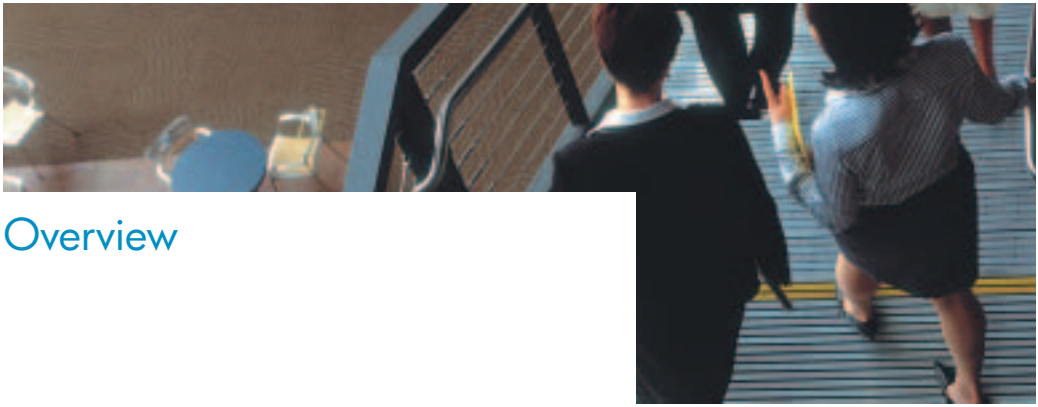
My First SAN solution guide

2nd edition

invent



Overview

Digital information is a critical component of business today. It not only grows in volume continuously, but increasingly it has to be available right around the clock. Inability to access your information – when running a system backup, for example – is no longer an option.

Add to that a shrinking IT budget, and you're presented with a real challenge. How do you provide efficient storage, management and availability of your data?

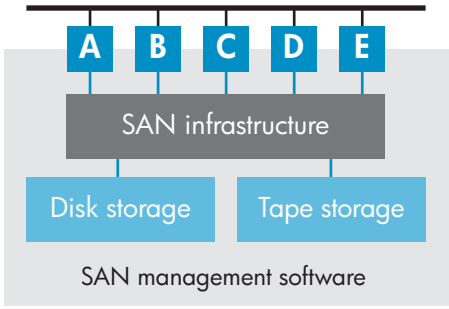
The solution can be found in a highly flexible, intelligent and easy-to-manage storage solution, that is also cost-effective. The storage area network.

How can this guide help?

Storage area networks (SANs) are regularly perceived as being suitable only for companies with vast budgets and specialist IT knowledge. This is not always the case. This solution guide will demonstrate that they are a truly viable option for all types and sizes of business. We'll look at:

- What a SAN is and whether you need one.
- A breakdown of the key hardware and software components of a SAN.
- The technologies and techniques HP provides within its SAN offering.
- An overview of the HP product portfolio.
- A selection of typical solutions to help you assess what's best for your needs.
- A simple decision tree to help you choose the right solution.

A typical SAN



A - E Multiple servers

Ethernet LAN cabling

Fibre-channel cabling

What is a storage area network?

The simplest way of understanding a storage area network is to compare it to an already popular type of IT infrastructure solution – the local area network (LAN).

LANs enable multiple PCs to share key IT resources such as applications, servers, shared files and printers. SANs provide similar resource sharing, but are specifically designed for servers to share storage devices such as disk arrays or tape libraries.

What will it do for you?

If you need to store and manage growing amounts of data more efficiently, while simultaneously cutting operational and management costs, a SAN will bring you the following benefits:

- **Online scalability** – so you can add storage with ease to meet changing capacity requirements.
- **High levels of availability** – ensuring your data and applications are fully accessible at all times, even during backup.
- **Simple and centralised management** – saving you vital human resources.
- **High utilisation of disk capacity** – for improved cost efficiency and near-instant returns on your investment even in the event of component failure or during backup.
- **Faster data restoration** – to return your business to full productivity.

SAN components

As shown in the graphic on page 3, there are five basic components of a SAN:

1. Servers

Multiple servers, from different vendors, running different operating systems can all be connected to a SAN. The most common and proven way of doing this is with fibre-optic cabling, which uses a special fibre-channel card called a host bus adaptor (HBA).

Servers can be connected to a SAN with either a single or dual connection. A dual connection gives you a fallback should one connection fail.

Benefit of a SAN:
Allows multiple servers to share storage for greater efficiency and increased availability.

2. SAN infrastructure

The SAN infrastructure (or "fabric") comprises the hardware, cabling and software components that enable data to move into and within the SAN. Host bus adaptors and fibre-channel switches form the foundation, enabling servers and other storage devices to connect to each other.

Switches can detect failed or congested connections and intelligently reroute data to the correct device. And when linked together (cascaded), they increase the number of available SAN connections – providing greater performance and resilience against individual connection failures.

Benefit of a SAN:
Creates a high-performance, resilient infrastructure that can easily be modified as your needs change.

