hp storage solutions

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invent

technical blueprint

hp StorageWorks mid-tier consolidation

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executive summary

This paper presents an HP storage consolidation technical blueprint for building mid-tier storage solutions. Technical blueprints are the second tier of HP solutions blueprints, with the business blueprints being the first tier. For access to the consolidation business blueprint, visit www.hp.com/go/hpstorage_blueprints. Using this blueprint, customers can consolidate their storage into a shared and centrally managed pool that makes more efficient use of their storage. Storage management can be done system wide from a single management station. In addition, the management tools allow easier and more efficient tape backup procedures. As a result, customers realize reduced IT administration expense, higher system availability, and better support for their Service Level Agreements (SLAs).

Offering storage solution blueprints is how HP defines a configuration for a specific storage problem and provides all the information necessary to implement it. A blueprint represents a fully tested and supported configuration, orderable as a set of individual components from the HP standard price list. Recognizing that one size does not fit all, guidance on flexibility and scalability is given—ranging from minor changes listed in the blueprint itself, to referenced design and consultancy services for total flexibility. Standard product support is provided for each component in a blueprint configuration, and optional design, build, integration, and enhanced support services are also available from HP. Overall, the customer's experience is a quicker time to solution, without the limits of a fixed-product bundle.

This blueprint includes the Storage Area Network (SAN) design rules and presents an example solution with a logical view, a physical view, and a bill of materials. Specifications are supplied for the solution components. Figure 1 presents a logical view of the mid-tier consolidation solution. Additional technical blueprints are available to build HP tested and supported consolidation solutions. See the "for more information" section for a list of these blueprints.

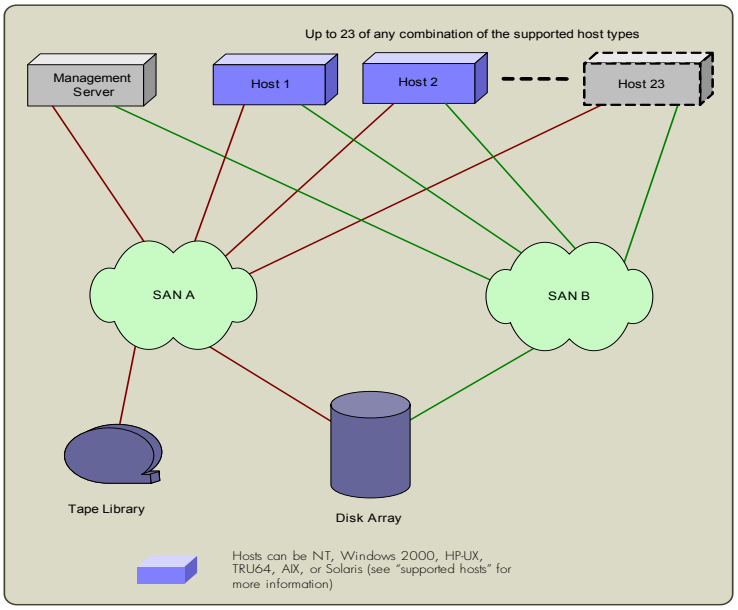

figure 1. mid-tier consolidation solution: logical view

business needs

Businesses today must capture and manage a rapidly expanding amount of digital information. In some cases information is the business, and its access and availability are critical to the business's success. In the "always-on" world of the Internet, lack of access to data can spell disaster.

Servers with direct attached storage have proven to be difficult to manage in a cost-effective way. Businesses often face the need to provide reserve storage capacity to be able to respond to unpredictable storage demands to avoid business disruption. IT resources are challenged to manage the storage requirements of each individual server and application. Adding storage capacity often requires taking hosts offline, decreasing the availability of applications and data to the end users.

