RA8000/ESA12000 FC-Switch Configurations for Windows NT - Intel

COMPAQ STORAGEWORKS

Application Note
AA-RHH6A-TE

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NOTE

This application note describes RA8000/ESA12000 FC-Switched Fabric configurations. For Fibre Channel Arbitrated Loop configurations, refer to Application Notes "RA8000/ESA12000 FC-AL Configurations for Windows NT – Intel" and "RA8000/ESA12000 FC-AL High Availability Configurations for Windows NT – Intel".

Enterprise Network Storage Architecture (ENSA)

Compaq StorageWorks RAID Array 8000 (RA8000 FC) and Enterprise Storage Array 12000 (ESA12000 FC) products are the latest in fully integrated Fibre Channel RAID storage solutions. These products provide the key steps in delivering on Compaq's ENSA vision. ENSA addresses the issues that our customers expect to face now and in the future. Both products address today's issues including: economical capacity growth, data protection, high availability, increased distance, multi-vendor platform support, and investment protection by being the base for building the ENSA vision.

With the addition of fibre channel switched fabric support in the RA8000 and ESA12000 FC storage products, Compaq has taken the next evolutionary step in delivery of the ENSA vision. Our customers can now realize the full benefits of a Storage Area Network (SAN) providing exceptional connectivity while increasing the effective bandwidth of the network. Fibre Channel Fabric provides the robust backbone needed to address dispersed server operation with shared storage access across the enterprise.

Product Overview

The RA8000 and ESA12000 FC storage systems are based on a common architecture and offer customers centralized management, high availability, and exceptional performance and scalability in open systems environments. These products provide a Fibre Channel storage solution with industry leading SAN support utilizing both FC-Fabric (switch) and FC-AL (arbitrated loop) technology.

The RA8000 FC is a mid-range storage system available in a pedestal enclosure for departmental use in the office. It can also be installed in server racks for small data centers. An easy-to-deploy, flexible solution for open systems, the RA8000 supports up to 1.3 TB of storage.

The ESA12000 FC, designed for the data center, is available in three easy-to-order building blocks, each optimized for specific, high-capacity customer requirements. The ESA12000 FC offers unprecedented levels of storage, scaling in performance and capacity as user requirements increase.

These storage systems incorporate the latest in RAID technology providing RAID levels 0, 1, 0+1, adaptive 3/5, and non-RAID disks. Compaq's implementation of RAID capability assures that data availability will be maintained despite hardware failure. Features such as read ahead cache and mirrored write back cache improve or minimize the affect on performance while preserving data availability and supporting high availability.

The RA8000/ESA12000 FC platform kits contain the necessary operating system specific software and documentation needed to install, configure, and monitor your storage system. All platform kits include the StorageWorks Command Console (SWCC) for storage management operations including configuring, status inquiry and notification facilities. SWCC provides a user oriented graphical user interface (GUI) simplifying the most complex of storage management operations.

Microsoft Cluster Server (MSCS)

A Windows NT MSCS cluster enables two servers to share an RA8000 or ESA12000 FC storage system through a Fibre Channel bus. If a server failure should occur, the storage I/O is re-routed through to the functioning server. This process, called cluster failover, requires no resource downtime ensuring the high availability of data.

The RA8000 and ESA12000 FC storage systems are supported in Windows NT MSCS cluster configurations. All of the cluster configurations provide full cluster failover capabilities through a fibre channel bus connected to both cluster servers.

In addition to cluster failover, the RAID array controllers can be configured in transparent failover mode to protect against the unlikely event of a single controller failure. This feature eliminates controllers as single points of failure and is invoked without the need for server intervention.

For the highest availability, two hardware paths between the cluster servers and the RA8000 or ESA12000 FC storage system can be configured using Compaq's Secure Path for Windows NT. This configuration provides two separate physical paths between the servers and the storage.

Secure Path for Windows NT

StorageWorks Secure Path is a high availability software product providing continuous data access for RA8000 and ESA12000 FC storage products configured on Windows NT platforms. Redundant hardware, advanced RAID technology and automated failover capability are used to enhance fault tolerance and availability. Secure Path effectively eliminates controllers, interconnect hardware and host bus adapters as single points of failure in the storage system.

Key to Secure Path's functionality is the capability of RA8000/ESA12000 FC dual HSG80 controllers to operate in the active/active Multiple-Bus failover mode. This failover mode allows each controller to be configured on its own bus and to process I/O independently under normal operation. Available storage units are "preferred" to one or the other of the two controllers which determines which controller path is used for access at system boot time. During runtime, storage units may be moved between paths at anytime through use of the management utility.

Controllers in Multiple-Bus failover mode monitor each other and automatically failover storage units from the failed member of a controller pair. The Secure Path software detects the failure of I/O operations to complete on a failed path and automatically re-routes all traffic to the surviving path. Controller and path failover is completed seamlessly, without process disruption or data loss.

