Heterogeneous SAN Platform and Storage System Rules

4

This chapter describes rules related to specific platforms, operating systems, and storage products. For additional information refer to the relevant platform and individual product specific documentation. Refer to the section About this Guide for a list of related documentation.

General Platform/Operating System and Storage System Rules

1. Each platform listed is supported in all SAN Fabric topology configurations unless otherwise noted in this guide or the applicable platform documentation.

2. Any mix of heterogeneous servers, clustered and standalone, is allowed in a SAN provided that you follow all individual platform rules, fabric rules, applicable server application rules, and the maximums listed in this guide and in the platform specific documentation.

3. All HP and multi-vendor hardware platforms and operating systems that are supported in a homogeneous SAN are supported in a heterogeneous SAN. Refer to Table 19 and Table 20 to determine if zoning is required for specific combinations of supported heterogeneous platforms.

4. Servers can attach to multiple fabrics. The number of separate fabrics per server is based on the specific server model capabilities and the maximum number of Fibre Channel host bus adapters supported.

5. Refer to the section "High Availability Configuration Considerations" in this chapter for cabling scheme options for platforms that support high availability multi-pathing.

6. Any mix of storage systems is allowed in a SAN, provided that you follow all applicable platform rules, storage system rules, and fabric rules.

   ■ For SANs consisting exclusively of StorageWorks Enterprise Virtual Array, EMA/ESA12000, EMA16000, MA/RA8000, MA6000, MSA1000, RA4000, or RA4100 storage systems, refer to "Specific Platform/Operating System Rules – Enterprise Virtual Array (VCS v3, VCS v2), EMA/ESA12000, EMA16000, MA/RA8000, MA6000 (ACS 8.7 or ACS 8.6) Storage Systems, B-Series and M-Series Switches", "Specific Platform/Operating System Rules – MSA1000, RA4100, RA4000", and Chapter 3, "SAN Fabric Design Rules".

   ■ For SANs consisting exclusively of HP XP or VA storage systems refer to "Specific Platform/Operating System Rules – HP XP and VA Storage Systems" in this chapter.

   ■ For SANs consisting of a mix of HP XP or VA and StorageWorks Enterprise Virtual Array, EMA/ESA12000, EMA16000, MA/RA8000, MA6000, MSA1000, RA4000, or RA4100 storage systems, refer to "Mixed Storage Common SAN Rules" and Chapter 3, "SAN Fabric Design Rules".

7. Refer to the section "**Platform Interoperability for Single Shared EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems – ACS 8.7**" for information related to mixing heterogeneous platforms on a single shared EMA/ESA12000, EMA16000, MA/RA8000, or MA6000 storage system. In certain situations multiple storage systems may be required to accommodate the requirements of different platforms or operating systems.

8. Currently, there are different limits relative to the number of switches supported in a SAN Fabric based on the Fibre Channel switch product line in use. Refer to Chapter 3, "SAN Fabric Design Rules" for more information.

Blade Server Support

The BL20P and BL40P are currently supported with B-Series Product Line switches only.

Mixed Storage Common SAN Rules

Common HP StorageWorks SANs consist of a mix of certain servers, storage, and infrastructure components supported by pre-merger HP and pre-merger Compaq. The common HP StorageWorks SAN rules closely match the pre-merger HP SAN rules, and can be considered a subset of the pre-merger Compaq rules.

Common HP StorageWorks SAN configurations are implemented by defining zones that isolate servers and storage running with existing HP products and feature sets, from servers and storage running with Compaq products and feature sets. Refer to the section "HP XP and VA Configuration Rules" in this chapter.

The rules regarding zoning will gradually be relaxed as the various product families are brought into synchronization. The current method is shown in Figure 26 for the B-Series Product Line of Core and SAN switch Fibre Channel switch models, in Figure 27 for the M-Series Fabric Product Line of Fibre Channel switches, and in Figure 29 and Figure 30 for the C-Series Product Line.

Operating systems, host bus adapters and storage systems from both HP and Compaq are supported in the common HP StorageWorks SAN Fabric environment, including products from the Enterprise Virtual Array, XP, VA, EMA/ESA/MA/RA, and MSA/RA4xxx families of RAID storage systems. Common server access to different storage system types is supported for specific configurations on HP-UX (Figure 28) and certain configurations utilizing EVA and EMA/ESA/MA/RA storage systems. Refer to the "Specific Storage System Rules" section in this guide for more information. In addition, certain storage solutions utilizing multiple storage types may specify support for common server access. In those cases, refer to the specific storage solution documentation for the supported common access configurations and rules.
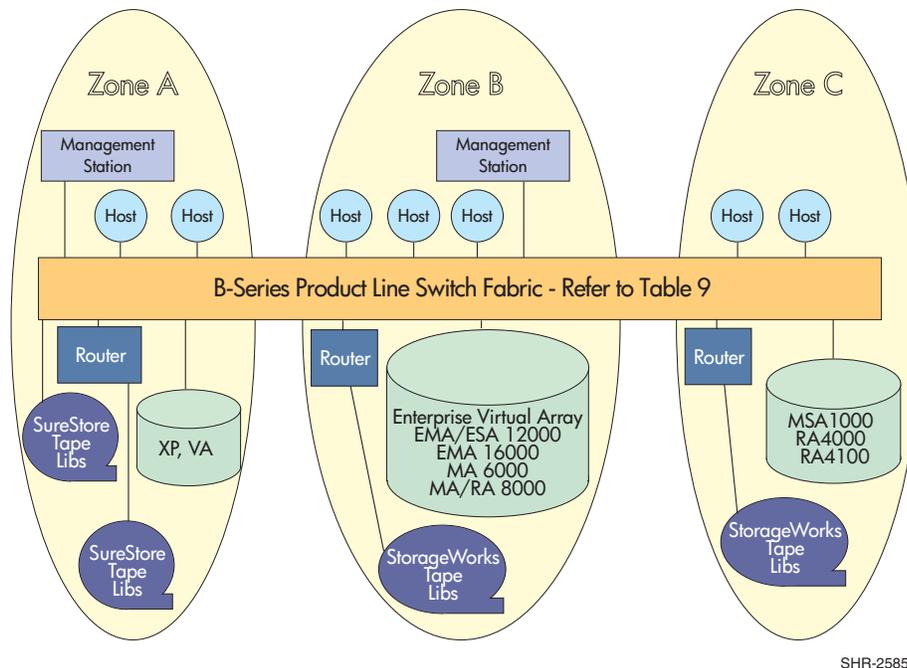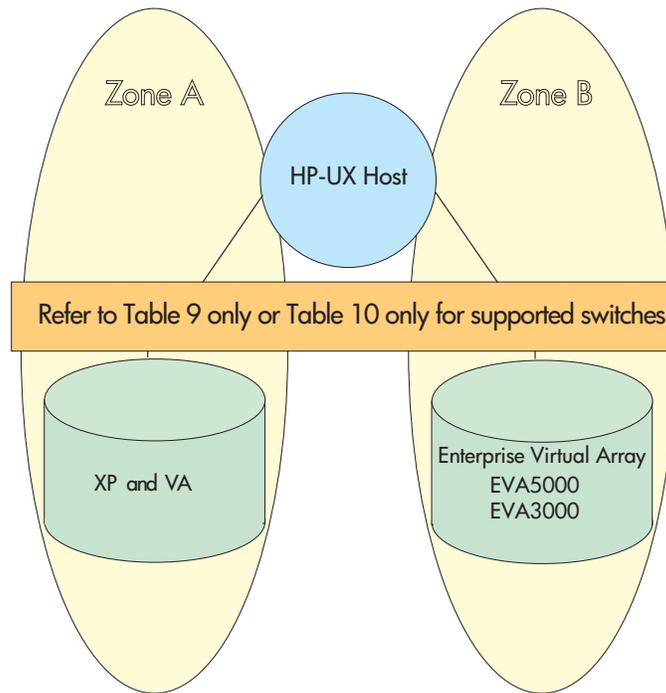

Figure 26: HP StorageWorks SAN using B-Series Switches
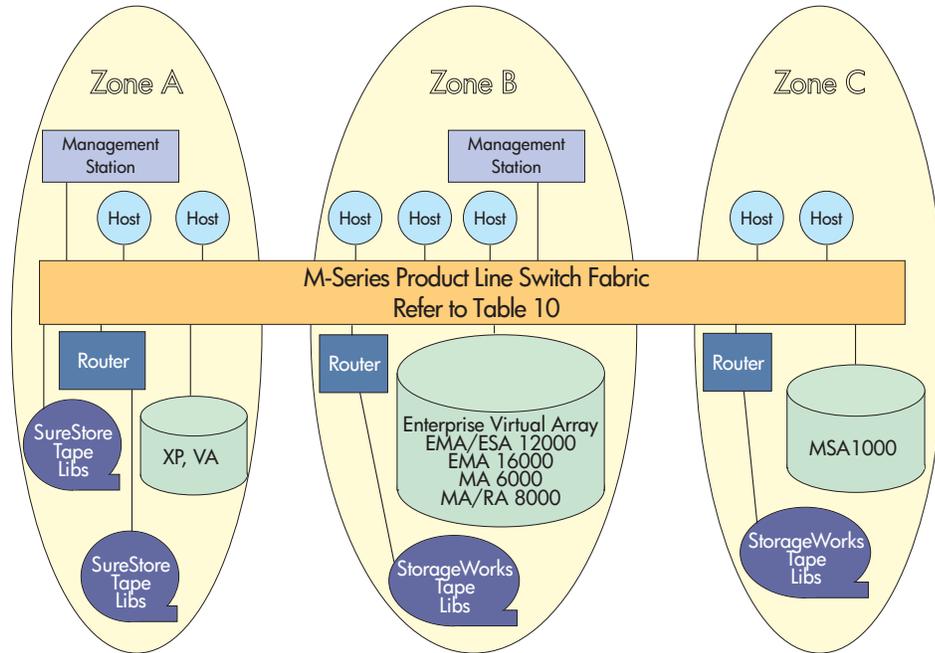
Figure 27: HP StorageWorks SAN using M-Series Switches

Figure 28: HP StorageWorks SAN with an HP-UX host accessing XP/VA storage in one zone and EVA storage in another zone

Mixed Storage Common SAN Rules

HP StorageWorks SAN configurations using Cisco switches are implemented by defining zones that isolate servers and storage running with existing HP products and feature sets.

Operating systems, host bus adapters and storage systems from HP are supported in the HP StorageWorks SAN Fabric with Cisco MDS switch environment, including the Enterprise Virtual Array, XP128/1024, EMA/ESA12000, EMA16000, MA/RA8000, MA6000, and MSA1000 RAID storage systems.

The current method for SAN fabrics with Cisco switches and XP 128/1024 and EVA storage is shown in Figure 29. The current method with EMA/ESA/MA/RA and MSA storage is shown in Figure 30. Clusters are not supported with C-Series Product Line switches at this time.
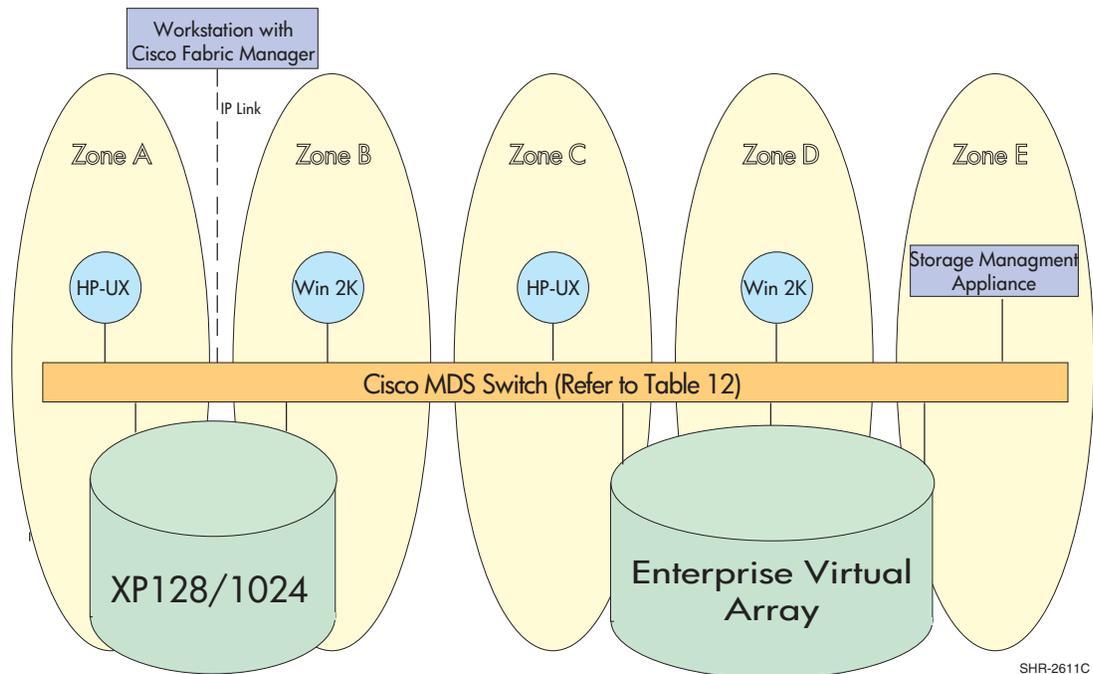

Figure 29: HP StorageWorks SAN using XP 128/1024 and EVA storage with Cisco switch
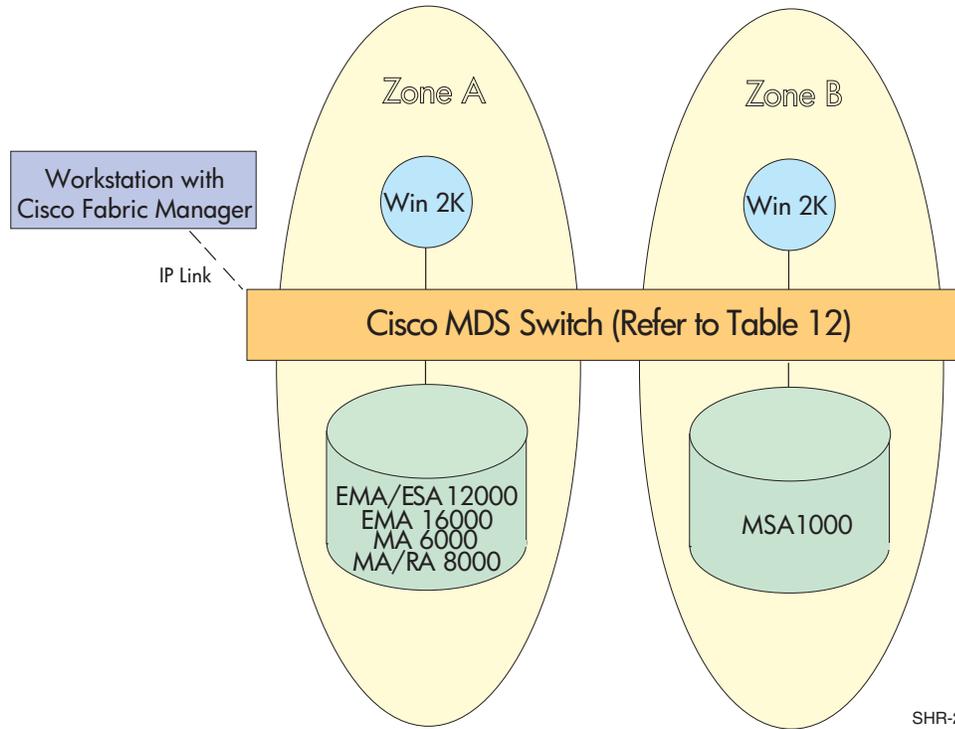
SHR-2612B

Figure 30: HP StorageWorks SAN using EMA/ESA/MA/RA and MSA Storage with Cisco switch

Specific Platform/Operating System Rules – HP XP and VA Storage Systems

Specific platform support rules and SAN fabric configuration rules for SANs consisting of HP XP and VA storage systems are described here.