An HP mid-tier consolidation solution provides customers solutions to these storage challenges. It enables customers to manage their storage resources in an efficient and cost-effective way, providing the following benefits:

- Improved utilization of storage resources, minimizing the need to maintain surplus storage to meet unexpected demand, thereby lowering the overall cost of storage.
- Improved data availability through the use of redundant data paths between hosts and storage.
- Capacity that can be expanded live, or online, providing storage where and when it is needed, without disrupting business activity.
- A central pool of storage that can be managed as a single unit, reducing the demand for IT resources.
- Increased data access as multiple hosts can access and share data.
- Data protection through offline storage to aid in rapid disaster recovery.
- A trusted, experienced partner that can help, as needed, in the design, implementation, operation, and evolution of your networked storage environment.

solution design and design rules

The Fibre Channel network infrastructure allows storage devices to be shared across heterogeneous hosts. A management server provides a single console to manage data backup and restore. A SAN Management Appliance manages the networked storage.

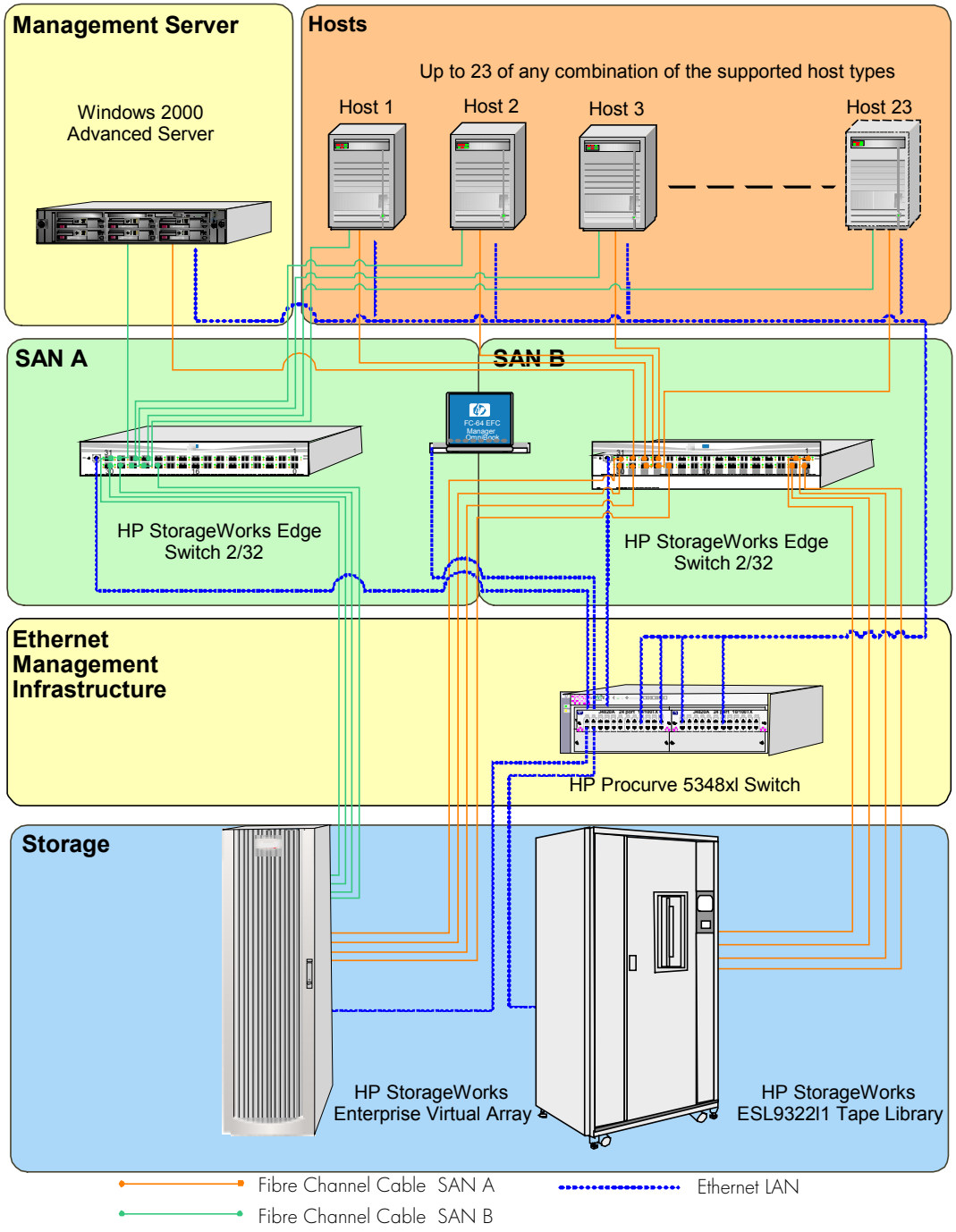

figure 2. example mid-tier consolidation solution: physical view

The Ethernet switch provides important LAN connectivity for out-of-band SAN component management. For example, host-based agent software can be downloaded from the management server using the Ethernet connection. See the "bill of materials" section for specific component information.

The example consolidation solution illustrated in this blueprint can be modified to meet specific customer needs. For guidance on this flexibility, review the following assumptions and design rules. This information is intended as a guide in configuring a specific solution to meet customer storage requirements.

assumptions:

array

- Enterprise Virtual Array (EVA) 2C6D-B is fully loaded (84 disks in six enclosures).
- Usable disk capacities are calculated with the EVA in Vraid 5 mode with Protection Level 2.

tape

- Incremental backups occur four days a week for each server.
- Full backups for each server are staggered throughout the week, occurring every fifth day in the backup cycle. A daily backup cycle takes no more than 8 hours.
- One full backup is retained for each server.
- Access to a tape library is not highly available (HA). There is a single logical path to the library.

