box opens (see Figure T4.2).

5. Click the **Logical_Test** text box and type **B13 / B4 > 0.8** (there are no spaces in this line). Notice that the moment you type 0.8, the label TRUE appears to the right of   the value. That indicates the current value of the expression based on the condition you just completed.

6. Click the **Value-if-true** text box and type **300**, which   is the value to return if the condition is true.

7. Click the **Value-if-false** text box and type **0**, which is   the value to return if the condition is false (see Figure T4.3).

8. Click **OK** to complete the function. Excel places the completed IF function into cell B16, calculates the value of the function, and displays 300.00 because the ratio of the down payment to the purchase price is greater than 0.8.

FIGURE T4.2

Function Arguments Dialog Box

Goal Seek

Goal Seek is an analytical function that allows a value in a formula to be adjusted to reach a desired result or answer. Goal Seek can eliminate unnecessary calculations that can be used to determine a single variable value in a formula. For example, a salesperson might participate in a bonus program that pays 3 percent of all sales dollars. The salesperson wants to receive a bonus of at least $2,500 and needs to know the target sales dollar amount needed.

Create a worksheet with the following information (see Figure T4.4 for a layout sample):

Label	Cell Address	Value
Sales Dollars	B1	(unknown—leave blank)
Bonus Percentage	B2	3%
Bonus Amount	B3	=B1*B2

When the Goal Seek command starts to run, it repeatedly tries new values in the variable cell to find a solution to the problem. This process is called *iteration,* and it continues until Excel has run the problem 100 times or has found an answer within .001 of the target value specified. The iteration settings can be adjusted by choosing Tools, Options, and adjusting the Iteration options in the Calculations tab. It calculates so fast, the Goal Seek command can save significant time and effort over the brute force method of trying one number after another in a formula.

FIGURE T4.3

Function Arguments Dialog Box

USING THE GOAL SEEK COMMAND

The Goal Seek feature is used to fill in the target value of the cell containing the *Sales Dollar* amount. The Goal

Seek values read "Set cell = B3, To value = 2500, By changing cell = $B$1."

To use the Goal Seek command:

1. Select **Tools** from the main menu, then select **Goal Seek**.

2. Specify the cell that contains the desired value in the **Set cell** text box. Type in or select **B3.**

3. Enter the desired value or answer in the **To value** text box. Type in **2500.**

4. Enter the cell whose value will be changed in the **By changing cell** text box. Type in or select **$B$1.**

5. The Goal Seek dialog box should look like Figure T4.5.

6. Choose **OK.**

a. If a solution is found, the Goal Seek Status dialog box appears.

b. The results are shown in Figure T4.6.

7. Select **OK.**

Goal Seek is used to adjust a single variable in a formula. Use the Solver feature to adjust multiple variables in a formula, as described in the next section.

FIGURE T4.4

Goal Seek Worksheet

Solver

Solver is part of a suite of functions sometimes called *what-if analysis tools* used for optimizing problems that contain more than one variable. The Solver add-in utility is needed to analyze the scenarios in decision-making situations that involve consideration of values and constraints for several variables simultaneously. This powerful function uses multiple changing variables and constraints to find the optimal solution to solve a problem.

For example, consider a coffee shop that currently sells three beverages: (1) regular fresh-brewed coffee, (2) premium caffe latte, and (3) premium caffe mocha. The current price for regular coffee is set at $1.25, caffe latte at $2.00, and caffe mocha at $2.25, but the revenue potential is uncertain. What special emphasis (or marketing) should be given to each of the beverages to maximize revenue? Although the premium coffees bring in more money, their ingredients are more expensive and they take more time to make than regular coffee. Making some basic calculations by hand is easy, but there needs to be some structure to the sales data in a worksheet so that periodic changes can be made and analyzed. To set up the Solver scenario, follow these steps:

INSTALLING SOLVER

Solver comes with the standard Excel package, but it has to be installed. To install Solver, do the following:

1. Select **Tools** from the main menu, then select **Add-Ins**.

2. After clicking **Add-Ins,** scroll down to **Solver Add-in** and click the box.

FIGURE T4.5

Goal Seek Function

SETTING UP THE PROBLEM

The first step in using the Solver command is to build a "Solver-friendly" worksheet. This involves creating a target cell to be the goal of your problem—for example, a formula that calculates total revenue—and assigning one or more variable cells that the Solver can change to reach the goal.

To use Solver, complete the following:

1. Set up a worksheet similar to Figure T4.7.

2. The three variable cells in the worksheet are cells **D5**, **D9**, and **D13**. These are the cells whose values the Solver needs to determine to maximize the weekly revenue.

3. In the bottom-right corner of the table is a list of constraints to use for forecasting.

4. The worksheet must contain cells (G6 through G8) that include the formulas used as constraints. The limiting values for the constraints are listed in cells G11 through G13.

   ■ No more than 500 total cups of coffee (both regular and premium).

   ■ No more than 350 cups of premium coffee (both caffe latte and caffe mocha).

   ■ No more than 125 caffe mochas.

FIGURE T4.6

Goal Seek Results

5. The subtotals for cells **D6**, **D10**, **D14** need to be calculated, as well as the **Total Revenue** (sum of D6, D10, and D14) in **G4**.

6. The value for cell **G6** should equal the value that will be calculated for **D5** and the value for cell **G7** will be the sum of the values from D9 and D13. The calculation of **G8** = SUM of D5, D9, and D13.

7. Click the target cell **G4**—the one containing the formula that is based on the variable cells you want the Solver to

determine.

8. Select **Tools** from the main menu, then select **Solver**. The Solver Parameters dialog box opens, as shown in Figure T4.8. Select the **Set Target Cell** text box (unless it already contains the correct reference), and then click cell **G4** to insert $G$4 as the target cell. The Equal To option button (Max) is already selected. Do not change this since the problem requests the maximum value for the target cell.

9. Select the **By Changing Cells** text box. Click the button in the text box to collapse the dialog box. Select each of the variable cells by holding down the **Ctrl key** and clicking **D5, D9,** and **D13.** This places commas between the three cell entries in the text box: $D$5, $D$9, $D$13 (refer to Figure T4.9).

FIGURE T4.7

Coffee Sales Data Sheet for Solver

10. This problem has three constraints. Click **Add** to add the first constraint in the Add Constraint dialog box.

   a. The first constraint is Pony Espresso can sell only 500 cups of coffee in one week. To enter this constraint, click cell **G8,** click <= in the operator drop-down list, and with the insertion point in the Constraint text box, type or click cell **G11.**

   b. Click **Add** to enter the first constraint and begin the second constraint—Pony Espresso can sell only 350 premium coffees in one week. With the insertion point in the Cell Reference text box, click cell **G7,** click <= in the operator drop-down list, and in the Constraint text box, type or click cell **G12.**

   c. Click **Add** to enter the second constraint and begin the third—Pony Espresso can sell only 125 caffe mochas in one week. Click cell **D13,** click <= in the operator drop-down list, and in the Constraint text box, type, or click cell **G13.**

   d. Click **OK** to add all three constraints to the Solver Parameters dialog box as shown in Figure T4.10.

FIGURE T4.8

Solver Parameters Dialog Box

11. Click **Solve** to calculate the result.

12. Solver displays a dialog box describing the results of the analysis. If the Solver runs into a problem, an error message will be displayed. If the Solver finds a solution, a Solver Results dialog box like Figure T4.11 will appear.

13. To display the new solution in the worksheet, click the **Keep Solver Solution** option button, and then click **OK.** The Solver places an optimum value in the target cell and fills the variable cells with the solutions that satisfy the constraints specified and provide the optimal result, as shown in Figure T4.12.

EDITING A SOLVER FORECAST

The Solver tool is very useful in modifying the constraints to evaluate new goals and possibilities. For example, if Pony Espresso wants to earn exactly $800 per week from coffee drinks, use the Solver to "solve" for the optimum combination of drinks. Setting a target value in the Solver is a little like using the Goal Seek command to determine a value for an unknown variable, although Solver can use more than one variable. To edit the Solver forecast to find the variables to reach a specific goal, follow these steps:

1. Select **Tools** from the main menu, then select **Solver**. The Solver Parameters dialog box appears, still displaying the variables and constraints of the last Solver problem. These will be adjusted to compute a new forecasting goal.

FIGURE T4.9

Solver Parameters by Changing Cells Values

2. Click the **Value of** option button and type **800** in the text box to the right. The **Value of** option button sets the target cell to a particular goal to determine the variable mix needed to reach the milestone. The dialog box should look similar to Figure T4.13.

3. Click **Solve** to find a solution to the problem. When the Solver has finished, click **OK** to display the new solution.

4. Figure T4.14 shows the new solution that Solver generates.

Note: The results presented in Figure T4.14 is one possible solution that Solver may return.

Scenario Manager

A *scenario* is a set of input values and corresponding results from calculations that Excel can save and report as needed. A worksheet can be used to conduct a "what-if" analysis on a particular set of data. Several input values in a worksheet might change depending on different situations or circumstances. Values that produce different results can be stored as scenarios.

FIGURE T4.10

Solver Parameters with Constraints

Excel's *Scenario Manager* allows 32 different scenarios or groups of values to be defined. The Scenario Manager can then be used to selectively display the desired values or scenario in the worksheet. The Scenario Manager eliminates the need to have multiple copies of the same worksheet representing different situations. For each group of input values a scenario must be named and stored before it can be used.

SETTING UP SCENARIOS

Each group of input values or scenarios must be named and stored before it can be used. Scenarios are stored with the worksheet. To set up a scenario:

1. Open the file **T4_Scenario_Data.xls** on the CD. (see Figure T4.15).

2. Select the cells containing the first set of values to store in a scenario.

FIGURE T4.11

Solver Results Dialog Box

3. On the toolbar, select **Tools**, from the main menu, then select **Scenarios**.

4. Click **Add** to display the Add Scenario dialog box.

5. Enter **Original** for the Scenario name.

6. In the Changing Cells text box, type **D9:D11** or use the Collapse Dialog button at the right side of the text box to manually select the cells that hold the Number of Technicians, Regular Hours, and Over Time Hours   values.

FIGURE T4.12

Optimum Revenue for Solver Results

7. Choose **OK.** The Scenario Values dialog box appears.

8. The Scenario Values dialog box will display the values for cells D9, D10, and D11 as 1, 300, and 0, respectively, as shown in Figure T4.16. Click **OK.**

9. Once the Original has been saved, the what-if scenarios need to be created.

10. Click **Add.** In the Add Scenario dialog box, type **Single Contractor Overtime.**

FIGURE T4.13

Editing Solver Forecast

11. Click **OK.** In the Scenario Values dialog box for cell D10, type **300** and for cell D11 enter **40.** The value in D9

remains at **1.**

12. Click **OK.** Ensure that the Single Contractor Overtime scenario is selected, and click **Show.** Excel reports that this project will need an additional $3,000, as shown in Figure T4.17.

13. Create one more scenario. In the Scenario Manager dialog box, click **Add** again.

14. The Add Scenario dialog box appears. In the Scenario Name text box, type **Two Contractors No Overtime.**

15. The Changing Cells (D9:D11) should already appear in the proper text box; if not, enter that range. Click **OK** to invoke the Scenario Values dialog box.

16. Two outside contractors are brought in (by charging $200 for each additional technician). Enter **2** in the text box for cell D9 and **0** in the text box for cell D11. This time in cell D10's text box, type **=300/2** since there will be two technicians to split the time. Click **OK.** A message box shown in Figure T4.18 says that Excel converted the formula into a value.

17. Click **OK** to dismiss the message, and Excel returns you to the Scenario Manager dialog box.

18. Select **Two Contractors** and click **Show.** Excel displays 150 in cell D10 even though the total hours are 300. This scenario gives a completion cost of $15,200.

FIGURE T4.14

Solver Solution

FIGURE T4.15

Scenario Data Template Example

Compare the Scenarios

Compare each scenario to determine the best solution, such as:

Scenario	Cost
Original	$15,000
Single Contractor Overtime	$18,000
Two Contractors No Overtime	$15,200

MODIFYING A SCENARIO

Once scenarios have been defined, the data values in the scenarios can be modified, as needed. To modify a scenario:

1. Select **Tools** from the main menu, then select **Scenarios**.

2. Select the desired scenario name.

3. Choose **Edit.**

4. Modify the scenario information as desired.

5. Close the Scenario Manager dialog box.

FIGURE T4.16

Scenario Values Dialog Box Values

CREATING A SCENARIO SUMMARY REPORT

Included in the Scenario Manager is a feature called the Summary Report that creates a report that summarizes the result cells that are affected by a scenario. The Summary Report appears in the form of a summary table that is placed on a new worksheet, which can be printed.

FIGURE T4.17

Single Contractor Overtime Scenario

To create a Scenario Summary Report:

1. Select **Tools** from the main menu, then select **Scenarios**.

FIGURE T4.18

Message Dialog Box

2. Choose **Summary.**

3. Choose **Scenario summary** in the Report type group box.

4. In the Result cells text box, type in **D7, D12, D15, D16, D17.** Result cells are the cells affected by the specified scenario.

5. Choose **OK.**

6. Excel produces a Scenario Summary Report like Figure T4.19.

FIGURE T4.19

Scenario Summary Report

PLUG-IN SUMMARY

Technology can and does play a vitally important role in both supporting decision making and, in some instances,

actually making decisions or recommendations. Microsoft Excel is spreadsheet software that has an integrated set of tools that combine the analytical methods that can be applied to different problems. If function, Goal Seek, Solver, and Scenario Manager are analysis tools that have the capability to identify patterns, trends, and rules and create *"what-if" analyses.*

MAKING BUSINESS DECISIONS

1. Spotlight Video Rentals

Spotlight Video is a premier video rental company in Denver, Colorado, offering the latest selections on DVD, game, and VHS releases. After DVDs and VHS tapes have been viewed a certain number of times, their quality deteriorates to the point that Spotlight Video considers them to be defective. Furthermore, some customers own DVD and VHS players that are defective and can ruin Spotlight Video's merchandise.

Spotlight Video wants to maintain an inventory of DVDs and VHS tapes that are at least 85 percent acceptable; although 95 percent is preferable. However, since it can't keep customers' machines from damaging the rentals, Spotlight Video has had to relax its criterion a little. You have been hired to create a spreadsheet that will evaluate each DVD and VHS based on the following criteria:

FIGURE T4.20

Spotlight Video Report Sample

■ Number of times each title has been rented.

■ Number of defects that have been reported.

■ The percent of defects must be above 85 percent based on usage. If the percentage reported is below 85 percent, then Spotlight Video wants to flag this video as "REPLACE."

Spotlight Video has provided you with the data in a file called **T4_SpotlightVideo_Data.xls**. You will want to create an IF function to write a conditional expression that examines the criteria mentioned above. Figure T4.20 displays a sample of the output that Spotlight Video needs.

2. Scheduling Solver

AirPlains Airline is a new airline company that maintains a schedule of two daily flights each way between Salt Lake City, Denver, and Chicago. AirPlains Airline must strategically position itself as a low-cost provider in a volatile industry. Therefore, it must work toward finding a minimum cost for assigning flight crews to a given flight schedule while satisfying restrictions dictated by the Federal Aviation Administration.

Using Excel Solver, determine all the possible crew rotations based on the flight schedule below. You will want to find an approximate expected cost of each combination and then solve the original crew scheduling problem by using these costs. Secondly, you will want to calculate the crew constraints to determine the decision variables, constraints, and objectives.

The AirPlains Airline flight schedule is as follows:

From	To	Departure	Arrival
Salt Lake City	Denver	9:00AM	12:00PM
Salt Lake City	Denver	2:00PM	5:00PM
Salt Lake City	Chicago	10:00AM	2:00PM
Salt Lake City	Chicago	3:00PM	7:00PM
Denver	Salt Lake City	8:00AM	11:00AM
Denver	Salt Lake City	2:00PM	5:00PM
Denver	Chicago	9:00AM	11:00AM
Denver	Chicago	3:00PM	5:00PM
Chicago	Salt Lake City	8:00AM	12:00PM
Chicago	Salt Lake City	2:00PM	6:00PM
Chicago	Denver	10:00AM	12:00PM
Chicago	Denver	4:00PM	6:00PM

Apply the following business rules (constraints) to your model:

1. A crew that leaves a city in the morning has to return to the same city at night.

2. The crew can return on another airplane. There are six airplanes in use.

3. When a crew is flying, the cost is $200 per hour.

4. When a crew is waiting or returning, the cost is $75 per hour.

3. DVD Sales

Hans Hultgren, the sales manager for DVD Sales, wants to maximize his profit on the sale of portable DVD players. He already has two portable models he plans to sell:

Products	Retail Price	Wholesale Cost
Panasonic DVD–LS50	$349.95	$192.47
Mintek MDP–1810	$199.95	$109.99

Hans needs your help in calculating his maximum profit. First, he would like you to use the Web to locate the retail price of two other portable DVD players not listed in the table above. The wholesale price of each unit is 55 percent of the retail price for both units you find. Hans has two constraints:

1. Hans has $200,000 to purchase new DVD players. The total wholesale cost of the four types of DVD units must be less than $200,000.

2. Hans must purchase a minimum of 100 units of each player from his wholesaler.

You want to use Excel Solver to maximize the total profit for Hans with the constraints mentioned above and limiting the number of units to positive integers.

4. Maximizing Profit

HotSprings Spas manufactures and sells two spa models: the Steamboat and the Classic. HotSprings Spas receives spa bodies from another manufacturer and then adds a pump and tubing to circulate the water. The Steamboat model demands 15.5 hours of labor and 14.5 feet of tubing. The Classic model requires 10.5 hours of labor and uses 20 feet of tubing. Based on selling patterns, the owner, Deborah Liebson, has determined that the Steamboat model generates a profit of $400 per unit, and the Classic model generates $345 profit. While Deborah would like a large labor capacity and sufficient tubing and motors to build any number of spas, her resources are limited. For the next production period, Deborah has 2,650 labor hours, 3,450 feet of tubing, and 231 pumps available. Deborah needs assistance in figuring out how many Steamboat and Classic models to build in order to maximize her profit. Given the constraints above, use Solver to assist Deborah in her what-if analysis.

FIGURE T4.21

HotSprings Spa Template

Deborah has provided you with a screen shot (see Figure T4.21) of a template you can use to get started.

5. Budget Constraints

Joanne Krol wants to purchase a newer model automobile to replace her rusty 1989 car. The bank where Joanne has a checking account, US Bank, is advertising an annual interest rate of 6.75 percent for a three-year loan on

used cars. By selling her old car and using some cash she has accumulated, Joanne has $3,000 available as a down payment. Under her current budget, Joanne figures that the maximum monthly loan payment she can afford is $300. She wants to find out the maximum car price she can afford and keep the monthly payment no higher than $300. She cannot alter the interest rate or the three-year term. Use the Excel Goal Seek command to figure out the highest purchase price Joanne can afford.

Designing Database Applications

LEARNING OUTCOMES

1. Describe the purpose of the relational database model in a database management system.

2. List the relational database model's basic components.

3. Describe why entities and attributes are organized into tables.

4. Describe how data redundancy is handled in the relational database model.

5. Explain the need for an entity-relationship diagram in a database management system.

6. Describe the Chen model symbols used in entity-relationship modeling.

7. Explain the purpose of normalization.

8. List the three normal forms typically used in normalization.

Introduction

Businesses rely on their database systems for accurate, up-to-date information. Without those databases of mission critical information, most businesses would be unable to perform their normal daily transactions, much less create summary reports that help management make strategic decisions. To be useful, the information must be accurate, complete, and organized in such a way that it can be retrieved when needed and in the format required.

The core units introduced the *database,* which maintains information about various types of objects (inventory), events (transactions), people (employees), and places (warehouses). A *database management system (DBMS)* is software through which users and application programs interact with a database. The *relational database model* is a type of database that stores its information in the form of logically related two-dimensional tables. This plug-in will build on the core units by providing specific details about how to design relational database applications.

Entities and Data Relationships

There are numerous elements in a business environment that need to store information, and those elements are related to one another in a variety of ways. Thus a database must contain not only the information but also

information about the relationships between the information.

The idea behind a database is that the user, either a person working interactively or an application program, has no need to worry about the way in which information is physically stored on disk. A database management system translates between the user's request for information and the physical storage.

A *data model* is a formal way to express data relationships to a database management system (DBMS). The underlying relationships in a database environment are independent of the data model and therefore independent of the DBMS that is being used. Before designing a database for any data model, data relationships need to be defined. An *entity-relationship diagram (ERD)* is a technique for documenting the relationships between entities in a database environment.

ENTITIES AND THEIR ATTRIBUTES

An *entity*, sometimes called a table, is a person, place, thing, transaction, or event about which information is stored. A customer is an entity, as is a merchandise item. Entities are not necessarily tangible; for instance, an appointment to see the doctor is an entity. *Attributes,* also called fields or columns, are characteristics or properties of an entity class. For example, a *CUSTOMER* entity can be described by a *Customer Number, First Name, Last Name, Street, City, State, Zip Code, Phone Number, Credit Card No,* and *Credit Card Exp* (refer to Figure T5.1).

When entities in a database are represented, only the attributes are stored. Each group of attributes models a single entity type in the real world, and values assigned to these attributes represent instances of objects (entity occurrences) corresponding to the entity. For example, in Figure T5.2, there are four instances of a *CUSTOMER* entity stored in a database. If there are 1,000 customers in the database, then there will be 1,000 instances of *CUSTOMER* entities. Instances can sometimes be referred to as records.

Entity Identifiers

An *entity identifier* ensures that each entity instance has a unique attribute value that distinguishes it from every other entity instance (an entity identifier is also referred to as a primary key, which will be discussed later in the plug-in). The primary purpose for entering the information that describes an entity into a database is to retrieve the information at some later date. This means there must be some way of distinguishing one entity from another in order to retrieve the correct entity. An entity identifier ensures that each entity has a unique attribute value that distinguishes it from every other entity.

FIGURE T5.1

Entities and Attributes Example

Assume, for example, that a local video store, Mega-Video, has two customers named John Smith. If an employee searches for the items John Smith has ordered, which John Smith will the DBMS retrieve? In this case, both of them. Since there is no way to distinguish between the two customers, the result of the query will be inaccurate. Mega-Video can solve the problem by creating an entity identifier.

Some entities, such as *ORDER,* come with natural identifiers, such as an *Order Number.* Typically, a unique, randomly generated number is assigned to entity identifiers.

FIGURE T5.2

Customer Entity Instance

A *constraint* is a rule to which some elements in a database must adhere. All entities must have a unique identifier that is a constraint. That is to say, when an instance of an entity in a database is stored, the DBMS needs to ensure that the new instance has a unique identifier. The enforcement of a variety of database constraints helps to maintain data consistency and accuracy.

ATTRIBUTES

There are several types of attributes, including:

■ Simple versus composite.

■ Single-valued versus multi-valued.

■ Stored versus derived.

■ Null-valued.

Simple versus Composite

Composite attributes can be divided into smaller subparts, which represent more basic attributes that have their own meanings. A common example of a composite attribute is *Address* (see Figure T5.3). *Address* can be broken down into a number of subparts, such as *Street, City, State, Zip Code. Street* may be further broken down by *Number, Street Name,* and *Apartment/Unit Number.* Attributes that are not divisible into subparts are called *simple attributes.*

Single-Valued versus Multi-Valued

When creating a relational database, the attributes in the data model must be single-valued. *Single-valued* means

having only a single value of each attribute at any given time. For example, a *CUSTOMER* entity allows only one *Phone Number* for each *CUSTOMER*. If a *CUSTOMER* has more than one *Phone Number* and wants them all included in the database, then the *CUSTOMER* entity cannot handle them.

FIGURE T5.3

Composite Attributes

The existence of more than one *Phone Number* turns the *Phone Number* attribute into a multi-valued attribute. *Multi-valued* means having the potential to contain more than one value for an attribute at any given time. An entity in a relational database cannot have multi-valued attributes. Those attributes must be handled by creating another entity to hold them.

In the case of the multiple *Phone Number*(s), a *PHONE NUMBER* entity needs to be created. Each instance of the entity would include the *Customer Number* of the person to whom the *Phone Number* belonged along with the *Phone Number*. If a customer had two *Phone Number*(s), then there would be two instances of the *PHONE NUMBER* entity for the *CUSTOMER* (see Figure T5.4).

Multi-valued attributes can cause problems with the meaning of data in the database, significantly slow down searching, and place unnecessary restrictions on the amount of data that can be stored. Relational databases do not allow multi-valued attributes for this reason. For example, an *EMPLOYEE* entity with attributes for the *Name(s)* and *Birthdate(s)* of dependents would be considered multi-valued.

FIGURE T5.4

Customer Entity and Phone Number Entity

When searching a multi-valued attribute, a DBMS must search each value in the attribute, most likely scanning the contents of the attribute sequentially. A sequential search is the slowest type of search available.

Generally, a multi-valued attribute is a major hint that another entity is needed. The only way to handle multiple values of the same attribute is to create an entity for which multiple instances can be stored, one for each value of the attribute. In the case of the *EMPLOYEE* entity, a *DEPENDENT* entity that could be related to the *EMPLOYEE* entity needs to be created. There would be one occurrence of the *DEPENDENT* entity related to an occurrence of the *EMPLOYEE* entity for each of an employee's dependents. In this way, there is no limit to the number of an employee's dependents. In addition, each occurrence of the *DEPENDENT* entity would contain the *Name* and *Birthdate* of only one dependent, eliminating any confusion about which *Name* was associated with which

Birthdate, as suggested in Figure T5.5. Searching would also be faster because the DBMS could use quicker search techniques on the individual *DEPENDENT* entity occurrences, without resorting to the slow sequential search.

Stored versus Derived

If an attribute can be calculated using the value of another attribute, it is called a *derived attribute.* The attribute that is used to derive the attribute is called a *stored attribute.* Derived attributes are not stored in the file, but can be derived when needed from the stored attributes. One example of a derived and stored attribute is a person's age. If the database has a stored attribute such as the person's *Date of Birth,* then you can create a derived attribute called *Age* from taking the *Current Date* (this is pulled from the system the database is running on) and subtracting the *Date of Birth* to get the age.

Null-Valued

There are cases where an attribute does not have an applicable value for an attribute. For these situations, the *null-valued* attribute is created. A person who does not have a mobile phone would have null stored at the value for the *Mobile Phone Number* attribute. Null can also be used in situations where the attribute value is unknown. There are two cases where this can occur, one where it is known that the attribute is valued, but the value is missing, for example *Hair Color.* Every person has a hair color, but the information may be missing. Another situation is if *Mobile Phone Number* is null, it is not known if the person does not have a mobile phone or if that information is just missing.

FIGURE T5.5

Employee Entity and Dependent Entity

Documenting Logical Data Relationships

The two most commonly used styles of ERD notation are Chen, named after the originator of entity-relationship modeling, Dr. Peter Chen, and Information Engineering, which grew out of work by James Martin and Clive Finkelstein. It does not matter which is used, as long as everyone who is using the diagram understands the notation.

The Chen model uses rectangles to represent entities. Each entity's name appears in the rectangle and is expressed in the singular, as in *CUSTOMER.* The original Chen model did not provide a method for showing attributes on the ERD itself. However, many people have extended the model to include the attributes in ovals as illustrated in Figure T5.6.

BASIC DATA RELATIONSHIPS

The relationships that are stored in a database are between instances of entities. For example, a Mega-Video customer is related to the *ITEM*(s) he or she *ORDER*(s). Each instance of the *CUSTOMER* entity is related to instances of the specific *ITEM* ordered (see Figure T5.7). This is a purely conceptual representation of what is in the database and is completely unrelated to the physical storage of the data.

FIGURE T5.6

Chen Model with Attributes

When data relationships are documented, such as drawing an ERD, types of relationships among entities are shown, displaying the possible relationships that are allowable in the database. Unless a relationship is mandatory, there is no requirement that every instance of an entity be involved in the documented relationships. For example, Mega-Video could store information about a *CUSTOMER* without the customer having any current *ORDER*(s) to which it is related.

Once the basic entities and their attributes in a database environment have been defined, the next task is to identify the relationships among those entities. There are three basic types of relationships: (1) one-to-one, (2) one-to-many, and (3) many-to-many.

One-to-One

A *one-to-one (1:1)* relationship is between two entities in which an instance of entity A can be related to only one instance of entity B and entity B can be related to only one instance of entity A. Consider an airport in a small town and the town in which the airport is located, both of which are described in a database of small town airports (this would not be true for some major metropolitan cities, such as New York City with two major airports). Each of these might be represented as an instance of a different type of entity. As shown in Figure T5.8, the relationships between the two instances can then be expressed as "The airport is located in one and only one town and the town contains one and only one airport." The Chen method, as displayed in Figure T5.8, uses rectangles to document entities, a diamond to represent the relationship, and numbers to show the type of relationship in this example, (1:1).

FIGURE T5.7

Entity Relationships

This is a true one-to-one relationship because at no time can a single *AIRPORT* be related to more than one

TOWN and no *TOWN* can be related to more than one *AIRPORT*. Although there are municipalities that have more than one *AIRPORT,* the *TOWN*(s) in this database are too small for that to happen.

True one-to-one relationships are rare in business. For example, assume that Mega-Video decides to start dealing with a new distributor of DVDs. At first, the company orders only one specialty title from the new distributor. The instance of the *DISTRIBUTOR* entity in the database is related to just the one merchandise *ITEM* instance. This would then appear to be a one-to-one relationship. Over time, Mega-Video may choose to order more titles from the new distributor, which would violate the rule that the distributor must be related to no more than one merchandise item. Therefore, this is not a true one-to-one relationship (this is an example of a one-to-many relationship, which is discussed next).

What if Mega-Video created a special *CREDIT CARD* entity to hold data about the credit cards that *CUSTOMER*(s) used to secure their rentals? Each *CUSTOMER* has only one credit card on file with the store. There would therefore seem to be a one-to-one relationship between the instance of a *CUSTOMER(s)* entity and the instance of the *CREDIT CARD* entity. In this case, it is a single entity. The *Credit Card Number,* the *Type of Credit Card,* and the *Credit Card Expiration Date* can all become attributes of the *CUSTOMER(s)* entity. Given that only one credit card is stored for each customer, the attributes are not multi-valued; no separate entity is needed.

FIGURE T5.8

A One-to-One Relationship

One-to-Many

A *one-to-many (1:M)* relationship is between two entities, in which an instance of entity A can be related to zero, one, or more instances of entity B and entity B can be related to only one instance of entity A. This is the most common type of relationship. In fact, most relational databases are constructed from the rare one-to-one relationship and numerous one-to-many relationships. Mega-Video typically *ORDER*(s) many *ITEM*(s) (in this scenario, an item is a DVD title) from each *DISTRIBUTOR* and a given *ITEM* comes from only one *DISTRIBUTOR* as Figure T5.9 demonstrates. Similarly, a *CUSTOMER* places many *ORDER*(s), but an *ORDER* comes from only one *CUSTOMER.*

FIGURE T5.9

A One-to-Many Relationship

When specifying data relationships, there needs to be an indication of the possible relationships, but an indication is not necessary that all instances of all entities participate in every documented relationship. There is no

requirement that a *DISTRIBUTOR* be related to any merchandise *ITEM,* much less one or more merchandise *ITEM*(s). It might not make much sense to have a *DISTRIBUTOR* in the database from whom the company did not *ORDER,* but there is nothing to prevent data about that *DISTRIBUTOR* from being stored.

Many-to-Many

A *many-to-many (M:N)* relationship is between two entities in which an instance of entity A can be related to zero, one, or more instances of entity B and entity B can be related to zero, one, or more instances of entity A. There is a many-to-many relationship between a Mega-Video *CUSTOMER* and the merchandise *ITEMs* carried by the store (refer to Figure T5.10). A *CUSTOMER* can order many *ITEM*(s) and each *ITEM(s)* can be ordered from many *CUSTOMERs.*

Many-to-many relationships bring two major problems to a database's design. These issues and the way in which they are solved are discussed in the section "Dealing with Many-to-Many Relationships" below.

RELATIONSHIP CONNECTIVITY AND CARDINALITY

Cardinality expresses the specific number of entity occurrences associated with one occurrence of the related entity. In the Chen model, the cardinality is indicated by placing numbers beside the entities in the format of (x, y). The first number in the cardinality represents the minimum value and the second number stands for the maximum value.

The data relationships discussed thus far have defined those relationships by starting each with "zero," indicating that the cardinality in a given instance of an entity in a relationship is optional. Mega-Video can store data about a *CUSTOMER* in its database before the *CUSTOMER* places an *ORDER.* An instance of the *CUSTOMER* entity does not have to be related to any instances of the *ORDER* entity, meaning there is an *optional* cardinality.

FIGURE T5.10

A Many-to-Many Relationship

However, the reverse is not true for the Mega-Video database. An *ORDER must* be related to a *CUSTOMER.* Without a *CUSTOMER,* an *ORDER* cannot exist. As a result, an *ORDER* is an example of a *weak entity,* one that cannot exist in the database unless a related instance of another entity is present and related to it. An instance of the *CUSTOMER* entity can be related to zero, one, or more orders. An instance of the *ORDER* entity must be related to one and only one *CUSTOMER,* having a cardinality of (1, 1). The "zero" option is not available to a weak entity. The relationship between an instance of the *ORDER* entity and the *CUSTOMER* is a mandatory relationship, as

illustrated in Figure T5.11.

FIGURE T5.11

A Weak Entity and a Mandatory Relationship

Identifying weak entities and their associated mandatory relationships is important for maintaining the consistency and integrity of the database. Consider the effect of storing an *ORDER* without knowing the *CUSTOMER* to which it belongs. There would be no way to ship the *ITEM* to the *CUSTOMER,* causing a company to lose business.

There is a need to define the relationship between an *ORDER* and the *ORDER LINES* (the specific items on the order) as one-to-many because an *ORDER LINE* cannot exist in the database without its being related to an *ORDER.* An *ORDER LINE* is meaningless without knowing the *ORDER* to which it belongs.

In contrast, a merchandise *ITEM* can exist in a database without indicating the *DISTRIBUTOR* from which it comes (assuming that there is only one source per item). Data about a new *ITEM* can be stored before a *DISTRIBUTOR* is selected. In this case, the relationship between a *DISTRIBUTOR* and an *ITEM* is actually zero-to-many.

Documenting Relationships—The Chen Method

As briefly described earlier, the Chen method uses diamonds for relationships and lines to show the type of relationship between entities. Figure T5.12 displays the relationship between a Mega-Video *CUSTOMER* and an *ORDER.* The number "1" next to the *CUSTOMER* entity indicates that an *ORDER* belongs to at most one *CUSTOMER.* The letter "M" next to the *ORDER* entity indicates that a *CUSTOMER* can place one or more *ORDER*(s). The word within the relationship diamond gives some indication of the meaning of the relationship.

There is one major limitation to the Chen method of drawing ERDs—there is no obvious way to indicate weak entities and mandatory relationships. An *ORDER* should not exist in the database without a *CUSTOMER. ORDER* is a weak entity and its relationship with a *CUSTOMER* is mandatory.

FIGURE T5.12

Chen Method Weak Entity Symbol

Some database designers have added a new symbol to the Chen method for a weak entity, a double-bordered rectangle, as shown in Figure T5.13. Whenever a weak entity is introduced into an ERD, it indicates that the relationship between that entity and at least one of its parents is mandatory.

DEALING WITH MANY-TO-MANY RELATIONSHIPS

There are problems associated with many-to-many relationships. One problem is straightforward—the relational data model cannot handle many-to-many relationships directly; it is limited to one-to-one and one-to-many relationships. This means that the many-to-many relationships need to be replaced with a collection of one-to-many relationships in a relational DBMS.

FIGURE T5.13

Chen Method with Relationship

A second problem is a bit more subtle. To understand it, consider the relationship between an *ORDER* Mega-Video places with a *DISTRIBUTOR* and the merchandise *ITEM* on the *ORDER*. There is a many-to-many relationship between the *ORDER* and the *ITEM* because each *ORDER* can be for many *ITEM*(s) and, over time, each *ITEM* can appear on many *ORDER*(s). Whenever Mega-Video places an *ORDER* for an *ITEM,* the number of copies of the *ITEM* varies, depending on the perceived demand for the *ITEM* at the time the *ORDER* is placed. Now the question: Where should we store the *Quantity* being ordered? It cannot be part of the *ORDER* entity because the *Quantity* depends on which item is being ordered. Similarly, the *Quantity* cannot be part of the *ITEM* entity because the *Quantity* depends on the specific *ORDER*.

Composite Entities

Entities that exist to represent the relationship between two other entities are known as *composite entities.* As an example of how composite entities work, consider the relationship between an *ORDER* placed by a *CUSTOMER* and the *ITEM*(s) in the *ORDER*. There is a many-to-many relationship between an *ITEM* and an *ORDER:* An *ORDER* can contain many *ITEM*(s) and over time, the same *ITEM* can appear on many *ORDER*(s).

What is needed is an entity that displays a specific title that appears on a specific order. Refer to Figure T5.14, there are three *ORDER* instances and three merchandise *ITEM* instances. The first *ORDER* for *Customer Number* 1111 (*Order Number* 1000) contains only one *ITEM* (*Item Number* 9244). The second *ORDER* for *Customer Number* 1111 (*Order Number* 1001) contains a second copy of *Item Number* 9244, but ordered on a different date. *Order Number* 1002, which belongs to *Customer Number* 1211, has two *ITEM*(s) in it (*Item Number* 9250 and *Item Number* 9255).

Therefore, a composite entity called *ORDER LINE* (think of it as a line item on a packing slip) is created to

represent the relationship between an *ORDER* and a *PRODUCT*. Figure T5.15 demonstrates the Chen notation for ERDs; the symbol for a composite entity is the combination of a rectangle and a diamond.

Each *ORDER* is related to one *ORDER LINE* instance for each *ORDER* on which it appears. Each *ORDER LINE* instance is related to one and only one *ORDER;* it is also related to one and only one *PRODUCT* item. As a result, the relationship between an *ORDER* and its *ORDER LINE* is one-to-many (one order has one or more line items) and the relationship between an *ITEM* and the *ORDER* on which it appears is one-to-many (one item appears in zero, one, or more line items). The presence of the composite entity has removed the original many-to-many relationship and turned it into two one-to-many relationships.

FIGURE T5.14

Composite Entity Example

FIGURE T5.15

ERD of Composite Entity

SCHEMAS

A *schema* is a completed entity-relationship diagram representing the overall, logical plan of a database. This is the way in which the people responsible for maintaining the database will view the design. Users (both interactive users and application programs) may work with only a portion of the logical schema. In addition, both the logical schema and the users' views of the data are at the same time distinct from the physical storage.

The underlying physical storage, which is managed by the DBMS, is known as the *physical schema.* It is for the most part determined by the DBMS (only very large DBMSs give any control over physical storage). The benefit of this arrangement is that both database designers and users do not need to be concerned about physical storage, greatly simplifying access to the database and making it much easier to make modifications.

The Relational Data Model

Once the ERD is completed, it can be translated from a conceptual logical schema into the formal data model required by the DBMS. Most database installations are based on the relational data model.

The relational data model is the result of the work of one person, Edgar (E. F.) Codd. During the 1960s, Dr. Codd, trained as a mathematician, began working with existing data models. His experience led him to believe that these were clumsy and unnatural ways of representing data relationships. He therefore went back to mathematical

set theory and focused on the construct known as a relation. Dr. Codd extended that concept to produce the relational database model, which he introduced in a historic seminal paper in 1970.

UNDERSTANDING RELATIONS

In mathematical set theory, a relation is the definition of a *table* with columns (e.g., attributes) and rows (e.g., records). The word "table" is used synonymously with "entity." The definition specifies what will be contained in each column of the table, but does not include information. When rows of information are included, an *instance* of a relation is created, such as the *CUSTOMER* relation in Figure T5.16.

At first glance, a relation looks much like a portion of a spreadsheet. Since it has its underpinnings in mathematical set theory, a relation has some very specific characteristics that distinguish it from other ways of looking at information. Each of these characteristics forms the basis of a constraint that will be enforced by the DBMS.

FIGURE T5.16

A Sample Customer Relation

Customer

Customer Number	First Name	Last Name	Phone Number
0001	Bill	Miller	777-777-7777
0505	Jane	Cook	444-444-4444
1111	Sam	Smith	555-555-5555
1212	John	Doe	666-666-6666

Columns and Column Characteristics

Two or more tables within the same relational schema may have columns with the same names; in fact, in some circumstances, this is highly desirable. But a single table must have unique column names. When the same column name appears in more than one table and tables that contain that column are used in the same operation (e.g., query), the name of the column must be qualified by preceding it with the name of the table and a period, as in:

CUSTOMER.<u>Customer Number,</u> First Name, Last Name, Phone Number

Note the proper notation is to capitalize the table name (e.g., *CUSTOMER*) and all columns are in title case (Customer Number).

Rows and Row Characteristics

A row in a relation has the following properties:

■ Only one value at the intersection of a column and row—a relation does not allow multi-valued attributes.

■ Uniqueness—there are no duplicate rows in a relation.

■ A primary key—a *primary key* is a field (or group of fields) that uniquely identifies a given entity in a table.

Primary Key

A *primary key* makes it possible to uniquely identify every row in a table. The primary key is important to define in order to retrieve every single piece of information put into a database.

As far as a relational database is concerned, there are only three pieces of information to retrieve for any specific bit of information: (1) the name of the table, (2) the name of the column, and (3) the primary key of the row. If primary keys are unique for every row, then the results will be exactly what was searched for. If they are not unique, then the data being retrieved will be a row with the primary key value, which may not be the row containing the data being searched.

The proper notation to use when documenting the name of the table, the column name, and primary key is as follows:

CUSTOMER(<u>Customer Number</u>, First Name, Last Name, Phone Number)

Again, notice that the table name is capitalized, the primary key is underlined, and it is the first attribute listed in the parenthetical statement containing the column names.

Along with being unique, a primary key must not contain the value null. *Null* is a special database value meaning "unknown." It is not the same as a zero or a blank. If one row has a null primary key, then the data structure is all right. The minute a second one is introduced, the property of uniqueness is lost. The presence of nulls in any primary key column is forbidden. This constraint, known as entity integrity, will be enforced by a DBMS whenever information is entered or modified. *Entity integrity* is a constraint on a relation that states that no part of a primary key can be null.

Selecting a primary key can be a challenge. Some entities have natural primary keys, such as purchase order numbers, as previously mentioned. Primary keys are often arbitrary, unique identifiers, such as a company attaches to the orders it sends to vendors. Two qualities of all primary keys are:

1. A primary key should contain some value that can never be null.

2. A primary key should never change.

REPRESENTING DATA RELATIONSHIPS

The use of identifiers in more than one relation was mentioned in the preceding section. This is the way in which relational databases represent relationships bet-ween entities.

Each table in Figure T5.17 is directly analogous to the entity by the same name in the Mega-Video ERD. The *CUSTOMER* entity is identified by a *Customer Number,* a randomly generated unique primary key. The *ORDER* entity is identified by an *Order Number,* another arbitrary unique primary key assigned by Mega-Video. The entity, *ORDER LINE,* tells the company which *ITEM*(s) are part of which *ORDER.* This table requires a *concatenated primary key* because multiple *ITEM*(s) can appear on multiple *ORDER*(s). The selection of this primary key, however, has more significance than simply identifying each row; it also represents a relationship between the *ORDER LINES,* the *ORDER* on which they appear, and the *ITEM*(s) being ordered. The *ITEM* entity is identified by an *Item Number,* an arbitrary unique primary key.

The *Item Number* column in the *ORDER LINE* relation is the same as the primary key of the *ITEM* table. This indicates a one-to-many relationship between the two tables. Similarly, there is also a one-to-many relationship between the *ORDER* and *ORDER LINE* tables because the *Order Number* column in the *ORDER LINE* table is the same as the primary key of the *ORDER* table.

When a table contains a column that is the same as the primary key of another table, the column is called a foreign key. A *foreign key* is a primary key of one table that appears as an attribute in another table and acts to provide a logical relationship between the two tables. The matching of foreign keys to primary keys represents data relationships in a relational database. As far as the user of a relational database is concerned, no structures show relationships other than the matching columns.

Foreign keys may be a part of a concatenated primary key or they may not be part of their table's primary key at all. Consider a pair of Mega-Video *CUSTOMER* and *ORDER* relations:

CUSTOMER(<u>Customer Number</u>, First Name, Last Name, Phone Number)

ORDER(<u>Order Number</u>, <u>Customer Number</u>, Order Date)

FIGURE T5.17

Relations from the Mega-Video Database

The *Customer Number* column in the *ORDER* table is a foreign key that matches the primary key of the *CUSTOMER* table. It represents the one-to-many relationship between *CUSTOMER*(s) and the *ORDER*(s) they place. However, the *Customer Number* is not part of the primary key of the *ORDER* table; it is a nonkey attribute that is nonetheless a foreign key, which is represented by using the double underline notation.

Technically, foreign keys need not have values unless they are part of a concatenated primary key; they can be null. However, in this particular database, Mega-Video would be in serious trouble if a *Customer Number* was null, since there would be no way to know which *CUSTOMER* placed an *ORDER*.

A relational DBMS uses the relationships indicated by matching data between primary and foreign keys. Assume that a Mega-Video employee wanted to see what *Titles* had been ordered with *Order Number* 1002. First, the DBMS identifies the rows in the *ORDER LINE* table that contain an *Order Number* of 1002. Then, it takes the *Item Number*(s) from the rows and matches them to the *Item Number*(s) in the *ITEM* table. In the rows where there are matches, the DBMS finally retrieves the associated *Title.*

Foreign Keys and Primary Keys in the Same Table

Foreign keys do not necessarily need to reference a primary key in a different table; they need only reference a primary key. As an example, consider the following employee relation:

EMPLOYEE(Employee Number, First Name, Last Name, Department, Manager Number)

A manager is also an employee. Therefore, the *Manager Number,* although named differently from the *Employee Number,* is actually a foreign key that references the primary key of its own table. The DBMS will therefore always ensure that whenever a user enters a *Manager Number,* that manager already exists in the table as an employee. Having a foreign key reference a primary key in the same table is relatively rare.