This section defines the rules and guidelines surrounding the design of SAN infrastructures for XP and VA arrays. For additional information on operating system HBA/driver/firmware/software support, refer to individual array Streams connectivity documents available through HP field representatives or partners via the HP internal SPOCK website.

These rules are sub divided into the following categories for ease of reference and are described briefly in the following pages.

- Legacy SAN Support
- High Availability/Mission Critical SAN Support
- SAN connectivity rules
- XP and VA with multiple OS's shared switch fabric
- XP, VA and tape with multiple OS's shared switch fabric
- Heterogeneous Storage support
- Secure Manager Support
- Third party switch support
- Boot support

Legacy SAN Support

Separate SANs are required if the environment consists of a mixture of legacy switches, devices, discontinued arrays and current products. Legacy products include..

- Discontinued storage devices
- Discontinued switches F16(HP first generation 16-port switch), SANBox-16 (Ancor/Qlogic)
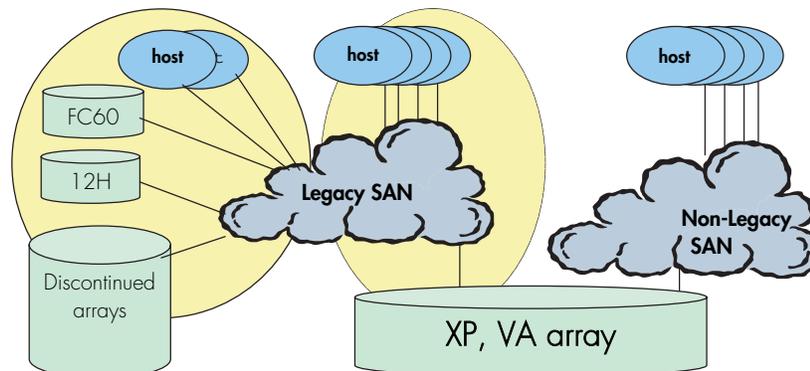- Storage devices like FC60, 12H etc.,

Figure 31: Legacy SAN Support

High Availability/Mission Critical SAN Support

High availability environments like HP Service Guard running on HP-UX servers require dual SAN configurations for achieving "no single point of failure" and meeting customer expectations of "no infrastructure or application downtime" for mission critical applications. This is true for other operating systems also supporting similar high availability solutions.

However, as an exception, SANs comprising of single FC-64 or director-2/64 products can be supported for HA applications as shown below.
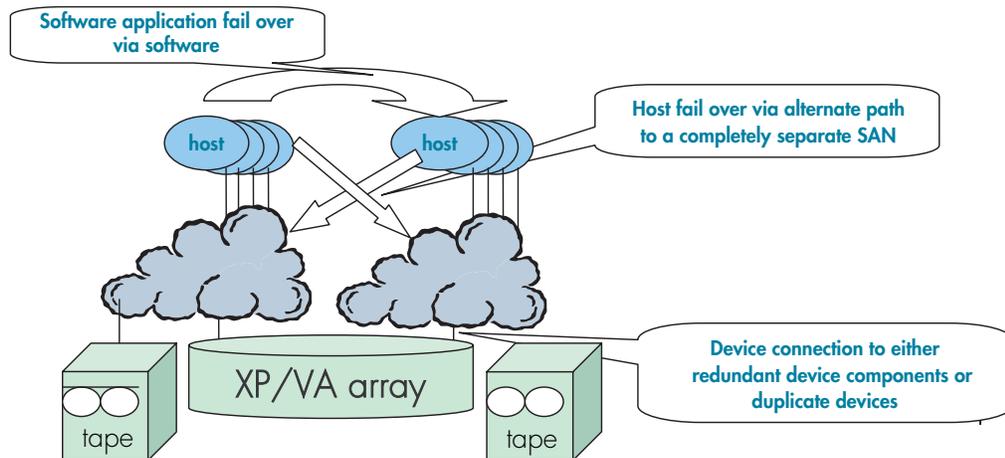
Figure 32: High Availability SAN with XP/VA
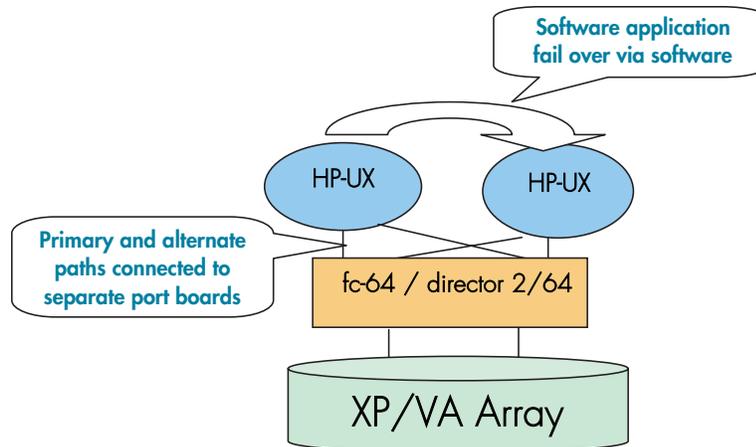
Figure 33: Software application fail-over

XP and VA with multiple OS's shared switch fabric

- Multiple OS's can be supported on the same switch/fabric with appropriate zoning
  — zones must contain homogeneous OS types only
  — overlapping zones supported if more than one OS needs to share an array port
- Heterogeneous OS' which use mode 00 or 08 may share an XP array port with restrictions (see Streams); All others must use a dedicated XP array port for each mode. XP-1024/128 may have some exceptions. See the relevant Streams document for details.

■ Secure Manager XP and Secure Manager VA required for LUN isolation with multiple hosts connected through a shared array port

Table 17: Zoning requirement for OSs sharing the same fabric with XP/VA storage

Platform OR OS type	HP-UX	Linux	Windows	Tru64 UNIX	OpenVMS	Sun Solaris	IBM AIX	Novell NetWare	SGI IRIX
HP-UX	Yes*	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required
Linux	Zoning Required	Yes*	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required
Windows	Zoning Required	Zoning Required	Yes*	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required
Tru64 UNIX	Zoning Required	Zoning Required	Zoning Required	Yes*	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required
OpenVMS	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Yes*	Zoning Required	Zoning Required	Zoning Required	Zoning Required
Sun Solaris	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Yes*	Zoning Required	Zoning Required	Zoning Required
IBM AIX	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Yes*	Zoning Required	Zoning Required
Novell NetWare	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Yes*	Zoning Required
SGI IRIX	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Yes*

*Yes indicates these OSes can be part of the same zone in a fabric with XP/VA.

The above table indicates that OS types do not mix in the same zone, however, they can selectively share the storage ports that support this feature (see SPOCK Streams for details) across zones. Storage ports can be overlapped in multiple zones.
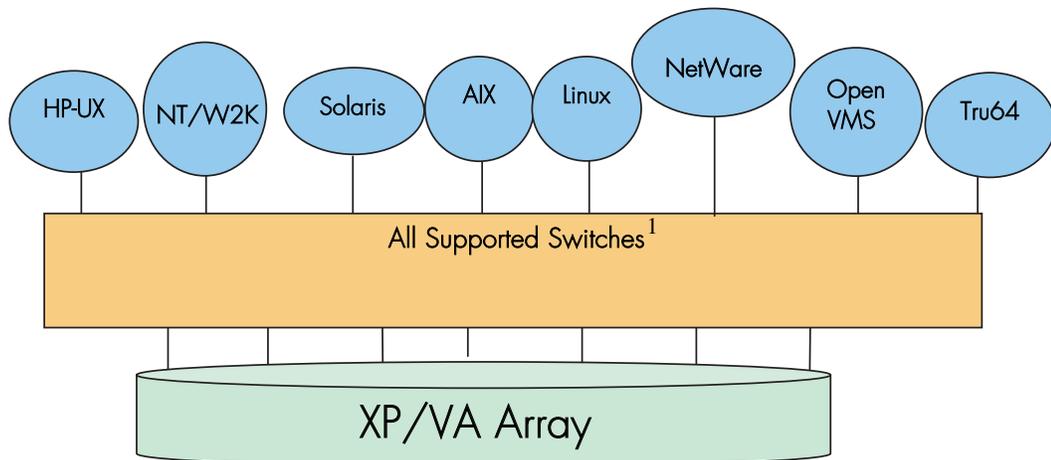

Figure 34: XP/VA with multiple OS's on a shared SAN fabric[1]

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1. See SPOCK Streams for model and firmware versions for supported switches. Third party switches like ED-5000 and Inrange FC 9000 are also supported with some XP arrays, limited to a maximum two switch configurations. Refer to Streams for specific details.

XP/VA and Tape with multiple OS's shared switch fabric

- Overlapping zones supported with disk and tape.

- Separate or common HBAs for disk and tape connections.

- Dedicated tape HBA connection is recommended for servers with backups requiring more than 4 DLT8000 tape drives or 2 Ultrium (LTO) tape drives.

- Secure Manager XP and Secure Manager VA required for LUN isolation with multiple hosts connected through a shared array port.

- See SAN Backup Configuration Guide for additional tape support on SPOCK

  http://hpso.rose.hp.com/spock/documents/backupSAN_configGuide_v4.pdf
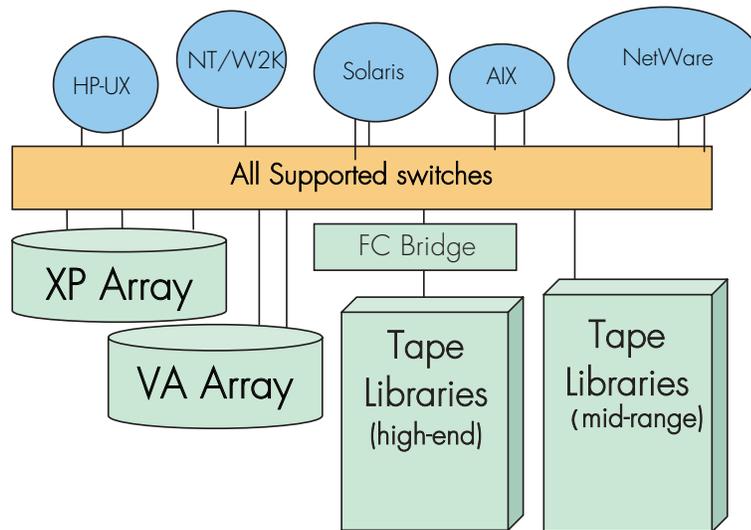

Figure 35: XP/VA with multiple OS's and tapes on a shared SAN fabric, fabric only[1]

Heterogeneous Storage Support

These configuration rules apply for heterogeneous SAN storage with the XP/VA:

- Zone XP array to isolate from all other vendor zones; no overlapping zones
  — XP zone may contain heterogeneous OS types for non-HA support
  — XP zone must contain homogeneous OS types for HA support

- Secure Manager required for LUN isolation with multiple hosts connected through a shared array port

- Other vendor array zones governed by their vendor's configuration guidelines.

- Shared HBAs or hosts across 3rd party storage vendors are NOT supported.

- Supports connection to a common server with XP/VA and EVA storage systems. Refer to "HP XP and VA Configuration Rules."
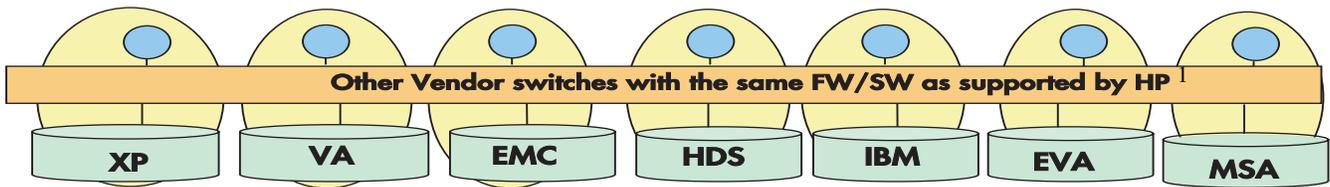
Figure 36: Heterogeneous storage support[1]

Secure Manager Support

Definition:

■ HP SureStore E Secure Manager XP is an array based, LUN security and configuration tool.

■ Provides the ability to limit access between hosts and array LUNs

■ Use host world-wide names to identify host access per LUN

Advantages:

■ Provides LUN security at the array level to secure data, irrespective of switch port or direct connect between host and the XP array

■ Provides consolidated and consistent data access management independent of switch vendor

■ Improves boot performance during ioscan by limiting the visibility between host and targets

Note: Product cost must be compared to cost of additional array ports and switch cost requirements
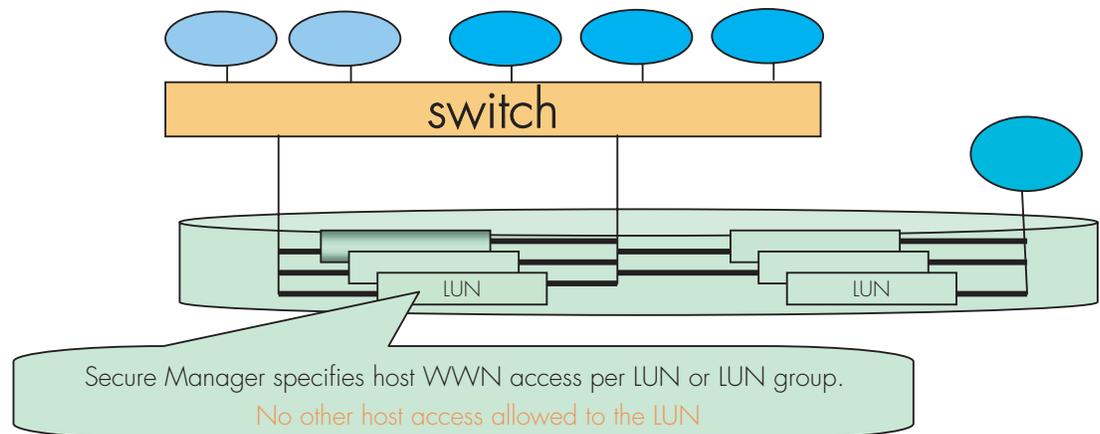

Figure 37: Secure Manager for XP support

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1. There is support for third party switches like the ED-5000 and the Inrange FC 9000 with some XP arrays, limited to a maximum two switch configuration. Refer to Streams for specific details.