Fibre Channel infrastructure

- The HP StorageWorks Edge Switch 2/32 provides both flexibility and expandability as requirements grow. The switch provides connectivity on demand through FlexPort technology in 8-port increments. End-users can start with a partially populated switch (16 ports) and pay for the additional connectivity when needed (in 8-port increments).

design rules:

- The consolidation solution can accommodate 1 to 23 hosts of any of the supported types (see the "supported hosts" section).
- A total of 14 Fibre Channel switch ports are used for the management server, the EVA, and the HP StorageWorks ESL9322 Tape Library. A maximum of 23 hosts can be supported with the remaining switch ports.
- All backup data flows are over the SAN, not the network, which achieves greater speed and reduces network traffic.
- If using 36.4-GB drives in the EVA, HP recommends an ESL9322 Tape Library with five Ultrium drives.

This is the configuration used in the example SAN solution.

Usable capacity: about 2.4 TB
Required number of Ultrium cartridges: 120

- If using 72.8-GB drives in the EVA, HP recommends an ESL9595 Tape Library with 12 Ultrium drives.
  Usable capacity: about 4.9 TB
  Required number of Ultrium cartridges: 230

component review

HP StorageWorks Edge Switch 2/32 Delivers the performance of 2-Gb technologies and the ability to support larger fabric implementations		• Auto sensing 1-Gb/s or 2-Gb/s ports • Scalable in 8-port increments, 16 to 32 ports • Redundant power supplies and fans • Seamless interoperability with other HA fabric switches and directors
HP Procurve Switch 5348xl Offers best in class for price, features, performance, quality, and ease of use		• 48 10/100Base TX ports preinstalled, expandable up to 96 ports • Optional redundant power supply • Optional 4-port Gigabit (optical) module
HP StorageWorks ESL9322l1 Tape Library Provides a highly reliable backup and restore solution for mission-critical data storage requirements		• Up to 32.2 TB native storage capacity • Hot-swappable redundant power supplies and fans • Up to 8 hot-pluggable Ultrium 230 drives • Native transfer rates up to 432 GB/hr • Up to 322 slots
HP StorageWorks EVA Offers an enterprise class, high performance, high capacity, and high-availability Vraid storage solution		• Model 2C6D-B up to 6.2 TB (raw) • 2-Gb/s end-to-end Fibre Channel technology in 2-Gb/s Open Fibre Channel SAN networks • State-of-the-art controller software, with VersaStor-enabled virtualization technology • Available drive capacities: 36.4 GB, 72.8 GB