The Secure Path management utility provides continuous monitoring capability and identifies failed paths and failed-over storage units. To facilitate static load balancing, storage units can be moved between paths using simple "drag-and-drop" operations.

The integration of Secure Path, Windows NT Clustering, and StorageWorks RAID Array Fibre Channel technology provides the maximum level of fault-tolerance, data availability, and performance required for mission-critical environments.

Performance Considerations

The performance of an application on a system that includes RA8000 or ESA12000 FC storage can be limited by many different components of the system. Some of the possible component limitations include the host CPU(s), memory size, the host bus adapter(s) (HBA), the fibre channel bus, the RAID controller, or the specific configuration of disks used behind the controller. The limiting factor can move to any of these components depending on the workload. Identifying the limits will assist in determining the best configuration for a given application.

Table 1 lists the upper limit performance specifications for the components of the RA8000 and ESA12000 FC storage systems based on testing using standard storage performance tests and methodologies. These numbers should be used to compare component level performance as a means to determine the best configuration from a performance perspective. User application tests may not necessarily reach these levels of performance as applications may perform additional levels of processing for each I/O. The controller specifications listed show both cache (no disk access) and media (with disk access) limitations.

The limits are based on I/O performance (I/O’s per second) - typical of small transfer applications such as databases and mail, and bandwidth performance (MB’s per second) - typical of large transfer applications such as video and graphics.

Table 1 Performance Limits of FC-Fabric Components

Transfer Size	IO/sec (small transfer sizes, random access)		MB/sec (large transfer sizes, sequential access)	
Operation Type	**Read**	**Write**	**Read**	**Write**
FC HBA - KGPSA-BC	**15,500**	**14,250**	**86**	**51**
FC Switch	**400,000**	**400,000**	**1600**	**1600**
Single HSG80 Controller (1 Active Port)	**12,000 Cache 4,100 Media**	**9,000 Cache 4,000 Media**	**77 Cache 54 Media**	**50 Cache 44 Media**
Single HSG80 Controller (2 Active Ports)	**12,000 Cache 4,100 Media**	**9,000 Cache 4,000 Media**	**98 Cache 54 Media**	**100 Cache 47 Media**
Dual HSG80 Controllers (2 Active/2 Standby Ports)	**24,000 Cache 8,200 Media**	**18,000 Cache 8,000 Media**	**154 Cache 102 Media**	**101 Cache 88 Media**
Dual HSG80 Controllers (4 Active Ports)	**24,000 Cache 8,200 Media**	**18,000 Cache 8,000 Media**	**195 Cache 102 Media**	**178 Cache 88 Media**

NOTE

FC Switch performance limits are theoretical. Actual measured performance is lower due to limits unrelated to the switch.

General Configuration Guidelines

One of the major benefits of fibre channel fabric technology is the ability to optimize and tailor configurations to best meet your specific needs today, while at the same time provide you the flexibility to expand your storage network as needed to address future needs. Consider future as well as present needs when determining the optimal initial configurations.

Configuration Maximums

This application note describes two RA8000/ESA12000 FC Windows NT switch configurations based on the configuration maximums for servers and storage systems per fibre channel switch (or switches). This document is not intended to describe all possible configurations, as the potential for fibre channel switch configurations is too numerous to define or illustrate. The configuration maximums should be used as a guide to determine the viability of a proposed configuration. It is strongly recommended that you not exceed the maximums listed.

- 500 meters per optical cable segment, 1 kilometer distance between server and storage
- The maximum number of FC HBAs per server is 4 (or total allowed in the server if less than 4)
- Fibre channel switches - Any combination of NT Servers and RA8000/ESA12000 storage systems is allowed per switch, provided the following rules are followed:
    1. A maximum of 8 NT servers per RA8000 or ESA12000 dual controller storage system. See "Extended Configurations" description below when 5 or more servers have access to the same HSG80 controller host port.
    2. A maximum of 4 RA8000 or ESA12000 (with 1 controller pair) can be configured on a FC 16-port switch (Note: If you configure all 4 HSG80 ports on each storage system the maximum is 3 RA8000 or ESA12000 storage systems per 16-port switch).
    3. A maximum of 4 RA8000 or ESA12000 (with 1 controller pair) can be configured across two FC switches for high availability. Refer to SAN Configuration 2 for specific support rules related to Secure Path for Windows NT.
    4. Cascading of switches is currently not allowed (supported in a future release).
- Extended Configurations - If you configure 5 or more (up to 8) Windows NT servers for access to a single host port on an RA8000/ESA12000 Fibre Channel storage system, you must select the "Extended Configuration" check box in the StorageWorks Platform Kit Fibre Channel Software Setup utility custom installation setup. Each NT server that comprises this configuration must have the option selected. Selecting this option will adjust registry settings for your KGPSA host bus adapter to operate in an "Extended Configuration" environment.
- The maximum storage capacity stated (1.3 TB) assumes 18GB disks, increases in disk drive capacity will increase overall storage capacity for the same enclosure footprint
- Intermixing of standalone, NT Cluster, and Secure Path configurations on a switch is allowed provided the rules listed above are followed.