3. Disk storage

Disk (or RAID) arrays provide dedicated storage for servers. Data is written to multiple disks within the array, so if one disk fails, the data will still be accessible from another. Disk arrays provide high levels of fault tolerance; a modular design to grow capacity and performance; and shared access for different servers running different operating systems.

Benefit of a SAN:
Provides increased availability and capacity usage, plus simplified management, by consolidating data in a disk array.

4. Tape storage

Within a SAN, any disk storage (disk array or internal to a server) can be connected directly to a tape library via fibre channel. This provides a fast and dedicated pathway for data backup, and frees the corporate LAN to perform its primary functions with greater efficiency.

Modern SAN solutions can also perform serverless backup. This enables the backup-and-restore process to take place without data passing through the server, enabling users to dedicate more of their resources to business use.

Benefit of a SAN:
Reduces your backup window with centrally managed, high-performance tape backup.

5. Management software

Although it is often overlooked, the management software is perhaps the most important part of any SAN. It helps you configure and optimise individual components for the best setup. It can then monitor the entire network for performance bottlenecks and areas of potential failure.

It also automates time-consuming tasks such as data backup, and provides usage statistics that enable you to cross-charge SAN users. In addition, virtualisation functionality lets you manage all available storage as one virtual pool, regardless of where it's located.

Benefit of a SAN:
Enhances efficiency further by managing your consolidated storage from one location.

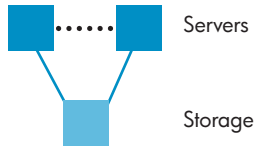
A SAN makes it easy to increase availability

Today's IT environments require increasingly high levels of availability at all times. SANs can offer 24x7 availability thanks to a fully redundant architecture. The following elements are building blocks for increased SAN availability.

Server clustering

Configuring two or more servers in a cluster provides the following advantages. It distributes processing requests evenly between servers in the cluster (load balancing). And it allows a recovery server to take over the operations of a primary server should failure occur.

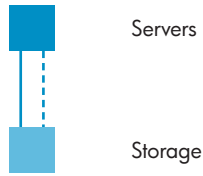
Clustered servers need access to the same data, which requires an external storage system. A SAN is recommended as it provides multiple storage connections and scalability to meet changing needs.



Multi-pathing

The connection between server and networked storage solution has several components – HBA, switch, cables, array controller. If one breaks, your connection will fail. Multi-pathing guards against this.

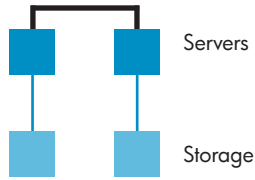
With redundant components, traffic can be swapped from one component to the other should a failure occur. HP StorageWorks Secure Path software detects failed connections and initiates automatic failover.



Storage replication

Storage replication maintains access to data – even if your entire storage system fails – by continuously copying it to a remote secondary array (e.g., at a second data centre).

While higher-end environments perform this directly between two disk arrays, smaller environments are more suited to replication between servers connected to a SAN over an IP network. This enables one-to-one, one-to-many and many-to-many replication, and data is synchronised in incremental blocks to minimise network traffic.



A SAN makes it easy to use different disk technologies

The optimum use of SATA disks versus SCSI/FC disks

SCSI disk technology is the right choice for entry-level networked storage, as it offers the same advantages that FC disks provide for large enterprise disk arrays. In addition, it offers a simple migration path from servers to SAN called DtS (DAS to SAN) – a unique HP feature explained on page 8.

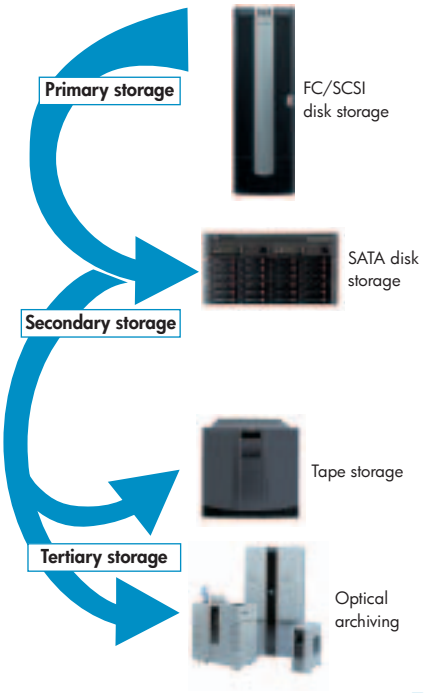
The introduction of Serial ATA (SATA) technology offers a new way of storing data within the MSA1500. Derived from the storage used in desktop PCs, its cheaper components provide a much lower cost per megabyte than SCSI or FC disks. However, as a consequence, its levels of performance and reliability are also lower.

That said, SATA is not intended as a replacement technology. SCSI or FC remains the first choice for reliable, high-performance application serving and storage. However, if you want cost-effective storage for infrequently accessed data – such as data repositories or reference information – then SATA is perfect.