For more information on HP storage products, visit:
www.hp.com/country/us/eng/prodserv/storage.html

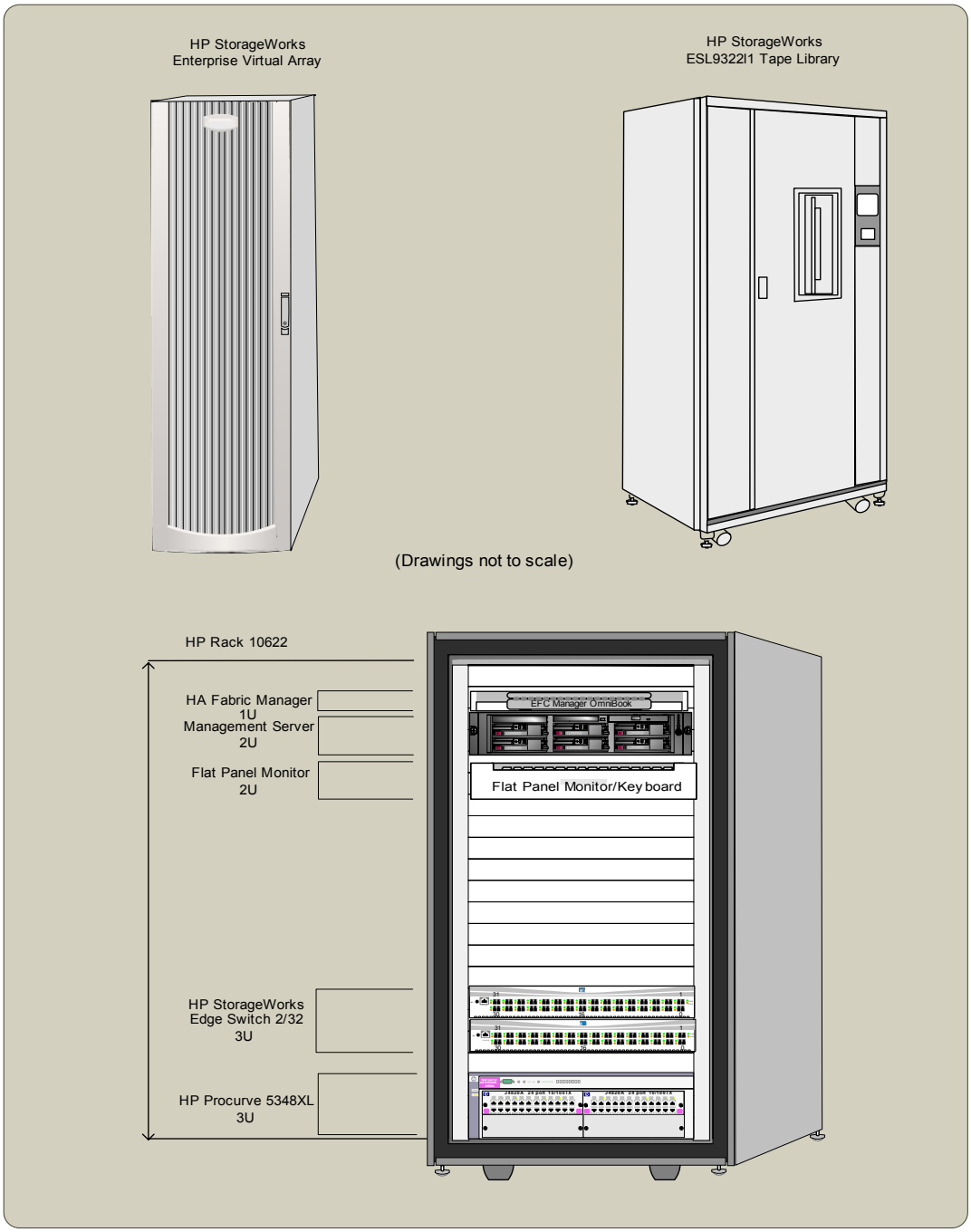

figure 3. example mid-tier consolidation solution rack

This consolidation solution can be racked to minimize space at a customer's site. Figure 3 shows solution components racked in an HP Rack 10622. A flat panel monitor is included for use with the management server. Multiple servers in the same rack can use this same monitor by adding a console switch. For EVA '-B' models, a 41U Graphite Utility Cabinet (289191-2x) is available to rack supporting equipment and other solution components.

supported hosts

supported hosts and Fibre Channel host bus adapters (HBAs)

Windows NT 4.0	Windows 2000	HP-UX 11.0	Tru64 UNIX 5.x	AIX 4.3.3	Solaris 2.6, 7, and 8
FCA-2101 KGPSA-BC KGPSA-CB	FCA-2101 KGPSA-BC KGPSA-CB	A5158A	KGPSA-BC KGPSA-CA FCA-2354	197819-B21	FC1063 (32-bit PCI) SWSA4-SB,SC (32-, 64-bit Sbus) SWSA4-PC (32-bit PCI)

interconnect

SAN Fibre Channel infrastructures

features	hp StorageWorks edge switch 2/32
number of ports	16/24/32
per port line speed	1.0625/2.125 Gb/s, Full Duplex

supported hosts

disk storage

storage device	MA8000		EMA12000 S14		EVA-2C6D-B	
number of enclosures	3		6		6	
number of disks	42		84		84	
disk drive size	36.4 GB	72.8 GB	36.4 GB	72.8 GB	36.4 GB	72.8 GB
total usable capacity	1.4 TB	2.8 TB	2.4 TB	4.8 TB	2.4 TB	4.9 TB
maximum storage capacity (raw)	3 TB		6.2 TB		6.2 TB	

Note: Shaded areas represent hardware used in example technical blueprint configuration.

Note: MA800 and EMA12000 disks use RAID 5 with two hot spares; EVA uses Vraid5, Protection Level 2.

tape storage

features	ESL9322		ESL9595	
drive type	LTO Ultrium	SDLT	LTO Ultrium	SDLT