Referential Integrity

The procedure described in the preceding section works very well unless for some there is no *Order Number* in the *ORDER* table to match a row in the *ORDER LINE* table. This is undesirable since there is no way to ship the ordered *ITEM* because there is no way to find out which *CUSTOMER* placed the *ORDER.*

The relational data model enforces a constraint called *referential integrity,* which states that every non-null foreign key value must match an existing primary key value. Of all the constraints in a relational database, this is probably the most important because it ensures the consistency of the cross-references among tables.

Referential integrity constraints stored in the database are enforced automatically by the DBMS. As with all other constraints, each time a user enters or modifies data, the DBMS checks the constraints and verifies that they are met. If the constraints are violated, the data modification will not be allowed.

The Data Dictionary

The *data dictionary* is a file that stores definitions of information types, identifies the primary and foreign keys, and maintains the relationships among the tables. The structure of a relational database is stored in the database's data dictionary, or catalog. The data dictionary is made up of a set of relations, identical in properties to the relations used to hold information. No user can modify the data dictionary tables directly. Data manipulation language commands (e.g., Structured Query Language) that create and remove database structural elements work by modifying rows in data dictionary tables.

The following types of information are typically found in a data dictionary:

■ Definitions of the columns that make up each table.

■ Integrity constraints placed on relations.

■ Security information (which user has the right to perform which operation of which table).

When a user attempts to access information in any way, a relational DBMS first goes to the data dictionary to determine whether the database elements the user has requested are actually part of the schema. In addition, the DBMS verifies that the user has the access rights to whatever he or she is requesting.

When a user attempts to modify information, the DBMS goes to the data dictionary to look for integrity constraints that may have been placed on the relation (see Figure T5.18). If the information has met the constraints, the modification is permitted. Otherwise, the DBMS returns an error message and does not allow the change. All access to a relational database is through the data dictionary.

RELATIONSHIPS AND BUSINESS RULES

In many ways, database design is as much an art as a science. The "correct" design for a specific business depends on the business rules; what is correct for one organization may not be correct for another.

Assume there is more than one store when creating a database for a retail establishment. One of the elements being modeled in the database is an employee's schedule. Before that can be done, the question of the relationship between an employee and a store needs to be answered: Is it one-to-many or many-to-many? Does an employee

always work at only one store, in which case the relationship is one-to-many, or can an employee split his or her time between more than one store, producing a many-to-many relationship? This is not a matter of right or wrong database design, but an issue of how the business operates. These types of questions must be answered before you design a database.

Normalization

Normalization is the process of placing attributes into tables that avoid the problems associated with poor database design. Given any group of entities and attributes, there is a large number of ways to group them into relations.

There are at least two ways to approach normalization. The first is to work from an ERD. If the diagram is drawn correctly, then there are some simple rules to use to translate it into relations that will avoid most relational design problems. The drawback to this approach is that it can be difficult to determine whether the design is correct. The second approach is to use the theoretical concepts behind good design to create relations. This is a bit more difficult than working from an ERD, but often results in a better design.

NORMAL FORMS

Normal forms are the theoretical rules that the design of a relation must meet. Each normal form represents an increasingly stringent set of rules. Theoretically, the higher the normal form, the better the design of the relation.

As illustrated in Figure T5.19, there are six nested normal forms, indicating that if a relation is in one of the higher, inner normal forms, it is also in all of the normal forms surrounding it. In most cases, if relations are in third normal form (3NF), then most of the problems common to bad relational designs are avoided. Boyce-Codd (BCNF) and fourth normal form (4NF) handle special situations that arise only occasionally. Fifth normal form (5NF) is a complex set of criteria that are extremely difficult to work with. It is very difficult to verify that a relation is in 5NF. Most practitioners do not bother with 5NF, knowing that if their relations are in 3NF (or 4NF if the situation warrants), then their designs are generally problem-free. BCNF, 4NF, and 5NF are beyond the scope of this plug-in; therefore they will not be discussed beyond what is mentioned in this section.

FIGURE T5.18

Data Dictionary Example

Table Name	Attribute Name	Contents	Type	Length	Format	Range	Req'd	Key	Referenced Table

Entity	Field	Field Name	Type	Length	Picture	Range	Req	Key	References
CUSTOMER	Customer Number	Customer Number	VCHAR	10	X(10)		Y	PK	
	First Name	First Name	VCHAR2	12	X(12)		Y		
	Last Name	Last Name	VCHAR2	15	X(15)		Y		
	Street	Street Address	VCHAR2	20	X(20)		Y		
	City	City	VCHAR2	20	X(20)		Y		
	State	State	VCHAR2	2	X(2)		Y		
	Zip Code	ZIP Code	NUMBER	5	99999		Y		
	Credit Card No	Credit Card Number	NUMBER	15	X(15)		Y		
	Credit Card Exp	Credit Card	DATE	8	MM/DD/YYYY				Expiration Date
ORDER	Order Number	Order Number	NUMBER	5	99999	1-99999	Y	PK	
	Customer Number	Customer Number	VCHAR	10	X(10)		Y	FK	CUSTOMER
	Order Date	Order Date	DATE	8	MM/DD/YYYY		Y		
	Order Filled	Ordered Filled	DATE	8	MM/DD/YYYY		Y		
ORDER LINE	Order Number	Order Number	NUMBER	5	99999	1-99999	Y	FK	ORDER
	Item Number	Item Number	NUMBER	5	99999	1-99999	Y	FK	ITEM
	Quantity	Quantity	NUMBER	3	999	1-999	Y		
	Price	Selling Price	NUMBER	5	$999.99		Y		
	Shipped	Shipped	VCHAR2	1	X	Y/N	Y		
ITEM	Item Number	Item Number	Number	5	99999	1-99999	Y	PK	
	Title	Title	VCHAR2	25	X(25)		Y		
	Distributor	Distributor	VCHAR2	20	X(20)		Y		
	Price	Price	Number	5	$999.99		Y		

First Normal Form (1NF)

First normal form (1NF) is where each field in a table contains different information. For example, in the column labeled "Customer," only customer names or numbers are permitted. A table is in first normal form (1NF) if the data

are stored in a two-dimensional table with no repeating groups.

FIGURE T5.19

Normal Forms

Although first normal form relations have no repeating groups, they are full of other problems. Expressed in the notation for relations that have been used in this plug-in, the relation notation would look like the following:

ORDER(Customer Number, First Name, Last Name, Street, City, State, ZIP, Phone, Order Number, Order Date, Item Number, Title, Price, Shipped)

The first thing is to determine the primary key for this table. The *Customer Number* alone will not be sufficient because the customer number repeats for every item ordered by the customer. The *Item Number* will also not suffice, because it is repeated for every order on which it appears. The *Order Number* cannot be used because it is repeated for every item on the order. The only solution is a concatenated key, in this example the combination of the *Order Number* and the *Item Number.*

Given that the primary key is made up of the *Order Number* and the *Item Number,* there are two important things that cannot be done with this relation:

■ Data about a customer cannot be added until the customer places at least one order because without an order and an item on that order, there is no complete primary key.

■ Data about a merchandise item cannot be added without that item being ordered. There must be an *Order Number* to complete the primary key.

First normal form relations can also present problems when deleting data. Consider, for example, what happens if a customer cancels the order of a single item:

■ In cases where the deleted item was the only item on the order, all data about the order is lost.

■ In cases where the order was the only order on which the item appeared, data about the item is lost.

■ In cases where the deleted item was the only item ordered by a customer, all data about the customer is lost.

There is a final type of inconsistency in the *ORDER*(s) relation that is not related to the primary key: a modification, or update, anomaly. The *ORDER*(s) relation has a great deal of unnecessary duplicated data; in particular, information about customers. When a customer moves, then the customer's data must be changed in every row, for every item on every order ever placed by the customer. If every row is not changed correctly, then data that should be the same are no longer the same.

Second Normal Form (2NF)

Second normal form (2NF) is when the relation is in first normal form and all nonkey attributes are functionally dependent on the entire primary key. The solution to anomalies in a first normal form relation is to break the relation down so that there is one relation for each entity in the 1NF relation. The *ORDER(s)* relation, for example, will break down into four relations (*CUSTOMER, ORDER, ORDER LINE,* and *ITEM*). Such relations are in at least 2NF.

Although second normal form eliminates problems from many relations, relations that are in second normal form still exhibit anomalies. Assume that each DVD title that Mega-Video carries comes from one *DISTRIBUTOR* and that each *DISTRIBUTOR* has only one warehouse, which has only one *Warehouse Phone Number.* The following relation is therefore in 2NF:

ITEM (<u>Item Number</u>, Title, Distributor, Warehouse Phone Number)

From each *Item Number,* there is only one value for the item's *Title, Distributor,* and *Warehouse Phone Number.* There is one insertion anomaly—data cannot be inserted about a *DISTRIBUTOR* until an item from the *DISTRIBUTOR* is entered. There is a deletion anomaly as well: if the only item from the *DISTRIBUTOR* is deleted, the data about the *DISTRIBUTOR* is lost.

Third Normal Form (3NF)

Third normal form (3NF) is when the relation is in second normal form and there are no transitive dependencies. In terms of entities, the items relation does contain two entities: the merchandise *ITEM* and the *DISTRIBUTOR.* The relation needs to be broken down into two smaller relations, both of which are now in 3NF:

ITEM(<u>Item Number</u>, Distributor Number)

DISTRIBUTOR(<u>Distributor Number</u>, Warehouse Phone Number)

NORMALIZED RELATIONS AND DATABASE PERFORMANCE

Normalizing the relations in a database separates entities into their own relations and makes it possible to enter, modify, and delete data without disturbing entities other than the one directly being modified. When relations are split so that relationships are represented by matching primary and foreign keys, DBMS is forced to perform matching operations between relations whenever a query requires data from more than one table. In a normalized database, data is stored about an *ORDER* in one relation, data about a *CUSTOMER* in a second relation, and data

about the *ORDER LINE*(s) in yet a third relation. The operation typically used to bring the data into a single table to prepare an output, such as an *INVOICE,* is known as a join. A *join* is an operation that combines two relations by matching rows based on values in columns in the two tables. The matching relationship is usually primary key to foreign key.

In theory, a join looks for rows with matching values between two tables and creates a new row in a result table every time it finds a match. In practice, however, performing a join involves manipulating more data than the simple combination of the two tables being joined would suggest. Joins of large tables (those of more than a few hundred rows) can significantly slow down the performance of a DBMS.

PLUG-IN SUMMARY

A database management system, or DBMS, is considered a basic component of data   processing. The main advantage of using a DBMS is to enforce a logical and structured organization of the data. Additionally, using a DBMS provides a central store of data that can be accessed by multiple users, from multiple locations. Data can be shared among multiple applications, instead of new iterations of the same data being reproduced and stored in new files for every new application.

The principal type of database used is a relational DBMS. Designing a database requires both a logical and physical design. The organization's data model should reflect its key business processes and decision-making requirements. Entity relationship diagrams and normalization are processes used to design a relational database.

MAKING BUSINESS DECISIONS

1. SportTech Events

SportTech Events puts on athletic events for local high school athletes. The company needs a database designed to keep track of the sponsor for the event and where the event is located. Each event needs a description, date, and cost. Separate costs are negotiated for each event. The company would also like to have a list of potential sponsors that includes each sponsor's contact information such as the name, phone number, and address. Each event will have a single sponsor, but a particular sponsor may sponsor more than one event. Each location will need an ID, contact person, and phone number. A particular event will use only one location, but a location may be used for multiple events. SportTech asks you to create an ERD from the information described above, and then create a normalization structure in 3NF.

2. Course and Student Schedules

Dick Scudder, the chairperson of the information technology department at the University of Denver, needs to create a database to keep track of all the courses offered by the department. In addition, Dick would like the database to include each instructor's basic contact information, such as ID number, name, office location, and phone number. Currently, Dick has nine instructors (seven full-time faculty members and two adjuncts) in the department.

For each course, Dick would like to keep track of the course ID, title, and number of credit hours. When courses are offered, the section of the course receives an ID number, and with that number, the department keeps track of which instructor is teaching the course.

Finally, Dick needs to be able to keep track of the IT students and to know which courses each student has taken. The information he would like to know about each student includes ID number, name, and phone number. He also needs to know what grade the student receives in each course.

Dick has asked you to create an ERD from the information described above, and then create a normalization structure in 3NF.

3. **Foothills Athletics**

Foothills Athletics is an athletic facility offering services in the greater Highlands Ranch, Colorado, area. All property owners living in Highlands Ranch are members of the Recreation Function of the Highlands Ranch Community Association (HRCA). Foothills Athletics consists of a recreation facility where residents have the opportunity to participate in athletic activities, enroll their children in day camp or preschool, or participate in an HRCA program.

Personnel: Foothills Athletics has a number of employees, primarily fitness course instructors and administrative personnel (e.g., billing clerks, equipment managers, etc.). Records are kept on each employee, past and present, detailing employee name, address, phone number, date of hire, position, and status as either a current or former employee. Employees are assigned a unique four-digit Employee ID number when they are hired.

Members: When joining the Foothills Athletic center, individuals are assigned a unique four-digit Member ID number. This information along with their name, address, phone number, gender, birth date, and date of membership are recorded. At the time of enrollment, each member decides on one of three available membership types along with a fixed membership fee: Platinum ($400), Gold ($300), and Silver ($200). This is a one-time fee

that establishes a lifetime membership.

Facilities and Equipment: Foothills Athletics has a variety of facilities and equipment choices. Each facility has a unique room number and a size limitation associated with it. Some of the rooms contain pieces of exercise equipment; all have a serial number (provided by its manufacturer) that is used for inventory purposes. In addition, for each piece of equipment, purchase date and the date of its last maintenance are recorded. Each piece of equipment belongs to a specific equipment type, such as stair master machine, and is assigned a unique three-digit identification number. The description, the manufacturer's model number, and the recommended maintenance interval for that model of equipment are also kept on file. Each equipment type is associated with a single manufacturer that is referenced by a unique two-digit manufacturer ID number. Additional information maintained on each manufacturer is the company name, address, and phone number.

The Task: You have been hired to assist Foothills Athletics with creating a database structure that will incorporate all the features and business rules mentioned above. You should start out developing an ERD and then proceed to create a normalization structure in 3NF.

4. **On-the-Vine Vineyard**

On-the-Vine Vineyard, Inc., is one of California's largest winemaking facilities in Sonoma Valley, striving to make both a visit to the vineyard and the wine tasting an unforgettable experience. On-the-Vine is a small, family-owned winery, specializing in limited production of premium quality Chardonnay, Sauvignon Blanc, Merlot, Syrah, Zinfandel, Sangiovese, Viognier, and Cabernet.

The Employees: On-the-Vine currently employs over 12 full-time employees, with positions ranging from administrative assistant to winemaker. Among the employees, supervisors have been appointed to manage the work of other employees. Each supervised employee reports to only one supervisor. Each employee, upon employment, is assigned a unique employee identification number. In addition to the employee's name, position, and identification number, the company also records each employee's Social Security number, address, phone number, and emergency contact.

The Vineyard: The grounds of On-the-Vine Vineyard include the Estate house with an award-winning rose garden, winery, and two vineyard plots of 40 acres each in separate locations. Each vineyard is managed by a single employee and is referred to by its own unique name, Sonoma Cellar and Sonoma Barrel. No employee manages more than one vineyard. Each vineyard is dedicated to the growing of a single grape variety per year.

As mentioned above, On-the-Vine Vineyard currently grows eight different grape varieties:

1. Chardonnay

2. Sauvignon Blanc

3. Merlot

4. Syrah

5. Zinfandel

6. Sangiovese

7. Viognier

8. Cabernet

The Winery: Each wine produced is given a unique identification number in addition to its name. Other information recorded for each wine is its vintage year, category (e.g., dry red, dessert, etc.), and percent alcohol, which is a legal requirement. Also recorded is the employee in charge of making that wine. Winemakers may be responsible for more than one wine at a time.

The composition of a wine may be entirely from a single grape variety or may be a blend of more than one variety. Several of the grape varieties are used in more than one blended wine.

The Customers: On-the-Vine customers are mainly restaurants and wine shops, but the winery also sells to individuals via the Internet. All customers are assigned a unique customer identification number, and this number is recorded along with their address and phone number. Individual customers also have their first name, last name, and date of birth, in order to demonstrate legal age, recorded. Restaurants and wine shops have their company name and tax identification number recorded.

All customers obtain their products by placing orders directly with On-the-Vine. Each order is assigned a unique order number, and the date the order is received, the product or products ordered, and the quantity or quantities desired are all recorded at the same time. A shipment status of "pending" is assigned to an order until it is actually shipped, whereupon the status is then changed to "shipped."

The Task: You have been hired to assist On-the-Vine Vineyard with creating a database structure that will incorporate all the features and business rules mentioned above. You should start out developing an ERD and then proceed to create a normalization structure in 3NF.

Basic Skills and Tools Using Access

LEARNING OUTCOMES

1. Describe the primary functions using Microsoft Access.

2. Describe the steps for creating a new database file using Microsoft Access.

3. Describe the steps for creating and modifying a table and fields using Microsoft Access.

4. Describe the steps for creating relationships between tables using Microsoft Access.

Introduction to Access

Microsoft Access is a powerful database program that allows you to enter and organize large amounts of data. Because Access allows you to relate tables and databases to one another, it is often referred to as a *relational database*. Plug-In T5, "Designing Database Applications," explains relational databases and their structures in detail.

This plug-in introduces the basics of creating a database using Microsoft Access. It is designed to show you the essentials, along with a few added-value features, to get you off to a good start using the program. However, you should review the CD, *MISource*, which accompanies this text for additional material, animated tutorials, and simulated practice files that go beyond what we cover in the text. Figure T6.1 displays all the tasks and lessons that are provided on the MISource CD.

In brief, a relational database is a group of tables related to one another by common fields. A *table* (or datasheet) looks similar to a spreadsheet. Each *row* in the table contains all the data for a single *record*. Each *column* in the table represents a specific data value called a *field*. All records have the same fields. For example, a table called *EMPLOYEE* might include fields for *Employee ID*, *Last Name*, *First Name*, *Address*, *City*, *State*, and *ZIP Code*. Another table called *TIME SHEET* might have fields for *Time sheet Number*, *Employee ID*, *Week*, *Hours Worked*, and *Rate of Pay*. The two tables are related by the *Employee ID* field, so the database can generate reports combining information from the two tables. Figure T6.2 displays this relationship.

Access comes with templates for common database categories, including project planning, employee time sheets,

expense reporting, and inventory management.

FIGURE T6.1

MISource Access Lessons

MISource CD Microsoft Access Lessons

Introduction to Access

- Introduction to Access 2003

- Opening an existing database

- Creating a new blank database

- Using the database wizard

- Using table views using form views

   using report views

- Using navigation controls in tables

- Using navigation controls in forms

- Changing datasheet column widths

- Changing the look of a datasheet

- Hiding and unhiding columns in a

   datasheet

Defining Relationships

- Using the relationships window

- Enforcing referential integrity

Creating and Modifying Tables

- Creating a table with the table design

   wizard

- Creating a table using data entry

- Creating a table in design view

- Setting the primary key

- Changing data types

- Saving the table

- Using the input mask wizard

- Adding a lookup field to a table

   using the lookup wizard

Producing Reports

- Using the report wizard

- Using autoreports

- Modifying the report design

- Changing margins and page

   orientation for reports

- Adding controls to the report

- Adding a calculated control to a report

   section

- Previewing and printing a report

- Modifying field properties in design view

- Using the format property

Creating and Modifying Queries

- Using the simple query wizard

- Reordering columns in the select query

  datasheet

- Creating a select query in design view

- Adding selection criteria to a select query

- Sorting data in a select query

- Adding a calculated field to a query

- Using the expression builder

- Using aggregate functions to calculate

  totals in queries

- Using aggregate values in calculated fields

- Formatting results displayed in a

  calculated field

- Using the crosstab query wizard

- Using the find duplicates query wizard

- Using the find unmatched query wizard

Creating and Modifying Forms

- Creating a form using the form wizard

- Creating and saving auto forms

- Modifying the properties of a form

- Modifying specific controls on a form

- Aligning controls in a form

- Adding form headers and footers

- Adding page headers and footers

Viewing and Organizing Information

Integrating with Other Applications

- Importing objects from another

  database

- Importing data from Excel

- Importing data from Outlook

- Exporting data from a table or query

- Using the page wizard to create a data

  Access page

Managing Databases

- Identifying object dependencies

- Printing database objects and data

- Backing up a database

- Using compact and repair

to a form

- Entering records into a table

- Entering records using a form

- Editing records in a table

- Deleting records in a table

- Using find and replace

- Using undo

- Sorting records in a datasheet

- Filtering by selection

- Filtering by form

An Access database includes more than just data. In addition to tables, an Access database file contains several different types of database objects:

- Saved queries for retrieving and organizing data.

- Forms for entering and displaying data on screen.

- Reports for printing table data or the results of   queries.

FIGURE T6.2

Database Relationship Example

This plug-in focuses on creating an Access database file, in addition to building tables, fields, attributes and relationships. Plug-In T7, "Problem Solving Using Access," concentrates on building queries, and Plug-In T8, "Decision Making Using Access." spotlights forms and reports.

CREATING A NEW BLANK DATABASE

To start a new database using Microsoft Access, click the **Blank Database** option in the New File task pane. The first thing you do is name your database. In Access, the database file cannot be moved to another disk or folder using the *Save As* command, so be sure to save the database to the preferred location when you start. (You can always move the database later using Windows Explorer.)

To create a blank database, follow these steps:

1. If the New File task pane (illustrated in Figure T6.3) is not visible, show it by clicking the **New** toolbar button, selecting **File**, **New**, or pressing **Ctrl + N**.

2. Click the **Blank Database** command in the New area of the New File task pane.

3. Select a location to save the file and enter **Slopeside Bikes** for the database file name in the File New Database dialog box.

4. Access will save the new, blank database in the specified database file (which will have the .mdb extension), and it will open the Database window within the main Access window.

FIGURE T6.3

Create a New Blank Database

OPENING AN EXISTING DATABASE

When you start Access, the task pane lists the most recently opened databases. To open a database that is not listed in the task pane, use the Open command. To open a database (refer to Figure T6.4):

1. Click the **Open** toolbar button.

2. If necessary, from the *Look-in:* drop-down list, select the drive or location where the database is stored.

3. If necessary, open the appropriate folder.

4. Double-click the name of the database to open it, or click the **name** of the database once to highlight it, then click the **Open** button.

FIGURE T6.4

Open Existing Database File

USING THE DATABASE WIZARD

Access includes a variety of templates to help you get started with some of the most common types of databases.

Templates include databases to manage contacts, expenses, and inventory. Once you select a template, the Wizard will ask you a series of questions about your data to tailor the template to your specific needs. When the Wizard is finished, you will have an empty database structure into which you can enter data. Here is an overview on how to create a new database using the Database Wizard (refer to Figure T6.5):

1. Click the **On my computer...** link in the Templates section of the New File task pane.

2. If necessary, click the **Databases tab**.

3. Click an **icon** to select a template, then click **OK**.

4. Type a **file name** for your database.

5. Read each screen carefully. Click **Next** to go to the next step.

6. The first step will present you with a list of tables that will be in your database. Some tables have optional fields. To add a field, click the **check box** in front of the field name. If you change your mind and want to remove a field from your database, click the check box to remove the checkmark.

7. Next, you will select a **graphic style** for screen display and **another style** for printed reports.

8. Finally, you will give the database a **title** and build the database.

FIGURE T6.5

Create a New Blank Database Using a Template

USING THE DATABASE WINDOW AND OBJECT VIEWS

Whenever a database is open, Access displays the Database window (shown in Figure T6.6), which serves as the central location for working with the database objects (tables, queries, forms, reports, etc.) in the opened database.

The following are among the important ways to work with database objects using the Database window:

■ *To work with a particular type of database object,* click the corresponding button in the left column of the Database window—Tables, Queries, Forms, Reports, Pages, and so on.

■ *To view a database object,* select it and then click the **Open** button in the Database window, or just double-click the object.

■ *To change the design of a database object,* select it and click the **Design View** button.

■ *To create a new database object* of the type currently displayed in the Database window, click the **New** button to open the New Object dialog box (New Table, New Query, New Form, New Report, or New Data Access page). The New Object dialog box will display a list of all the ways to create a new database object (the list varies according to the type of object that is being created).

■ *To make a copy of a database object,* **right-click** it and choose **Copy** from the shortcut menu. Then right-click a blank spot in the Database window and choose Paste from the shortcut menu.

■ *To rename a database object,* select it and **press F2**.

■ *To delete a database object,* select it and press the **Delete key** or click the **Delete button** in the Database window.

■ *To close the current database,* together with the Database window, click the **Close button** in the upper-right corner of the window.

FIGURE T6.6

Access Database Window

Using Table Views

You can open database objects in different views, depending on what you want to do. *Datasheet view* is the view to use when entering data (See Figure T6.7). Use *Design view* when you want to change the structure or properties of the table. To open a table from the Database window:

1. In the Database window, click **Tables** on the Objects bar to display your list of tables.

2. To automatically open a table in Datasheet View, double-click the **name** of the table. This is the Datasheet view where you can enter data in the table.

3. To change to Design view, click the **View** button on the toolbar (refer to Figure T6.7). In Design view, you can add or remove fields or change field properties.

4. To switch back to Datasheet view, click the **View** button again.

Creating and Modifying Tables

Access gives you several different ways to create tables:

■ Create a table with the Table Design Wizard.

■ Create a table using data entry.

■ Create a table in Design view.

CREATING A TABLE WITH THE TABLE DESIGN WIZARD

Beginning a new database can be daunting. To make it easier, Access offers a wide variety of sample tables. Rather than creating your first table from scratch, try using the Table Design Wizard.

FIGURE T6.7

Datasheet View

To create a table using the Table Design Wizard (see Figure T6.8):

1. Double-click **Create table by using wizard** in the Tables window.

2. Select the **type of table** you need: business or personal.

3. Select the **Sample Table** that best fits your needs.

4. Select the **fields** from the sample that you want to include in your table.

5. Give your Table a meaningful **name**, such as **CUSTOMER**.

6. Allow Access to set the **Primary Key**.

7. Select what you want to do next: modify the table design, enter data in Datasheet view, or create a data entry form based on the table you just created.

8. Click the **Finish** button to end the wizard and finalize your table.

FIGURE T6.8

Create a Table By Using Wizard

CREATING A TABLE USING DATA ENTRY

Sometimes you need to create a very simple table. In this case, the data entry method might be easiest. A new table created with the data entry method appears as a plain datasheet. Fields are named Field1, Field2, Field3, etc., until you rename them. To create a table using the data entry method (refer to Figure T6.9):

FIGURE T6.9

Create a Table By Entering Data

1. If necessary, click **Tables** in the Objects bar.

2. Double-click **Create table by entering data**.

3. The new table appears and is ready for data entry.

4. Rename the fields that you are going to use by double-clicking the **column name** (Field1, Field2, etc.) and typing the new **name** (First Name, Last Name, etc.).

Creating a Table in Design View

Sometimes the Table Design Wizard does not offer a sample that fits your needs. In this case, you might want to design your table using Design view. In this next step, you will be using the Slopeside Bikes database that you created in the "Creating a New Blank Database" section to use for many of the remaining steps in this plug-in. To create a table using Design view, follow these steps:

1. In the left column of the Database window, make sure that the **Tables** object is selected.

2. Click **Design** on the Database dialog box.

3. Create fields for the following (see Figure T6.10):

    a.   Field Name = BikeID, Data Type = Number, Field Size = Long Integer, and make

the BikeID the Primary Key

b.   Field Name = Description, Data Type = Text, Field Size = 25, Required = Yes

c.   Field Name = CostPerHour, Data Type = Currency, Required = Yes

Note: Designate a primary key. The *primary key* consists of one or more fields that Access can use to uniquely identify the records contained within the table. A table must have a primary key if it is on the "one" side of a one-to-many relationship, as explained in Plug-In T5.

FIGURE T6.10

Bike Table

When a single field is designated as the primary key, the field's *Indexed* property is automatically set to *Yes (No Duplicates)*. This setting cannot be changed. When data in a record are entered or modified, Access will not allow a primary key field to be left blank.

To designate a field, or a group of fields, as the primary key, select the field or fields in the field list and choose **Edit**, **Primary Key** or click the **Primary Key button** on the toolbar. Access will mark the primary key field(s) with a key icon, as shown in Figure T6.11. To remove the primary key designation from a field, select it and choose the Primary Key command or click the Primary Key toolbar button again.

4. **Close** the Table dialog box, and click **Yes** to Save the changes. Enter **BIKE** as the Table name.

5. Create fields for each entry in Figure T6.12, using field sizes and descriptions as appropriate. Remember to set the **primary key** and that the **Required** property is set to **Yes** as appropriate.

6. **Close** the Table dialog box, and click **Yes** to Save the changes. Enter **CUSTOMER** as the Table name.

7. Create fields for each entry in Figure T6.13, using field sizes and descriptions as appropriate. Since there are three primary keys in this scenario (each acts as a composite key comprised as one primary key), make sure all three (*Drivers License*, *Date*, and *Bike ID*) are selected by holding down the **CTRL** key when clicking each field, then select the **Primary Key** button on the toolbar.

8. **Close** the Tables dialog box, and click **Yes** to Save the changes. Enter **RENTAL** for the Table name.

FIGURE T6.11

Setting the Primary Key

FIGURE T6.12

Customer Table

FIGURE T6.13

Rental Table

CHANGING DATA TYPES

By default, the data type for a new field is text. You can change the data type to number, AutoNumber, Date/Time, Currency, or one of the other options available. Specifying the appropriate data type for a field is crucial to designing a useful database. For example, you cannot run calculations on a field with the text field type, and you cannot sort a date field efficiently unless you use the date/time field type.

Carefully consider the type of data you will include in each field before you decide on the data type. To change the data type for a field:

1. **Open** the table in Design view.

2. Click the **data type** for the field that you want to change.

3. Click the **drop-down** arrow to see the list of available data types.

4. Select the appropriate **data type** for your data (see Figure T6.14).

USING THE INPUT MASK WIZARD

To ensure that users enter data in a particular format, use the *Input Mask* property. Rather than typing the mask format yourself, Access has a wizard that offers samples of the most common data formats. To use the Input Mask Wizard (see Figure T6.15):

1. Open the **CUSTOMER** table in Design view.

2. Click the **Telephone** field.

3. Click the **Input Mask** box in the Field Properties pane.

Data Types

Text	Any field that does not fit criteria for one of the other data types. This includes not only text, but also formatted numbers like ZIP codes and phone numbers.
Memo	Text descriptions longer than 255 characters.
Number	Quantities; values that will have mathematical calculations performed on them.
Date/Time	Dates and times. There are a variety of date and time formats to choose from. Although you can enter dates and times as text data types, you must use the date/time data type if you want to sort the values.

| **Currency** | Money amounts. Choose from a variety of currency formats. You can perform mathematical calculations on currency values. |

Currency   Money amounts. Choose from a variety of currency formats. You can perform mathematical calculations on currency values.

AutoNumber   Primary Keys or other ID fields.

Yes/No   Fields to which there is only a yes or no response.

OLE Object   Pictures or other graphics. Links to other files such as Word or Excel documents.

Hyperlink   E-mail or Web site addresses.

Lookup Wizard...   Limits the data in the field to values in a list (either from another table or from a list that you create).

FIGURE T6.14

Data Types

4. Click the **Input Mask Wizard** build button (the **...** ellipse button).

5. If you need to save the table, Access will prompt you to do so now.

6. Select the **Phone Number** under the Input Mask column.

7. Click the **Next** button to continue.

8. In this step, you can modify the input mask or change the placeholder character. To change the placeholder character, click the **drop-down** arrow and select the **character** you want. You can test the new format by typing in the *Try It:* box.

9. Finally, choose how you want to store the data. Click the **With the symbols in the mask, like this:** radio button

FIGURE T6.15

Input Mask Wizard

10.   Click **Next** to go to the last step.

11.   Click **Finish** to complete the input mask.

USING THE FORMAT PROPERTY

Use the format property to ensure that data are entered in a consistent format. You can choose from predefined formats or design your own. To select a predefined format or enter a custom text format (see Figure T6.16):

1. Open the **BIKE** table in Design view.

2. Click the **Cost Per Hour** field.

3. Click the Format **drop-down arrow** to display the list of predefined formats. Refer back to Figure T6.14 for a list of the data formats.

4. Select the **Currency** format.

5. Close the BIKE table window.

Note: You can include Autotext in your custom text formats. For example, if you are entering apartment numbers, you could use the format "Apt. " @-@. Entering the value B1 will display Apt. B-1. Placing quotation marks around "Apt. " tells Access that this is a text string that should be included automatically in each data entry. Notice the space inside the quotation marks to ensure that a space will display between "Apt." and the apartment number. Using this text format will save data entry time. Figure T6.17 displays the different data formats used in Access.

Defining Relationships

Remember that Access is a relational database. Objects in your database are related to one another through relationships defined by common fields between tables. There are three types of relationships: one-to-many, one-to-one, and many-to-many.

One-to-many relationships are the most common. In a one-to-many relationship, the primary table contains a primary key field that is included as a field (as a foreign key) in the secondary table. Thus, one record in the first table can relate to many records in the second table.

When these fields have the same names, Access automatically creates the one-to-many relationship for you. However, the fields may have different names. In those cases, you may want to manually create the relationship using the Relationships window.

FIGURE T6.16

Format Property

FIGURE T6.17

Data Formats

Text Formats

| < | Forces text to lowercase. | Type: Leash, Extra Long Display: leash, extra long |
| > | Forces text to uppercase. | Type: ca |

Display: CA

@   Requires character entry or   Example: Use for a text field that   space.   must always have the same number of characters (like a Social Security number)   @@@-@@-@@@@.

@;none   Controls what value is shown.   Displays value entered; if no value entered, displays "none."

Number/Currency Formats

General Number   Displays the number as entered. Example: 24000

Currency   Uses the currency format specified in your Windows Regional Settings, including the comma separator and currency symbol. Example: $24,000.00

Euro   Uses the standard currency format with the euro symbol.   Example: €24,000.00

Fixed   Uses the number format specified in your Windows Regional Settings. Displays at least one digit. Example: 24000.00

Standard   Uses the number format specified in your Windows Regional Settings, including the comma thousands separator. Example: 24,000.00

Percent   Multiplies the value by 100 and adds % symbol.   Enter: .03   Displays 3%

Scientific   Converts the number to scientific notation.   Example: 24E+3

USING THE RELATIONSHIPS WINDOW

To define relationships between tables follow these steps:

1. Open the Relationships window by choosing **Tools**, **Relationships** or, if the Database window is active, by clicking the **Relationships** button on the toolbar (refer to Figure T6.18).

2. The Show Table dialog box appears. Select each table listed (i.e., **BIKE**, **CUSTOMER,** and **RENTAL**) and click the **Add** button, then click the **Close** button.

3. To define a new relationship, click and drag the **Bike ID** from the **BIKE** table and drop it on the **Bike ID** in the **RENTAL** table. Click the **Create** button in the Edit Relationships dialog box that Access shows (see Figure T6.19). Make sure the Table names and field names are the correct ones being linked. Select the **Enforce Referential Integrity** box (refer to Figure T6.19). Note that related fields do not need to have the same name, only the same data type (although it is best to give the same name to clarify the relationship).

FIGURE T6.18

Data Formats

FIGURE T6.19

Edit Relationships Dialog Box

   a. To change the features of a relationship, double-click the relationship's line in the Relationships window.

   b. To delete a relationship, click the line to select it and then press the **Delete** key.

4. Complete the diagram with the Relationships shown in Figure T6.20.

5. Close the Relationships window, and **Save** the layout.

   Notice the change to the relationship line. The "1" indicates the "one" table in the one-to-many relationship. The "infinity symbol" indicates the "many" table. When these symbols appear, you know that the relationship has referential integrity enforced.

FIGURE T6.20

Completed Relationships Window

PLUG-IN SUMMARY

Most organizations maintain and manage large amounts of information. One of the most efficient information management computer-based applications is Microsoft Access. Access provides a powerful set of tools for creating and maintaining a relational database. A few of the basic modules that most users utilize when working with Access are building tables and relationships.

MAKING BUSINESS DECISIONS

1. WasteNot Recycling

   WasteNot Recycling picks up recyclables from homeowners in Boulder, Colorado. Neighborhoods subscribe to the service so that pickup is cost-effective. WasteNot provides special containers to subscribers for sorting recyclables: a blue container for paper products and a purple container for aluminum, plastic, and glass products.

   Subscribers place their recycling containers on the curb for biweekly pickup. Each recycling container is weighed before being emptied. WasteNot drivers carry handheld recording devices used to track each pickup. Subscribers receive quarterly profit-sharing checks based on their contributions. If WasteNot does not make a profit, subscribers are not paid for their recyclables. If WasteNot makes a profit, subscribers share in that profit. WasteNot has asked you to help develop a relational database that will effectively track subscribers using the

data downloaded from the drivers' devices. WasteNot has provided you with a snapshot of two tables you need to create. The CUSTOMER table listed below will hold static customer information such as name, address, and phone. The CUSTOMER RECORD table holds data about each recyclable pickup.

Specifically, WasteNot needs you to:

Customer Table

Customer Name	Last Name	First Street	City	State	Code	ZIP Phone	Pickup	First	ID	Name
1 05/25/2004	Wagoner	Sam	5480 Alpine Street	Boulder	CO	80308	(303)			161-5545
2 05/25/2004	Calahan	Eliza	2140 Edgewood Avenue	Boulder	CO	80308	(303)			886-6003
3 08/25/2005 4499	Lake	James	701 Eastman Road	Boulder	CO	80308	(303)			562-
4 02/28/2004 36460	Meadows	Sara	Pond Hill Drive	Boulder	CO	80308	(303)			792-
20 06/02/2004 7111	Smith	Alto	114 Lexington Street	Boulder	CO	80308	(303)			838-
64 07/17/2005 4847	Monarch	Shiela	431 Phillips Lane	Boulder	CO	80308	(303)			352-
65 05/19/2005 6731	Guo	Amy	1935 Snow Avenue	Boulder	CO	80308	(303)			555-
80 12/28/2004	Rivera	Juan	482 Weston Avenue	Boulder	CO	80308	(303)			815-

2456

85   Williams   Max   230 Southpark   Boulder   CO   80308   (303)   333-

07/19/2003   Circle

0000

Customer Record Table

Customer IDSrvc Date	Weight Paper	Weight Other
1 11/22/2006	8	15
1 10/15/2006	32	85
1 11/7/2006	12	43
2 11/7/2006	19	0
2 11/22/2006	28	174
3 10/15/2006	5	8
3 11/22/2006	16	32
3 12/4/2006	7	12
20 10/15/2006	18	40
20 11/22/2006	35	60
80 10/15/2006	10	10
80 11/7/2006	9	13
80 11/22/2006	16	18
80 12/4/2006	18	21

1. Create a Microsoft Access database.

2. Create the tables, fields, data types, and primary key(s) for the database.

3. Populate the database with the data provided above.

4. Create the relationship(s) needed between the tables.

2. **It's A Grind Coffee Shop**

It's A Grind Coffee Shop is an Oakland, California, neighborhood coffee shop. Besides serving gourmet coffee,

It's A Grind dishes up sandwiches and desserts. Local bands, Internet connections, and floor-to-ceiling books on

every wall provide entertainment. Kate Fitzgerald, the proprietor, has decided that a database would be helpful in

the acquisition of new books. Although customers rarely buy books, they do disappear or fall apart from use. Kate needs a way to keep track of what books she has so that she does not pick up duplicates. She has hired you to help design a database to keep track of the books. To assist with the design, Kate has provided you with some data in an Excel spreadsheet, **T6_ItsAGrindCoffee_Data.xls**. The spreadsheet is not normalized; Kate asks you to assist with that before you start to create the database.

Specifically, Kate wants you to:

1. Create a Microsoft Access database.

2. Create the tables, fields, data types, and primary key(s) for the database using the structure provided in the **T6_ItsAGrindCoffee_Data.xls** file.

3. Populate the database with the data provided in the **T6_ItsAGrindCoffee_Data.xls** file.

4. Create the relationship(s) needed between the tables.

3. **Academic Software**

Launched in 2005 in Boston, Massachusetts, Academic Software has consistently been the fastest-growing, education-focused software retailer in North America. It is committed exclusively to academic customers, offering thousands of full-version software titles at great discounts. Academic Software has partnered with the top technology manufacturers, including Adobe, Microsoft, Sibelius, Sony Media Software, and Wacom, to bring excellent service and prices, which are available only to students, schools, and teachers.

From the very beginning, Academic Software has relied heavily on technology to ensure a positive shopping experience for its customers. The company's philosophy is simple: Hire amazing people, give them the best tools, and help them deliver an unbeatable customer experience.

One facet of Academic Software's business that needs assistance is its database organization. You have been asked to assist Academic Software with creating a relational database structure for organizing software, vendors, and academic categories. Currently this information is stored in an Excel spreadsheet, **T6_AcademicSoftware_Data.xls**, which Academic Software has provided to you.

Specifically, you are asked to:

1. Create a Microsoft Access database.

2. Create the tables, fields, data types, and primary key(s) for the database using the structure provided in the **T6_AcademicSoftware_Data.xls** file.

3. Populate the database with the data provided in the **T6_AcademicSoftware_Data.xls** file.

4. Create the relationship(s) needed between the tables.

4. **On-Campus Health**

On-Campus Health is the infirmary located on the campus of the University of Denver. Recordkeeping at the infirmary's pharmacy, although meticulous and professional, is inefficient. Maintaining the recordkeeping using mostly manual systems is becoming more costly as additional people are hired to meet stricter industry regulations regarding the Health Insurance Portability and Accountability Act (HIPAA) and because of state regulations that affect the sale, storage, and dispensing of prescription drugs. Although Campus Health succeeded in automating some of the data management for the pharmacy in an Excel spreadsheet, a more substantial change is needed to properly maintain and store data.

Students who use the infirmary can request prescriptions, either by presenting a written order from a doctor or asking for a refill of an existing prescription. The pharmacist adds this request to the system by getting the required information to fill it, including information about the drug, the student's name, the student's health plan, and the prescribing doctor. Use the data that Campus Health has provided you in the file **T6_CampusHeath_Data.xls** to complete the following:

1. Create a Microsoft Access database.

2. Create the tables, fields, data types, primary key(s), and the like for the database.

3. Populate the database with the data.

4. Create the relationship(s) needed between the tables.

Problem Solving Using Access

LEARNING OUTCOMES

1. Describe the process of using the Simple Query Wizard using Access.

2. Describe the process of using the Design view for creating a query using Access.

3. Describe the process of adding a calculated field to a query using Access.

4. Describe the process of using aggregate functions to calculate totals in queries using Access.

5. Describe how to format results displayed in calculated fields using Access.

Introduction

A *query* is a tool for extracting, combining, and displaying data from one or more tables, according to criteria you specify. For example, in a book inventory database, you could create a query to view a list of all hardcover books with more than 500 pages that you purchased in the past five months. In a query, you can sort information, summarize data (display totals, averages, counts, and so on), display the results of calculations on data, and choose exactly which fields are shown. You can view the results of a query in a tabular format, or you can view the query's data through a form or on a report (which is covered in Plug-In T8, "Decision Making Using Access"). In this plug-in, you will learn how to use the Query Wizard and Query-By-Example (QBE) tool to solve problems using Microsoft Access.

Creating Simple Queries

Use the Simple Query Wizard to create a select query. A *select query* displays data from a table or tables, based on the fields that you select, but it does not sort or filter the data. For example, if you owned a Bicycle shop and wanted a list of customer names that rented bikes, use a simple query that shows fields from a CUSTOMER table.

To create a query using the Simple Query Wizard:

1. Open the file **T7_SlopesideBikes_Data.mdb** from the data file that accompanies this text.

2. Click **Queries** in the Objects bar to open the Queries window.

3. Double-click **Create query by using wizard**.

FIGURE T7.1

Create Query By Using Wizard

4. Click the **Tables/Queries box** drop-down arrow. Click **Table: CUSTOMER** (refer to Figure T7.1).

5. Add all the **fields** by clicking on the **right double arrow button**.

6. Click **Next**.

7. Make sure that the radio button **Detail** is selected and click **Next**.

8. Type **Customer Query** as the Query title.

9. Click **Finish** to view the query in Datasheet view (refer to Figure T7.2).

10. Close the query (it will automatically be saved).

By modifying the query in Design view, you can specify that the query display only records that meet certain criteria or that the query display records in a specific order.

Note: Keep in mind that a query database object stores only the query definition—field names, data selection criteria, sorting orders, grouping information, and so on. It does not store the actual data that it displays; that data is stored only in the database tables. Consequently, every time you run a particular query, it shows the current state of the data stored in the database tables.

REORDERING COLUMNS IN THE SELECT QUERY DATASHEET

If you use the Simple Query Wizard, the query datasheet displays fields in the order you added them. You can reorder columns by clicking and dragging.

To reorder columns (refer to Figure T7.3):

1. Open the **Customer Query** by double-clicking on it from the objects list.

2. Click the **First Name** field selector and **drag** to the **left** one column (e.g., First Name is to the left of Last Name).

3. Notice the black column border line that appears to the left of the selected column. As you move your mouse across the screen, the column border line will move with it.

4. Close and **Save** the query.

Note: You can select adjacent columns by clicking a field selector and dragging the mouse across other field selectors.

FIGURE T7.2

Query in Datasheet View

FIGURE T7.3

Query in Datasheet View

CREATING A SELECT QUERY IN DESIGN VIEW

You do not have to use the Simple Query Wizard to create select queries; you can create a new select query in Design view (which can be referred to as a Query-By-Example, or QBE, tool).