Note: Since LUNs may be shared across array ports, limiting a host's visibility to a switch port does not limit it's access to LUNs. Array based configuration management, such as Secure Manager, is the only way to ensure data security.

Fabric Boot support for XP/VA

XP and VA LUNs can be booted from the SAN using both SAN B-Series Product Line switches and SAN M-Series Product Line switches (refer to SPOCK Streams for exceptions.)

Booting from the SAN has dependencies that include PDC code, firmware, HBA, OS version/type, platform speed, and Fibre Channel port speed.

For more information, refer to the individual array Streams connectivity documents available externally through HP field representatives or partners. The information is available internally on the HP SPOCK website.

The following table describes boot support at a high level. Refer to Streams documents for more detailed information. This table does not cover different versions and flavors within each OS type and switch type. "Yes" indicates at least one combination of array, HBA, OS type, and switch is supported as a bootable configuration.

Table 18: XP/VA OS Boot Support

OS/ Array	HP-UX	Linux	Windows	Tru64 UNIX	Open- VMS	Sun Solaris	AIX	Net- Ware	SGI- IRIX	B-Series Switches	M-Series Switches
XP-1024/128	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
XP-512/48	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
VA-7410	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes
VA-7400	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes
VA-7110	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes
VA-7100	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes

Specific Platform/Operating System Rules – Enterprise Virtual Array (VCS v3, VCS v2), EMA/ESA12000, EMA16000, MA/RA8000, MA6000 (ACS 8.7 or ACS 8.6) Storage Systems, B-Series and M-Series Switches

This section defines the rules and guidelines related to specific platforms/operating systems for EVA and EMA/ESA/MA/RA8000 storage systems, when used with B-Series and M-Series switches. For operating system storage attachment, HBA attachment, current HBA/driver/FW revision support, multi-pathing software versions, and specific VCS and ACS version patch level support, refer to the individual array Streams connectivity documents available externally through HP field representatives or partners. The information is available internally on the HP SPOCK website.

HP-UX 11.0, 11.11

- Zoning is required when HP-UX 11.0 or 11.11 is used in a Heterogeneous SAN with other operating systems.
- Supports MC/ServiceGuard. A.11.13 or later

VCS v3, v2

Enterprise Virtual Array:

- Supports Multiple-Bus Failover mode. Secure Path multi-path driver is required for Multiple-Bus failover if configured with two or more paths.
- Supports connection of single HBA servers, refer to the whitepaper "Connecting Single HBA Servers to the Enterprise Virtual Array without Multipathing Software at:

  ftp://ftp.compaq.com/pub/products/storageworks/whitepapers

- Supports connection to a common server with EVA and XP/VA storage systems. Refer to "Enterprise Virtual Array Configuration Rules."
- Does not support L-Port attachment.
- The initial release of Continuous Access on EVA5000 with VCS v3 requires that all servers and storage systems configured for Continuous Access EVA must be in a SAN of 2 fabrics, and contain only Continuous Access EVA supported operating systems. There can be up to 30 servers, and up to 8 EVA5000 arrays in the dedicated SAN. In addition, that SAN is limited to 10 switches per fabric, and no more than 60 HBA/FCA ports per fabric. Multiple zones may be required, due to multiple operating systems as defined in Table 19. See the Continuous Access EVA Design Reference Guide for additional details.

ACS 8.7, 8.6

EMA/ESA12000, EMA16000, MA/RA8000, and MA6000 Storage Systems:

- Supports Transparent failover mode and Multiple-Bus failover mode. Multiple-Bus failover mode is supported for HP-UX version 11.0 and 11.11 using the Secure Path multi-path driver. Supports multi-path high availability configuration implemented in separate fabrics or in a single fabric with zoned paths.
- Supports L-Port attachment with Table 9 Fibre Channel SAN switches that support the QuickLoop feature

■ Requires that all servers and storage systems configured for DRM must be in a zone or group of zones that excludes all non DRM supported operating systems. Multiple DRM zones are supported to reduce the size and/or complexity of a particular DRM solution instance. Multiple zones may be required due to multiple operating systems as defined in Table 20.

OpenVMS 7.2-2, 7.3, 7.3-1

■ Supports OpenVMS Clusters

■ Supports Multiple-Bus failover mode. Multi-path driver is embedded in the operating system

■ Supports multi-path high availability configuration implemented in separate fabrics or a single fabric

■ Zoning required when used in a Heterogeneous SAN with HP-UX, IBM AIX or Linux

■ Supports booting over the SAN Fabric. Refer to the section "Booting from the SAN."

VCS v3, v2

■ Enterprise Virtual Array storage is supported.

■ Supports connection of single HBA servers, refer to the whitepaper "Connecting Single HBA Servers to the Enterprise Virtual Array without Multipathing Software" (SingleHBAforEVA_F.pdf) at:

ftp://ftp.compaq.com/pub/products/storageworks/whitepapers

■ The initial release of Continuous Access on EVA5000 with VCS v3 requires that all servers and storage systems configured for Continuous Access EVA must be in a SAN of 2 fabrics, and contain only Continuous Access EVA supported operating systems. There can be up to 30 servers and up to 8 EVA5000 arrays in the dedicated SAN. In addition, that SAN is limited to 10 switches per fabric, and no more than 60 HBA/FCA ports per fabric. Multiple zones may be required due to multiple operating systems as defined in Table 19. See the Continuous Access EVA Design Reference Guide for additional details.

ACS 8.7, 8.6

EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems:

■ All servers and storage systems configured for DRM must be in a zone or group of zones that excludes all non DRM supported operating systems. Multiple DRM zones are supported to reduce the size and/or complexity of a particular DRM solution instance. Multiple zones may be required due to multiple operating systems as defined in Table 20.

Tru64 UNIX

■ Tru64 UNIX version V5.1 supports TruCluster Server Version 5.1

■ Tru64 UNIX version V5.1A supports TruCluster Server Version 5.1A

■ Tru64 UNIX version V5.1B supports TruCluster Server Version 5.1B

■ Supports multi-path high availability configuration implemented in separate fabrics or a single fabric

■ Zoning is required when used in a Heterogeneous SAN with HP-UX, IBM AIX or Linux

■ Supports booting over the SAN Fabric. Refer to the section "Booting from the SAN."

5.1, 5.1A, 5.1B – VCS v3, v2.

Enterprise Virtual Array:

■ Supports Multiple-Bus Failover mode. Multi-path driver is embedded in the V5.1/V5.1A operating systems.

■ Supports connection of single HBA servers, refer to the whitepaper "Connecting Single HBA Servers to the Enterprise Virtual Array without Multipathing Software" at:

ftp://ftp.compaq.com/pub/products/storageworks/whitepapers

■ Requires Tru64 ERP (Early Release Patch)

■ The initial release of Continuous Access on EVA5000 with VCS v3 requires that all servers and storage systems configured for Continuous Access EVA must be in a SAN of 2 fabrics, and contain only Continuous Access EVA supported operating systems. There can be up to 30 servers, and up to 8 EVA5000 arrays in the dedicated SAN. In addition, that SAN is limited to 10 switches per fabric, and no more than 60 HBA/FCA ports per fabric. Multiple zones may be required, due to multiple operating systems as defined in Table 19. See the Continuous Access EVA Design Reference Guide for additional details.

4.0F, 4.0G, 5.1, 5.1A, 5.1B – ACS 8.7, 8.6

EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems:

■ Tru64 UNIX version 4.0F supports Transparent failover mode.

■ Tru64 UNIX version 5.1and 5.1A supports Transparent and Multiple-Bus failover mode. Multi-path driver is embedded in the V5.1/V5.1A operating systems.

■ Zoning is required when a SAN is configured for multiple TruCluster products with Tru64 UNIX 4.0F. Each TruCluster configured with Tru64 UNIX 4.0F must be in its own zone.

■ All servers and storage systems configured for DRM (supported on Tru64 versions 5.1, 5.1A, and 5.1B only), must be in a zone or group of zones that excludes all non DRM supported operating systems. Multiple DRM zones are supported to reduce the size and/or complexity of a particular DRM solution instance. Multiple zones may be required due to multiple operating systems as defined in Table 20.

IBM AIX 4.3.3, 5.1

■ Supports HACMP/ES Clusters 4.4.1 ES

■ Zoning is required when used in a Heterogeneous SAN with other operating systems.

■ Supports HACMP/ES Clusters 4.4.1 ES.

■ Supports Multiple-Bus Failover mode. Secure Path multi-path driver is required for Multiple-Bus failover. Supports multi-path high availability configuration implemented in separate fabrics or in a single fabric with zoned paths.

VCS v3, v2

Enterprise Virtual Array storage is supported.

■ The initial release of Continuous Access on EVA5000 with VCS v3 requires that all servers and storage systems configured for Continuous Access EVA must be in a SAN of 2 fabrics, and contain only Continuous Access EVA supported operating systems. There can be up to 30 servers, and up to 8 EVA5000 arrays in the dedicated SAN. In addition,

that SAN is limited to 10 switches per fabric, and no more than 60 HBA/FCA ports per fabric. Multiple zones may be required, due to multiple operating systems as defined in Table 19. See the Continuous Access EVA Design Reference Guide for additional details.

ACS 8.7, 8.6

For EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems:

■ All servers and storage systems configured for DRM must be in a zone or group of zones that excludes all non DRM supported operating systems. Multiple DRM zones are supported to reduce the size and/or complexity of a particular DRM solution instance. Multiple zones may be required due to multiple operating systems as defined in Table 20.

Secure Path for IBM AIX

■ When using Multiple-Bus Failover and Secure Path for IBM AIX, zoning is required to limit each IBM server HBA access to one controller port per controller since typical installations in a heterogeneous SAN utilize more then one controller port cable connection per controller. Refer to the *Secure Path for IBM AIX Installation and Reference Guide, AA-RLTOC-TE,* for more information. Zoning is required for the AIX servers for instances where the storage system is being shared with other heterogeneous servers that require cabled access to more than one controller port per controller.

Linux

VCS v3, v2 - Red Hat 7.2 (ProLiant x86), Advanced Server 2.1 (BL20P, BL40P, ProLiant x86), SuSE SLES 7 (ProLiant x86)

Enterprise Virtual Array:

■ The initial release of Continuous Access on EVA5000 with VCS v3 requires that all servers and storage systems configured for Continuous Access EVA must be in a SAN of 2 fabrics, and contain only Continuous Access EVA supported operating systems. There can be up to 30 servers, and up to 8 EVA5000 arrays in the dedicated SAN. In addition, that SAN is limited to 10 switches per fabric, and no more than 60 HBA/FCA ports per fabric. Multiple zones may be required, due to multiple operating systems as defined in Table 19. See the Continuous Access EVA Design Reference Guide for additional details.

■ Multi-pathing with Secure Path is supported on Red Hat Advanced Server 2.1 and SuSE SLES 7.

■ Supports Lifekeeper Clusters

■ Supports connection of single HBA servers, refer to the whitepaper "Connecting Single HBA Servers to the Enterprise Virtual Array without Multipathing Software" at: http://h18006.www1.hp.com/storage/arraywhitepapers.html

■ Zoning is required when used in a Heterogeneous SAN with other operating systems.

ACS 8.7 - Red Hat 7.2 (ProLiant x86), Advanced Server 2.1 (BL20P, BL40P, ProLiant x86), 7.1, 7.2 (Alpha), SuSE 7.2 (ProLiant x86), SuSE SLES 7 (ProLiant x86)

EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems:

■ Supports Lifekeeper Clusters

■ Supports Transparent failover mode

■ Zoning is required when used in a Heterogeneous SAN with other operating systems.

- Supports connection of single HBA servers, refer to the whitepaper "Connecting Single HBA Servers to the Enterprise Virtual Array without Multipathing Software" at:

  http://h18006.www1.hp.com/storage/arraywhitepapers.html

- Multi-pathing with Secure Path is supported on Red Hat Advanced Server 2.1 and SuSE SLES 7.

ACS 8.7 - Secure Path for Linux, Red Hat Advanced Server 2.1 (BL20P, BL40P, Proliant x86) SLES 7 (ProLiant x86)

- Supports Multiple-Bus failover mode

- Zoning is required when used in a Heterogeneous SAN with other operating systems.

Microsoft Windows 2000 Server, Advanced Server w/SP2, SP3, Windows NT 4.0 w/SP6a (BL20P, BL40P, Intel and Proliant x86)

- Supports MSCS

- Supports multi-path high availability configuration implemented in separate fabrics or in a single fabric with zoned paths.

- Zoning is required when used in a heterogeneous SAN with HP-UX, IBM AIX or Linux.

VCS v3, v2

Enterprise Virtual Array:

- Supports Multiple-Bus Failover mode. Secure Path multi-path driver is required for Multiple-Bus failover if configured with two or more paths.

- Supports connection of single HBA servers, refer to the whitepaper "Connecting Single HBA Servers to the Enterprise Virtual Array without Multipathing Software at:

  http://h18004.www1.hp.com/products/storageworks/enterprise/documentation.html

- The initial release of Continuous Access on EVA5000 with VCS v3 requires that all servers and storage systems configured for Continuous Access EVA must be in a SAN of 2 fabrics, and contain only Continuous Access EVA supported operating systems. There can be up to 30 servers, and up to 8 EVA5000 arrays in the dedicated SAN. In addition, that SAN is limited to 10 switches per fabric, and no more than 60 HBA/FCA ports per fabric. Multiple zones may be required, due to multiple operating systems as defined in Table 19. See the Continuous Access EVA Design Reference Guide for additional details.

ACS 8.7, 8.6

EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems:

- Supports Transparent failover mode and Multiple-Bus failover mode. Secure Path multi-path driver is required for Multiple-Bus failover.

- All servers and storage systems configured for DRM must be in a zone or group of zones that excludes all non DRM supported operating systems. Multiple DRM zones are supported to reduce the size and/or complexity of a particular DRM solution instance. Multiple zones may be required due to multiple operating systems as defined in Table 20.

- Supports booting over the SAN Fabric. Refer to the section "Booting from the SAN."

- Extended Configurations with Microsoft Windows NT 4.0

If you configure greater than 4 (up to 8) servers (assuming one Fibre Channel HBA per server) for access to a single controller host port on an MA6000, MA/RA8000, EMA/ESA12000, and EMA16000 storage system, and 1 or more of those servers is Windows based, select the "Extended Configuration" check box in the StorageWorks Windows NT/Windows 2000 Platform Kit Fibre Channel Software Setup utility custom installation setup for each Windows server. Select this option to adjust registry settings for your KGPSA host bus adapter to operate in an "Extended Configuration" environment.

Note: The default for this option is checked, so be sure to uncheck this option when you have 4 or fewer servers configured for access to a single controller host port.

Microsoft Windows 2000 Datacenter

- Supports MSCS
- Supports multi-path high availability configuration implemented in separate fabrics or in a single fabric with zoned paths.
- Zoning is required when used in a heterogeneous SAN with HP-UX, IBM AIX or Linux.

