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 25, Table 27, and Table 28 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 fabric rules, platform/operating system rules, storage system rules, and mixed storage common SAN rules.

   - Fabric Rules - Refer to Chapter 3

   - Platform/Operating System Rules - Based on the storage system type(s) and switch product line(s) utilized, refer to:

   — "Specific Platform/Operating System Rules – EVA5000/EVA3000 (VCS v3), EMA/ESA12000, EMA16000, MA/RA8000, MA6000 (ACS 8.7) Storage Systems, B-Series and M-Series Switches"

   — "Specific Platform/Operating System Rules – Enterprise Virtual Array (VCS v2), XP48/512, XP128/1024, EMA/ESA12000, EMA16000, MA/RA8000, MA6000 (ACS 8.7) Storage Systems, C-Series Switches"

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

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

   - Storage System Rules - Based on the storage system type(s) utilized, refer to:

   — HP XP and VA Configuration Rules

   — EVA5000/EVA3000 Configuration Rules

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

   — MSA1000 Configuration Rules

   — RA4100 and RA4000 Configuration Rules

   - Mixed Storage Type SAN Rules - B-Series, C-Series, M-Series Switches - For SAN fabrics containing a mix of different storage system types

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 and M-Series product line switches only. Refer to the *hp ProLiant BL p-Class system overview and planning white paper* at:

ftp://ftp.compaq.com/pub/supportinformation/papers/5981-6911en_rev1_us.pdf

Mixed Storage Type SAN Rules - B-Series, C-Series, M-Series Switches

HP supports SANs consisting of a mixture of storage system types. This section defines the rules for mixing different storage system types within a SAN using switch models exclusively from one product line of Fibre Channel switch products. For information about interoperability rules and support for SANs or SAN fabrics with mixed switch product line types, refer to Heterogeneous/Interoperable SAN Fabrics in Chapter 3.

Common SAN Access

In general, support in the same SAN for mixed storage system families is provided by implementing separate zones for servers and the storage system families being accessed as shown in Figure 23 for the B-Series product line of switches, Figure 24 for the M-Series, and Figure 25 for the C-Series.

Common Server Access

Common server access allows for simultaneous connectivity to different disk storage system families from the same server and, in some cases, the same HBA.

In addition, certain storage solutions utilizing multiple storage types, for example, disk and tape, may also specify support for common server access. In those cases, refer to the specific storage solution documentation for the supported common access configurations and rules.

Common Server, Separate HBAs

Common server access using separate HBAs is supported for XP, VA, and EVA storage systems for these specific configurations. Contact your HP storage representative for a configuration review prior to deployment.

- **XP and EVA on Sun Solaris** - Connection to a common server requires separate VxVM DMP for XP and Secure Path for EVA HBAs and zones. Specific minimum versions of VxVM DMP and Secure Path are required. This is supported with B-Series and M-Series switches only.

- **XP and EVA on IBM AIX** - Connection to a common server requires separate Autopath for XP and Secure Path for EVA HBAs and zones. Specific minimum versions of Auto Path and Secure Path are required. This is supported with B-Series and M-Series switches only.

- **XP/VA, MSA, EVA/EMA/ESA12000, EMA16000, MA/RA8000, MA6000 on Microsoft Windows** - Connection to a common server requires separate HBAs and zones for XP/VA, MSA, and EVA/EMA/ESA12000, EMA16000, MA/RA8000, and MA6000. All products are supported using a common version of Secure Path for Windows. This is supported with B-Series and M-Series switches only.

- **MSA on all supported operating systems** - Connection to a common server with other storage systems requires dedicated HBAs and zones for the MSA1000.

Common Server, Common HBAs

Simultaneous access to different storage system types from the same Server/HBA is supported when the storage system families listed use common HBA model numbers, drivers, and multi-path software versions. HP currently supports the following storage types and operating systems for common server, common HBA access.

XP/VA and EVA on HP-UX - Connection to a common server with a common HBA is supported. Specific minimum versions of Secure Path and AutoPath are required. Contact your HP storage representative for a configuration review prior to deployment.

EVA and EMA/ESA12000, EMA16000, MA/RA8000, MA6000 on Microsoft Windows and Linux - Connection to a common server with a common HBA is supported on the following operating systems:

■ **Microsoft Windows** - HP recommends use of the EVA V3.0B platform kit (minimum version). This ensures that Windows servers attached to storage types utilizing VCS V2.x or higher and ACS 8.7-x can be accessed simultaneously. The EVA platform kit can also be used for Windows servers that have only an EVA or only an EMA/ESA12000, EMA16000, MA/RA8000, or MA6000 storage system.

■ **Linux** - HP recommends use of the EVA V3.0B platform kit (minimum version). This ensures that Linux servers attached to storage types utilizing VCS V2.x or higher and ACS 8.7-x can be accessed simultaneously. The EVA platform kit can also be used for Linux servers that have only an EVA or only an EMA/ESA12000, EMA16000, MA/RA8000, or MA6000 storage system.