To create a select query in Design view (refer to Figure T7.4):

1. In the Queries window, double-click **Create query in Design view**.

2. Click the name of the **BIKE** table. Click the **Add** button.

3. Click the **Close** button to continue.

4. Double-click the **Bike ID** field. You can also click the name and drag it to the design grid.

5. Double-click the **Description** field.

6. Run the query by clicking the **Run** button (or select Run from the Query menu) (see Figure T7.5).

7. Close and **Save** the query as **Bike List.**

Note: If you want to include all the fields from a table in your query, click and drag the asterisk (*) to the field row. Notice that rather than listing each field from the table separately, there is only one field called table. The * character represents a wild card. Rather than look for specific field names, the query will look for all the fields in that table. Therefore, if you later add or delete fields, you will not need to change the query design.

You can add tables to the field list by clicking the toolbar button or selecting Show Table from the Query menu.

FIGURE T7.4

Query in Design View

ADDING SELECTION CRITERIA TO A SELECT QUERY

Although a select query displays only the fields you select, by default, it will show all of the records. By modifying the select query in Design view, you can refine the query so that it shows only records that meet specific criteria. You can also hide fields so they do not display in Datasheet view.

FIGURE T7.5

Run Query in Design View

   To specify criteria for a select query:

1. Open the **Bike List** query.

2. In Design view, double-click the **Cost Per Hour** field.

3. Click in the **Criteria** cell under the **Cost Per Hour** field and type in **<15** (refer to Figure T7.6).

4. **Run** the query.

5. **Close** and **Save** the query as **Bikes Under $15.**

   If you need to hide a query field in Datasheet view:

1. In Design view, click the **Show** box to remove the checkmark for the field you want to hide.

2. **Run** the query.

Note: Criteria expressions are not case sensitive.

SORTING DATA IN A SELECT QUERY

You can control how records appear in Query datasheet view by using the sort feature.

FIGURE T7.6

Criteria for a Select Query

   To modify the select query to sort records:

1. Open the **Bikes Under $15** query that you created in the previous section.

2. In Design view, click **Sort** under the **Description** field.

3. Click the **drop-down arrow** and select **Ascending**.

4. **Run** the query.

5. **Close** and **Save** the query as **Sorted Bikes Under $15**.

   If you want to sort the results of a select query while in Datasheet view:

1. Click in the **field** that you want to sort on.

2. Click the **Sort Ascending** or **Sort Descending** toolbar button.

Note: If two fields have the sort option selected, Access will sort first by the field that appears to the farthest left.

Advanced Queries

Database fields generally display the data that are entered into them. However, a calculated field will automatically

figure its value based on values in other fields. Queries often include calculated fields that display values based on other values returned by the query.

To enter formulas in calculated fields, follow these steps:

1. In the Queries window, double-click **Create query in Design view**.

2. Click the name of the **BIKE**, **CUSTOMER**, and **RENTAL** tables (hold down the CTRL key to select each one). Click the **Add** button.

3. Click the **Close** button to continue.

4. Double-click the **Last Name** and **First Name** fields from the **CUSTOMER** table, double-click the **Date** field from the **RENTAL** table, and double-click the **Description** field from the **BIKE** table.

5. To add a **new calculated field**, click inside the field row of a blank column, and type **Rental Amount:**. This is the name of an anonymous field (this is actually a variable name to hold the value of the calculated field).

6. Now you will enter the expression to be calculated. Type in **([Time In]-[Time Out])*24*[Cost Per Hour]** (refer to Figure T7.7). **Note:** When referring to a field name, enclose the name in brackets. You can use standard mathematical operator symbols like * (multiplication), / (division), + (addition), - (subtraction), and ^ (exponentiation).

7. Click on the **Show** check box under the Rental Amount column.

8. **Run** the query to see the results of the calculated field.

9. **Close** and **Save** the query as **Rental Amount.**

Note: When using a calculated field to combine text fields, you usually want to hide the text fields that are being combined and show only the new calculated field.

USING THE EXPRESSION BUILDER

You do not always have to type your calculated field expressions. The *Expression Builder* lets you construct expressions with just a few clicks of the mouse. It even has a built-in checker, so you will know right away if you have made a mistake.

FIGURE T7.7

Expression to Be Calculated

To create a calculated field with the Expression Builder:

1. In the Queries window, double-click **Create query in Design view**.

2. Click the name of the **BIKE**, **CUSTOMER**, and **RENTAL** table (hold down the CTRL key to select each one). Click the **Add** button.

3. Click the **Close** button to continue.

4. Double-click the **Last Name** and **First Name** fields from the **CUSTOMER** table, double-click the **Date** field from the **RENTAL** table, and double-click the **Description** field from the **BIKE** table.

5. Click the **Build** toolbar button, refer to Figure T7.5 (or right-click and select **Build...** from the shortcut menu).

6. Click the **(** button, and then double-click the **Tables** folder on the left side of the Expression Builder window.

7. Double-click the **Rental** folder. In the middle pane, double-click on **Time In**, click on the **–** button, double-click on **Time Out**, then double-click the **)** button.

8. Refer to Figure T7.8 and continue to build the expression.

9. Click **OK** to add the expression to your query.

10. **Run** the query to see the results of the calculated field.

11. **Close** and **Save** the query as **Rental Amount 2.**

FIGURE T7.8

Query Expression Builder

When you create a new calculated field, by default, Access will set the Show option to off. Be sure to check the Show check box, or your new field will not show when you run the query.

When you create a calculated field with the Expression Builder, Access will automatically name the field "Expr1." Rename the field by clicking in the field name box and typing the name you want. Be sure not to delete the colon after the name; Access needs this to know that this is a calculated field.

USING AGGREGATE FUNCTIONS TO CALCULATE TOTALS IN QUERIES

Access includes a group of powerful built-in commands known as aggregate (or total) functions. Using *aggregate functions*, you can easily calculate totals for groups of records returned by the query specifications. Aggregate functions can calculate the sum, minimum, maximum, average, count, variance, and standard deviation. In the Query Design window, you should include a field to group by as well as the field that contains the values needed for the calculation. The values of aggregate calculations are not stored in the table; instead, Access recalculates the

totals each time the query is run.

To use aggregate functions in queries:

1. In the Queries window, double-click **Create query in Design view**.

2. Click the name of the **BIKE** table and click the **Add** button.

3. Click the **Close** button to continue.

4. Double-click the **Description** and **Cost Per Hour** fields.

5. Click the **Totals** button (the Sigma icon on the menu bar) to add the total row to the query grid (refer to Figure T7.9).

6. Click in the total row for the **Description**. Click the **arrow** and select **Group By**.

7. Click in the total row for the **Cost Per Hour** cell. Click the **arrow** and select the **Avg** function (refer to Figure T7.9).

8. Click the **Run** button.

9. Notice that the query does not return individual records. Instead, there is one row for each unique value in the Group by field. Each row shows the calculated total for that group of records (refer to Figure T7.10).

10. **Close** and **Save** the query as **Bike Average Cost Per Hour.**

Note: Queries with aggregate calculations are often used to form the basis for strategic analysis or statistical reports.

FIGURE T7.9

Calculate Totals in a Query

FORMATTING RESULTS DISPLAYED IN A CALCULATED FIELD

You can specify the format for calculated field results by changing the format property. To use the format property for calculated fields:

1. Open the **Rental Amount** query in Design view.

2. **Right-click** in the **Rental Amount** calculated field.

3. Click **Properties...** from the shortcut menu.

4. Click in the **Format** box.

5. Click the **drop-down arrow**.

6. Scroll down and click the **Currency** format.

7. Close the Field Properties dialog box by clicking the **close box** in the upper right corner.

8. Click the **Run** button.

9. Close the **Save** the query.

FIGURE T7.10

Calculate Totals for a Group

FIGURE T7.11

Query Type Option

Note: Be careful that you are viewing the field properties and not the query properties. If the field does not have the Show check box checked, you will open the Query Properties dialog instead of the Field Properties dialog.

CREATING AND RUNNING QUERIES TO MODIFY DATA

So far, this plug-in has described one major type of query: the select query. Four additional types of queries, which are known as action queries, can actually change your data:

1. A make-table query.

2. An append query.

3. A delete query.

4. An update query.

To use action queries:

1. Create a **New** query in Design view

2. Select the **BIKE** table and click **Add**. **Close** the Show Table Dialog box.

3. Double-click the **Cost Per Hour** field to add it to the query grid.

4. Convert the query to an action query by choosing the **Query Type** button on the tool bar (refer to Figure T7.11)—Make-Table Query, Update Query, Append Query, or Delete Query. Select **Update Query**.

5. Notice that you now have another line on the query grid called "Update To."

6. Click inside the **Update To:** row and type in **[Cost Per Hour] +.50** (this will add 50 cents to each cost per hour).

7. Run the query. You will first get a warning message, as shown in Figure T7.12. Click **Yes**.

8. Close and **Save** the query as **Update Query**.

Note: Make-Table, Append, and Delete queries work the same way as the Update Query example above. Before

running any of the queries, make a backup copy of your database. These queries can permanently modify your database, possibly removing a large amount of data.

FIGURE T7.12

Query Type Warning

PLUG-IN SUMMARY

A *query* is a tool for extracting, combining, and displaying data from one or more tables, according to criteria you specify. You can use the Query Wizard or Query-By-Example tool to select specific data from a table or tables. You can sort the rows of a query by a particular field, hide a particular field, enter a value to search on, summarize information, and even perform modify data using a query.

MAKING BUSINESS DECISIONS

1. ProSwing Analysis

Carol Redden had been a part-time tennis instructor for several years. Frustrated with the tennis equipment available in the market, she started her own company. With the aid of her attorneys and investors, she founded ProSwing to design tennis equipment and apparel.

Carol developed a strong product line and was becoming successful in the United States, but she was having trouble with the firm's international marketing strategy. Carol thought that the most effective way to advertise was by getting players to use and wear her products. She wanted to be sure that the players using her line were the players followed by the fans (her target market). She knew that this would bring ProSwing attention from tennis players around the world. She decided to concentrate on the tennis players with the highest current winnings, since they were likely to be very popular and visible to the fans. She would approach the top 25 international men and women players about using ProSwing products. She would then additionally advertise during tennis matches in the four countries most represented by the top players in order to represent both the men and women top players.

Carol prepared a database after finding recent sport statistics on the Web and compiled data on the top players. Included in the database are the player's name, country of residence, most recent winnings, and gender. Carol needs your help to organize the data to plan her international strategy. She has provided you with the database file **T7_ProSwing_Data.mdb** in order to complete the following:

1. Create a query that will sort the player data in descending order by winnings. Save the query as **Player**

Winnings Query.

2. Create a query that will sort the data in ascending order by Country Name and then in descending order by winnings within each country. Change the order of the columns so that Country is the first column, followed by Winnings, and then Player. Save the query as **Country Winnings Query**.

3. Create a query that will total the winnings for each country. Use the Country Name for the criteria and sort the winnings in descending order. Save the query as **Total Winnings for Country Query**.

2. WasteNot Recycling

WasteNot Recycling is an organization that picks up recyclables from homeowners in Boulder, Colorado, as introduced in Plug-In T6. The *CUSTOMER* table holds static customer information such as name, address, and phone. The *CUSTOMERRECORD* table holds data about each recyclable pickup. Enough test data has been added to each table to test queries (use the **T7_WasteNotRecycling_Data.mdb** file associated with this text).

The owners of WasteNot Recycling have asked you to assist with creating several queries. Specifically they need the following information:

1. Create a query using the *CUSTOMER* data that will select records for customers who had their first pickup in May 2004. Sort the records by customer's last name. Save the query as **May Pickup Query**.

2. Create a query on *CUSTOMERRECORD* to determine the total weights of paper and other products each customer has had picked up. Use the CUSTOMER Last Name and First Name in the query. Save the query as **Customer Weight Query**.

3. Create a query using the name, street, address, and weight fields from the *CUSTOMERDETAIL* table. Enter the criteria that will select customers with less than 10 pounds in either recyclable field. Save the query as **Low Volume Query**.

3. Scale Classic Cars

Johnny Krol runs a body shop that specializes in restoring classic cars. Johnny owns three classics and began collecting scale models when his wife put her foot down and said no to building more garage space for his cars.

Although Johnny frequently used the Internet and e-mail, he had never considered starting an e-business. The Scale Classics Web site began as a technology class project for Johnny's son J.J., who created a basic text and graphics informational site. Johnny liked the site, but wanted a complex site dedicated to the serious collector. He envisioned a storefront, auction house, and collector's forums and had been unable to find such a site in his

online searches. Johnny hired a local consultant to build the site, found a processing house to manage orders and payments, and began shipping scale models from the body shop.

The storefront is largely for American classic cars, which come in 1/18, 1/24, l/43, and 1/64 scale. Popular foreign cars are also available. Johnny has hired you to create some business analysis queries; specifically he wants you to:

1. Use the **T7_ClassicCars_Data.mdb** database.

2. Create a query to select any record with "coupe" in the model name. Include the Make and Model in the query. Save the query as **Coupe Query**.

3. Create a query to select the models that cost less than $35. The query should display the Car ID, Make, Model, and Price fields and sort the result from the highest to the lowest price. Save the query as **Less Than $35 Query**.

4. Create a query listing classic cars grouped by their make. The query should display only the Make Model, and Price fields. Sort by the model and calculate the average price for each make. Save the query as **Cars By Model Query**.

4. **BookFinder.com**

BookFinder.com is an open marketplace for books online, a one-stop e-commerce search engine where you can search through more than 100 million new, used, rare, and out-of-print books for sale.

The site is produced by a team of high-tech librarians and programmers, working since 2004 to connect readers with the books they are looking for. They are part of their own audience; members of the BookFinder.com team are heavy readers, and buy several dozen books every year using BookFinder.com. They also blog about their work, connecting readers and booksellers from around the world, and supporting public access to a strong, diverse, bookselling industry.

BookFinder.com was first developed in 2004 by then-19-year-old University of Denver undergraduate Charles Cook (as a personal Web site). Over the years, the site has grown to become one of the best online resources for book-related e-commerce, as evidenced by the great feedback received from users and the press. Whether customers collect rare books or buy cheap paperbacks to read, BookFinder.com is an unbiased marketplace and search engine.

Charles needs help developing some custom queries for his sales and marketing team members. He has

provided you with a sample data file, **T7_BookFinder_Data.mdb**. Specifically, what Charles needs is:

1. A query of all authors who have written a book that costs more than $10 and is a novel. The query needs to have the author's first name, last name, title of book, price, and category displayed. Save the query as **Authors Query**.

2. A query that calculates a 15 percent increase in the purchase price of each book. Format the calculated field with the currency format. Sort the query on the new calculated field. Save the query as **Book Prices Query**.

3. A query that displays the minimum price of all the books. Save the query as **Min Book Price Query**.

4. A query that updates the price of each book by subtracting 50 cents. Save the query as **Less 50 Cents Query**.

Decision Making Using Access

LEARNING OUTCOMES

1. Describe the steps for creating a form using the Form Wizard using Access.

2. Describe the steps for creating and saving AutoForms using Access.

3. Describe the steps to modify the properties of a form using Access.

4. Describe the steps for creating a report using the Report Wizard using Access.

5. Describe the steps to modify the properties of a report using Access.

Introduction

This plug-in focuses on the two functions of decision making using Access: creating forms and creating reports. A *form* is nothing more than a graphical representation of a table. You can add, update, and delete records in your table by using a form. Although a form can be named different from a table, they both still manipulate the same information and the same data. Hence, if you change a record in a form, it will be changed in the table as well.

A form is useful when you have numerous fields in a table. This way you can see all the fields in one screen, whereas if you were in the table view (datasheet) you would have to keep scrolling to get the field you desire.

A *report* is an effective way to present your data in a printed format. Because you have control over the size and appearance of everything on a report, you can display the information the way you want to see it.

Forms

An Access form is a window, similar to a dialog box, that contains a set of controls (such as labels, text boxes, and check boxes) to view, enter, or edit database information, typically one record at a time.

In a form, data are obtained directly from one or more tables or data that have been extracted using a query. Although it is possible to directly enter and edit the information in tables in Datasheet view, a database usually includes a set of forms, which can make entering and editing data considerably easier and can limit the fields that can be viewed or modified.

CREATING A FORM USING THE FORM WIZARD

Forms allow you to enter data one record at a time. Often, it is easier to enter data in a well-designed form rather than in a wide datasheet. You can create a form that has fields from more than one table or query. Like other wizards, the Form Wizard walks you step-by-step through the process of creating a form.

FIGURE T8.1

Create a Form by Using Wizard

To create a form using the Form Wizard:

1. Open the file **T8_SlopesideBikes_Data.mbd** from the data file that accompanies this text.

2. Double-click **Create form by using wizard**.

3. Click the Tables/Queries drop-down arrow and select **Table: BIKE**.

4. Add all BIKE fields by clicking on the **double right arrow**. Click **Next** to go to the next step.

5. Select the **Columnar** form layout. Click **Next**.

6. Select the **Standard** graphic style. Click **Next**.

7. Type in **BIKE Title** for a form title.

8. Click **Finish** to open the form and begin entering data (see Figure T8.1).

Accessing Several Tables or Queries in a Form

When you select the fields for your form in the first Form Wizard dialog box, you can add fields from several tables or queries. To add fields from each table or query, select it in the Tables/Queries drop-down list and then use the buttons to move the fields you want to the Selected Fields list.

If you add fields from several forms or queries, the wizard will display one or two additional dialog boxes that weren't shown in the previous section: one dialog box in which you specify the form or query by which you want to view your data (for example, if you selected fields from the CUSTOMER and the BIKE tables, you would choose to view your data either "by Customer" or "by Bike") and possibly another dialog box in which you select a layout for a subform. The choices you make determine the form's record source.

If your form includes fields from two tables that are related in a one-to-many relationship and if you selected to view your data by the primary table, the wizard will let you display the records from the related table in a subform contained within the form. As an alternative, the wizard will let you set up a linked form, which is a separate form

that displays the related data and which you open by clicking a button on the main form.

On the other hand, if you chose to view your data by the related table in the one-to-many relationship, when the form displays a record in the related table, it will simply display the unique matching fields from the primary table along with the fields from the current record in the related table.

A form that accesses data from several tables or queries can be complex to design from scratch or to modify. However, if you create the form using the Form Wizard, almost everything is set up for you.

CREATING AND SAVING AUTOFORMS

The AutoForm Wizard is the quickest and easiest way to create a form. There are five types of AutoForms: (1) Columnar, (2) Tabular, (3) Datasheet, (4) PivotTable, and (5) PivotChart. The Columnar Form is the default format.

FIGURE T8.2

Create a Form by Using AutoForm

To use the AutoForm Wizard to create a Columnar Form:

1. Display the Tables window.

2. Select the **CUSTOMER** table.

3. Click the **New Object:AutoForm** toolbar button (refer to Figure T8.2). (If the New Object toolbar button is not in the AutoForm state, click the New Object arrow and select AutoForm.)

4. Access automatically creates a Columnar Form based on the CUSTOMER table you selected.

5. **Close** the form by clicking the Close box in the upper-right corner.

6. Access will automatically prompt you to save the form. Save the form as **Customer**.

Note: Notice that the *New Object* toolbar button changes. The button will change to reflect the most recent object type.

MODIFYING THE PROPERTIES OF A FORM

Once you have created a form using one of the wizards, you can still change the way the form looks and functions. The AutoFormat button allows you to change the form's graphic style. Opening the Properties dialog allows you to change other form properties.

Here is a description on how to modify the properties of a form:

1. With the form open in Design view, use the **AutoFormat** toolbar button to change the graphic style of the form

(refer to Figure T8.3).

2. To change other form properties, open the Properties dialog box by clicking the **Properties** toolbar button (refer to Figure T8.3).

3. Make sure that you are viewing the properties for the form by looking at the box at the top of the dialog.

4. Scroll through the list of properties.

5. Click the **box** next to the property that you want to change. Some properties have a drop-down list with specific choices. For other properties, you enter a specific value.

6. When you have made the changes you want, **close** the Properties dialog box by clicking the Close box in the upper-right corner.

7. Click on the **View** button to switch to **Form View** to see the changes you have made (refer to Figure T8.3).

MODIFYING SPECIFIC CONTROLS ON A FORM

Not all controls on your form may be of equal importance. You may want to modify the look of a specific control to make it stand out, or you may want to modify the control behavior. When designing forms, be careful not to over-design. Too many different colors, styles, or behaviors can distract from accurate data entry.

To modify the properties of a specific control (refer to Figure T8.3):

1. Open **BIKE form** in Design view.

2. Since the BIKE form you created using the wizard did not include a title for the form, you should create one.

3. Select all the objects on the form by pressing **CTRL + A**. Use your **down arrow** key to move the selected objects down enough for you to enter a form title label.

4. Using the **Toolbar options**, select the **Label** tool. Notice that the pointer changes to a plus (+) sign.

5. Click and drag a rectangular box at the top of the form. Type **SLOPESIDE BIKE FORM** inside the label box.

6. Select **Properties** from the shortcut menu.

7. Click the **Format** tab if necessary.

8. Click the **Font Weight** property, and select **Bold** in the drop-down list.

9. Click the **Text Align** property, and select **Center** in the drop-down list. **Note:** Some properties have a drop-down list with specific choices. For other properties, you enter a specific value.

10. **Close** the Properties dialog box by clicking the Close box in the upper-right corner.

FIGURE T8.3

Modify Form Properties and Controls

11. Switch to **Form View** to see the changes you have made.

12. Close and **Save** the form.

Note: Common properties to modify are the use of scroll bars and growing or shrinking the size of the control based on data the user enters. If you turn off scroll bars, users can only see the data that fits within the specific control dimensions. If you turn on *Can Grow* or *Can Shrink*, the control area will grow and/or shrink to fit the data.

Many formatting options are available from the shortcut menu (selecting a control, then right mouse click). You can change the background color, font color, and which special effect is applied to the control.

ALIGNING CONTROLS IN A FORM

To give your form a professional look, make sure that controls are aligned evenly. You can use the form rulers or display the form grid to give you visual guidelines. Rather than trying to manually align controls, use the Access alignment tools. You can select multiple controls and then align them by the left side, right side, top, or bottom.

To align controls in a form:

1. Open the **CUSTOMER** form.

2. Show the form grid by selecting **Grid** from the **View** menu.

3. Show the rules by selecting **Ruler** from the **View** menu.

4. Select all the **label controls** to the left of the text boxes.

5. Select **Align** from the **Format** menu. Select the **Right** alignment (refer to Figure T8.4).

6. Switch to **Form View** to see the changes you have made.

7. Close and **Save** the form.

Note: Use left or right alignment for controls that are in the same column. Use top or bottom alignment for controls that are in the same row.

FIGURE T8.4

Modify Form Properties

If you specify an alignment that would cause controls to overlap, Access will place the edges of the controls right next to each other, but will not overlap them.

Reports

Reports are used primarily for printing selected database information. A report labels, groups, sorts, and summarizes the data it presents. Like a form, a report can display data directly from one or more tables or it can display the results of a query.

USING THE REPORT WIZARD

Like other wizards, the Report Wizard walks you step-by-step through the process of creating a report. Unlike forms, which are designed for on-screen data entry, reports are designed for print.

To create a report using the Report Wizard:

1. In the Reports window, double-click **Create report by using wizard**.

2. Click the Tables/Queries drop-down arrow. Select the **CUSTOMER** table and select all the fields except the *Drivers License*, *Telephone,* and *Credit Card No*. Then select the **RENTAL** table and select the **Date** field. Lastly, select the **BIKE** table and select the **Description** field.

3. Click **Next** to go to the next step. **Note:** If you selected fields from more than one table or query in the previous step, the second Report Wizard dialog box asks you to choose one table or query that will be used for grouping the information in the report, if possible.

4. The next wizard asks how you want to view the report. Double-click **BIKE**. Click **Next**.

5. Make **Date** the Grouping. (**Note:** Use a grouping level to organize the data into subgroups by the value of a specific field.) Click **Next**.

6. Next, specify **State** as the data sort. Click **Next**.

7. Select the **Stepped** report layout and **Landscape** orientation. Click **Next**.

8. Select the **Bold** graphic style for the report. Click **Next**.

9. Type in **Customer Rental by State Report** for the title and select **View the report**.

10. Click **Finish**. Figure T8.5 displays the results.

MODIFYING THE REPORT DESIGN

Once you create a report, you can modify the report's design to make it more visually attractive. As with forms, be careful not to overdesign your report. A poorly designed report can distract from the information being presented. To modify the design, you must have the report open in Design view.

To modify the report design:

1. Preview the report first. Double-click the **Customer Rental by State Report**. Notice that the Description name is truncated and the State column needs to be moved to the right.

2. Switch to **Design view** by clicking the **View** button.

3. Click the **Description** control under the Bike_Id header section, and then **drag** the sizing **right handle** to increase the width of the control box (this will allow more characters to be visible in the report). You can also select **Size** from the **Format** menu. Select **To Fit** to automatically resize the label or control to fit your data.

FIGURE T8.5

View Report

4. Select the **State** column heading and the **State** control (to select both, hold down the Shift key when selecting) and move to the **right** a few spaces using the **right arrow** key. Do not worry if some of the controls overlap.

5. Switch back to **Preview** mode to see the effects of your changes. Figure T8.6 displays the modified report.

FIGURE T8.6

Modified Report Properties

Note: Change the graphic style of the report by clicking the AutoFormat toolbar button. The AutoFormat style list is the same list of styles that you choose from when creating a report using the Report Wizard.

CHANGING MARGINS AND PAGE ORIENTATION FOR REPORTS

The default page orientation for a report is portrait. This means the height of the page is greater than the width. You may want to change this orientation to accommodate multiple columns of data so they fit on one page. Margins are the blank spaces at the top, bottom, left, and right of a report. By adjusting the page margins, you can control the number of records printed on each page. Use the dialog box to adjust margins and page orientation for your reports.

Here is a description on how to change the margins for a report:

1. Double-click the **report name** in the Reports window.

2. Click the **Setup** toolbar button.

3. The **Page Setup** dialog box opens with the Margins tab on top.

4. Change the values for the top, bottom, left, or right margin.

5. Click **OK**.

To change the page orientation for a report:

1. Double-click the **report name** in the Reports window.

2. In the Page Setup dialog box, click the **Page** tab.

3. Click the radio button for Portrait or Landscape orientation.

4. Click **OK**.

Note: When you print a report, Access prints the data along with all graphic elements associated with the report's AutoFormat. To print only the data and not the graphic elements of a report, select the Print Data Only check box on the Margins tab of the Page Setup dialog box.

PLUG-IN SUMMARY

T o have Microsoft Access create the form for you according to your specifications, select the Form Wizard option. The Form Wizard lets you choose the specific fields to include, which can belong to one or more tables or queries. To have Access quickly create a form that has a particular configuration (Columnar, Tabular, Datasheet, PivotTable, or PivotChart), based on the record source table or query you select in the drop-down list, select one of the five AutoForm options. Access will immediately create the form, including all fields from the record source and using default options without asking for your specifications.

To have Microsoft Access help you design a report, select the Report Wizard option. To use default settings to quickly create a report based on a single table or query, with a columnar or tabular layout, select the AutoReport: Columnar or the AutoReport: Tabular option. Either report will include all the fields belonging to the record source table or query that you select in the drop-down list at the bottom of the New Report dialog box.

MAKING BUSINESS DECISIONS

1. WasteNot Recycling

WasteNot Recycling, introduced in Plug-In T6 and reintroduced in T7, picks up recyclables from homeowners in Boulder, Colorado. The owners of WasteNot Recycling have asked you to assist with creating a form and several reports. They have provided you with an updated database file, **T8_WasteNotRecycling_Data.mdb**. Specifically they want you to do the following:

1. Create a form that will allow the owners to enter data into the CUSTOMER and the CUSTOMER RECORD tables. They have left the design (i.e., aesthetics) up to you. However, they have asked that you locate an appropriate graphic to include on the form. You will want to use the Internet to find such a graphic. Make

sure you align all the controls and adjust the size of all the controls to fit the data. Save the form as **Customers**.

2. Create a report that groups the records by customer. The report should include data on the customer first and last name, service date of pickup, weight of paper, and weight of other. The report should be sorted by customer last name. You will need to create a subtotal for the weights for each customer. Create a report title called **Customer Weights**.

2. It's A Grind Coffee Shop

It's A Grind Coffee Shop, introduced in Plug-In T6, is an Oakland, California, neighborhood coffee shop. Kate Fitzgerald, the proprietor, has decided that she needs a form and a few reports created to help her purchase new books for her coffee shop.

Kate has provided you with an updated database file, **T8_ItsAGrindCoffee_Data.mdb**.

Specifically, Kate wants you to:

1. Create a form that will allow Kate to add new books to the BOOK table. Kate has asked you to use a Columnar layout and the Sumi Painting style. Kate has given you her logo to add to the form, **ItsAGrindImage.jpg**. Position the logo in the top-left corner. Save the form as **Books.**

2. Create a report that groups the records by author. Include only the author from the AUTHOR table and book title, year, and condition from the BOOK table. Sort the report by book title. Create a title labeled Current Authors; center the title on the report. Set the label properties to 12 point, bold, italic. Save the report as **Books By Author**.

3. Create a report using the publisher name, book title, year, and author name. Group the report on publisher and sort on the year the book was published. Create a report title to say **Books By Publisher**. Align the columns evenly and use a professional looking font style and layout. Save the report as **Publishers**.

3. TechIT Seminars

TechIT Seminars is an organization of independent seminar facilitators who provide onsite technical training to large businesses around the world. The facilitators build curriculum that is marketed by TechIT. TechIT books the seminars, arranges facilities, enrolls participants, and collects the money. While the facilitators are not employees of TechIT, they provide the service that is marketed, and their skills and schedules need to be available to all TechIT offices. Deborah Wallbridge has been charged with tracking facilitators and their

classification. She has asked you to help develop a form and a few reports to assist in scheduling seminars.

1. Use the **T8_TechITSeminars_Data.mdb** file.

2. Create a data entry form for the FACILITATOR table. Set the form background color to a blue color (hue). Organize and align all controls for effective use and full data display. For the phone data, use the Phone input mask. Save the form as **Facilitators Form**.

3. Use the ENROLLMENT table to create a report listing the students currently enrolled in each seminar. The report field order is Seminar ID, Last Name, First Name, Phone Number, and Student Number. Adjust all controls to display all of their contents. Adjust the color and content of the column headings as shown in Figure T8.7. Align all controls. Add a gray line above and below the column headings. Use Sorting and Grouping to sort by Seminar ID, Last Name, and First Name. Place the report date, time, and Page XX of XX in the Page Footer. Format the date and time to long format. Save the report as **Students By Seminar Report**.

FIGURE T8.7

Students by Seminar Report

4. Scale Classic Cars

Johnny Krol, introduced in Plug-In T7, runs a body shop that specializes in restoring classic cars. Johnny owns three classics and began collecting scale models when his wife put her foot down and said no to building more garage space for his cars. Johnny has decided that he needs a form and a few reports created to help in identifying the buying habits of his customers. Johnny has provided you with an updated database file, **T8_ClassicCars_Data.mdb**.

Specifically, Johnny wants you to:

1. Create a form that will allow Johnny to enter new classic cars and update existing records. The form should use a Columnar format and the Sandstone style. Save the form as **Catalog**.

2. Create a report listing classic cars grouped by their make. The report should display all fields from the CATALOG table, sort by model name, and calculate the average price for each make. Use the Formal style. Save the report as **Cars By Model.**

Designing Web Pages

LEARNING OUTCOMES

1. Explain why Web design is not like print design.

2. List the basic steps involved in Web site development.

3. Describe several guidelines you can use to test your interface design.

4. Explain HTML.

5. Describe the two main groups of HTML tags.

6. List the basic fonts that all computers use.

7. Describe the basic Web graphic formats.

Introduction

As is the case with many innovations, the Web has gone through a period of extremes. At its inception, the Web was all about information. Visual design was accidental at best. Web pages were clumsily assembled, and Web sites were accumulations of hyperlinked documents lacking structure or coherence. Designers then took over and constructed attractive, eccentric, and often baffling containers for information. The Web became a better-looking place, but many users hit barriers of large graphics, complex layouts, and nonstandard coding. Every site was different, and each required users to relearn how to use the Web, because "real" designers could not be bound by standards or conventions. Instead, designers pushed the boundaries of HTML, using work-arounds and hacks to design on the cutting edge.

Today, Web design is seen much more as a craft than an art, where function takes precedence over form and content is king. Innovative designs using fancy navigational doodads are generally seen as an annoyance standing between the user and what he or she seeks. Large graphic eye candy, no matter how pleasing, is simply wasted bandwidth. Like 1960s architecture, much of yesterday's Web design now makes users wince and wonder how it could ever have been fashionable. Now, if you want to be a Web designer, you also need to be an information architect and usability engineer. Instead of constantly requiring users to relearn the Web, sites are beginning to look

more alike and to employ the same metaphors and conventions.

This plug-in introduces the functional aspects of Web design.

The World Wide Web

Like other Internet services, the World Wide Web is not a certain network, based on a certain computer. Instead, it is a way of organizing information so that any computer around the world that operates according to the rules can access it. The rules that specify how to access and transfer files over the Web are called HTTP, for *hypertext transfer protocol*.

FIGURE T9.1

HTTP Server, Web Browser, and Web Page Relationship

The Web was a breakthrough in many ways. Perhaps its most important feature, though, is its use of *hypertext*. Text and other content in a Web document can be made to link to any other document, anywhere in the world, that is saved on an HTTP server and connected to the Internet. An *HTTP server* is a computer that is responsible for accepting HTTP requests from clients, known as Web browsers, and serving them Web pages, which are usually HTML documents. Figure T9.1 displays the relationship between HTTP (or Web) server, Web browser, and Web page.

THE WEB IS MEDIA RICH

Anyone who has worked with personal computers in any kind of collaborative project knows that sharing files can be a headache. Too often, you may try to share a file with colleagues or friends, only to find that they are on a different kind of computer or they do not have the software needed to read it. How do developers on the Internet provide files that might be read by anyone, anywhere in the world?

The one sure way is to rely on pure text documents, with no formatting information. Or you could specify that everyone reading your files must get special software that reads the standard formats you will be using for your online documents. Or you could use formats that are commonly used on many different platforms and readable by many different kinds of software. Publishers on the World Wide Web depend on a combination of these three tactics.

The basic format for text published on the Web is *ASCII*, or plain text void of any formatting (such as underlining, bolding, and the like). Actually it is ASCII with a twist; the files contain certain "tags," referred to as

hypertext markup language, or HTML, that help them take on a bit of character when they are pulled up on the reader's screen. The scheme also depends on the reader having special software, called a browser, that is specially made to retrieve and display HTML files and other commonly used formats to help users navigate through the Web.

Any format that cannot be read by the browser, those belonging to particular applications or in a specific medium, such as video, that the browser does not support, can be read by software, called plug-ins, that launch alongside the browser to open those files.

THE WEB IS INTERACTIVE

Unlike material printed in a book or brochure, Web publications can respond to input by the user. A Web site's visitors can communicate with the site's creator and order products online. Sites can play an animation when a user's pointer rolls over an on-screen graphic. Users can ask for exactly the information they need, interacting with databases on the server that send back customized responses. Figure T9.2 displays a typical Web form.

FIGURE T9.2

Typical Web Form

WEB PAGES CAN BE DESIGNED

Thanks to HTML and its ability to support graphics and other media, the World Wide Web is the first service on the Internet that lends itself to any kind of graphic design. That, perhaps more than any other attribute, is what made it the first service on the Internet to grab the attention of the public, publishers, and businesses. Thanks to its use of hyperlinks for navigation, it presents an exciting design problem that challenges Web page creators to produce fluid and friendly interfaces, as well as attractive graphic design, to help visitors find, scan, and enjoy the material published there.

THE WEB IS NONLINEAR

The first thing to remember about your site on the Web is that visitors access each page by hypertext links from another page on your site or from anywhere else on the Web. You could lead the visitor through a controlled series of pages, but that is not what the Web is about; it is about letting the visitor choose his or her own path through the information. Your site will probably be just one among dozens the visitor will view in the space of several minutes. Visitors following a link from another site can land at any page on your site, may stay for just a few seconds, and then launch to another site.

In this context, you have to make each page represent what you are intending; after all, it might be the only one of your pages the visitor sees. Equally important, every page should entice the visitor to explore your site further, and make it easy to do so. How you accomplish this is wide open, of course; there is no single right way to do it. The challenge is finding the method that works best for the content you are presenting and the experience you want to invoke.

THE WEB HAS NO CONTROL

As mentioned earlier, most Web content is in the form of ASCII files, tagged with HTML. The *HTML tags*, which are simple codes placed between brackets within a file, label each element of the document, <P> for paragraph text or <H1> for a first-level heading, for example. The browser software interprets the codes and displays the document on screen accordingly.

On the Web, though, you have less control over how those codes are interpreted. Default specifications are programmed into the browser. For example, for paragraph text (marked with the HTML <P> tag), most browsers use 12-point Times with a line space above. First-level heads (marked <H1>) are displayed as 16-point Times with a space above and below.

However, you cannot count on the defaults because they can be changed by individual users. Users can pick another favorite font for their default face, and many users set a larger type size for easier reading. Readers can also turn off graphics for faster downloading. Pages also appear different depending on the browser they are viewed in. The three major browsers—Netscape Navigator, Microsoft Internet Explorer, and Mozilla Firefox—use similar settings for most, but not all, tags, and the settings may vary even between different releases of the same browser. Figure T9.3 displays the same Web page viewed in each browser, Netscape Navigator, Microsoft Internet Explorer, and Mozilla Firefox.

FIGURE T9.3

Netscape Navigator, Microsoft Internet Explorer, and Mozilla Firefox

Pages will look different on different platforms. For example, font type looks bigger on Windows machines than on Macintoshs. And the resolution of the user's monitor can make graphics and type appear larger or smaller. In addition, not all browsers are on personal computers. Web surfers can read pages on TVs, palmtop computers, smart phones, text-only devices, and Braille readers. Some of these issues will be discussed in the next section.

DESIGNING FOR THE UNKNOWN

The Web is a unique medium, forcing you to give up control over many things that print media has always allowed. Many elements, such as colors, fonts, and page layout, are determined by the user or the user's browser software.

There is no guarantee that people will see your pages the same way you design them on your screen. Much of Web design is about designing for the unknown; that is, unknown users, unknown browsers, unknown platforms, unknown monitor sizes, and so on.

Unknown Browsers

Hundreds of browsers are in use today. In fact, there are dozens of versions of Internet Explorer alone, once you count all the past releases, partial releases, and various platform versions of each.

These browsers may display the same page differently. This is due in part to built-in defaults for rendering fonts and form elements. Some browsers, such as Lynx, do not display graphics at all. Each browser has its own slight variation on how to interpret standard HTML tags in terms of fonts and sizes. In addition, some sets of tags work only in Netscape or only in Internet Explorer (they were created by each company to give their browsers a competitive edge). If you use these tags, users with a competing browser will not see your content the way you intended.

FIGURE T9.4

Web Page Viewed on PC and Macintosh

Browser difference has the most impact in the support of Web development technologies such as *Cascading Style Sheets*, or *CSS* (a method for advanced control of text and page formatting), and *DHTML* (a method for adding interactivity and motion to Web pages). While they tend not to be an issue in the latest browser versions, enough out-of-date browsers are still in use that your special effects may be missed by a certain percentage of your audience.

Similarly, it is impossible to know whether your users will have the browser plug-ins necessary to play multimedia files such as Flash, Windows Media, or QuickTime movies. If you design a Web page that requires a plug-in, be sure you make it easy for users to download a copy.

Unknown Platforms

Another variable that affects how users see your pages is the platform, or operating system, of their computers. Although most Web users have personal computers running some version of the Windows operating system,

significant portions view the Web from Macintosh computers and UNIX/Linux systems. Each operating system has its own characteristics and quirks that affect how your page will look and perform. Figure T9.4 displays an example of the same Web page viewed on a Windows machine and on a Macintosh.

For instance, Windows machines and Macintoshs have different ways of displaying type, leading to the same size type appearing much larger on Windows machines than on Macintosh machines. If you set the type on your Web page to be small on your Windows machine, it may be illegible for Macintosh users.

Form elements such as scrolling lists and pull-down menus take on the general appearance of the operating system, and therefore appear quite differently (and as different sizes), depending on the machine you view them from. The viewers' platforms also have an effect on the way they see colors. This will be discussed in more detail later in this plug-in.

In addition, there is usually a slight discrepancy between the functionality of browsers across different platforms. In general, browser and plug-in releases for the Macintosh lag behind the Windows versions. Although UNIX was the platform upon which the Web was built, it is often ignored by software developers eager to hit the dominant Windows market.

FIGURE T9.5

Different User Settings

Unknown User Preferences

At the heart of the original Web concept lies the belief that the end user should have ultimate control over the presentation of information. For that reason, browsers are built with features that enable users to set the default appearance of the pages they view. The users' settings will override yours, and there is not much you can do about it. Figure T9.5 shows how the same page might look for different users.

Users also might opt to turn off the graphics completely. There are still people who do this to alleviate the wait for bandwidth-hogging graphics over slow modem connections. Make sure your pages are at least functional with the graphics turned off. The Web page in Figure T9.6 becomes unusable with the graphics turned off because the navigation elements lose their labels.

FIGURE T9.6

Web Graphics Turned On or Off

Unknown Window Size and Monitor Resolution

When designing on the Web, you really have no idea how big your "page" will be. The available space, or what is sometimes called "screen real estate," is determined by the size of the browser window when the page is opened.

Web pages are also more fluid than print; they reflow to fill the available space. Although you may prefer the way your page looks when the window is just larger than the headline graphic, users can set the window as wide or narrow as they please. This is one of the most vexing aspects of Web design. Figure T9.7 shows how the elements on the page rewrap to fill the available space when a browser window is resized.

Because browser windows can only be opened as large as the monitors displaying them, standard monitor resolution (the total number of pixels available on the screen) is useful in anticipating the likely dimensions of your page. This is particularly true on Windows machines, since the browser window is typically optimized to fill the monitor.

For instance, one of the lowest standard monitor resolutions is 640x480 pixels. After you allow for the space that the browser and all its rows of buttons and scrollbars take up, that leaves a space as small as 623x278 pixels for your page. That is not very much space.

Other common pixel dimensions are 800x600, 1024x768, and 1280x1024 (although they do go even higher). At the highest resolutions, it is difficult to predict the browser window size because users are likely to resize the window smaller or open several pages at once. Most commercial Web sites today are designed to fit in an 800x600 resolution.

How do you cope with the unknown window size dilemma? One approach is to use a table to fix the dimensions of your content to a specific pixel width. That way, when the window is resized smaller, the elements do not shift, and users have a better chance of viewing the page as you intended.

However, this solution has its drawbacks. When the window is resized smaller than the contents of the page, the content outside the browser window is simply no longer visible without horizontal scrolling. Users with smaller monitors may not even know it is there.

FIGURE T9.7

Web Page Viewed with Different Size Windows

FIGURE T9.8

Web Page Viewed at Different Resolutions

Figure T9.8 shows a Web site that has been designed to fit a 1280x1024-pixel browser window. However, if the

page is viewed at 800x600, you have to scroll down or to the right to see the navigational elements. This is one of the problems of fixing Web pages to a particular width, especially if the width is larger than the lowest common denominator.

You might choose to tell your users how you would like them to size their screens. Every now and then (although not as often as in the early days of Web design), a friendly note will appear at the top of a Web page that says, "For optimal viewing of this site, please size your browser this wide," followed by a graphical bar of a certain width. The best you can do is hope that users will play along.

Another way to deal with unknown window size is to just accept it as the nature of the medium. It is possible to design for flexibility; good Web pages are functional and not seriously compromised by a certain amount of adjustments.

Unknown Connection Speed

Remember that a Web page is published over a network, and it will need to go zipping through the lines as little bundles of data before it reaches the end user. In most cases, the speed of that connection is a mystery. On the high end, folks with T1 connections, cable modems, ISDN, and other high-speed Internet access may be viewing your pages at a rate of up to 500 Kbps. On the other end of the scale are people dialing in with modems whose speed can range from 56 Kbps to as slow as 14.4 Kbps.

Many factors affect download times, including the speed of the server, the amount of traffic it is receiving when the Web page is requested, and the general congestion of the Internet lines.

Larger amounts of data will require more time to arrive. When you are counting on maintaining the interest of your readers, every millisecond counts. For this reason, it is wise to follow the golden rule of Web design: Keep your files as small as possible!

One of the worst culprits for hogging bandwidth is graphics files, so it is especially important that you spend time optimizing them for the Web. HTML files, although generally just a few kilobytes (KB) in size, can be optimized as well by removing redundant tags and extra spaces. Audio, video, and multimedia content consume lots of bandwidth. Unless you are designing specifically for high-bandwidth applications, assume the worst when it comes to connection speeds.

Unknown Colors

When you are publishing materials that will be viewed on computer monitors, you need to deal with the varying ways computers handle color. Monitors differ in the number of colors they are able to display. They typically display 24-bit (approximately 17 million colors), 16-bit (approximately 65,000 colors), or 8-bit color (256 colors).

A full-color photograph may contain many thousands of shades of blended colors to produce a smooth image, which is not a problem for 24- or 16-bit monitors. What happens to all those colors on an 8-bit monitor with only 256 available colors?

On 8-bit monitors, the image will be approximated out of the set of colors (called a palette) that the browser has on hand. Some colors from that full-color photo will shift to the nearest palette color. Others will be approximated by dithering. *Dithering* is the most common means of reducing the color range of images down to the 256 (or fewer) colors seen in 8-bit GIF images. Be aware that colors may behave differently depending on the monitor used to view them.