VCS v3, v2

Enterprise Virtual Array:

- Supports Multiple-Bus Failover mode. Secure Path multi-path driver is required for Multiple-Bus failover.
- The initial release of Continuous Access on EVA5000 with VCS v3 requires that all servers and storage systems configured for Continuous Access EVA must be in a SAN of 2 fabrics, and contain only Continuous Access EVA supported operating systems. There can be up to 30 servers, and up to 8 EVA5000 arrays in the dedicated SAN. In addition, that SAN is limited to 10 switches per fabric, and no more than 60 HBA/FCA ports per fabric. Multiple zones may be required, due to multiple operating systems as defined in Table 19. See the Continuous Access EVA Design Reference Guide for additional details.

ACS 8.7, 8.6

EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems:

- Supports Transparent failover mode and Multiple-Bus failover mode. Secure Path multi-path driver is required for Multiple-Bus failover.
- Supports heterogeneous operating system shared access to a single storage system when using ACS 8.7. Heterogeneous operating system shared access is not supported with ACS 8.6.

Secure Path for Windows

EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems:

- Supports using single host bus adapter with Secure Path and Multiple-Bus failover. Refer to the white paper, *Using Secure Path for Servers with Single Host Bus Adapter (HBA)*, 14JK-0301A-WWEN.
- One instance of the Secure Path Manager can support multiple managed entities called profiles. For 4.x versions of Secure Path, a single profile can consist of up to 128 servers total, standalone or clustered, connected to and sharing up to 128 storage systems. For 3.x versions of Secure Path, a single profile can consist of up to 8 standalone servers

connected to and sharing up to 8 storage systems, or up to 8 clustered servers connected to and sharing up to 8 storage systems. For 3.x versions, you cannot manage both standalone and clustered servers in the same profile.

■ Secure Path configurations utilizing 4 active controller ports connected to the same server or servers offer the flexibility to use the 4 active ports for either increased total LUN count, or increased PATH accessibility to a lesser number of LUNs. Refer to the section "High Availability Configuration Considerations" in this chapter for more information.

■ Provides for dynamic port I/O load distribution in non-clustered servers when configured for maximum paths.

■ Distribute units equally across both controllers for proper static load balancing using the Unit Preferred Path parameter to assign units to a specific controller at initial boot.

■ SSP/LUN level masking - Storagesets (LUNs) must be enabled for access from all server or clustered server paths using the storage LUN presentation or Unit Connection Name parameter feature.

■ For Windows NT or Windows 2000, when using Secure Path in single or dual fabric configurations with both Multiple-bus Failover and Transparent Failover storage systems, the Transparent Failover storage systems must be in a different fabric zone and not be accessed by servers running Secure Path multipath software.

Novell NetWare

■ Supports NetWare Clusters 1.06 (NetWare 6.0) and 1.01 (NetWare 5.1)

■ Zoning required when used in a Heterogeneous SAN with Sun, HP-UX, IBM AIX, or Linux

5.1, 6.0 – VCS v3, v2

Enterprise Virtual Array:

■ Supports Multiple-Bus Failover mode. Secure Path multi-path driver is required for Multiple-Bus failover if configured with two or more paths. Multiple-Bus Failover configurations currently support clusters with a maximum of two nodes.

■ Supports connection of single HBA servers, refer to the whitepaper "Connecting Single HBA Servers to the Enterprise Virtual Array without Multipathing Software" at:

http://h18006.www1.hp.com/storage/arraywhitepapers.html

■ The initial release of Continuous Access on EVA5000 with VCS v3 requires that all servers and storage systems configured for Continuous Access EVA must be in a SAN of 2 fabrics, and contain only Continuous Access EVA supported operating systems. There can be up to 30 servers, and up to 8 EVA5000 arrays in the dedicated SAN. In addition, that SAN is limited to 10 switches per fabric, and no more than 60 HBA/FCA ports per fabric. Multiple zones may be required, due to multiple operating systems as defined in Table 19. See the Continuous Access EVA Design Reference Guide for additional details.

4.2 – ACS 8.7, 8.6

EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems supported using Transparent failover mode only.

5.1, 6.0 – ACS 8.7, 8.6

EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems:

- Supports NetWare Clusters.

- Supports Transparent failover mode and Multiple-Bus failover mode. Secure Path multi-path driver is required for Multiple-Bus failover.

- Supports multi-path high availability configuration implemented in separate fabrics or in a single fabric with zoned paths.

- All servers and storage systems configured for DRM must be in a zone or group of zones that excludes all non DRM supported operating systems. Multiple DRM zones are supported to reduce the size and/or complexity of a particular DRM solution instance. Multiple zones may be required due to multiple operating systems as defined in Table 20.

Sun Solaris 2.6, 7, 8, 9

- Supports Sun Clusters v2.2 (Solaris 2.6, 7, 8) and Veritas Clusters 3.5. A cluster must be in its own zone.

- Zoning required when used in a Heterogeneous SAN with NetWare, HP-UX, IBM AIX, or Linux

- Supports multi-path high availability configuration implemented in separate fabrics or in a single fabric with zoned paths.

VCS v3, v2

Enterprise Virtual Array:

- Supports Multiple-Bus Failover mode. Secure Path multi-path driver is required for Multiple-Bus failover if configured with two or more paths.

- Supports connection of single HBA servers, refer to the whitepaper "Connecting Single HBA Servers to the Enterprise Virtual Array without Multipathing Software" at:

  ftp://ftp.compaq.com/pub/products/storageworks/whitepapers

- Supports Sun Clusters and Veritas Clusters. A cluster must be in its own zone.

- Supports 64-bit cPCI HBA on Solaris 8 and 9

- 32-bit Sbus HBA not supported

- The initial release of Continuous Access on EVA5000 with VCS v3 requires that all servers and storage systems configured for Continuous Access EVA must be in a SAN of 2 fabrics, and contain only Continuous Access EVA supported operating systems. There can be up to 30 servers, and up to 8 EVA5000 arrays in the dedicated SAN. In addition, that SAN is limited to 10 switches per fabric, and no more than 60 HBA/FCA ports per fabric. Multiple zones may be required, due to multiple operating systems as defined in Table 19. See the Continuous Access EVA Design Reference Guide for additional details.

ACS 8.7, 8.6

EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems:

- Supports Transparent failover mode and Multiple-Bus failover mode. Secure Path multi-path driver is required for Multiple-Bus failover.

- Supports Sun Clusters and Veritas Clusters. A cluster must be in its own zone.

- Supports 64-bit cPCI HBA on Solaris 8 and 9

- All servers and storage systems configured for DRM must be in a zone or group of zones that excludes all non DRM supported operating systems. Multiple DRM zones are supported to reduce the size and/or complexity of a particular DRM solution instance. Multiple zones may be required due to multiple operating systems as defined in Table 20.

Specific Platform/Operating System Rules – Enterprise Virtual Array (VCS v2), EMA/ESA12000, EMA16000, MA/RA8000, MA6000 (ACS 8.7) Storage Systems, C-Series Switches

This section defines the rules and guidelines related to specific platforms/operating systems for EVA and EMA/ESA/MA/RA8000 storage systems, when used with C-Series switches. For operating system storage attachment, HBA attachment, current HBA/driver/FW revision support, multi-pathing software versions, and specific VCS and ACS version patch level support, refer to the individual array Streams connectivity documents available externally through HP field representatives or partners. The information is available internally on the HP SPOCK website.

HP-UX 11.0, 11.11

- Zoning is required when HP-UX 11.0 or 11.11 is used in a Heterogeneous SAN with other operating systems.
- Clusters are not supported at this time.

VCS v2.002, v2.004

Enterprise Virtual Array:

- Supports Multiple-Bus Failover mode. Secure Path multi-path driver is required for Multiple-Bus failover.

Microsoft Windows 2000 Server, Advanced Server w/SP3 (Intel and Proliant x86)

- Zoning is required when used in a heterogeneous SAN with HP-UX.
- Clusters are not supported at this time.

VCS v2.002

Enterprise Virtual Array:

- Supports Multiple-Bus Failover mode. Secure Path multi-path driver is required for Multiple-Bus failover.

ACS 8.7-1

- Supports Transparent failover mode and Multiple-Bus failover mode. Secure Path multi-path driver is required for Multiple-Bus failover.

Heterogeneous SAN Platform Interoperability for Enterprise Virtual Array

For the Enterprise Virtual Array, heterogeneous SAN platform interoperability is defined in Table 19. A "*Yes*" in the table indicates that the listed platforms can be configured for shared access to the same Enterprise Virtual Array. "*Zoning Required*" indicates the platforms listed must be configured in different fabric zones in order to co-exist in the same physical SAN or share the same Enterprise Virtual Array.

Table 19: SAN/Platform Zoning Requirements for the Enterprise Virtual Array Storage Systems

Platform or Operating System	HP-UX	OpenVMS	Tru64 UNIX	IBM AIX	Linux	Microsoft Windows	Novell NetWare	Sun Solaris
HP-UX	Yes	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required
OpenVMS	Zoning Required	Yes	Yes	Zoning Required	Zoning Required	Yes	Yes	Yes
Tru64 UNIX	Zoning Required	Yes	Yes	Zoning Required	Zoning Required	Yes	Yes	Yes
IBM AIX	Zoning Required	Zoning Required	Zoning Required	Yes	Zoning Required	Zoning Required	Zoning Required	Zoning Required
Linux	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Yes	Zoning Required	Zoning Required	Zoning Required
Microsoft Windows	Zoning Required	Yes	Yes	Zoning Required	Zoning Required	Yes	Yes	Yes
Novell NetWare	Zoning Required	Yes	Yes	Zoning Required	Zoning Required	Yes	Yes	Zoning Required
Sun Solaris	Zoning Required	Yes	Yes	Zoning Required	Zoning Required	Yes	Zoning Required	Yes

Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
NetWare OpenVMS Tru64 UNIX Microsoft Windows	Sun OpenVMS Microsoft Windows Tru64 UNIX	Linux	HP-UX	IBM AIX

Note: The above zoning table is summarized as:

- NetWare and Sun platforms are incompatible in the same zone.
- HP-UX, IBM AIX, and Linux platforms are incompatible in zones with all other platforms.

Heterogeneous SAN Platform Interoperability for EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems

For EMA/ESA12000, EMA16000, MA/RA8000, MA6000 storage systems there are three levels of heterogeneous interoperability rules: platform zoning rules, controller SCSI-modes, and controller failover modes.

The platform zoning rules define which platforms or operating systems must be in different fabric zones in order to coexist in the same physical SAN. Refer to Table 20, "SAN/Platform Zoning Requirements for EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems."

The controller SCSI-mode and controller failover rules define which platforms or operating systems can be configured for shared access to a single shared storage system based on controller SCSI-mode and failover mode compatibility. Refer to step 21, "Compatible SCSI Modes for EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems Using ACS 8.7" and Table 22, "Compatible Failover Modes for EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems Using ACS 8.7."

An additional table, Table 23, combines (and to some extent repeats) the information from the other tables into a single table that can be quickly referenced to determine the settings and rules for mixing all possible combinations of any two platforms.

Platform Zoning Rules

This table summarizes the zone compatibility for different platforms in a SAN. Platforms in the same columns can coexist in the same zone.

Table 20: SAN/Platform Zoning Requirements for EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems

Platform or Operating System	HP-UX	OpenVMS	Tru64 UNIX	IBM AIX	Linux	Microsoft Windows	Novell NetWare	Sun Solaris
HP-UX	Yes	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Zoning Required
OpenVMS	Zoning Required	Yes	Yes	Zoning Required	Zoning Required	Yes	Yes	Yes
Tru64 UNIX	Zoning Required	Yes	Yes	Zoning Required	Zoning Required	Yes	Yes	Yes
IBM AIX	Zoning Required	Zoning Required	Zoning Required	Yes	Zoning Required	Zoning Required	Zoning Required	Zoning Required
Linux	Zoning Required	Zoning Required	Zoning Required	Zoning Required	Yes	Zoning Required	Zoning Required	Zoning Required
Microsoft Windows NT 4.0 Windows 2000 Server, Advanced Server	Zoning Required	Yes	Yes	Zoning Required	Zoning Required	Yes	Yes	Yes
Novell NetWare	Zoning Required	Yes	Yes	Zoning Required	Zoning Required	Yes	Yes	Zoning Required
Sun Solaris	Zoning Required	Yes	Yes	Zoning Required	Zoning Required	Yes	Zoning Required	Yes

Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
NetWare OpenVMS Tru64 UNIX Microsoft Windows	Sun OpenVMS Microsoft Windows	Linux	HP-UX	IBM AIX

Note: The above table is summarized as:

- NetWare and Sun platforms are incompatible in the same zone.
- HP-UX, IBM AIX, and Linux platforms are each incompatible in zones with all other platforms.

Compatible Controller SCSI-Modes and Controller Failover Modes

The following tables summarize information about supported controller SCSI modes and failover modes for all platforms. Table 21 summarizes information about compatible SCSI modes and Table 22 summarizes information about supported storage system failover modes for all platforms for EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems using ACS 8.7.

Table 21: Compatible SCSI Modes for EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems Using ACS 8.7

SCSI-2 CCL	SCSI-2 No CCL	SCSI-3
HP-UX	HP-UX	HP-UX
		OpenVMS
Tru64 UNIX 4.0F, 4.0G	Tru64 UNIX 4.0F, 4.0G	
Tru64 UNIX 5.1, 5.1A, 5.1B	Tru64 UNIX 5.1, 5.1A, 5.1B	Tru64 UNIX 5.1, 5.1A, 5.1B
IBM AIX	IBM AIX	IBM AIX
		Linux
	Microsoft Windows NT 4.0 Microsoft Windows 2000 Server, Advanced Server	Microsoft Windows NT 4.0 Microsoft Windows 2000 Server, Advanced Server
Novell NetWare	Novell NetWare	Novell NetWare
Sun Solaris	Sun Solaris	Sun Solaris

Table 22: Compatible Failover Modes for EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems Using ACS 8.7

Transparent	Multiple-Bus
HP-UX	HP-UX
	OpenVMS
Tru64 UNIX 4.0F, 4.0G, 5.1, 5.1A, 5.1B	Tru64 UNIX 5.1, 5.1A, 5.1B
IBM AIX	IBM AIX
Linux	

Table 22: Compatible Failover Modes for EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems Using ACS 8.7 (Continued)

Transparent	Multiple-Bus
SuSE SLES 7 (ProLiant x86)	
Microsoft Windows	Microsoft Windows
Novell NetWare 4.2, 5.1, 6.0	Novell NetWare 5.1, 6.0
Sun Solaris	Sun Solaris

Combined Shared Access Interoperability Table

Table 23 combines the information from the previous tables into a single table. The table can be used to determine controller settings for a single EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems using ACS 8.7, being shared between two or more platforms and operating systems.