XP, EVA, and EMA/ESA12000, EMA16000, MA/RA8000, MA6000 on Alpha - Connection to a common server with a common HBA is supported on the following operating systems:

■ Tru64 UNIX

■ OpenVMS

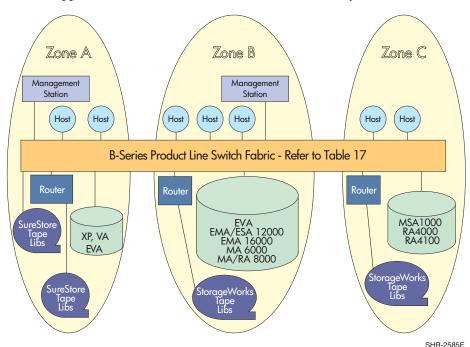This is supported with B-Series and M-Series switches only.
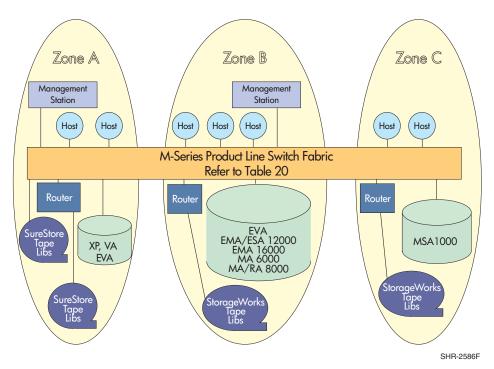

Figure 23: HP StorageWorks SAN using B-Series Switches

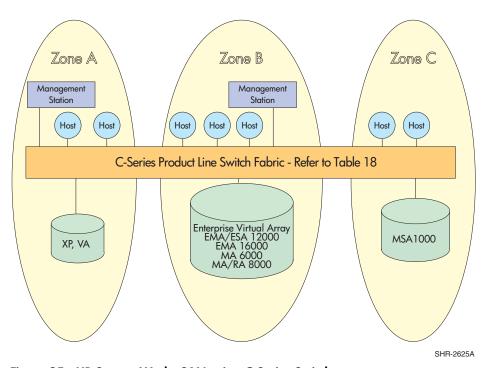**Figure 24: HP StorageWorks SAN using M-Series Switches**

Figure 25: HP StorageWorks SAN using C-Series Switches

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, contact your HP field representative.

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)
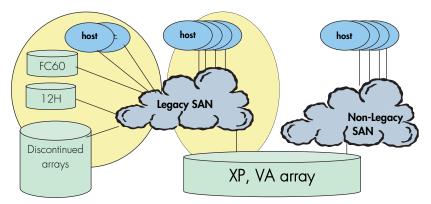- Storage devices like FC60, 12H etc.,

Figure 26: Legacy SAN Support

High Availability/Mission Critical SAN Support

High availability environments like HP Service Guard running on HP-UX servers require dual fabric 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.

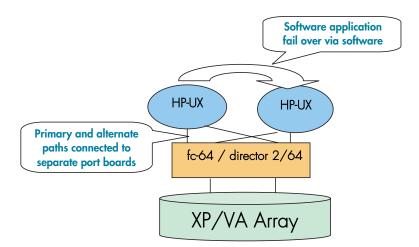**Figure 27: High Availability SAN with XP/VA**

Figure 28: Software application fail-over

XP and VA with multiple operating systems in a shared switch fabric

■ Multiple OS's and multiple clusters can be supported on the same switch/fabric with appropriate zoning

— host zones must contain homogeneous operating system types only

— overlapping storage port zones supported if more than one operating system needs to share an array port

- ■ Heterogeneous operating systems may share an XP array port with the appropriate host group/mode settings (see XP array documentation); All others must use a dedicated XP array port.
- ■ Secure Manager XP and Secure Manager VA required for LUN isolation with multiple hosts connected through a shared array port

Table 25: 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 across zones. Storage ports can be overlapped in multiple zones.
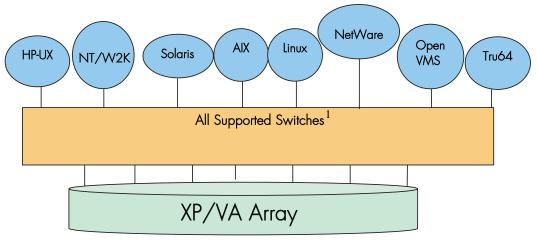

Figure 29: XP/VA with multiple OS's on a shared SAN fabric[1]

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.

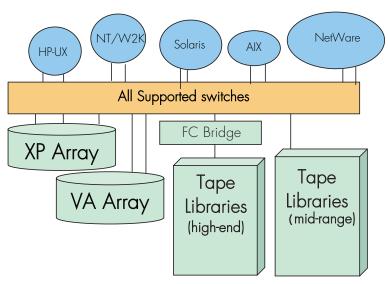■ Contact your HP representative for more information on tape support.

Figure 30: 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 the storage ports to isolate from all other storage vendor zones; no overlapping zones containing multiple storage ports

■ Storage ports may be accessed from heterogeneous operating system types and multiple clusters for HA and non-HA configurations; overlapping zones are supported

■ 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 "Common Server Access."

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1. Contact your HP representative 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.
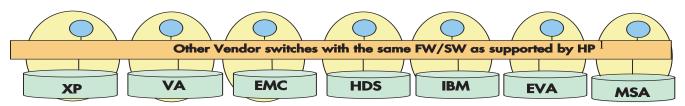
Figure 31: Heterogeneous storage support[1]

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

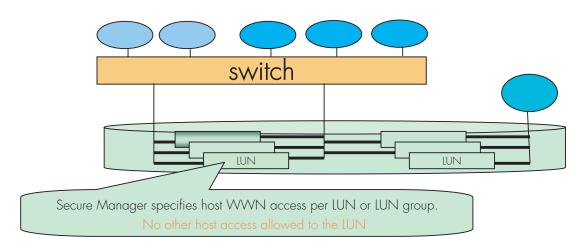**Note:** Product cost must be compared to cost of additional array ports and switch cost requirements

Figure 32: 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. Contact your HP representative 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 (contact your HP representative 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, contact your HP field representative.