Unknown Fonts

Another aspect of Web design that you may find shocking is that you have virtually no control over the fonts used to display your content. The way text appears is a result of browser settings, platform, and user preferences.

Even though there are methods for specifying a font face (style sheets and the HTML <font> tag), the font will display only if it is already installed on the end user's machine. It is more like "suggesting" a font than controlling it. There is no guarantee your chosen font will be available. If it is not found on the user's computer, a default font will be used instead.

About the only thing you can be sure of is that you have two fonts to work with—a proportional font (such as Times or Helvetica) that is used for the majority of body text and headlines on a page, and a monospaced font (such as Courier) that is used for code or text tagged with the "preformatted" tag <pre>.

Technologies are available for embedding fonts into a file, but they are not supported by most browsers. This lack of control over fonts is something you have to get used to. The only way to absolutely control type is to put it in a graphic, but that has its drawbacks and is obviously not appropriate for the main body text on a site.

The Process of Web Design

The ideal Web design process should be flexible enough to accommodate a range of developments. This means a combination of a layered approach, which is where one task is commenced only on the completion of its

predecessor, and overlapping, an approach whereby tasks and functions are undertaken at the same time. This may sound confusing, but it is essential to incorporate a series of "layers" or milestones within a project where phases are completed before the next phase commences.

Web sites come in all shapes and sizes—from a single page about a favorite sport, to monstrous sites conducting business worldwide. Regardless of the scale and scope of your Web site, the development process involves the same basic steps:

1. Analyze and plan.

2. Create and organize content.

3. Develop the "look and feel."

4. Produce graphics and HTML documents.

5. Create a working prototype.

6. Test, test, test.

7. Upload to a Web server and test again.

8. Maintain.

ANALYZE AND PLAN

Before designing your Web site, you need to brainstorm and think about defining goals and purposes of the Web site. Here is a great starting point; ask yourself:

■ "I want to create a site in order to..."

■ Promote a product or service.

■ Tell customers about my company.

■ Tell a story.

■ Teach people a skill.

■ Entertain my audience.

■ Provide a unique resource on a topic.

  You will also want to ask:

■ "Who is my target audience?"

■ "Who will be using this site?"

■ "What will the users (audience) do when they visit my site?"

The structure of a Web site grows from the way you want visitors to, first, understand, and, second, get to the information you post there. This phase should define what information you want to have available, what interactions you want to offer, and your broader marketing goals: the ideas and impressions visitors to the site should take away with them. For example, if you want to create an online snowboarding shop you will want your customers to have access to a complete catalog of available snowboards (content), to be able to order snowboards on line (interaction), and to learn that you offer snowboards for every ability (marketing message). All three facets are key in planning any site. The site's final content and the way it presents itself to your users must achieve all these goals.

CREATE AND ORGANIZE CONTENT

The most important part of a Web site is its content. Despite the buzz about technologies and tools, content is still king on the Internet. There must be something of value, whether it is something to read or something to do, to draw visitors, and keep them coming back (sometimes referred to as stickiness).

Once you have content, or at least a very clear idea of what content you will have, the next step is to organize the content so it will be easily and intuitively accessible to your audience. In the business world, the information design may be handled by a specialist in information architecture. It might also be decided by a team made up of designers and the client. However, personal sites require attention to the division and organization of information. Create lists and sketchbooks. Organize your content by importance, timeliness, category, and so on. Decide what goes on the home page and what is divided into sections.

The result of the information design phase is usually a diagram (often called a site map) that reveals the overall "shape" of the site. Pages in diagrams are usually represented by rectangles; arrows indicate links between pages or sections of the site. A site map gives you a sense of the scale of the site and how sections are related, and aids in the navigation design. Figure T9.9 illustrates a site map.

There is still no topping pen and paper when it comes to starting and documenting the creative process. Before you dig into the HTML, hyperlinks, and images, there is no better way to hash out your ideas than on a notepad, or a napkin, or a whiteboard. Be as creative as you can.

FIGURE T9.9

Web Site Map

Structuring the Site

A Web site's pages are linked to one another, and to the rest of the Web, by a series of hyperlinks. Any page can link to any other anywhere in the world. Although you cannot control the path a Web user chooses to travel on the Web, it is your job to make the content of a site available and enticing to every visitor who finds his or her way there. That requires both a careful analysis of the content you are presenting, determining its main messages or components, and skills for helping visitors find and understand those messages. Doing this successfully combines the tasks of information architecture, the creation of a structure for the site's information, and interface design, the crafting of tools that help visitors navigate that structure and find information that will be of interest to them.

Allow for Change

The contents of a Web site will, or should, change constantly. Visitors should feel that your site will hold something new for them each time they visit, giving them a reason to return to the site again and again.

This factor affects the interface as well as the structural design of a site. You should think in terms of rules, or templates, for styling the content, thinking ahead to the uses to which each element might be put. That is not to say that new features cannot have their own individual design, but as with printed media, the site's graphic identity should remain constant while the specific content changes.

With the goals understood, the challenge becomes how to achieve those goals creatively and effectively using the technology of the Web. Despite everything mentioned previously in this plug-in about the Web's current limitations, it is potentially the most flexible of media. Using basic HTML tools, the Web can work like an encyclopedia (random-access reference information), a book (sequential pages), a magazine (graphically presented "departments"), or a promotional brochure (an unfolding "pitch"). Adding multimedia to the mix, it can mimic more familiar electronic media such as television (an active, animated presentation), a slide show (sequential, bite-size messages), or a computer game (mysterious clues). Interactive technologies, such as Shockwave, JavaScript, and Java, can turn a Web page into online software, providing real-time interaction and access to up-to-date, searchable information based on databases. There are countless ways to execute and combine such effects, so it is impossible to suggest specific rules for right and wrong ways to create a Web site's structure. At the same time, though, a few simple tests can help you gauge the effectiveness of your site plan. Ask yourself these questions:

1. **Have you created a logical structure that represents the view of the information you want to convey?** In most cases, a visitor to your home page should be able to see at a glance what information your site has to offer, a goal best achieved by determining and offering a limited set of content categories. Common wisdom and

cognitive psychology experts hold that the set should be limited to no more than seven basic groups, the number of separate items that most people can grasp at one time.

2. Does the content of each page represent a logical module of information? The hyperlinked structure of the Web counts on the ability of users to get straight to the information they need, from a variety of different starting points. The best way to achieve that is to limit each page to one topic. Keeping each module of information on its own page also makes updates easy; when the information needs updating, you change it in only one place.

3. Does the structure pass the three-click test? No important information should be more than three (mouse) clicks away from the home page and, if possible, no more than three clicks away from any page on the site. On the Web, remember, each click costs the visitor valuable time, so the information you want everyone to see, or the information most likely to be looked for, should be as close as possible to the top of the structure.

Navigation

With the basic site structure and content defined, you will want to make it easy for visitors to find the information they need on your site. On the Web, that means creating a system of hyperlinks that will allow visitors to move around the site efficiently.

You can count on a built-in set of navigation controls that are standard in Web browsers. These include bookmarks, history lists, and Forward and Back buttons. Users depend on the browser's controls for such functions, and you should not confuse the issue by duplicating them in your site's interface.

Creating site-specific navigation tools requires deciding which pages will be linked to what others. Part of this is ad hoc and logical. The other part is more systematic, coming up with a sitewide plan for putting as many pages as possible at the visitors' fingertips, no matter where they are on the site.

The simplest way to do this is to offer a link to the site's home page from every other page on the site; once users return there, they can find their way back down the hierarchy to any other piece of information on the site. A somewhat more powerful option is a navigation bar, a standard element that lists the site's main sections on every page, offering a deeper level of access with a single click (see Figure T9.10). For more complex sites, a site index or table of contents is a popular tool. In addition, particularly large sites often offer a search function that allows the visitor to look for occurrences of particular words or concepts anywhere on the site.

HTML frames let you divide the browser window into separate, independently scrollable regions, each holding a different HTML file. One popular use for frames is to isolate a site's navigation elements into their own frame,

which stays constantly on screen while pages requested by hyperlinks appear in other sections. You can even use frames to create a new window to hold your site's navigation tools.

DEVELOP THE LOOK AND FEEL

After the essential structure of the site is documented and you have decided how to provide access to its different levels, it is time to think about the interface—the way your site presents itself to the user. Interface design is responsible for creating a strong subjective impression as well as an easily understood overview of how the site works. Ideally, a strong interface seamlessly mixes navigational tools and the graphic identity that gives a Web site its character.

Site navigation was mentioned in the previous section; however, you need to be aware of some navigational design conventions already built into Web browsers. For example, visitors will work on the assumption that at every site they visit, text hyperlinks will look the same. Preferences for whether or not they are underlined and the color they are displayed in can often be set in each browser, but Web users know that blue-colored text that is underlined (and bold text on some nongraphics systems) signals a hyperlink. You need to respect that convention and refrain from coloring any text that is not a link. The flip side is that you can take advantage of that convention to identify links in graphics by showing them as colored text.

FIGURE T9.10

Navigation Bar

Another convention of graphical browsers is to have the pointer turn into a pointing hand when it passes over a hyperlink. You can count on that interface to tip off users that a graphic is "live." Any other clues about how to move around your own Web site, and reasons the visitor might want to, are up to the site's own user interface to convey. The art of interface design is to create an environment that includes the information users need in a quickly assimilated and attractive manner.

As with site architecture, interface design has too many possibilities to be subject to simple rules, yet you can test your ideas against a few guidelines. Ask yourself these questions:

1. **Does the interface convey a look and feel appropriate to your message?** Illustrations, metaphors, and layout should all be combined to convey the image you have named as a goal-friendly, sophisticated, businesslike Web site.

2. **Will the use of your site be obvious to first-time visitors?** A site's use will be more obvious to visitors if you

use familiar metaphors and conventions—a map for navigating a geographic area, a labeled door for entering a new area, a question mark icon indicating a help section, or a beveled interface indicating a clickable button. But there is room for originality. It is almost impossible to know whether what seems like a clear interface to you will be equally obvious to others. The only way to really find out whether your interface is working is with user testing; running tests with people who have never used or seen your site can tell you how likely it is that someone who has no history with the site and its development will understand your solutions. Testing will be discussed in more detail later in this plug-in.

3. **Are cues and feedback consistent?** Any interface has to be learned to some extent. Even when an interface uses only the most time-honored conventions, a visitor starts by testing his or her assumptions about how it will work. If a tool works as expected—if clicking an upward-pointing arrow takes you to the top of the page, for instance—the visitor learns a skill (getting to the top of a page), is encouraged to explore more, and learns to trust the interface. If on another page the upward-pointing arrow behaves differently, that trust is broken, the skill is unlearned, and the visitor is discouraged from exploring. A hallmark of a good interface is that it uses metaphor, location on screen, shape, color, sound, and every other cue consistently.

PRODUCE GRAPHICS AND HTML DOCUMENTS

Once the design is set and the content is ready to go, your site enters the production phase. You can use graphic tools, such as Adobe Photoshop or Macromedia Fireworks, to create all the graphics needed for your site. The content will be formatted into HTML documents by HTML editors, such as Microsoft FrontPage (see Figure T9.11) or Macromedia Dreamweaver, or you can write the HTML code by hand. Multimedia elements may also be produced and scripts and programs written. In short, all the elements of your site must be created in this phase.

One very important question to ask in the design phase is, "Does the design accommodate lowest-common denominator systems?" Web sites often depend on graphics to convey important navigation information and content, making the site unusable to visitors who do not have access to graphics. This is not to say that you cannot use graphical navigation systems on your site. It only means that you may sometimes need to provide alternate paths for text-only browsers, and you should take advantage of the methods for accommodating text-only systems that are built into HTML's image tags. Similarly, if your target audience includes users on low-bandwidth systems and older browsers, you should plan interface elements with minimum file sizes and avoid using Shockwave or other specialized media to execute your ideas.

CREATE A WORKING PROTOTYPE

At some point, all the pieces are brought together into a working prototype. This is not necessarily a distinct step; it is more likely to be an ongoing process as the HTML files and graphics are being produced.

Once the pages are viewed in a browser, it is necessary to tweak the HTML documents, graphics, and scripting until everything fits smoothly in place and works as intended.

TEST, TEST, TEST

Just because a page is working well on your machine does not mean it will look that way to everyone. As discussed in the beginning of this plug-in, your page will be viewed through seemingly infinite combinations of browsers, platforms, window sizes, and user settings.

For this reason, you need to test your pages under as many conditions as possible. Professional Web design firms build time and resources into the production schedule for rigorous testing. This phase is often called QA (short for "quality assurance"). Check that your site is in working order, that all the links work, and that the site performs appropriately on a wide variety of browsers and platforms. Try viewing your Web pages in the following situations:

- **On another browser**. If you developed your pages using Internet Explorer, open them in Netscape. Hang onto old versions of browsers so you can open the pages in a less technically advanced browser as well.

- **On a different kind of computer than the one on which you developed the pages**. You may need to visit a friend and use his or her computer. If you worked on a Windows machine, you may be surprised to see how your pages look on a Macintosh, and vice versa.

- **With the graphics turned off, and with a text-only browser, such as Lynx**. Is your page still functional?

- **With the browser window set to different widths and lengths (be sure to check the extremes)**. Try changing the resolution of your monitor to a lower setting.

- **With your monitor set to 8-bit color**. Are your graphics still clear?

- **Over a slow modem connection**. Chances are you have fast Internet access where you are working. Try using a dial-up modem to view your Web page.

User Testing

Another important type of testing is user testing. This process involves ordinary people interacting with your site and seeing how easily they can find information and complete tasks. User testing is generally conducted as early in the production process as possible so changes can be made to the final site.

An interface that seems perfectly clear to its designer may be extremely opaque to someone who has not been involved in its development, or to someone to whom the color red, or any other interface cue, simply has a different connotation. Since the success of a Web site depends on the ability of a wide variety of users to understand its clues, it is of prime importance that you understand just how a broad range of people react to the interface choices.

Anyone developing a very high profile site might find time spent testing designs with broad-based focus groups a worthwhile investment, but most projects, and most schedules, will not be able to afford such formal testing. However, you should be able to get time with friends, colleagues, and others who will not mind looking over prototypes at different stages of your Web site development. Extra feedback is bound to point out some issues you may have missed.

UPLOAD TO A WEB SERVER AND TEST AGAIN

Once you have a stable, reliable site, it is time to upload it to the final Web server and make it available to the world. You should do one final round of testing to make sure everything was transferred successfully and the pages function properly under the configuration of the final server. Check that the graphics appear and the links are working. This may seem like extra work, but if the reputation of your Web message is riding on the success of the Web site, attention to detail is essential.

MAINTAIN

Another aspect of Web site design to be considered is how it is going to be maintained. A Web site is never truly done; in fact, the ability to make updates and keep content current is one of the advantages of the Web medium.

Maintenance is an ongoing process that happens after the site is created. The refresh rate will likely affect the way you organize information and design the site.

You should also consider the life span of the site. If it is a site promoting a specific event, what happens to the site when the event is over? Even sites that are designed to be around a while will usually require a redesign after a few years to keep up with current technologies and changes in content requirements.

HTML Basics

HTML, the hypertext markup language, was introduced earlier in this plug-in. It was created along with the Web to provide a hyperlinked interface to the content of the Internet. However, to design for the Web, you are going to have to get to know HTML a lot better.

HTML is the backbone on which Web pages are built, and its characteristics determine what you can and cannot do on the Web. Even if you will be working with an HTML editor, you will still need to understand HTML's features in order to design for the Web.

VIEWING THE SOURCE

Basic HTML is not hard to master. Many of the codes it uses are simple descriptive words (e.g., align = "center") or abbreviations (B for bold, for example) for the effect they create.

The quickest way to become acquainted with HTML is to take advantage of a command you will find in almost any browser; View Document Source lets you see the HTML that makes up any page you read on the Web. When you compare the tags in the HTML file to the results in the browser, you will begin to understand what can be done and how it is accomplished. Figure T9.12 displays the View Document Source of one Web page.

HTML 101

HTML is not a file format in the sense that QuarkXPress or Microsoft Word have file formats. As explained earlier, HTML documents are ASCII-text only, and can be read by practically any application. HTML is actually a set of codes, or tags, that are embedded in these text files, between angle brackets.

FIGURE T9.12

View Document Source

Most people think of HTML as a language that describes the layout of text in an HTML file, but that is not exactly right. HTML tags can affect the layout of the file, but HTML is actually a structural markup language. It was designed to name the different elements of a document so that the browser can deal with them appropriately; HTML does not specifically specify layout.

There are many different types of elements in an HTML page, not just the ones that actually appear as text in the browser window. In addition to paragraphs, headings, and other text, HTML tags label elements such as scripts (the <SCRIPT> tag), multimedia objects and embedded programs (the <OBJECT> tag), hypertext anchors (the <A> tag), and other special elements. The browser's tells it how to interpret and handle each tag, whether that means to

display it in the page or take another action, like loading a script or image file.

TYPES OF TAGS

Although it is clear that there are several different types of HTML tags, it is hard to define just what those types are. HTML started out as an extremely simple application of tags, enough to tag the key parts of very basic documents, plus an extra feature that identified text anchors for hyperlinks. The first additions were to support graphics and interactive forms. When Netscape, the first commercial Internet browser maker, entered the world, HTML's growth went into hyperdrive. Tags appeared for features such as tables, frames, background colors, and interactive scripts. You can split these tags up in any number of ways, and every HTML reference you look at will probably split them up differently.

In one sense, there are two types of tags: (1) those that belong in the head of an HTML document, supplying general information about the file, and (2) those that belong in the body, tagging the content that is shown in the browser window. The most useful breakdown is to think of the tags as falling into two main groups (refer to Figure T9.13):

1. **Structural tags**, which label the parts of a document: headings, paragraphs, lists, tables, images, and so on.

2. **Style tags**, which tell the browser exactly how to present the labeled text.

FIGURE T9.13

Structural and Style Tags

STRUCTURAL TAGS

File	<HTML> <HEAD> <BODY> <META> <TITLE>
Section level	<DIV> <DIR> <DL> <MENU> <OL> <UL>
Paragraph level	<BLOCKQUOTE> <P> <DD> <DT> <U>
Phrase level	<ABBR> <ACRONYM> <CITE> <CODE> <DEL> <DFN> <EM> <INS> <KBD> <PRE> <Q> <SAMP> <SPAN> <STRONG> <VAR>
Headings	<Hl> <H2> <H3> <H4> <H5> <H6>
Rules	<HR>
Form elements	<FORM> <BUTTON> <FIELDSET> <INPUT> <LABEL> <LEGEND> <OPTGROUP> <OPTION> <SELECT> <TEXTAREA>

Table elements	<TABLE> <CAPTION> <COL> <COLGROUP> <TBODY> <TD> <TFOOT> <TH> <THEAD> <TR>
Frameset elements	<FRAMESET> <FRAME> <IFRAME> <NOFRAMES>
Interactive elements	<A> <AREA> <MAP> <SCRIPT> <NOSCRIPT> <PARAM>
Additional code and media	<APPLET> <EMBED> <IMG> <UNK> <OBJECT>
STYLE TAGS	
Line	 <NOBR> <WBR>
Font	<FONTface=>>
Font size	<BIG> <SMALL> <FONT size=>
Font color	<BODY alink=> <BODY link=> <BODY text=> <BODY vlink=> <FONT color=>
Font style	<B> <I> <S> <STRIKE> <SUB> <SUP> <TT> <U>
Placement	<CENTER> <IMG align=>
General style information	<STYLE>

For the most part, "official" HTML, defined by the World Wide Web Consortium (the organization that monitors and guides the development of the Web), or the W3C, sticks tightly to structural tags. This is in keeping with the basic tenets to use the markup language to specify only the structure of a document and leave it to the piece of software that reads the file to format it according to that system's capabilities and the user's preferences.

Many of the style tags were added by browser manufacturers eager to fulfill designers' demands for more control over the look of documents. In the Web's early days, the degree of control offered by such tags was about the only way to exert any influence over Web page layout. Most of those tags have served their purpose and should fade away over time, replaced by the control offered by style sheets.

THE ANATOMY OF A TAG

An HTML tag usually has several parts. The "start tag" tells the browser that a particular element is about to begin; text following the tag should be treated according to the rules for that element. Most HTML codes also use an "end tag," which signifies the end of the element. The end tag is usually a repeat of the start tag, preceded by a slash (/) character. For example, the beginning of an ordered list is marked by the <OL> tag and the end by the </OL> tag.

Anatomy of an HTML Tag

In addition, many tags have optional or required "attributes," which give the browser additional information about how the tag should be interpreted. The "attributes" follow the start tag, inside the start tag's bracket delimiters. Attribute names are often followed by an equal sign (=) and then the attribute's "value." Figure T9.14 displays the parts of an HTML tag.

Basic Fonts

Most file formats do not actually save fonts in the file itself. Instead, most files simply include information about what fonts are used in the document. To be displayed, those fonts must be installed in the system of the computer displaying the file. If the right font is not there, the system uses a default typeface, usually Courier on Macintosh and Arial on Windows machine.

Since there is no way of knowing which fonts each visitor to your site will have installed, it does little good to specify a font in the file. Accordingly, early HTML did not include any commands for specifying fonts. HTML 2.0 (the current version is HTML 4.01) did, however, assume the reader had at least two fonts installed: a regular text font and an alternate, monospaced font, used for special purposes. To display text at all, though, a browser needs to select some typeface to display it in. Since Times and Courier ship with almost every operating system, most browser manufacturers assign those two typefaces as the default text and monospaced typefaces, respectively, and then allow individual users to assign new defaults in their own browsers.

While *style sheets* provide control over most aspects of type layout, they cannot affect the requirement of typography, the ability to choose the typeface the text will be set in.

Macintosh and Windows computers ship with different sets of fonts, and the only faces they have in common are Times (called Times New Roman in Windows), Courier (Courier New in Windows), and Symbol. Additional fonts are distributed with Internet Explorer and are available free from Microsoft's Web site (www.microsoft.com/typography/default.mspx) for both the Windows and Macintosh platforms (see Figure T9.15).

FIGURE T9.15

Standard Fonts for Macintosh and Windows Platforms

Macintosh	Windows	Free Web Fonts

Courier	Arial	Arial Black
Times	Courier New	Comic Sans
Charcoal	Times New Roman	Georgia
Chicago	Wingdings	Impact
Geneva	Symbol	Monotype
Helvetica		Trebuchet MS
Monaco		Verdana
New York		Webdings
Palatino		
Symbol		

Web Graphics

The explosion of the World Wide Web can be traced to one event, the creation of Mosaic, the first browser able to display graphics. Finally, information on the Internet could have color and personality. Suddenly, the Internet became more than a way to exchange useful information and e-mail; it became an entertainment medium. Graphics, like text, are subject to tight limits on the Web. The first is size; since files are transmitted at about 1K per second over a slow modem connection, graphics file sizes are realistically limited to 30K or less (about 30 seconds of download time), and the smaller the better. Second, is format; most browsers are set up to handle GIF and JPEG-compressed formats that have gained popularity mostly through their use on the Web. Handled creatively, graphics can turn your Web page into a stylized interface matching anything available in print. Handled badly, they can make your Web page unreadable.

GRAPHIC FORMATS

Mosaic, the first Web browser that supported graphics, supported just one format for in-line images: GIF, an 8-bit, compressed format. GIF is still the basic format for online graphics; however, current browsers also support JPEG, another highly compressed format. A third format, called PNG, combines some of best features of GIF and JPEG. Like JPEG, PNG supports 16.7 million colors and compresses photographic images to smaller sizes than GIF does. It allows for transparent backgrounds and interlacing (this is explained below), and it even improves on those features by allowing for various degrees of transparency (explained below) and for two-dimensional interlacing,

which transmits a rough overall view of the image faster than the one-dimensional scheme used by GIF (a similar scheme is used by Progressive JPEG). Since direct support for PNG has only recently been added to browsers, its use is still risky on the Web.

This is the basic trio of Web graphic formats. Most popular graphics applications can now save files in any of them. There are actually two versions of GIF and JPEG. For GIF, the versions are called GIF87a and GIF89a. JPEG has a new version referred to as Progressive JPEG. The differences are shown in Figure T9.16.

GIF and JPEG each have particular characteristics that make them appropriate for some types of images, and not for others, but between the two of them; they handle most images quite well. As a rule, images that use few, flat colors are usually best saved as GIF. For complex images, such as photographs, that use many shades and gradations between colors, JPEG can provide significantly smaller file sizes than GIF can. JPEG can also support 24-bit color (up to 16.7 million colors), while GIF can support only 8-bit (256 colors).

The GIF and JPEG formats also differ in their support of three important features: interlacing, transparency, and animation. *Interlacing*, a feature of GIF89a and Progressive JPEG, allows the browser to download and display the image in alternate lines, so that a rough version of the entire image becomes visible quickly, and visitors can view and interact with it without waiting for the entire file to download. The other two features are available only in GIF89a. *Transparency* allows you to specify that one of the colors in an image (usually the background color) should be treated as invisible, allowing you to create irregularly shaped images that float in space. Animation allows you to see a Web graphic spinning, blinking, fading in or out, or various other forms of "action".

FIGURE T9.16

Graphic Formats

Graphic Format Considerations

	GIF87a	GIF89a	JPEG	Progressive JPEG	PNG
Native support for most browsers	X	X	X	X	
Lossless compression	X	X			X
Supports transparent backgrounds		X			X
Supports interlacing	X	X			
Supports animation		X			
Maximum number of colors	256	256	16.7 million	16.7 million	16.7 million

Choosing the Best File Format

Part of the trick to making quality Web graphics that download quickly is choosing the right file format for the job. Figure T9.17 provides a good starting point.

LIMITED COLOR PALETTES

Most graphics are created in 24-bit color but, unfortunately, most Web surfers do not view images that way. As your graphics enter a less-optimal viewing environment, the visitor's own screen, you will need to remember that they will be viewed according to the rules of that world, not yours. Many users will view graphics at a different bit depth or on platforms other than the one you used to create them. The same graphics look much different on a Macintosh than on a PC, or in 8-bit rather than 24-bit color.

Netscape Navigator, Internet Explorer, and Firefox have their own ideas about what colors to use on 8-bit displays, a 216-color palette, referred to as the *browser-safe palette*, which they apply to every graphic displayed on such systems. The browser-safe palette contains only 216 colors out of a possible 256, because the remaining 40 colors vary on Macintoshs and Windows machines. By eliminating the 40 variable colors, this palette is optimized for cross-platform use.

Also, the 256-color allowance on an 8-bit monitor has to cover all the images that are shown on screen at one time. Once 256 colors have been used, any remaining colors will simply be mapped to the closest equivalent among the first 256, or approximated by dithering (dithering was explained earlier in this plug-in) two or more available shades. If you are using many photographic illustrations with different palettes, you can optimize your palettes in an image-processing program. One method is to combine all the images you expect to show on a single page into a single Photoshop document, and then convert it to an 8-bit indexed color image with an adaptive palette with no dithering. As with so many aspects of Web design, no matter how many precautions you take, the only way to make sure all your preparations work is to test the results on a variety of systems.

FIGURE T9.17

File Format Comparison

If your image...	Use...	Because...
is graphical, with flat colors	GIF	it will compress more efficiently and keep
is photographic or contains	JPEG	the JPEG compression works best on gradations of colors,

such as		images with blends of colors, and it can watercolor painting portray images with millions of colors, resulting in better image quality at smaller file sizes.
is a combination of flat and such as a a flat	GIF	in most cases, it is better to preserve your photographic art, flat colors and crisp edges and to tolerate banner with text on a little dithering in the photographic background and a small edges than to turn the whole image over
photographic image		to JPEG compression.
is a postage stamp- or	GIF or JPEG	although JPEG is better suited for icon-sized photograph photographic images, when the image dimensions are really small, GIF usually creates smaller file sizes with acceptable
		image quality. It is advisable to try both and find the one that works best for your particular image.
includes a transparent area	GIF	it is the only file format that supports transparency.
needs to be animated	GIF	it is the only format that supports native animation.

PIXELS, NOT INCHES

If you have ever used pixel-based images such as TIFFs in print design, you are familiar with the term *resolution,* the number of pixels per inch. For print, an image typically has a resolution of 300 dots per inch (or dpi).

On the Web, images need to be created at much lower resolutions; 72 dpi has become the de facto standard, but in reality, the whole notion of inches and even dots per inch becomes irrelevant in the Web environment. In the end, the only meaningful measurement of a Web graphic is its actual number of pixels.

When a graphic is displayed on a Web page, the pixels map one-to-one with the display resolution of the monitor. Because the monitor resolution varies by platform and user, the image will appear larger or smaller depending on the configuration.

TOOLS OF THE TRADE

What follows is a brief summary to the most popular graphics tools among professional Web designers. It is by no means an exhaustive list.

- **Adobe Photoshop/ImageReady**. The industry standard for Web graphics creation is Adobe Photoshop. It is the tool of choice of most graphic designers. Starting with Version 5.5, Photoshop includes many Web-specific features such as a "Save to Web" option that shows previews of your graphic in different file formats and at different compression rates.

  Adobe's ImageReady, which comes with Photoshop, does special Web tricks such as animation and rollover effects. ImageReady also provides sophisticated tools for optimizing image file size.

- **JASC Paint Shop Pro**. If you work on a PC and are on a budget, you might want to try out Paint Shop Pro, which has many of the same features as Photoshop, but at a much lower cost ($99 as of this printing). It comes with Animation Shop for creating animated GIFs.

- **Macromedia Fireworks**. This is one of the first graphics programs designed from the ground up to address the special requirements of Web graphics. It has tools for creating both vector (line-based) and raster (pixel-based) images. Its features include side-by-side export previews, animation and rollover tools, advanced image-slicing tools, great file optimization, and more. It is also well integrated with Macromedia Dreamweaver, the industry standard Web-authoring tool.

PLUG-IN SUMMARY

Y   ou don't need to know a lot about the technical underpinnings of the World Wide Web   to design great Web pages. It will help, however, to have some knowledge in what the   Web is, how it relates to other parts of the Internet, and the design constructs of the Web. The Web is nonlinear, page layout is not necessarily under the designer's control, HTML's capabilities are changing all the time, download time sets the standards, and the tools are improving, quickly!

Web sites come in all shapes and sizes—regardless of the scale and scope of a Web site, the development process involves the same basic steps:

1. Analyze and plan.
2. Create and organize content.
3. Develop the "look and feel."

4. Produce graphics and HTML documents.

5. Create a working prototype.

6. Test, test, test.

7. Upload to a Web server and test again.

8. Maintain.

MAKING BUSINESS DECISIONS

1. **Resize Your Window**

   If you have a browser and access to the Web, get a feel for how Web pages respond when the browser window is resized. Make sure your browser window is not optimized to fill the screen.

   a. Go to www.w3c.org. Make the browser as wide as your monitor will allow. Now make it extremely narrow. How many lines of text are at the top? What happens to the headline?

   b. Now look at www.cnn.com. Play around with the width of the browser. Do you notice how the text and page elements always fill the width of the screen? What happens when the page gets very narrow? Can you see the information in the right column?

2. **Designing "Above the Fold"**

   Newspaper editors know the importance of putting the most important information "above the fold," that is, visible when the paper is folded and on the rack. This principle applies to Web design as well. Web designers have adopted the phrase to refer to the first screenful of a Web page. It is what users will see without scrolling, and it bears the burden of holding their attention and enticing them to click further. Some elements that you typically see above the fold include:

   ■ The name of the site and the logo.

   ■ The primary message.

   ■ Some indication of what the site is about (e.g., shopping, directory, magazine, etc.).

   ■ Navigation to key parts of the site.

   ■ Crucial calls to action, such as "Register Now."

   ■ Any other important information, such as a toll-free number.

   ■ An advertising banner (advertisers may require it).

   However, how much is a "screenful"? Unfortunately, this varies by browser window size. Your available

space could be as small as 623x278 pixels in a browser on a 640x480 monitor.

In general, the level of confidence in what will be seen on the first "page" is highest in the top-left corner of the browser window and then diminishes as the pages move down and to the right. When the browser window is made very small, the bottom and the right edge are the most likely to be cut off. One strategy for page layout is to put your most important elements and messages in that top-left corner and work out from there through hierarchies of importance.

Locate three Web sites that you think do an excellent job of designing above the fold and three Web sites that do not.

3. **Playing with Preferences**

See how bad you can get your favorite Web pages to look. Keep in mind that some users may be doing this to you!

■ Launch your browser. Select **Edit**, **Preferences** from the menu.

■ Select **Appearance** (Netscape) or **Web Content** and **Language/Fonts** (Internet Explorer).

■ Go crazy setting new text and background colors. Change the size and fonts of the text. Be sure to check or uncheck boxes so that your preferences will override the document's settings. Try turning off image display. Now look at some Web pages. How do you like their makeover?

4. **Know Your Audience**

In this plug-in, you have learned to consider a lot of unknown factors when designing a Web page. But a known factor when you begin the design process should be your target audience. In professional Web development companies, researching the characteristics and needs of the target audience is one of the most important parts of the design process.

A good understanding of your audience can help you make better design decisions. Below are a few scenarios for you to analyze and make design recommendations based on the considerations presented in this plug-in.

Scenario 1: A site that sells educational software.

Scenario 2: A site with resources for professional graphic designers.

Scenario 3: A site used to share company information for in-house use only (also known as an intranet).

Basic Skills Using FrontPage

LEARNING OUTCOMES

1. Describe the different kinds of Web sites that you can build using Microsoft FrontPage.

2. Explain the different Microsoft FrontPage views.

3. Describe how to build a Web site using Microsoft FrontPage.

4. Describe how to build a Web page using Microsoft FrontPage.

5. Describe the method used to insert a graphic into a Web page using Microsoft FrontPage.

6. Describe the different types of hyperlinks you can create using Microsoft FrontPage.

7. Describe how to create a list and table in a Web page using Microsoft FrontPage.

8. Define the benefits of using Themes when developing a Web page using Microsoft FrontPage.

Introduction

Microsoft *FrontPage* is Web authoring software. *Web authoring* software helps you design and develop Web sites and pages that you publish on the Web. FrontPage allows anyone with limited Web page design experience to create, modify, and maintain full-featured, professional-looking pages without having to learn how to code all the functions and features from scratch.

Using FrontPage, you can create Web pages, complete with formatted text and graphics, tables, buttons, animations, and sounds. You can add frames, borders, and hyperlinks to connect the pages to a Web site, or connect the pages to other Web sites. In FrontPage, you create Web pages in much the same way as you create documents using word processing software. For example, Figure T10.1 shows how similar FrontPage and Microsoft Word really are. By using the FrontPage menus and toolbar buttons, you enter and format text, pictures, and other page elements in much the same way as you enter and format these items in Word.

Part of FrontPage's power is that it is *scalable*, meaning its use can expand (or shrink) to fit anyone's needs. This means that if you do have some experience in creating Web pages, you can use FrontPage to accelerate, as well as automate, both the creation and publication process.

Hypertext markup language (HTML) is the language you use to create a Web page. HTML allows you to specify the content of your Web site and format the content such as adding bold, underline, and numbered lists. FrontPage generates the HTML tags in the background, so you need never concern yourself with them. However, if you want to go into the HTML view and make changes, you can do that as well.

FIGURE T10.1

Microsoft FrontPage and Microsoft Word Interfaces

Web Sites, Web Pages, and HTML

The Web sometimes seems like a vast, confusing place, and publishing a Web site can seem like a daunting task. It helps to realize that the Web is not really a place at all, but rather files stored on computers called *Web servers*, all of which are hooked together with certain types of network connections. When you surf the Web using a Web browser such as Microsoft Internet Explorer or Mozilla Firefox, you merely access files stored on the Web servers. The files themselves are called Web pages. A *Web page* is a specific portion of a Web site that deals with a certain topic. The text, pictures, and other elements that you see on your computer screen as you explore the Web are stored or referenced on Web pages. A *Web site is* a specific location on the Web where you visit, gather information, and perhaps even order products. The first step in creating a Web site is to make the Web pages. (But before that you should plan your Web site; consider its look and feel and what you want it to communicate, which is referred to as *storyboarding*.)

Underneath the text-and-picture pages you see on your computer screen when you surf the Internet is the skeletal system of every Web page: the HTML. *HTML* is the language you use to create a Web site. Web browsers interpret the HTML language, which is represented by tags so that you can see text, pictures, and whatever else is on a Web page. For example, one HTML tag, <strong>, creates bold text; another HTML tag, <img src>, inserts an image onto a page. When you view a Web page using a Web browser, the browser translates the HTML tags into easy to read, clearly laid-out pages. Figure T10.2 shows the HTML tags that produce the Web page shown in Figure T10.3.

HTML tags can be somewhat scary. Not so long ago, Web page creation was reserved for individuals with a technical background who understood HTML tags. Many people shied away from learning HTML and relied on professionals to build Web pages. Fortunately, you no longer need to learn HTML in detail to create Web pages; tools such as FrontPage can help you build a Web site even if you know nothing about HTML and don't care to

learn it.

HTML Tags

FRONTPAGE BUILDS WEB SITES BIG AND SMALL

You can use FrontPage to build many different kinds of Web sites:

■ *Personal Web site*—A popular type of public Internet site, the personal Web site is all about you. It can describe your interests, friends, and family, or offer hyperlinks to your favorite Web sites. Many Web development professionals started by creating a personal Web site. The personal Web site is a chance to be creative.

■ *Small business Web site*—If you have a home-based or small business and your advertising budget is small, a Web site is a great way to spread the news about your product or service. By using the FrontPage templates, you can set up a professional storefront without having to spend months learning techniques and technologies.

■ *Corporate Web site*—Large companies   want their Web sites to provide product information, customer support, consumer relations information, and even online shopping. FrontPage is useful in a corporate setting because its powerful tracking features make it possible for more than one person to make changes and updates to Web site pages. FrontPage is compatible with and can be integrated with many other software products, such as Microsoft Excel and Microsoft PowerPoint.

■ *Corporate intranet*—A *corporate intranet* is an internal company network that employees can surf in the same way that they surf the Internet. A Web site on an intranet is like a Web site on the Internet except that it is available only to employees who can access the company network. Because an intranet is protected from curious Web surfers, internal company information such as sales figures, human resources communications, and department resources can be transmitted companywide. FrontPage has tools for creating customized intranets.

HTML Rendered in a Browser

Navigation in FrontPage

With FrontPage, you can quickly create Web pages with all the familiarity and ease of use found in other Microsoft Office applications. To the maximum extent possible, FrontPage's menu structure, toolbar icons, dialog boxes, and working conventions strongly resemble these other applications. You can look at the HTML if you want to, and

even modify it, but you can also create great-looking Web pages without seeing any HTML. As a result, you can concentrate fully on your message and let FrontPage handle the mechanics.

UNDERSTANDING THE INTERFACE

The first time you start FrontPage, it displays an application window such as Figure T10.4.

FIGURE T10.4

The FrontPage Interface

The Menu Bar

The FrontPage menu bar is typical of those found in all Microsoft Windows applications; File, Edit, and View are on the left; Help is on the right. You can customize the menu bar by choosing Customize from the Tools menu.

By default, FrontPage displays personalized menus. This means the commands you use most appear when you first display a menu, and the rest appear after you leave the menu open for a few seconds or click the double arrow at the bottom of the menu. If you find personalized menus more distracting than useful:

1. Select **Customize** from the **Tools** menu.

2. Select the **Options** tab.

3. To see full menus all the time, select the **Always Show Full Menus** option.

4. To see full menus only when you click the double arrows, clear the **Show Full Menus After A Short Delay** option.

The Standard Toolbar

The most fundamental and most often used FrontPage commands—New, Open, Save, Cut, Copy, Paste, and so forth—appear on the Standard toolbar.

FrontPage, like many other Windows applications, features *dockable* toolbars. This means you can rearrange toolbars, lengthen them, shorten them, dock them at any side of the window or let them float anywhere on the screen. To display or hide a particular toolbar:

1. Select **Toolbars** from the **View** menu, and select or deselect the appropriate toolbar.

2. Or right-click a toolbar, and choose the toolbar you want from the shortcut menu.

The Main Window Area

The bulk of the FrontPage screen is taken up by the main window area. This is where you do your actual work and

the contents change depending on which view you are in. For example, if you are in Page view, the main window area is where you view and build your pages.

The Task Pane

The Task Pane provides easy access to options related to a variety of common tasks. These tasks include creating a new page or Web site, getting help, performing searches, using the clipboard, creating layout tables, cell formatting, working with themes, and many other tasks. You can switch tasks by clicking the small down arrow to the right of the Task Pane title and choosing the task from the drop-down list.

To show or hide the Task Pane:

1. Select **View**, then **Task Pane**. The Task Pane is docked to the right edge of the screen by default. However, you can move the Task Pane by clicking and holding down the left mouse button on the title bar, and dragging the Task Pane away from the right edge.

2. Once you have undocked the Task Pane, it turns into a free-floating window. You can drag this window and dock it to any edge of the screen.

FRONTPAGE VIEWS

Like other software, FrontPage has a main menu and toolbars along the top of the screen for giving commands. Where FrontPage differs from other programs, however, is the Views bar. Use it to change views of the Web site you are working on. To change views, click an icon in the Views bar.

Each view presents a different form of information about the Web site you are working on and enables you to work with the site in a different way.

The view where you will probably spend most of your time in FrontPage is the Page view (see Figure T10.4). Page view is your document editor; it's where you build your Web pages, create and format text, add graphics, set up hyperlinks, and create tables. In short, you add all the content to your Web site using the Page view.

Page view gives you four ways of looking at your Web page (see Figure T10.5): (1) Design, (2) Split, (3) Code, and (4) Preview. If you have multiple pages open, you can switch between the pages in any of these views either by selecting the page you want from the Window menu or by clicking on the page tab for the page you want.

FIGURE T10.5

Page Views

If you open enough pages, the tabs won't all fit in the Page view. In that case, FrontPage displays a set of arrows in the upper-left corner of the Page view so that you can scroll left and right through the tabs.

Design Page View

To switch to this view from any other view, click on the Design button at the bottom-left corner of the working area (see Figure T10.5). Design Page view is where you actually build your Web pages, using the tools discussed in this module. While this view gives you a pretty good idea of what your page will look like, the layout is not exact. Design Page view is a working environment, not a testing environment.

Split Page View

The Split Page view (see Figure T10.6) shows you both the code and the design views of the page on one screen. Selecting an item in either view also highlights the item in the other view. For example, if you select an image in the Design Page view, FrontPage selects the section of code that defines the image properties on the Page. If you make changes to the Design Page view, those changes are reflected instantly in the Code Page view. However, if you make changes in the Code Page view, those changes are not reflected in the Design Page view until you click in the Design view.

Code Page View

As briefly discussed in the introduction, Web pages are largely made up of HTML code. When you add and modify text and graphics in the Design Page view, FrontPage automatically generates the HTML code that makes up your page. You do not even have to look at this programming code if you do not want to. Still, there are times when it can be helpful to work with a page's HTML source code, as well as other code such as JavaScript. This is especially true if you know how to program, and you want to add your own code to the page. The Code Page view (refer to Figure T10.2) enables you to view and even modify the defining code for a Web page. To switch to this view from another view, click on the Code button at the bottom-left corner of the working area (refer to Figure T10.5).

FIGURE T10.6

Split Page View

Preview Page View

The Preview Page view does a good job of showing you how your page will look in a browser. However, the view you get is not exact, and certain features do not work in the Preview Page view. For example, the Scrolling Marquee

does not work in Preview but works in Browser view.

To remedy this situation, FrontPage enables you to preview your page in a browser. When you install FrontPage, it tries to detect which browser(s) you have installed, and automatically sets up options for previewing in that browser in various resolutions by choosing File, then Preview in Browser, and then selecting the browser version and resolution to view your page in.

Building a Web Site

The best way to learn a new skill is to just do it. On the following pages, you will use FrontPage to create a new Web site and new Web pages. Along the way, you will become familiar with the FrontPage interface and learn how to add new Web pages to a Web site.

STARTING FRONTPAGE

Starting FrontPage requires the same steps as starting most other Windows applications. To start FrontPage:

1. Click on the **Start** button, select **Programs**, then choose **Microsoft Office**, and then **Microsoft FrontPage**.

2. If you do not have FrontPage installed, you can order a 30-day trial version from the Microsoft Web site at www.microsoft.com/office/frontpage/prodinfo/trial.mspx.

Once FrontPage is open, you are ready to start to create a Web site. There are three ways that you can create a Web site using FrontPage: (1) with templates; (2) with a wizard; (3) with an empty Web site.

Creating a Web Site with Templates

If you are not sure how to begin building a Web site or you need a complete Web site fast, FrontPage gives you plenty of help in the form of templates. A *FrontPage template* is a ready-made Web site where all that is required of you is entering text where the placeholder text is and, if you wish, inserting new graphics where the placeholder graphics are. The idea is for you to customize these ready-made pages with your own text and designs.

FrontPage provides templates for many different purposes, including a "Personal Web site" and a "Project Web site." There is also the "One Page Web site" for creating a Web site that comprises a single blank page and an "Empty Web site" for creating the structure of a Web site but nothing more.

Follow these steps to create a Web site from a template:

1. Click **File**, then **New.**

2. In the **New Web site** section of the Task Pane, select **More Web site templates.**

3. Click to highlight the **Personal Web Site** icon.

4. On the right side of the dialog box, enter the folder where you want to store your new Web site.

5. Click **OK** to create the new site.

6. Figure T10.7 displays the results of creating a Web site from a template.

FIGURE T10.7

Personal Web Site Layout

Creating a Web Site with a Wizard

FrontPage provides wizards for creating its two most complex templates, the "Corporate Presence Web site" and the "Discussion Web site." A *wizard* is a series of dialog boxes that ask you questions about something you want to create, in this case, a Web site. After you tell the wizard what you want, the wizard generates the Web site. FrontPage offers several types of wizards:

■ *Corporate Presence Web Wizard* builds an entire corporate site by asking you what kind of information you want to present on the site.