Table 23: Platform Interoperability for Single Shared EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems – ACS 8.7

Platform or Operating System	HP-UX MC/ ServiceGuard Clusters	OpenVMS Clusters	Tru64 UNIX 4.0F, 4.0G Trucluster Software Products V1.6	Tru64 UNIX 5.1, 5.1A, 5.1B TruCluster Server Version 5.1, 5.1A, 5.1B	IBM AIX	Linux	Microsoft Windows MSCS	Novell NetWare 4.2, 5.1, 6.0 Clusters 1.01, 1.06	Sun Solaris Sun Clusters VERITAS Clusters
HP-UX MC/ Service-Guard Clusters	Fabric attachment Transparent or Multiple-Bus FABRIC SCSI-2 or SCSI-3 FC-AL attachment, Transparent or Multiple-Bus LOOP_HARD SCSI-2	Fabric attachment With Zoning Multiple-Bus FABRIC SCSI-3	Fabric attachment With Zoning Transparent FABRIC SCSI-2	Fabric attachment With Zoning Transparent or Multiple-Bus FABRIC SCSI-2 or SCSI-3	Fabric attachment With Zoning Transparent or Multiple-Bus FABRIC SCSI-2 or SCSI-3	Fabric attachment With Zoning Transparent FABRIC SCSI-3	Fabric attachment With Zoning Transparent or Multiple-Bus FABRIC SCSI-2 No CCL or SCSI-3	Fabric attachment With Zoning Transparent or Multiple-Bus (5.1, 6.0) FABRIC SCSI-2 or SCSI-3	Fabric attachment With Zoning Transparent or Multiple-Bus FABRIC SCSI-2 or SCSI-3
OpenVMS Clusters	Fabric attachment With Zoning Multiple-Bus FABRIC SCSI-3	Multiple-Bus FABRIC SCSI-3	Requires two storage systems	Multiple-Bus FABRIC SCSI-3	With Zoning Multiple-Bus FABRIC SCSI-3	Requires two storage systems	Multiple-Bus FABRIC SCSI-3	5.1, 6.0: Multiple-Bus FABRIC SCSI-3 4.2: Requires two storage systems	Multiple-Bus FABRIC SCSI-3
Tru64 UNIX 4.0F, 4.0G Trucluster Software Products V1.6	Fabric attachment With Zoning Transparent FABRIC SCSI-2	Requires two storage systems	Transparent FABRIC SCSI-2	Transparent FABRIC SCSI-2	With Zoning Transparent FABRIC SCSI-2	Requires two storage systems	Transparent FABRIC SCSI-2 No CCL	Transparent FABRIC SCSI-2	Transparent FABRIC SCSI-2
Tru64 UNIX 5.1, 5.1A, 5.1B TruCluster Server Version 5.1, 5.1A, 5.1B	Fabric attachment With Zoning Transparent or Multiple-Bus FABRIC SCSI-2 or SCSI-3	Multiple-Bus FABRIC SCSI-3	Transparent FABRIC SCSI-2	Transparent or Multiple-Bus FABRIC SCSI-2 or SCSI-3	With Zoning Transparent or Multiple-Bus FABRIC SCSI-2 or SCSI-3	With Zoning Transparent FABRIC SCSI-3	Transparent or Multiple-Bus FABRIC SCSI-2 No CCL or SCSI-3	Transparent or Multiple-Bus (5.1, 6.0) FABRIC SCSI-2 or SCSI-3	Transparent or Multiple-Bus FABRIC SCSI-2 or SCSI-3

Table 23: Platform Interoperability for Single Shared EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems – ACS 8.7

Platform or Operating System	HP-UX MC/ ServiceGuard Clusters	OpenVMS Clusters	Tru64 UNIX 4.0F, 4.0G Trucluster Software Products V1.6	Tru64 UNIX 5.1, 5.1A, 5.1B TruCluster Server Version 5.1, 5.1A, 5.1B	IBM AIX	Linux	Microsoft Windows MSCS	Novell NetWare 4.2, 5.1, 6.0 Clusters 1.01, 1.06	Sun Solaris Sun Clusters VERITAS Clusters
IBM AIX	Fabric attachment With Zoning Transparent or Multiple-Bus FABRIC SCSI-2 or SCSI-3	With Zoning Multiple-Bus FABRIC SCSI-3	With Zoning Transparent FABRIC SCSI-2	With Zoning Transparent or Multiple-Bus FABRIC SCSI-2 or SCSI-3	Transparent or Multiple-Bus FABRIC SCSI-2 or SCSI-3	With Zoning Transparent FABRIC SCSI-3	With Zoning Transparent or Multiple-Bus FABRIC SCSI-2 No CCL or SCSI-3	With Zoning Transparent or Multiple Bus (5.1, 6.0) FABRIC SCSI-2 or SCSI-3	With Zoning Transparent or Multiple-Bus FABRIC SCSI-2 or SCSI-3
Linux	Fabric attachment With Zoning Transparent FABRIC SCSI-3	Requires two storage systems	Requires two storage systems	With Zoning Transparent FABRIC SCSI-3	With Zoning Transparent FABRIC SCSI-3	Transparent FABRIC SCSI-3	With Zoning Transparent FABRIC SCSI-3	With Zoning Transparent FABRIC SCSI-3	With Zoning Transparent FABRIC SCSI-3
Microsoft Windows MSCS	Fabric attachment With Zoning Transparent or Multiple-Bus FABRIC SCSI-2 No CCL or SCSI-3	Multiple-Bus FABRIC SCSI-3	Transparent FABRIC SCSI-2 No CCL	Transparent or Multiple-Bus FABRIC SCSI-2 No CCL or SCSI-3	With Zoning Transparent or Multiple-Bus FABRIC SCSI-2 No CCL or SCSI-3	With Zoning Transparent FABRIC SCSI-3	Transparent or Multiple-Bus FABRIC SCSI-2 No CCL or SCSI-3	Transparent or Multiple-Bus (5.1, 6.0) FABRIC SCSI-2 No CCL or SCSI-3	Transparent or Multiple-Bus FABRIC SCSI-2 No CCL or SCSI-3
Novell NetWare 4.2, 5.1, 6.0 Clusters 1.01, 1.06	Fabric attachment With Zoning Transparent or Multiple-Bus (5.1, 6.0) FABRIC SCSI-2 or SCSI-3	5.1, 6.0: Multiple-Bus FABRIC SCSI-3 4.2: Requires two storage systems	Transparent FABRIC SCSI-2	Transparent or Multiple-Bus (5.1, 6.0) FABRIC SCSI-2 or SCSI-3	With Zoning Transparent or Multiple Bus (5.1, 6.0) FABRIC SCSI-2 or SCSI-3	With Zoning Transparent FABRIC SCSI-3	Transparent or Multiple-Bus (5.1, 6.0) FABRIC SCSI-2 No CCL or SCSI-3	Transparent or Multiple-Bus (5.1, 6.0) FABRIC SCSI-2 or SCSI-3	With Zoning Transparent or Multiple-Bus (5.1, 6.0) FABRIC SCSI-2 or SCSI-3
Sun Solaris Sun Clusters VERITAS Clusters	Fabric attachment With Zoning Transparent or Multiple-Bus FABRIC SCSI-2 or SCSI-3	Multiple-Bus FABRIC SCSI-3	Transparent FABRIC SCSI-2	Transparent or Multiple-Bus FABRIC SCSI-2 or SCSI-3	With Zoning Transparent or Multiple-Bus FABRIC SCSI-2 or SCSI-3	With Zoning Transparent FABRIC SCSI-3	Transparent or Multiple-Bus FABRIC SCSI-2 No CCL or SCSI-3	With Zoning Transparent or Multiple-Bus (5.1, 6.0) FABRIC SCSI-2 or SCSI-3	Transparent or Multiple-Bus FABRIC SCSI-2 or SCSI-3

Booting from the SAN

Table 24 indicates the platforms and operating systems that are currently able to boot from SAN storage.

Table 24: SAN Boot by OS

Platform/Operating System	Comments
Microsoft Windows 2000 Server, Advanced Server, Windows NT 4.0 MSCS	Enterprise Virtual Array: KGPSA-CB, FCA2101 **Note:** Requires Secure Path for Windows, boot not supported in a single-path configuration. EMA/ESA12000, EMA16000, MA/RA8000, MA6000: KGPSA-CB, FCA2101 Refer to *Booting Windows from a Storage Area Network* (AA-RS2UD-TE) for more information
OpenVMS Clusters Tru64 UNIX TruCluster Software Products	Enterprise Virtual Array: KGPSA-CA/DA EMA/ESA12000, EMA16000, MA/RA8000, MA6000: **KGPSA-CA** Requires use of *wwidmgr,* SRM console firmware v5.6 (minimum) **KGPSA-DA** Requires use of *wwidmgr* and SRM console firmware v6.1 (minimum)

Specific Storage System Rules

HP XP and VA Configuration Rules

These rules apply to SAN Fabrics consisting of a mix of HP XP or VA storage systems with Enterprise Virtual Array, EMA/ESA12000, EMA16000, MA/RA8000, MA6000, MSA1000, RA4100, or RA4000 storage systems.

The common HP StorageWorks SAN configurations are implemented by defining zones that isolate servers and storage, refer to Figure 26 and Figure 27.

1. Refer to Chapter 3, "SAN Fabric Rules – B-Series Product Line", Chapter 3, "SAN Fabric Rules – M-Series Fabric Product Line", and Chapter 3, "Supported Switch Models – C-Series Product Line" for specific SAN Fabric rules when mixing the storage systems listed above in the same SAN Fabric.

2. When using HP-UX, supports XP/VA connection to a common server with EVA storage systems. Requires separate Autopath and Secure Path HBAs and zones. Refer to the array Streams for the required minimum versions of Autopath and Secure Path. See Figure 28. This is supported with B-Series and M-Series switches only.

3. Servers accessing HP XP or VA storage systems must not have access to Enterprise Virtual Array, EMA/ESA12000, EMA16000, MA/RA8000, MA6000, MSA1000, RA4100, or RA4000 storage systems. Zoning is required when configuring these storage system types in the same physical SAN.

4. XP is supported in SAN fabrics consisting of B-Series switches listed in Table 9 or M-Series switches listed in Table 10 or C-Series switches listed in Table 12 (XP128/1024 only.) VA is supported in SAN fabrics consisting of B-Series switches listed in Table 9 or M-Series switches listed in Table 10.

5. For specific rules information related to the HP XP/VA fabric zone, refer to the appropriate sections of this document.

6. For specific rules information related to the Enterprise Virtual Array, EMA/ESA12000, EMA16000, MA/RA8000, MA6000, or MSA1000, RA4100, and RA4000 zones, refer to the appropriate sections in this document.

Enterprise Virtual Array Configuration Rules

1. The Enterprise Virtual Array Storage System is supported in all SAN Fabric topology configurations described in this guide. The Enterprise Virtual Array is compatible in SANs using the Fibre Channel switches listed in Table 9, Table 10, and Table 12.

2. For SANs with more than 1024 HBAs, use fabric zoning to limit the number of connections visible to each storage system to a maximum of 1024.

3. The supported platforms and operating systems are listed in this section on page 97.

4. Shared access and heterogeneous platform zoning requirements are listed in Table 23.

5. Supports Multiple-Bus Failover mode only. Generally, Multiple-Bus Failover requires a minimum of 2 Fibre Channel HBAs and native operating system or layered multi-path driver functionality. Refer to the whitepaper listed below for exceptions.

6. Supports connection of single HBA servers, refer to the whitepaper "Connecting Single HBA Servers to the Enterprise Virtual Array without Multipathing Software" at:

    ftp://ftp.compaq.com/pub/products/storageworks/whitepapers and also

    http://storage.inet.cpqcorp.net/Document_Storage/whitepapers/new_library/SingleHBA_for_EVA-HP3_121002.pdf

Note: Single HBA servers, and servers without multi-pathing software are NOT supported by Continuous Access EVA at this time.

7. When using HP-UX, supports EVA connection to a common server with XP/VA storage systems. Requires separate Autopath and Secure Path HBAs and zones. Refer to the array Streams for the required minimum versions of Autopath and Secure Path. See Figure 28. This is supported with B-Series and M-Series switches only.

8. Supports simultaneous access to Enterprise Virtual Array and EMA/ESA12000, EMA16000, MA/RA8000, MA6000 storage systems from the same Server/HBA when both storage system families use common HBA, driver, and multi-path software versions. Refer to the latest Streams documents for details.

9. All host table entries must have the proper operating system type parameter set based on the platform type accessing the assigned LUNs.

10. Servers accessing Enterprise Virtual Arrays must not have access to HP XP or VA storage systems, or MSA1000, RA4100 or RA4000 storage systems. Zoning is required when configuring these storage system types in the same physical SAN.

11. SSP/LUN level masking – Use storage system LUN presentation to enable/disable LUN access to specific hosts.

Note: Shared access between different servers to the same storage unit (LUN) requires specific application software (i.e., cluster software) to ensure proper data preservation.

Enterprise Virtual Array Maximums

Table 25 lists the maximum connections supported by EVA5000 and EVA3000 storage systems. In addition, Table 25 lists the maximum supported storage limits for each hardware platform or operating system. The maximums shown here are for access to a single Enterprise Virtual Array with dual redundant controllers. If the connection requirements for the number of servers in a particular SAN exceed the maximums, then deploy multiple storage systems within the SAN.

Note: This section specifies general EVA limits. Specific solution subset configurations such as high availability clusters or applications such as Continuous Access may impose lower level limits on connectivity for the solution. In these instances, the solution limits must be adhered to as specified by the solution configuration documentation.

- Maximum of 1024 Host Bus Adapters (HBA)
- Maximum of 512 LUNs
- Maximum of 256 Hosts: A Host is defined to contain one or more HBAs
- The total number of LUN Presentations for all LUNs must not exceed 8192
  A LUN Presentation is defined as the number of Hosts a LUN is presented to, irrespective of how many adapters might be in any given Host
  (e.g.If a LUN is presented to 8 Hosts then that LUN has 8 LUN Presentations
  If a LUN is presented to 2 Hosts then that LUN has 2 LUN Presentations).

Ex: LUNs #001 thru #032 are presented to a 8 Node Cluster   = 0256 LUN Presentations
LUNs #033 thru #064 are presented to a 8 Node Cluster   = 0256 LUN Presentations
LUNs #065 thru #096 are presented to a 8 Node Cluster   = 0256 LUN Presentations
LUNs #097 thru #128 are presented to a 8 Node Cluster   = 0256 LUN Presentations
LUNs #129 thru #160 are presented to a 8 Node Cluster   = 0256 LUN Presentations
LUNs #161 thru #192 are presented to a 4 Node Cluster   = 0128 LUN Presentations
LUNs #193 thru #200 are presented to a single host   = 0008 LUN Presentations
Total LUN Presentations   **=** 1416 LUN Presentations

■   When all LUNS are presented to all Hosts then the following simpler rule applies:
The # of LUNs times the # of Hosts must not exceed 8192

Table 25: SAN/Platform Storage Maximums - EVA5000

Platform or Operating System	Host Bus Adapters per Server	Active Controller Ports (Targets) per HBA	LUNs per HBA Target
See **Reference Notes**	1	2	3, 4
HP-UX	16	4	128
OpenVMS	26	128	511 (9999)
Tru64 UNIX	64	128	255
IBM AIX	16	4 (2 storage systems)	32
Linux	4	4 (2 storage systems)	32 (128)
Microsoft Windows	8	4 (2 storage systems)	8/64
Novell NetWare	4	16 (8 storage systems)	128
Sun Solaris	16	4 (2 storage systems)	128

Reference Notes

1. The maximum number of HBAs supported per server is dependent on the specific server model.

2. For Tru64 UNIX and OpenVMS this column typically represents the total number of active controller ports per HBA when accessing all ports of a storage system or ports on multiple storage systems. For all other platforms, this column typically represents 2 ports per storage system, or a total of 4 ports across 2 storage systems. Use of zoning may be required to limit the number of active targets presented to each HBA to the maximums stated for each platform in this column.