The following table describes boot support at a high level. 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 26: XP/VA SAN Boot by Operating System

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 – EVA5000/EVA3000 (VCS v3), EMA/ESA12000, EMA16000, MA/RA8000, MA6000 (ACS 8.7) 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 minor release and ACS version patch level support, contact your HP field representative.

HP-UX 11.0, 11.11, 11.23

- Zoning is required when HP-UX is used in a Heterogeneous SAN with other operating systems.
- Supports MC/ServiceGuard. A.11.14/A.11.15 or later
- HP-UX 11.23 is supported on EVA3000/5000 v3.01 or later

VCS v3

EVA5000/EVA3000:

- 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 "EVA5000/EVA3000 Configuration Rules."
- Does not support L-Port attachment.
- When using Continuous Access on EVA5000 with VCS v3 or EVA 5000/3000 on V3.01, HP recommends that all servers and storage systems configured for Continuous Access EVA be in a High Availability SAN of two fabrics (Figure 43), and contain only Continuous Access EVA supported operating systems. If servers running non-supported operating systems exist within the SAN, they should be excluded from the Continuous Access management environment via zoning. In addition, that SAN (or management zone within a larger SAN) is limited to a maximum of 16 EVA, and 256 HBA per EVA. Additional operating system specific zones within the larger Continuous Access environment zone may be required as defined in Table 27. See the *Continuous Access EVA Design Reference Guide* for additional details and configuration limitations.

ACS 8.7

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 17 Fibre Channel SAN switches that support the QuickLoop feature
- Requires ACS 8.7P for DRM support

- 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 28.

- HP-UX 11.23 is not supported with HSG-based storage at this time.

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

- EVA5000/EVA3000 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

- When using Continuous Access on EVA5000 with VCS v3 or EVA 5000/3000 on V3.01, HP recommends that all servers and storage systems configured for Continuous Access EVA be in a High Availability SAN of two fabrics (Figure 43), and contain only Continuous Access EVA supported operating systems. If servers running non-supported operating systems exist within the SAN, they should be excluded from the Continuous Access management environment via zoning. In addition, that SAN (or management zone within a larger SAN) is limited to a maximum of 16 EVA, and 256 HBA per EVA. Additional operating system specific zones within the larger Continuous Access environment zone may be required as defined in Table 27. See the *Continuous Access EVA Design Reference Guide* for additional details and configuration limitations.

ACS 8.7

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 28.

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

EVA5000/EVA3000:

■ 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

■ When using Continuous Access on EVA5000 with VCS v3 or EVA 5000/3000 on V3.01, HP recommends that all servers and storage systems configured for Continuous Access EVA be in a High Availability SAN of two fabrics (Figure 43), and contain only Continuous Access EVA supported operating systems. If servers running non-supported operating systems exist within the SAN, they should be excluded from the Continuous Access management environment via zoning. In addition, that SAN (or management zone within a larger SAN) is limited to a maximum of 16 EVA, and 256 HBA per EVA. Additional operating system specific zones within the larger Continuous Access environment zone may be required as defined in Table 27. See the *Continuous Access EVA Design Reference Guide* for additional details and configuration limitations.

4.0F, 4.0G, 5.1, 5.1A, 5.1B – ACS 8.7

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

■ Tru64 UNIX version 4.0F/4.0G supports Transparent failover mode only.

■ 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/V5.1B operating systems.

■ Zoning is required when a SAN is configured for multiple TruCluster products with Tru64 UNIX 4.0F/4.0G. Each TruCluster configured with Tru64 UNIX 4.0F/4.0G 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 28.

IBM AIX 4.3.3, 5.1, 5.2

■ Supports HACMP/ES Clusters 4.4.1 ES, 4.5

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

■ 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

EVA5000/EVA3000 storage is supported.

- When using Continuous Access on EVA5000 with VCS v3 or EVA 5000/3000 on V3.01, HP recommends that all servers and storage systems configured for Continuous Access EVA be in a High Availability SAN of two fabrics (Figure 43), and contain only Continuous Access EVA supported operating systems. If servers running non-supported operating systems exist within the SAN, they should be excluded from the Continuous Access management environment via zoning. In addition, that SAN (or management zone within a larger SAN) is limited to a maximum of 16 EVA, and 256 HBA per EVA. Additional operating system specific zones within the larger Continuous Access environment zone may be required as defined in Table 27. See the *Continuous Access EVA Design Reference Guide* for additional details and configuration limitations.

ACS 8.7

For EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems (AIX 5.2 not supported):

- 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 28.

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 - Red Hat 7.2 (ProLiant x86), Advanced Server 2.1 (BL20P, BL40P, ProLiant x86), SuSE SLES 7 (ProLiant x86), SLES 8 (United Linux 1.0)

EVA5000/EVA3000:

- When using Continuous Access on EVA5000 with VCS v3 or EVA 5000/3000 on V3.01, HP recommends that all servers and storage systems configured for Continuous Access EVA be in a High Availability SAN of two fabrics (Figure 43), and contain only Continuous Access EVA supported operating systems. If servers running non-supported operating systems exist within the SAN, they should be excluded from the Continuous Access management environment via zoning. In addition, that SAN (or management zone within a larger SAN) is limited to a maximum of 16 EVA, and 256 HBA per EVA. Additional operating system specific zones within the larger Continuous Access environment zone may be required as defined in Table 27. See the *Continuous Access EVA Design Reference Guide* for additional details and configuration limitations.

