HP SAN Backup Solution

Configuration Guide

Revision 4.0
October, 2002

Revision History:

Revision 1.0 – July 21, Initial Creation of document
Revision 2.0 – September 1, Final Review

- Addition of Electronic Address of this document with revision history
- Addition of Omniback and Netbackup ordering details
- Corrections of driver versions, software versions
- Addition of SAN ordering example with 2 HP-UX, 10/180, 4 NT, & 1 Solaris
- Addition of a Bibliography
- Updated date of Emulex and QLogic HBAs to ~10/00
- Info about SAN Manager DM & LM
- Diagram of NT, tape libraries and FC60 storage on same SAN added
- Addition of the Commercial Channel and Enterprise Channel (formerly known as SF88/SF21) part number matrix in Appendix A

Revision 2.1 – September 20 – November 1

- Add A-Class server (400/500) to supported server list
- Update release/support dates on Emulex, QLogic, JNI HBA releases
- Revision of explanation of why a 4/2 and 4/1 bridge cannot be on the same switch in a Solaris, HP-UX, and NT SAN (p. 19)

Revision 3.0 – January 2001

- Addition of "What's New" section
- Addition of LTO drive configurations, performance tips, and product numbers
- Addition of the Bridge 2/1 LV information
- Addition of LTO drive upgrade path information
- Addition of disk and tape SAN configurations and explanations
- Addition of information on HBA configuration (redundant, separate, common) in SAN
- Addition of 10/588 tape library support in a SAN

Revision 3.1 – January 2001

- Update LTO Enterprise product numbers

Revision 3.2 – June 2001

- Updated "What's New" section
- Added support for HP-UX 11.11and 10.20
- Added HBA and platform support to include K, D, R-class servers and Superdome.
- Added support for the Director FC64 switch
- Expanded switch cascading support
- Added support for VA7100 in the disk and tape configurations
- Removed Windows support for the Bridge FC 4/2
- Removed references to Veritas Netbackup CPL information
- Updated support statement for Storage Node Manager and Storage Allocator

Revision 3.3 – August 2001

- Updated "What's New" section
- Added QLogic HBA support for Windows
- Expanded switch cascading support to include 5 switches
- Added support for VA7400 in the disk and tape configurations

Revision 3.4 – September 2001

- Removed Enterprise and Commercial designations per new Universal Product Merger
- Added support for the HP Surestore Switch 6164
- Added support for Solaris 8 and new JNI cards
- Added support for a single overlapping tape zone
- Added support for disk and tape configurations with EMC Symmetrix disk arrays
- Added Emulex HBA support for Windows

Revision 3.5 – October 2001

- Added support for Novell Netware

Revision 3.6 – December 2001

- Added support for AIX
- Added support for ED5000
- Added support 2gbit hba and the Brocade 3800

Revision 3.7 – February 2002

- Added Surestore Interface Manager for 10/180 and 20/700 Tape Libraries
- Added support for 2 Gb 8-port switches
- Updated performance recommendations for 2 Gb HBAs

Revision 4.0 – October 2002

- Removed legacy tape library products and corresponding interfaces (10/180, 20/700,etc.)
- Added new HP tape library product (MSL, ESL) and interface support information

Table of Contents

What's New in This Document

- HP MSL and ESL Tape Libraries
- HP Fibre Channel Routers for ESL and MSL Tape libraries
- HP FC Switches – Legacy and current switch matrices
- Removal of legacy tape library and interface product information

HP SAN Backup Solution

Introduction

This document is intended for field, resellers, system integrators, or end-users that are specifying and designing a HP SAN Backup Solution.

This document provides an overview of the SAN backup solution with an emphasis on tape backup. It describes supported configurations and components for the solution, information on sizing a solution, example configurations and an ordering guide.

The reader is assumed to be familiar with storage as well as have general understanding of backup including tape technologies, tape libraries, and backup software. The reader also is assumed to have some understanding of SAN and Fibre Channel, but not specifically SAN tape backup.

SAN Backup Solution Overview

Traditional Backup Methods

Until recently, there have been two primary models for attaching tape libraries for backup and recovery. The first is through a backup server. Data is moved from target hosts over the network to a backup server and then to direct-attached tape library and tape drives.

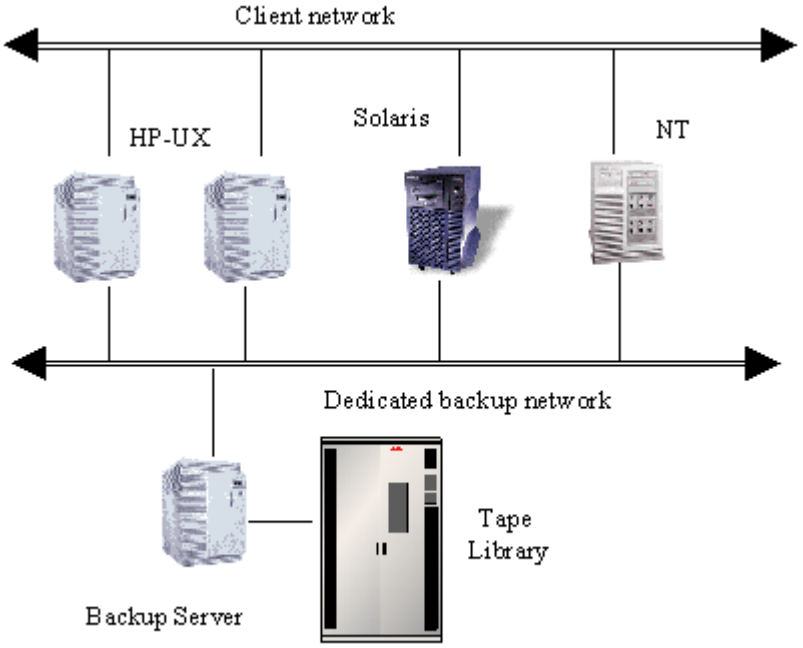


Figure 1 -- Network backup model

The advantage of this approach is that it allows a customer to leverage shared use of a large tape library across their environment. This solution can also leverage existing LAN infrastructure.

The primary limitation is that the network bandwidth often becomes a bottleneck for capacity and performance of the system. Additionally, backing up over the primary client LAN will often negatively impact the performance of the network.

In some cases, customers have deployed a dedicated network for backup separate from their primary client network. This is shown in the figure above. This mitigates the performance impact on the client network, but the solution is still limited by network bandwidth.

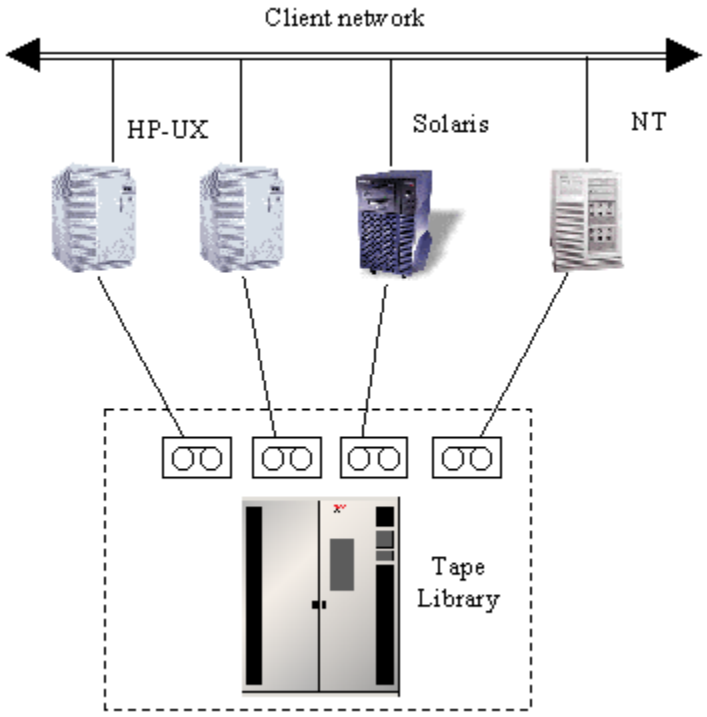


Figure 2 -- Direct attached backup model

The second commonly deployed model is direct attached backup. In this case, tape drives are connected directly to each server to be backed up. These tape drives may be housed in a single library in order to benefit from automated tape handling.

The benefit of this solution is high performance access to the tape drives. Large backups can be done in a short time by connecting additional tape drives to a server.

The disadvantage is that the number of tape drives available (e.g. the number of tape drives in the tape library) limits the number of servers that can be backed up. Also, since each tape drive is dedicated to a specific server, when that server is not using the tape drive, another server cannot use it. This can result in a lot of backup capacity unusable throughout the backup window.

SAN Backup

SAN backup provides an evolutionary step for these two models. Tape drives and libraries are connected to hosts over a high-speed Fibre Channel network. It combines the benefits shared access to tape drives and libraries from the network backup model with the benefit of high-speed access from the direct attach model.