3. Microsoft Windows NT supports 8 LUNs per HBA target with Large LUN feature disabled and 64 LUNs per HBA target with Large LUN feature enabled. Windows 2000 supports Large LUN by default (LUNs 0 - 199), Secure Path for Windows supports usage of LUNs 0 - 63.

4. For Sun configurations configured with the same HBA accessing both an Enterprise Virtual Array and an EMA/ESA12000, EMA16000, MA/RA8000, or MA6000, the maximum number of LUNs per HBA target is 64 for the EMA/ESA12000, EMA16000, MA/RA8000, or MA6000 storage system.

EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Configuration Rules

These storage systems are supported in all SAN Fabric topology configurations described in this guide. These storage systems are supported in SANs using the Fibre Channel switches listed in Table 9 and Table 10.

1. Limit the number of connections visible to each storage system to a maximum of 96 by using fabric zoning. (This is the maximum supported limit for ACS 8.7).

2. See this section beginning on page 97 for supported platforms and operating systems

3. Shared access and heterogeneous platform zoning requirements are listed in Table 23. The heterogeneous platform and operating system mix in the SAN determines the appropriate controller topology attachment, SCSI mode, and Command Console LUN settings for shared storage systems.

4. Single or dual redundant controller configurations are supported. For dual redundant controllers, the available failover modes are Transparent and Multiple-Bus. Multiple-Bus failover requires native operating system or layered multi-path driver functionality.

5. All host connection table entries must have the proper operating system type parameter set based on the platform type accessing the assigned LUNs.

6. Supports simultaneous access to EMA/ESA12000, EMA16000, MA/RA8000, or MA6000 storage systems and the Enterprise Virtual Array from the same Server/HBA when both storage system families use common HBA, driver, and multi-path software versions. Refer to the latest Streams documents.

   Refer to Chapter 3 for information about configuring the Storage Management Appliance to manage Enterprise Virtual Arrays and EMA/ESA12000, EMA16000, MA/RA8000, MA6000 storage systems in the same SAN.

7. Servers accessing EMA/ESA12000, EMA16000, MA/RA8000, or MA6000 storage systems must not have access to HP XP or VA, storage systems, or MSA1000, RA4000, or RA4100 storage systems. Zoning is required when configuring these storage system types in the same physical SAN.

8. SSP/LUN level masking – Use storage system Selective Storage Presentation to enable/disable LUN access to specific connections. Use the unit offset feature to provide needed LUN numbering for host connections. The default LUN numbering for Transparent Failover mode is 0 to 99 for controller port 1 and 100 to 199 for controller port 2. For Multiple-bus Failover mode the default LUN numbering is 0 to 199 on all controller ports.

Note: Shared access between different servers to the same storage unit (LUN) requires specific application software (i.e., cluster software) to ensure proper data preservation.

9. F-Port fabric attachment to the SAN is available through all Fibre Channel switches listed in Table 9 and Table 10. Controller setting is FABRIC topology.

10. FL-Port fabric loop attachment to the SAN with QuickLoop is available through certain Fibre Channel SAN switch models. Refer to Table 9 and the specific Fibre Channel SAN switch model documentation for more information. Controller port topology set to "LOOP_HARD".

11. All controller ports must be set to the same topology type.

Maximum Paths or Maximum LUNs

For EMA/ESA12000, EMA16000, MA/RA8000, or MA6000 storage systems, use the HSG60/80 controller Unit Offset feature to maximize path accessibility or to maximize the number of LUNs.

■ **For Maximum Controller Path Accessibility to the same set of LUNs**

Use a common unit offset value for all 4 controller ports. Access to a common set of LUNs through all 4 controller host ports is provided by using the same unit offset value on all controller host port connections for each server. For example, set the unit offset value for connections on all 4 controller ports to zero (0) for a given server. The server will be capable of accessing one set of LUNs beginning with LUN 0 (LUN 0 is the Command Console LUN if set to SCSI-3 mode) from all 4 controller host ports. This method provides for the highest number of paths to a given set of LUNs.

■ **For Maximum LUN Count**

Use distinct controller port unit offsets for each port pair. Access one set of LUNs with controller port 1 of each controller and access a different set of LUNs with controller port 2 of each controller. For example, set the unit offset value for connections on controller port 1 of each controller to zero, and then set a unit offset value for connections on controller port 2 of each controller to 100 for a given server. The server will be capable of accessing one set of LUNs beginning with LUN 0 (LUN 0 is the Command Console LUN if set to SCSI-3 mode) through controller port 1 on each controller, and a second set of LUNs beginning with LUN 100 through controller port 2 of each controller. This method provides the highest number of LUNs accessed through a reduced number of paths. It also allows for the highest number of servers. Refer to Figure 38.

EMA/ESA12000, EMA16000, MA/RA8000, and MA6000 Maximums

Table 26 lists the maximum supported storage limits for each hardware platform or operating system. The maximums shown are for access to MA6000 storage systems with dual redundant HSG60 controllers, and EMA/ESA12000, EMA16000, or MA/RA8000 storage systems with dual redundant HSG80 controllers. If the maximums listed are below the requirements for the number for servers required, deploy multiple storage systems within the SAN.

Table 26: Platform Maximums - MA6000, MA/RA8000, EMA/ESA12000, EMA16000 Storage Systems Using ACS 8.7

Platform or Operating System	Host Bus Adapters per Server	Active Controller Ports (Targets) per HBA	LUNs per HBA Target	Port Maximums HBAs per Active Controller Port		Storage System Maximums HBAs per Storage System	
Controller Failover Mode				TF	MB	TF	MB
HP-UX 11.0, 11.11	16	2/4	8/128	8	8	16	32
OpenVMS 7.2-2, 7.3, 7.3-1	26	128	128 (10000)	N/A	24	N/A	48
Tru64 UNIX 4.0F, 4.0G	32	4	8	4	N/A	8	N/A
Tru64 UNIX 5.1, 5.1A, 5.1B	64	128	128 (255)	48	24	96	48
IBM AIX 4.3.3, 5.1	8	4/8	32	12	12	24	24
Red Hat Linux 7.2, (Proliant x86) Red Hat Linux 7.1, 7.2 (Alpha)	2	2/4	64	4	N/A	8	N/A

**Table 26: Platform Maximums - MA6000, MA/RA8000, EMA/ESA12000, EMA16000
Storage Systems Using ACS 8.7 (Continued)**

Platform or Operating System	Host Bus Adapters per Server	Active Controller Ports (Targets) per HBA	LUNs per HBA Target	Port Maximums HBAs per Active Controller Port		Storage System Maximums HBAs per Storage System	
Advanced Server 2.1 (BL20P, BL40P, Proliant x86)	2	2/4	64	4	4	8	16
SuSE Linux 7.2 (ProLiant x86)	2	2/4	64	4	N/A	8	N/A
SuSE SLES 7(ProLiant x86)	2	2/4	64	4	4	8	16
Microsoft Windows 2000 Server, Advanced Server SP2, SP3 Windows 2000 Datacenter	8	2/4	8/64	8	16 (See Figure 40)	16	32 (See Figure 40)
Microsoft Windows NT 4.0 SP6a	8	2/4	8/64	8	8 (See Figure 38)	16	32 (See Figure 38)
Novell NetWare 4.2, 5.0, 6.1	4	2/4	32	8	8	16	32
SUN Solaris 2.6, 7 & 8 (32/64 bit)	16	2/4	64	8	8	16	32
Reference Notes	1	2	3, 4, 5, 6	7, 8, 9, 10		7, 9, 10	

Reference Notes

1. The maximum number of HBAs supported per server depends on the specific server model.

2. For Tru64 UNIX and OpenVMS this column typically represents the total number of active controller ports per HBA when accessing all ports of a storage system or ports on multiple storage systems. For all other platforms this column typically represents 2 ports per storage system, or a total of 4 ports across 2 storage systems. Use of zoning may be required to limit the number of active targets (controller ports) presented to each HBA to the maximums stated for each platform in this column. A minimum of OpenVMS 7.2-2 is required for the indicated maximum.

3. Numbers in this column are reduced by one if the command console LUN is enabled.

4. Microsoft Windows NT supports 8 LUNs per HBA target with Large LUN feature disabled and 64 LUNs per HBA target with Large LUN feature enabled. Windows 2000 supports Large LUN by default (LUNs 0 - 199), Secure Path for Windows supports usage of LUNs 0 - 63.

5. For Tru64 5.1, 5.1A, 5.1B, the operating system maximum is 255 LUNs per target. For OpenVMS, the operating system maximum is 10000 LUNs. The single storage system maximum is 128 LUNs.

6. For HP-UX, 128 LUNs per HBA target when the connection operating system type is set to HP_VSA.

7. Use of a Storage Management Appliance requires 2 connection table entries per fabric. However, these connection table entries do not affect the total number of servers or HBAs supported as long as there are available entries in the table. For example, under Windows, the maximum number of servers supported is 16 whether using a Storage Management Appliance or not. Since the Storage Management Appliance executes management commands through its Fibre Channel connection, it is not counted when determining the total number of servers allowed on a single storage system from an I/O load perspective.

8. The maximum number of HBAs that can be configured for access to an active controller port. Assumes 1 HBA per server for single path using controller transparent failover or 2 HBAs per server for multi-path using controller multiple-bus failover. For transparent failover, the limit is specified by controller port pair–1 active and 1 standby controller port. For multiple-bus failover, the limit is specified per single active port.

9. The maximums specified for each platform are the result of one or more of following limiting conditions:

— A qualification limit

— Command flow queuing characteristics of specific HBA drivers

— Connection table size in the array controller software in conjunction with the number of HBA to controller port paths.

For maximum server or HBA connectivity using controller transparent failover, limit the number of active HBA to controller port paths to one per server (Figure 38.) The use of zoning is required to limit the number HBAs visible to each active controller port.
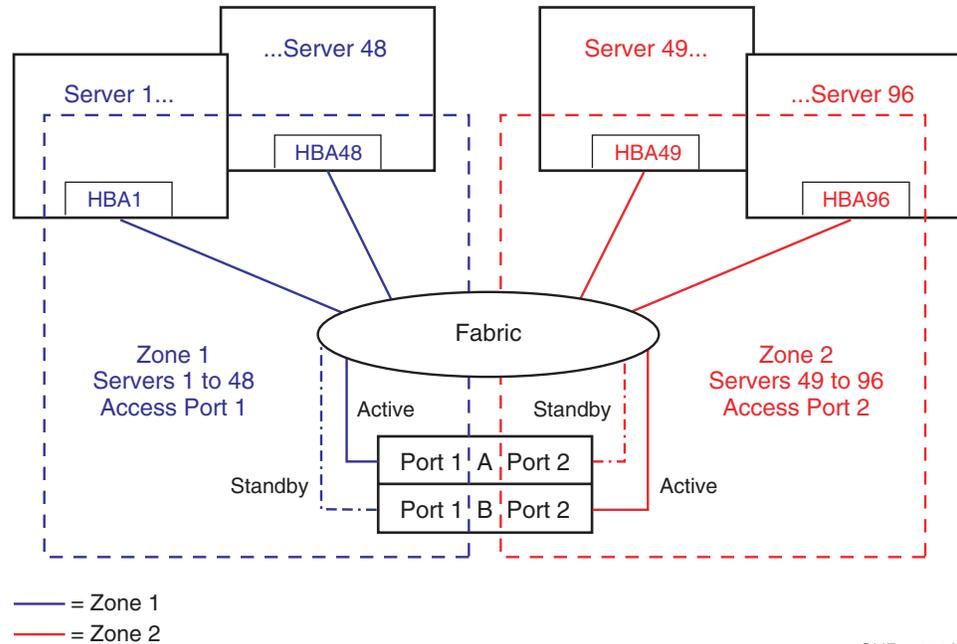
Figure 38: Maximum server example for Tru64 UNIX 5.x with transparent failover using 96 connections and one path per server
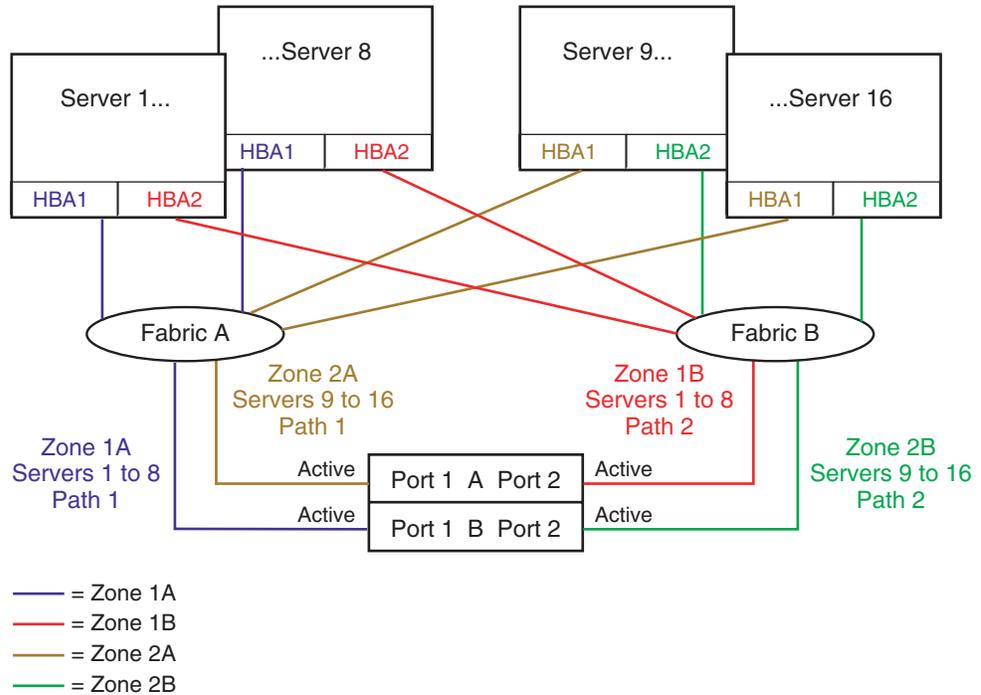
Figure 39: Maximum server example for Windows NT using 16 servers with multiple-bus failover and two paths per server

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Note: Zones for the figure above are visible on-screen or on a color printout.

For maximum server or HBA connectivity on most operating systems, when using controller multiple-bus failover, limit the number of active HBA to controller port paths to two per server (Figure 39) The use of zoning is required to limit the number of HBAs visible to each active controller port.

