hp storage

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invent

technical blueprint

mid-market Exchange configuration blueprint for the MSA1000 and the EVA3000

configuring an Exchange 2000 environment to support up to 5000 users

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executive summary

Messaging and collaboration tools are changing the way companies do business today. The ability to communicate with coworkers, customers, and suppliers via messaging applications is critical. With mission-critical data being sent and received, the issues of availability and storage in your messaging system are of utmost importance to the success of your business.

Exchange 2000 from Microsoft® is a leading messaging application for businesses large and small. Given the increasing importance of this messaging application to our customers, HP provides technical blueprints to build tested and supported Exchange solutions. These solutions are designed to meet your messaging needs today and to grow with your requirements over time. This flexibility and scalability ensure that your solution provides you the lowest total cost of ownership possible.

This document presents an Exchange 2000 solution supporting up to 5000 users. This solution provides the following:

- A storage solution built around the HP StorageWorks Modular SAN Array 1000 (MSA1000) and the Enterprise Virtual Array 3000 (EVA3000), providing exceptional data protection and availability with ease of management.
- A highly available solution based on clustered HP servers with multiple paths managed by HP StorageWorks Secure Path software and Fibre Channel connected storage area network (SAN).
- A scalable solution that can grow with your requirements.
- Diagrams, design rules, scalability options, and a bill of materials for the example configuration. In addition, information is provided on HP Services that can help you design, install, and maintain your Exchange 2000 messaging application. See the section titled "for more information" at the end of this document for additional information on HP Exchange solution blueprints.

today's challenges in messaging applications

Exchange 2000 from Microsoft is one of the leading business critical messaging applications available today. As more and more business activities rely on its operation, the cost of its failure can pose a significant threat to a company's success. The three major concerns customers have for their Exchange 2000 environment are:

- availability – eliminating down time and minimizing the recovery window in case of downtime
- scalability – scaling up capacity and performance as an organization grows, without affecting availability
- manageability – providing effective management to achieve availability and scalability requirements

configuration overview

servers

This solution is designed around an HP ProLiant DL580 G2. This server can support a clustered Exchange server consolidation strategy and can be configured to meet your specific requirements, including the number of processors, the amount of available RAM, and the number of network adapters.

As reported by Microsoft, HP servers consistently rank among the top performing platforms in Exchange MMB2 performance testing: (http://www.microsoft.com/exchange/techinfo/planning/2000/PerfScal.asp). This, together with HP worldwide service and warranty offerings, makes HP servers the perfect platform for your Exchange solution.

storage

Two storage configurations are presented, one using the MSA1000,the other using the EVA3000. Either configuration is suitable to support a 5000-user Exchange environment. The MSA1000 offers a low priced entry point into a SAN configuration, whereas the EVA3000 offers additional scalability and storage virtualization features.

MSA1000

The HP StorageWorks Modular SAN Array 1000 (MSA1000) is a 2 Gb Fibre Channel storage system for the entry-level to midrange SAN. It is designed to reduce the complexity, expense, and risk of SAN deployments in an x86 server environment. This array provides the customer with a low-cost, scalable, high-performance storage system with investment protection. The MSA1000 comes standard with a single high-performance controller (a second controller is optional). With the addition of two more drive enclosures, the MSA1000 can control up to 42 Ultra2, Ultra3, or Ultra320 SCSI drives, providing a maximum capacity of six terabytes.

Direct Attach to SAN (DtS) architecture is an exclusive MSA1000 feature that provides a quick and easy way to migrate stored data protected by most Smart Array controllers to an MSA1000 storage system. Data that is currently stored on 1" Universal disk drives using newer HP Smart Array controllers, as well as data on an RA4100, can easily be migrated to the MSA1000. Simply remove the drives from the older systems and insert them into the MSA1000. All configuration information and data will be preserved, allowing migration to be completed in minutes, not hours or days. For more information, reference the *DtS Data Migration to the MSA1000, Microsoft Environments* white paper at: ftp://ftp.compaq.com/pub/products/storageworks/whitepapers/15D6-0801A-WWEN.pdf

EVA3000

The HP StorageWorks Enterprise Virtual Array 3000 (EVA3000) is the newest generation of the StorageWorks Disk Array enabled by VersaStor technology. The EVA is a high performance, high capacity, and high availability "virtual" RAID storage solution for the midrange to high-end enterprise class marketplace that removes the time, space, and cost boundaries of traditionally architected storage.