Tiered storage environments

In a tiered storage environment, you can match your data to storage that has an appropriate level of performance and availability – giving you a lower cost of ownership, without any negative impact on your business. Here's how it could work in a typical disk-to-disk-to-tape environment:

- Data with the highest requirements is stored in tier one on SCSI/FC disks.
- The second tier stores near-online or infrequently accessed data (e.g., disk-to-disk backup copies) on SATA disks.
- Tier three comprises tape-based backup copies, or even archived data on optical storage.



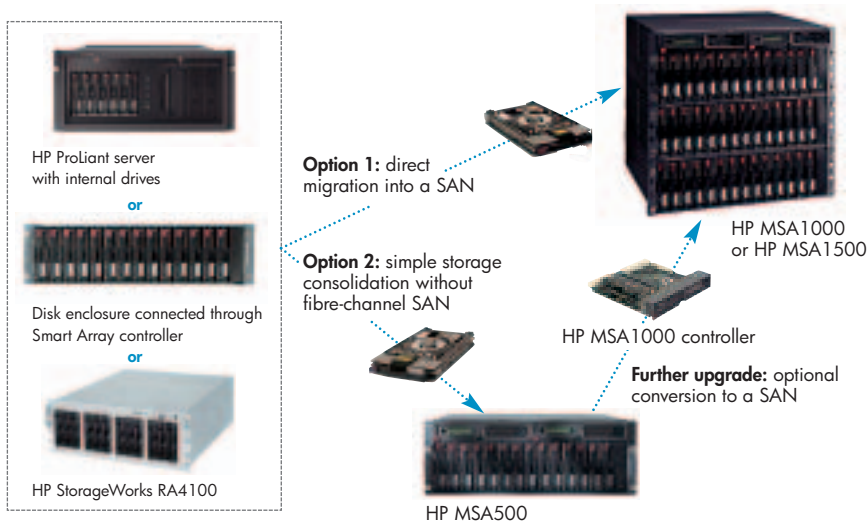
HP makes it easy to migrate data to a SAN

Direct Attached Storage (DAS) to SAN migration

With HP's unique DAS to SAN migration, you can move ProLiant-based (DAS) storage to a new MSA array quickly and easily. The same HP Smart Array technology used in your ProLiant server is used by the MSA to automatically recognise the configuration of your data – including RAID level – thus minimising downtime during migration. No other solution makes it this simple to consolidate your storage.

- **Investment protection:** re-use existing SCSI universal disk drives in your new MSA array.*
- **Simplicity:** Smart Array technology makes it quick and easy to access your data from its new location.
- **Flexibility:** migrate at your own speed with the MSA family. Start with simple external storage (MSA500), then move to a full SAN when you're ready.**
- **Familiarity:** the MSA family uses the same management tools as existing ProLiant systems, reducing training costs.

DAS to SAN migration with HP Smart Array technology



*Requirements: HP/Compaq universal disk drives Ultra2, Ultra3, Ultra320. For detailed process information on how to perform DAS to SAN migration, please visit: **www.hp.com/eur/myfirstsan**

**Simple upgrade/conversion: exchange the controller, then connect the array (with the embedded switch) and the servers (via FC HBA) to the network.

HP StorageWorks
Modular Smart Array family

The seamless portfolio for storage consolidation





	MSA20	MSA30	MSA500 G2	MSA1000	MSA1500
	Low-cost SATA disk enclosure	High-performance SCSI disk enclosure	Affordable external storage solution	Affordable starter SAN solution	Flexible, scalable SAN solution
Disk technology	SATA	SCSI	SCSI	SCSI	SATA or SCSI[1]
Scalability	Supports cascading for scalability to multiple TBs		Scale up to 2 TB	Scale up to 6 TB	Scale up to 24 TB (SATA) or 8 TB (SCSI disks)
Consolidation	Driven by server consolidation		Consolidate storage of up to 4 servers and/or one cluster	Enhanced storage consolidation in a fibre-channel SAN with multi-server clustering	
RAID management/ redundancy	1 controller in the server enables RAID management		Full redundancy with up to 2 array controllers	No single point of failure with redundant controllers and SAN	
Operating system support	Microsoft® Windows® Linux® NetWare Tru64 OpenVMS		Windows Linux NetWare	Windows Linux NetWare Tru64 OpenVMS HP-UX (limited)[2]	Windows Linux NetWare Future: HP-UX Tru64 OpenVMS
Other features	Can be used as an expansion cabinet for MSA1500	Can be used as an expansion cabinet for MSA1000 and MSA1500	Enables host-based virtualisation[3] and replication over IP in Windows environments. Embedded switch option on MSA1000		

[1] Mixed configurations (both SCSI and SATA) will be supported soon after launch.

[2] See the QuickSpecs at **www.hp.com/go/msa** for latest product details, including operating systems support.