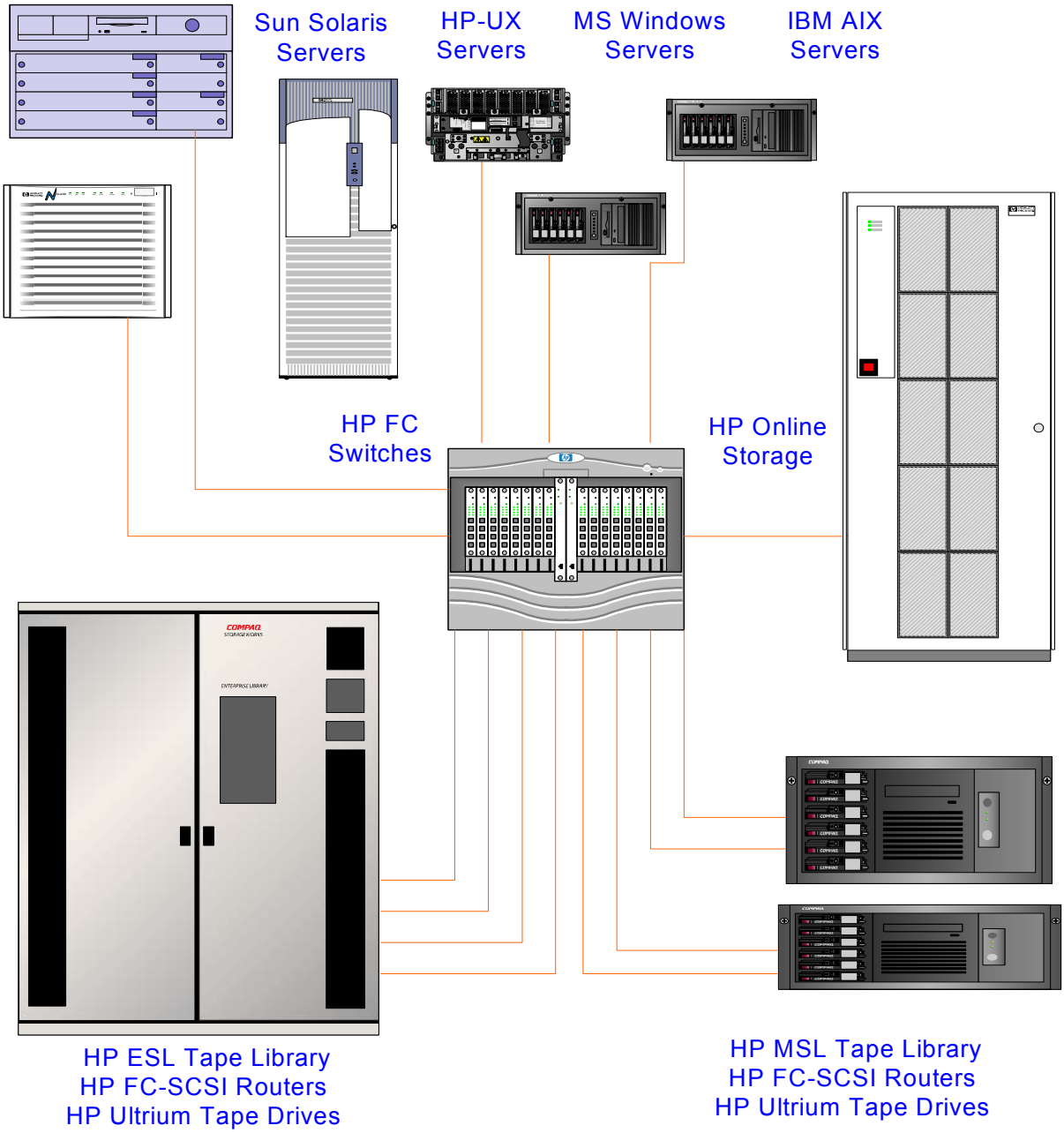


Figure 3 – SAN backup diagram

Each of the hosts sees what looks like its own dedicated tape drive. Backup software installed on each of the hosts manages access to the tape drives sequencing backup jobs from multiple hosts to the pool of available tape drives.

There are several significant benefits to deploying a SAN-based backup solution:

High Performance	The solution provides performance comparable to direct attach solutions. It does not suffer from network bandwidth limitations inherent in traditional network backup solutions.
Scalability	Tape resources are pooled and shared across all hosts in the environment. Once the solution is deployed, capacity is easily expanded by adding additional tape drives to the pool.
Flexibility	Backup capacity is readily allocated and reallocated as the environment changes. Tape drives are dedicated or locked in to specific servers as with direct attach backup.
Leveraged Investment	Tape drives and libraries are pooled. These investments shared across the enterprise data center.
Reduced Administrative Costs	Consolidated backup operations, centrally located and managed hardware result in less administrative effort.

SAN Topologies

A Fibre Channel SAN supports several network topologies, including point-to-point and switched fabric. These configurations are constructed using switches and routers.

Point-to-Point

Point-to-point connections are direct connections between two nodes, such as a server and an attached tape library. This configuration requires no switch to implement. It is very similar to a SCSI bus model, in that the storage devices are dedicated to a server.

Figure 4 – Point-to-point topology

Switched Fabric

A switched-fabric topology allows nodes to talk directly to each other through temporarily established direct connections. This provides simultaneous dedicated bandwidth for each communication between nodes (see Figure 5).

Because of this, switched fabric topologies provide significantly more performance and scalability than arbitrated loop topologies.

Also, switched fabric topologies do not suffer from susceptibility to I/O interruptions due to errors, resets, or power failures from third party nodes. Because communications are established directly between nodes, interruption events are isolated by the fabric environment.

Finally, because many nodes never need to communicate with each other, such as between two hosts, interoperability issues are significantly mitigated in a fabric topology as compared to loops. Nodes need only interoperate with the switch and the target node instead of every node on the loop or fabric.

Switched fabric configurations are implemented with Fibre Channel switches. Switches may be cascaded together to form larger fabrics. Switches may also be combined with hubs to form mixed fabric and loop topologies.

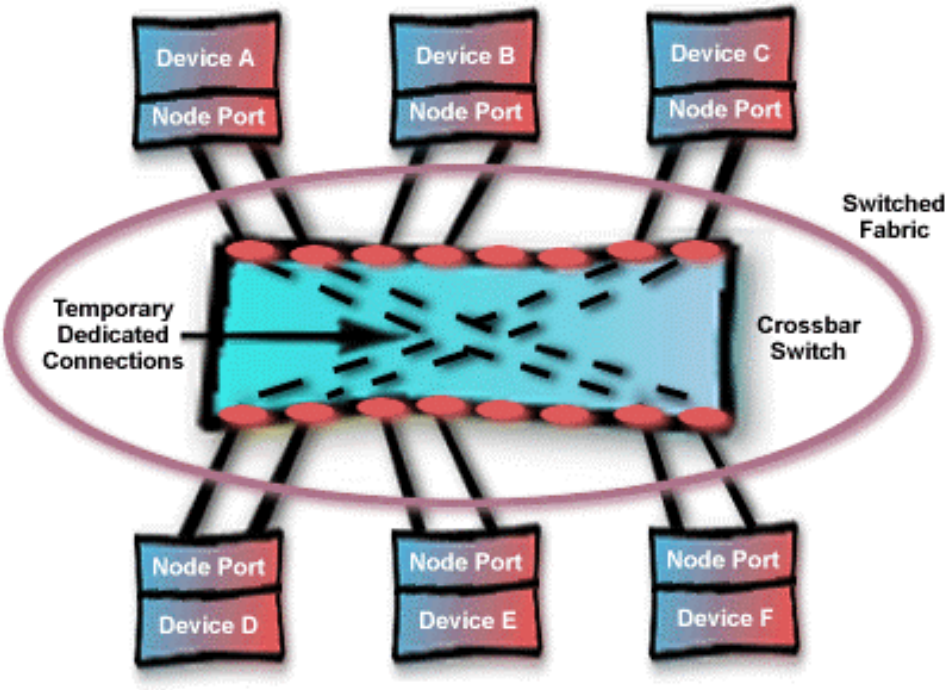


Figure 5 – Switched Fabric

SAN Backup Components

The following section describes the key components comprising a SAN backup solution.

Host Bus Adapter

Host bus adapters or HBAs are used to connect servers to fibre channel topologies. They provide a similar function to SCSI host bus adapters or network interface cards (NIC).

The device driver for an HBA is typically responsible for providing support for any of the fibre channel topologies – point-to-point, loop, or fabric. In most cases, the device driver also provides a translation function of presenting fibre channel targets as SCSI devices to the operating system. This provides compatibility with existing storage applications and file systems that were developed for SCSI devices.

Switch

Switches are the Fibre Channel infrastructure component used to construct fabrics. Switches may be cascaded together to configure larger fabrics.