- Supports Lifekeeper Clusters 4.2/4.3 plus Service Guard 11.14.02/11.15.01 (version is HBA dependant)

- 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 4.2

- 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 only.

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, SP4 for VCS3.x only, Windows NT 4.0 w/SP6a (BL20P, BL40P, Intel and Proliant x86), Windows 2003 Server

- Supports MSCS for EMA/ESA12000, EMA16000, and MA/RA8000 system in a 2-node configuration only

- 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

- BL20P and BL40P are only supported with Windows 2000 and Windows 2003

VCS v3

EVA5000/EVA3000:

- Supports MS Windows 2003 Enterprise edition (32 bit)

- 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

- When using Continuous Access on EVA5000 with VCS v3 or EVA 5000/3000 on V3.01, HP recommends that all servers and storage systems configured for Continuous Access EVA be in a High Availability SAN of two fabrics (Figure 43), and contain only

Continuous Access EVA supported operating systems. If servers running non-supported operating systems exist within the SAN, they should be excluded from the Continuous Access management environment via zoning. In addition, that SAN (or management zone within a larger SAN) is limited to a maximum of 16 EVA, and 256 HBA per EVA. Additional operating system specific zones within the larger Continuous Access environment zone may be required as defined in Table 27. See the *Continuous Access EVA Design Reference Guide* for additional details and configuration limitations.

ACS 8.7

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

■   Supports MS Windows 2003 Enterprise edition (32 bit) and Standard edition (32 bit)

■   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 28.

■   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

EVA5000/EVA3000:

■   VCS v3 is supported on WS2003 32/64 bit

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

■   When using Continuous Access on EVA5000 with VCS v3 or EVA 5000/3000 on V3.01, HP recommends that all servers and storage systems configured for Continuous Access EVA be in a High Availability SAN of two fabrics (Figure 43), and contain only Continuous Access EVA supported operating systems. If servers running non-supported

operating systems exist within the SAN, they should be excluded from the Continuous Access management environment via zoning. In addition, that SAN (or management zone within a larger SAN) is limited to a maximum of 16 EVA, and 256 HBA per EVA. Additional operating system specific zones within the larger Continuous Access environment zone may be required as defined in Table 27. See the *Continuous Access EVA Design Reference Guide* for additional details and configuration limitations.

ACS 8.7

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 1.7 (NetWare 6.5) for EVA5000/EVA3000 only, 1.06 (NetWare 6) 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, 6.5 – VCS v3

EVA5000/EVA3000:

- NetWare 6.5 is supported with VCS v3 only.

- 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

- When using Continuous Access on EVA5000 with VCS v3 or EVA 5000/3000 on V3.01, HP recommends that all servers and storage systems configured for Continuous Access EVA be in a High Availability SAN of two fabrics (Figure 43), and contain only Continuous Access EVA supported operating systems. If servers running non-supported operating systems exist within the SAN, they should be excluded from the Continuous Access management environment via zoning. In addition, that SAN (or management zone within a larger SAN) is limited to a maximum of 16 EVA, and 256 HBA per EVA. Additional operating system specific zones within the larger Continuous Access environment zone may be required as defined in Table 27. See the *Continuous Access EVA Design Reference Guide* for additional details and configuration limitations.

4.2 – ACS 8.7

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

5.1 SP6, 6 SP3– ACS 8.7

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 inTable 28.

Sun Solaris 2.6, 7, 8, 9

- Supports Sun Clusters v2.2 (Solaris 7 and 8) and Veritas Clusters 3.5 (Solaris 7, 8, and 9.) 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

EVA5000/EVA3000:

- 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 2.0 and 3.5. A cluster must be in its own zone.

- Supports 64-bit cPCI HBA on Solaris 8 and 9 (64 bit SBUS and 32 bit PCI are supported on 2.6, 7, 8 only)

- 32-bit Sbus HBA not supported

- When using Continuous Access on EVA5000 with VCS v3 or EVA 5000/3000 on V3.01, HP recommends that all servers and storage systems configured for Continuous Access EVA be in a High Availability SAN of two fabrics (Figure 43), and contain only Continuous Access EVA supported operating systems. If servers running non-supported operating systems exist within the SAN, they should be excluded from the Continuous Access management environment via zoning. In addition, that SAN (or management zone within a larger SAN) is limited to a maximum of 16 EVA, and 256 HBA per EVA. Additional operating system specific zones within the larger Continuous Access environment zone may be required as defined in Table 27. See the *Continuous Access EVA Design Reference Guide* for additional details and configuration limitations.

ACS 8.7

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 (64 bit SBUS and 32 bit PCI are supported on 2.6, 7, 8 only)

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 28.

Specific Platform/Operating System Rules – Enterprise Virtual Array (VCS v2), XP48/512, XP128/1024, 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 XP48/512, XP128/1024, 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 you HP representative for more information.

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.

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

Supported HBAs:

■ DS-KGPSA-CA

■ DS-KGPSA-DA

Supported storage systems:

■ MA8000

■ EVA5000/EVA3000

■ XP48/512, XP128/1024

Heterogeneous SAN Platform Interoperability for EVA5000/EVA3000

For the EVA5000/EVA3000, heterogeneous SAN platform interoperability is defined in Table 27. A "*Yes*" in the table indicates that the listed platforms can be configured for shared access to the same EVA5000/EVA3000. "*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 EVA5000/EVA3000. For C-Series switches, each operating system type must be a separate zone.

Table 27: SAN/Platform Zoning Requirements for EVA Storage Systems (B-Series and M-Series switches)

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 28, "SAN/Platform Zoning Requirements for EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems (B-Series and M-Series switches)."