General Configuration Notes

- Dual redundant controllers can be configured for Transparent Failover Mode or Multiple-Bus Failover Mode
- All configuration diagrams show a front view of the storage system, Controller A is the top controller; Controller B is the bottom controller. Controller Host Port 1 is the left port; Host Port 2 is the right port
- Each storage system can be configured using SWCC or the Command Line Interface (CLI) through either the HSG80 controller maintenance serial port or a TCP/IP interface
- All configurations utilize ACS V8.4F (Array Controller Software) configured for FC-FABRIC topology
- All configurations utilize short wavelength lasers and multi-mode fibre channel optical cables in each cable segment. Label both ends of each FC cable with the same unique identification marking (number, letter, etc.) prior to installation

- All configurations require the *Connection Name Operating System* parameter set to "WINNT"
- By default the HSG80 Command Console LUN (CCL) is enabled. This must be **disabled for Windows NT** (using the CLI, "SET *controller* NOCOMMAND_CONSOLE_LUN")
- For configurations with more than one server accessing through the same HSG80 controller host port,

  Use the Connection Name *Unit Offset* value to set the range of unit numbers to be visible from each server (using the CLI, "SET *connection-name* UNIT_OFFSET = *n*")

  Use the Unit *Connection Name* parameter to allow exclusive access to units from each server (using the CLI, "SET unit-number DISABLE_ACCESS_PATH = ALL ENABLE_ACCESS_PATH = *connection-name*")
- All Multiple-Bus Failover configurations require Compaq Secure Path for Windows NT (minimum revision v2.1)

  For standalone servers (non-cluster), a separate instance of the Secure Path Manager is run on each server.

  For Windows NT Clusters, one instance of the Secure Path Manager can be run

  Use the Unit Preferred Path parameter to assign units to a specific controller

  Distribute units equally across both controllers for proper load balancing

  Secure Path configurations require two FC HBAs in a server. Each FC HBA must be connected to a *different* FC switch, but on the *same* switch port number, for example:

  Server 1 FC HBA 1 to FC Switch 1 - Switch Port 1
  Server 1 FC HBA 2 to FC Switch 2 - Switch Port 1
  Server 2 FC HBA 1 to FC Switch 1 - Switch Port 2
  Server 2 FC HBA 2 to FC Switch 2 - Switch Port 2

  The Secure Path Manager uses order of discovery to determine which path (controller) will be displayed first in the GUI, thus FC HBA PCI slot number and switch port cabling affect the display order. The Secure Path Manager will display the controller connected to the first FC HBA (lowest PCI slot number in the server) as the top path and label it as "CONTROLLER A". The controller connected to the FC HBA in the next highest PCI slot is the bottom path in the display labeled as "CONTROLLER B"
- Record the FC HBA *Worldwide ID* (WWID) IEEE address shown on the back of each FC HBA prior to installing into a server
- Use the recorded WWID to identify the connection name displayed from the CLI at the controller using the "SHOW CONNECTIONS" command
- Rename connection names. By default new connection names are automatically added to the controller connection name table by the controllers when they detect a path to an adapter from each active controller host port. The default connection name assigned by the controllers will be "!NEWCONnn", where nn is a number from 1 to 32. After the controllers detect all paths, rename each connection name to be more meaningful to the configuration i.e., SERVER1P1, SERVER1P2, etc. (connection names can be a maximum of 9 characters)
- Each active controller host port presents one SCSI Target ID with up to eight LUNs to each server (FC HBA) on the same switch. LUNs (logical units) can consist of single disks (JBOD), a storageset of multiple disks or a partition (up to 8), configured for a specific RAID level of 0, 1, 0 + 1, or 3/5

Configuration Descriptions

Table 2 lists two RA8000 and ESA12000 FC-Fabric SAN maximum configurations for Windows NT and the pages of this document where a description of capacities, configuration notes, and performance considerations are provided. The configurations are based on the maximums listed in the general configuration guideline section. They show the limits with regard to:

- Number of servers and storage systems per FC switch
- High Availability - No Single Point of Failure – Servers per RA8000 or ESA12000 FC dual controller

SAN configuration 1 describes maximums with the RA8000 and ESA12000 HSG80 controllers configured in controller Transparent Failover Mode. SAN configuration 2 describes the maximums when using controller Multiple-Bus Failover Mode with Compaq Secure Path for Windows NT software. All Transparent failover configurations allow the flexibility to trade-off server and storage system count based on FC switch port availability. All configurations support a mix of both clustered and non-clustered (MSCS) servers. All configurations illustrated utilize 16-port FC switches. The 8-port FC switch is supported in the same configuration types with less connectivity due to the reduced number of ports available.