Switches typically have an Ethernet port for managing them over the network. This port provides status and configuration for the switch and individual ports.

Tape Library

The tape library and tape drives it contains provide the offline storage for backup on the SAN. The tape library provides automated tape handling which becomes a key requirement when consolidating backup across multiple servers.

Router

The FC-SCSI router (sometimes referred to as a bridge) device provides connection between fibre channel topologies and SCSI devices. It does this by presenting the SCSI devices as fibre channel devices to the SAN, and then relaying fibre channel commands to these SCSI devices. These are typically used for tape drives and libraries.

Cables and GBICs

Three types of cables exist to connect Fibre Channel devices together – copper cables, short-wave or multi-mode optical cables, and long-wave or single-mode optical cables. Each type of cable provides different maximum lengths, as well as cost.

Fibre Channel devices have ports which either require a specific type of cable, or require a separate module referred to as a GBIC (gigabit interface converter). A GBIC-based port allows a user to use multiple types of cabling by utilizing the appropriate type of GBIC with it.

Backup Software

Backup software is deployed on each of the hosts on a SAN that will perform backup. This typically requires installing server-type licenses and software on each of these hosts. Many of these backup applications also provide a separate

module or option, which enables software to manage shared access to the tape drives on a SAN. This may need to be purchased in addition to the typical software licenses.

SAN Management Software

SAN Management software is used to manage resources, security, and functionality on a SAN. This can be integrated with host-based device management utilities or embedded management functionality such as hub or switch Ethernet ports.

Supported Configurations and Topologies

This section provides information for each of the components of the solution, describing supported configurations and topologies. Throughout the material, some information regarding future support is also provided.

Platform and Operating System Support

The following table lists supported host platforms. Reference this list for platform supportability throughout this document.

Table 1 – Operating Systems and Platforms

Operating System	Version	Servers
HP-UX	11.11 11.0 (32 & 64 bit) 10.20	HP 9000-800 A-, V-, N-, and L–class servers HP 9000-700 K-, D-, and R–class servers Superdome, rp8000
Solaris	2.6, 7, 8	Sun Ultra Enterprise, Enterprise, Ultra2
Windows NT 4.0 Server, NT Enterprise Edition	4.0 SP6	HP NetServers, HP Proliant, Dell PowerEdge, and IBM Netfinity, Compaq Proliant
Windows 2000 Server, Advanced Server	SP2, SP3	HP NetServers, HP Proliant, Dell PowerEdge, and IBM Netfinity, Compaq Proliant
IBM AIX	4.3.3 ML09	RS6000 servers
Novell Netware	5.x	HP NetServers, HP Proliant, Dell PowerEdge, and IBM Netfinity, Compaq Proliant

Heterogeneous platform tape sharing is supported. All platforms may be connected through one or more switches to a tape library. The switches do not need to be separated by operating system type, nor should they be configured with separate zones for each operating system.

All hosts need to "see" all tape drives; shared access to tape drives is handled by the backup application software running on each host. Software requirements and supportability may vary from one platform to another. Check the software vendors' support matrices for platform information.

Table 2 – Supported host bus adapters

Vendor	Product No.	Operating Systems	Drivers / Notes
Hewlett Packard	A5158A	HP-UX 11.0, 11.11	11.11 Driver AR_1201 & PHKL_23626 11.0 Driver AR_1201 & PHKL_23939
	A6795A	HP-UX 11.0, 11.11	11.11 Driver AR_1201 & PHKL_23626 11.0 Driver AR_1201 & PHKL_23939
	A6684A	HP-UX 11.0, 11.11, 10.20	11.11 Driver AR_1201 & PHKL_23626 11.0 Driver AR_1201 & PHKL_23939
	A6685A	HP-UX 11.0, 11.11, 10.20	11.11 Driver AR_1201 & PHKL_23626 11.0 Driver AR_1201 & PHKL_23939 10.20 DART 54 Patch Dependencies J3630BA, PHSS_23581, PHKL_17590, PHKL_167511
JNI	FC64-1063N (sbus) FCI-1063N (pci)	Solaris 2.6, 7, 8	Driver 2.5.18
	FCE-1063-N (sbus) FCE-6410-N (pci)	Solaris 2.6, 7, 8	Driver 4.0.5
QLogic	QLA-2200F	Windows NT 4.0, Windows 2000	Driver 8.00.08
Emulex	LP8000 LP952L	Windows NT 4.0, Windows 2000	NT Driver 4-4.82a4 Win2k Driver 5-4.82a4
Compaq	176479-B21 245299-B21	Windows NT 4.0, Windows 2000	NT Driver 4-4.82a4 Win2k Driver 5-4.82a4
IBM	FC6228	AIX 4.3.3	Firmware 3.82A1, Driver 4.3.3.75 (64-bit PCI FC Adapter Device - device.pci.df1000f9.rte)

FDA=Fabric Direct Attach (aka N-Port)

For an up-to-date list of required driver and firmware revisions, please check the website, http://www.hp.com or call your local HP representative regarding SAN backup configurations installation options.

Tape Libraries and FC Routers

The following tables lists the libraries, tape drives, and FC interface routers supported for the SAN tape backup solution. This table references MSL- and ESL-class tape libraries. Supported tape drives for use in SAN backup solution with these automated libraries is shown in Table 3a.

Table 3 – Tape Libraries

Product No.	Tape Library Description	Firmware Versions
301897-B21	MSL5030, 0 DRV, RM Library	4.04
301897-B22	MSL5030, 1 DRV, LTO Ultrium 230, RM Library	4.04
301897-B23	MSL5030, 2 DRV, LTO Ultrium 230, RM Library	4.04
301897-B24	MSL5030, 1 DRV, LTO Ultrium 230, embedded Fibre, RM Library	4.04
301897-B25	MSL 5030, 2 DRV, LTO Ultrium 230, embedded Fibre, RM Library	4.04
301898-B21	MSL5030, 1 DRV, LTO Ultrium 230, TT Library	4.04
301898-B22	MSL5030, 2 DRV, LTO Ultrium 230, TT Library	4.04
301899-B21	MSL5060, 0 DRV, Ultrium 230, RM Library	4.04
301900-B21	MSL5060, 2 DRV, Ultrium 230, TT Library	4.04
301899-B22	MSL5060, 2 DRV, Ultrium 230, RM Library	4.04
301899-B23	MSL5060, 2 DRV, Ultrium 230, embedded Fibre, RM Library	4.04
301927-B22	ESL9322 222 slot 2 LTO Ultrium 230 Drive Enterprise Library	3.31p5
301927-B28	ESL9322 222 slot 8 LTO Ultrium 230 Drive Enterprise Library	3.31p5
301928-B22	ESL9322 322 slot 2 LTO Ultrium 230 Drive Enterprise Library	3.31p5
301928-B28	ESL9322 322 slot 8 LTO Ultrium 230 Drive Enterprise Library	3.31p5
301929-B22	ESL9595L1 400 slot 2 LTO Ultrium 230 drives Enterprise Library	3.31p5
301929-B28	ESL9595L1 400 slot 16 LTO Ultrium 230 drives Enterprise Library	3.31p5
301931-B22	ESL9595L1 500 slot 2 LTO Ultrium 230 drives Enterprise Library	3.31p5
301931-B28	ESL9595L1 500 slot 16 LTO Ultrium 230 drives Enterprise Library	3.31p5
301932-B22	ESL9595L1 595 slot 2 LTO Ultrium 230 drives Enterprise Library	3.31p5
301932-B28	ESL9595L1 595 slot 16 LTO Ultrium 230 drives Enterprise Library	3.31p5

Table 3a – Supported Tape Drives

Product No.	Tape Drive Description	Firmware Versions
-	HP Ultrium LTO 230	-

Table 4 – Fibre channel interfaces

Part No.	Description	Supported Tape Libraries	Firmware versions
262653-B21	M2402 Network Storage Router 2 FC x 4 LVD SCSI	ESL 9000 Tape Libraries MSL5000 Tape Libraries	4.03.16
262665-B21 262664-B21*	E2400 Embedded Data Router 2 FC x 4 LVD SCSI ports	ESL 9000 Tape Libraries	4.03.16
262672-B21	E1200 Network Storage router 1 FC x 2 LVD SCSI	ESL 9000 Tape Libraries MSL 5000 Tape Libraries	4.03.16
280823-B21	N1200 Network Storage router 1 FC x 2 LVD SCSI	ESL 9000 Tape Libraries MSL 5000 Tape Libraries	4.03.16

Note: The upgrade router kit includes: two 1FC x 2LVD SCSI router cards, four VHDCI-WIDE SCSI cables, User Guide CD. This SKU does not include a card cage; it is an upgrade SKU and requires 262665-B21 to be configured first, when configured it increases the number of SCSI ports available to connect drives in an ESL9000 library to the SAN, to a total of eight.