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 29, "Compatible SCSI Modes for EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems Using ACS 8.7" and Table 30, "Compatible Failover Modes for EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems Using ACS 8.7."

An additional table, Table 31, 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 using B-Series or M-Series switches. Platforms in the same columns can coexist in the same zone. For C-Series switches, each operating system type must be a separate zone.

Table 28: SAN/Platform Zoning Requirements for EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems (B-Series and M-Series switches)

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	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 29 summarizes information about compatible SCSI modes and Table 30 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 29: 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	Microsoft Windows
Novell NetWare	Novell NetWare	Novell NetWare
Sun Solaris	Sun Solaris	Sun Solaris

Table 30: 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	
SuSE SLES 7 (ProLiant x86)	

Table 30: Compatible Failover Modes for EMA/ESA12000, EMA16000, MA/RA8000, MA6000 Storage Systems Using ACS 8.7 (Continued)

Transparent	Multiple-Bus
Microsoft Windows	Microsoft Windows
Novell NetWare	Novell NetWare
Sun Solaris	Sun Solaris

Combined Shared Access Interoperability Table

Table 31 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 31: 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	No... Net... 5.1, Clu... 1... 1...
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 attachm... With Z... Transp... Multiple (5.1, 6) FABRIC SCSI-2 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: Multiple FABRIC SCSI-3 4.2: Re... two sto... system
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	Transp... 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	Transp... Multiple (5.1, 6) FABRIC SCSI-2 SCSI-3
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 Z... Transp... Multiple (5.1, 6) FABRIC SCSI-2 SCSI-3

Table 31: 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	No Net 5.1, Clu 1. 1.
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 Z Transp FABR 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	Transp Multiple (5.1, 6) FABRIC SCSI-2 CCL or
Novell NetWare 5.1, 6, 6.5 Clusters 1.01, 1.06	Fabric attachment With Zoning Transparent or Multiple-Bus (5.1, 6) FABRIC SCSI-2 or SCSI-3	5.1, 6: Multiple-Bus FABRIC SCSI-3 4.2: Requires two storage systems	Transparent FABRIC SCSI-2	Transparent or Multiple-Bus (5.1, 6) FABRIC SCSI-2 or SCSI-3	With Zoning Transparent or Multiple Bus (5.1, 6) FABRIC SCSI-2 or SCSI-3	With Zoning Transparent FABRIC SCSI-3	Transparent or Multiple-Bus (5.1, 6) FABRIC SCSI-2 No CCL or SCSI-3	Transp Multiple (5.1, 6) FABRIC SCSI-2 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 Z Transp Multiple (5.1, 6) FABRIC SCSI-2 SCSI-3

Booting from the SAN

Table 32 indicates the platforms and operating systems that are currently able to boot from SAN storage.

Table 32: EVA, EMA/ESA12000, EMA16000, MA/RA800, MA6000 SAN Boot by Operating System (B-Series and M-Series Product Line only)

Platform/Operating System	Comments
Microsoft Windows 2000 Server, Advanced Server, Windows NT 4.0 MSCS MS Windows Server 2003 Standard Edition and Enterprise Edition (32-bit)	EVA5000/EVA3000, EMA/ESA12000, EMA16000, MA/RA8000, MA6000, MSA1000 HBA's supported for Windows NT, Windows 2000 & 2003: DS-KGPSA-CB, FCA2101, FCA2355 HBA's supported for Widows 2000 & 2003 only: FC2214, FCA2214DC, FCA2404 Refer to *Booting Windows from a Storage Area Network* (AA-RS2UD-TE) for more information
OpenVMS Clusters Tru64 UNIX TruCluster Software Products	EVA5000/EVA3000: HBA: DS-KGPSA-CA/DA/EA EMA/ESA12000, EMA16000, MA/RA8000, MA6000, MSA1000, HBA: DS-KGPSA-CA/DA/EA Requires use of *wwidmgr,* SRM console firmware v6.5 (minimum)

Any version of Continuous Access EVA also supports the replication of the boot disk as long as the page and swap files are not on that disk. HP recommends that these two disks be placed on storage internal to the server due to the high performance needed. This support is limited to those operating systems listed in Table 32.

Specific Storage System Rules

HP XP and VA Configuration Rules

1. XP storage systems are supported in all SAN fabric topology configurations described in this guide in SANs using the Fibre Channel switches listed in Table 17 (B-Series), Table 18 (C-Series), and Table 20 (M-Series) except when otherwise listed below.

2. VA storage systems are supported in all SAN fabric topology configurations described in this guide in SANs using the Fibre Channel switches listed in Table 17 (B-Series) and Table 20 (M-Series).

   ■ C-Series switches support VA7410 model only.

3. VA storage systems supported shared between MSCS (Windows) and MC/Service Guard (HP-UX) clusters. Requires proper assignment and securing of LUNs to the individual clusters.

4. In general, servers accessing HP XP or VA storage systems must not have access to EVA5000/EVA3000, 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. Refer to "Common Server Access", page 96, for supported common server access configurations.

EVA5000/EVA3000 Configuration Rules

1. The EVA5000/EVA3000 Storage System is supported in all SAN Fabric topology configurations described in this guide. The EVA5000/EVA3000 is compatible in SANs using the Fibre Channel switches listed in Table 17, Table 18, and Table 20.

2. For SANs with more than 1024 HBAs, an HSV controller must be zoned so that it can see no more than 1024 HBAs. It may be necessary to add a zone to a SAN to satisfy the 1024 HBA limit. (The limit is 256 HBAs when using Continuous Access EVA.)