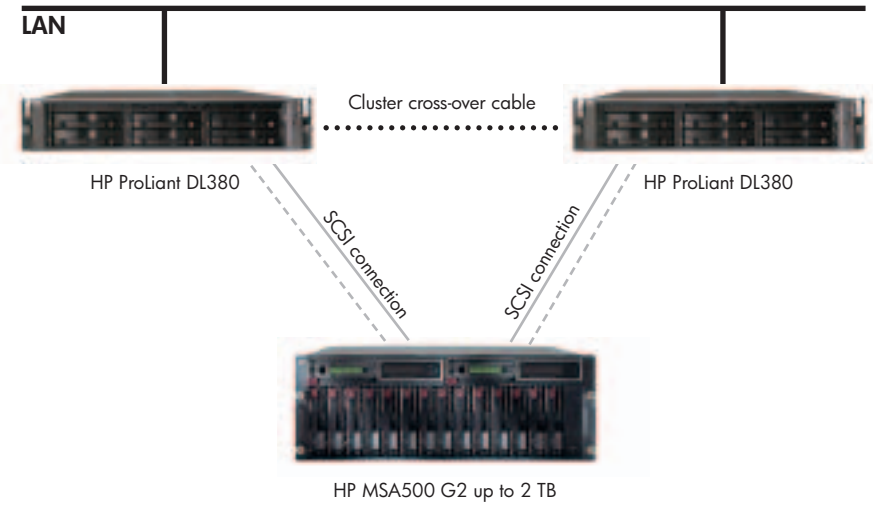
[3] Virtualisation: the ability to hide the complexity of a storage subsystem by presenting it to hosts as LUNs or volumes, instead of a series of discrete devices (see Q&A section).

Typical solutions for storage consolidation

The following examples show how customers have used storage solutions based on HP StorageWorks Modular Smart Arrays to solve their specific business challenges.

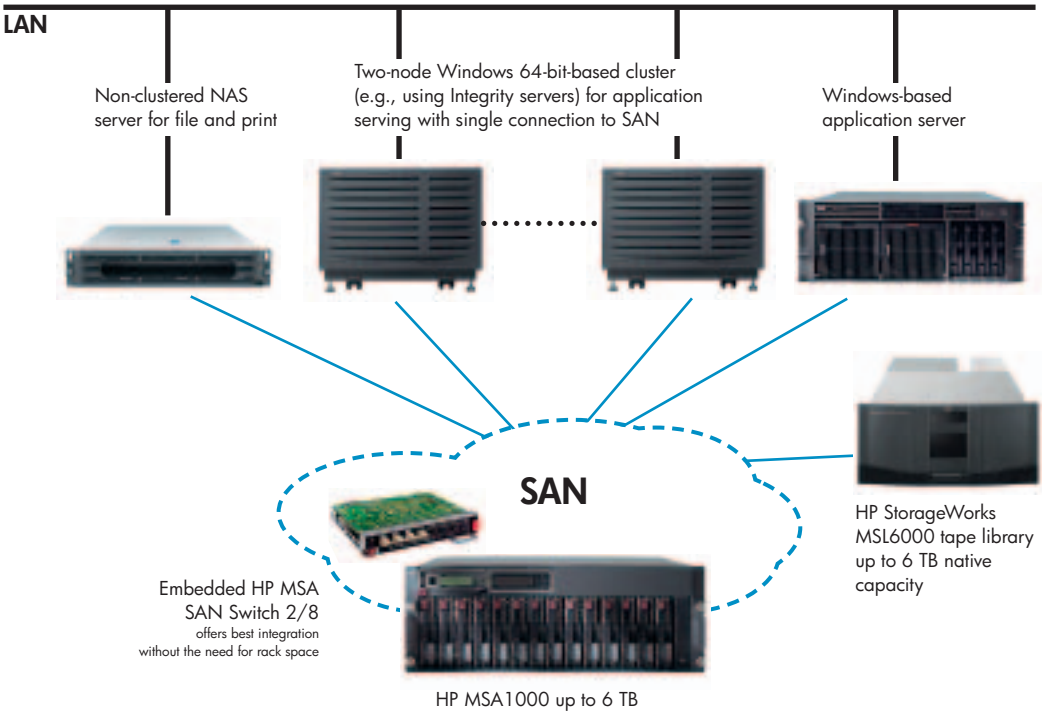
Two-node cluster with MSA500 G2

The HP MSA500 G2 enables external storage to be configured within a two-node cluster, without having to invest in a fibre-channel network. In this scenario, two servers are connected redundandly via SCSI cables to the storage array, and act as fallback or recovery servers to each other. The cross-over connection enables the two servers to synchronise.