number of drives	1–8	1–8	1–16	1–16
number of slots	222/322	222/322	400/500/595	400/500/595
maximum storage capacity (native)	32.2 TB	51.5 TB	59.5 TB	95.2 TB
max native data transfer rate (fully loaded)	120 MB/s 432 GB/hr	128 MB/s 460.8 GB/hr	240 MB/s 864 GB/hr	256 MB/s 921.6 GB/hr

Note: Shaded areas represent hardware used in example technical blueprint configuration.

management

SAN management server

model	memory	operating system	internal RAID	HBA
ProLiant DL380 G3	512 MB	Windows 2000 Advanced Server	Smart Array 5i Controller (Built-in)	FCA-2101

out-of-band SAN management—Ethernet switch

features	HP Procurve Switch 4000	HP Procurve Switch 5348xl
number of ports	Up to 80	Up to 96
speed	10/100 Mb/s	10/100 Mb/s
management capable	√	√
Note: Shaded areas represent hardware used in example technical blueprint configuration.		

management software components

software name	management server	SAN appliance	host agent software	description/notes
HP OpenView Storage Management Appliance software		√		Provides a Web-based aggregation and entry point for centralized storage management. Included with the HP OpenView Storage Management Appliance.
HSV Element Manager for StorageWorks EVA		√		Provides the Web-based management interface for Virtual Controller Software (VCS) and HSV110 array controllers. Included with the HP OpenView Storage Management Appliance.
HP StorageWorks Secure Path	√		√	Secure Path effectively eliminates controllers, disk drives, interconnect hardware, and HBAs as single points of failure in the storage subsystem.
VERITAS NetBackup	√		√	Enterprise-class backup and recovery, with intuitive graphical user interfaces enabling organizations to manage all aspects of backup and recovery.