For LTO connectivity it is recommended that drives are connected to routers in a configuration of one tape drive per SCSI bus with a maximum of 2 drives per SCSI bus.

The number of tape drives configured in the library determines the number of external FC bridges or internal FC interface cards required. Due to performance and reliability concerns, it is recommended that no more than two tape drives be connected per SCSI bus on a fibre channel router. For ESL tape libraries with a full capacity of tape drives, two tape drives per bus is required since the maximum number of buses is reached with the embedded FC routers.

Backup and SAN Management Software

Table 5 – Supported Backup and SAN Management Software

Software	Versions	Platforms Supported
HP Omniback II	4.0, 4.1	HP-UX, Solaris, MS Windows, NetWare, IBM AIX
HP Openview Storage Data Protector	5.0	HP-UX, Solaris, MS Windows, NetWare, IBM AIX
Veritas Netbackup	3.4.3	HP-UX, Solaris, MS Windows, IBM AIX
Legato	6.1.2	HP-UX, MS Windows
Veritas BackupExec	8.6	MS Windows
Computer Associates ARCserve 2000	Build 16	MS Windows
HP OpenView Storage Manager (OV-SAM)	2.2	See HP Blueprints for OV-SAM for more information on OpenView Storage Manager configuration support

FC Switches

The following table provides a list of the supported FC switches for the SAN backup solution.

Table 6 – Supported FC Switches

Product No	Description	Ports	Firmware Versions
A7340A	HP FC 1Gb/2Gb 16B switch Brocade Silkworm 3800	16	3.0.2f
A7347A (A7346A[1])	HP FC 1Gb/2Gb 8B switch Brocade Silkworm 3250 (3240)	8	-
A5624A	HP/Brocade Silkworm 2800	16	A2.4.1
A5625A A5667A	HP/Brocade Silkworm 2400	8	A2.4.1

[1] *Note the A7346A is an entry-level switch with no zoning support and limitations for cascading.*

A6534A A6534AZ	HP Director FC64	64	01.01.02, 1.3
A7326A A7326AZ	HP Switch 6164	64	-
-	McData ED5000	32	4.0
-	Connectrix ED-1032	32	4.0
-	McData ES-3232	32	-

287055-B21 283056-B21	HP SAN Switch 2/16	16	2.6.0c
258707-B21	HP SAN Switch 2/8-EL	8	2.6.0c
286810-B21	HP Edge Switch 2/32	32	02.00.02
286811-B21	HP Edge Switch 2/16	16	02.00.02
286809-B21	HP Director 2/64	64	02.00.02
254508-B21	HP Core Switch 2/64	64	4.0.0c

SAN Backup Configuration Information

Cascading switches

Switches may be used alone, or cascaded to provide additional host connectivity.

The figure below provides a simple example SAN backup configuration.

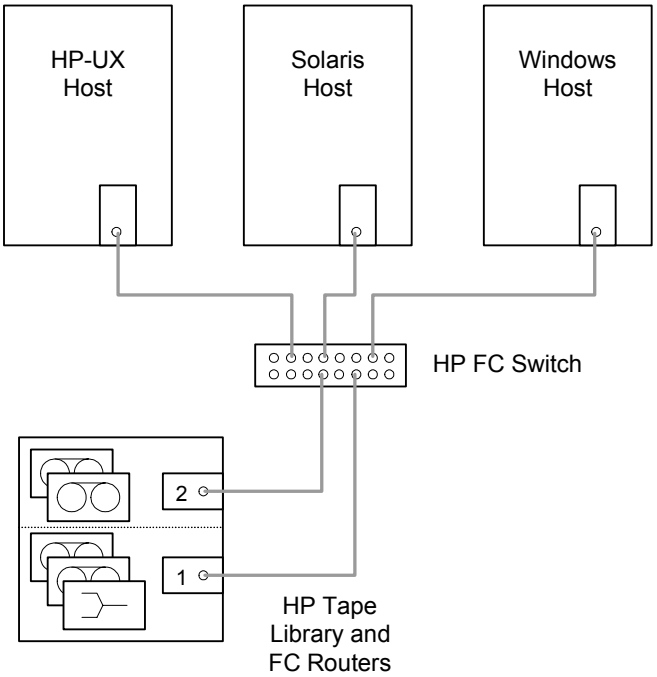


Figure 6 – Shared tape library with HP-UX, Solaris, and NT

Another configuration example demonstrating supported cascaded switch configurations is shown in Figure 7. This topology allows configurations to be created with a single switch serving as a 'storage' switch in the center of the topology to which disk storage and tape libraries are connected. Up to four additional 'host' switches are connected to the 'storage' switch and provide for a larger number of hosts to be connected to the topology. Hosts may also be connected to the 'storage' switch, in addition to the 'host' switches.

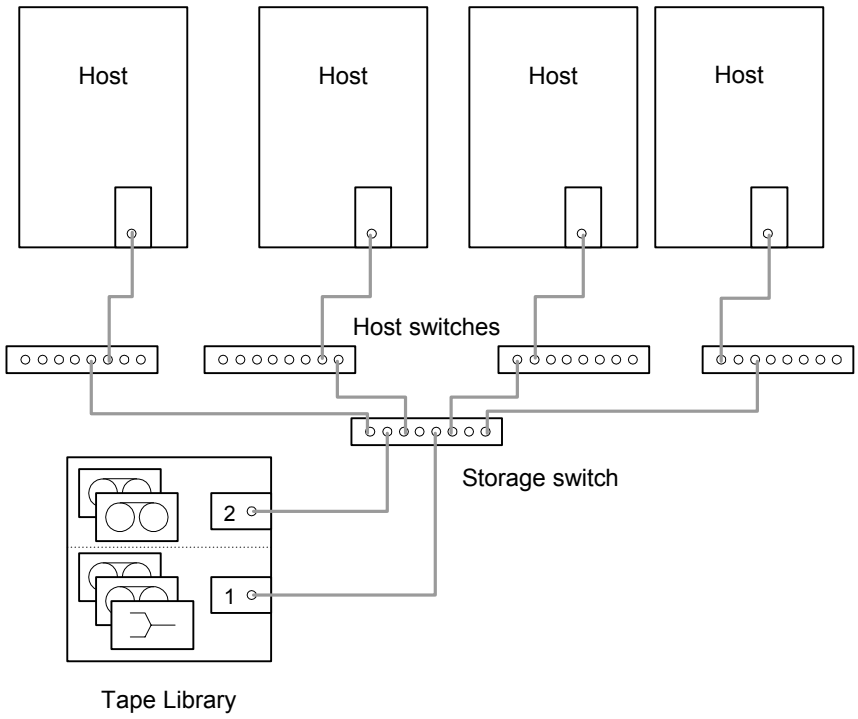
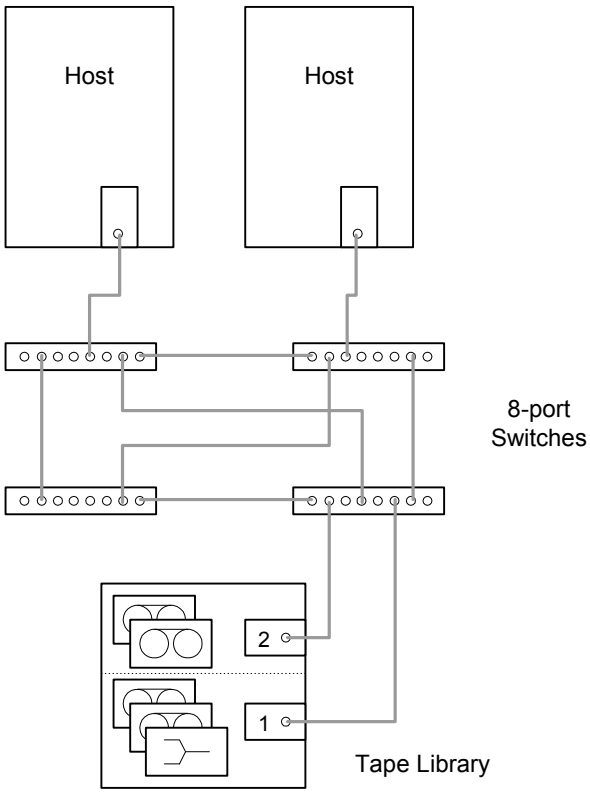


Figure 7 – Fan-out cascaded switch configuration



Current support for meshed switches in a SAN backup configuration is limited to a 6-switch mesh (or one HP 6164 switch) with HP/Brocade 8-/16-port switches and a maximum of three hops between the hosts and the storage.
Mixing switch vendors' products is not supported.

Figure 8 –Support for meshed switches

Inter-switch links

Connections made between switches in order to cascade them are referred to as Inter-switch links (ISL). Multiple ISLs may be used between switches to provide additional bandwidth and improve network performance as shown in Figure 9.

An ISL is recommended for every four HP Ultrium Tape Drives connected to the fabric.