Table 2 RA8000 / ESA12000 FC-Switch SAN Configurations Windows NT Index

SAN Configuration #	Description	Pages
1	**One FC 16-Port Switch - Up to Eight Servers or Up to Four Storage Systems, Controller Transparent Failover**	**7 – 8**
2	**Two FC 16-Port Switches - Up to Eight Servers, Up to Four Storage Systems, Secure Path, Controller Multiple-Bus Failover**	**9 – 10**

Configuration Parts List

A complete list of parts is provided at the end of this document following the configuration descriptions.

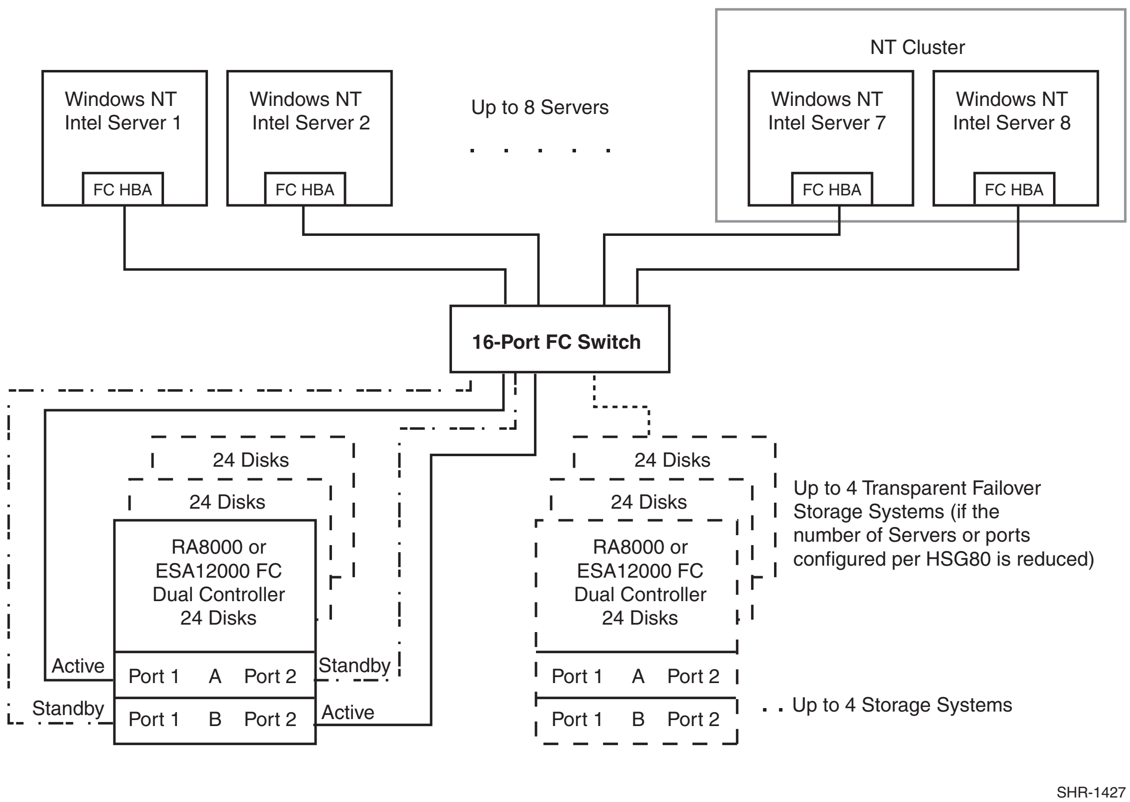
Additional Information/References

A table of all available product documentation is included at the end of this application note for reference. Refer to the documents listed for more details on the product installation and configuration.

SAN Configuration 1 - One FC 16-Port Switch - Up to Eight Servers or Up to Four Storage Systems, Controller Transparent Failover

SAN Configuration 1 (Figure 1) shows the maximum server connectivity currently supported through a single 16-port FC switch. Up to eight separate (non-cooperating) servers or up to four pairs of clustered (cooperating) servers can be connected through the switch providing access from all servers to a single storage system. This configuration utilizes the high connectivity and high performance capabilities of the FC 16-port switch. The HSG80 array controllers within the RA8000 or ESA12000 storage enclosure are configured in Transparent failover mode providing full controller redundancy in the unlikely event of either controller failing. In the initial configuration two active controller host ports provide up to 128 LUNs across up to 24 disks (48 for ESA12000 48 disk). Additional disks can be added using expansion enclosures. With a single 16-port FC switch you can connect up to 2 storage systems with 8 servers or reduce the server count and connect up to 4 storage systems.