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

backup

HP StorageWorks tape devices and the HP OpenView Storage Data Protector software provide a secure and manageable solution for customer data protection. Data Protector provides flexible backup protection for Exchange with minimal impact on system performance and application availability. Depending on the available hardware, Data Protector can write backup streams to single or multiple tape drives. Backup streams can either go to devices locally attached to the Exchange server, go through the LAN to any system or, for maximum performance, make use of a SAN and move the data to Fibre Channel-connected devices. By using this flexible architecture, Data Protector allows you to distribute the backup load and achieve the lowest possible backup times. Data Protector is scalable with your infrastructure to provide highly reliable and cost-effective backup in systems of any size.

table 1. component overview

HP ProLiant DL580 G2		• Four-way Intel Xeon, 2.0 GHz • (4) 72 GB disk drives • 4 GB SDRAM • Hot-swappable redundant power supplies and fans • 4U rack-mountable enclosure
HP StorageWorks SAN switch 2/8-EL		• Eight 1Gb/2Gb universal auto-sensing FC ports • 1U rack-mountable enclosure
HP StorageWorks MSL6060 Tape Library		• Up to 4 HP Ultrium 460 tape drives • Up to 12 TB native storage capacity • 60 slots
HP StorageWorks Modular SAN Array 1000		• Up to 6 TB in 10U space • Scalable to 42 drives • Embedded MSA SAN Switch 2/8 • Available drive capacities: 18 GB, 36 GB, 72 GB, and 146 GB

HP StorageWorks Enterprise Virtual Array 3000		• Supports up to 8.1 TB • Supports all O/S platforms • High availability "virtual" RAID • Virtually instantaneous snapclones

solution design

The example Exchange solution in this blueprint can be modified to meet your specific needs. The assumptions, design rules, and an example of its scalability are shown below.