Starter SAN consolidation with MSA1000

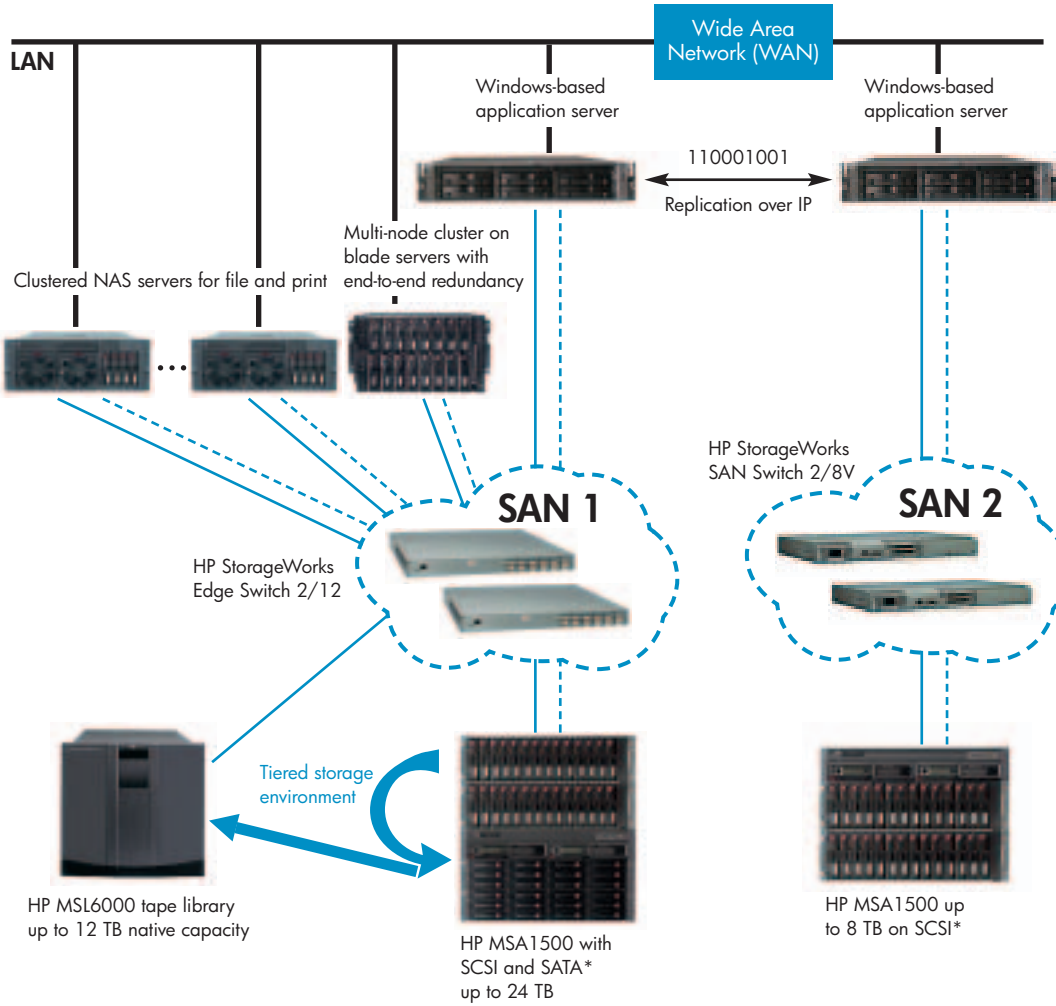
When consolidating storage from multiple servers (clustered or non-clustered), a SAN solution based on the MSA1000* offers the best efficiency, flexibility and scalability. You may start off with a non-redundant configuration to save costs.



*The MSA1500 provides the same functionality as the MSA1000 within this scenario.

Fully integrated high-availability SAN

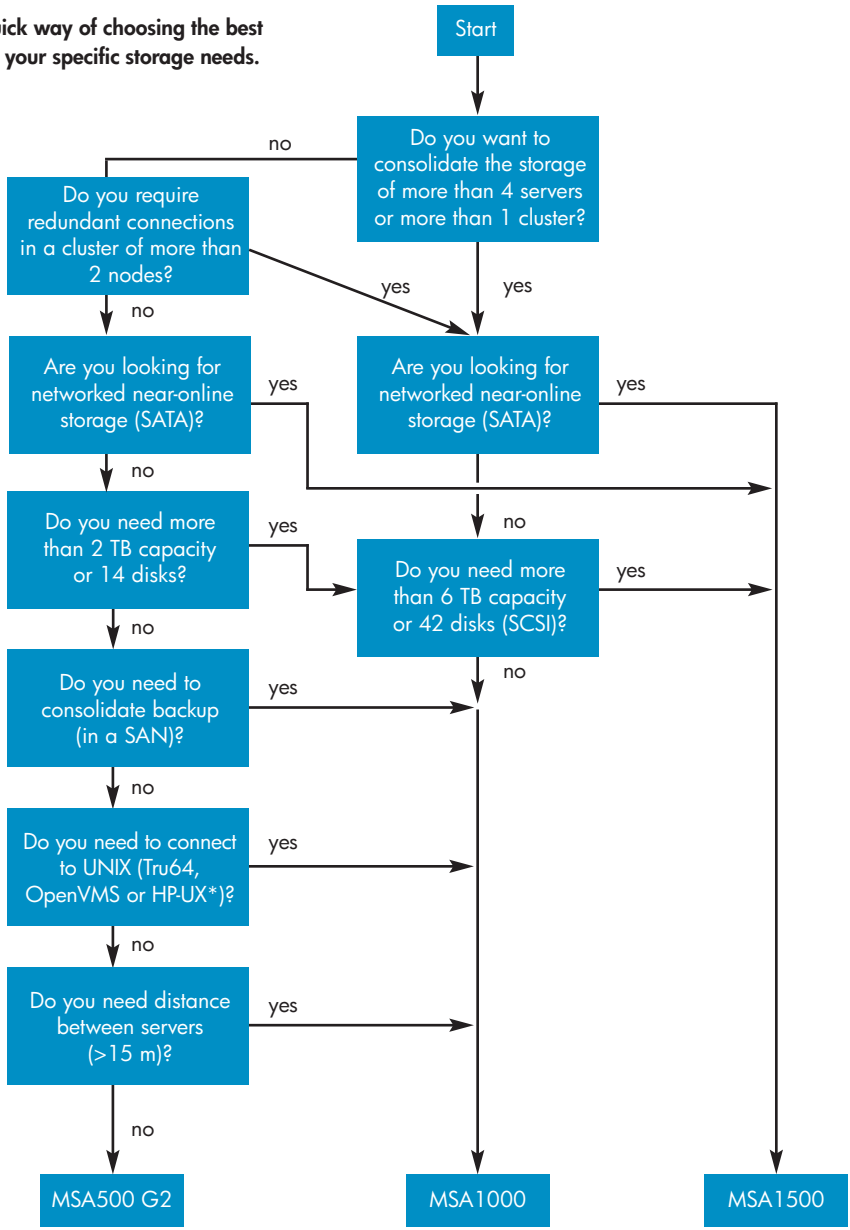
In this scenario, the MSA1500 provides the option of low-cost near-online storage based on SATA disks. A second SAN (located over a distance from the first) is also shown. Data can be copied from SAN 1 to SAN 2 using IP replication – ensuring data remains available, even if a disaster occurs at SAN 1.