synergy of components

The Edge Switch 2/32 offers availability features not found in any other switch, including redundant power supplies; hot-plug optics; and online, non-disruptive firmware load (post-2.0 firmware release) and activation, making them ideal for supporting medium to large infrastructure implementations. Key features include:

- Available: incorporates hot-plug, redundant power supplies and fans and hot-plug optics
- High-performance: supports 2-Gb/s transfer with no head-of-line blocking for highest performance
- Cost-effective: integrates into 1-Gb and 2-Gb director/edge fabrics

Designed to accommodate the most demanding network needs, the HP Procurve Switch 5300xl series delivers the fastest layer 2/3/4 switches for the price of competitor's layer 2 modular switches. The Switch 5300xl series offers scalable, layer 3 wire-speed switching in compact, 4- or 8-slot modular form factors.

- Increased productivity with wire-speed data exchange: 48 mpps (5372xl and 5308xl) or 24 mpps (5348xl and 5304xl)
- Layer 2/3/4 switch; 76.8-Gb/s non-blocking crossbar switching fabric

The ESL9322 Tape Library provides a highly reliable backup and restore solution for mission-critical data storage requirements of high-end enterprise customers, providing component level redundancy, high availability, enterprise level capacity, and LTO Ultrium drives in a compact footprint, for direct SCSI and SAN environments.

- Up to eight HP LTO Ultrium 230 tape drives
- Based on a PCI backplane architecture, the ESL9000 family provides a simple upgrade path for future "plug-in" features

EVA is designed for the data center where there is a critical need for improved storage utilization and scalability while meeting application-specific demands for consistently high transaction I/O and MB data rate performance, seamless capacity expansion, instantaneous replication, and simplified storage administration.

- Outstanding self-tuning performance ensures consistency in meeting application SLAs, allowing users or clients to accomplish more in less time, scale capacity on-demand, and minimize data administration overhead.
- VersaStor-enabled virtualization technology helps improve performance, increases disk utilization efficiency, and allows for easy dynamic storage expansion, which helps lower costs.
- With VCS v2.0a code, all EVA models are 2-Gb/s Fibre Channel Switched Fabric (FC-SW) enabled and can operate on 2-Gb/s or 1-Gb/s FC-SW SANs. They can co-exist in the same Fibre Channel SAN with MA6000/MA8000/EMA12000/EMA16000 and RA8000/ESA12000 Fibre Channel storage solutions.

scaling–growth–flexibility

The example SAN can be grown to support additional hosts, storage arrays, and tape libraries if required. For specific guidelines on selecting the appropriate components, consult your HP sales representative or channel partner. Answers to frequently asked questions are provided in the following sections.

What happens if I run out of disk space?

- The modular design of the EVA allows storage enclosures and controllers to be scaled as needs change. The controller and drive enclosures are independent of each other to allow for a wide range of configuration options. This flexibility offers both high-capacity and high-performance configurations. A fully configured EVA storage system supports up to 168 drives installed in one cabinet for a maximum capacity of 12.3 TB, using 72.8-GB drives. By adding an expansion cabinet, 240 drives can be used, providing 17.5 TB of storage when using 72.8-GB drives. Additional capacity is achieved by adding up to 15 additional EVA systems to the SAN (16 EVAs in any one fabric).
- The dual HSV110 controllers in an EVA can support up to 512 virtual disks ranging in size from 1 GB to 2 TB, with multiple Vraid types within a single storage pool. Virtualization enables administrators using the EVA to monitor the capacity usage of a volume or storage pool and dynamically allocate capacity in 1-GB increments to either as is needed.
- Tape backup capacity can be expanded using hot-plug drive trays for online drive additions. The ESL9322 Tape Library supports up to eight drives per unit.