■ *Discussion Web Wizard* creates a FrontPage *discussion group,* a Web site that hosts a public forum where visitors can post articles and respond to articles that others have posted, such as *blogs*.

■ *Import Web Wizard* is for gathering files and documents for a Web site.

■ *Database Interface Wizard* is for creating a Web site that enables visitors to query, sort, and add records to a database table.

Follow these steps to create a Web site using a wizard:

1. Select **File**, then **New.**

2. In the **New Web site** section of the Task Pane, select **More Web site templates.**

3. Choose the **Corporate Presence Web Wizard** icon and click **OK.**

4. Read the introduction and click the **Next** button.

5. Specify which pages you would like to have included in your Web site and click **Next.**

6. Type **FrontPage Demonstration** for a descriptive title.

7. In each subsequent panel, read and follow the wizard's directions and click **Next.**

8. When you reach the final panel, click the **Finish** button.

When the Web site is complete, you can open and view it by clicking **Folders** on the **Views** bar and then double-clicking the **index.htm** file (see Figure T10.8). Now you can start customizing your Web page.

Creating an Empty Web Site

If you're not sure where to begin, or if you'd like to see examples of how typical Web sites are structured, FrontPage templates and wizards are the way to go. But if you know your way around FrontPage and you want to start from scratch, you can start with a single blank Web site. This section will describe how to create a Web site that models the online example (see Figure T10.9), www.du.edu/~amyphill/T10. To do this, follow these steps:

1. Choose **File**, then **New.**

2. In the **New Web site** section of the Task Pane, select **More Web site templates.**

3. Choose the **Empty Web Site** icon.

4. In the **Specify The Location Of The New Web** text box, either type the path to the folder where you want to store your new Web site or click the **Browse** button and select the folder in the New Web Location dialog box.

5. Click **OK** to create the new site.

FIGURE T10.8

Corporate index.htm

SAVING A WEB SITE

Before you go very far in building a Web site, you'll need to know how to save the page so it is not lost if your machine locks up or a similar misfortune strikes. Saving a Web page is not very different from saving any other type of file. To save a Web page for the first time, choose File, and then Save. This opens the Save As dialog box. From here, you can choose to save the file in the current Web site on your hard drive.

Building a Web Page

After you have created a Web site, the next step is to start adding Web pages and content. To create a new page, you can rely on a template or simply attach a blank page to your Web site.

FIGURE T10.9

Personal Web Site Example

CREATING A WEB PAGE FROM A TEMPLATE

Creating a Web page from a template, you save yourself from doing some of the layout work. You get a Web page

that was laid out and developed by a professional. All you have to do is enter your own text and graphics where the placeholder text and graphics are on the page.

Follow these steps to create a new Web page from a template:

1. Select **File**, then **New.**

2. In the **New Page** section of the Task Pane, select **More page templates.**

3. Select a page, such as **Photo Gallery.**

4. Click **OK.**

FIGURE T10.10

Photo Gallery Template Web Page

Figure T10.10 displays an example of the completed Photo Gallery template Web page.

Pages created with a template come with placeholder text and, in some cases, sample graphics to help you get an idea what a completed page is supposed to look like (such as the example displayed in Figure T10.10). You can replace the generic text with your own verbiage and make other layout changes as you see fit.

CREATING A BLANK WEB PAGE

To add a Web page to your Web site that you created from the previous section, you will want to create a new blank page from scratch. Follow these steps:

1. Select **File**, then **New.**

2. In the **New Page** section of the Task Pane, select **Blank page.**

3. The file name is called **new_page_1.htm**, unless you are starting from a template (in that case, the file is called **index.htm**).

4. Press **Enter** to create the new page (see Figure T10.11).

The dotted gridlines that surround the text in most templates are the boundaries of *invisible tables* (tables without any border specifications). Invisible tables form the framework in which the table is laid out. (This is discussed in a later section.)

FIGURE T10.11

Blank Web Page

ENTERING TEXT ON A WEB PAGE

Entering text on a Web page is very much like entering text in a word processing document. You can copy or cut text from a text file, a Microsoft Word file, an e-mail message, or another Web page, and then paste it into the page you are working on. To do this, perform the following steps:

1. Put your cursor on the first line of the Web page (**new_page_1.htm**) you created in the previous section.

2. Type in the following text, **KATE FITZGERALD.**

3. Press **Enter.**

4. Type the following text, **2101 University Boulevard Denver, CO 80210 (303) 999-9999,** pressing **Enter** at the end of each address break (as you see in our online example www.du.edu/~amyphill/T10).

5. Press **Enter.**

6. Type in **Navigation.**

7. Press **Enter.**

8. Under the subheading Navigation in our online example (www.du. edu/~amyphill/T10) type in the information in the middle left column.

9. Press **Enter** at the end of each line.

FORMATTING TEXT

Controlling fonts on Web pages presents difficulties. For one, there is no way of knowing what fonts or font technologies a given Web visitor will have available. For another, it is unlikely that all the same fonts will be available to any two Web visitors. Finally, even fonts that appear identical down to their names might have subtle differences when obtained from different vendors or even from the same vendor when used on different platforms.

The original HTML specification tried to avoid font confusion by dodging fonts. That is, instead of providing a way to specify fonts by name, it provided ways to flag blocks of text by their structural use in the document. Responsibility for assigning specific fonts then fell to the Web visitor's browser.

Some newer versions of HTML do support specific font name assignments, as does FrontPage. However, just because FrontPage lets you specify font names such as Estrangella Edessa and Palatino Linotype does not mean those fonts are available to your Web visitors. If the remote system does not have a font with the name you specify, it will substitute another font—usually the default browser font, which, if not stylish, will at least be legible. However, you should be mindful that font substitution could cause an integrity issue with some of your Web pages.

Plug-In T9, Designing Web Pages, discusses the use and limitations of fonts in more detail.

Recommendations for Using Fonts on the Web

Consider these suggestions for using font attributes effectively in your Web pages:

■ *Use fonts large enough to read.* The Web is not a place to be stingy. If the text is not important enough to present legibly, omit it.

■ *Do not waste space with large fonts.* Large amounts of text in a large font slow down the reader and lead to excessive scrolling. In addition, they have far less impact than a pleasing and effective page design.

■ *Stick to mainstream fonts.* If Web visitors do not have the artistic font you want, their browser will probably substitute an ugly one.

■ *Avoid ransom notes.* Stick to a few well-chosen sizes and styles of type.

■ *Aim for contrast, not clash.* Achieve a pleasing contrast between background and text.

FrontPage provides a variety of font-related icons on the Formatting toolbar (see Figure T10.12). Each icon applies an attribute to the selected text, or removes an attribute previously applied.

■ *Font:* applies a selected font name.

■ *Font size:* increases or decreases font size.

■ *Bold:* toggles boldfacing on and off.

■ *Italic:* toggles italicizing on and off.

■ *Underline:* toggles underlining on and off.

■ *Highlight:* controls a text area's background color.

■ *Font color:* controls the color in which the browser displays text.

You can also toggle boldfacing, italicizing, and underlining of selected words on and off by pressing Ctrl+B, Ctrl+I, and Ctrl+U, respectively. Press Ctrl+Shift+> to increase the font size of selected words, and Ctrl+Shift+> to decrease it. Ctrl+Shift++ formats text as a superscript and Ctrl+= formats it as a subscript. However, for maximum control of font settings, select the text you want to modify and then choose Font from the Format menu.

FIGURE T10.12

Formatting Toolbar

To adjust the font style, font size, and other text attributes, follow these steps:

1. Select the text **KATE FITZGERALD**, choose **Font** from the **Format** menu.

2. Select the font **Tahoma**, under the Font type select **Bold**, and then select **3(12pt)** for the size.

3. Click **OK.**

4. Select the text **Navigation**, choose **Font** from the **Format** menu.

5. Select the font **Tahoma**, under the Font type select **Bold**, and then select **2(10pt)** for the size.

6. Select all the remaining text, choose **Font** from the **Format** menu.

7. Select the font **Tahoma**, under the Font type select **Regular**, and then select **2(10pt)** for the size.

8. Click **OK.**

PARAGRAPHS

Words turn into sentences, and sentences have a habit of turning into paragraphs. When you reach the end of one line, text wraps, or moves down to continue on the next line. Press **Enter** to create a new paragraph such as you did in the section Entering Text on a Web Page.

In HTML, paragraph breaks do not mean quite the same thing that they do on the printed page. Short of entering a few blank spaces, for example, indenting the first line of a paragraph is impossible. On most Web pages, white space marks the end of one paragraph and the beginning of the next.

A paragraph in FrontPage is simply all the text that comes before a paragraph break. A heading is a paragraph. So is a single line of text. Why do you need to know this? Because when you give a paragraph formatting command, your command applies to all the text in the paragraph.

Inserting a Paragraph Break

In Design Page view, inserting a paragraph break is as simple as pressing the **Enter** key. FrontPage inserts a paragraph break, which is then marked in HTML by the <p> tag. If you click Code Page view and examine the source code of your Web page, you will see a <p> at the end of each paragraph where you pressed the Enter key. The <p> tag inserts a blank line and enters a line of blank space between one page element and the next.

Breaking a Line

Line breaks, represented as <br> in HTML, can be used to format text when you want to end one line and continue it on the following line, without inserting a blank line between the items you're delineating. For example, suppose you are formatting the text of a poem, a recipe, a masthead, or a table of contents and you want a break but not a chasm of white space to appear between lines. Figure T10.13 shows a Web page in Preview mode formatted with

several lines using paragraph breaks, and the several lines below it, formatted with line breaks.

To insert a line break, follow these steps:

1. In Page view, place your cursor at the beginning of the second line and press the **Backspace** key (this removes the **Paragraph** break).

2. Choose **Insert**, and then select **Break**, then select the **Normal Line Break** option button, then click **OK.**

3. Or use **Shift+Enter** is a shortcut.

4. Repeat the previous three steps to remove the **Paragraph** break for each line, except for the Paragraph break before the Navigation text (we want to leave that break to show a separation between the address information and the navigation information), and insert a **line break** (it is easier to use the shortcut method, **Shift+Enter).**

FIGURE T10.13

Paragraph Break and Line Break Comparison

Aligning Paragraphs

Figure T10.14 demonstrates the different ways that you can align text. Starting in Page view, follow these steps to tell FrontPage how you want to align the text:

1. Highlight the text **KATE FITZGERALD** and the **address** text.

2. Click the **Center** alignment button on the Standard toolbar or choose **Format**, then select **Paragraph** and, in the Paragraph dialog box, select **Center** in the Alignment drop-down list.

3. The Paragraph dialog box allows more precision and options than the alignment buttons on the Standard toolbar.

Indenting Paragraphs

It is possible to indent a paragraph from the left margin or right margin of a Web page. Remember: A paragraph in FrontPage means any amount of text—a word, a heading, a Faulkneresque 500-word strung-together sentence. To indent a paragraph or paragraphs, follow these steps:

1. Select all the text below the subheading **Navigation.**

2. Click the **Increase Indent** button on the Formatting toolbar.

FIGURE T10.14

Paragraph Alignment Options

FIGURE T10.15

Paragraph Styles

You can click the button as many times as necessary to increase the amount of the indentation. To unindent a paragraph, click the **Decrease Indent** button (or press **Ctrl+Shift+M**).

Formatting Paragraphs

The arrangement and layout of paragraphs, or any blocks of text, are key elements of page layout and visual communication. FrontPage provides a rich assortment of tools that control paragraph appearance.

FrontPage supports the basic HTML paragraph styles shown in Figure T10.15. These are paragraph styles and not font styles; they modify the appearance of an entire paragraph and not of any specific text. HTML was designed to specify the structure of a document's elements, not the explicit formatting of a given element; therefore, each browser will display these elements according to its own settings and the system configuration on which it is running.

Headings 1 through 6 are for successively lower-level titles. In practice, any page with six levels of titles is probably too long and an excellent candidate for separation into multiple pages.

The *Normal style* is designated for most ordinary text. Like the heading styles and most of the others, it specifies no fixed line width, but instead wraps within the current browser window.

The *Formatted style* is unique in three respects: (1) it uses a monospaced font, (2) it preserves and displays multiple spaces, and (3) it does not wrap within the browser window. Because of these characteristics, the Formatted style is useful for applications like tabular data and program-code listings, where preservation of columns and letter spaces is vital.

The *Defined Term* and *Definition* are meant to be used together. The term being defined is entered first in Defined Term style. When you press Enter, FrontPage automatically switches to the Definition style, which you use to provide the definition.

The *Address style* is designated to identify Web addresses. Its most common use is making e-mail hyperlinks stand out from ordinary text. Web address paragraphs frequently appear in italics.

The numbered and unnumbered list (sometimes referred to as numbered and bulleted list) are collections of paragraphs the browser will format with leading numbers or bullets. Both numbers and bullets are indented.

To assign one of the default styles to a paragraph, set the insertion point in the paragraph or select any part of the paragraph, and then select the desired style from the Style drop-down list on the Formatting toolbar.

Working with Graphics

The Web consists of much more than just text. Today's Web site is designed to have a handful of graphics. To make Web pages more compelling, you can include a clip art image from the Microsoft Clip Organizer, a graphic stored on your computer, or an image from the Internet.

Graphics must be in the GIF or JPEG format to be viewed using most Web browsers. If the images you want to use are not in one of these two formats, use an image editor, such as LView Pro or Paint, to convert them to GIF or JPEG files.

FIGURE T10.16

Horizontal Rules

USING RULED LINES

Horizontal rules are pretty much what they sound like: horizontal lines that separate one part of a Web page from another. You can insert lines beneath document heads, between parts of a memo or article, or anywhere else you please. There are basically two kinds of rules: (1) horizontal rules created through the <hr> tag in HTML and (2) graphics that look like lines (and act to divide space) but don't share their HTML properties. Many of the decorative ruled lines that you have seen on the Web are probably graphics. Figure T10.16 shows several different ruled lines; the two at the bottom are graphic images.

Standard HTML-based horizontal rules include a line of white space before and after the line itself, and their properties include height, width, and the option of shading. When you insert a horizontal rule, you get an engraved line that is centered on the page and occupies 100 percent of the width of the window. You can then change the look and properties of this line; additional lines you create after adjusting the properties of that line will continue to look like it until you reset their properties.

PUTTING YOUR OWN IMAGES ON A WEB PAGE

Chances are you keep more than a few images and photographs on your computer. Remember that GIF and JPEG graphics are the best choice for a Web page because all browsers can display them easily. First, you need an image available to insert on your Web page. For this next step, you will have to go to our online example to download an image you will use. To do this go to www.du.edu/~amyphill/T10, right-click on the personal photo and select Save Picture As. Save the image in the same folder as your Web site and Web page from the previous steps. To place the

image on a Web page, follow these steps:

1. In Page view, click just below the text at the bottom of the Web page.

2. Choose **Insert** from the main menu, then **Picture**, and then **From File.**

3. In the Picture dialog box, open the drop-down menu on the Views button and choose **Preview.**

4. Select the file you just downloaded, **photo.gif.**

5. Click the **Insert** button.

FIGURE T10.17

Picture Properties Dialog Box

You can drag your image to a new location if it was not placed where you wanted it. If the image refuses to be dragged elsewhere, display the Pictures toolbar and click the **Position Absolutely** button.

Grabbing images from other people's Web pages is easy, but the legal ramifications of doing so are not so simple. If the images are clearly marked as being public domain, and you are very confident that this is true, feel free to use them as you like. Otherwise, the author of the image holds copyright on it; there are very few exceptions to this rule of intellectual property. If you cannot live without an image, send its owner an e-mail message and ask permission to use it.

Changing a Graphic's Size, Alignment, and Spacing

After you insert a graphic onto a Web page, you might want to change something about it. Maybe you'd like to change its size or realign it. Maybe you would like to place a border around it.

To fiddle with a graphic's properties, click to select the graphic and then open the Picture Properties dialog box (see Figure T10.17). FrontPage offers four different ways to open the Picture Properties dialog box:

1. Choose **Format**, then **Properties**.

2. Double-click the graphic.

3. Right-click and choose **Picture Properties**.

4. Press **Alt+Enter**.

The General tab of the Picture Properties dialog box offers the following commands:

■ *Picture*—This is the file name of the picture to be included.

■ *Picture File Type* button—Change the graphic type from GIF or JPEG.

FIGURE T10.18

Graphic Layout Alignment Options

Option What It Does

Left Places the graphic on the left side of the browser window, with text or other elements wrapped around the right side of the graphic.

Right Places the graphic on the right side of the browser window, with text or other elements wrapped around the left side of the graphic.

Top Aligns the top of the graphic with the top of the tallest element on the same line.

Texttop Aligns the top of the graphic with the top of the tallest character on the same line.

Middle Aligns the middle of the graphic with the middle of the surrounding text.

Absmiddle Aligns the middle of the graphic with the middle of the largest item on the current line (stands for absolute middle).

Baseline Aligns the bottom of the graphic with the imaginary line on which the surrounding text rests. Use this option to place a small image on a line of text.

Bottom Aligns the bottom of the graphic with the bottom of the surrounding text (this is another name for *baseline*).

Absbottom Aligns the bottom of the graphic with the bottom of the current line of text (stands for absolute bottom).

Center Centers the graphic horizontally in the browser window.

■ *Low-Res*—Some people configure their browsers to show low-resolution, black-and-white graphics in place of normal ones. To satisfy these users, click the Browse button under Type and choose a low-resolution or black-and-white graphic in the Select Alternate Picture dialog box.

■ *Text*—In the Text box, enter a description of the graphic. Someone who visits your Web page and moves the mouse over the graphic will see the text you enter.

■ *Long Description*—This is a longer version of the text property mentioned above.

■ *Default Hyperlink*—These options (Location and Target Frame) have to do with frames. Frames will not be discussed in this plug-in.

It is very important to include alternate text for any image that will be visibly displayed. Many people accessing

the Web cannot see or choose not to see images. Individuals in remote areas are often at the mercy of restricted bandwidth or older computer systems, necessitating text-only browsing, or browsing without images. Still others prefer fast access to information; so they will browse with the automatic image-loading feature in their browser turned off.

Click the Appearance tab of the Picture Properties dialog box to tell FrontPage where you want the graphic to be on the page. Here are your options:

■ *Wrapping Style*—Choose the None, Left, or Right option to tell FrontPage what to do when text runs up against the graphic. Text can run around its left or right side. The None option leaves white space on either side of the graphic.

■ *Layout Alignment*—Choose alignment for the graphic. You can align the image according to the browser's default behavior (most browsers use Baseline as the default), in which case choose the Default setting. To choose another alignment, open the Alignment drop-down list and choose an option. Figure T10.18 explains the options.

■ *Horizontal and Vertical Spacing*—You can specify that the browser leave a margin of white space around your graphic by entering a number (in pixels) in the Horizontal Spacing and Vertical Spacing text boxes (10 is a good start; you can experiment from there).

■ *Border Thickness*—You can have a solid border appear around an image. If you would like your image to include a border, type a number (in pixels) in the Border Thickness text box. Entering 0 (or leaving the text box empty) prevents the border from appearing at all.

■ *Size*—Specifying the size of an image allows the browser to load the page more efficiently, because it can draw a placeholder while it is fetching the image itself. FrontPage automatically sets the image size when you first insert it, but if you want to resize the image, you can do so.

Including Hyperlinks

Hyperlinks probably constitute the biggest difference between the Web and other media. You cannot click on a map on TV, an author's name in a magazine, or a song title in a book and expect to go anywhere.

A link can point to any address on the Internet. Click a link and you go to another Web page, another place on the same Web page, or another Web site. Sometimes you click a link to download a file, hear a sound, or play a video. Click certain links and your e-mail software opens so you can send an e-mail message.

FIGURE T10.19

Insert Hyperlink Dialog Box

CREATING A HYPERLINK

To link to a Web page on the Internet, follow these basic steps:

1. In Design Page view, select the text **Introduction.**

2. Choose **Insert**, then select **Hyperlink**, or click the **Hyperlink** button on the Standard toolbar, or press **Ctrl+K.**

3. Under the **Link To** section, make sure that **Existing File or Web Page** is selected.

4. In the **Address** section, type the Web address **index.html** (see Figure T10.19).

5. Note: Since the information under the text **Navigation** will represent your hyperlinks to other pages, and should be included in all your pages within this Web site, the **Introduction** will represent the index.html page.

6. Click **OK.**

After you create a hyperlink, be sure to test it. To do so, click the Preview button and then click the link you just created. If it does not work or if it goes to the wrong location, click the Design button, then right-click the link, and choose Hyperlink Properties on the shortcut menu. You see the Edit Hyperlink dialog box, where you can alter the link. (It works exactly like the Insert Hyperlink dialog box shown in Figure T10.19.) To remove a link, click the Remove Link button in the Edit Hyperlink dialog box.

CREATING A LINK TO AN E-MAIL ADDRESS

After Web addresses, the most common type of address you will want to provide a link to is your e-mail address. When someone clicks the link, his or her default e-mail software opens. Your e-mail address is entered automatically in an e-mail message. To create a link to an e-mail address, perform these steps:

1. In Design Page view, go to the bottom of the page, enter a new line by pressing **Enter** and add the text **Contact me: kate@yahoo.net.**

2. Highlight **kate@yahoo.net.**

3. Choose **Insert**, then **Hyperlink**, or press **Ctrl+K**, or click the **Insert Hyperlink** button.

4. Under **Link To**, click the **E-Mail Address** icon.

5. As shown in Figure T10.20, the Insert Hyperlink dialog box offers new options for creating an e-mail link.

FIGURE T10.20

E-Mail Dialog Box

6. In the E-Mail Address text box, type **kate@yahoo.net.**

7. In the Subject text box, type in **Great Web Site!**

8. Click **OK.**

Now, when your page is loaded onto the Web and someone clicks the link to your e-mail address, that person will be able to send you a message.

Presenting Information in Lists and Tables

There are a variety of ways to fine-tune the presentation of your Web pages. Two ways that allow organization of information are using lists and tables. Before HTML tags for tables were finalized, authors had to carefully format their tabular information within <pre> tags, counting spaces, and previewing their output. Tables are very useful for presentation of tabular information as well as a boon to creative HTML designers who use the table tags to present their regular Web pages.

WORKING WITH LISTS

When you need to present information in a structured way, lists are extremely useful. Lists help you communicate information in a concise and linear way. You can use unnumbered (i.e., bulleted) lists or numbered lists. Unnumbered lists are better when there is no particular order to the list. Numbered lists help you represent the order of the information, such as performing a sequence of steps. They can also be used to rank things in order of importance. You can use graphics for the bullets in a bulleted list, and even create sublists when you need to break down one list item into smaller parts. To create a numbered list, perform the following steps:

FIGURE T10.21

Numbered List Dialog Box

1. Select all the text under Navigation, except for Contact me: kate@yahoo.net.

2. Choose **Format**, and then select **Bullets and Numbering**.

3. Click the **Numbers** tab and choose the Roman number format.

4. Make sure **Start At** is set to **1** (see Figure T10.21).

5. Choose **OK**.

FIGURE T10.22

Insert Table Dialog Box

6. Chances are the line break after each word under the text Navigation will not allow the numbers to appear as a numbered list; therefore you will have to use the **Backspace** key to remove each line break and enter a **Paragraph** break instead.

To create a bulleted list on a page, you would use the Plain Bullet tab and select the type of bullet you want.

WORKING WITH TABLES

FrontPage tables are similar to tables in other Microsoft Office applications. For example, if you have ever worked with tables in Microsoft Word, you are already familiar with many of the features of FrontPage tables, although FrontPage tables give you many more configuration options.

The basic premise of tables is that they arrange information into rows and columns. The intersection of each row and column is referred to as a *cell*, much like the cells in a spreadsheet. You can place any information you want into a cell—text, graphics, hyperlinks, and even another table.

To insert a table into a Web page using the Table menu, choose Table, then Insert Table. This displays the Insert Table dialog box (see Figure T10.22). Use the fields in the Insert Table dialog box to configure the table. Here are a few of the property settings that you can modify for greater control (feel free to experiment with the settings that are not listed):

- *Rows.* Use the Rows list box to set the number of rows in the table. You can also type the number of rows into this field.

- *Columns.* Use the Columns list box to set the number of columns in the table. You can also type the number of columns into this field.

- *Alignment.* Use the Alignment list to specify whether you want the table against the left margin, the right margin, or centered on the page. Note that if you specify the width of the table to be 100 percent of the page width, the table alignment setting does not really change anything.

- *Cell padding.* Use the Cell Padding list box to specify the amount of white space (in pixels) you want between the cell's contents and the inside edge of the cell boundary. You can override this quantity on a cell-by-cell basis.

- *Cell spacing.* Use the Cell Spacing list box to specify the amount of white space (in pixels) you want between cells.

- *Specify width.* Set the width either in pixels or in percent by choosing the appropriate option. Type the width into

the Specify Width text field. When you add contents into the cells, the table will expand to maintain the specified width.

■ *Specify height.* Set the height in either pixels or percent by choosing the appropriate option. Type the height into the Specify Height text field. Note that if you specify a height that is too small to contain the contents of the table, FrontPage will ignore the specified height.

■ *Border size.* Use the Size drop-down list in the Borders section to set the thickness of the table border in pixels. A value of 0 specifies no border.

■ *Background color.* Set the background color for the table by selecting the color from the Color drop-down list in the Background section. This background color also serves as the default background color for all the cells, although you can override the background color on a cell-by-cell basis.

To create a table, follow these steps:

1. Put your cursor at the bottom of your Web page, click **Table** on the toolbar, then select **Insert**, then choose **Table.**

2. Fill in the fields with the information displayed in Figure T10.22.

3. Click **OK.**

Add Content to Cells

As mentioned earlier, you can populate the cells of a table with almost anything you can put on a page. As you insert content, the cell will resize to hold the content. To add text to a cell, place the text cursor in the cell and begin typing. The text wraps around when it reaches the cell margin, and it will push the bottom of the row down to make room if necessary. You can add text and paragraph formatting just as you would with any other block of text, such as creating bulleted and numbered lists; adjusting font, size, style, effects, and color; and setting the alignment of the paragraph. To move quickly from one cell to another, press the Tab key. To insert images or any other page element, click in the cell and use the appropriate menu to insert the item.

To add the text that is already on your Web page, do this:

1. Select **Navigation** and all the information under that text, except for **Contact me: kate@yahoo.net**, right-click and select **Cut.**

2. Place your cursor in the **third row, left-hand cell**, right-click and select **Paste.**

3. Select the image, **photo.jpg,** right-click and select **Cut.**

4. Place your cursor in the **third row, right-hand cell,** right-click and select **Paste.**

WORKING WITH ROWS AND COLUMNS

You are not limited to the number of rows and columns you specified when you first created the table. FrontPage makes it easy to add or remove both rows and columns from your table.

Add Rows and Columns

If you do not get the table exactly the right size, you can add rows and columns to the table. Here is how you would do this:

■ To insert a single row above the currently selected cell or row, click the cell (or select the row) and choose Insert Row from the cell's shortcut menu, or click the Insert Row button in the Tables toolbar.

■ To insert a single column to the left of the currently selected cell or column, click the cell (or select the column) and choose Insert Column from the cell's shortcut menu or click the Insert Column button in the Tables toolbar.

■ To control the position and number of added rows and columns, choose Table, then select Insert Rows Or Columns. This displays the Insert Rows Or Columns dialog box.

Choose the option you want (Rows or Columns) and then use the list box to select the number of rows or columns you want inserted. Use the options in the Location section to determine whether you want the insertion done Above Selection or Below Selection (for Rows) or Left of Selection or Right of Selection (for Columns).

Size Rows and Columns

You can change the size of a row or column easily. To change the size of a column, move the mouse pointer over the left or right edge of the column until it becomes a double-headed arrow. Click and drag the border. As you do, a dashed line appears to show you where the border will be when you release the mouse button.

Changing the size of a row works just the same way. Move your mouse pointer over the top or bottom of the row until it becomes a double-headed arrow. Click and drag the border. As you do, a dashed line appears to show you where the border will be when you release the mouse button.

Distribute Rows and Columns Evenly

You can select multiple adjacent columns or rows to make all the selected columns or rows the same size. To provide an even distribution of columns, select the columns and choose either the Distribute Columns Evenly button on the Tables toolbar, or the Distribute Columns Evenly menu option in the shortcut menu or the Table menu. For

rows, the Tables toolbar button is called Distribute Rows Evenly, as is the menu option in the shortcut menu and the Table menu.

WORKING WITH CELLS

You can modify a table structure by working directly with the cells. Unlike a spreadsheet, tables do not have to be even sets of rows and columns. You can remove cells, merge multiple cells into a single cell, and even stretch a cell across multiple columns and rows. You are free to arrange your table pretty much any way you please.

Split and Merge Cells

If you find that a regular rectangular grid of cells doesn't meet your needs, you can split and merge cells to get the exact table layout you want. To split a cell, click in the cell and choose Split Cells from either the shortcut menu or the Table menu. Alternatively, you can choose the Split Cells button in the Tables toolbar. FrontPage will then display the Split Cells dialog box.

In the Split Cells dialog box, choose whether to split the cells into columns or into rows by picking the appropriate option. Use the Number Of Columns list box to set the number of rows or columns to split the cell into. Data in the original cell are preserved. If you split a cell into columns, the original data are placed in the leftmost cell. If you split a cell into rows, the original data are placed in the uppermost cell.

You can merge multiple adjacent cells into a single cell. To do so, follow these steps:

1. Select all the cells in the first row of your table.

2. Right-click and select **Merge Cells.**

3. The first row in the table has been merged into one cell.

4. Select the text title **KATE FITZGERALD** and the **address** text, right-click, select **Cut**, place your cursor into the newly merged cell, right-click and select **Paste.**

5. You may have to click on the **Center** button to center the text within the cell.

6. Select all the cells in the second row; repeat Step 2.

7. Add the text **My Personal Web Site**, make the text **bold**, **centered**, and match the **font face** and **size** of the other text.

8. Select all the cells in the last row; repeat Step 2.

9. Select the text **Contact me: kate@yahoo.net,** right-click, select **Cut**, place your cursor into the newly merged

cell, right-click and select **Paste.**

10. In the third row, right-hand cell (the cell with the image), enter in the remaining information that you see on the demo Web site.

Set Cell Properties

You can customize the way a cell looks and acts from the Cell Properties dialog box (see Figure T10.23). With the Cell Properties dialog box, you can align the contents of the cell, customize the border and background, and set the size of the cell. To display the Cell Properties dialog box, select one or more cells and choose Cell Properties from the shortcut menu or choose Table, then Table Properties, and then select Cell. Use the fields in the Cell Property dialog box to configure the cell. Here are a few of the properties that you can modify:

■ *Vertical and Horizontal Alignment.* Depending on what you put into a cell, you may wish to change the alignment of the contents. You can set the alignment of cell contents using the Horizontal Alignment and Vertical Alignment drop-down lists in the Cell Properties dialog box. You can change the vertical alignment using the Align Top, Center Vertically, or Align Bottom buttons in the Tables toolbar.

FIGURE T10.23

Cell Properties Dialog Box

■ *Rows and Columns Span.* You can force a cell to stretch across more than one column or row. This is called *spanning.* To set the cell span, use the Rows Spanned and Columns Spanned list box in the Cell Properties dialog box. The effect is similar to merging cells into a larger cell. The difference is that when you span a cell, the cells it spans across are pushed down or sideways, as if you had inserted cells.

■ *Specify Width.* You can set the minimum cell width in the Cell Properties dialog box by checking the Specify Width check box and entering a value in the field. Specify whether the entered value is in pixels or percent; percent is usually the better choice to allow for different browser resolutions.

Change the cell background color to match that of our online example (www.du.edu/~amyphill/T10). Try this:

1. Place your cursor in the **first row**, **right-click** and select **Cell Properties**.

2. Select the **Color** list box under the **Background** section.

3. Click **More Colors**; the More Color Dialog box opens.

4. Click one of the **medium hue blue** colors; it is OK that these colors do not match our online example exactly.

5. Click **OK** and then **OK** again.

6. Make sure that the color blue is not too dark, as you will lose the legibility of the black text in the cell.

7. Place your cursor in the second row, right-click to select the Cell Properties, and repeat Steps 2 to 5 using a lighter shade of blue you selected in Step 4 for contrast.

Formatting Pages

The previous sections described how to create a Web site, create a Web page, and add text, graphics, and tables; this section describes how to apply formatting that applies to the page as a whole. This formatting includes specifying the page background, applying "themes" (coordinated sets of colors and bullets), setting margins, and managing pages with the workgroup tools.

SETTING PAGE PROPERTIES

You can set many properties for your Web pages using the Page Properties dialog box. To open the Page Properties dialog box, right-click anywhere on the page and choose Page Properties from the shortcut menu. Alternatively, you can choose File, then Properties. The Page Properties dialog box has several tabs as displayed in Figure T10.24. Here is a brief description of some of the properties and features:

FIGURE T10.24

Page Properties Dialog Box

- *General Properties.* From the General tab, you can change the title of the page by typing it in the Title field and a description by typing it into the Page Description field. You can also add a background sound to play when the reader first enters the page.

- *Formatting.* The Formatting tab of the Page Properties dialog box is only available if the page does not have a theme assigned to it. There are many options in this section, such as:

- *Background Picture.* If you wish, you can use a picture as the background for the page. Remember that a busy picture will make the page exceedingly hard to read, so you should pick a simple picture, such as a subdued texture.

- *Background Colors.* To use a single color for the page background, click the Background drop-down list in the Colors section of the Formatting tab. This displays the standard Color tool. Choose the color you want to use from the Color tool.

- *Text Colors.* You can pick a default color for all the text on the page from the Text drop-down list. This text color

can be overridden by assigning colors to specific text on the page.

■ *Hyperlink Colors.* You can assign colors to the three types of hyperlinks: (1) Hyperlink (a hyperlink you have not visited), (2) Visited Hyperlink (hyperlinks that you have visited), and (3) Active Hyperlink (the currently selected hyperlink). Be sure to choose distinct colors for these different types of hyperlinks, as most people use the color cues to remember whether they have been to the hyperlink's destination.

■ *Advanced.* The Advanced tab of the Page Properties dialog box allows you to specify margins, styles, and control scripting. The Margins section will be discussed here; however, the other options are beyond the scope of this module.

■ *Page Margins.* You can set the top, left, bottom, and right margins of the page from the Advanced tab of the Page Properties dialog box. The margins are all specified in pixels.

THEMES

A *theme* is a collection of properties you can apply to selected pages or to your whole Web site. These properties include a coordinated palette of colors, button styles, bullet styles, page background properties (graphic, color, rollover effect), and text styles. The purpose of a theme is to give a consistent look to your site. To pick a theme for your page or site, use the Themes Task Pane, shown in Figure T10.25.

Apply Themes to Web Pages or a Web Site

To apply a theme to a page or a site, open the Themes Task Pane by choosing Format, then Theme. The Themes Task Pane displays the following information:

■ *Current Theme.* At the top of the Task Pane is the current theme. This page may be selected in the Folder List, Web Site Folders view, Navigation view, or Hyperlinks view.

■ *Web Site Default Theme.* If you assigned a default theme for the entire Web site (which can be overridden on a page-by-page basis), the Web site default theme identifies which theme that is.

■ *Recently Used Themes.* Any themes you've applied to a page appear in the Recently Used Themes portion of the Task Pane.

■ *All Available Themes.* All available themes are displayed in this section of the Task Pane, including the Web site default theme and recently used themes.

FIGURE T10.25

Themes Task Pane

Set Theme Options

You can modify some of the options associated with a theme using the three check boxes at the bottom of the Themes Task Pane. The available options are:

■ *Vivid Colors—*provides a brighter set of theme colors.

■ *Active Graphics—*converts the buttons and bullets into Dynamic HTML (DHTML) elements that support DHTML formatting (DHTML is beyond the scope of this module).

■ *Background Picture—*overrides the color default and uses the background picture instead. Some themes include both a background color and a background graphic. Themes only use one of these options at a time, and those themes that include both either use the background graphic or the color as the default.

Modify the Properties of a Theme

FrontPage provides many themes, and one may be perfect for you to use just the way it is. If you want to modify a theme, FrontPage allows you to do that. To modify a theme, open the Themes Task Pane and either choose Customize from a theme shortcut menu or click the Create New Theme hyperlink near the bottom of the Task Pane. Choosing Customize from the shortcut menu enables you to use the selected theme as a starting point, whereas clicking Create New Theme enables you to start building a theme from a generic starting point. Either way, FrontPage displays the Customize Theme dialog box, which displays the current properties of the theme as well as three buttons: (1) Colors, (2) Graphics, and (3) Text.

Modify Theme Colors

To modify the theme's colors, click the Colors button to open the Customize Theme dialog box. This dialog box contains three different methods for modifying a theme's colors. Each method has its own tab. The Color Schemes tab (see Figure T10.26) enables you to choose a color scheme from another theme. To do so, choose the name of the theme whose color scheme you want to use from the list of themes on the left side of the dialog box. Click the Vivid Colors option to use a richer color set. The Preview Of area on the right side of the dialog box shows you how your choice will look. Choosing an already defined color scheme is useful in giving you a starting point for making further color modifications. You can also create a theme that combines a color scheme from one theme with custom graphics and text specifications.

Save Your Theme Changes

Two other buttons also appear in the Customize Themes dialog box: Save and Save As. Use the Save button to save your changes to the currently selected theme, overwriting the theme. The Save As button saves your changes to a new theme (this is much safer). When you select the Save As button, you must enter a new name for the theme in the Save Theme dialog box that appears. Clicking OK in the Save Theme dialog box saves your theme under its new name, and the new theme is then available in the list of themes.

FIGURE T10.26

Customize Theme

PLUG-IN SUMMARY

FrontPage allows a user to create many different types of Web sites, such as a personal Web site, a small business Web site, or a corporate Web site. There are several ways to navigate around FrontPage, such as using the menu bar, using the standard toolbar, the main window area, and the task pane. FrontPage allows users to switch between many different views depending on the need or function. Users have the choice of building a Web site using a template, wizard, or using an empty Web site. FrontPage provides templates and wizards for many different purposes.

Graphic images come in basically two flavors, GIF and JPG. Hyperlinks probably constitute the biggest difference between the Web and other media. A link can go to another Web page, another place on the same Web page, another Web site altogether, a file to download, hear a sound, play a video, or an e-mail address.

List and tables allow information to be presented in a structured way. Lists help communicate information in a concise and memorable way. Tables arrange information into rows and columns and give you more flexibility in layout and design. Themes can be applied to selected pages or to your whole Web site. From one location theme properties can alter the palette of colors, button styles, bullet styles, page background properties (graphic, color, rollover effect), and text styles.

MAKING BUSINESS DECISIONS

1. Selecting Web-Safe Colors

Computers with different operating systems (Macintosh, Windows 95/98/Me/2000/XP, and so on) use different color palettes. They do, however, have 216 colors in common. These colors are called *Web-safe colors* (or browser-safe colors) because a browser, regardless of the operating system on which it is running, will display

these colors consistently. Although FrontPage allows you to select any standard color or create your own custom color, you can run into trouble if you use colors that are not considered to be Web-safe. If you create a custom color in a Web page using a monitor with high resolution and 16.7 million colors (32-bit color), you might be surprised when viewing the page on a lower-resolution monitor that is set for 256 colors—the color will most likely be dithered or look washed out. A color that you create on a Macintosh might look different, even terrible, when viewed on a computer running a Windows operating system.

a. Go to www.lynda.com/hex.html.

b. Review **The Web-Safe Color Dilemma** section. Click on the **hue** and **value** hyperlinks to examine the 216 Web-safe colors.

c. Go to www.lynda.com/products/books/dwg/dithering.html and review the test page that Lynda has created. Here you will visually see the dithering effects of graphics that were not saved using a Web-safe color palette.

d. Search the Internet for Web sites that demonstrate the Web-safe colors (search using the keywords "Web-safe colors" or "browser-safe colors").

e. Make a list of the ways you can detect if a Web page is using Web-safe colors or not.

2. **Using Images as Hyperlinks**

Images can be used as hyperlinks, which allow users to click a picture and link to another location. This is an effective way to create visual reference to your pages on a Web site. Look at www.cnn.com for an example of an image that is used as a hyperlink. Several images, if clicked on, will bring you to a detailed story.

a. Create a blank Web page.

b. Search the Internet to find an image of the Tetons and download that to your computer.

c. Insert the image you just downloaded onto the blank Web page you created in *Step a*.

d. Right-click on the image, select **Picture Properties**.

e. Click on the **General** tab.

f. Under the **Default Hyperlink** section, type in the **Location** text box **www.nps.gov/grte/.**

g. **Save** the file.

h. Open the file in your browser and click on the image. You should be taken directly to the National Park Service Grand Teton Web site.

3. **Inserting a Background Sound**

You can have a background sound play when a Web page is loaded or refreshed in a browser; the sound is played using a program and speakers on the user's computer.

a. Go to www.findsounds.com.

b. Locate a small sound clip to add to a Web page. Remember the key here is small! Download the sound clip (this can be a 25k-50k .wav or .au file) onto your computer.

c. To insert a background sound in a Web page, open any Web page you have created or downloaded using FrontPage, select **File** on the menu bar, click **Properties**, click the **General** tab in the Page Properties dialog box, click **Browse** in the Background sound section to find the sound file that you downloaded in the previous step, and then double-click to insert the sound file.

d. Do not select the **Forever** check box, and click **OK**.

e. When you save the Web page, you will need to save the embedded sound file in the Web site's images folder to save it with the Web page.

f. Test the sound clip by opening the Web page in your browser.

4. Developing a Web Site

You have been asked to assist a friend, Arlene Palmer, who is looking to create a Web site called www.topgolf.com to post the top golf clubs available in her area. She wants to display the golf clubs in three categories: (1) woods, (2) iron sets, and (3) putters. Figure T10.27 displays a graphical storyboard of how Arlene wants the main Web page to look.

a. Create a table that will give Arlene the same visual appearance as Figure T10.27.

FIGURE T10.27

Top Golf Web Page Storyboard Design

b. Add all the text and attributes according to Figure T10.27.

c. Search the Internet for three graphical images you can use as a heading for each column. Place them in the appropriate cell within the table.

d. Create a hyperlink to the golf club manufacturer's Web site for the first golf club in each column. You will have to search the Internet to find the URL.

e. In the last row, insert the text **Last Updated:** then add today's date beside that.

f. Add your initials next to the text that you typed in the previous step, highlight your initials, and insert an **e-mail**

hyperlink.

T11

Business Basics

LEARNING OUTCOMES

1. Define the three common business forms.

2. List and describe the seven departments commonly found in most organizations.

3. Describe a transaction and its importance to the accounting department.

4. Identify the four primary financial statements used by most organizations.

5. Define the relationship between sales and marketing, along with a brief discussion of the marketing mix.

6. Define business process reengineering and explain how an organization can use it to transform its business.

Introduction

A sign posted beside a road in Colorado states, "Failing to plan is planning to fail." Playnix Toys posted the sign after successfully completing its 20th year in the toy business in Colorado. The company's mission is to provide a superior selection of high-end toys for children of all ages. When the company began, it generated interest by using unique marketing strategies and promotions. The toy business has a lot of tough competition. Large chain stores such as Wal-Mart and Target offer toys at deep discount prices. Finding the right strategy to remain competitive is difficult in this industry, as FAO Schwarz discovered when it filed for bankruptcy after 143 years in the toy business.[1]

This plug-in introduces basic business fundamentals beginning with the three most common business structures— sole proprietorship, partnership, and corporation. It then focuses on the internal operations of a corporation including accounting, finance, human resources, sales, marketing, operations/production, and management information systems.

Types of Business

Businesses come in all shapes and sizes and exist to sell products or perform services. Businesses make profits or

incur losses. A ***profit*** occurs when businesses sell products or services for more than they cost to produce. A ***loss*** occurs when businesses sell products or services for less then they cost to produce. Businesses typically organize in one of the following types:

1. Sole proprietorship

2. Partnership

3. Corporation

SOLE PROPRIETORSHIP

The ***sole proprietorship*** is a business form in which a single person is the sole owner and is personally responsible for all the profits and losses of the business. The sole proprietorship is the quickest and easiest way to set up a business operation. No prerequisites or specific costs are associated with starting a sole proprietorship. A simple business license costing around $25 from the local county clerk is all that is required to start a sole proprietorship. The person who starts the sole proprietorship is the sole owner.

PARTNERSHIP

Partnerships are similar to sole proprietorships, except that this legal structure allows for more than one owner. Each partner is personally responsible for all the profits and losses of the business. Similar to the sole proprietorship, starting a partnership is a relatively easy process since there are no prerequisites or specific costs required. When starting a partnership, it is wise to have a lawyer draft a partnership agreement. A ***partnership agreement*** is a legal agreement between two or more business partners that outlines core business issues. Partnership agreements typically include:

■ Amount of capital each partner expects to contribute. ***Capital*** represents money whose purpose is to make more money, for example, the money used to buy a rental property or a business.

■ Duties and responsibilities expected from each partner.

■ Expectations for sharing profits and losses.

■ Partner's salary requirements.

■ Methods for conflict resolution.

■ Methods for dissolving the partnership.

Limited Partnership

A ***limited partnership*** is much like a general partnership except for one important fundamental difference; the law

protects the limited partner from being responsible for all of the partnership's losses. The limited partner's legal liability in the business is limited to the amount of his or her investment. The limited partnership enables this special type of investor to share in the partnership profits without being exposed to its losses in the event the company goes out of business. However, this protection exists only as long as the limited partner does not play an active role in the operation of the business.

CORPORATION

The corporation is the most sophisticated form of business entity and the most common among large companies. The *corporation* (also called *organization*, *enterprise*, or *business*) is an artificially created legal entity that exists separate and apart from those individuals who created it and carry on its operations. In a corporation, the business entity is separate from the business owners. *Shareholder* is another term for business owners. An important advantage of using a corporation as a business form is that it offers the shareholders limited liability. *Limited liability* means that the shareholders are not personally liable for the losses incurred by the corporation. In most instances, financial losses incurred by a corporation are limited to the assets owned by the corporation. Shareholders' personal assets, such as their homes or investments, cannot be claimed to pay off debt or losses incurred by the corporation.