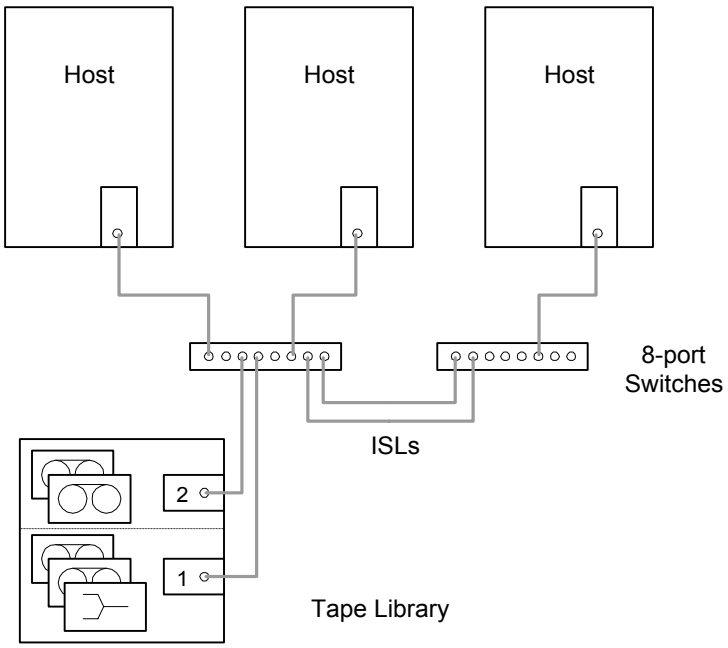


Figure 9 – Multiple inter-switch links (ISLs)

Zoning

Zoning refers to the ability to partition the switch into multiple logical SANs. This feature is primarily supported for disk and tape configurations. Shared access to tape drives is handled by the backup application software running on each host. As such, generally any tape-related zones need to be configured to allow all hosts to see all tape drives and libraries.

Zoning is not used for the purpose of isolating I/O traffic in the SAN or fibre channel events from a third-party host such as LIPs. These events are automatically isolated through the switch and fabric topology.

Overlapping zones refer to a configuration where a single switch port or device WWN participates in more than one zone. Support has been recently added to allow for a single overlapping tape zone in order to provide flexibility for customers using zoning for disk storage needs.

Emulated Private Loop

Emulated Private Loop (EPL) is a feature that allows a switch to emulate a hub and provide private arbitrated loop connectivity for non-public hosts or devices. Brocade refers to this feature in their switches as Quickloop.

Due to potential for LIPs to interrupt an I/O during a tape backup, this feature is NOT supported for tape devices.

FC Connections

Only short-wave optical cables are supported for connection between hosts/switches/hubs and tape libraries with their FC bridges. But, short-wave optical cables may be used for any connection through out the topology and are recommended for most situations.

Long-wave optical cables can provide long distance connections between FC switches (ISLs). This allows customers to connect SANs across different rooms or buildings on a site, or across multiple sites where a long-wave fibre cable is available. HP supplies long-wave GBICs but does not provide long-wave cables. The customer needs to obtain these through a third-party.

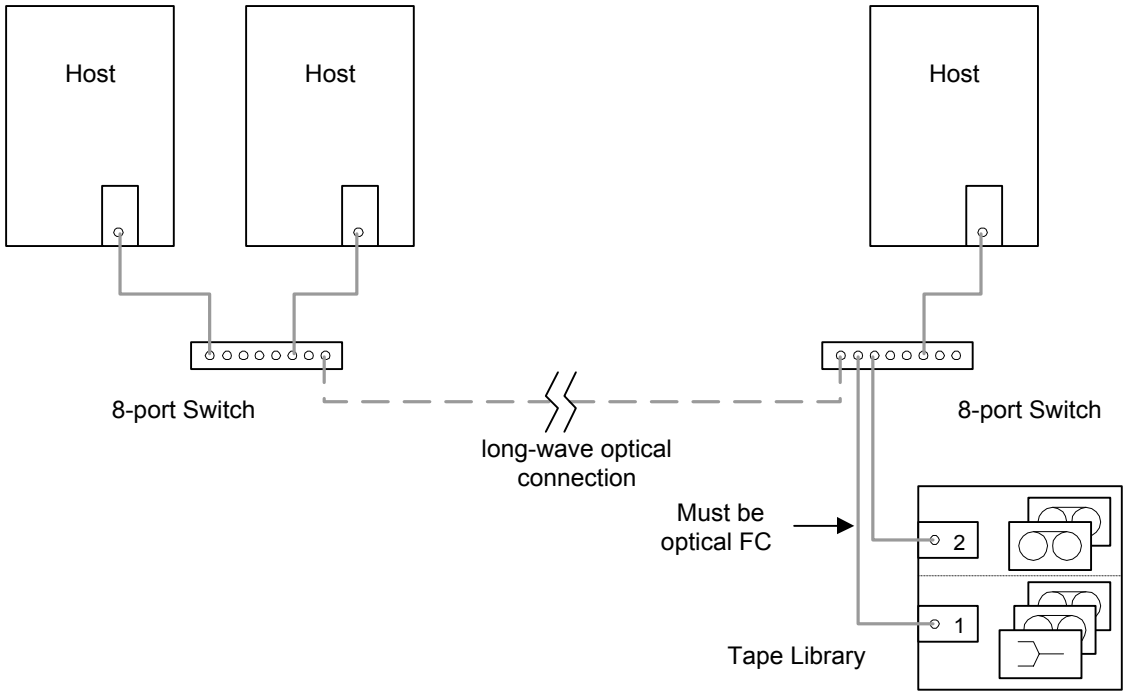


Figure 10 – Long-wave optical FC connection between buildings or sites

Configurations with Disk and Tape

Configurations including both disk and tape on the same SAN maybe deployed in one of two ways.

The first method requires separate dedicated HBAs for disk and tape connections. Tape connections are separated in the SAN by using a 'tape-only' zone. This method provides easier configuration while maintaining optimum performance bandwidth for disk and tape I/O to the server.

The second method uses a common HBA for connecting both disk and tape. In this configuration, no zoning is used. However, consideration needs to be given to achieve expected performance during backup or restore operations. This method provides customers a lower cost means to connect many servers to a SAN for large environments.

Disk and Tape using Separate Switches

The following diagram shows previous support for disk and tape configurations. This required separate switches for disk and tape connections. Support for this configuration is continued for customers who wish to maintain separate disk and tape SAN environments, as well as cases where disk configuration limitations do not allow for one of the above methods.

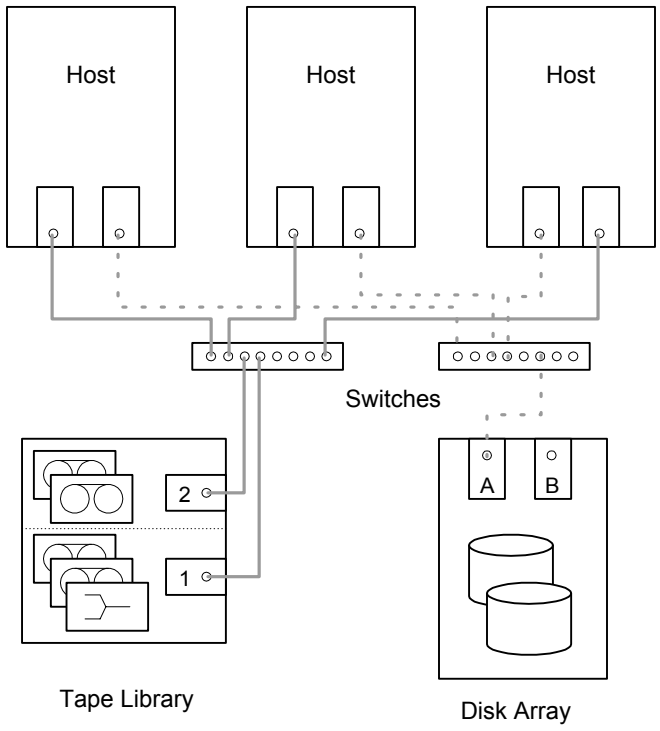


Figure 11 – Disk and tape using separate switches

In addition to providing dedicated bandwidth for tape I/O, this option enables easier configuration of tape libraries and tape drives for the hosts and backup software.

Disk and Tape using Separate Host Bus Adapters

In this configuration, a common switch is used for both disk and tape SAN connections. Separate HBAs are used on the host to isolate disk and tape traffic to and from the server. A single switch or multiple switches may be used according to the cascading limitations discussed earlier.

A 'tape-only' zone is created to include the tape connections and the tape-dedicated HBAs on each server in the SAN. The purpose of the 'tape-only' zone is to simplify configuration of tape devices for the hosts and backup software. Without the zone, multiple tape images would appear on the host for a given tape drive, requiring manual configuration of device driver files and backup software to resolve the I/O mapping.