What if I want to add more servers?

- The common architecture shared between HP StorageWorks directors and edge switches means seamless interoperability, allowing you to expand your fabric while maintaining the required performance and availability. Discuss your requirements with your HP representative to determine what configuration of director and edge switches best meets your needs.
- VCS supports a maximum of 512 LUNs presented to the hosts, allowing the user to build and manage larger SANs by attaching to up to a maximum of 256 host connections (up to 1024 HBAs). Host port connection support is operating system specific. Consult the EVA installation and configuration guides for details.

How can I increase storage resilience or availability?

- EVA redundant architecture and value-added software eliminates single points of failure from server to storage in clustered or single server configurations with multi-pathing. Dual and multi-node cluster support is provided for host level fault tolerance and high system availability.
- Redundant drive enclosure power supplies, blowers, controllers, cache battery backup, distributed hot spare disks, and a multi-level Vraid architecture (Vraid0—no redundancy; Vraid1—high redundancy; and Vraid5—medium redundancy levels) ensure fault tolerance against system outages and data loss. Drives and most solution components are hot swappable.
- With the optional snapshot controller software, two types of snapshots—Standard and Virtually Capacity-Free (Vsnaps)—are supported by VCS. In a Virtually Capacity-Free Snapshot, the storage system does not reserve capacity for the snapshot volume in advance. This can save customers significant disk space and improve disk utilization efficiency.

How can I increase the intelligence of my storage system to automate tasks and increase visibility and control?

- The Storage Management Appliance optimizes SAN availability and performance while streamlining manageability by enabling policy-based automation of repetitive storage management tasks. It provides an intuitive, Web-based interface and storage management aggregation point enabling the user to organize, configure, visualize, monitor, and provision storage from anywhere, anytime.

How can I enhance my support options?

- See the "hp services" section for a description of available support offerings from HP.

high availability—disaster recovery/disaster tolerance

- HP StorageWorks Enterprise Volume Manager (EVM) is Management Appliance-based application software that manages controller-based replicated volume operations. Clones, snapclones, and snapshots are replicated volumes that can be used to virtually eliminate the application downtime traditionally required for system backups as well as facilitate other data center tasks.
- Dual and multi-node cluster support is provided for host-level fault tolerance and high system availability. TruClusters support is provided on Tru64 UNIX; VERITAS Cluster 1.3 support and SUN Cluster 2.2 support is provided on SUN Solaris; Microsoft Cluster Server (MSCS) is provided on ProLiant servers and other x86 platforms for Microsoft Windows NT 4.0 Enterprise Edition and Windows 2000 Advanced Server; and HACMP 4.4 is supported on IBM AIX. MSCS requires the use of Secure Path 4.0. Formal MSCS HCL certification (with Secure Path 4.0) is pending. MC Service Guard currently is not supported on HP-UX.

solution-specific configuration

The following is a listed bill of materials (BOM) representing the major hardware and software used in the example consolidation solution in this blueprint. Required cables, HBAs, and other necessary items have not been included. For assistance, contact your HP sales representative. To explore other tape backup configurations, see the EBS Sizer application at www.hp.com.