Figure 1 SAN Configuration 1



SAN Configuration 1 Notes

- Single 16-port Fibre Channel Switch
- Up to 8 servers, clustered or non-clustered
- Shared storage enclosure(s)
- HSG80 controllers configured in Transparent Failover Mode
- Additional HSG80 controllers configured in Transparent Failover Mode
- Up to 500 meters per cable segment
- Up to 72 disks with 2 optional expansion enclosures per storage system
- Standard configuration - With 8 servers, up to 64 LUNs, 8 available to each server
- Extended configuration - With 8 servers, up to 128 LUNs, 16 available to each server
- Rename the connection names, i.e., SERVER1P1, SERVER2P1, SERVER1P2, etc.
- Set the connection name unit offset values. By default, setting the controller pairs in Transparent

- failover mode will automatically configure Port 1 and Port 2 of both controllers to the Active and
- Standby state indicated, and set unit offset values to 0 for Port 1 and 100 for Port 2. Use the default connection unit offset values for two of the servers and set new unit offset values for connections to the other ten servers as shown below.
- Set exclusive unit access for each unit to a specific server connection name, i.e., for unit D0 ENABLE = SERVER1P1, for unit D100 ENABLE = SERVER7P2. If you are using SWCC to create units, by default units are enabled on all known connection names. You must explicitly disable connection names enabled for units to prevent access.
- Suggested unit numbering and connection parameters for 8 servers/8 LUNs per server results in the units being divided equally across controller host ports as follows:

Server 1: Port 1 units D0 – D7
Connection name, unit offset value: SERVER1P1, 0
Server 2: Port 1 units D10 – D17
Connection name, unit offset value: SERVER2P1, 10
Server 3: Port 1 units D20 – D27
Connection name, unit offset value: SERVER3P1, 20
Server 4: Port 1 units D30 – D37
Connection name, unit offset value: SERVER4P1, 30
Server 5: Port 2 units D100 – D107
Connection name, unit offset value: SERVER5P1, 100
Server 6: Port 2 units D110 – D117
Connection name, unit offset value: SERVER6P1, 110
Server 7: Port 2 units D120 – D127
Connection name, unit offset value: SERVER7P2, 120
Server 8: Port 2 units D130 – D137
Connection name, unit offset value: SERVER8P2, 130

NOTE

The listed connection parameters utilize a single connection to each server – either Port 1 or Port 2. Utilizing both Port 1 and Port 2 connections on all servers and selecting the “Extended Configuration” option in the FC software setup utility can double the number of LUNs available to each server.

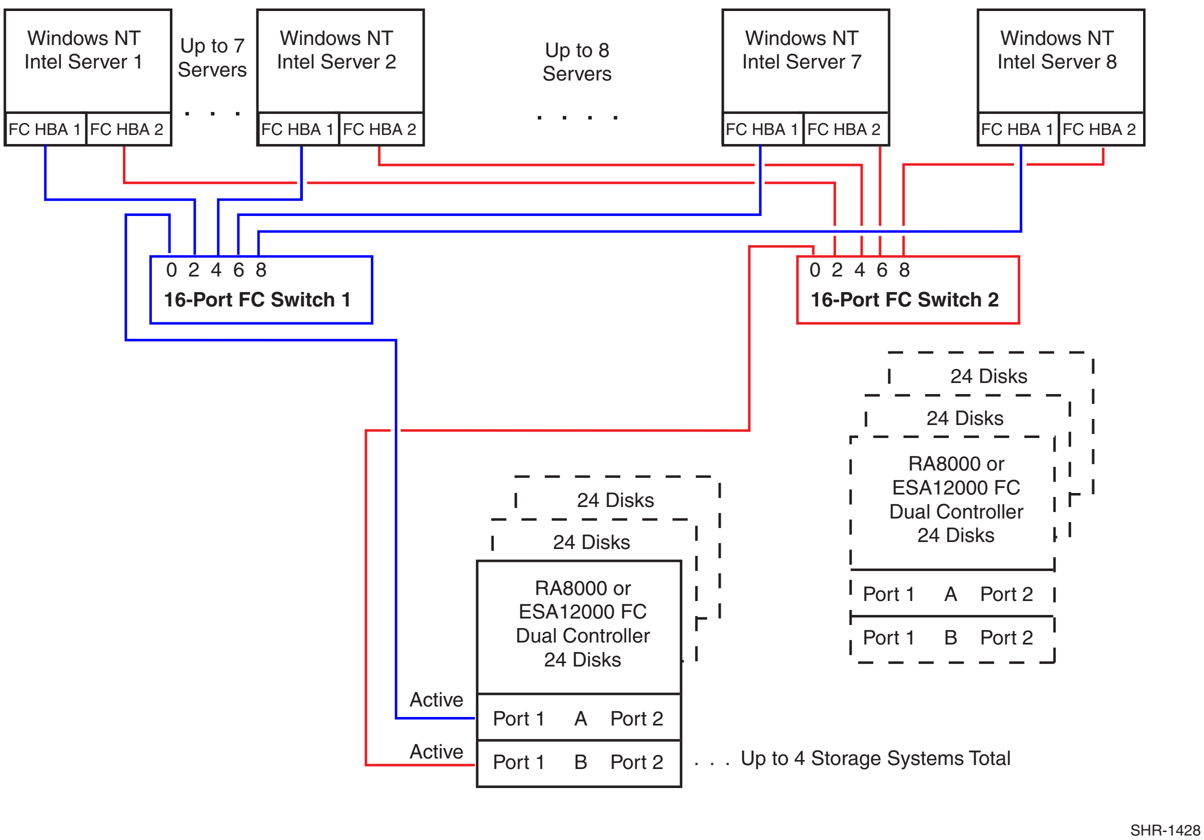
SAN Configuration 1 Performance Considerations