In addition to simplifying the configuration process, this method also enables optimal performance for disk and tape during backup operations by providing separate dedicated paths for data being read from disk while also being written to tape.

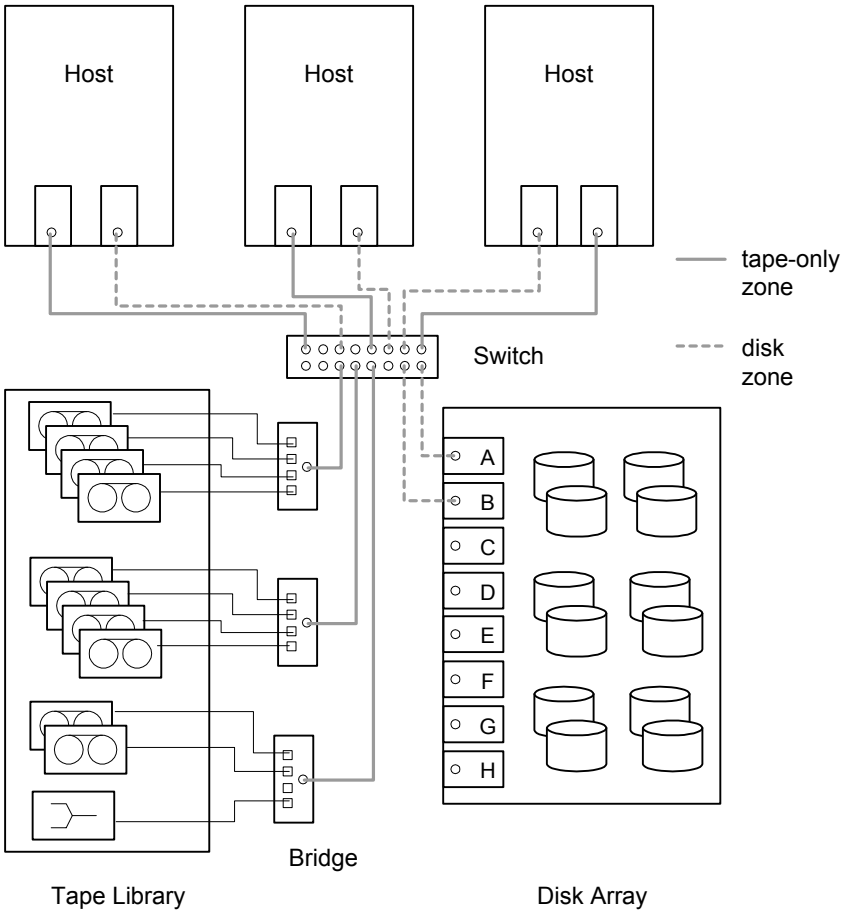


Figure 12 – Disk and tape support using separate HBAs

Disk and Tape using Common Host Bus Adapters

In addition to utilizing common switches, the second option provides configurations using a common HBA on the server to connect to both disk and tape devices. This method is beneficial for customers deploying a SAN in large environments with many servers by saving the cost of additional dedicated HBAs and switch ports for tape connections. One or more switches may be used according to cascading limitations. This configuration does not use zoning.

Consideration needs to be given in order to meet performance expectations. In this configuration, traffic for disk and tape go through a common HBA on the servers. During a backup operation, a server needs to read data from disk while writing it again to tape. Therefore, the maximum throughput is theoretically half the bandwidth of the HBA (50 Mbytes/sec). However, because of inefficiencies in the HBA, server, and software, actual throughput can be significantly less.

For HP LTO Ultrium drive configurations:

- 1Gbit bandwidth limit to a maximum of 2 LTO tape drives
- 2Gbit bandwidth limited to a maximum of 3 LTO tape drives.

In these cases where more tape drives need to be configured per HBA, separate HBAs tape SAN connections are recommended. These recommendations are based on an average data compression rate of 1.4:1. In cases where the customer has more compressible data or for increased performance margin, configure less drives per HBA than the above recommendation.

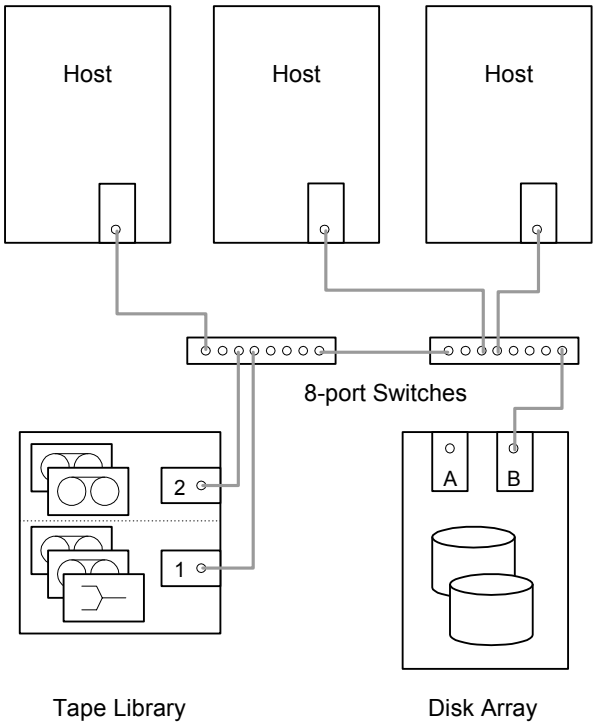


Figure 13 – Disk and tape support using common HBAs

Disk and Tape using both Separate and Common Host Bus Adapters

Configurations including both separate HBAs and common HBAs may be mixed where customers have varying data protections needs. In these cases, some hosts are configured to use a common HBA to access both disk and tape devices, while others separate access through the use of dedicated HBAs.

Support has been added to provide a single overlapping tape zone to allow access to all tape drives and libraries from all servers in the SAN. Individual zones can then be used as necessary to separate disk access from each host. The benefit of using the overlapping zone for tape is that it maintains flexibility for the customer. Tape drives to not need to be divided between multiple non-overlapping zones as in previously supported configurations.

Figure 14 and Figure 15 show an example of this configuration using a single overlapping zone for tape. In this example, host A has dedicated HBAs for disk and tape to provide optimal performance. Hosts B & C have smaller storage or larger backup windows and require less than 4 DLT or 2 Ultrium tape drives each for their nightly backups.

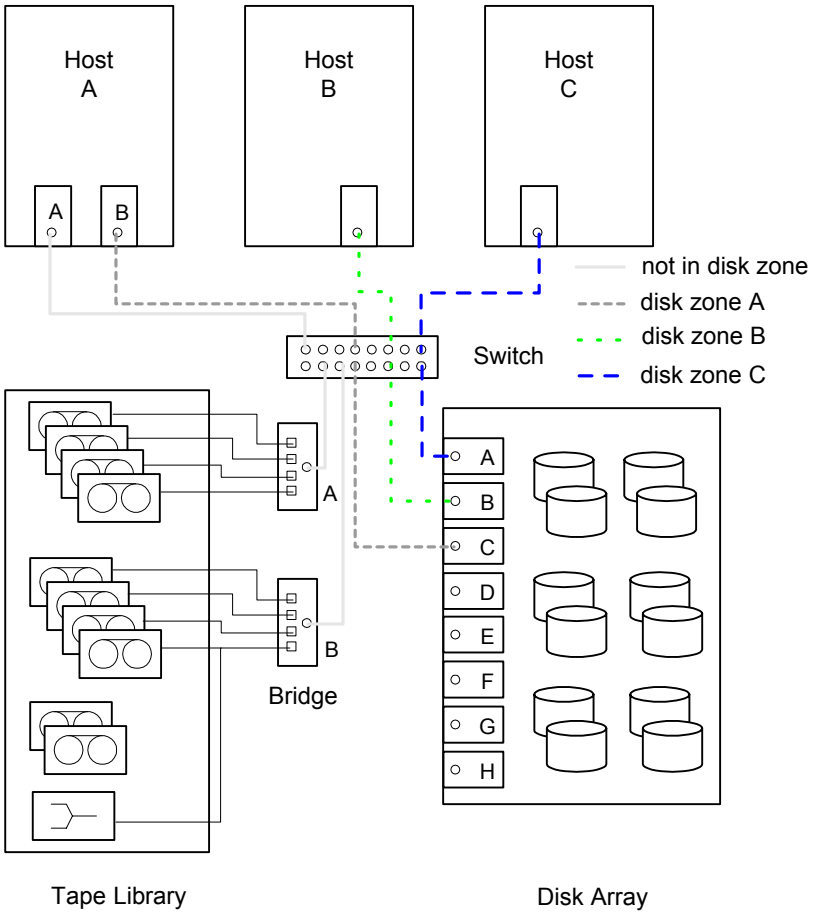


Figure 14 – Disk and tape support using separate and common HBAs (disk zones)