configuration

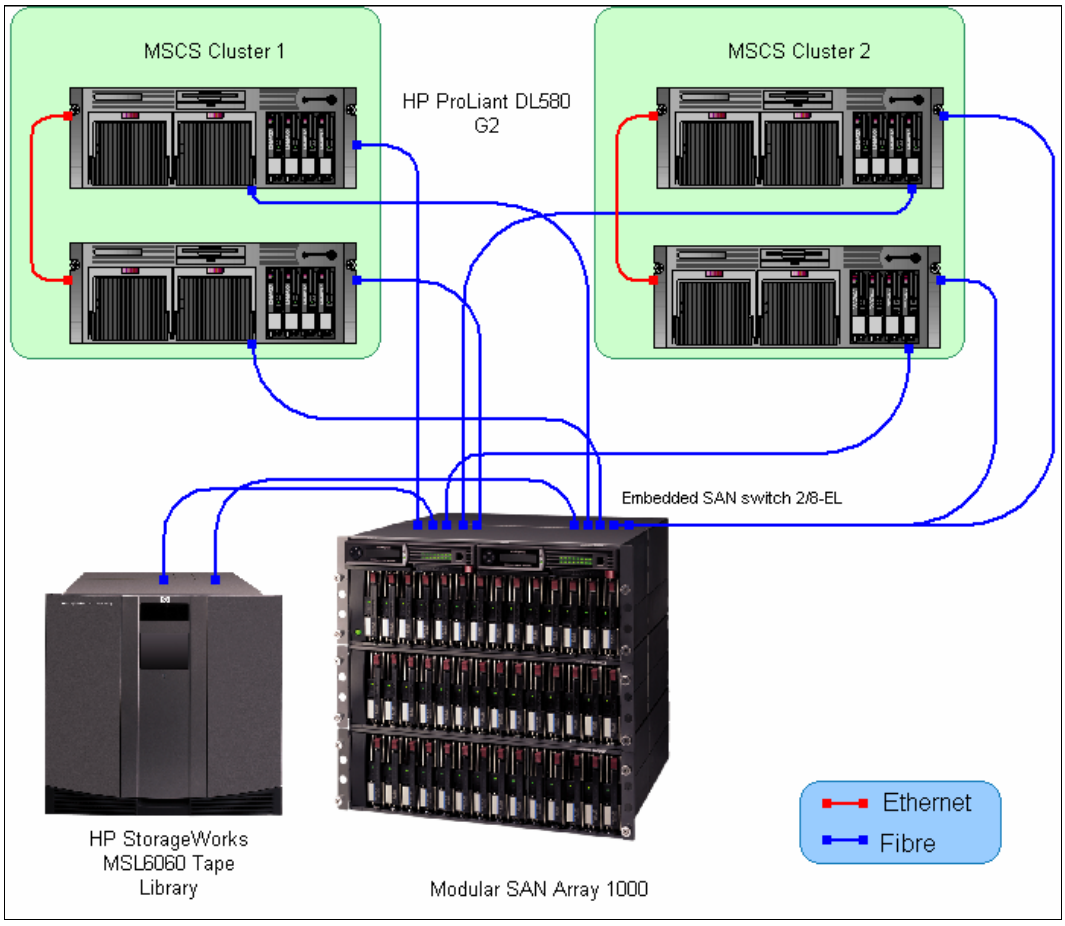

figure 1. example mid-level Exchange solution physical view, using one MSA1000 array