There are two general types of corporations—for profit and not for profit. *For profit corporations* primarily focus on making money and all profits and losses are shared by the business owners. *Not for profit* (or *nonprofit*) *corporations* usually exist to accomplish some charitable, humanitarian, or educational purpose, and the profits and losses are not shared by the business owners. Donations to nonprofit businesses may be tax deductible for the donor. Typical examples include hospitals, colleges, universities, and foundations.

Eleanor Josaitis is a tiny 72-year-old woman who co-founded the Detroit civil-rights group Focus: HOPE. Focus: HOPE, founded in 1968, began as a food program serving pregnant women, new mothers, and their children. Josaitis has built the nonprofit organization from a basement operation run by a handful of friends into a sprawling 40-acre campus in Detroit that now employs over 500 people, boasts more than 50,000 volunteers and donors, and has helped over 30,000 people become gainfully employed.

Josaitis and her team developed a technical school to help job seekers gain certifications in IT support. They operate a machinists' training program that funnels people into the employment pipeline at local automotive companies. The organization also teams up with local universities to help disadvantaged students receive college educations, and it

runs a child care center to make sure all these opportunities are available to working and single parents. Josaitis states that the most courageous act she has performed in her life occurred 36 years ago when she turned off her television, got up off the couch, and decided to do something. "You have to have the guts to try something, because you won't change a thing by sitting in front of the TV with the clicker in your hand," Josaitis said.[2]

Forming a corporation typically costs several hundred dollars in fees, and the owners must file a charter within the respective state. The charter typically includes:

- Purpose of the intended corporation.
- Names and addresses of the incorporators.
- Amount and types of stock the corporation will be authorized to issue.
- Rights and privileges of the shareholders.

FIGURE T11.1

Reasons Businesses Choose to Incorporate

Reasons Businesses Choose to Incorporate

Limited liability	In most instances, financial losses or judgments against the corporation are limited to the assets owned by the corporation.
Unlimited life	Unlike sole proprietorships and partnerships, the life of the corporation is not dependent on the life of a particular individual or individuals. It can continue indefinitely until it accomplishes its objective, merges with another business, or goes bankrupt. Unless stated otherwise, it could go on indefinitely.
Transferability of shares	It is easy to sell, transfer, or give the ownership interest in a corporation to another person. The process of divesting sole proprietorships or partnerships can be cumbersome and costly. Property has to be re-titled, new deeds drawn, and other administrative steps taken any time the slightest change of ownership occurs. With a corporation, all of the individual owners' rights and privileges are represented by the shares of stock they own. Corporations can quickly transfer ownership by simply having the shareholders endorse the back of each stock certificate to another party.
Ability to raise investment capital	It is easy to attract new investors into a corporate entity because of limited liability and the easy transferability of ownership.

Comparison of Business Structures

	Sole Proprietorship	**Partnership**	**Corporation**
Licensing	Local license, $25–$100	Partnership agreement, legal fees	Articles of incorporation through the Secretary of State
Income	Business flows directly into personal income	Distributions taken by partners, as agreed by partners	Business and personal earnings separate, depending on corporate structure
Liability	Owner is liable	Owners are liable	Only business is liable

The most common reason for incurring the cost of setting up a corporation is the recognition that the shareholder is not legally liable for the actions of the corporation. Figure T11.1 displays the primary reasons businesses choose to incorporate.

The Limited Liability Corporation (LLC)

The *limited liability corporation (LLC)* is a hybrid entity that has the legal protections of a corporation and the ability to be taxed (one time) as a partnership. A company can form an LLC for any lawful business as long as the nature of the business is not banking, insurance, and certain professional service operations. By simply filing articles of organization with the respective state agency, an LLC takes on a separate identity similar to a corporation, but without the tax problems of the corporation. Figure T11.2 summarizes the primary differences between the three most common business structures.

Internal Operations of a Corporation

The majority of corporations use different specialized departments to perform the unique operations required to run the business. These departments commonly include accounting, finance, human resources, sales, marketing, operations/production, and management information systems (see Figure T11.3).

Accounting

The *accounting department* provides quantitative information about the finances of the business including recording, measuring, and describing financial information. People tend to use the terms *accounting* and

bookkeeping synonymously; however, the two are different. ***Bookkeeping*** is the actual recording of the business's transactions, without any analysis of the information. ***Accounting*** analyzes the transactional information of the business so the owners and investors can make sound economic decisions.

FIGURE T11.3

Departmental Structure of a Typical Organization

The two primary types of accounting are financial and managerial. ***Financial accounting*** involves preparing financial reports that provide information about the business's performance to external parties such as investors, creditors, and tax authorities. Financial accounting must follow strict guidelines known as Generally Accepted Accounting Principles (GAAP) guidelines. ***Managerial accounting*** involves analyzing business operations for internal decision making and does not have to follow any rules issued by standard-setting bodies such as GAAP.

FINANCIAL STATEMENTS

All businesses operate using the same basic element, the transaction. A ***transaction*** is an exchange or transfer of goods, services, or funds involving two or more people. Each time a transaction occurs a source document captures all of the key data involved with the transaction. The ***source document*** describes the basic transaction data such as its date, purpose, and amount and includes cash receipts, canceled checks, invoices, customer refunds, employee time sheet, etc. The source document is the beginning step in the accounting process and serves as evidence that the transaction occurred. ***Financial statements*** are the written records of the financial status of the business that allow interested parties to evaluate the profitability and solvency of the business. ***Solvency*** represents the ability of the business to pay its bills and service its debt. The financial statements are the final product of the accountant's analysis of the business transactions. Preparing the financial statements is a major undertaking and requires a significant amount of effort. Financial statements must be understandable, timely, relevant, fair, and objective in order to be useful. The four primary financial statements include:

- Balance sheet.
- Income statement.
- Statement of owner's equity.
- Statement of cash flows.

Balance Sheet

The ***balance sheet*** gives an accounting picture of property owned by a company and of claims against the property

on a specific date. The balance sheet is based on the fundamental accounting principle that assets = liabilities + owner's equity. An *asset* is anything owned that has value or earning power. A *liability* is an obligation to make financial payments. *Owner's equity* is the portion of a company belonging to the owners. The left (debit) side of a balance sheet states assets. The right (credit) side shows liabilities and owners' equity. The two sides must be equal (balance). The balance sheet is like a snapshot of the position of an individual or business at one point in time (see Figure T11.4).

Income Statement

The *income statement* (also referred to as *earnings report, operating statement,* and *profit-and-loss (P&L) statement*) reports operating results (revenues minus expenses) for a given time period ending at a specified date. *Revenue* refers to the amount earned resulting from the delivery or manufacture of a product or from the rendering of a service. Revenue can include sales from a product or an amount received for performing a service. *Expenses* refer to the costs incurred in operating and maintaining a business. The income statement reports a company's *net income*, or the amount of money remaining after paying taxes (see Figure T11.5).

FIGURE T11.4

Balance Sheet Example

FIGURE T11.5

Income Statement Example

Income Statement

Revenue (Sales)	$60,000,000
Cost of Goods Sold	$30,000,000
Gross Profit (Sales – Cost of Goods Sold)	$30,000,000
Operating Expenses	$7,000,000
Profit Before Taxes (Gross Profit – Operating Expenses)	$23,000,000
Taxes	$18,000,000

Net Profit (or Loss)	$5,000,000

Statement of Owner's Equity

The *statement of owner's equity* (also called the *statement of retained earnings* or *equity statement*) tracks and communicates changes in the shareholder's earnings. Profitable organizations typically pay the shareholders dividends. *Dividends* are a distribution of earnings to shareholders.

Statement of Cash Flows

Cash flow represents the money an investment produces after subtracting cash expenses from income. The *statement of cash flows* summarizes sources and uses of cash, indicates whether enough cash is available to carry on routine operations, and offers an analysis of all business transactions, reporting where the firm obtained its cash and how it chose to allocate the cash. The cash flow statement shows where money comes from, how the company is going to spend it, and when the company will require additional cash. Companies typically project cash flow statements on a monthly basis for the current year and a quarterly basis for the next two to five years. A *financial quarter* indicates a three-month period (four quarters per year). Cash flow statements become less valid over time since numerous assumptions are required to project into the future.

When it comes to decreasing expenses and managing a company's cash flow, managers need to look at all costs. Ben Worthen, executive vice president and CIO of Manufacturers Bank in Los Angeles, states that everyone notices the million-dollar negotiation; however, a couple of thousand dollars here and there are just as important. When attempting to cut costs, Worthen listed every contract the bank had. He saved $5,000 by renegotiating a contract with the vendor who watered the plants, a vendor that most employees did not even know existed. He also saved $50,000 by renegotiating the contract with the bank's cleaning agency. "You need to think of everything when cutting costs," Worthen said. "$5,000 buys three or four laptops for salespersons."[3]

Finance

Finance deals with the strategic financial issues associated with increasing the value of the business while observing applicable laws and social responsibilities. Financial decisions include such things as:

- How the company should raise and spend its capital.
- Where the company should invest its money.
- What portion of profits will be paid to shareholders in the form of dividends.

■   Should the company merge with or acquire another business.

Financial decisions are short term (usually up to one year), medium term (one to seven years), or long term (more than seven years). The typical forms of financing include loans (debt or equity) or grants. Financing may be required for immediate use in business operations or for an investment.

FINANCIAL ANALYSIS

Different financial ratios are used to evaluate a company's performance. Companies can gain additional insight into their performance by comparing financial ratios against other companies in their industry. A few of the more common financial ratios include:

■   **Internal rate of return (IRR)**—the rate at which the net present value of an investment equals zero.

■   **Return on investment (ROI)**—indicates the earning power of a project and is measured by dividing the benefits of a project by the investment.

■   **Cash flow analysis**—a means to conduct a periodic check on the company's financial health. A projected cash flow statement estimates what the stream of money will be in coming months or years, based on a history of sales and expenses. A monthly cash flow statement reveals the current state of affairs. The ability to perform a cash flow analysis is an essential skill for every business owner; it can be the difference between being able to open a business and being able to stay in business.

■   **Break-even analysis**—a way to determine the volume of business required to make a profit at the current prices charged for the products or services. For example, if a promotional mailing costs $1,000 and each item generates $50 in revenue, the company must generate 20 sales to break even and cover the cost of the mailing. The *break-even point* is the point at which revenues equal costs. The point is located by performing a break-even analysis. All sales over the break-even point produce profits; any drop in sales below that point will produce losses (see Figure T11.6).

Human Resources

Human resources (HR) includes the policies, plans, and procedures for the effective management of employees (human resources). HR typically focuses on the following:

■   Employee recruitment.

■   Employee selection.

- ■ Employee training and development.

- ■ Employee appraisals, evaluations, and rewards.

- ■ Employee communications7.

FIGURE T11.6

Break-Even Analysis

The primary goal of HR is to instill employee commitment by creating an environment of shared values, innovation, flexibility, and empowerment. Most organizations recognize that focusing on strong HR practices that foster employee growth and satisfaction can significantly contribute to achieving business success. The most obvious way HR practices create business success is through quality employee selection. Hiring the right employee who suits the company's culture is difficult. Organizations create employee value by implementing employment practices such as training, skill development, and rewards. An organization that focuses on HR creates valuable employees with strategic business competencies.

MANAGEMENT TECHNIQUES

There may be no such thing as a best practice for managing people. Numerous management techniques are used by all different types of managers in a variety of industries. For example, Sears and Nordstrom are legends in the retailing industry; however, their approaches to HR are completely different. Sears is one of the pioneering companies in the science of employee selection, relying on some of the most sophisticated selection tests in American industry. Sears employees receive extensive training in company practices; management tracks employee attitudes and morale through frequent and rigorous employee surveys. The company provides its sales representatives, who work on salary rather than commission, with intensive training in Sears' products, the company's operating systems, and sales techniques.

Nordstrom operates with virtually no formal personnel practices. Its hiring is decentralized, using no formal selection tests. Managers look for applicants with experience in customer contact, but the main desirable quality appears to be pleasant personalities and motivation. The company has only one rule in its personnel handbook: "Use your best judgment at all times." Individual salesclerks virtually run their areas as private stores. Nordstrom maintains a continuous stream of programs to motivate employees to provide intensive service, but it offers very little training. Its commission-based payroll system makes it possible for salesclerks to earn sizable incomes. Nordstrom sales personnel are ranked within each department according to their monthly sales; the most successful

are promoted (almost all managers are promoted from within the company) and the least successful are terminated.[4]

Sears and Nordstrom are both highly successful retailers, yet they operate using widely different recruitment policies. One of the biggest success factors for any business is the company's management and personnel. Employees must possess certain critical skills for the company to succeed. The HR department takes on the important task of hiring, training, evaluating, rewarding, and terminating employees. Effective HR goes far beyond executing a standard set of policies and procedures; it requires questioning and understanding the relationships between choices in managing people, the strategies and goals of the organization, and the possibilities presented by the external environment. Today's competitive environment features rapid technological change, increasingly global markets, and a diverse workforce comprising not just men and women with different sorts of career objectives, but also potential workers from diverse cultural and ethnic backgrounds. HR must ensure that the choices made in managing people are made sensibly and with clear purposes in mind.

Sales

Sales is the function of selling a good or service and focuses on increasing customer sales, which increases company revenues. A salesperson has the main activity of selling a product or service. Many industries require a license before a salesperson can sell the products, such as real estate, insurance, and securities.

A common view of the sales department is to see the salespersons only concerned with making the sale now, without any regard to the cost of the sale to the business. This is called the hard sell, where the salesperson heavily pushes a product (even when the customer does not want the product) and where price cuts are given even if they cause financial losses for the company. A broader view of the sales department sees it as taking on the task of building strong customer relationships where the primary emphasis is on securing new customers and keeping current customers satisfied. Many sales departments are currently focusing on building strong customer relationships.

THE SALES PROCESS

Figure T11.7 depicts the typical sales process, which begins with an opportunity and ends with billing the customer for the sale. An opportunity is a name of a potential customer who might be interested in making a purchase (opportunities are also called leads). The company finds opportunities from a variety of sources such as mailing lists and customer inquiries. The name is sent to a salesperson who contacts the potential customer and sets up a meeting

to discuss the products. During the meeting, all problems and issues are identified and resolved, and the salesperson generates a quote for the customer. If the customer decides to accept the quote, a sales order is placed. The company fulfills the order and delivers the product, and the process ends when the customer is billed.

FIGURE T11.7

The Sales Process

MARKET SHARE

Sales figures offer a good indication of how well a company is performing. For example, high sales volumes typically indicate that a company is performing well. However, they do not always indicate how a firm is performing relative to its competitors. For example, changes in sales might simply reflect shifts in market size or in economic conditions. A sales increase might occur because the market increased in size, not because the company is performing better.

Measuring the proportion of the market that a firm captures is one way to measure a firm's performance relative to its competitors. This proportion is the firm's ***market share*** and is calculated by dividing the firm's sales by the total market sales for the entire industry. For example, if a firm's total sales (revenues) were $2 million and the sales for the entire industry were $10 million, the firm would have captured 20 percent of the total market, or have a 20 percent market share.

Many video game products launch with great enthusiasm and die a quick death such as Sega's GameGear and DreamCast, Atari's Lynx, and Nintendo's Virtual Boy. Video game consoles die quickly when only a limited number of game publishers sign up to supply games for the particular product. Producing video game products is a tough competitive business in a finicky market.

Sony recently released its first hand-held video game player, the PSP (for PlayStation Portable). The current market leader is Nintendo's GameBoy, which uses pricey cartridges for games. Instead of pricey cartridges, the PSP plays inexpensive mini disks to bring PlayStation2-quality graphics to the relatively primitive hand-held market. When Sony announced the PSP, game publishers raced to get a piece of the action, and Sony had 89 companies contracted to build games within a few weeks. In contrast, when Nokia launched its N-Gage game device, it struggled to land five game publishers. Electronic Arts, the world's biggest game publisher, has already committed to developing almost a dozen PSP games and has declared that the PSP will be the biggest driver of growth in the video game market for the next five years. For a new video game product heading into an uncertain and high-stakes market, that

is the ultimate vote of confidence.[5]

Reasons to Increase Market Share

Many organizations seek to increase their market share because many individuals assimilate market share with profitability. Figure T11.8 indicates the primary reasons organizations seek to increase their market share.

FIGURE T11.8

Reasons to Increase Market Share

Reasons to Increase Market Share

Economies of scale—An organization can develop a cost advantage by selling additional

products or higher volumes.

Sales growth in a stagnant industry—If an industry stops growing, an organization can

increase its sales by increasing its market share.

Reputation—A successful organization with a solid reputation can use its clout to its

advantage.

Increased bargaining power—Larger organizations have an advantage in negotiating

with suppliers and distributors.

Ways to Increase Market Share

A primary way to increase market share is by changing one of the following variables: product, price, place, or promotion (see Figure T11.9). It is common to refer to these four variables as the marketing mix, discussed in detail below.

Reasons Not to Increase Market Share

Surprisingly, it is not always a good idea to increase an organization's market share. Figure T11.10 offers a few reasons why increasing an organization's market share can actually decrease an organization's revenues.

Marketing

Marketing is the process associated with promoting the sale of goods or services. The marketing department supports the sales department by creating promotions that help sell the company's products. *Marketing communications* seek to build product or service awareness and to educate potential consumers on the product or service.

Jenny Ming, president of Old Navy, a division of Gap Inc., believes that unique marketing ideas for Old Navy's original designs heavily contributed to the success of the $6.5 billion brand. Ideas come from anywhere, and Ming found one of the company's most successful products when she was dropping her daughter off at school. It was pajama day at school, and all of the girls were wearing pajama bottoms with a tank top. Ming began wondering why they even created and sold pajama tops; nobody seemed to wear them. The company, having problems selling pajama sets, quickly introduced "just bottoms," a line of pajama bottoms selling at $15. A full pajama set cost $25. Along with the bottoms, the company offered tank tops in different colors so the customer could mix and match the items. The company built a huge business from the "just bottoms" line. Ming encourages her staff to look for marketing and product opportunities everywhere, even in the most unlikely of places.[6]

FIGURE T11.9

Ways to Increase Market Share

Ways to Increase Market Share

Product—An organization can change product attributes to provide more value to the customer. Improving product quality is one example.
Price—An organization can decrease a product's price to increase sales. This strategy will not work if competitors are willing to match discounts.
Place (Distribution)—An organization can add new distribution channels. This allows the organization to increase the size of its market, which should increase sales.
Promotion—An organization can increase spending on product advertising, which should increase sales. This strategy will not work if competitors also increase advertising.

FIGURE T11.10

Reasons Not to Increase Market Share

Reasons Not to Increase Market Share

If an organization is near its production capacity and it experiences an increase in market share, it could cause the organization's supply to fall below its demand. Not being able to deliver products to meet demand could damage the organization's reputation.
Profits could decrease if an organization gains market share by offering deep discounts or by increasing the amount of money it spends on advertising.

If the organization is not prepared to handle the new growth, it could begin to offer

shoddy products or less attentive customer service. This could result in the loss of its

professional reputation and valuable customers.

MARKETING MIX

The classic components of marketing include the four Ps in the marketing mix: product, price, place, and promotion.

The *marketing mix* includes the variables that marketing managers can control in order to best satisfy customers in

the target market (see Figure T11.11). The organization attempts to generate a positive response in the target market

by blending these four marketing mix variables in an optimal manner.

Figure T11.12 summarizes the primary attributes involved with each decision made in the marketing mix.

FIGURE T11.11

The Marketing Mix

FIGURE T11.12

Common Attributes Involved with Each P in the Marketing Mix

Product	Price	Place (Distribution)	Promotion
Quality	Discount	Channel	Advertising
Brand	Financing	Market	Sales
Appearance	Lease	Location	Public relations
Package		Logistics	Marketing message
Function		Service Level	Media type
Warranty			Budget
Service/Support			

CUSTOMER SEGMENTATION

Market segmentation is the division of a market into similar groups of customers. It is not always optimal for an

organization to offer the same marketing mix to vastly different customers. Market segmentation makes it possible

for organizations to tailor the marketing mix for specific target markets, hence better satisfying its customer needs.

Not all attributes of the marketing mix need to be changed for each market segment. For example, one market

segment might require a discounted price, while another market segment might require better customer service. An

organization uses marketing research, market trends, and managerial judgment when deciding the optimal way to

segment a market. Market segmentation typically includes:

■   **Geographic segmentation**—based on regional variables such as region, climate, population density, and population growth rate.

■   **Demographic segmentation**—based on variables such as age, gender, ethnicity, education, occupation, income, and family status.

■   **Psychographic segmentation**—based on variables such as values, attitudes, and lifestyles.

■   **Behavioral segmentation**—based on variables such as usage rate, usage patterns, price sensitivity, and brand loyalty.

THE PRODUCT LIFE CYCLE

The *product life cycle* includes the four phases a product progresses through during its life cycle including introduction, growth, maturity, and decline. An organization's marketing of a product will change depending on its stage in the product life cycle. An organization can plot a product's profits as a function of the product life cycle (see Figure T11.13).

Joanne Bischmann, vice president, Harley-Davidson Inc., is still awed by the lengths customers will go to display their commitment to Harley-Davidson products. Recently, she saw a man who had tattooed a portrait of the four founding fathers along with their 100th anniversary logo on his back. When Bischmann was hired, her manager told her the following, "This will be the best job you're ever going to have because it isn't just about working at a company that makes motorcycles. The founding fathers actually seep out of the walls here." After 15 years with the company, Bischmann agrees with that statement. She always receives calls asking for the Harley-Davidson manual on how to keep customers passionate. Unfortunately, there is no manual. According to Bischmann, Harley-Davidson is a brand that none can own individually; it is more like a tribe, and its members carry on its traditions so it will be here for future generations.[7]

Operations/Production

Operations management (also called *production management)* includes the methods, tasks, and techniques organizations use to produce goods and services. The operations department oversees the transformation of input resources (i.e., labor, materials, and machines) into output resources (i.e., products and services). The operations department is critical because it manages the physical processes by which companies take in raw materials, convert

them into products, and distribute them to customers. The operations department generally ranks high in the responsibilities of general management.

BUSINESS PROCESS REENGINEERING

A *business process* is a standardized set of activities that accomplishes a specific task, such as processing a customer's order. *Business process reengineering (BPR)* is the analysis and redesign of workflow within and between enterprises. In business process reengineering, the project team starts with a clean sheet of paper and redesigns the process to increase efficiency and effectiveness. The project team does not take anything for granted and questions all the aspects of the process and the business. The reengineering project team obtains dramatic process improvement by redesigning processes that cross departments.

FIGURE T11.13

The Product Life Cycle

Most of the major opportunities for process improvement exist in cross-departmental processes. Information technology usually plays a key role in process improvement by making possible a radically faster and almost paperless process. However, IT is only an enabling factor. A classic reengineering project example is the accounts payable process at Ford. Through BPR, Ford reduced the number of people required to perform the process from 500 to 125.[8]

TRANSFORMING CORPORATIONS

Complete transformation of an organization, or an entire industry, is the ultimate goal of successful business process reengineering. Figure T11.14 displays a matrix that has project scope on one axis and project speed on the other. For a project with a relatively narrow scope where the speed is fast, reengineering occurs. Fast speed with broad scope may be a turnaround situation requiring downsizing and tough decision making. A project with a relatively slow speed and narrow scope results in continuous improvement. In the upper right-hand corner of Figure T11.14, where the project scope is broad and the time frame for achieving that change is longer, the term *transformation* is appropriate.

FIGURE T11.14

Organizational Transformation Through BPR

Progressive Insurance offers a great example of a corporation that transformed its entire industry by reengineering the insurance claims process. Progressive Insurance has seen phenomenal growth in an otherwise staid auto

insurance market. Progressive's growth came not through acquisitions or mergers—the stuff that puts CEOs on the front page of *The Wall Street Journal*—but through substantial innovations in everyday operations. Progressive reengineered the insurance claim process. When a customer has an auto accident, Progressive representatives are on hand 24 hours a day to take the call and schedule a claims adjustor. The claims adjustor works out of a mobile van, enabling a nine-hour turnaround rather than the industry-standard of 10 to 17 days. The Progressive adjustor prepares an estimate on the spot and will, in most cases, write the customer a check immediately and even offer a ride home.

What provoked this innovation? Progressive says it was the strong connection it has to its customers, its willingness to listen to customers' frustrations, and the common sense to act on those frustrations by changing the core of its business operations. As a result of customer feedback, the company did not merely tweak the details of the claims adjustment process. It dramatically rewrote the process, resulting in significant cost savings for the company. More important, however, the hassle-free claims process keeps customers happy and loyal, reducing the significant burden of constantly replacing lapsed customers with new ones.[9]

Management Information Systems

Information technology (IT) is any computer-based tool that people use to work with information and support the information and information-processing needs of an organization. Information technology is a broad subject concerned with technology and other aspects of managing and processing information, especially in large organizations. In particular, IT deals with the use of electronic computers and computer software to convert, store, protect, process, transmit, and retrieve information. For that reason, computer professionals are often called IT specialists, and the division that deals with software technology is often called the IT department.

Management information systems is a business function just as marketing, finance, operations, and human resources management are business functions. Formally defined, ***management information systems (MIS)*** is the function that plans for, develops, implements, and maintains IT hardware, software, and applications that people use to support the goals of an organization. Other names for MIS include information services (IS), management information services (MIS), or managed service provider (MSP). In business, MIS supports business processes and operations, decision making, and competitive strategies. MIS involves collecting, recording, storing, and basic processing of information including:

■ Accounting records such as sales, purchase, investment, and payroll information, processed into financial statements such as income statements, balance sheets, ledgers, management reports, and so on.

■ Operations records such as inventory, work-in-process, equipment repair and maintenance, supply chain, and other production/operations information, processed into production schedules, production controllers, inventory systems, and production monitoring systems.

■ Human resources records such as personnel, salary, and employment history information, processed into employee expense reports and performance-based reports.

■ Marketing records such as customer profiles, customer purchase histories, marketing research, advertising, and other marketing information, processed into advertising reports, marketing plans, and sales activity reports.

■ Strategic records such as business intelligence, competitor analysis, industry analysis, corporate objectives, and other strategic information, processed into industry trends reports, market share reports, mission statements, and portfolio models.

The bottom line is that management information systems use all of the above to implement, control, and monitor plans, strategies, tactics, new products, new business models, or new business ventures. Unit 1 covers IT and MIS in detail.

PLUG - IN SUMMARY

The study of business begins with understanding the different types of businesses including a sole proprietorship, partnership, or a corporation. Figure T11.15 highlights seven departments found in a typical business.

All of these departments must be able to execute activities specific to their business function and also be able to work with the other departments to create synergies throughout the entire business.

FIGURE T11.15

Common Departments in a Business

■ **Accounting** provides quantitative information about the finances of the business including recording, measuring, and describing financial information.

■ **Finance** deals with the strategic financial issues associated with increasing the value of the business, while observing applicable laws and social responsibilities.

■ **Human resources (HR)** includes the policies, plans, and procedures for the effective management of employees (human resources).

■ **Sales** is the function of selling a good or service and focuses on increasing customer sales, which increases company revenues.

■ **Marketing** is the process associated with promoting the sale of goods or services. The marketing department supports the sales department by creating promotions that help sell the company's products.

■ **Operations management (**also called **production management)**includes the methods, tasks, and techniques organizations use to produce goods and services. Transportation (also called logistics) is part of operations management.

■ **Management information systems (MIS)** is the function that plans for, develops, implements, and maintains IT hardware, software, and applications that people use to support the goals of an organization.

KEY TERMS

MAKING BUSINESS DECISIONS

1.   Setting Up a Business

Your friend, Lindsay Harvey, is going to start her own chocolate shop, called Chocolate-By-Design. Lindsay is an expert candy maker and one of the city's top pastry chefs. Lindsay has come to you for advice on what type of business Chocolate-By-Design should be—a sole proprietorship, partnership, or corporation. Create a report comparing the three different types of businesses, along with your recommendation for Chocolate-By-Design's business structure.

2.   Guest Lecturing on Business

As a recent college graduate, your favorite professor, Dr. Henning, has asked you to come back and guest lecture at his introduction to business course. Create a presentation defining the different departments in a typical business, what roles each play, and why it is important that they all work together.

3.   Expanding Markets

J. R. Cash created a small business selling handmade cowboy boots, and within a year his business is booming. J. R. currently builds all of the boots in his store and takes orders over the phone and from walk-in customers. There is currently a three-month waiting list for boots. J. R. is not sure how to grow his business and has come to you for advice. Describe the reasons and ways some businesses increase market share and why J. R. might choose not to increase his market share.

4.   Segmenting Customers

Due to your vast marketing experience, you have been hired by a new company, Sugar, to perform a strategic analysis on chewing gum. The company wants to understand the many market segments for the different brands, flavors, sizes, and colors of gum. Create an analysis of the different market segments for chewing gum. What market segment would you recommend Sugar pursue?

5.   Product Life Cycle

An associate, Carl Grotenhuis, has developed a new brand of laundry detergent called Clean. Carl wants your opinion on his potential to enter and dominate the laundry detergent market. Using the product life cycle create a recommendation for Carl's new product.

6.   Redesigning a Business

Tom Walton is the new CEO for Lakeside, a large cereal manufacturing company. Tom's predecessor had run the company for 50 years and did little in terms of process improvement; in fact, his motto was "if it isn't broke, why fix it." Tom wants to take advantage of technology to create new processes for the entire company. He believes that improving operations will increase efficiency and lower costs.

Tom has a major hurdle to overcome before he can begin revamping the company—its employees. Many of the employees have worked at the company for decades and are comfortable with the motto "if it isn't broke, why fix it." Develop a plan Tom can use to communicate to his employees the potential value gained from business process reengineering.

Notes

10.   "Toy Wars," www.pbs.org, accessed December 23, 2003.

11.   "Innovative Managers," *BusinessWeek,* April 24, 2005.

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[1] Julie Schlosser, "Toys 'R'Us Braces for a Holiday Battle," *Money,* December 22, 2003.

[2] Alison Overholdt, "The Housewife Who Got Up Off the Couch," *Fast Company,* September 2004, p. 94.

[3] Adrian Danescu, "Save $55,000," *CIO Magazine,* December 15, 2004, p. 70.

[4] "Can the Nordstroms Find the Right Style?" *BusinessWeek,* July 30, 2001.

[5] Geoff Keighley, "Will Sony's PSP Become the iPod of Gaming Devices?" *Business 2.0,* May 2004, p. 29.

[6] "From the Bottom Up," *Fast Company,* June 2004, p. 54.

[7] "Harley-Davidson: Ride Your Heritage," *Fast Company,* August 2004, p. 44.

[8] "Ford on Top," *Fast Company,* June 2004, p. 54.

[9] Michael Hammer, *Beyond Reengineering: How the Process-Centered Organization Is Changing Our Work and Our Lives* (New York: HarperCollins Publishers, 1997).

T12

Business Process

LEARNING OUTCOMES

1. Describe business processes and their importance to an organization.

2. Differentiate between customer facing processes and business facing processes.

3. Compare the continuous process improvement model and business process reengineering.

4. Describe the importance of business process modeling (or mapping) and business process models.

5. Explain business process management along with the reason for its importance to an organization.

Introduction

The benefits of business process improvement vary, but a rough rule of thumb is that it will, at a minimum, double the gains of a project by streamlining outdated practices, enhancing efficiency, promoting compliance and standardization, and making an organization more agile. Business process improvement involves three key steps:

1. Measure what matters to most customers.

2. Monitor the performance of key business processes.

3. Assign accountability for process improvement.

Comprehensive business process management systems help organizations model and define complete business processes, implement those processes integrated with existing systems, and provide business leaders with the ability to analyze, manage, and improve the execution of processes in real time.

Examining Business Processes

Waiting in line at a grocery store is a great example of the need for process improvement. In this case, the "process" is called checkout, and the purpose is to pay for and bag groceries. The process begins when a customer steps into line and ends when the customer receives the receipt and leaves the store. The *process* steps are the activities the customer and store personnel do to complete the transaction. A **business process** is a standardized set of activities that accomplish a specific task, such as processing a customer's order. Business processes transform a set of inputs into a set of outputs (goods or services) for another person or process by using people and tools. This simple example describes a customer checkout process. Imagine other business processes: developing new products, building a new home, ordering clothes from mail-order companies, requesting new telephone service from a telephone company, administering Social Security payments, and so on.

Examining business processes helps an organization determine bottlenecks and identify outdated, duplicate, and smooth running processes. To stay competitive, organizations must optimize and automate their business processes. To identify which business processes need to be optimized, the organization must clearly understand its business processes, which typically have the following important characteristics:

■ The processes have internal and external users.

■ A process is cross-departmental. Departments are functional towers of expertise, but processes cut across departments.

■ The processes occur across organizations.

■ The processes are based on how work is done in the organization.

■ Every process should be documented and fully understood by everyone participating in the process.

■ Processes should be modeled to promote complete understanding.

A business process can be viewed as a "value chain." By contributing to the creation or delivery of a product or service, each step in a process should add value to the preceding step. For example, one step in the product development process consists of conducting market acceptance tests. This step adds value by ensuring that the product meets the needs of the market before the product or service is finalized. A tremendous amount of learning and improvement can result from the documentation and examination of the input-output linkages. However, between every input and every output is a process. Knowledge and improvement can only be

completed by peeling the layers of the onion and examining the processes through which inputs are converted into outputs. Figure T12.1 displays several sample business processes.

Some processes (such as a programming process) may be contained wholly within a single department. However, most processes (such as ordering a product) are cross-departmental, spanning the entire organization. Figure T12.2 displays the different categories of cross-departmental business processes. *Customer facing processes* result in a product or service that is received by an organization's external customer. *Business facing processes* are invisible to the external customer but essential to the effective management of the business and include goal setting, day-to-day planning, performance feedback, rewards, and resource allocation.

UNDERSTANDING THE IMPORTANCE OF BUSINESS PROCESSES

Organizations are only as effective as their business processes. Developing logical business processes can help an organization achieve its goals. For example, an automobile manufacturer might have a goal to reduce the time it takes to deliver a car to a customer. The automobile manufacturer cannot hope to meet this goal with an inefficient ordering process or a convoluted distribution process. Sales representatives might be making mistakes when completing order forms, data-entry clerks might not accurately code order information, and dock crews might be inefficiently loading cars onto trucks. All of these errors increase the time it will take to get the car to the customer. Improving any one of these business processes can have a significant effect on the total distribution process, made up of the order entry, production scheduling, and transportation processes.

FIGURE Ts12.1

Sample Business Processes

Sample Business Processes
ACCOUNTING BUSINESS PROCESSES
■ Accounts payable
■ Accounts receivable
■ Bad/NSF checks
■ Bank account reconciliation
■ Cash receipts

- Check requests

- Check signing authority

- Depreciation

- Invoice billings

- Petty cash

- Month-end closing procedures

CUSTOMER SERVICE BUSINESS PROCESSES

- Customer satisfaction survey

- Customer service contact/complaint handling

- Guarantee customer service satisfaction

- Postsale customer follow-up

- Warranty and service policies

ENVIRONMENTAL BUSINESS PROCESSES

- Environmental protection

- Hazardous waste management

- Air/water/soil resource management

FINANCE BUSINESS PROCESSES

- Account collection

- Bank loan applications

- Banking policy and relations

- Business plans and forecasts

- Customer credit approval and credit terms

- Exercise of incentive stock options

- Property tax assessments

- Release of financial or confidential information

- Stock transactions

- Weekly financial and six-week cash flow reports

HUMAN RESOURCES BUSINESS PROCESSES

- Board of directors and shareholders meetings, minutes, and protocol

- Disabilities employment policies

- Drug-free workplace employment policies

- Employee hiring policies

- Employee orientation

- Family and medical leave act

- Files and records management

- Health care benefits

- Paid and unpaid time off

- Pay and payroll matters

- Performance appraisals and salary adjustments

- Resignations and terminations

- Sexual harassment policies

- Training/tuition reimbursement

- Travel and entertainment

- Workplace rules and guidelines

- Workplace safety

MANAGEMENT INFORMATION SYSTEMS BUSINESS PROCESSES

- Disaster recovery procedures

- Backup/recovery procedures

- Service agreements, emergency services, and community resources

- Emergency notification procedures

- Office and department recovery

- User workstation standards

- Use of personal software

- Computer security incident reporting

- Control of computer virus programs

- Computer user/staff training plan

- Internet use policy

- E-mail policy

- Computer support center

MANUFACTURING BUSINESS PROCESSES

- Assembly manuals

- Bill of materials

- Calibration for testing and measuring equipment

- FDA inspections

- Manufacturing change orders

- Master parts list and files

- Serial number designation

- Quality control for finished goods

- Quality assurance audit procedure

SALES AND MARKETING BUSINESS PROCESSES

- Collection of sales tax

- Copyrights and trademarks

- Marketing plans model number

- Designation public relations

- Return of goods from customers

- Sales leads

- Sales order entry

- Sales training

- Trade shows

SHIPPING, PURCHASING, AND INVENTORY CONTROL BUSINESS PROCESSES

- Packing, storage, and distribution

- Physical inventory procedures

- Purchasing procedures

- ■ Receiving, inspection, and stocking of parts and materials

- ■ Shipping and freight claims

- ■ Vendor selection, files, and inspections

IBM Business Consulting Services helped Bank of America's card services division identify $40 million of simplification and cost savings projects over two years by improving business processes to identify opportunities, eliminate redundancies, consolidate systems/applications, and remove duplicate processes. Within the card services and e-commerce division were several fragmented strategies and IT architectures. These were consolidated and simplified to streamline the business area and provide better and faster response to customer demand.

The scope of the IT strategy and architecture business process realignment project included all consumer card segments (including military, school, airlines, etc.), ATM cards and services, and e-commerce.[1]

FIGURE T12.2

Customer Facing, Industry-Specific, and Business Facing Processes

Customer Facing Processes	Industry-Specific Customer Facing Processes	Business Facing Processes
Marketing and sales	Banking—loan processing	Strategic planning
Product development	Insurance—claims processing	Tactical planning
Service development	Government—grant allocation	Budgeting
Manufacturing	Retail—merchandise return	Training
Distribution	Restaurant—food preparation	Purchasing
Billing	Airline—baggage handling	
Order processing	Hotel—reservation handling	
Customer service		

Business Process Improvement

Improving business processes is paramount for businesses to stay competitive in today's marketplace. Over the past 10 to 15 years, companies have been forced to improve their business processes because customers

are demanding better products and services; if they do not receive what they want from one supplier, they have many others to choose from (hence the competitive issue for businesses). Figure T12.3 displays several opportunities for business process improvement.

Many organizations began business process improvement with a continuous improvement model. A *continuous process improvement* model attempts to understand and measure the current process, and make performance improvements accordingly. Figure T12.4 illustrates the basic steps for continuous process improvement. Organizations begin by documenting what they do today, establish some way to measure the process based on what customers want, perform the process, measure the results, and then identify improvement opportunities based on the collected information. The next step is to implement process improvements, and then measure the performance of the new process. This loop repeats over and over again and is called continuous process improvement. It might also be called business process improvement or functional process improvement.

FIGURE T12.3

Opportunities for Business Process Improvement

Business Process Improvement Examples
Eliminate duplicate activities
Combine related activities
Eliminate multiple reviews and approvals
Eliminate inspections
Simplify processes
Reduce batch sizes
Process in parallel
Implement demand pull
Outsource inefficient activities
Eliminate movement of work

| Organize multifunctional teams |
| Design cellular workplaces |
| Centralize/decentralize |

This method for improving business processes is effective to obtain gradual, incremental improvement. However, several factors have accelerated the need to improve business processes. The most obvious is technology. New technologies (like the Internet and wireless) rapidly bring new capabilities to businesses, thereby raising the competitive bar and the need to improve business processes dramatically.

FIGURE T12.4

Continuous Process Improvement Model

Another apparent trend is the opening of world markets and increased free trade. Such changes bring more companies into the marketplace, adding to the competition. In today's marketplace, major changes are required just to stay in the game. As a result, companies have requested methods for faster business process improvement. Also, companies want breakthrough performance changes, not just incremental changes, and they want it now. Because the rate of change has increased for everyone, few businesses can afford a slow change process. One approach for rapid change and dramatic improvement is business process reengineering (BPR).

FIGURE T12.5

Business Process Reengineering Model

BUSINESS PROCESS REENGINEERING (BPR)

An organization must continuously revise and reexamine its decisions, goals, and targets to improve its performance. A bank may have many activities, such as investing, credit cards, loans, and so on, and it may be involved in cross-selling (e.g., insurance) with other preferred vendors in the market. If the credit card department is not functioning in an efficient manner, the bank might reengineer the credit card business process. This activity, *business process reengineering (BPR),* is the analysis and redesign of workflow within and between enterprises. BPR relies on a different school of thought than continuous process improvement. *In the extreme*, BPR assumes the current process is irrelevant, does not work, or is broken and must be overhauled from scratch. Such a clean slate enables business process designers to disassociate themselves

from today's process and focus on a new process. It is like the designers projecting themselves into the future and asking: What should the process look like? What do customers want it to look like? What do other employees want it to look like? How do best-in-class companies do it? How can new technology facilitate the process?

Figure T12.5 displays the basic steps in a business process reengineering effort. It begins with defining the scope and objectives of the reengineering project, then goes through a learning process (with customers, employees, competitors, noncompetitors, and new technology). Given this knowledge base, the designers can create a vision for the future and design new business processes by creating a plan of action based on the gap between current processes, technologies, structures, and process vision. It is then a matter of implementing the chosen solution. The Department of Defense (DoD) is an expert at reengineering business process. Figure T12.6 highlights the Department of Defense's best-in-class suggestions for a managerial approach to a reengineering effort.

Business Process Design

After choosing the method of business process improvement that is appropriate for the organization, the process designers must determine the most efficient way to begin revamping the processes. To determine whether each process is appropriately structured, organizations should create a cross-functional team to build process models that display input-output relationships among process-dependent operations and departments. They should create business process models documenting a step-by-step process sequence for the activities that are required to convert inputs to outputs for the specific process.

Business process modeling (or *mapping*) is the activity of creating a detailed flow chart or process map of a work process showing its inputs, tasks, and activities, in a structured sequence. A *business process model* is a graphic description of a process, showing the sequence of process tasks, which is developed for a specific purpose and from a selected viewpoint. A set of one or more process models details the many functions of a system or subject area with graphics and text and its purpose is to:

FIGURE T12.6

Managerial Approach to Reengineering Projects

Managerial Approach to Reengineering Projects

1.	**Define the scope.** Define functional objectives; determine the management strategy to be followed in streamlining and standardizing processes; and establish the process, data, and information systems baselines from which to begin process improvement.
2.	**Analyze.** Analyze business processes to eliminate non-value-added processes; simplify and streamline processes of little value; and identify more effective and efficient alternatives to the process, data, and system baselines.
3.	**Evaluate.** Conduct a preliminary, functional, economic analysis to evaluate alternatives to baseline processes and select a preferred course of action.
4.	**Plan.** Develop detailed statements of requirements, baseline impacts, costs, benefits, and schedules to implement the planned course of action.
5.	**Approve.** Finalize the functional economic analysis using information from the planning data, and present to senior management for approval to proceed with the proposed process improvements and any associated data or system changes.
6.	**Execute.** Execute the approved process and data changes, and provide functional management oversight of any associated information system changes.

■ Expose process detail gradually and in a controlled manner.

■ Encourage conciseness and accuracy in describing the process model.

■ Focus attention on the process model interfaces.

■ Provide a powerful process analysis and consistent design vocabulary.

FIGURE T12.7

As-Is and To-Be Process Model for Ordering a Hamburger

A process model typically displays activities as boxes and uses arrows to represent data and interfaces. Process modeling usually begins with a functional process representation of *what* the process problem is or an As-Is process model. *As-Is process models* represent the current state of the operation that has been mapped, without any specific improvements or changes to existing processes. The next step is to build a To-Be process model that displays *how* the process problem will be solved or implemented. *To-Be process models* show the

results of applying change improvement opportunities to the current (As-Is) process model. This approach ensures that the process is fully and clearly understood before the details of a process solution are decided. The To-Be process model shows *how* the *what* is to be realized. Figure T12.7 displays the As-Is and To-Be process models for ordering a hamburger.

Analyzing As-Is business process models leads to success in business process reengineering since these diagrams are very powerful in visualizing the activities, processes, and data flow of an organization. As-Is and To-Be process models are integral in process reengineering projects. Figure T12.8 illustrates an As-Is process model of an order-filling process developed by a process modeling team representing all departments that contribute to the process. The process modeling team traces the process of converting the input (orders) through all the intervening steps until the final required output (payment) is produced. The map shows how all departments are involved as the order is processed.

FIGURE T12.8

As-Is Process Model for Order Entry

It is easy to become bogged down in excessive detail when creating an As-Is process model. The objective is to aggressively eliminate, simplify, or improve the To-Be processes. Successful process improvement efforts result in positive answers to the key process design or improvement question: Is this the most efficient and effective process for accomplishing the process goals? This process modeling structure allows the team to identify all the critical interfaces, overlay the time to complete various processes, start to define the opportunities for process simulation, and identify disconnects (illogical, missing, or extraneous steps) in the processes. Figure T12.9 displays sample disconnects in the order filling process in Figure T12.8.

The team then creates a To-Be process model, which reflects a disconnect-free order fulfillment process (see Figure T12.10). Disconnects fixed by the new process include

■ Direct order entry by sales, eliminating sales administration.

■ Parallel order processing and credit checking.

■ Elimination of multiple order-entry and order-logging steps.

FIGURE T12.9

Issues in the As-Is Process Model for Order Entry

Issues in the As-Is Order Process Model

■ Sales representatives take too long to submit orders.