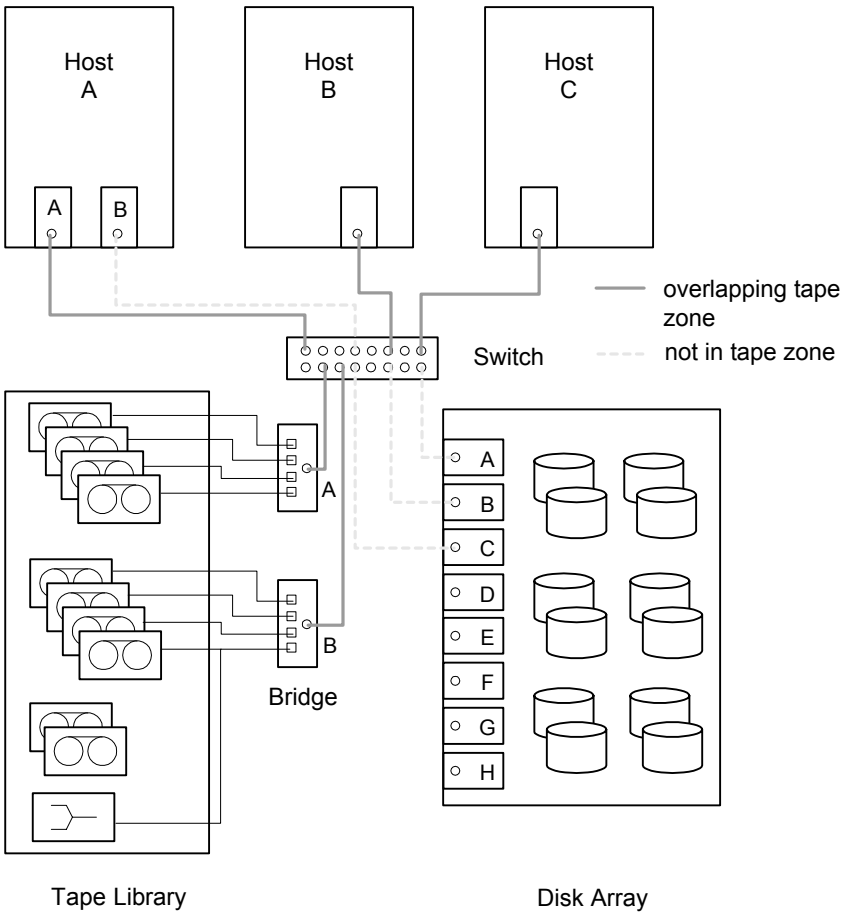


Figure 15 – Disk and tape support using separate and common HBAs (tape zone)

Zone	Hosts or Devices
Disk Zone A	Host A (HBA B), Disk C
Disk Zone B	Host B, Disk B
Disk Zone C	Host C, Disk A
Overlapping Tape Zone	Host A (HBA A), Host B, Host C, Router A, Router B

Supported Disk Arrays

The following disk arrays are supported for disk and tape SAN configurations using either separate or common HBAs. The operating systems supported for these configurations are listed as well. All tape libraries and SAN backup components are supported for disk and tape configurations.

Disk Array	Operating Systems
XP1024	HP-UX 11.11, 11.0, &10.20; Windows NT 4.0, Windows 2000; Solaris 2.6, 7, 8; AIX 4.3.3; Netware 5.x
XP256	HP-UX 11.11, 11.0, &10.20; Windows NT 4.0, Windows 2000; Solaris 2.6, 7, 8; AIX 4.3.3; Netware 5.x
XP48/XP512	HP-UX 11.11, 11.0, & 10.20; Windows NT 4.0, Windows 2000; Solaris 2.6, 7, 8; AIX 4.3.3; Netware 5.x
VA7100	HP-UX 11.11, 11.0, & 10.20; Windows NT 4.0, Windows 2000; Solaris 2.6, 7, 8; AIX 4.3.3; Netware 5.x
VA7400	HP-UX 11.11, 11.0, & 10.20; Windows NT 4.0, Windows 2000; Solaris 2.6, 7, 8; AIX 4.3.3; Netware 5.x
FC60 (Windows version)	Windows NT 4.0, Windows 2000
EMC Symmetrix 3000, 5000, and 8000	HP-UX 11.11, 11.0, & 10.20; Windows NT 4.0, Windows 2000; Solaris 2.6, 7, 8; AIX 4.3.3; Netware 5.x

Note -- All limitations for the above disk arrays must be followed for disk and tape SAN configurations. This includes cascading, zoning, and heterogeneous platform support. Check the appropriate ordering and configuration guide of the disk array for details.

High Availability Configurations

Typical high availability and cluster configurations for online storage include multiple paths to the disk array. This provides redundant I/O paths and maintains system uptime if a path fails. There is currently no capability like this for tape configurations. Currently, only a single path can be used between any host and tape device or tape library controller.

Multi-path disk array configurations typically utilize a special driver on the host. This driver recognizes two views of the same disk array, presents only one device image to the host, and provides a fail-over capability between them. This type of functionality would need to be developed for tape devices either in a device driver or within the backup application for a redundant-path capability to be present.

Error recovery provides an additional hurdle for this type of configuration. When a disk I/O such as a read or write to a logical block fails, the host can simply retry the I/O. In this case, the device driver switches

over to a different path when it sees the first attempt fail and the whole process is transparent to the application writing or reading the data.

For tape backup it is not as simple. Because the tape drive is a very state-full device, additional information is needed on how the I/O failed in order to recover properly. For example if a write command sent to a tape drive fails, one possible condition might be that the tape device did not receive the command. If that were the case, the host would simply resend the command. Another possibility might be that the tape device received the command, executed it, but then failed to send status back to the host. In this case, the tape would need to be rewound to a specific point that is prior to the failure, and the sequence of writes restarted from there. Similar issues exist when sending positioning commands to a tape drive such as forward or rewind.

FC-TAPE adds error recovery protocols to the fibre channel standard (FCP-2) to address these issues, but they are limited to work for a single HBA in a host. In order to have a backup automatically fail-over between two HBAs on the same host, further development needs to occur within the tape driver and backup application.

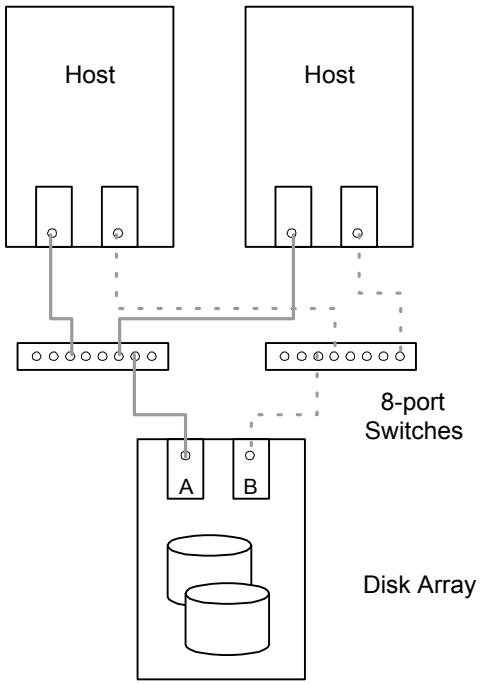


Figure 16 – Typical multi-path configuration for disk

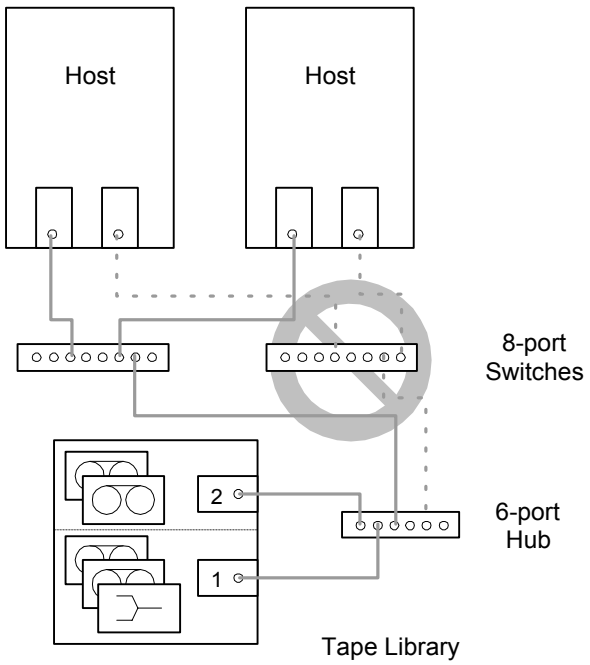


Figure 17 -- No multi-path fail-over capability for tape

Backup for cluster configurations may be deployed utilizing either separate switches or common HBAs as described in the previous section. However, these configurations do not provide a fail-over path for tape or tape libraries.