* Mixed configurations (both SCSI and SATA) will be supported soon after launch.

Which HP StorageWorks MSA family member is right for you?

Here's a quick way of choosing the best solution for your specific storage needs.



*See **www.hp.com/go/msa** for current support on OpenVMS, Tru64 and HP-UX for MSA1000 and MSA1500.

Choose your configuration

To simplify the configuration of your selected product, HP has defined solution bundles for the MSA500 G2 and for the MSA1000. These provide you with an easy way to choose a complete configuration, and offer the flexibility to add your required level of capacity. We've also provided two configuration examples for the MSA1500 related to primary storage with SCSI disks and to near-online storage with SATA disks.

MSA500 G2 based 500-GB capacity solution for a two-node cluster

Description	Part number	Quantity
MSA500 G2 (single controller, 2 host bus adaptors, cabling)	335880-B21	1
MSA500 G2 High Availability Upgrade Kit (redundant controller, 2 host bus adaptors, 4-port I/O module, multi-path software, cabling)	360229-B21	1
73-GB 15k SCSI hard disk drive	286778-B22	7

Connect up to four ProLiant servers to this configuration to get to a full solution.
Note: you may also consider a MSA500 packaged cluster solution including two ProLiant DL380 servers.

MSA1000 SAN Starter Kit with High Availability Upgrade Kit and 2.5-TB capacity for 2 Windows-based servers (SAN Starter Kit also available for Linux)

Description		Part number	Quantity
MSA1000 SAN Starter Kit (supports both Windows and Linux connect)		353803-B22	1
Consisting of:	1 x MSA1000 (with 14 drive bays standard)		
	1 x MSA SAN Switch 2/8 (embedded)		
	2 x FCA2214 2-Gb FC HBA		
	2 x fibre-channel cable (5m)		
MSA1000 High Availability Upgrade Kit for Windows (also available for Linux: part number 353805-B21)		353804-B21	1
Consisting of:	1 x MSA1000 Controller		
	1 x MSA SAN Switch 2/8 (embedded)		
	2 x FCA 2214 2Gb FC HBA		
	1 x F200 cluster kit (2x Secure Path software)		
	2 x fibre-channel cable (5m)		
MSA30 SCSI disk enclosure, single bus		302969-B21	1
146-GB 10k SCSI hard disk drive		286716-B22	17
Option: MSL tape library (model and specification to meet requirements) and HP OpenView Data Protector for backup and restore; for more information, visit HP Ultimate Business Protection at **www.hp.com/eur/ubp**			

MSA1500 redundant SAN with 6-TB capacity for 2 Windows or Linux and 2 NetWare servers

Description	Part number	Quantity
Disk array		
MSA1500 (controller shelf, no drive bays)	AA986A	1
Redundant controller for MSA1000/MSA1500	218231-B22	1
MSA1500 cs Fibre-Channel I/O Module	AA987A	1
MSA1500 cs Dual-Channel SCSI I/O Module	AA988A	3
MSA30 disk enclosure, single bus	302969-B21	4
Infrastructure		
HP StorageWorks Edge Switch 2/12*	348406-B21	2
4-FlexPort Upgrade for Edge Switch 2/12*	348407-B21	2
FCA2404 PCI-X 2GB FC HBA (Windows Server 2003)	305573-B21	4
FCA2210 Host Bus Adaptor (NetWare)	281540-B21	4
Fibre-channel cable (5m)	221692-B22	10
Software components		
ProLiant Cluster HA/F200 for MSA (Windows only, take HP Secure Path for other OS)	252409-B24	1
Disks		
73-GB 15k SCSI hard disk drive	286778-B22	20
146-GB 10k SCSI hard disk drive	286716-B22	32

*Switch can be upgraded non-disruptively in 4-port increments up to 12 FC ports. SFPs are included.