This configuration is meant to show the high connectivity available through a single FC switch. It utilizes a single 16-port FC Switch with up to 8 servers and 2 dual controller storage systems. Assuming that all 8 servers are not always accessing the HSG80 array controllers with the same intensity, the potential throughput and bandwidth available to a single server in this configuration is the dual HSG80 two active port limit of 24,000(cache)/13,000(media) I/O/sec and 154(cache)/102(media) MB/sec. Conversely, when there is simultaneous access, the servers will share the total available resources of the two array controllers. Based on your specific application performance needs, you may consider adding additional controllers and/or reducing the server count.

SAN Configuration 2 – Two FC 16-Port Switches - Up to Eight Servers, Up to Four Storage Systems, Secure Path, Controller Multiple-Bus Failover

SAN Configuration 2 (Figure 2) shows the maximum server and storage connectivity available for high availability applications when the storage systems are configured in Multiple-Bus failover mode. Up to eight separate (non-cooperating) servers or up to four pairs of clustered (cooperating) servers can be connected through two 16-port FC switches to up to 4 storage systems. This configuration adds the high availability features of Multiple-Bus failover and Secure Path for Windows NT software. With Secure Path for Windows NT, two FC HBAs in each server, and two FC switches, a second separate path to the storage is provided to the storage from each server. In the initial configuration two active controller host ports provide up to 64 LUNs across up to 24 disks (48 for ESA12000 48 disk). Additional disks can be added using expansion enclosures.

Figure 2 SAN Configuration 2



SAN Configuration 2 Notes

- Secure Path v2.1 – Up to 4 storage systems total, maximum of 1 storage system configured in Multiple-Bus Failover Mode. When mixing a storage system configured in Multiple-Bus Failover mode with additional storage systems configured in Transparent Failover mode on the same switches, the Multiple-Bus storage system controller host ports must be on switch port number 0 in both switches (see Figure 2), for example:

  HSG80 Multiple-Bus Controller A Host Port 1 to FC Switch 1 – Switch Port 0
  HSG80 Multiple-Bus Controller B Host Port 1 to FC Switch 2 – Switch Port 0
- Secure Path v2.2 – Up to 4 storage systems total, Multiple-Bus Failover Mode or Transparent Failover Mode
- Two 16-port Fibre Channel Switches
- Up to 8 servers

- Shared storage enclosure(s)
- Up to 4 HSG80 controller pairs configured in Multiple-Bus Failover Mode (Secure Path v2.2)
- Up to 500 meters per cable segment
- Up to 72 disks with 2 optional expansion enclosures per storage system
- With 8 servers, up to 64 LUNs, 8 available to each server
- Set the Unit Preferred Path. Use the Preferred Path unit parameter to distribute units equally across controllers for load balancing as shown below
- Rename the connection names, i.e., SRV1A1P1, SRV2A2P1, SRV5A1P1, etc.
- Set the connection name unit offset values for each connection as shown below.
- Set exclusive unit access for each unit to a specific server connection name, i.e., for unit D0 ENABLE = SRV1A1P1, SRV1A2P1, for unit D100 ENABLE = SRV5A1P1, SRV5A2P1. If you are using SWCC to create units, by default units are enabled on all known connection names. You must explicitly disable connection names enabled for units to prevent access.
- Suggested unit numbering, preferred paths, and connection parameters for 8 results in the units being divided equally across controller host ports as follows:

  Server 1: Port 1 units D0 – D7. Prefer D0 - D3 to Controller A, D4 - D7 to Controller B
  Connection names, unit offset value: SRV1A1P1, 0. SRV1A2P1, 0
  Server 2: Port 1 units D10 – D17. Prefer D10 - D13 to Controller A, D14 - D17 to Controller B
  Connection name, unit offset value: SRV2A1P1, 10. SRV2A2P1, 10
  Server 3: Port 1 units D20 – D27. Prefer D20 - D23 to Controller A, D24 - D27 to Controller B
  Connection name, unit offset value: SRV3A1P1, 20. SRV3A2P1, 20
  Server 4: Port 1 units D30 – D37. Prefer D30 - D33 to Controller A, D34 - D37 to Controller B
  Connection name, unit offset value: SRV4A1P1, 30. SRV4A2P1, 30
  Server 5: Port 1 units D40 – D47. Prefer D40 - D43 to Controller A, D44 - D47 to Controller B
  Connection name, unit offset value: SRV5A1P1, 40. SRV5A2P1, 40
  Server 6: Port 1 units D50 – D57. Prefer D50 - D53 to Controller A, D54 - D57 to Controller B
  Connection name, unit offset value: SRV6A1P1, 50. SRV6A2P1, 50
  Server 7: Port 1 units D60 – D67. Prefer D60 - D63 to Controller A, D64 - D67 to Controller B
  Connection name, unit offset value: SRV7A1P1, 60. SRV7A2P1, 60
  Server 8: Port 2 units D70 – D77. Prefer D70 – D73 to Controller A, D74 – D77 to Controller B
  Connection name, unit offset value: SRV8A1P1, 100. SRV8A2P1, 100