In order to use separate switches, the configuration requires installing an additional HBA in each server, and a separate switch, as shown in the following diagram. Again, this option provides better performance for applications with large storage and/or short backup window requirements.

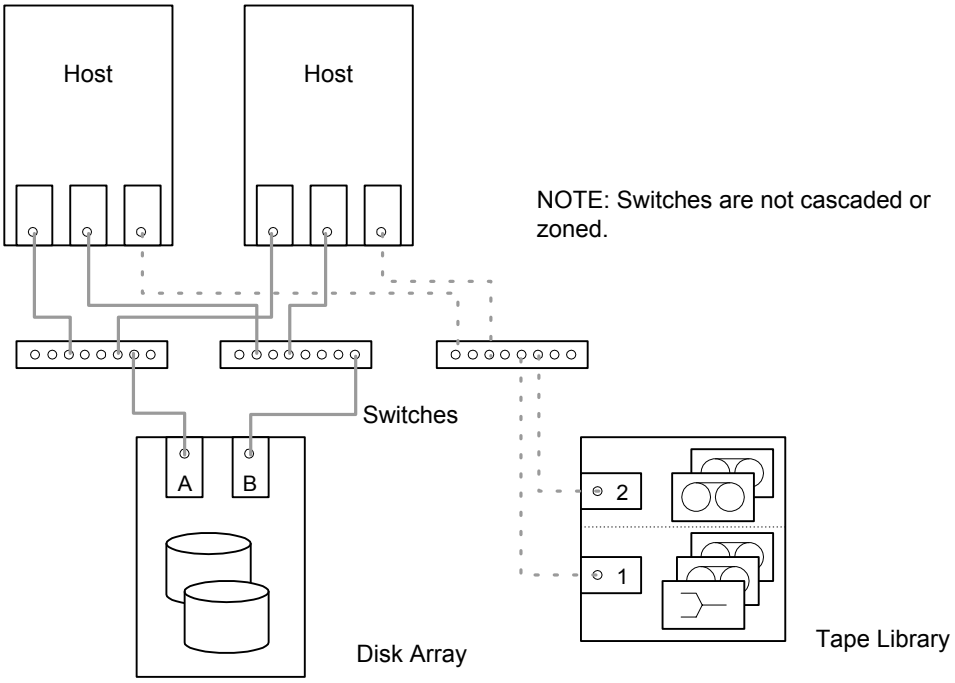


Figure 18 – Cluster configuration with separate switches for disk and tape

In addition, configurations may be deployed using a common HBA for disk and tape. In these configurations, multiple HBAs and switches are used to provide fail-over and redundancy for the disk subsystem. One of the HBAs and switches are shared for tape access. The following diagram provides an example.

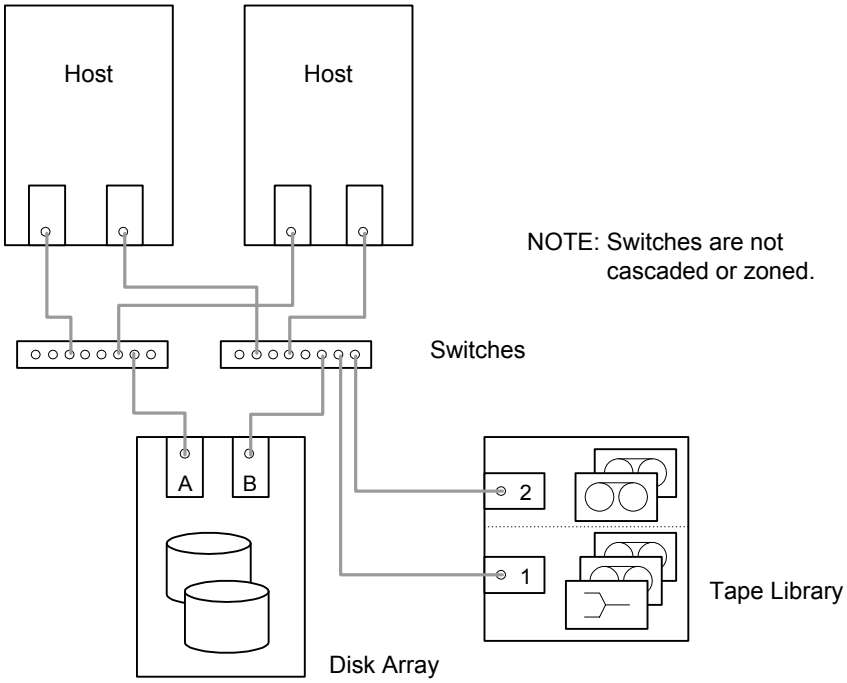


Figure 19 – Cluster configuration with a common HBA for disk and tape

Backup for MC/ServiceGuard configurations may be deployed using standard backup software, such as HP Omniback II or Veritas Netbackup without installing and configuring Advanced Tape Services (ATS). In this case, the backup software instead of ATS provides all backup functionality including sharing and fail-over. This is the only option for MC/SG configurations participating in a multi-cluster or heterogeneous SAN environment.

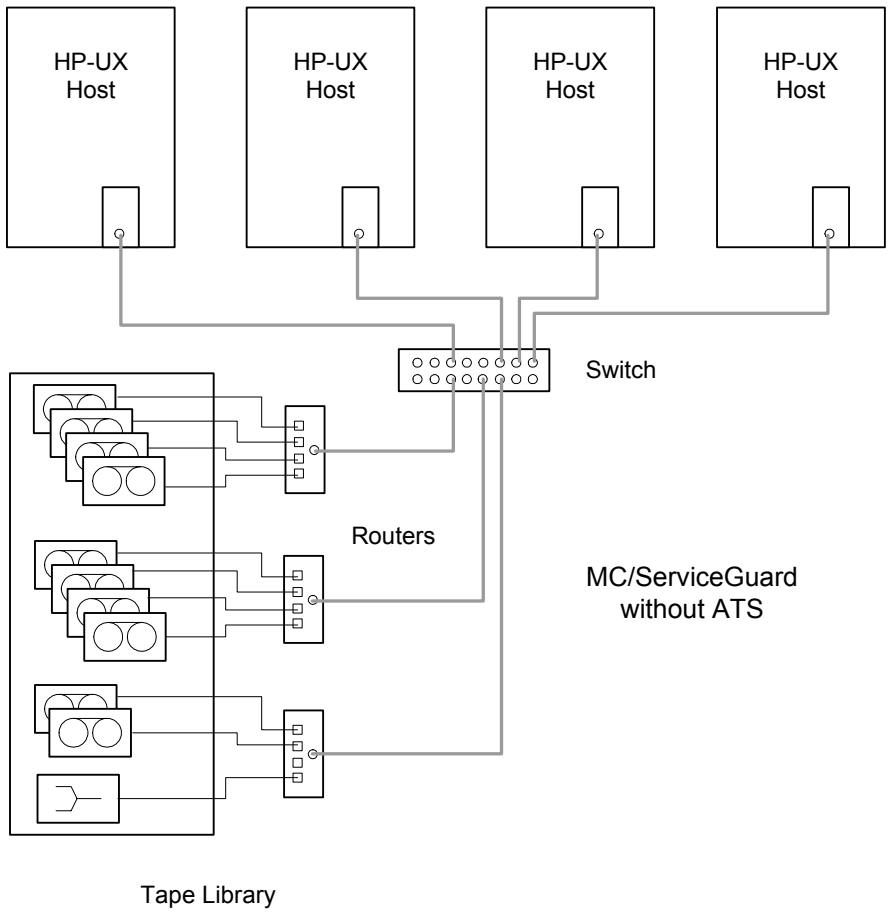


Figure 20 – Backup for a 4 node HP-UX MC/ServiceGuard Cluster

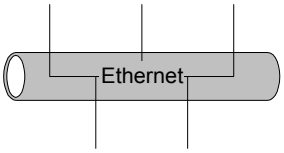
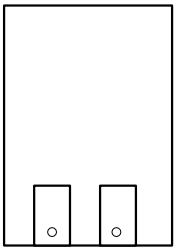
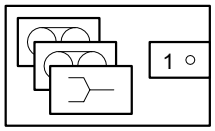
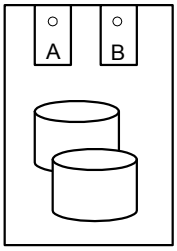
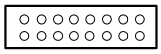
Backup Sizing and QuickSpecs - Backup Solutions

For information on capacity sizing tape library backup devices, see the backup sizing tool at HP Backup Sizing Tool.

For information on tape library part numbers and related interfaces and components, see the HP Storage Quickspecs.

Diagram Legend

Table 7 – Diagram Legend

Symbol	Description	Symbol	Description
	Ethernet LAN		Host with two FC host bus adapters
	2/20 Tape Library with one FC interface card		Host Bus Adapter
	Tape Library Controller (robotics)		Fibre Channel connections
	Tape Drive		SCSI or LAN connection
	Disk Array with two FC controllers		16-port FC Switch