For OpenVMS, Tru64 UNIX, and Windows 2000, the maximum server or HBA connectivity is available with up to four paths per server in multiple-bus failover mode. The maximum Windows 2000 configuration is shown in Figure 40.
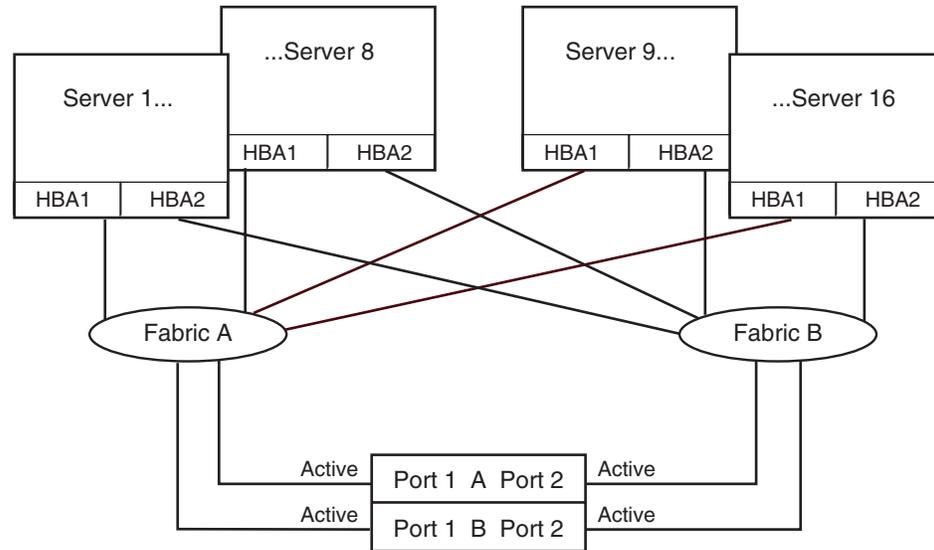
SHR-2555A

Figure 40: Maximum server example for Windows 2000 using 16 servers with multiple-bus failover and four paths per server

10. In a heterogeneous SAN environment where different platform or operating system types are sharing a single storage system, the maximum number of servers or HBAs supported is equal to the lowest maximum listed in these columns for the operating systems that are sharing the storage system. All platforms or operating systems listed are supported for shared access to the same storage system provided the rules listed in "Heterogeneous SAN Platform Interoperability for EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems" in this chapter are followed. Refer to Table 23 for specific information about sharing a single storage system across multiple platform or operating system types.

Note: Refer to SAN/DRM Integration in this chapter for the maximum number of servers supported for storage systems configured for DRM.

Note: Refer to the SAN/Continuous Access EVA Integration section in this chapter for the maximum number of servers supported for storage systems configured for Continuous Access EVA.

Specific Platform/Operating System Rules – MSA1000, RA4100, RA4000

This section defines the rules and guidelines related to specific platforms/operating systems for MSA1000, RA4100, and RA4000 storage systems. For operating system storage attachment, HBA attachment, current HBA/driver/FW revision support, and specific MSA and RA4x FW version support, refer to the individual array Streams connectivity documents available externally through HP field representatives or partners. The information is available internally on the HP SPOCK website

MSA1000 FW 3.2x

OpenVMS 7.3-1, 7.3, 7.2-2

- 7.3-1 requires DEC-AXPVMS-V731_FIBRE_SCSI-V0300-4
- 7.3 requires DEC-AXPVMS-V73_FIBRE_SCSI-V0500-4
- 7.2-2 requires DEC-AXPVMS-V22_FIBRE_SCSI-V0400-4

Tru64 UNIX 5.1A, 5.1B

- 5.1A requires Patch Kit 4
- 5.1B requires Patch Kit 1

MSA1000 FW 2.38

- Windows 2003 (32-bit) (requires dedicated MSA1000 storage system.)
- Windows 2000 SP3, Windows NT 4.0 SP6a
- Novell NetWare 5.1, 6.0
- Red Hat Linux 7.2, Advanced Server 2.1, SuSE SLES 7

Heterogeneous SAN Platform Interoperability for MSA1000 Storage

This section specifies the rules for shared access to a single MSA1000 storage system. MSA1000 storage systems are supported for shared access within two combinations of operating system groups. A single MSA1000 is supported for shared access for one combination mix only. Mixing of operating system types between the two combinations listed below is not supported.

Single MSA1000 shared access, operating system combination 1

Any mix of:

- Servers with Windows 2000 SP3
- Servers with Windows NT 4.0 SP6a
- Novell NetWare 5.1, 6.0
- Red Hat Linux 7.2, Advanced Server 2.1, SuSE SLES 7

Single MSA1000 shared access, operating system combination 2

Any mix of:

- Tru64 UNIX 5.1A, 5.1B
- OpenVMS 7.3-1, 7.3, 7.2-2

Additional rules:

- Multi-path servers cannot share dual controller MSA1000(s) with single path servers
- Servers can only support a single or redundant path (not both)

MSA1000 Configuration Rules

The MSA1000 storage systems can be configured in a SAN directly using the switch models shown in Table 9, Table 10, and Table 12, unless otherwise specified. The section Specific Platform/Operating System Rules – MSA1000, RA4100, RA4000 lists the platforms and operating systems that are supported using these storage systems.

■ MSA1000 storage systems with the MSA SAN Switch 2/8 are supported with B-Series Product Line switches only.

■ MSA1000 storage systems are supported with C-Series Product Line switches as shown in Figure 30 only.

■ Linux multi-path is supported with switch models listed in Table 8 only

■ Multi-pathing with Novell NetWare and Microsoft Windows is supported

■ The attachment of non-Secure Path (single HBA) servers to an MSA1000 with dual controllers having servers with Secure Path (dual HBA) attached is supported where the operating systems are Microsoft or Novell. Users must realize that in the event of a controller fail-over, (failure of active controller) the single path servers will lose access to their data on the MSA1000.

Note: If Secure Path for Linux is used on any node or cluster attached to an MSA1000, all nodes must also have Secure Path installed, regardless of operating systems. NOTE: refer to http://www.hp.com/go/securepath for the latest Secure Path parameters.

■ Supports single or redundant controllers with Active/Passive controllers

■ Use ACU to enable/disable LUN access to specific connections

■ Servers accessing MSA1000 storage systems must not have access to Enterprise Virtual Array, HP XP or VA, EMA/ESA12000, EMA16000, MA/RA8000, MA6000, RA4100 or RA4000 storage systems. Zoning is required to prevent access from servers to multiple storage system types when configuring these storage systems in the same physical SAN.

MSA1000 Maximums

The following table lists the maximum configurations for MSA1000 systems.

Table 27: MSA1000 Maximum Configurations

Platform or Operating System	Host Bus Adapters per Server	Active Controller Ports (Targets) per HBA	LUNs per HBA Target	Port Maximums HBAs per Active Controller Port
Microsoft Windows Server 2003 (32-bit), Windows 2000 Server, Advanced Server SP2 Windows NT 4.0 SP6a Red Hat Linux v7.2, Advanced Server 2.1, SuSE SLES 7 Novell NetWare 5.1, 6.0 Clusters 1.01, 1.06	2	8	32	32
Tru64 UNIX 5.1A, 5.1B OpenVMS 7.3-1, 7.3, 7.2-2	Server Dependent			

Heterogeneous SAN Platform Interoperability for RA4100/RA4000 Storage Systems

This section specifies the rules for shared access to a single RA4100 or RA4000 storage system. RA4100/4000 storage systems are supported for shared access with any combination of the following operating systems:

— Linux Red Hat 7.0, 7.1

— Linux SuSE 7.1

— Microsoft Windows 2000 Server, Advanced Server SP1

— Microsoft Windows NT 4.0, SP5, SP6a

— Novell NetWare 5.1

■ RA4100/RA4000 systems can not be shared by more than one cluster when using Microsoft Windows NT 4.0 or Microsoft Windows 2000

■ RA4100/RA4000 systems owned by a Microsoft Windows NT or Microsoft Windows 2000 cluster can not be shared with a standalone server or server

RA4100 and RA4000 Configuration Rules

These storage systems can be configured in a SAN directly using the switch models shown in Table 9, and through the Compaq FC-AL Switch 8 cascaded to the other switch models listed. The section Specific Platform/Operating System Rules – MSA1000, RA4100, RA4000 lists the platforms and operating systems that are supported using these storage systems.

■ Supports all fabric rules for SAN fabrics using the Fibre Channel switches listed in Table 9

■ The Compaq FC-AL Switch 8 is supported for cascaded attachment to the SAN through a single FL-Port.

■ Use single or redundant controllers with Active/Passive controllers.

■ Use ACU to enable/disable LUN access to specific connections.

■ For RA4100/RA4000 SAN configurations with *heavy I/O traffic*, it is necessary to increase the fabric switch buffer capacity from the default value of 16 to 27.

■ Servers accessing RA4100 or RA4000 storage systems must not have access to Enterprise Virtual Array, HP XP or VA, EMA/ESA12000, EMA16000, MA/RA8000, MA6000, or MSA1000 storage systems. Zoning is required to prevent access from servers to multiple storage system types when configuring these storage systems in the same physical SAN.

■ Zoning is required with multiple clusters. Each cluster must be in its own zone.

RA4100 and RA4000 Maximums

The following table lists the maximum configurations for RA4100/RA4000 storage systems.

Table 28: RA4100 and RA4000 Maximum Configurations

Platform or Operating System	Host Bus Adapters per Server	Active Controller Ports (Targets) per HBA	LUNs per HBA Target	Port Maximums HBAs per Active Controller Port
Red Hat Linux 7.0, 7.1 Suse Linux 7.1	1	1	32	32
Microsoft Windows 2000 Server, Advanced Server SP2 Windows NT 4.0 SP6a	2	1	32	32
Novell NetWare 5.1	2	1	32	32

SAN/Continuous Access EVA Integration

The HP Storageworks Continuous Access EVA solution is is approved for use within a larger Heterogeneous Open SAN provided the following additional rules are followed: All Continuous Access EVA implementations require Level 4 NSPOF SANs using two separate fabrics. Refer to Chapter 2, "Data Availability in a SAN." For additional information see the Continuous Access EVA Design Reference Guide which is available on the Web at:

http://h18006.www1.hp.com/products/storage/software/conaccesseva/index.html

The current DRM solution supports a sub-set of those operating systems listed in this guide which limits the type of servers that may reside within the Continuous Access EVA management zone.

1. Shared usage of Continuous Access EVA configured storage systems by non-Continuous Access EVA configured servers

   (e.g., single HBA or an OS without multi-path support) or non-Continuous Access EVA supported operating systems is not supported.

Table 29: Heterogeneous Continuous Access EVA Operating Systems

Operating System	Version
HP-UX	V11.0 and 11i ■ HP MC/Serviceguard Clusters VA.11.12 ■ Cluster Object Manager VA.01.01. ■ HP StorageWorks Secure Path for HP-UX V3.0A
HP OpenVMS	V7.2-2 and 7.3-1 ■ VMSClusters appropriate to OS version
HP Tru64 UNIX	V5.1, V5.1a, and V5.1b ■ TruClusters appropriate to OS version
IBM AIX	V4.3.3 and V5.1, HACMP appropriate to OS version
Microsoft Windows 2000/NT Server, Windows 2000/NT Advanced Server	V5.0 ■ Service Pack 3 ■ Microsoft Cluster Server (MSCS) ■ HP StorageWorks Secure Path for Windows V4.0 required
Microsoft Windows NT Server	V4.0 ■ Service Pack 6a ■ Microsoft Cluster Server (MSCS) ■ HP StorageWorks Secure Path for Windows V4.0 required
Novell NetWare	V5.1 and V6.0
Red Hat Linux	Advanced Server V2.1
Sun Solaris	V2.6, V7, V8, and V9 ■ HP StorageWorks Secure Path for Sun V3.0A SP1 or V3.0B required ■ VERITAS Clusters V1.3, 3.5, or Sun Clusters 2.2
SuSE Linux	SLES 7

2. Each DRM solution may contain up to 30 servers, and 8 EVAs, where each fabric is also limited to 10 switches and 60 HBAs. In some cases the actual limit will be smaller due to restrictions imposed by the intersite link. Continuous Access EVA supports the limit of up to 10 switches and 7 hops between devices from Table 9, or 10 switches and 3 hops between devices from Table 10, with the understanding that there are three links involved. There is the host to local storage link, the local storage to remote storage link, and the local host to remote storage link. Each of these links must not exceed 7 or 3 hops, depending on the device. All active/standby host-to-storage links as well as local-to-remote storage links must conform to the 7/3-hop limit

3. A single array may support up to 64 DR Groups, and up to 64 Copy Sets. A single DR Group supports at least one and not more than eight copy sets.

4. The Continuous Access EVA Link supports mixed heterogeneous SAN, DRM, Continuous Access EVA, and Host Based Shadowing traffic.

5. Two Storage Management Appliance (sma) Command View element mangers are required, one active and one in a stand-by mode. The active appliance and Command View EVA can be used for initial setup of Continuous Access EVA storage. Management of the operational Continuous Access EVA environment is done through the Continuous Access user interface, and separate product also installed on the storage management appliances. See the Continuous Access EVA Design Reference Guide and Continuous Access EVA Operations Guide for additional information.

6. Please see the Continuous Access EVA release notes for current information about the solution. The release notes are available at this URL:
http://h18006.www1.hp.com/products/storage/software/conaccesseva/index.html

SAN/DRM Integration

The HP Data Replication Manager for HSG80 (DRM) is approved for use within a larger Heterogeneous Open SAN provided the following additional rules are followed: All DRM implementations require Level 4 NSPOF SANs using two separate fabrics. Refer to Chapter 2, "Data Availability in a SAN". Several special purpose DRM configurations are also supported as defined in the DRM for HSG80 Design Guide which is available on the Web at:

DRM Technical Documentation
http://h18000.www1.hp.com/products/sanworks/drm/documentation.html

Each shared storage array must adhere to the DRM sharing rules as defined in the *DRM Design Guide*. These sharing rules may be more restrictive than those in this guide due to the requirements for DRM, for example, the operating system must support multiple-bus failover. In addition, the current DRM solution supports a sub-set of those operating systems listed in this guide.

1. Shared usage of the DRM configured storage systems by non-DRM configured servers (e.g., running in transparent failover) or non-DRM supported operating systems is not supported.

2. All servers sharing the same storage sub-system must share a compatible SCSI command mode as shown by a yes in the following table:

Table 30: Heterogeneous DRM Operating Systems

Operating System	Versions	SCSI-2	SCSI-3
HP OpenVMS	7.2-2, 7.3, 7.3-1	No	Yes
HP Tru64 UNIX	5.1, 5.1A, 5.1B	Yes	Yes
HP-UX	11.0, 11.11	Yes	Yes
IBM AIX	4.3.3, 5.1	Yes	Yes
Microsoft Windows NT	4.0	Yes	Yes
Microsoft Windows 2000 Server, Advanced Server	Server, Advanced Server, Datacenter	Yes	Yes
Novell NetWare	5.1, 6.0	Yes	Yes
Sun Solaris	2.6, 7, 8	Yes	Yes

3. Each DRM solution instance may contain up to 96 servers and 8 storage arrays. With large fabrics, multiple solution instances may exist, as long as each is in a separate zone. In other cases the actual limit will be smaller due to restrictions imposed by the intersite link. DRM supports the limit of up to 7 hops between devices from Table 9, or 3 hops between devices from Table 10, with the understanding that there are three links involved. There is the host to local storage link, the local storage to remote storage link, and the local host to remote storage link. Each of these links must not exceed 7 or 3 hops, depending on the device. All active/standby host-to-storage links as well as local-to-remote storage links must conform to the 7/3-hop limit

4. Each DRM solution instance may contain up to 12 servers per storage system per site provided both controllers of the storage system are using the "P" version of ACS configured in remote peer-to-peer replication mode. With 1 remote copy set per server, a maximum of 12 remote copy sets per pair of storage systems, and a maximum of 8 storage systems per site per instance, a single DRM instance can support up to 96 servers per site. If you increase the number of remote copy sets per server, you must reduce the total number of servers per storage system. For example, if you configure 2 remote copy sets per server, the maximum limit is 6 servers per storage system.