MSA1500 non-redundant SAN for near-online storage with 12-TB capacity for 4 Linux servers

Description	Part number	Quantity
Disk array		
MSA1500 (controller shelf, no drive bays)	AA986A	1
MSA1500 cs Dual-Channel SCSI I/O Module	AA988A	1
MSA20 disk enclosure	335921-B21	4
Infrastructure		
HP StorageWorks SAN Switch 2/8V	AA979A	1
Short Wave SFP	300834-B21	5
FCA2214 2GB FC HBA (Linux/Windows)	281541-B21	4
Fibre-channel cable (5m)	221692-B22	4
Disks		
250-GB SATA disk	349239-B21	48
Option for both MSA1500 configurations: MSL tape library (model and specification to meet requirements); for more information, visit HP Ultimate Business Protection at **www.hp.com/eur/ubp**		

Further optional software components	Part number
ProLiant Cluster HA/F100 for MSA	252408-B24
HP OpenView Storage Mirroring (media kit)	T2557AA
HP OpenView Storage Virtual Replicator (one LTU included with MSA1000/1500)	261770-B22

Configure your own solution with the NSS Sizing Tool at **www.hp.com/go/nsssizer**

HP Services

When business needs change over time, you may have different requirements for your SAN. HP Services can help evolve your solution with a range of services, including design, integration, data migration and support. For full details, please contact your HP sales representative or visit: **www.hp.com/hps/storage**

Available services include:

Design and integration
Use our proven expertise and experience to help design and integrate your SAN architecture. Following a trouble-free and quick on-site installation, we can also assist in critical areas such as SAN management, data protection and recovery.

Data migration
Stress-free data migration, with end-to-end management, from your existing mission-critical storage systems (HP-UX, Windows 2000/NT, Sun, EMC etc.) to the HP StorageWorks SAN platform.

Operate-and-evolve services
Ranging from reactive hardware and software support to comprehensive, proactive mission-sensitive and mission-critical environment support. To help evolve your storage environment, we can analyse its performance and capacity use, including all major system components, and provide a detailed report with recommendations on how best to optimise your system's performance.

HP Proactive Essentials (PE) Service is an entry-level mission-critical package that combines reactive technical assistance with proactive account services for selected distributions of Windows and Linux, storage and/or storage area networks. It increases system performance, expedites problem resolution and decreases downtime due to software defects.

HP Care Pack Services

HP Care Pack Services are pre-packaged service offerings for defined HP hardware. The table below displays the most important fixed Care Packs for the MSA family. All Care Packs are available in either hardcopy (suffix A) or electronic format (suffix E). MSA starter kits require the same Care Packs as MSA base products.

		MSA500 G2	MSA1000/MSA1500	MSA1000 HA upgrade kits
Hardware installation		U6458A/E	U4368A/E	U9990A/E
3-year	**Next business day, on-site**	N/A	U6355A	N/A
	Same business day, on-site, 13x5	U6455A/E	U6356A/E	Support Plus: U9611A/E
	On-site, 24x7	U6456A/E	U6357A/E	Support Plus 24: U9612A/E
	6-hour, call to repair, 24x7	U6457A/E	U9934A/E	N/A
	Proactive Essentials*	N/A	Storage: U9976A/E SAN: UA102A/E	N/A
4-year	**Same business day, on-site, 13x5**	N/A	U9398A/E	
	On-site, 24x7	N/A	U9399A/E	N/A
5-year	**Same business day, on-site, 13x5**	N/A	U9400A/E	N/A
	On-site, 24x7	N/A	U9401A/E	N/A

*Incident-based software support Care Packs available for Windows and Linux.

Your questions answered

What happens if I need to add more storage capacity?

HP StorageWorks MSA disk arrays are modular, so you can add capacity as your needs grow, internally or externally, with additional disk enclosures.

- Scale up to 2 TB on the MSA500 G2 (without external expansion)
- Scale up to 6 TB on the MSA1000 (with 2 x MSA30)
- Scale up to 24 TB on the MSA1500 (with 8 x MSA20) or up to 8 TB (with 4 x MSA30)

If you need even more, simply add more MSA to your SAN!

What if I want to add more servers to the SAN?

To add more servers, the SAN fabric requires additional HBAs, and consequently more SAN ports. HP SAN fabrics can be expanded simply by connecting additional HP switches as your needs change.

To increase the number of ports in your FC network, you can cascade multiple switches. With automatic detection of both the speed and type of fibre-channel connection, configuration is as simple as plugging in the fibre-channel cable. For cascading of more than four switches, we recommend you to work with your preferred HP storage partner.