3. The supported platforms and operating systems are listed in this section on page 105.

4. Shared access and heterogeneous platform zoning requirements are listed in Table 31.

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.Compaqcorp.net/Document_Storage/whitepapers/new_library/SingleHBA_for_EVA-HP3_121002.pdf

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Note: Servers without multi-pathing software are NOT supported by Continuous Access EVA at this time.

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7. Overlapping zones are supported with disk and tape.

8. Overlapping storage port zones supported if more than one operating system needs to share an array port.

9. Supports simultaneous access to EMA/ESA12000, EMA16000, MA/RA8000, or MA6000 storage systems and the EVA5000/EVA3000 from the same Server/HBA when both storage system families use common HBA, driver, and multi-path software versions. Refer to "Common Server Access", page 96 for more information.

   Refer to Chapter 3 for information about configuring the Storage Management Appliance to manage EVA5000/EVA3000s and EMA/ESA12000, EMA16000, MA/RA8000, MA6000 storage systems in the same SAN.

10. In general, servers accessing EVA5000/EVA3000s 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. Refer to "Common Server Access", page 96 for supported common server access configurations.

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

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

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.

EVA5000/EVA3000 Maximums

Table 33 lists the maximum connections supported by EVA5000 and EVA3000 storage systems. In addition, Table 33 lists the maximum supported storage limits for each hardware platform or operating system. The maximums shown here are for access to a single EVA5000/EVA3000 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 (see SAN/Continuous Access EVA Integration) 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

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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 33: 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 EVA5000/EVA3000 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.

EVA5000/EVA3000 Microsoft Windows Cluster Maximums

The maximum number of nodes which are part of a Microsoft cluster attached to one Enterprise Virtual Array may not exceed a total amount of 32 nodes. For example, the following configurations are all valid:

■ sixteen 2-node Windows 2000

■ four 8-node Windows Server 2003

■ two 2-node Windows 2000, three 4-node Windows Server 2003, and two 8-node Windows Server 2003

While using Continuous Access an Enterprise Virtual Array may not exceed these figures, even after a failover has been performed, as the limits are based on numbers of nodes/hosts whether or not LUN are actively presented to the node/host.

Additional standalone servers of any supported type, or non-Windows clustered servers, up to the limit per EVA specified for the particular clustered operating system, may be added up to the total published EVA limit of 256 servers.

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

1. 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 17, Table 18, and Table 20.

2. 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).

3. See this section beginning on page 105 for supported platforms and operating systems

4. Shared access and heterogeneous platform zoning requirements are listed in Table 31. 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.

5. Overlapping zones are supported with disk and tape.

6. Overlapping storage port zones supported if more than one operating system needs to share an array port.

7. 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.

Note: Windows 2003 is not supported with Transparent failover mode.

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

9. Supports simultaneous access to EMA/ESA12000, EMA16000, MA/RA8000, or MA6000 storage systems and the EVA5000/EVA3000 from the same Server/HBA when both storage system families use common HBA, driver, and multi-path software versions. Refer to"Common Server Access", page 96 for more information.

   Refer to Chapter 3 for information about configuring the Storage Management Appliance to manage EVA5000/EVA3000s and EMA/ESA12000, EMA16000, MA/RA8000, MA6000 storage systems in the same SAN.

10. 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.

11. 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.

12. F-Port fabric attachment to the SAN is available through all Fibre Channel switches listed in Table 17 and Table 20. Controller setting is FABRIC topology.

13. FL-Port fabric loop attachment to the SAN with QuickLoop is available through certain Fibre Channel SAN switch models. Refer to Table 17 and the specific Fibre Channel SAN switch model documentation for more information. Controller port topology set to "LOOP_HARD".

14. 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 33.

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

Table 34 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 34: 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
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 MS Windows Server 2003 Standard Edition and Enterprise Edition (32-bit)	8	2/4	8/64	8	16 (See Figure 35)	16	32 (See Figure 35)
Microsoft Windows NT 4.0 SP6a	8	2/4	8/64	8	8 (See Figure 34)	16	32 (See Figure 34)
Novell NetWare 5.1, 6, 6.5	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 33.) The use of zoning is required to limit the number HBAs visible to each active controller port.
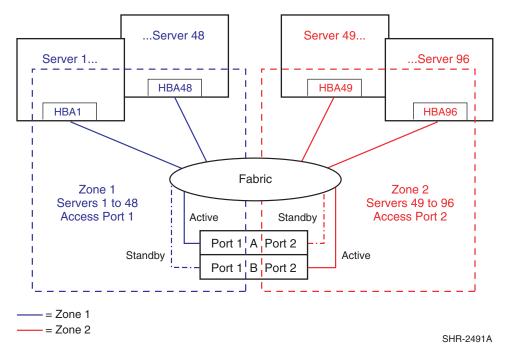

SHR-2491A

Figure 33: Maximum server example for Tru64 UNIX 5.x with transparent failover using 96 connections and one path per server
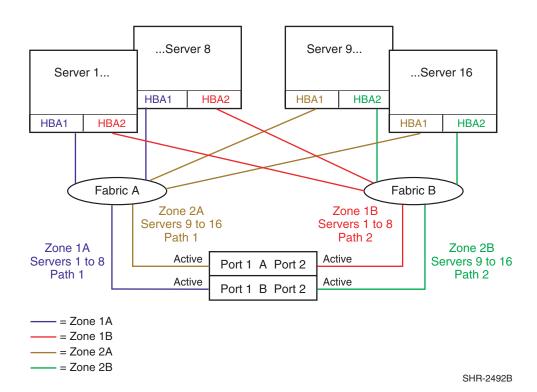
Figure 34: Maximum server example for Windows NT using 16 servers with multiple-bus failover and two paths per server