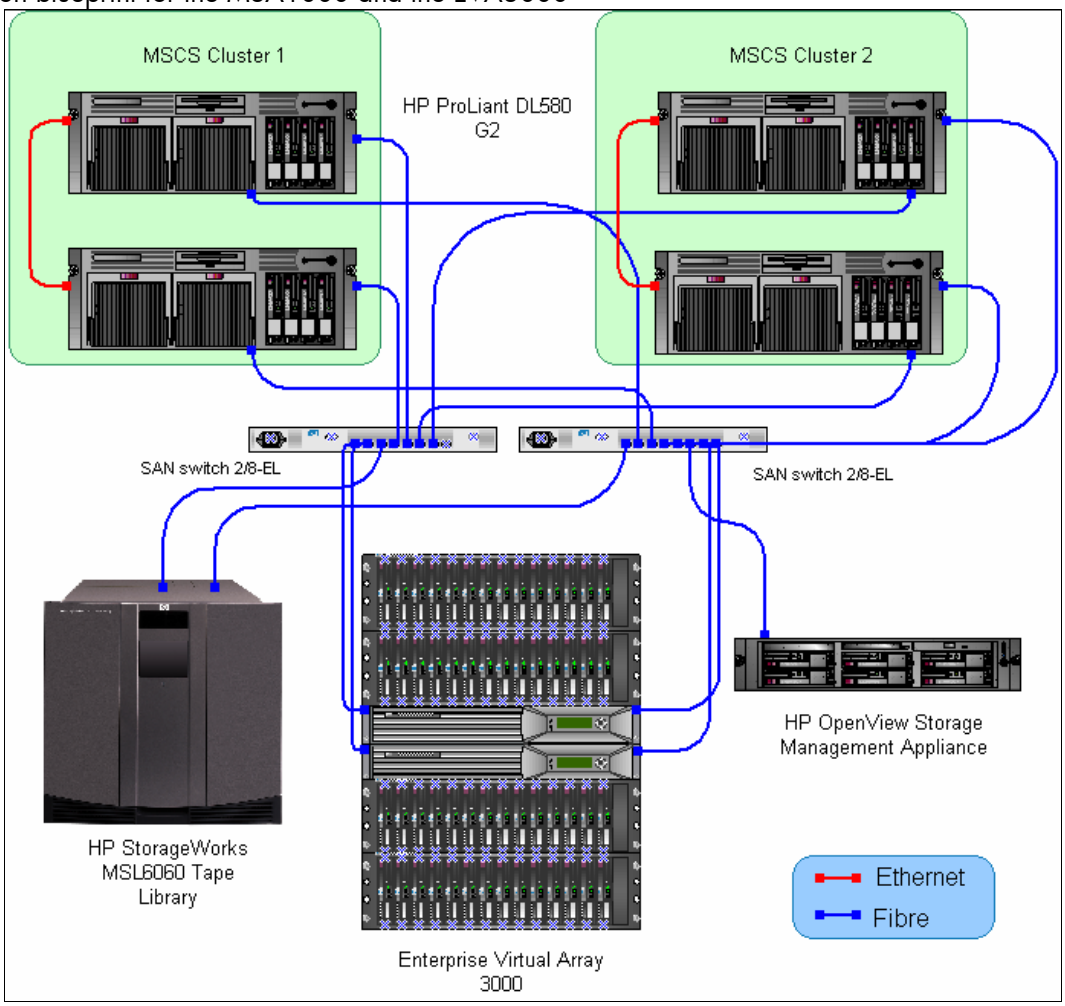

figure 2. example mid-level Exchange solution physical view, using one EVA3000 array

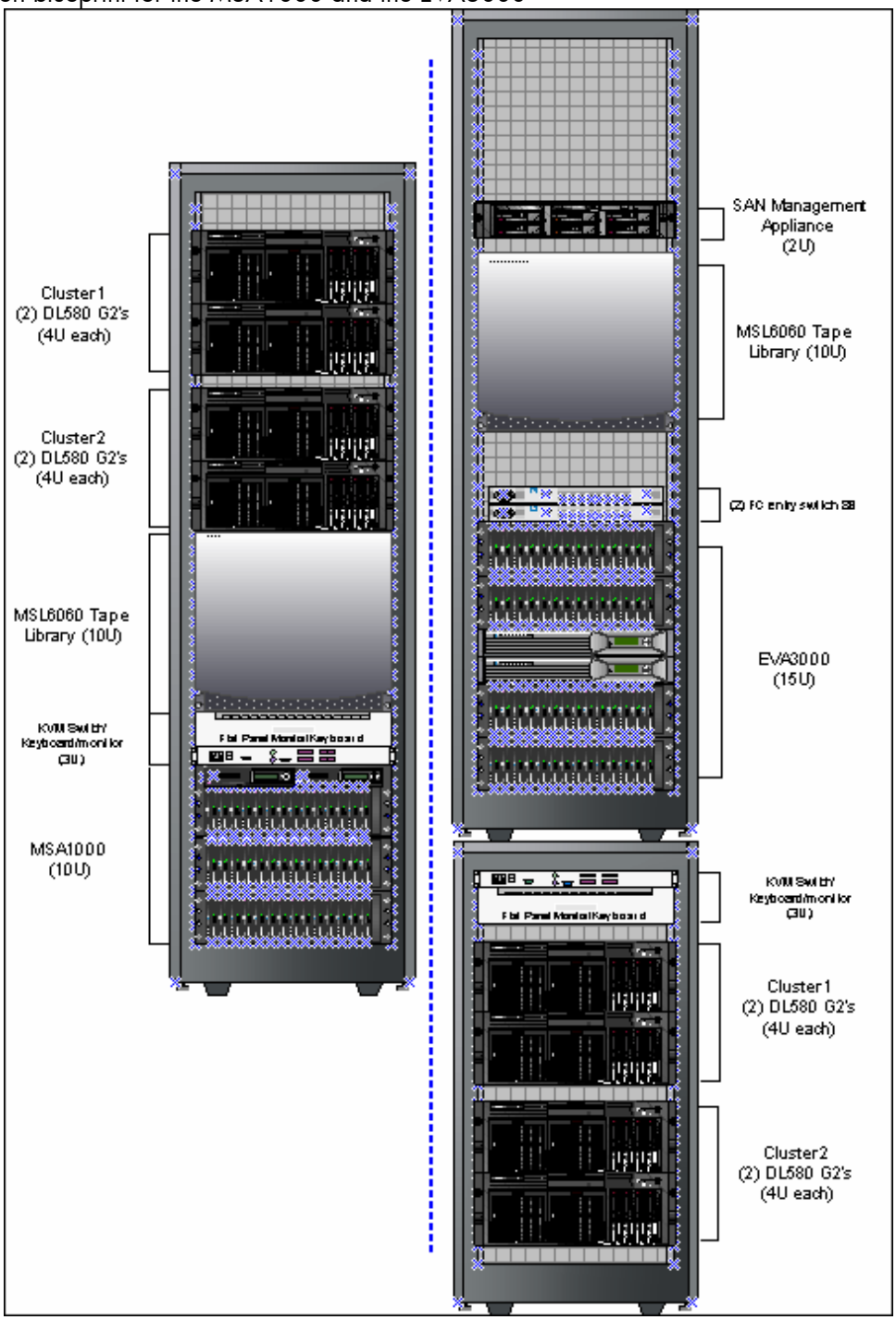

figure 3. example entry-level Exchange rack configurations for MSA1000 (left) and EVA3000 (right)