■ There are too many process steps.

■ Sales administration slows down the process by batch-processing orders.

■ Credit checking is performed for both old and new customers.

■ Credit checking holds up the process because it is done before (rather than concurrently with) order picking.

FIGURE T12.10

To-Be Process Model for Order Entry

The consulting firm KPMG Peat Marwick uses process modeling as part of its business reengineering practice. Recently the firm helped a large financial services company slash costs and improve productivity in its Manufactured Housing Finance Division. Turnaround time for loan approval was reduced by half, using 40 percent fewer staff members.

Modeling helped the team analyze the complex aspects of the project. "In parts of the loan origination process, a lot of things happen in a short period of time," according to team leader Bob Karrick of KPMG. "During data capture, information is pulled from a number of different sources, and the person doing the risk assessment has to make judgment calls at different points throughout the process. There is often a need to stop, raise questions, make follow-up calls, and so on and then continue with the process modeling effort. Modeling allows us to do a thorough analysis that takes into account all these decision points and variables."[2]

SELECTING A PROCESS TO REENGINEER

An organization can reengineer its cross-departmental business processes or an individual department's business processes according to its needs. When selecting a business process to reengineer, wise organizations will focus on those core processes that are critical to their performance, rather than marginal processes that have little impact. Reengineering practitioners can use several criteria to determine the importance of the process:

■ Is the process broken?

■ Is it feasible that reengineering of this process will succeed?

- Does it have a high impact on the agency's strategic direction?

- Does it significantly impact customer satisfaction?

- Is it antiquated?

- Does it fall far below best-in-class?

- Is it crucial for productivity improvement?

- Will savings from automation be clearly visible?

- Is the return on investment from implementation high and preferably immediate?

Business Process Management (BPM)

A key advantage of technology is its ability to improve business processes. Working faster and smarter has become a necessity for companies. Initial emphasis was given to areas such as production, accounting, procurement, and logistics. The next big areas to discover technology's value in business process were sales and marketing automation, customer relationship management, and supplier relationship management. Some of these processes involve several departments of the company and some are the result of real-time interaction of the company with its suppliers, customers, and other business partners. The latest area to discover the power of technology in automating and reengineering business process is business process management. *Business process management (BPM)* integrates all of an organization's business process to make individual processes more efficient. BPM can be used to solve a single glitch or to create one unifying system to consolidate a myriad of processes.

Many organizations are unhappy with their current mix of software applications and dealing with business processes that are subject to constant change. These organizations are turning to BPM systems that can flexibly automate their processes and glue their enterprise applications together. Figure T12.11 displays the key reasons organizations are embracing BPM technologies.

BPM technologies effectively track and orchestrate the business process. BPM can automate tasks involving information from multiple systems, with rules to define the sequence in which the tasks are performed as well as responsibilities, conditions, and other aspects of the process (see Figure T12.12 for BPM

benefits). BPM not only allows a business process to be executed more efficiently, but it also provides the tools to measure performance and identify opportunities for improvement—as well as to easily make changes in processes to act upon those opportunities such as:

FIGURE T12.11

Key Reasons for BPM

- Bringing processes, people, and information together.

- Identifying the business processes is relatively easy. Breaking down the barriers between business areas and finding owners for the processes are difficult.

- Managing business processes within the enterprise and outside the enterprise with suppliers, business partners, and customers.

- Looking at automation horizontally instead of vertically.

FIGURE T12.12

Benefits of BPM

BPM Benefits

■   Update processes in real time
■   Reduce overhead expenses
■   Automate key decisions
■   Reduce process maintenance cost
■   Reduce operating cost
■   Improve productivity
■   Improve process cycle time
■   Improve forecasting
■   Improve customer service

IS BPM FOR BUSINESS OR IT?

A good BPM solution requires two great parts to work together as one. Since BPM solutions cross application and system boundaries, they often need to be sanctioned and implemented by the IT organization, while at the

same time BPM products are business tools that business managers need to own. Therefore, confusion often arises in companies as to whether business or IT managers should be responsible for driving the selection of a new BPM solution.

The key requirement for BPM's success in an organization is the understanding that it is a collaboration of business and IT, and thus both parties need to be involved in evaluating, selecting, and implementing a BPM solution. IT managers need to understand the business drivers behind the processes, and business managers need to understand the impact the BPM solution may have on the infrastructure. Generally, companies that have successfully deployed BPM solutions are those whose business and IT groups have worked together as a cohesive team.

All companies can benefit from a better understanding of their key business processes, analyzing them for areas of improvement and implementing improvements. BPM applications have been successfully developed to improve complex business issues of some medium- to large-sized companies. Like many large-scale implementation projects, BPM solutions are most successful in companies with a good understanding of their technology landscape and management willing to approach business in a new way. BPM solutions are truly driven by the business process and the company's owners.

Effective BPM solutions allow business owners to manage many aspects of the technology through business rules they develop and maintain. Companies that cannot support or manage cultural and organizational changes may lack positive BPM results.

FIGURE T12.13

Popular BPM Tools

Tool Name	Company Name
BPM Suite	Ultimus
Process Suite	Staffware
Business Manager	Savvion
Pega Rules Process Commander	PegaSystem
E Work Vision	MetaStorm
Team Works	Lombardi Software
Intalio	Intalio

Bizflow	Handysoft
FugeoBPM	Fugeo
Business Process Manager	Filenet

BPM TOOLS

Business process management tools are used to create an application that is helpful in designing business process models and also helpful in simulating, optimizing, monitoring, and maintaining various processes that occur within an organization. Many tasks are involved in achieving a goal, and these tasks are done either manually or with the help of software systems. For example, if an organization needs to buy a software application that costs $6 million, then a request has to be approved by several authorities and managers. The request approval may be done manually. However, when a person applies for a loan of $300,000, several internal and external business processes are triggered to find out details about that person before approving the loan. For these activities, BPM tool creates an application that coordinates the manual and automated tasks. Figure T12.13 displays several popular BPM tools.

BPM RISKS AND REWARDS

If an organization is considering BPM, it must be aware of the risks involved in implementing these systems. One factor that commonly derails a BPM project has nothing to do with technology and everything to do with people. BPM projects involve cultural and organizational changes that companies must make to support the new management approach required for success. Where 10 area leaders once controlled 10 pieces of an end-to-end process, there is now a new group involved in implementing a BPM solution across all these areas. Suddenly the span of control is consolidated and all are accountable to the whole process, not just one piece of the puzzle.

The added benefit of BPM is not only a technology solution, but also a business solution. BPM is a new business architecture and approach to managing the process and enabling proactive, continuous improvement. The new organizational structure and roles created to support BPM help maximize the continuous benefits to ensure success.

An IT director from a large financial services company gave this feedback when asked about his experience

in using a BPM solution to improve the company's application help desk process. "Before BPM, the company's application help desk was a manual process, filled with inefficiencies, human error, and no personal accountability. In addition, the old process provided no visibility into the process. There was absolutely no way to track requests, since it was all manual. Business user satisfaction with the process was extremely low. A BPM solution provided a way for the company to automate, execute, manage, and monitor the process in real time. The biggest technical challenge in implementation was ensuring that the user group was self-sufficient. While the company recognized that the IT organization is needed, it wanted to be able to maintain and implement any necessary process changes with little reliance on IT. It views process management as empowering the business users to maintain, control, and monitor the process. BPM goes a long way to enable this process."[3]

FIGURE T12.14

Critical Success Factors for BPM Projects

Critical Success Factors for BPM Projects

1. **Understand reengineering.**

   ■ Understand business process fundamentals.

   ■ Know what reengineering is.

   ■ Differentiate and integrate process improvement approaches.

2. **Build a business and political case.**

   ■ Have necessary and sufficient business (mission delivery) reasons for reengineering.

   ■ Have the organizational commitment and capacity to initiate and sustain reengineering.

   ■ Secure and sustain political support for reengineering projects.

3. **Adopt a process management approach.**

   ■ Understand the organizational mandate and set mission-strategic directions and goals cascading to process-specific goals and decision making across and down the organization.

   ■ Define, model, and prioritize business processes important for mission

performance.

■ Practice hands-on senior management ownership of process improvement through personal involvement, responsibility, and decision making.

■ Adjust organizational structure to better support process management initiatives.

■ Create an assessment program to evaluate process management.

4. **Measure and track performance continuously.**

■ Create organizational understanding of the value of measurement and how it will be used.

■ Tie performance management to customer and stakeholder current and future expectations.

5. **Practice change management and provide central support.**

■ Develop human resource management strategies to support reengineering.

■ Build information resources management strategies and a technology framework to support process change.

■ Create a central support group to assist and integrate reengineering efforts and other improvement efforts across the organization.

■ Create an overarching and project-specific internal and external communication and education program.

6. **Manage reengineering projects for results.**

■ Have a clear criterion to select what should be reengineered.

■ Place the project at the right level with a defined reengineering team purpose and goals.

■ Use a well-trained, diversified, expert team to ensure optimum project performance.

■ Follow a structured, disciplined approach for reengineering.

CRITICAL SUCCESS FACTORS

In a publication for the National Academy of Public Administration, Dr. Sharon L. Caudle identified six

critical success factors that ensure government BPM initiatives achieve the desired results (see Figure T12.14).

FIGURE T12.15

E-Business Process Model

Business Process Modeling Examples

A picture is worth a thousand words. Just ask Wayne Kendrick, a system analyst for Mobil Oil Corporation in Dallas, Texas. Kendrick, whose work involves planning and designing complex processes, was scheduled to make a presentation to familiarize top management with a number of projects his group was working on. "I was given 10 minutes for my presentation, and I had 20 to 30 pages of detailed documentation to present. Obviously, I could not get through it all in the time allocated." Kendrick turned to business process models to help communicate his projects. "I think people can relate to pictures better than words," Kendrick said. He applied his thinking to his presentation by using Microsoft's Visio to create business process models and graphs to represent the original 30 pages of text. "It was an effective way to get people interested in my projects and to quickly see the importance of each project," he stated. The process models worked and Kendrick received immediate approval to proceed with all of his projects. Figures T12.15 through T12.21 offer examples of business process models.[4]

FIGURE T12.16

Online Banking Business Process Model

FIGURE T12.17

Customer Order Business Process Model

FIGURE T12.18

eBay Buyer Business Process Model

FIGURE T12.19

eBay Seller Business Process Model

FIGURE T12.20

Customer Service Business Process Model

FIGURE T12.21

Business Process Improvement Model

PLUG - IN SUMMARY

Investment in continuous process improvement, business process reengineering, or business process management is the same as any other technology-related investment. Planning the project properly, setting clear goals, educating those people who have to change their mind-set once the system is implemented, and retaining strong management support will help with a successful implementation generating a solid return on investment.

Organizations must go beyond the basics when implementing business process improvement and realize that it is not a one-time project. Management and improvement of end-to-end business processes is difficult and requires more than a simple, one-time effort. Continuously monitoring and improving core business processes will guarantee performance improvements across an organization.

KEY TERMS

MAKING BUSINESS DECISIONS

1. Discovering Reengineering Opportunities

In an effort to increase efficiency, your college has hired you to analyze its current business processes for registering for classes. Analyze the current business processes from paying tuition to registering for classes and determine which steps in the process are:

■ Broken

■ Redundant

■ Antiquated

Be sure to define how you would reengineer the processes for efficiency.

2. **Modeling a Business Process**

Do you hate waiting in line at the grocery store? Do you find it frustrating when you go to the movie store and cannot find the movie you wanted to rent? Do you get annoyed when the pizza delivery person brings you the wrong order? This is your chance to reengineer the annoying process that drives you craze. Choose a problem you are currently experiencing and reengineer the process to make it more efficient. Be sure to provide an As-Is and To-Be process model.

3. **Revamping Business Processes**

The following is the sales order business process for MusicMan. Draw the As-Is process model based on the following narrative:

1. A customer submits an order for goods to MusicMan, a music retailer, through an online mechanism such as a browser-based order form. The customer supplies his or her name, the appropriate e-mail address, the state to which the order will be shipped, the desired items (IDs and names), and the requested quantities.

2. The order is received by a processing system, which reads the data and appends an ID number to the order.

3. The order is forwarded to a customer service representative, who checks the customer's credit information.

4. If the credit check fails, the customer service representative is assigned the task of notifying the customer to obtain correct credit information, and the process becomes manual from this point on.

5. If the credit check passes, the system checks a database for the current inventory of the ordered item, according to the item ID, and it compares the quantity of items available with the quantity requested.

6. If the amount of stock is not sufficient to accommodate the order, the order is placed on hold until

new inventory arrives. When the system receives notice of new incoming inventory, it repeats step 5 until it can verify that the inventory is sufficient to process the order.

7.   If the inventory is sufficient, the order is forwarded simultaneously to a shipping agent who arranges shipment and an accounting agent who instructs the system to generate an invoice for the order.

8.   If the system encounters an error in processing the input necessary to calculate the total price for the invoice, including state sales tax, the accounting agent who initiated the billing process is notified and prompted to provide the correct information.

9.   The system calculates the total price of the order.

10.   The system confirms that the order has been shipped and notifies the customer via e-mail.

11.   At any point in the transaction before shipping, the order can be canceled by notification from the customer.

4. Revamping Accounts

The accounting department at your company deals with the processing of critical documents. These documents must arrive at their intended destination in a secure and efficient manner. Such documents include invoices, purchase orders, statements, purchase requisitions, financial statements, sales orders, and quotes.

The current processing of documents is done manually, which causes a negative ripple effect. Documents tend to be misplaced or delayed through the mailing process. Unsecured documents are vulnerable to people making changes or seeing confidential documents. In addition, the accounting department incurs costs such as preprinted forms, inefficient distribution, and storage. Explain BPM and how it can be used to revamp the accounting department.

Notes

5.   Hammer, *Beyond Reengineering.*Hammer, Michael, Champy, James, "Reengineering the Corporation: A Manifest for Business Revolution," 1993.

6.   Government Business Process Reengineering (BPR) Readiness Assessment Guide, General Services

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Chang, Richard, "Process Reengineering in Action: A Practical Guide to Achieving Breakthrough Results (Quality Improvement Series)," 1996.

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[1] Michael Hammer, *Beyond Reengineering: How the Process-Centered Organization Is Changing Our Work and Our Lives* (New York: HarperCollins Publishers, 1996).

[2] H. James Harrington, *Business Process Improvement: The Breakthrough Strategy for Total Quality, Productivity, and Competitiveness* (New York: McGraw-Hill, 1991).

[3] Bjorn Andersen, *Business Process Improvement Toolbox* (Milwaukee, WI: ASQ Quality Press, 1999).

[4] H. James Harrington, *Business Process Improvement Workbook: Documentation, Analysis, Design, and Management of Business Process Improvement* (New York: McGraw-Hill, 1997).

APPLY YOUR KNOWLEDGE

Apply Your Knowledge Project Overview

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43	Managing Martin	Excel	Data Mining	Advanced Development: Pivot Table act	436
44	Mountain Cycle	Excel	Break Even Analysis	Advanced Development: Goal Seek	437
45	Lutz Motors	Excel	Sales Analysis	Advanced Development: Scenario Manager	437
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48	iToys Inventory	Access	SCM	Intermediate Development	440

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Project 1:

Capitalizing on Your Career

Business leaders need to be involved in information technology—any computer-based tool that people use to work with information and support the information and information-processing needs of an organization—for the following (primary) reasons:

■ The sheer magnitude of the dollars spent on IT must be managed to ensure business value.

■ Research has consistently shown that when business leaders are involved in information technology, it enables a number of business initiatives, such as gaining a competitive advantage, streamlining business processes, and even transforming entire organizations.

■ Research has consistently shown that when business leaders are not involved in IT, systems fail, revenue is lost, and even entire companies can fail as a result of poorly managed IT.

One of the biggest challenges facing organizations is, "How do we get general business leaders involved in IT?" Research has shown that involvement is highly correlated with personal experience with IT and IT education, including university classes and IT executive seminars. Once general business leaders understand IT through experience and education, they are more likely to be involved in IT, and more likely to lead their organizations in achieving business success through IT.

Project Focus

1. Search the Internet to find examples of the types of technologies that are currently used in the field or industry that you plan to pursue. For example, if you are planning on a career in accounting or finance, you should become familiar with financial systems such as Oracle Financials. If you are planning a career in logistics or distribution, you should research supply chain management systems. If you are planning a career in marketing, you should research customer relationship management systems, blogs, and eMarketing.

2. IT is described as an enabler/facilitator of competitive advantage, organizational effectiveness, and organizational efficiency. As a competitive tool, IT can differentiate an organization's products,

services, and prices from its competitors by improving product quality, shortening product development or delivery time, creating new IT-based products and services, and improving customer service before, during, and after a transaction. Search the Internet and find several examples of companies in the industry where you plan to work that have achieved a competitive advantage through IT.

3. Create a simple report of your findings; include a brief overview of the type of technologies you found and how organizations are using them to achieve a competitive advantage.

Project 2:

Achieving Alignment

Most companies would like to be in the market-leading position of JetBlue, Dell, or Wal-Mart, all of which have used information technology to secure their respective spots in the marketplace. These companies have a relentless goal of keeping the cost of technology down by combining the best of IT and business leadership.

It takes more than a simple handshake between groups to start on the journey toward financial gains; it requires operational discipline and a linkage between business and technology units. Only recently have companies not on the "path for profits" followed the lead of their successful counterparts, requiring more operational discipline from their IT groups as well as more IT participation from their business units. Bridging this gap is one of the greatest breakthroughs a company can make.

Companies that master the art of finely tuned, cost-effective IT management will have a major advantage. Their success will force their competitors to also master the art or fail miserably. This phenomenon has already occurred in the retail and wholesale distribution markets, which have had to react to Wal-Mart's IT mastery, as one example. Other industries will follow. This trend will change not only the face of IT, but also the future of corporate America.

As world markets continue to grow, the potential gains are greater than ever. However, so are the potential losses. The future belongs to those who are perceptive enough to grasp the significance of IT and resourceful enough to synchronize business management and information technology.

Project Focus

1. Use any resource to answer the question, "Why is business-IT alignment so difficult?" Use the following questions to begin your analysis:

    a. -How do companies prioritize the demands of various business units as they relate to IT?

b. What are some of the greatest IT challenges for the coming year?

c. What drives IT decisions?

d. Who or what is the moving force behind IT decisions?

e. -What types of efficiency metrics and effectiveness metrics might these companies use to measure the impact of IT?

f. How can a company use financial metrics to monitor and measure IT investments?

g. What are some of the issues with using financial metrics to evaluate IT?

Project 3:

Market Dissection

To illustrate the use of the three generic strategies, consider Figure AYK.1. The matrix shown demonstrates the relationships among strategies (cost leadership versus differentiation) and market segmentation (broad versus focused).

■ Hyundai is following a broad cost leadership strategy. Hyundai offers low-cost vehicles, in each particular model stratification, that appeal to a large audience.

■ Audi is pursuing a broad differentiation strategy with its Quattro models available at several price points. Audi's differentiation is safety and it prices its various Quattro models (higher than Hyundai) to reach a large, stratified audience.

■ Kia has a more focused cost leadership strategy. Kia mainly offers low-cost vehicles in the lower levels of model stratification.

■ Hummer offers the most focused differentiation strategy of any in the industry (including Mercedes-Benz).

Project Focus

Create a similar graph displaying each strategy for a product of your choice. The strategy must include an example of the product in each of the following markets: (1) cost leadership, broad market, (2) differentiation, broad market, (3) cost leadership, focused market, and (4) differentiation, focused market. Potential products include:

■ Cereal

■ Dog food

■ Soft drinks

- Computers

- Shampoo

- Snack foods

- Jeans

- Sneakers

- Sandals

- Mountain bikes

- TV shows

- Movies

Project 4:

Grading Security

Making The Grade is a nonprofit organization that helps students learn how to achieve better grades in school. The organization has 40 offices in 25 states and more than 2,000 employees. The company wants to build a Web site to offer its services online. Making The Grade's online services will provide parents seven key pieces of advice for communicating with their children to help them achieve academic success. The Web site will offer information on how to maintain open lines of communication, set goals, organize academics, regularly track progress, identify trouble spots, get to know their child's teacher, and celebrate their children's successes.

Project Focus

You and your team work for the director of information security. Your team's assignment is to develop a document discussing the importance of creating information security polices and an information security plan. Be sure to include the following:

- The importance of educating employees on information security.

- A few samples of employee information security policies specifically for Making The Grade.

- Other major areas the information security plan should address.

- Signs the company should look for to determine if the Web site is being hacked.

- The major types of attacks the company should expect to experience.

Project 5:

Eyes Everywhere

The movie *Minority Report* chronicled a futuristic world where people are uniquely identifiable by their eyes. A scan of each person's eyes gives or denies them access to rooms, computers, and anything else with restrictions. The movie portrayed a black market in new eyeballs to help people hide from the authorities. (Why did they not just change the database entry instead? That would have been much easier, but a lot less dramatic.)

The idea of using a biological signature is entirely plausible since biometrics is currently being widely used and is expected to gain wider acceptance in the near future because forging documents has become much easier with the advances in computer graphics programs and color printers. The next time you get a new passport, it may incorporate a chip that has your biometric information encoded on it. Office of Special Investigations (OSI) agents with fake documents found that it was relatively easy to enter the United States from Canada, Mexico, and Jamaica, by land, sea, and air.

The task of policing the borders is daunting. Some 500 million foreigners enter the country every year and go through identity checkpoints. More than 13 million permanent-resident and border-crossing cards have been issued by the U.S. government. Also, citizens of 27 countries do not need visas to enter this country. They are expected to have passports that comply with U.S. specifications that will also be readable at the border.

In the post-9/11 atmosphere of tightened security, unrestricted border crossing is not acceptable. The Department of Homeland Security (DHS) is charged with securing the nation's borders, and as part of this plan, new entry/exit procedures were instituted at the beginning of 2003. An integrated system, using biometrics, will be used to identify foreign visitors to the United States and reduce the likelihood of terrorists entering the country.

Early in 2003, after 6 million biometric border-crossing cards had been issued, a pilot test conducted at the Canadian border detected more than 250 imposters. The testing started with two biometric identifiers: photographs for facial recognition and fingerprint scans. As people enter and leave the country, their actual fingerprints and facial features are compared to the data on the biometric chip in the passport.

Project Focus

In a team, discuss the following:

1.   How do you feel about having your fingerprints, facial features, and perhaps more of your biometric features encoded in documents like your passport? Explain your answer.

2. Would you feel the same way about having biometric information on your driver's license as on your passport? Why or why not?

3. Is it reasonable to have different biometric identification requirements for visitors from different nations? Explain your answer. What would you recommend as criteria for deciding which countries fall into what categories?

4.   The checkpoints U.S. citizens pass through upon returning to the country vary greatly in the depth of the checks and the time spent. The simplest involves simply walking past the border guards who may or may not ask you your citizenship. The other end of the spectrum requires that you put up with long waits in airports where you have to line up with hundreds of other passengers while each person is questioned and must produce a passport to be scanned. Would you welcome biometric information on passports if it would speed the process, or do you think that the disadvantages of the reduction in privacy, caused by biometric information, outweighs the advantages of better security and faster border processing? Explain your answer.

Project 6:

Setting Boundaries

Even the most ethical people sometimes face difficult choices. Acting ethically means behaving in a principled fashion and treating other people with respect and dignity. It is simple to say, but not so simple to do since some situations are complex or ambiguous. The important role of ethics in our lives has long been recognized. As far back as 44 B.C., Cicero said that ethics are indispensable to anyone who wants to have a good career. Having said that, Cicero, along with some of the greatest minds over the centuries, struggled with what the rules of ethics should be.

Our ethics are rooted in our history, culture, and religion, and our sense of ethics may shift over time. The electronic age brings with it a new dimension in the ethics debate—the amount of personal information that we can collect and store, and the speed with which we can access and process that information.

Project Focus

In a team, discuss how you would react to the following situations:

1.   A senior marketing manager informs you that one of her employees is looking for another job and she

wants you to give her access to look through her e-mail.

2. A vice president of sales informs you that he has made a deal to provide customer information to a strategic partner, and he wants you to burn all of the customer information onto a DVD.

3. You are asked to monitor your employee's e-mail to discover if he is sexually harassing another employee.

4. You are asked to install a video surveillance system in your office to watch if employees are taking office supplies home with them.

5. You are looking on the shared network drive and discover that your boss's entire hard drive has been copied to the network for everyone to view. What do you do?

6. You have been accidentally copied on an e-mail from the CEO, which details who will be the targets

of the next round of layoffs. What would you do?

Project 7:

Contemplating Sharing

Bram Cohen is the creator of one of the most successful peer-to-peer (P2P) programs ever developed, BitTorrent. BitTorrent allows users to quickly upload and download enormous amounts of data, including files that are hundreds or thousands of times bigger than a single MP3. BitTorrent's program is faster and more efficient than traditional P2P networking.

Cohen showed his code to the world at a hacker conference, as a free, open source project aimed at computer users who need a cheap way to swap software online. But the real audience turns out to be TV and movie fanatics. It takes hours to download a ripped episode of *Alias* or *Monk* off Kazaa, but BitTorrent can do it in minutes. As a result, more than 20 million people have downloaded the BitTorrent application. If any one of them misses a favorite TV show, no worries. Surely, someone has posted it as a "torrent." As for movies, if you can find it at Blockbuster, you can probably find it online somewhere—and use BitTorrent to download it. "Give and ye shall receive" became Cohen's motto, which he printed on T-shirts and sold to supporters.

Project Focus

There is much debate surrounding the ethics of peer-to-peer networking. Do you believe BitTorrent is ethical or unethical? Justify your answer.

Project 8:

Dashboard Design

Digital dashboards offer an effective and efficient way to view enterprisewide information at near real time. According to Nucleus Research, there is a direct correlation between use of digital dashboards and a company's return on investment (ROI), hence all executives should be using or pushing the development of digital dashboards to monitor and analyze organizational operations.

Project Focus

Design a digital dashboard for a CRM and ERP system. Be sure to address all of the following:

CRM System	ERP System
■ Customers	■ Accounting
■ Marketing	■ Finance
■ Order entry	■ Logistics
■ Collections	■ Production
■ Sales	■ Distribution
■ Customer service	■ Manufacturing
■ Billing	■ Human resources
■ Credit limits	■ SCM
■ Transportation	■ CRM

Project 9:

Great Stories

With the advent of the Internet, when customers have an unpleasant customer experience, the company no longer has to worry about them telling a few friends and family; the company has to worry about them telling everyone. Internet service providers are giving consumers frustrated with how they were treated by a company another means of fighting back. Free or low-cost computer space for Internet Web sites is empowering consumers to tell not only their friends, but also the world about the way they have been treated. A few examples of disgruntled customer stories from the Internet include:

■ **Bad Experience with Blue Marble Biking**—Tourist on biking tour is bitten by dog, requires stitches.

Company is barred from hotel because of incident, and in turn it bars the tourist from any further tours.

■ **Best Buy Receipt Check**—Shopper declines to show register receipt for purchase to door guard at Lakewood Best Buy, which is voluntary. Employees attempt to seize cart, stand in shopper's path, and park a truck behind shopper's car to prevent departure.

■ **Enterprise Rent-A-Car Is a Failing Enterprise**—Enterprise Rent-A-Car did not honor reservations, did not have cars ready as stated, rented cars with nearly empty tanks, and charged higher prices to corporate account holders.

Project Focus

The Internet is raising the stakes for customer service. With the ability to create a Web site dedicated to a particular issue, a disgruntled customer can have nearly the same reach as a manufacturer. The Internet is making it more difficult for companies to ignore their customers' complaints. In a group, search the Web for the most outrageous story of a disgruntled customer. A few places to start include:

■ **Complain Complain (complaincomplain.net)—** Provides professionally written, custom complaint letters to businesses.

■ **The Complaint Department (www.thecomplaintdepartment.ca)—** A for-fee consumer complaint resolution and letter writing service.

■ **The Complaint Station (www.thecomplaintstation.com)—** Provides a central location to complain about issues related to companies' products, services, employment, and get rich quick scams.

■ **Complaints.com Consumer Complaints (www.complaints.com)—** Database of consumer complaints and consumer advocacy.

■ **Baddealings.com (www.baddealings.com)—** Forum and database on consumer complaints and scams on products and services.

Project 10:

Classic Car Problems

Classic Cars Inc. operates high-end automotive dealerships that offer luxury cars along with luxury service. The company is proud of its extensive inventory, top-of-the-line mechanics, and especially its exceptional service, which even includes a cappuccino bar at each dealership.

The company currently has 40 sales representatives at four locations. Each location maintains its own

computer systems, and all sales representatives have their own contact management systems. This splintered approach to operations causes numerous problems including customer communication issues, pricing strategy issues, and inventory control issues. A few examples include:

■ A customer shopping at one dealership can go to another dealership and receive a quote for a different price for the same car.

■ Sales representatives are frequently stealing each other's customers and commissions.

■ Sales representatives frequently send their customers to other dealerships to see specific cars and when the customer arrives, the car is not on the lot.

■ Marketing campaigns are not designed to target specific customers; they are typically generic, such as 10 percent off a new car.

■ If a sales representative quits, all of his or her customer information is lost.

Project Focus

You are working for Customer One, a small consulting company that specializes in CRM strategies. The owner of Classic Cars Inc., Tom Repicci, has hired you to help him formulate a strategy to put his company back on track. Develop a proposal for Tom detailing how a CRM system can alleviate the company's issues and create new opportunities.

Project 11:

Building Visibility

Visionary companies are building extended enterprises to best compete in the new Internet economy. An extended enterprise combines the Internet's power with new business structures and processes to eliminate old corporate boundaries and geographic restrictions. Networked supply chains create seamless paths of communication among partners, suppliers, manufacturers, retailers, and customers. Because of advances in manufacturing and distribution, the cost of developing new products and services is dropping, and time to market is speeding up. This has resulted in increasing customer demands, local and global competition, and increased pressure on the supply chain.

To stay competitive, companies must reinvent themselves so that the supply chain—sourcing and procurement, production scheduling, order fulfillment, inventory management, and customer care—is no longer a cost-based back-office exercise, but rather a flexible operation designed to effectively address today's

challenges.

The Internet is proving an effective tool in transforming supply chains across all industries. Suppliers, distributors, manufacturers, and resellers now work together more closely and effectively than ever. Today's technology-driven supply chain enables customers to manage their own buying experiences, increases coordination and connectivity among supply partners, and helps reduce operating costs for every company in the chain.

Project Focus

In the past, assets were a crucial component of success in supply chain management. In today's market, however, a customer-centric orientation is key to retaining competitive advantage. Using the Internet and any other resources available, develop a strategic plan for implementing a networked, flexible supply chain management system for a start-up company of your choice. Research Netflix if you are unfamiliar with how start-up companies are changing the supply chain. Be sure that your supply chain integrates all partners— manufacturers, retailers, suppliers, carriers, and vendors—into a seamless unit and views customer relationship management as a key competitive advantage. There are several points to consider when creating your customer-centric supply chain strategy:

- Taking orders is only one part of serving customer needs.
- Businesses must fulfill the promise they make to customers by delivering products and information upon request—not when it is convenient for the company.
- Time to market is a key competitive advantage. Companies must ensure uninterrupted supply, and information about customer demands and activities is essential to this requirement.
- Cost is an important factor. Companies need to squeeze the costs from internal processes to make the final products less expensive.
- Reducing design-cycle times is critical, as this allows companies to get their products out more quickly to meet customer demand.

Project 12:

Bean Integration

At Flavors, a premium coffee shop, customers receive more than just a great cup of coffee—they receive exposure to music, art, literature, and town events. Flavor's calendar for programs gives their customers a

quick view into their corner of the world—from live music and art displays, to volunteering or a coffee tasting. Flavors offers the following:

- Music Center—Information to all live music events occurring in the area. The store also hosts an open microphone two nights a week for local musicians.

- Art Gallery—A space in the store filled with great pieces from local artists.

- Book Clubs—Customers can meet to discuss current and classic literature.

- Coffee Sampler—Customers can sample coffees from around the world with the experts.

- Community Events—Weekly meetings are held where customers can find ways to become more involved in their community.

- Brewing Courses—Offer the finer details of the brewing, grinding, and blending equipment for sale in Flavor stores—from the traditional press to a digital espresso machine. Also includes a trouble-shooting guide developed by brewing specialists.

Project Focus

Flavors sales are great and profits are soaring however, current operations need a complete overhaul. The owners of Flavors, J.P. Field and Marla Lily, built the business piece-by-piece over the last 12 years. The following offers a quick look at current operations.

- Flavors does not receive any information on how many of its customers attend live music events. Musicians typically maintain a fan e-mail listing and CD sales records for the event, however this information is not always provided to the store.

- Book club events are booked and run through the local book store—Pages Up. Pages Up runs a tab during the book club and provides Flavor with a check at the end of each month for all book club events. Flavors has no access to book club customer information or sales information.

- Artist gallery is run by several local artists who pay Flavors a small commission on each sale. Flavors has no input into the art contained in the store or information on customers who purchase art.

- Coffee sampler events are run through Flavors primary operations.

- Community event information is open to all members of the community. Each event is run by a separate organization, which provides monthly event feedback to Flavors in a variety of formats from Word to Access files.

■ Brewing and machine resource courses are run by the equipment manufacturer and all customer and sales information is provided to Flavors in a Word document at the end of each year.

You have been hired as a consultant to Flavors. The owners want to revamp the way the company operates so it can take advantage of marketing and sales opportunities across its many different lines of business. For example, offering customers who attend book club events discounts on art and brewing and machine resource courses. They also want to gain a better understanding of how the different events impact sales. For example, should they have more open microphone nights or more book clubs? Currently, they have no way to tell which events result in higher sales. Flavors would like you to create a CRM marketing strategy to help them gain visibility across their company.

Project 13:

Working Together

Upon execution of a business process, a workflow system dictates the presentation of the information, tracks the information, and maintains the information's status. For example, the following highlights the common steps performed during a team project:

1. Find out what information and deliverables are required for the project and the due date.

2. Divide the work among the team members.

3. Determine due dates for the different pieces of work.

4. Compile all the completed work together into a single project.

One of the hardest parts of a team project is getting team members to complete their work on time. Often one team member cannot perform his or her work until another team member has finished. This situation causes work to sit idle waiting for a team member to pick it up to either approve it, continue working on it, or reformat it. Workflow systems help to automate the process of presenting and passing information around a team.

Project Focus

You have just received an assignment to work on a group project with 10 other students. The project requires you to develop a detailed business plan for a business of your choice. The types of activities you will need to perform include market analysis, industry analysis, growth opportunities, Porter's Five Forces analysis, financial forecasts, competitive advantage analysis, and so on. For your project, determine the following:

1. How could you use collaboration tools to facilitate the sharing of information and the completion of the project?

2. What advantages can your group gain from using Groupware?

3. What advantages can your group gain from using IM?

4. How could you use a workflow system to manage the tasks for the group members?

5. Describe a few of the biggest issues you anticipate experiencing during the group project. Identify ways that you can resolve these issues using collaboration tools.

Project 14:

Different Dimensions

The focus of data warehousing is to extend the transformation of data into information. Data warehouses offer strategic level, external, integrated, and historical information so businesses can make projections, identify trends, and make key business decisions. The data warehouse collects and stores integrated sets of historical information from multiple operational systems and feeds them to one or more data marts. It may also provide end-user access to support enterprisewide views of information.

Project Focus

You are currently working on a marketing team for a large corporation that sells jewelry around the world. Your boss has asked you to look at the following dimensions of data to determine which ones you want in your data mart for performing sales and market analysis (see Figure AYK.2). As a team, categorize the different dimensions ranking them from 1 to 5, with 1 indicating that the dimension offers the highest value and must be in your data mart and 5 indicating that the dimension offers the lowest value and does not need to be in your data mart.

FIGURE AYK.2

Data Warehouse Data

Dimension	Value (1–5)	Dimension	Value (1–5)
Product number		Season	
Store location		Promotion	
Customer net worth		Payment method	
Number of sales personnel		Commission policy	

Customer eating habits	Manufacturer
Store hours	Traffic report
Sales person ID	Customer language
Product style	Weather
Order date	Customer gender
Product quantity	Local tax information
Ship date	Local cultural demographics
Current interest rate	Stock market closing
Product cost	Customer religious affiliation
Customer's political affiliation	Reason for purchase
Local market analysis	Employee dress code policy
Order time	Customer age
Customer spending habits	Employee vacation policy
Product price	Employee benefits
Exchange rates	Current tariff information
Product gross margin	

Project 15:

Connecting Components

Components of a solid enterprise architecture include everything from documentation to business concepts to software and hardware. Deciding which components to implement and how to implement them can be a challenge. New IT components are released daily, and business needs continually change. An enterprise architecture that meets your organization's needs today may not meet those needs tomorrow. Building an enterprise architecture that is scalable, flexible, available, accessible, and reliable is key to your organization's success.

Project Focus

You are the enterprise architect for a large clothing company called Xedous. You are responsible for developing the initial enterprise architecture. Create a list of questions you will need answered to develop your

architecture. Below is an example of a few questions you might ask.

- What are the company's growth expectations?

- Will systems be able to handle additional users?

- How long will information be stored in the systems?

- How much customer history must be stored?

- What are the organization's business hours?

- What are the organization's backup requirements?

Project 16:

Internet Groceries

E-Grocery, founded in 2005, is an online grocery shopping and delivery service. The company caters to thousands of customers in the Phoenix, Seattle, and Denver areas. Established on the idea that people will buy groceries over the Internet, e-Grocery offers over 25,000 items.

Ninety percent of e-Grocery's orders come in via computer; the rest are received by fax. Orders are received at the central office in Lakewood, Colorado, and then distributed by e-mail to a local affiliate store. The store receives the order, the delivery address, and a map to the order location. A store employee designated to online orders will fill, deliver, and collect for the order. E-Grocery members are charged actual shelf prices, plus a per-order charge of $5.00 or 5 percent of the order amount, whichever is greater. Members also receive additional benefits such as electronic coupons, customer discounts, recipes, and tips.

Project Focus

The company is using interactive technology to change the shopping experience. The success of e-Grocery lies within many areas. Analyze the e-Grocery business model using the questions below. Feel free to think outside the box to develop your own analysis of online grocery shopping and e-business models.

1. What is e-Grocery's e-business model?

2. How does e-Grocery compete with traditional retailers?

3. What value can e-Grocery offer as a true competitive advantage in this marketplace?

4. What is the threat of new entrants in this market segment?

5. How is e-Grocery using technology to change the shopping experience?

6. What are the logistics for making e-Grocery profitable?

7. How does e-Grocery profit from online customer interaction?

8. What kinds of e-business strategies can e-Grocery's marketing department use to help grow its business?

9. What are some of the benefits and challenges facing e-Grocery?

Project 17:

Getting Personal

Consider Sally Albright the reigning queen of customization in the movie *When Harry Met Sally*. Take, for example, the scene where she orders pie a la mode: "I'd like the pie heated. And I don't want the ice cream on top; I want it on the side. And I'd like strawberry instead of vanilla if you have it. If not, then no ice cream, just whipped cream, but only if it's real." Particular, yes, but Sally knew what she liked—and was not afraid to ask for it.

Project Focus

A growing number of online retailers are letting you have it your way, too. Choose a company highlighted in Figure AYK.3 and create your own product. Was the Web site easy to use? Would this service entice you as a customer to make a purchase over a generic product? If you could personalize a product what would it be and how would the Web site work?

FIGURE AYK.3

Customization Companies

Company	Product
Tommy Hilfiger, custom.tomm.com	Premium-cotton chinos and jeans ($98)
Lands' End, www.landsend.com	Utilitarian jeans and chinos made of luxurious twill in traditional silhouettes ($59)
JCPenney, www.custom.jcpenney.com	Substantial twill pants in classic cuts ($44)
Ralph Lauren Polo, www.polo.com	Everything from basic polos to oxford shirts ($80)
TIMBUK2; www.timbuk2.com	Hip nylon messenger bags ($105)
L.L. Bean, www.llbean.com	Sturdy and colorful books, totes, and messenger bags ($70)

Nike, www.nikeid.com	Full range of athletic shoes and accessories ($90)
VANS, www.vans.com	Classic "Old Skool" lace-up or slip-on sneakers ($50)
Converse, www.converseone.com	Custom Chuck Taylors, the company's most classic style ($60)

Project 18:

Express Yourself

One of the most popular Web sites among students is MySpace, a site that allows students to express themselves by personalizing their home page. What is your favorite band? Who is your favorite author? What is your favorite movie? You can find out a lot about a person by finding out the answers to these questions.

Project Focus

Build a Web site dedicated to your favorite band, book, or movie. Your Web site must contain all of the following:

- An image.
- Two different size headings.
- Different sizes and colors of text.
- Two horizontal rules.
- Text that is bolded, underlined, and/or italicized.
- A textured background.
- A link to a Web site.
- A link to your e-mail.
- One numbered and one unnumbered list.

Project 19:

Creating a Presence

More than 1 billion people are on the Internet. Having an Internet presence is critical for any business that wants to remain competitive. Businesses need their Web sites to create a "buzz" to attract customers. E-business Web sites must be innovative, stimulating, add value, and provide useful information. In short, the site must build a sense of community and collaboration, eventually becoming the "port of entry" for business.

Project Focus

You are applying for a job at BagEm, a start-up e-business devoted to selling custom book bags that does not have any physical stores and only sells bags over the Internet. You are up against several other candidates for the job. BagEm has asked you to use your business expertise and Web site development skills to design and build a potential Web site. The candidate with the best Web site will be awarded the job. Good luck!

Project 20:

GoGo Gadgets

Now that wi-fi and other types of high-speed wireless networks are becoming common, devices using that technology are multiplying rapidly. Wireless gadgets run the gamut from cell phones to kitchen appliances and digital cameras. Here are some of the hottest new wireless broadband gadgets.

- Samsung's $3,499 POPCON refrigerator will feature a wi-fi enabled, detachable screen that can function as a TV. The fridge also can be programmed to remember products' expiration dates and generate alerts when the milk is getting old.

- The Nokia 770 Internet Tablet is small enough to fit in a pocket. It comes with a 4.13-inch-wide touch screen that can be used to access the Web over a wi-fi network. The $350 device can also access the Web via a cell phone with a Bluetooth connection.

- Motorola's latest E815 mobile phone operates over Verizon Wireless's new EVDO (Evolution Data Optimized) wireless network, offering speeds comparable to digital subscriber line (DSL). The phone can even record and play back video clips. It also features a built-in MP3 digital music player.

- Hop-On's just-announced HOP 1515 may look like a typical cell phone, but it actually makes calls over wi-fi networks. Typically sold with a $20 to $30 monthly service plan, the phone allows for unlimited over-the-Web international and long-distance calling. The $39 HOP 1515 is sold through wi-fi hotspot operators, wireless carriers, and retailers.

- Eastman Kodak's EasyShare-One is a digital camera with wi-fi capabilities, allowing users to share their snapshots wirelessly. You will be able to snap a photo and immediately show it to a friend on a wi-fi-enabled PC or TV.

Project Focus

A dizzying array of new wireless technologies now promises to make today's wi-fi networks seem like poky

dial-up connections by comparison. These new technologies will extend the reach of wireless networks, not just geographically but also into new uses in the home and office.

1. Research the Internet and discover new wireless devices that entrepreneurs and established companies can use to improve their business.

2. Explain how businesses can use these devices to create competitive advantages, streamline production, and improve productivity.

Project 21:

Back on Your Feet

You are working for GetSmart, a document creation company for legal professionals. Due to the highly sensitive nature in the industry, employees must store all work on the network drive and are not allowed to backup the data to a CD, flash drive, or any other type of external storage including home computers. The company has been following this policy for the last three years without any issues. You return to work Monday morning after a long weekend to find that the building was struck by lightning destroying several servers. Unfortunately, the backup strategy failed and all of the data from your department has been lost.

When the head of the company demanded an explanation as to why they did not have any individual backups, he was shown the company policy he had signed not once but three times. The end result was the head of IT along with four of his cronies that had developed this ridiculous policy were fired.

Project Focus

You have been placed on a committee with several of your peers to revamp the backup and recovery policies and create a new disaster recovery plan. You must create policies and procedures that will preserve the sensitive nature of the documents, while ensuring the company is safe from disasters. Be sure to address a worst case scenario where the entire building is lost.

Project 22:

GEM Athletic Center

First Information Corporation is a large consulting company that specializes in systems analysis and design. The company has over 2,000 employees and first-quarter revenues reached $15 million. The company prides itself on maintaining an 85 percent success rate for all project implementations. The primary reason attributed to the unusually high project success rate is the company's ability to define accurate, complete, and high

quality business requirements.

   The GEM Athletic Center located in Cleveland, Ohio, is interested in implementing a new payroll system. The current payroll process is manual and takes three employees two days each month to complete. The GEM Athletic Center does not have an IT department and is outsourcing the entire procurement, customization, and installation of the new payroll system to First Information Corporation.

Project Focus

You have been working for First Information for a little over one month. Your team has just been assigned the GEM Athletic Center project and your first task is to define the initial business requirements for the development of the new payroll system.

1.   Review the testimony of three current GEM Athletic Center accounting employees who detail the current payroll process along with their wish list for the new system. Use the files MaggieCleaver.doc, AnneLogan.doc, JimPoulos.doc.

2.   Review the Characteristics of Good Business Requirements document (BusinessRequirements.doc) that highlights several techniques you can use to develop solid business requirements.

3.   After careful analysis, create a report detailing the business requirements for the new system. Be sure to list any assumptions, issues, or questions in your document.

   Data Folder: AYK 22_Data

Project 23:

Confusing Coffee

Business requirements are the detailed set of business requests that any new system must meet in order to be successful. A sample business requirement might state "The system must track all customer sales by product, region, and sales representative." This requirement states what the system must do from the business perspective, giving no details or information on how the system is going to meet this requirement.