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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 34) 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 35.
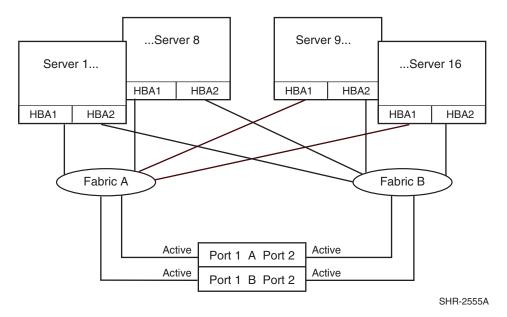
SHR-2555A

Figure 35: 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 31 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, contact your HP field representative. Information about the latest MSA1000 support is available at:

http://www.hp.com/go/msa1000

MSA1000 FW 4.24, 2.38 (Intel servers only)

The following platforms are supported:

- Windows 2003 Enterprise Edition (32/64-bit)
- Windows 2000 Server, Advanced Server SP3/SP4, Windows NT 4.0 SP6a
- MSCS
- Novell NetWare 5.1, 6, 6.5
- Novell NetWare Clusters
- Lifekeeper Clusters 4.3
- Red Hat Advanced Server 2.1 32/64-bit
- Red Hat Professional 7.2 32-bit
- SuSE SLES 7
- SLES 8/United Linux 1.0 32-bit, single path

MSA1000 FW 4.24 (AlphaServers only)

The following platforms are supported:

OpenVMS 7.3-1, 7.3, 7.2-2 support:

- 7.3-1 requires DEC-AXPVMS-V731_MSA1000-V0100 and DEC-AXPVMS-V731_FIBRE_SCSI-V0400
- 7.3 requires DEC-AXPVMS-V73_FIBRE_SCSI-V0500
- 7.2-2 requires DEC-AXPVMS-V22_FIBRE_SCSI-V0400

Tru64 UNIX 5.1A, 5.1B support:

- 5.1A requires Patch Kit 4 and New Hardware Delivery kit 6 (NHD6)
- 5.1B requires Patch Kit 1

Heterogeneous SAN Platform Interoperability for MSA1000 Storage

This section specifies the rules for shared heterogeneous access to a single MSA1000 storage system. MSA1000 storage systems are supported for shared access with combinations of operating systems.

Single MSA1000 shared heterogeneous access:

Any mix of:

- Windows 2003 Enterprise Edition (32-bit)
- Windows 2000 SP3/SP4
- Windows NT 4.0 SP6a
- Novell NetWare 5.1, 6, 6.5
- Red Hat Linux 7.2, Advanced Server 2.1
- SuSE SLES 7 single path
- SLES 8/United Linux 1.0 32-bit, single path

Additionally, standalone servers and clustered servers are supported on the same MSA1000.

Homogeneous SAN Platform Support for MSA1000 Storage

MSA1000 supports homogeneous access with the following operating systems:

■ Tru64 UNIX 5.1A, 5.1B

■ OpenVMS 7.3-1, 7.3, 7.2-2

Each operating systems requires a dedicated MSA1000.

Additional rules:

■ For Tru64 UNIX, supports standalone servers or up to four node clusters

■ For OpenVMS, supports standalone servers or an eight node cluster

MSA1000 Configuration Rules

■ The MSA1000 storage systems are supported in all all SAN fabric topology configurations described in this guide and can be configured in a SAN directly using the switch models shown in Table 17, Table 18, and Table 20, 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 B-Series, C-Series, and M-Series product line switches. Linux multi-pathing is not supported with C-Series switches.

■ For standalone server and cluster maximums per MSA1000, refer to the *MSA1000 Compatibility Guide* available at:

http://www.hp.com/go/msa1000

■ Multi-pathing with Linux, 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. 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 EVA5000/EVA3000, 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.

As an exception to this rule, certain storage solutions utilizing multiple storage types, for example, disk and tape, 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.

MSA1000 Maximums

The following table lists the maximum configurations for MSA1000 systems.

Table 35: 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 (32/64-bit), Windows 2000 Server SP3/SP4, Advanced Server SP2 MS Windows Server 2003 Standard Edition and Enterprise Edition (32-bit) Windows NT 4.0 SP6a Red Hat Professional v7.2, Advanced Server 2.1, SuSE SLES 7, SLES 8/United Linux 1.0 Novell NetWare 5.1, 6, 6.5 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 17, 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 17

- The Compaq FC-AL Switch 8 is supported for cascaded attachment to the SAN through a single FL-Port on B-Series switches only.