bill of materials

bill of materials

management server		
quantity	**part number**	**description**
1	257917-001	HP ProLiant DL380 G3
4	286713-B22	36.4-GB 10,000-rpm, U320 Universal 1-inch hard drive
2	245299-B21	FCA-2101
disk storage: EVA 2C6D-B		
quantity	**part number**	**description**
84	238590-B21	Fibre Channel 36 GB 10K 2 Gb/s
4	Fibre to Hub/ Switch LC	Connection from Storage to FC Hub/Switch
1	283198-B21	EVA 2C6D-B 60Hz (41u Graphite with backend FC loop switches)
1	250203-B24	VCS PKG DUAL HSV2.0A
1	253256-B22	VCS V2.0 Snapshot software (up to 3.1 TB)
1	263670-B22	EVM V2.0D Starter Kit (server software and five host agents)
1	263671-B22	EVM V2.0D additional EVM server license
1	263673-B22	EVM V2.0D 10 additional host agent licenses
tape storage: ESL9322L1		
quantity	**part number**	**description**
1	301927-B22	ESL9322L1 222 slot 2 LTO Ultrium 230 Drive Enterprise Library
3	301930-B21	ESL9000 LTO Ultrium 1 Upgrade Drive
120	C7971A	HP Ultrium data cartridge
1	C7978A	HP LTO Ultrium universal cleaning cartridge
1	262653-B21	2 FCx4 LVD SCSI
1	262659-B21	LVD Module Option Kit
1	262661-B21	FC Module Option Kit

figure 4. example mid-tier consolidation solution BOM

storage interconnect		
quantity	**part number**	**description**
2	286810-B21	HP StorageWorks Edge Switch 2/32
2	189715-002	SANworks Management Appliance II
software		
quantity	**part number**	**description**
1	203828-001	EBS with VERITAS NetBackup Solution Kit
1	231292-B22	SANworks Secure Path for Windows, 5 licenses
1	231300-B23	SANworks Secure Path for Sun Solaris, 5 licenses
1	231312-B22	SANworks Secure Path for AIX, 5 licenses
1	261706-B22	SANworks Secure Path for HP-UX, 5 licenses

figure 4. example mid-tier consolidation solution BOM (cont.)

why hp

HP provides a tested and supported end-to-end solution built with world-class components, supported by a single point of contact—HP. With a service and support organization of 5,000 storage service professionals in 160 countries, expert and responsive support is readily available. With a broad portfolio of storage-specific services, HP offers customers the peace of mind that comes from knowing that their solution works right now and can expand into their future with them.

HP consolidation solutions offer the most scalable configuration—low/mid-range to enterprise-class storage—on the market. The solution can be scaled up and out to grow with customer needs, providing return on investment today and tomorrow. By offering the broadest range of operating system and HBA support, your solution works in your heterogeneous IT environment.

for more information

consolidation solutions

For additional HP Consolidation Solution technical blueprints, visit:

www.hp.com/go/hpstorage_blueprints

Mid-range SAN (EMA/EVA)
Mid-range SAN (VA)
Enterprise SAN (XP)

For more business-level information on the benefits that consolidation can bring your company, take a look at the consolidation solution business blueprints:

Storage Efficiency Consolidation

To get answers on further solution implementation questions, contact your HP sales representative who will consult our regularly updated interoperability matrices and provide guidance on additional operating system, fabric topology, and third-party/legacy device interoperability.

hp SAN components

To get further information on the individual components in an HP SAN, visit:

www.hp.com/go/SAN

hp services

A full range of storage services are available including design, integration, data migration, support, and services to help you evolve your SAN as needs change. For full details, contact your HP sales representative or visit:

www.hp.com/hps/storage

The following services are available.

design and implementation services

We provide our expertise and experience to assist you in creating your SAN architecture and design. HP also offers storage/SAN integration services, which provide a trouble-free and quick on-site installation of your SAN solution. We also provide additional services in critical areas such as SAN management, data protection, and recovery.

data migration services

We offer a stress-free data migration from mission-critical HP-UX, Windows NT/Windows 2000, SUN legacy, and EMC storage systems to the HP StorageWorks SAN platform based on an end-to-end management of the entire data migration process.

operate and evolve services

Services range from reactive hardware and software support (8 x 5, 3-day response to 24 x 7, same-day response with 6-hour Call-to-Restoration commitments) to comprehensive, proactive mission-sensitive and mission-critical environment support. To help you evolve your storage environment, HP analyzes the performance and capacity usage of your storage environment including all major system components. A detailed performance and capacity report with recommendations on how to tune your performance and optimize your capacity usage is provided.

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