SAN Configuration 2 Performance Considerations

This configuration is meant to show the maximum connectivity available to a single RA8000 or ESA12000 FC dual controller storage system in a Fibre Channel switched environment when configured with dual paths to the storage. It utilizes two 16-port FC Switches with up to 8 servers configured for access to 1 dual controller storage system. Assuming that all 8 servers are not always accessing the HSG80 array controllers with the same intensity, the potential throughput and bandwidth available to a single server in this configuration is the dual HSG80 two active port limit of 24,000(cache)/8,200(media) I/O/sec and 154(cache)/102(media) MB/sec. Conversely, when there is simultaneous access, the servers will share the total available resources of the two array controllers. Based on your specific application performance needs, you may consider adding additional storage resources and/or reducing the server count.

Parts List

- Intel Servers with Microsoft Windows NT 4.0, Service Pack 3 (minimum)

Compaq Part #	Description
380551-001	RA8000/ESA12000 FC Solution Software V8.4 for Windows NT/Intel
TBS	ACS V8.4F Controller SW
380594-001	Secure Path for WNT
380574-001	KGPSA-BC PCI FC HBA
380560-B21 (Blue) 380560-B22 (Opal) 380670-B21 380580-001 (Blue) 380580-002 (Opal) 380590-B21 (Blue) 380590-B22 (Opal) 380600-001 (Blue) 380600-002 (Opal) 380610-B21 (Blue) 380610-B22 (Opal) 380620-001 (Blue) 380620-002 (Opal) 380630-B21 (Blue) 380630-B22 (Opal)	RA8000 Pedestal w/dual HSG80 RA8000 Pedestal w/dual HSG80 RA8000 Rackable w/dual HSG80 ESA12000 w/dual HSG80 24 Slot 60HZ ESA12000 w/dual HSG80 24 Slot 60HZ ESA12000 w/dual HSG80 24 Slot 50HZ ESA12000 w/dual HSG80 24 Slot 50HZ ESA12000 w/dual HSG80 48 Slot 60HZ ESA12000 w/dual HSG80 48 Slot 60HZ ESA12000 w/dual HSG80 48 Slot 50HZ ESA12000 w/dual HSG80 48 Slot 50HZ ESA12000 w/2 pairs/dual HSG80 48 Slot 60HZ ESA12000 w/2 pairs/dual HSG80 48 Slot 60HZ ESA12000 w/2 pairs/dual HSG80 48 Slot 50HZ ESA12000 w/2 pairs/dual HSG80 48 Slot 50HZ
380570-B21 (Blue) 380570-B22 (Opal) 380568-B21 380640-001 (Blue) 380640-002 (Opal) 380650-B21 (Blue) 380650-B22 (Opal)	Pedestal Expansion 24 slots Pedestal Expansion 24 slots Rackable Expansion 24 slots ESA12000 Expansion 48 Slot 60HZ ESA12000 Expansion 48 Slot 60HZ ESA12000 Expansion 48 Slot 50HZ ESA12000 Expansion 48 Slot 50HZ
380578-B21 (Blue) 380578-B22 (Opal) 380591-B21 (Blue) 380591-B22 (Opal)	FC Switch 16 port (no GBICs) FC Switch 16 port (no GBICs) FC Switch 8 port (no GBICs) FC Switch 8 port (no GBICs)
380561-B21	FC Optical GBIC
234457-B21 234457-B22 234457-B23 234457-B24 234457-B25	FC 2 Meter Optical Cable FC 5 Meter Optical Cable FC 15 Meter Optical Cable FC 30 Meter Optical Cable FC 50 Meter Optical Cable
380691-B21 380595-B21 380694-B21 380588-B21 380589-B21	4GB UW 7200 RPM Disk 9GB UW 7200 RPM Disk 18GB UW 7200 RPM Disk 9GB UW 10000 RPM Disk 18GB UW 10000 RPM Disk

Product Details

The RA8000/ESA12000 storage systems utilize the Compaq HSG80 RAID controller running Array Controller Software (ACS) V8.4F. The ACS software is designed to support multiple platforms providing features including: dual controller operation, two controller failover modes – Transparent and Multiple-Bus, mirrored write back cache, read ahead cache, RAID implementation, disk mirroring, and disk partitioning capabilities. In addition, ACS manages host interconnect and protocol services to provide data for event notification and status such as displayed by SWCC.