- 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 EVA5000/EVA3000, 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 36: 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 Continuous Access 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 37: Heterogeneous Continuous Access EVA Operating Systems

Operating System	Version
HP-UX	V11.0 ■ HP MC/Serviceguard Clusters V11.14 and up to 8 nodes V11.11 ■ HP MC/Serviceguard Clusters either SG V11.14 or 11.15 and up to 8 nodes V11.23 ■ HP MC/Serviceguard Clusters V11.15 and up to 8 nodes V11.0, 11.11, and 11.23 ■ 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, V5.1,and V5.2, HACMP appropriate to OS version
Microsoft Windows 2000 Server, Windows 2000 Advanced Server Windows 2003 32 and 64 bit	Windows 2000 (V5), Windows 2003 (V6) ■ (Windows 2000) Service Pack 3, Service Pack 4 ■ Microsoft Cluster Server (MSCS) ■ HP StorageWorks Secure Path for Windows V4.0 required (The exact version of Secure Path depends on the driver, HBA, and OS.)
Microsoft Windows NT Server	V4.0 ■ Service Pack 6a ■ Microsoft Cluster Server (MSCS) ■ HP StorageWorks Secure Path for Windows V4.0 required
Novell NetWare	V5.1Service Pack 6, V6 Service Pack 3, V6.5 V6 supports a max of 6 nodes, V6.5 supports up to 12 nodes clusters
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 V2, 3.5, or Sun Clusters 2.2, all with maximum of 16 nodes
SuSE Linux	SLES 7, SLES 8, United Linux 1.0

2. Each Continuous Access EVA solution may contain up to 16 EVAs, where each EVA is limited to at most 256 HBAs which at 2 HBA per server, equates to 128 servers. Multiple Continuous Access EVA solutions may exist within the same SAN as long as no one solution exceeds the 16 array limit, and that limit is imposed by zoning. Any SAN running Continuous Access EVA may contain up to 28 switches and 7 hops between devices from Table 17, 11 switches and 3 hops for C-series switches, or 24 switches and 3 hops between devices from Table 20, 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 switch family. All active/standby host-to-storage links as well as local-to-remote storage links must conform to the 7/3/3-hop limit.

3. A single array may support up to 128 DR Groups, and up to 128 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 either active in stand by mode or in powered off passive 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 38: 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	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 17, or 3 hops between devices from Table 20, 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. DRM is not supported on C-Series switches

5. 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.

6. DRM over ATM configurations are supported for switches in Table 17 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.

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

8. 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.

9. 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 EVA5000/EVA3000, MA6000, MA/RA8000, EMA/ESA12000, and EMA16000 storage systems. Figure 36 and Figure 37 show cabling options when implementing a Level 4 high availability no single point of failure configuration. Figure 38 and Figure 39 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 36 and Figure 43. The cabling is also described in the Continuous Access EVA Design Reference Guide. See URL:
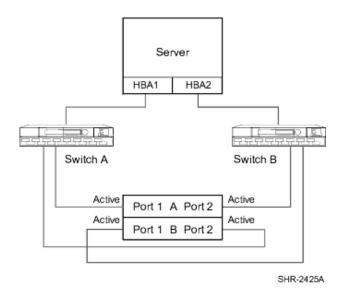> http://h18006.www1.hp.com/products/storage/software/conaccesseva/index.html

Figure 36: Cross-Cable High Availability NSPOF Configuration

Figure 36 shows the physical connections for a cross cable, high availability, no single-point of failure configuration for storage systems using two separate fabrics.
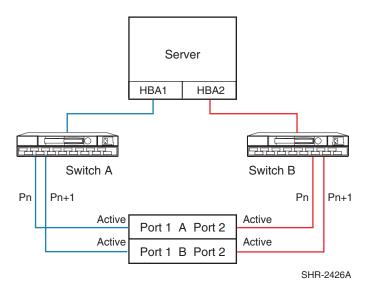

Figure 37: Straight-Cable High Availability NSPOF Configuration

Figure 37 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 38 and Figure 39 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 36 and Figure 37. 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.
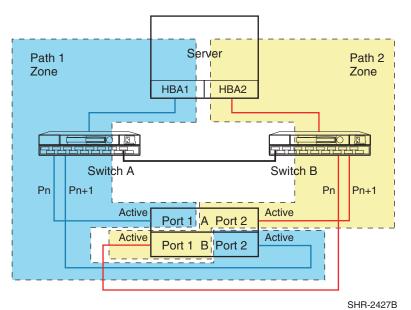

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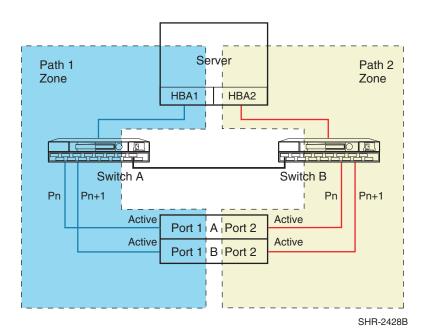**Figure 38: Cross-Cable High Availability Single Fabric Zoned Configuration**

SHR-2428B

Figure 39: 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 40 or Figure 41. 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.
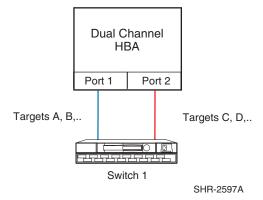

Figure 40: Single PCI Slot with Dual Channel HBA and One Switch

Figure 40 provides connectivity with both HBA paths connected to the same Fibre Channel switch.
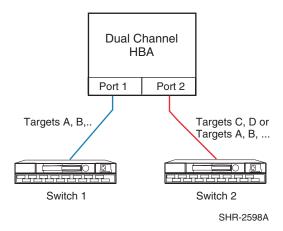
SHR-2598A

Figure 41: Single PCI Slot with Dual Channel HBA and Two Switches

Figure 41 provides increased availability over Figure 40 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.
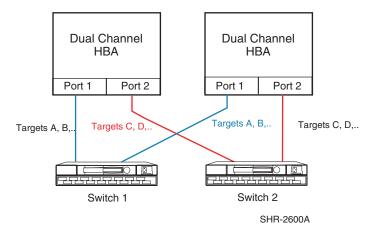

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Figure 42: Two PCI Slots with Dual Channel HBAs - NSPOF

Figure 42 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.