Project Focus

You have been hired to build an employee payroll system for a new coffee shop. Review the following business requirements and highlight any potential issues.

■ All employees must have a unique employee ID.

■ The system must track employee hours worked based on employee's last name.

- Employees must be scheduled to work a minimum of eight hours per day.

- Employee payroll is calculated by multiplying the employee's hours worked by $7.25.

- Managers must be scheduled to work morning shifts.

- Employees cannot be scheduled to work more than eight hours per day.

- Servers cannot be scheduled to work morning, afternoon, or evening shifts.

- The system must allow managers to change and delete employees from the system.

Project 24:

Picking Projects

You are a project management contractor attempting to contract work at a large telecommunications company, Hex Incorporated. Your interview with Debbie Fernandez, the senior vice president of IT, went smoothly. The last thing Debbie wants to see from you before she makes her final hiring decision is a prioritized list of the projects below. You are sure to land the job if Debbie is satisfied with your prioritization.

Project Focus

Create a report for Debbie prioritizing the following projects and be sure to include the business justifications for your prioritization.

- Upgrade accounting system.

- Develop employee vacation tracking system.

- Enhance employee intranet.

- Cleanse and scrub data warehouse information.

- Performance test all hardware to ensure 20 percent growth scalability.

- Implement changes to employee benefits system.

- Develop backup and recovery strategy.

- Implement supply chain management system.

- Upgrade customer relationship management system.

- Build executive information system for CEO.

Project 25:

Keeping Time

Time Keepers Inc. is a small firm that specializes in project management consulting. You are a senior project

manager, and you have recently been assigned to the Tahiti Tanning Lotion account. The Tahiti Tanning Lotion company is currently experiencing a 10 percent success rate (90 percent failure rate) on all internal IT projects. Your first assignment is to analyze one of the current project plans being used to develop a new CRM system (see Figure AYK.4).

FIGURE AYK.4

Sample Project Plan

Project Focus

1. Review the project plan and create a document listing the numerous errors in the plan. Be sure to also provide suggestions on how to fix the errors.

2. If you have access to Microsoft Project, open the file BadProject.mpp. Fix the errors you found in question 1 directly to BadProject.mpp. (If you are new to using Microsoft Project, review the document MSProjectGuidelines.doc for an overview of several tips for using Microsoft Project.)

   Data Folder: AYK 25_Data

Project 26:

Controlling Your Spend

You have been introduced to Microsoft Excel and are ready to begin using it to help track your monthly expenses and take charge of your financial destiny. The first step is to create a personal budget so you can see where you are spending money and if you need to decrease your monthly expenses or increase your monthly income.

Project Focus

Create a template for a monthly budget of your income and expenditures, with some money set aside for savings. Create variations of this budget to show how much you could save if you cut back on certain expenses, found another roommate, or got a part-time job. Compare costs of meal plan to costs of groceries. Consider how much interest would be earned on savings if $100 saved monthly. Or how much debt paid on student loans or credit card bills. To expand your data set, make a fantasy budget for 10 years from now, when you might own a home, owe student loan payments, and have a good salary.

Project 27:

Gearing for Cash

Gears is a five year old company that specializes in bike components. The company is having trouble paying for its monthly supplies and would like to perform a cash flow analysis so it can understand its financial position. Cash flow represents the money an investment produces after subtracting cash expenses from income. The statement of cash flows summarizes sources and uses of cash, indicates whether enough cash is available to carry on routine operations, and offers an analysis of all business transactions, reporting where the firm obtained its cash and how it chose to allocate the cash. The cash flow statement shows where money comes from, how the company is going to spend it, and when the company will require additional cash. Gears would like to project a cash flow statement for the next month.

Project Focus

Please create the following cash flow statement for Gears in Excel. Be sure to create formulas so the company can simply input numbers in the future to determine cash flow.

Gears Cash Flow Statement January 2009

Cash on Hand (beginning of month)	$18,456
CASH RECEIVED	
Cash Sales	$23,894
Credit Sales Accounts	$36,421
TOTAL CASH RECEIVED	$60,315
CASH PAID OUT	
Inventory	$15,340
Payroll expenses	$17,560
Supplies (office & oper.)	$ 4,500
Repairs & maintenance	$ 3,500
Advertising	$ 2,890
Car, delivery & travel	$ 1,500
Accounting & legal	$ 750
Rent	$ 4,000
Telephone	$ 120

Utilities	$ 430
Insurance	$ 1,020
Taxes (real estate, etc.)	$ 600
Miscellaneous	$ 350
TOTAL CASH PAID OUT	**$52,560**
CASH POSITION (END OF MONTH)	**$ 7,755**

Project 28:

Book Boxes

Books, Books, Books is a wholesale distributor of popular books. The business buys overstocked books and sells them for a discount of over 50 percent to local area bookstores. The owner of the company, BK Kane, would like to determine the best approach to boxing books so he can make the most profit possible. The local bookstores accept all shipments from Books, Books, Books because of BK's incredibly low prices. BK can order as many overstocked books as he requires, and this week's options include:

Title	Weight	Cost	Sale Price
Harry Potter, JK Rowling	5 lb	$9	$17
The Lord of the Rings, JRR T o lkien	4 lb	$8	$13
Chronicles of Narnia, CS Lewis	3.5 lb	$7	$11
A Series of Unfortunate Events, Lemony Snicket	3 lb	$6	$9
Charlie and the Chocolate Factory, Roald Dahl	2.5 lb	$5	$7
A Wrinkle in Time, Madeleine L 'Engle	1 lb	$4	$5

Project Focus

When packing a single box BK must adhere to the following:

■ 20 books or less.

■ Books by three different authors.

■ Between four and eight books from each author.

■ Weight equal to or less than 50 pounds.

BK has come to you to help him determine which books he should order to maximize his profit based on the above information. Using Excel, determine the optimal book order for a single box of books.

Project 29:

SplashEm

SplashEm is a popular amusement park filled with roller coasters, games, and a water park. Boasting 24 roller coasters, 10 of which exceed 200 feet and 70 miles per hour, and five water parks, the park's attendance remains steady throughout the season. Due to the park's popularity, it is not uncommon for entrance lines to exceed one hour on busy days. SplashEm would like your help to find a solution to decrease park entrance lines.

Project Focus

SplashEm would like to implement a scanner system that can allow employees to walk around the front gates and accept credit card purchases and print tickets on the spot. The park anticipates an overall increase in sales of 4 percent per year with online ticketing, with an expense of 6 percent of total sales for the scanning equipment. SplashEm would like you to create a workbook that compares scanning sales and traditional sales. Be sure to include formulas for all assumptions including:

■ Tickets sold at the booth.

■ Tickets sold by the scanner.

■ Revenues generated by booth sales.

■ Revenues generated by scanner sales.

■ Scanner ticket expense.

■ Revenue with and without scanner sales.

■ Three year row totals.

   Data Folder: AYK 29_Data

Project 30:

Tally's Purchases

Tally is a start-up Web site development company located in Seattle, Washington. The company currently has seven employees and is looking to hire six new employees in the next month.

Project Focus

You are in charge of purchasing for the Tally company. Your first task is to purchase the computers for the new employees. Your budget is $250,000 to buy the best computer systems with a scanner, three color printers, and business software. Use the Web to research various products and calculate the costs of different systems using Excel. Use plenty of formulas as you analyze costs and compare prices.

Project 31:

Tracking Donations

Lazarus Consulting is a large computer consulting company in New York. Pete Lazarus, the CEO and founder, is well known for his philanthropic efforts. Pete knows that most of his employees contribute to nonprofit organizations and wants to reward them for their efforts while encouraging others to contribute to charities. Pete began a program that matches 50 percent of each employee donation. The only stipulations are that the charity must be a nonprofit organization and the company will only match up to $2,000 per year per employee.

Project Focus

Open the file Lazarus_data.xls and determine the following:

■ What was the total donation amount per organization?

■ What were the average donations per organization?

   Data Folder: AYK 31_Data

Project 32:

All Aboard

You have decided to spend the summer traveling abroad with your friends. Your trip is going to take you to France, England, Italy, Switzerland, Germany, Norway, and Ireland. You want to use Excel to convert currencies as you travel around the world.

Project Focus

Locate one of the exchange rate calculators on the Internet (www.xe.com or www.x-rates.com). Find the exchange rates for each of the countries listed above and create formulas in Excel to convert $100, $500, and $1,000.

Project 33:

In With the Out

Founded in 2005, Innovative Software provides advanced search software, Web site accessibility testing/repair software, and usability testing/repair software. All serve as part of its desktop and enterprise content management solutions for government, corporate, educational, and consumer markets. The company's solutions are used by Web site publishers, digital media publishers, content managers, document managers, business users, consumers, software companies, and consulting services companies. Innovative Software solutions help organizations develop long-term strategies to achieve Web content accessibility, enhance usability, and comply with U.S. and search standards.

In the past, Innovative Software has continually focused on providing outstanding customer service. With the informal motto of "Grow big, but stay small," the company takes pride in achieving 100 percent customer care callback. Its personal service has been an integral part of its outstanding customer service. However, the success of its "grow big" philosophy has presented new challenges.

Innovative Software has experienced rapid growth to six times its original customer-base size and is forced to deal with difficult questions for the first time, such as, "Can we serve this many customers?" "How do we ensure our commitment to personal service is not compromised as we grow?" In addition, the number of phone calls from customers having problems with one of the newer applications is on the rise.

As customer service manager for Innovative Software, your goal is to maintain the company's reputation for excellent customer service. You have been considering the option of outsourcing as a means of keeping up with the expanding call volume and are currently reviewing e-Bank, a company that has had great success with outsourcing. E-Bank outsourced its customer service to handle its large number of customers who interact with the company through several customer interaction channels. The company felt that its competencies were primarily in finance, rather than in customer service, and that it could greatly benefit from the expertise of a customer service-focused provider. E-Bank discovered that it was cost-effective to outsource its customer service center. Additionally, the outsourcing approach was relatively hassle-free, since e-Bank did not have to set up its own customer contact center (i.e., call center).

Project Focus

1. Create an analysis from the data provided in Forecast_Data.xls, which includes:

- -DATE—the actual date of the phone calls made to customer service about the search software.

- SALES VOLUME—the number of search software units sold that day.

- ■ -NUMBER OF CALLS—the number of calls received in customer service for the search software.

  Business assumptions include:

- ■ -Innovative Software's customer service department is already near its call volume capacity. Any significant increase in calls would result in a decline in the company's 100 percent callback record.

- ■ -You need to consider what approach would be more cost effective—adding customer service representatives or outsourcing—if your forecast predicts sudden growth in call volume. All else being equal, it would cost 30 percent less to increase call volume capacity by 50 percent if you outsourced.

- ■ -The price of the products, the actual product type, and any warrantee information is irrelevant.

- ■ -Develop a growth, trend, and forecast analysis. You should use a three-day moving average; a shorter moving average might not display the trend well and a much longer moving average would shorten the trend too much. Hint: A three-day moving average is done by taking the Actual Calls and dividing that by the Forecast Calls over a three-day period. As an example, on the fourth day you would calculate the average for the Actual Calls for days 1, 2, and 3.

- ■ -You can create an effective forecast as long as you have a reasonable baseline to create a forecast. A baseline is a set of numeric observations made over time that is ordered from the earliest observation to the most recent. All the time periods in the baseline are of equal length.

- ■ -You will want to use the TREND worksheet function in Excel to create a regression forecast. The regression approach to forecasting will help you to make projections into the future. The TREND function creates forecasts based on a linear relationship between the times that the observation was made. However, you will have to create a GROWTH pattern to determine the nonlinear forecasts if the line has a dramatic upward or downward curve to it.

- ■ -Upon completing your analysis, provide detailed and thorough documentation (in narrative, numeric, and graphic forms) that justifies your outsourcing recommendations.

  Data Folder: AYK 33_Data

Project 34:

Woods You

One of the main products of the Fairway Woods Company is custom-made golf clubs. The clubs are manufactured at three plants (Denver, Colorado; Phoenix, Arizona; and Dallas, Texas) and are then shipped by

truck to five distribution warehouses in Sacramento, California; Salt Lake City, Utah; Chicago, Illinois; Albuquerque, New Mexico; and New York City, New York. Since shipping costs are a major expense, management has begun an analysis to determine ways to reduce them. For the upcoming golf season, an estimate has been made of what the output will be from each manufacturing plant and how much each warehouse will require to satisfy its customers.

The CIO from Fairway Woods Company has created a workbook for you, Fairways_Data.xls, of the shipping costs from each manufacturing plant to each warehouse as a baseline analysis. Some business rules and requirements you should be aware of include:

- The problem presented involves the shipment of goods from three plants to five regional warehouses.

- Goods can be shipped from any plant to any warehouse, but it costs more to ship goods over long distances than over short distances.

Project Focus

1.   Your goal is to minimize the costs of shipping goods from production plants to warehouses, thereby meeting the demand from each metropolitan area while not exceeding the supply available from each plant. To complete this project it is recommended that you use the Solver function in Excel to assist with the analysis.

2.   Specifically you want to focus on:

- Minimize the total shipping costs.

- Total shipped must be less than or equal to supply at a plant.

- Total shipped to warehouses must be greater than or equal to the warehouse demand.

- Number to ship must be greater than or equal to 0.

   Data Folder: AYK 34_Data

Project 35:

Bill's Boots

Bill Schultz is thinking of starting a store that specializes in handmade cowboy boots. Bill is a longtime rancher in the town of Taos, New Mexico. Bill's reputation for honesty and integrity is well-known around town, and he is positive that his new store will be highly successful.

Project Focus

Before opening his store, Bill is curious about how his profit, revenue, and variable costs will change

depending on the amount he charges for his boots. Bill would like you to perform the work required for this analysis and has put together a workbook called BillsBoots_Data.xls. Here are a few things to consider while you perform your analysis:

- Current competitive prices for custom cowboy boots are between $225 and $275 a pair.

- Variable costs will be either $100 or $150 a pair depending on the types of materials Bill chooses to use.

- Fixed costs are $10,000 a month.

Data Folder: AYK 35_Data

Project 36:

Adequate Acquisitions

XMark.com is a major Internet company specializing in organic food. XMark.com is thinking of purchasing GoodGrow, another organic food Internet company. GoodGrow has current revenues of $100 million, with expenses of $150 million. Current projections indicate that GoodGrow's revenues are increasing at 35 percent per year and its expenses are increasing by 10 percent per year. XMark.com understands that projections can be erroneous, however; the company must determine the number of years before GoodGrow will return a profit.

Project Focus

You need to help XMark.com determine the number of years required to break even, using annual growth rates in revenue between 20 percent and 60 percent and annual expense growth rates between 10 and 30 percent.

Data Folder: AYK 36_Data

Project 37:

Formatting Grades

Professor Streterstein is a bit absentminded. His instructor's grade book is a mess, and he would like your help cleaning it up and making it easier to use. In Professor Sterterstein's course, the maximum possible points a student can earn is 750. The following table displays the grade equivalent to total points for the course.

Total Points	Calculated Grade
675	A

635	A-
600	B
560	B-
535	C
490	C-
450	D
0	F

Project Focus

Help Professor Streterstein rework his grade book. Open the file Streterstein_data.xls and perform the following:

1. Reformat the workbook so it is readable, understandable, and consistent. Replace column labels, format and align the headings, add borders and shading.

2. Add a column in the grade book for final grade next to the total points earned column.

3. Use the VLookup Function to automatically assess final grades based on the total points column.

4. Using the If Function, format the workbook so each student's grade shows a high level pass or fail—P for pass, F for Fail—based on the total points.

Data Folder: AYK 37_Data

Project 38:

Moving Espressos

Pony Espresso is a small business that sells specialty coffee drinks at office buildings. Each morning and afternoon, trucks arrive at offices' front entrances, and the office employees purchase various beverages such as Java du Jour and Café de Colombia. The business is profitable. Pony Espresso offices, however, are located to the north of town, where lease rates are less expensive, and the principal sales area is south of town. This means that the trucks must drive cross-town four times each day.

The cost of transportation to and from the sales area, plus the power demands of the truck's coffee brewing equipment, is a significant portion of variable costs. Pony Espresso could reduce the amount of driving and, therefore, the variable costs, if it moved the offices closer to the sales area.

Pony Espresso presently has fixed costs of $10,000 per month. The lease of a new office, closer to the sales

area, would cost an additional $2,200 per month. This would increase the fixed costs to $12,200 per month.

Although the lease of new offices would increase the fixed costs, a careful estimate of the potential savings in gasoline and vehicle maintenance indicates that Pony Espresso could reduce the variable costs from $0.60 per unit to $0.35 per unit. Total sales are unlikely to increase as a result of the move, but the savings in variable costs should increase the annual profit.

Project Focus

Consider the information provided to you from the owner (PonyEspresso.xls). Especially look at the change in the variability of the profit from month to month. From November through January, when it is much more difficult to lure office workers out into the cold to purchase coffee, Pony Espresso barely breaks even. In fact, in December 2004, the business lost money.

1.   Develop the cost analysis on the existing lease information using the monthly sales figures provided to you in the file PonyEspresso.xls.

2. Develop the cost analysis from the new lease information provided above.

3. Calculate the variability that is reflected in the month-to-month standard deviation of earnings for the current cost structure and the projected cost structure.

4. Do not consider any association with downsizing such as overhead—simply focus on the information provided to you.

5.   You will need to calculate the EBIT (earnings before interest and taxes).

Data Folder: AYK 38_Data

Project 39:

Reducing Transports

Hoover Transportation, Inc., is a large distribution company located in Denver, Colorado. The company is currently looking to gain operational efficiencies in its supply chain by reducing the number of transportation carriers that it is using to outsource. Operational efficiencies for Hoover Transportation, Inc., suggest that reducing the number of carriers from the Denver distribution center to warehouses in the selected states will lead to reduced costs. Brian Hoover, the CEO of Hoover Transportation, requests that the number of carriers transporting products from its Denver distribution center to wholesalers in Arizona, Arkansas, Iowa, Missouri, Montana, Oklahoma, Oregon, and Washington be reduced from the current five carriers to one or two carriers.

Project Focus

Carrier selection should be based on the assumptions that all environmental factors are equal and historical cost trends will continue. Review the historical raw data from the past several years to determine your recommendation for the top two carriers that Hoover Transportation should continue to use.

1. Analyze the last 24 months of Hoover's Transportation carrier transactions found in HooverTransportation.xls.

2. Create a report detailing your recommendation for the top two carriers with which Hoover Transportation should continue to do business. Be sure to use PivotTables and PivotCharts in your report. A few questions to get you started include:

■ Calculate the average cost per carrier.

■ Calculate the total shipping costs per state.

■ Calculate the total shipping weights per state.

■ Calculate the average shipping costs per pound.

■ Calculate the average cost per carrier.

  Data Folder: AYK 39_Data

Project 40:

Better Business

Schweizer Distribution specializes in distributing fresh produce to local restaurants in the Chicago area. The company currently sells 12 different products through the efforts of three sales representatives to 10 restaurants. The company, like all small businesses, is always interested in finding ways to increase revenues and decrease expenses.

The company's founder, Bob Schweizer, has recently hired you as a new business analyst. You have just graduated from college with a degree in marketing and a specialization in customer relationship management. Bob is eager to hear your thoughts and ideas on how to improve the business and help the company build strong lasting relationships with its customers.

Project Focus

Bob has provided you with last year's sales information in the file RestaurantSales_Data.xls. Help Bob analyze his distribution company by using a Pivot Table to determine the following:

1. Who is Bob's best customer by total sales?

2. Who is Bob's worst customer by total sales

3. Who is Bob's best customer by total profit?

4. Who is Bob's worst customer by total profit?

5. What is Bob's best selling product by total sales?

6. What is Bob's worst selling product by total sales?

7. What is Bob's best selling product by total profit?

8. What is Bob's worst selling product by total profit?

9. Who is Bob's best sales representative by total profit?

10. Who is Bob's worst sales representative by total profit?

11. What is the best sales representative's best selling product (by total profit)?

12. Who is the best sales representative's best customer (by total profit)?

13. What is the best sales representative's worst selling product (by total profit)?

14. Who is the best sales representative's worst customer (by total profit)?

Data Folder: AYK 40_Data

Project 41:

Too Much Information

You have just landed the job of vice president of operations for The Pitt Stop Restaurants, a national chain of full-service, casual-themed restaurants. During your first week on the job, Suzanne Graham, your boss and CEO of the company, has asked you to provide an analysis of how well the company's restaurants are performing. Specifically, she would like to know which units and regions are performing extremely well, which ones are performing moderately well, and which ones are underperforming. Her goal is to identify where you should be spending time and focusing efforts to improve the overall health of the company.

Project Focus

Review the workbook entitled PittStop_Data.xls and determine how best to analyze and interpret the data. Create a formal presentation of your findings. A few things to consider include:

■ Should underperforming restaurants be closed or sold?

■ Should high performing restaurants be expanded to accommodate more seats?

- Should the company spend more or less on advertising?

- Which markets should adjustments be made to the advertising budget?

- How are The Pitt Stop Restaurants performing compared to its competition?

- How are units of like size performing relative to each other?

Data Folder: AYK 41_Data

Project 42:

Gizmos Turnover

Employee turnover rates are at an all-time high at Gizmo's Manufacturing plants. The company is experiencing severe worker retention issues, which are leading to productivity and quality control problems. The majority of the company's workers perform a variety of tasks and are paid by the hour. The company currently tests each potential applicant to ensure they have the skills necessary for the intense mental concentration and dexterity required to fill the positions. Since there are significant costs associated with employee turnover, Gizmo Manufacturing wants to find a way to predict which applicants have the characteristics of being a short-term versus a long-term employee.

Project Focus

1. Review the information that Gizmo Manufacturing has collected from two of its different data sources. The first file, Gizmo_Data.xls, contains information regarding employee wages. The second file, Gizmo2_Data.xls, contains information regarding employee retention.

2. Using Excel analysis functions, determine the employee characteristics that you would recommend Gizmo Manufacturing look for when hiring new personnel. It is highly recommended that you use PivotTables as part of your analysis.

3. Prepare a report based on your findings (which should include several forms of graphical representation) for your recommendations.

Data Folder: AYK 42_Data

Project 43:

Managing Martin

Martin Resorts, Inc., owns and operates four Spa and Golf resorts in Colorado. The company has five traditional lines of business: (1) golf sales; (2) golf lessons; (3) restaurants; (4) retail and rentals; and (5)

hotels. David Logan, director of marketing technology at Martin Resorts, Inc., and Donald Mayer, the lead strategic analyst for Martin Resorts, are soliciting your input for their CRM strategic initiative.

Martin Resorts' IT infrastructure is pieced together with various systems and applications. Currently, the company has a difficult time with CRM because its systems are not integrated. The company cannot determine vital information such as which customers are golfing and staying at the hotel or which customers are staying at the hotel and not golfing.

For example, the three details that the customer Diego Titus (1) stayed four nights at a Martin Resorts' managed hotel, (2) golfed three days, and (3) took an all-day spa treatment the first day, are discrete facts housed in separate systems. Martin Resorts hopes that by using data warehousing technology to integrate its data, the next time Diego reserves lodging for another trip, sales associates may ask him if he would like to book a spa treatment as well, and even if he would like the same masseuse that he had on his prior trip.

Martin Resorts is excited about the possibility of taking advantage of customer segmentation and CRM strategies to help increase its business.

Project Focus

The company wants to use CRM and data warehouse technologies to improve service and personalization at each customer touch point. Using a data warehousing tool, important customer information can be accessed from all of its systems either daily, weekly, monthly, or once or twice per year. Analyze the sample data in Martin_Data.xls for the following:

1. Currently, the quality of the data within the above disparate systems is low. Develop a report for David and Donald discussing the importance of high quality information and how low quality information can affect Martin Resorts' business.

2. Review the data that David and Donald are working with from the data warehouse in the file Martin_Data.xls and Key_Data.doc.

    A. -Give examples from the data showing the kind of information Martin Resorts might be able to use to gain a better understanding of its customers. Include the types of data quality issues the company can anticipate and the strategies it can use to help avoid such issues.

    B. -Determine who are Martin Resorts' best customers, and provide examples of the types of marketing campaigns the company should offer these valuable customers.

C. -Prepare a report that summarizes the benefits Martin Resorts can receive from using business intelligence to mine the data warehouse. Include a financial analysis of the costs and benefits.

Data Folder: AYK 43_Data

Project 44:

Mountain Cycle

Mountain Cycle is a company that specializes in making custom mountain bikes. The company founder, PJ Steffan, is having a hard time making the store profitable. Knowing that you have great business knowledge and solid financial sense, PJ has come to you for your advice.

Project Focus

PJ would like you to determine how many bikes Mountain Cycle needs to sell per year to break even. Using Goal Seek in Excel solve the following:

- Fixed cost equals $65,000.

- Variable cost equals $1,575.

- Bike price equals $2,500.

Project 45:

Lutz Motors

Murry Lutz owns a small shop that sells and services vintage motorcycles, Lutz Motors. Murry is curious how his profit will be affected by his sales over the next year.

Project Focus

Murry would like your help creating best, worst, and most-likely scenarios for his motorcycle sales over the next year. Using Scenario Manager help Murry analyze the worksheet Lutz_Data.xls.

Data Folder: AYK 45_Data

Project 46:

Animal Relations

Foothills Animal Hospital is a full-service small animal veterinary hospital located in Morrison, Colorado, specializing in routine medical care, vaccinations, laboratory testing, and surgery. The hospital has experienced tremendous growth over the past six months due to customer referrals. While Foothills Animal Hospital has typically kept its daily service records in a workbook format, it feels the need to expand its

reporting capabilities to develop a relational database as a more functional structure.

Foothills Animal Hospital needs help developing a database, specifically:

■ Create a customer table—name, address, phone, and date of entrance.

■ Create a pet table—pet name, type of animal, breed, gender, color, neutered/spayed, weight, and comments.

■ Create a medications table—medication code, name of medication, and cost of medication.

■ Create a visit table—details of treatments performed, medications dispensed, and the date of the visit.

■ Produce a daily invoice report.

Figure AYK.5 displays a sample daily invoice report that the Foothills Animal Hospital accountants have requested. Foothills Animal Hospital organizes its treatments using the codes displayed in Figure AYK.6. The entity classes and primary keys for the database have been identified in Figure AYK.7.

The following business rules have been identified:

1. A customer can have many pets but must have at least one.

2. A pet must be assigned to one and only one customer.

3. A pet can have one or more treatments per visit but must have at least one.

4. A pet can have one or more medications but need not have any.

FIGURE AYK.5

Foothills Animal Hospital Daily Invoice Report Sample

FIGURE AYK.6

Treatment Codes, Treatments, and Price Descriptions

Treatment Code	Treatment	Price
0100	Tetrinious Shot	$10.00
0201	Rabonius Shot	$20.00
0300	General Exam	$50.00
0303	Eye/Ear Examination	$20.00
0400	Spay/Neuter	$225.00

0405	Reset Dislocation	$165.00
0406	Amputation of Limb	$450.00
0407	Wrap Affected Area	$15.00
0408	Cast Affected Area	$120.00
1000	Lab Work—Blood	$50.00
1003	Lab Work—Misc	$35.00
2003	Flea Spray	$25.00
9999	Other Not Listed	$10.00

FIGURE AYK.7

Entity Names and Primary Keys for Foothills Animal Hospital

Entity	Primary Key
CUSTOMER	Customer Number
PET	Pet Number
VISIT	Visit Number
VISIT	Visit Number and Line Number
DETAIL	(a composite key)
TREATMENT	Treatment Code
MEDICATION	Medication Code

Project Focus

Your job is to complete the following tasks as they relate to this project:

1. Develop and describe the entity-relationship diagram.

2. Use normalization to assure the correctness of the tables (relations).

3. Create the database using a personal DBMS package (preferably Microsoft Access).

4. Use the data in Figure AYK.5 to populate your tables. Feel free to enter your own personal information.

5. Use the DBMS package to create the basic report in Figure AYK.5.

Project 47:

On-The-Level

On-The-Level Construction Company is a Denver-based construction company that specializes in subcontracting the development of single-family homes. In business since 1998, On-The-Level Construction has maintained a talented pool of certified staff and independent consultants providing the flexibility and combined experience required to meet the needs of its nearly 300 completed projects in the Denver metropolitan area. The field of operation methods that On-The-Level Construction is responsible for includes structural development, heating and cooling, plumbing, and electricity.

The company charges its clients by billing the hours spent on each contract. The hourly billing rate is dependent on the employee's position according to the field of operations (as noted above).

Figure AYK.8 shows a basic report that On-The-Level Construction foremen would like to see every week concerning what projects are being assigned, the overall assignment hours, and the charges for the assignment. On-The-Level Construction organizes its internal structure in four different operations—Structure (500), Plumbing (501), Electrical (502), and Heating and Ventilation (503). Each of these operational departments can and should have many subcontractors who specialize in that area.

Due to the boom in home sales over the last several years, On-The-Level Construction has decided to implement a relational database model to track project details according to project name, hours assigned, and charges per hour for each job description. Originally, On-The-Level Construction decided to let one of its employees handle the construction of the database. However, that employee has not had the time to completely implement the project. On-The-Level Construction has asked you to take over and complete the development of the database.

FIGURE AYK.8

On-The-Level Construction Project Detail Report

The entity classes and primary keys for the database have been identified in Figure AYK.9.

The following business rules have been identified:

1.   A job can have many employees assigned but must have at least one.

2.   An employee must be assigned to one and only one job number.

3.   An employee can be assigned to work on one or more projects.

4.   A project can be assigned to only one employee but need not be assigned to any employee.

Project Focus

Your job is to complete the following tasks:

1.   Develop and describe the entity-relationship diagram.

2. Use normalization to assure the correctness of the tables (relations).

3. -Create the database using a personal DBMS package (preferably Microsoft Access).

4.Use the DBMS package to create the basic report in Figure AYK.8.

5.-You may not be able to develop a report that looks exactly like the one in Figure AYK.8. However, your report should include the same information.

6.-Complete personnel information is tracked by another database. For this application, include only the minimum: employee number, last name, and first name.

7.-Information concerning all projects, employees, and jobs is not readily available. You should, however, create information for several fictitious projects, employees, and jobs to include in your database.

FIGURE AYK.9

Entity Classes and Primary Keys for On-The-Level Construction

Entity	Primary Key
PROJECT	Project Number
EMPLOYEE	Employee Number
JOB	Job Number
ASSIGNMENT	Assignment Number

Project 48:

iToys Inventory

An independent retailer of mobile entertainment and wireless phones, iToys.com has built its business on offering the widest selection, expert advice, and outstanding customer service. However, iToys.com does not use a formal, consistent inventory tracking system. Periodically, an iToys.com employee visually checks to see what items are in stock. Although iToys.com does try to keep a certain level of each "top seller" in stock, the lack of a formal inventory tracking system has led to the overstocking of some items and understocking of other items. In fact, on occasion, a customer will request a hot item, and it is only then that iToys.com realizes that the item is out of stock. If an item is not available, iToys.com risks losing a customer to a competitor.

Lately, iToys.com has become concerned with its inventory management methods. The owner of iToys.com, Dan Connolly, wants to better manage his inventory.

The company receives orders by mail, telephone or through its Web site. Regardless of how the orders are received, what Dan needs is for a database to automate the inventory checking and ordering process.

Project Focus

Dan has provided you with a simplified version of the company's current system (an Excel workbook) for recording inventory and orders (iToys_Data.xls).

1. Develop an ERD diagram before you begin to create the database. You will need to use the information provided here as well as the data given in the Excel workbook.

2. Create an Access database that will track items (i.e., products), orders, order details, categories, suppliers, and shipping methods.

3. In addition to what is mentioned above, the database needs to track the inventory levels for each product, according to a reorder level and lead time.

4. At this time, Dan does not need information stored about the customer; he simply needs you to focus on the inventory structure.

5. Develop a query that will display the products that need to be ordered from their supplier. To complete this, you will want to compare a reorder level with how many units are in stock.

6. Develop several reports that displays:

    a.   -Each product ordered by its supplier. The report should include the product name, quantity on hand, and reorder level.

    b. Each supplier ordered by shipping method.

    c. -Each product that requires more than five days lead time. (Hint: You will want to create a query for this first).

    d.   Each product ordered by category.

7. Here are some additional business rules to assist you in completing this task:

    a. An order must have at least one product, but can contain more than one product.

    b. A product can have one or more orders, but need not have any orders.

    c. -A product must belong to one and only one category, but a category many contain many different

products.

d. -A product can only be stocked by one supplier, but a supplier can provide more than one product.

    e. -A supplier will use one type of shipping method, but shipping methods can be used by more than one supplier.

Data Folder: AYK 48_Data

Project 49:

Call Around

A manufacturing company, Teleworks, has been a market leader in the wireless telephone business for the last 10 years. Other firms have imitated its product with some degree of success, but they occupy a dominant position in the marketplace because Teleworks was there first with a quality product.

Just recently Teleworks began selling a new, enhanced wireless phone. This new phone does not replace its current product, but offers additional features, greater durability, and better performance for a somewhat higher price. Offering this enhanced phone has established a new revenue stream for the company.

Many sales executives at Teleworks seem to subscribe to the-more-you-have, the-more-you-want theory of managing customer data. That is, they believe they can never accumulate too much information about their customers, and that they can do their jobs more effectively by collecting infinite amounts of customer details. Having a firm grasp on a wide range of customer-focused details—specifically reports summarizing call center information—can be critical in enabling your company to successfully manage a customer relationship management (CRM) solution that creates a positive impact.

To continue to provide excellent customer support, and in anticipation of increased calls due to the release of its new product, Teleworks needs a database that it can use to record, track, and query call center information. Teleworks CIO, KED Davisson, has hired you to develop this database.

Project Focus

1.   Teleworks has provided you with a workbook data file; its current approach for recording cell center information (Telworks_Data.xls).

2. Develop an ERD diagram before you begin to create the database.

3. Create an Access database that will allow data analysts to enter call center data according to the type of issue, the customer, assign each call to a consultant, and prioritize the call.

4. Develop a query that will display all issues that are "open."

5. Develop a screen form to browse all issues.

6. Develop several reports that display:

    a. All closed issues.

    b. Each issue in detail ordered by issue ID.

    c. Each issue in detail ordered by consultant.

    d. Each issue in detail ordered by category.

    e. Each issue in detail ordered by status.

7. Here are some additional business rules to assist you in completing this task:

    a. An issue must have at least one customer.

    b. A customer can have more than one issue.

    c. Each issue must be assigned to one consultant.

    d. Each consultant can be assigned to more than one issue.

    e. An issue can only belong to one category.

    f. An issue must be assigned only one status code.

    g. An issue must be assigned a priority code.

8. Priorities are assigned accordingly:

Priority

Level

Critical

High

Moderate

Standard

Low

9. Status is recorded as either open or closed.

10.   The categories of each issue needs to be recorded as:

Category

Hardware/Phone

Software/Voicemail

_____

Internet/Web

Data Folder: AYK 49_Data

Project 50:

MoveIT

MoveIT is a moving company that provides moving and storage services in Colorado, New Mexico, and Wyoming. MoveIT provides a truck, driver, and one or more moving assistants to move residential and commercial items from one location to another within the defined coverage area. In addition to moving services, the company provides temporary and long-term storage in its warehouses. MoveIT's customers are commercial and residential. Some of the storage warehouses are climatically controlled for customers who need to store items that are sensitive to extreme temperatures.

The business started in 1990 with a single truck and a single warehouse in Colorado. Due to a very satisfied clientele, the company has grown over the years into a much larger business. Currently, MoveIT has one warehouse in each state it services and is working on a merger with another company that offers similar services in different service areas. When the merger is complete, MoveIT will acquire additional storage warehouses, trucks, and employees and will expand its operations into different states.

Colin Baker is the general manager of MoveIT. In the past, Colin managed the business using a combination of workbooks and paper forms. However, with a merger in the company's future, Colin needs to expand his system to manage data better. Colin recently hired Zachary Wilson, an information systems specialist, to recommend and implement a new plan for managing the company's data.

Zach's first task is to understand the current system and its limitations by talking extensively with Colin about data management and user needs. Colin explains that the office in each state accepts reservations for moving and storage services by completing a form that includes the customer's name, address, phone number, and the job's details. Jobs that involve trucking items from one location to another or from an outside location to a storage unit in a warehouse are maintained in a filing cabinet that is organized by customer name. Leases for storage space are stored alphabetically in a separate filing cabinet for each warehouse. All of the forms are stored in the on-site offices at the warehouse from which they were purchased.

Each warehouse has its own manager, office staff, and moving assistants. Drivers are contract employees

and can work for any warehouse. Colin wants the new system to manage employee data, including personal information, salary information, and work performance. In addition to managing personnel data, Colin also wants to use the new system to manage information about drivers, including their personal information and driving records. The system also needs to store information about the trucks and vans that MoveIT owns and operates.

Finally, the system must maintain data about customers who utilize moving and storage services. Some customers might require storage in more than one location. When there is a request for services, the request is recorded on a form.

Zach gathered a collection of documents that will help you design the database. You need to be certain that every data item in the existing documents is also represented in the tables in your design.

FIGURE AYK.10

MoveIT Employee Data

Project Focus

Phase 1: Design the database

1.   Zach gave you the form shown in Figure AYK.10, which collects data about employees. In addition to storing the data shown in Figure AYK.10, Zach also needs to identify the warehouse in which the employee works. On paper, design an employee table based on this form. The table design for all tables that you create should include field names, data types, field properties (as necessary), and field descriptions. Remember that each table must have a primary key field.

2.   The database must manage data about drivers, who are hired on a contract basis. Design a table that stores information about drivers. The table should include the same information stored for employees, except for an indication about the warehouse in which the driver works, in addition to storing the following additional information:

■ Drivers are not paid an hourly rate or salary; they are paid based on the number of miles driven for any job. The payment for a job is determined by multiplying the rate per mile by the number of miles for the job.

■ MoveIT rates drivers based on their safety records, successful on-time deliveries, and other factors. The company's rating system uses the values A, B, C, D, and F to rate drivers, with A being the highest rating and F being the lowest rating. (You do not need to worry about how MoveIT assigns ratings to drivers; you only

need to store the driver's rating.)

3.   Design a table that stores data about the trucks and vans owned by MoveIT. Each vehicle has a unique identification number appearing on the vehicle in the format TRK-001 for trucks or VAN-009 for vans. Colin wants to store the vehicle's license plate number, number of axles, and color.

4. Design a table that stores data about warehouses using the data shown below. The warehouse identification number is the two-letter state abbreviation in which the warehouse is located followed by a dash and then a number. For example, the warehouse in Wyoming is WY-1.

Warehouse ID	Address	City	State	ZIP	Phone	Climate	Security Gate
CO-1	101 Park Way	Denver	CO	80210	(503) 551-2432	No	Yes
NM-1	1A Warehouse	Santa Fe	NM	87501	(206) 324-2312	Yes	Yes
WY-1	510 Hixson Pike	Jackson Hole	WY	83001	(307) 541-3571	Yes	No

5. Currently, information about storage units is stored in an Excel workbook; a portion of this data is shown in Figure AYK.11. Use this information to help you design a table that manages data about the storage units.

6. You also need to manage data to indicate which customer rents each unit. Colin wants to store the date the lease started and ended on each unit in each warehouse. For current customers, the ending lease date will be null. Design a table that manages data about the unit rentals.

7. When the customer requests a job, the administrative assistant from the warehouse that will perform the services fills out the form shown in Figure AYK.12. This form is considered a job order.

8. Colin needs to store the following data about customers: company name (for commercial customers only), the job contact's name, and the address, city, state, ZIP code, and phone number. Design a customer table using this information.

9. The administrative assistant uses a scheduling program to manage and assign vehicles and drivers for moving jobs, and then this information is entered into the database. Upon completion of a job, the database must store the details about the job, including the customer, truck or van used, driver, actual mileage, and actual weight. This step is considered to be the job detail. Colin wants to store job detail

data separately from job order data. Design a table that manages the job detail information.

10. For each table you designed, use a piece of paper to sketch the table design so that you can enter five sample records into it. After creating five records, determine whether you need to adjust your table designs so that each table is in third normal form. If you need to make any changes to your table designs, do so on your paper and add the necessary documentation to the existing table designs.

11. Review each table design to ensure you have created all of the necessary fields. Be certain that you have designated a primary key field in each table and that your primary key field will contain unique values for each record.

12. Draw arrows to indicate the fields that will form the relationships in the database.

FIGURE AYK.11

MoveIT Workbook

FIGURE AYK.12

Customer Request Form

Phase 2: Build the database

1. Use the table designs you created in Phase 1 to build the tables in Access.

2. Check your database carefully to ensure that you have created all the tables, all the fields and set their properties, and all the necessary relationships.

3. Use the data shown below to populate the Position table.

PositionID	Title
1	General Manager
2	Warehouse Manager
3	Administrative Assistant
4	Accountant
5	Maintenance
6	Moving Assistant
7	Information Systems

4. Use the data shown below to populate the Warehouse table.

Warehouse ID	Address	City	State	ZIP	Phone	Climate	Security Gate
CO-1	101 Park Way	Denver	CO	80210	(503) 551-2432	No	Yes
NM-1	1A Warehouse	Santa Fe	NM	87501	(206) 324-2312	Yes	Yes
WY-1	510 Hixson Pike	Jackson Hole	WY	83001	(307) 541-3571	Yes	No

5. Populate the tables in your database using the data stored in the MoveIT.xls file.

Phase 3: Queries

Now that you have worked with Zach to develop the design for the MoveIT database, he explains that the most pressing task is to serve the needs of the human resources department. Haley Adams is an administrative assistant responsible for many human resources tasks, and she asks for your help extracting information from the MoveIT database. Although an outside company processes payroll for MoveIT, Haley and others maintain complete employment information and strive to meet management's goal of recruiting and retaining skilled, qualified employees who are well-trained in customer service. Having employees working in three warehouses in three states has made it difficult to track employee information, and the potential merger and expansion means that human resources must take advantage of the MoveIT database to maintain and retrieve employee information. Haley asks for your help in filtering data and creating queries that provide the information that she needs.

1. The truck drivers for MoveIT are a special type of employee, and their data are stored in a table separate from the rest of the employees because of driving certification requirements. Drivers are certified to drive trucks with a specified number of axles, and MoveIT must be certain that a driver is certified to drive a particular truck.

    a. -When Haley meets with Colin, she learns that only drivers who have a driving record of A or B are allowed to drive the large trucks (those with four axles or more). She asks you to identify the drivers qualified to drive the four-axle trucks. Because she will use the list you create to call drivers when she needs a substitute, include the phone numbers and driving record for each driver. Save the query as 4AxleDrivers.

    b. -Haley also learns that she must immediately review drivers who have a driving record lower than A or B. Those drivers who have a record of C will be put on notice, and those with a record D or F can be

terminated immediately. List the drivers with these low driving records, and sort the list so that Haley can easily determine the driving record of each driver. Because she can enroll long-term drivers in a training program, she also needs to know when each driver started working for MoveIT and whether the driver is still employed. Save the query as DriversWithLowRecords.

    c.   -If drivers have been terminated because of their driving record, Haley wants to include them in an additional list. Create this list for Haley, and include all relevant employment information. Save this query as DriversForTermination.

2. Colin is considering providing bonuses to long-term employees. Haley asks you to list the 10 employees who have worked for MoveIT the longest. Name the query LongestEmployment.

3. To prepare for a payroll, Haley must provide a list of employees that includes their salary or hourly pay rate. The list must also include Social Security numbers and employee IDs so that an outside firm can properly process the payroll. Produce an employee list that provides this information, and sort it so that it's easy to find an employee by name. For those employees who are on a salary, the list should show their monthly wage. Save the query as Payroll.

Phase 4: Forms

Zach asks you to begin building forms that let users view and enter data. He suggests that you start by building some simple forms that will be used for entering data into the customers, drivers, employees, trucks, and warehouses tables.

1.   Zach states that he wants to have simple data-entry forms for each of the following tables: customers (CustomerData), drivers (DriverData), employees (EmployeeData), vehicles (VehicleData), and warehouses (WarehouseData). Create those forms and save them in the database. As you create the forms, consider the design and layout of the form. Make selections that you feel are most appropriate for this application.

2. Open each form and view it from the perspective of the user. As you observe the form, make decisions as to what fields need to be rearranged, sized, aligned, and so on. You might even decide that a particular field doesn't need to be on the data-entry form. For example, when you are entering a customer's records, would you need the balance field for that customer? Be sure each form is attractively presented.

3. Zach has given you the logo for MoveIT (MoveIT-logo.jpg). He asks you to include the logo as well as

a title on each of your forms.

Phase 5: Reports

In this project, you work with Olivia Benson, an accountant in the New Mexico warehouse of MoveIT Inc. Olivia needs to prepare a series of financial reports to present to Colin, the warehouse managers, and the accountants at MoveIT at their annual meeting. They are naturally interested in how much revenue recent jobs have generated, as well as the labor costs that offset this revenue.

1.   Because Olivia will discuss all the reports at the same time, she wants them to look similar and present a consistent, unified package. She suggests that you use the following guidelines as you design the reports:

■ Include the MoveIT logo at the top of every report.

■ Provide an appropriate title that clearly states the purpose of each report.

■ Show all dollar amounts with a dollar sign and two decimal places.

■ -At the bottom of every page, include the page number, total number of pages, date, and name of the person who prepared the report in the format "Prepared By: Your Name."

2. Olivia also needs a report that shows the income from the storage units. Group the information by warehouse and show the name of the renter so that it's easy to identify the renter by last name. The report should also include the rent per unit, the total rent for each warehouse, and a grand total of rent for all warehouses. Name the report StorageRevenue.

3.   Olivia suspects that MoveIT could increase its income from storage units by encouraging more long-term rentals. Add a calculation to StorageRevenue that shows how long each renter has rented a storage unit. Show the figure in years with one decimal place. Name the report Longevity.