5. DRM over ATM configurations are supported for switches in Table 9 with switch FW 2.1.9m only, with a limit of two Fibre Channel switches per fabric, for a total of 4 switches, one at each end of each fabric (2 fabrics, times 2 switches per fabric equals 4 switches). Cascaded switches are not supported. This no-cascaded switch restriction also includes non-support for the SAN Switch Integrated/32 or SAN Switch Integrated/64 port switches due to the fact that these switch models are made up internally of 6, 16-port switches that are cascaded together.

6. The DRM Link supports mixed heterogeneous SAN, DRM, and Host Based Shadowing traffic.

7. StorageWorks Command Console (SWCC) and the Storage Management Appliance (SMA) element manger can be used for initial setup of Data Replication Manager (DRM) storage sub-systems. However, neither of these tools should be used for DRM failover and failback operations. Therefore to prevent any potential inference by MA polling of the HSG80 when running DRM scripts, it is recommended that the MA be removed from all DRM zones before running the scripts.

8. Please see the DRM release notes for current information on any hop count restrictions between devices.

SAN/DRM/OpenVMS Host Based Volume Shadowing Integration

OpenVMS servers implementing Host Based Volume Shadowing are supported integrated in a heterogeneous SAN with remote shadowset distances of up to 160 km over 1 Gbps direct fiber. The direct fiber long distance link supports mixed heterogeneous SAN, DRM, Continuous Access EVA, and OpenVMS Host Based Volume Shadowing traffic.

StorageWorks CSS 2105 Storage System Interoperability and Integration

HP provides support for heterogeneous multi-vendor online storage interoperability on a common SAN. This support includes both the StorageWorks Centralized Shared Storage 2105 (CSS 2105) and the StorageWorks Enterprise RAID Array.

The initial integration support represents the first phase or level of interoperability. This level of support provides for:

1. Coexistence of HP and IBM storage systems in a common heterogeneous Open SAN. The HP and IBM storage systems operate in separate fabric zones within the same physical SAN.

2. Data migration support between HP and IBM storage systems using a shared server running either Windows 2000/NT, IBM AIX, or Sun Solaris.

3. Multi-path failover capabilities using HP Secure Path for the HP storage and the IBM Subsystem Device Driver on a single shared server running Windows NT, IBM AIX, or Sun Solaris. Each storage system is connected to the server using independent HBA pairs.

4. Simultaneous enterprise backup support from both the HP storage and IBM storage utilizing a single shared server and the HP Enterprise Backup Solution with VERITAS NetBackup to a common tape library for Windows 2000/NT.

Refer to the Technical Note "Compaq StorageWorks Centralized Shared Storage 2105 Interoperability" for additional information. Future phases will provide additional levels of interoperability over time.

High Availability Configuration Considerations

Cabling Scheme Options

This section describes cabling scheme options for implementing high availability multi-path configurations for Enterprise Virtual Array, MA6000, MA/RA8000, EMA/ESA12000, and EMA16000 storage systems. Figure 41 and Figure 42 show cabling options when implementing a Level 4 high availability no single point of failure configuration. Figure 43 and Figure 44 show the cabling and associated zoning requirements when implementing a Level 3 high availability configuration. Refer to Chapter 2, "Levels of Availability" for a description of the availability levels.

> **Note:** DRM requires the high availability NSPOF configuration. DRM cabling is fully described in the DRM Design Guide, available at:
>
> http://h18000.www1.hp.com/products/sanworks/drm/documentation.html

Note: Continuous Access EVA cabling is supported as shown in Figure 41 and Figure 49. The cabling is also described in the Continuous Access EVA Design Reference Guide. See URL:
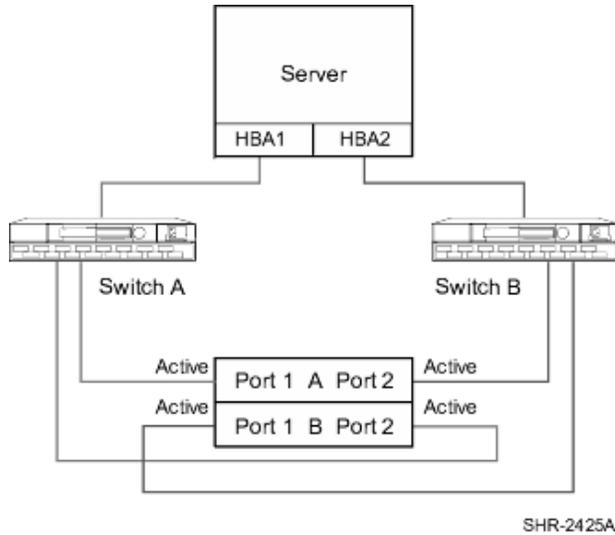
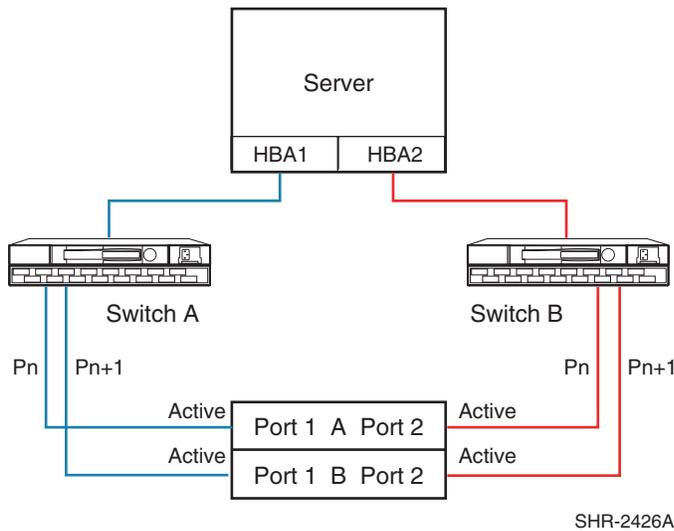http://h18006.www1.hp.com/products/storage/software/conaccesseva/index.html

SHR-2425A

Figure 41: Cross-Cable High Availability NSPOF Configuration

Figure 41 shows the physical connections for a cross cable, high availability, no single-point of failure configuration for storage systems using two separate fabrics.

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Figure 42: Straight-Cable High Availability NSPOF Configuration

Figure 42 shows the physical connections for a straight cable, high availability, no single point-of-failure configuration. The advantage of this cabling scheme is that it is the same cabling scheme used in Transparent failover mode for MA6000, MA/RA8000,

EMA/ESA12000, and EMA16000 storage systems. This allows you to migrate from Transparent failover mode to Multiple-Bus failover mode without the need to re-cable the controller connections.

Figure 43 and Figure 44 below specify the logical path zoning that may be required for cross cable and straight cable configurations when implementing a level 3 single fabric high availability configuration. The requirement to zone separate logical paths in single fabric high availability implementations is O/S and platform specific. The zoning specified enforces and effectively results in the same configuration as physically depicted in Figure 41 and Figure 42. Single fabric cross cable implementations require cross port zoning, straight cable implementations require straight port zoning. In order to provide high availability, ensure each HBA is cabled to a different switch and configured for access to specific controller ports.
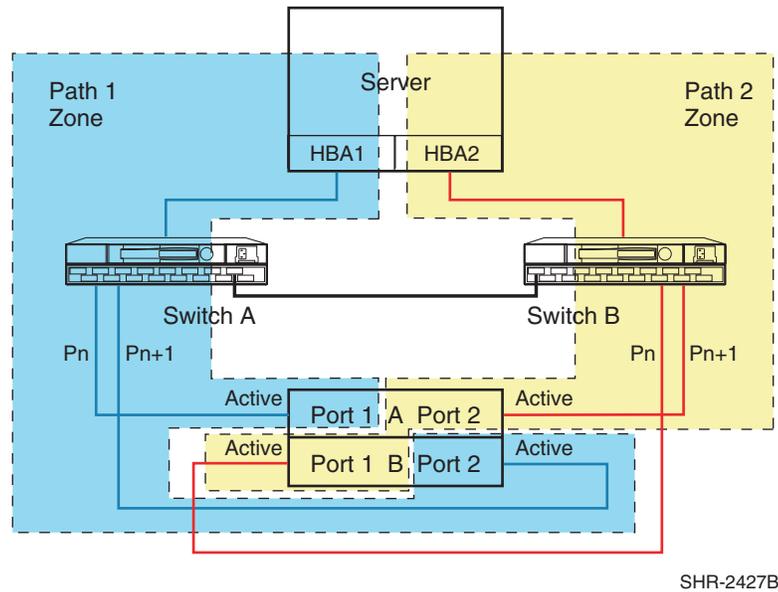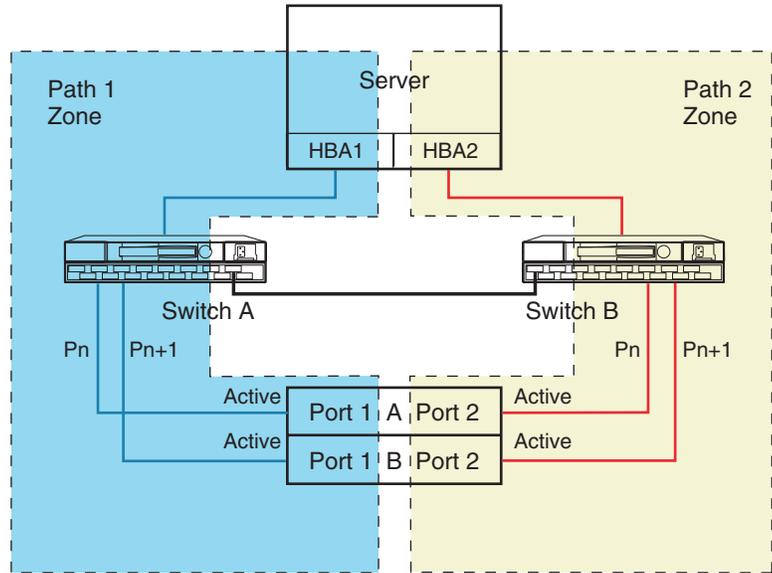

SHR-2427B

Figure 43: Cross-Cable High Availability Single Fabric Zoned Configuration

SHR-2428B

Figure 44: Straight-Cable High Availability Single Fabric Zoned Configuration

For two or more high availability server configurations, it is suggested that the first adapter in each server be connected to the first (same) Fibre Channel switch, the second two adapters to the second switch, etc. For example:

■ Server 1 Fibre Channel HBA 1 to Fibre Channel Switch 1 - Switch Port 1

■ Server 1 Fibre Channel HBA 2 to Fibre Channel Switch 2 - Switch Port 1

■ Server 2 Fibre Channel HBA 1 to Fibre Channel Switch 1 - Switch Port 2

■ Server 2 Fibre Channel HBA 2 to Fibre Channel Switch 2 - Switch Port 2

It is highly recommended that the cabling scheme shown in each Secure Path multiple-bus configuration be followed as depicted. This is not required; however, it does aid in understanding logical to physical LUN and path mapping for maintenance purposes.

Cabling Scheme Options for Dual Channel HBAs

Dual channel HBAs are typically utilized in situations where the number of server PCI slots is limited. As such, most installations are configured as shown in either Figure 42 or Figure 43. Both configurations are implemented using a single PCI slot to provide access to either the same Targets/LUNs or a different set of storage Targets/LUNs through separate ports on the HBA.

Note: Each dual channel HBA is theoretically capable of twice the performance of a single channel HBA for a given single PCI slot.

Note: Target ranges are shown for example purposes; the number of storage controller Targets and LUNs associated with each Target accessible is operating system dependent.
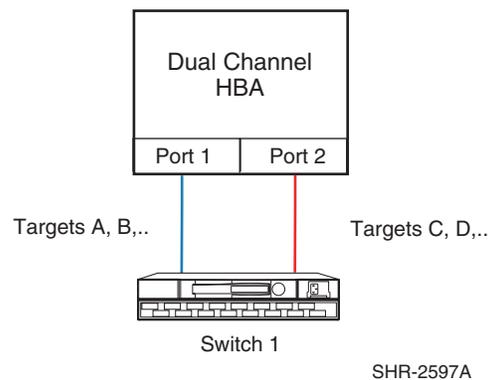

SHR-2597A

Figure 45: Single PCI Slot with Dual Channel HBA and One Switch

Figure 45 provides connectivity with both HBA paths connected to the same Fibre Channel switch.
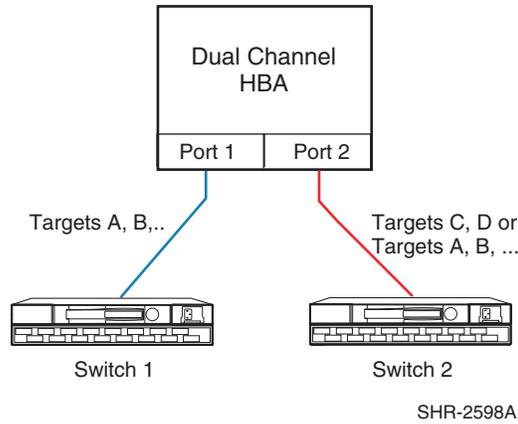
Figure 46: Single PCI Slot with Dual Channel HBA and Two Switches

Figure 46 provides increased availability over Figure 45 in the event of a single switch failure. Availability to a specific set of Targets/ LUNs can be further increased by configuring access to the Targets (A, B..) on both paths as shown.
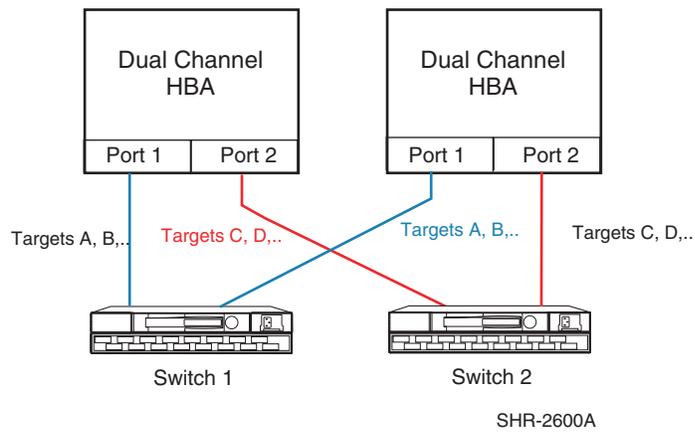

Figure 47: Two PCI Slots with Dual Channel HBAs - NSPOF

Figure 47 shows an example of how a no single point of failure solution can be implemented with two dual channel HBAs. From an availability standpoint, this equates to the use of two single channel HBAs. Refer to Chapter 2, "Levels of Availability" for further information.