Each MSA1000/1500 disk array will support a connection of up to 32 hosts (i.e., 32 servers each with a single HBA or 16 servers with dual HBAs). But it is recommended that for connections to more than 20 hosts you use an additional MSA1000/1500 disk array to split the workload across two MSA arrays.

How do I adjust my backup strategy to match storage consolidation in my MSA array?

You can grow your HP StorageWorks tape libraries in the same way as you grow your storage array. Their modular design enables you to increase performance and capacity by adding additional drives or tape libraries.

HP OpenView Data Protector also follows this concept with a modular licensing structure. You only pay for what you currently require, but you still keep the flexibility to scale up when needed.

How can I increase the intelligence of my MSA with virtualisation technology?

HP OpenView Storage Virtual Replicator automates storage tasks through virtualisation – increasing visibility and control.

The software provides advanced storage services such as online volume growth, point-in-time copies and centralised management, which complement the standard capabilities of the operating system. A single user licence is included with every MSA1000/1500 disk array. It can pool physical storage and create large-sized virtual disks tailored to your environment, maximising the use of available resources. Virtual disk space can be allocated as needed, allowing you to respond quickly to changing storage capacity requirements.

Jargon buster

Cascading
The ability to connect switches to one another to create a large SAN fabric.

DAS (direct attached storage)
A deployment of dedicated storage devices for each server, usually using SCSI cabling or technology. Can be an inefficient use of storage, plus DAS environments often involve a mix of different vendor storage and management interfaces.

DtS (DAS to SAN technology)
An exclusive HP feature that provides a quick and easy way to migrate disks and stored data running on Smart Array or RA4100 storage solutions to an HP StorageWorks MSA500 G2, MSA1000 or MSA1500 disk array (see page 8).

FC (fibre channel)
A technology for transmitting data between servers and storage devices at high-speed. Fibre-channel configurations use fibre-optic cabling, connected to switches, host bus adaptors or fibre-channel controllers.

HBA (host bus adaptor)
A PCI adaptor that connects a server to the SAN fabric. Each HBA installed is referred to as a host.

LAN-free backup
A configuration where data backup/restore operations take place over a fibre-channel connection instead of a LAN.

MSA (Modular Smart Array)
HP's family of entry-level storage arrays, spanning from SATA and SCSI disk enclosures up to shared storage and SAN arrays.

Near-online
Technology that uses disk-based storage devices to store infrequently accessed data. This includes tiered storage environments or disk-to-disk-to-tape backup. Near-online is often implemented with low-cost disk drives. However, their ability to match requirements needs to be verified.

RAID (Redundant Array of Independent Disks)
A method of writing data simultaneously over multiple disk drives used in disk arrays for increased protection.

Replication
Mirroring data between two arrays – usually located in separated data centres – to achieve highest availability in case of failure of one data centre. This can be achieved via host/IP-based replication or – for enterprise arrays such as EVA or XP – via SAN-based replication directly between two arrays.

SAN fabric
The hardware that connects workstations and servers to storage devices in a SAN. It enables any-server-to-any-storage-device connectivity through fibre-channel switching.

SATA (Serial Advanced Technology Attachment)
New interface technology for ATA HDDs, providing the lowest cost per MB – ideal for storing low-usage reference information (an increasing regulatory requirement). SATA provides basic reliability and performance (based on an 8-hour and 10-30% duty cycle) compared to SCSI (and fibre-channel) HDDs, which are more advanced, offering a 24x7 and 80-100% active duty cycle (read/write).

SCSI (Small Computer System Interface)
A protocol used to communicate with SCSI devices. Also used by fibre-channel technology to communicate with disk drives.

Serverless backup
Disk-to-tape backup with minimal or no data passing through the server – improving performance for users.

SAN (storage area network)
High-speed, special-purpose network connecting different data storage devices to servers. May extend to multiple or remote locations for backup and archival storage.

Switch
A network device that selects a path or circuit for sending a unit of data to its next destination.

Virtualisation
Technologies that help remove physical storage boundaries by treating all available storage, regardless of its location, as one 'virtual' pool.

For more information

My First SAN from HP. Find out more at:
www.hp.com/eur/myfirstsan

For detailed information on the
HP StorageWorks MSA family, visit:
www.hp.com/go/msa

Configure your own SAN solution with the
NSS Sizing Tool. Get the download at
www.hp.com/go/nsssizer

Interested in NAS?
Visit the Easy as NAS programme at:
www.hp.com/eur/easyasnas

Explore the range of backup and restore
options for data protection with the
Ultimate Business Protection programme:
www.hp.com/eur/ubp

Quotes

"The MSA1000 provided a quantum leap in performance. It delivers high availability and satisfies our needs in terms of performance, reliability and scalability."

Joey Merz, Vice President of Systems, Match.com

"The investment into a SAN has been absolutely worthwhile. The systems are faster and more flexible. New features can be added quickly without any problems. And last but not least, the infrastructure as good as pays for itself. We have been operational for half a year now, and based on the first results, we expect to have recouped our investment within two years."

Marc Schmid, CEO Fleurop Interflora AG, Switzerland

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