The HSG80 controller has two FC host ports providing up to a total of nearly 200 Mbytes per second of available bandwidth. Disk drives are connected to the controller through 6 UltraSCSI channels providing up to 40 Mbytes per second per channel of available bandwidth. Servers can use multiple host bus adapters (HBAs) to multiple RA8000 FC systems for unlimited storage capacity.

The RA8000 FC is supplied in two basic building blocks, a pedestal style cabinet and what has been termed a “rackable” model. The pedestal is a self-contained desk height cabinet, it is available in Digital Classic Top Gun blue and in Compaq Opal. The rackable is shipped ready to be mounted in a 19” Compaq rack or a 19”cabinet/rack using an included universal RETMA/metric mounting kit.

RA8000 FC controllers come with 64 MB of cache. Cache options allow for 128 MB, 256 MB and 512MB of cache in each controller. ESA12000 FC controllers come with 256 MB of cache. Cache options allow for 512MB of cache in each controller. Cache features include read ahead and mirrored write back cache for use in optimizing performance where redundant capabilities are required for high availability system configurations. In the rare event that a storage controller fails the mirrored data is immediately available to the remaining controller for continuing operation.

The RA8000 FC pedestals and rackables come in both single controller and in dual controller models to allow the customer to select the level of high availability required for their application. A single controller model can be upgraded to a dual controller model when warranted by the application.

High availability is supported by the use of redundancy and hot swappable components. The RA8000 FC disk enclosures include redundant cooling, and have 5 power supplies providing N+1 redundancy. Power can be upgraded to full redundancy with the addition of 3 more supplies and a 2nd power distribution unit for AC input redundancy. StorageWorks components are “hot” swappable including storage controllers when operating as a redundant pair.

You can configure and monitor the RA8000 and ESA12000 FC using the StorageWorks Command Console (SWCC). SWCC is included in the HSG80 Software Solutions Platform kit. Using this client/server tool, you can configure RAID sets locally or over a TCP/IP network. The client provides an easy to use graphical user interface. It can be used to monitor your storage system and notify you of events by updating a graphical display, sending electronic mail, or alerting via a pager. The Command Console Client includes applications (or Storage Windows) that communicate with the Command Console Agent software running on the host platform.

The Command Console client is available on Windows 95 and on Intel/Alpha platforms running Windows NT. A Storage Window for the HSG80 controller supports the Array Controller Software (ACS) V8.4F and offers integration with Compaq's Insight Manager(CIM). Insight Manager can receive SNMP traps from the Command Console Agent and Insight Manager services can directly launch SWCC for notification or configuring operations.

Configuration References

The following documents provide further information on the configuration of RA8000 and ESA12000 Fibre Channel Storage Systems:

Table 3 Configuration Reference Material

Topic	Document Title	Order Number
RA8000/ESA12000 Standard FC-AL Configurations Application Note	*RA8000/ESA12000 FC-AL Configurations for Windows NT - Intel*	*AA-RH0RA-TE*
RA8000/ESA12000 High Availability FC-AL Configurations Application Note	*RA8000/ESA12000 FC-AL High Availability Configurations for Windows NT - Intel*	*AA–RH0SA–TE*
Windows NT - Intel HSG80 Array Controller	*Release Notes, HSG80 Array Controller (ACS V8.4F) for Windows NT Server - Intel*	*AA–RH0QA–TE*
Quick Setup Guide	*RAID Array 8000/ESA12000 Fibre Channel Storage Subsystem for Windows NT Server - Intel*	*AA–RFA7B–TE*
Windows NT - Intel RA8000/ESA12000 Installation	*RA8000/ESA12000 HSG80 Solution Software V8.4 for Windows NT – Intel Installation Reference Guide*	*AA–RFA9B–TE*
Windows NT Clusters	*RAID Array 8000/ESA12000 Fibre Channel Cluster Solutions for Windows NT*	*EK-NTC8K-IG*
Secure Path Installation	*StorageWorks Secure Path for Windows NT Installation Guide*	*EK-WNTMP-MH*
HSG80 Array Controller Configuration	*HSG80 Array Controller ACS Version 8.4 Configuration and CLI Reference Guide*	*TBS*
HSG80 Array Controller Maintenance	*HSG80 Array Controller ACS Version 8.4 Maintenance and Service Guide*	*TBS*
StorageWorks Command Console	*Command Console V2.1 (HSG80) for RAID Array 8000/ESA12000, User's Guide*	*AA–RFA2A–TE*
Warranty Information	*DIGITAL StorageWorks Warranty Terms and Conditions*	*EK-HSXSW-WC*
HSG80 Array Controller Parts	*HSG80 Array Controller Illustrated Parts Map*	*EK-HSG80-MP or 355217-001*
RA8000/ESA12000 Configuration	*RA8000/ESA12000 Fibre Channel HSG80 Storage Subsystem Configuration Poster*	*EK–HSG80-CP or 355207-001*