The Exchange solution for the MSA1000 can be assembled in a single HP 10000 Series Rack System/42U rack to minimize space at your site. The example rack configurations in figure 3 include HP rack-mounted flat monitor/keyboards with KVM switching. This optional component provides device management capability at the rack within a minimum amount of space.

Exchange profile

table 2. Exchange user profile assumptions

Exchange parameter	value	Exchange parameter	value
mailbox quota	50 MB	Internet users	10%
maximum number of users	5000	Bridgehead servers	No
average message size	10 KB	Front-end servers	No
MAPI users	90%		

Exchange architecture

- Utilizes an existing Windows 2000 Active Directory Domain.
- Provides two Storage Groups with 4 mailbox stores each (~300 users/database) per cluster, for a total of four Storage Groups and 16 databases.
- Supports 5000 users with two clusters.

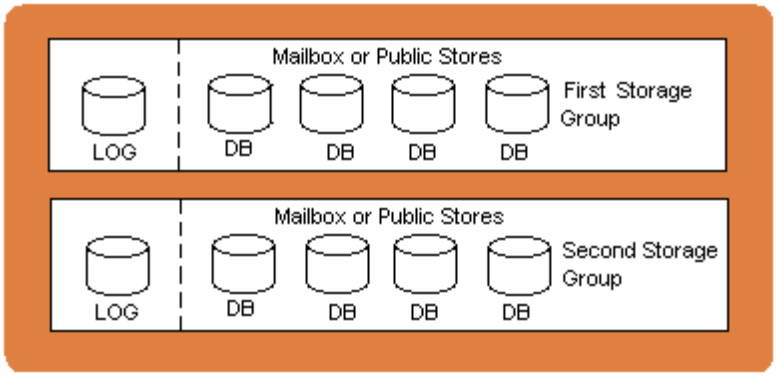

figure 4. storage groups for each one cluster

- Total storage required for mailbox stores is ~250 GB (each user has a 50 MB mailbox quota). Per Microsoft recommendations, twice that amount of storage is provided to allow for restore and recovery operations. In addition, 30 GB is provided for each Storage Group log files, and 10 GB is provided for a quorum disk, per cluster.
- Databases and transaction log files are on separated LUNs on the disk array.
- Different redundancy groups must be used for different storage groups and logs on the storage array.

server

- Four ProLiant DL580 G2s with 4-way processors and redundant power supplies and fans. See “specifications” for details.
- Two HBAs per server with HP SANworks Secure Path software (included in ProLiant Cluster package) to manage multi-path I/O.
- Two Network Interface Cards (NIC) per server. One connection is needed for the cluster heartbeat.
- Exchange 2000 Enterprise Server.
- Data Protector Disk Agent is downloaded from a backup management server running Data Protector Cell Manager.

mid-market Exchange configuration blueprint for the MSA1000 and the EVA3000

A ProLiant sizing tool is available to provide sizing guidelines for Microsoft Exchange 2000 solutions, incorporating the results from HP characterization testing to develop configuration details for Exchange 2000 mailbox servers and OWA and SMTP Bridgehead front-end servers. This tool generates recommendations for highly available, high performance Exchange deployments.

http://h71019.www7.hp.com/ActiveAnswers/Render/1,1027,2402-6-100-225-1,00.htm

array

MSA1000

- MSA1000 array with two 512 MB controllers.
- Two 4314R enclosures to maximize available storage.
- Disk capacities calculated using RAID 1+0 with 2 hot spares.

table 3. MSA1000 storage configuration options using 72 GB disk drives

5000 users (50MB mailboxes)	disk 1	disk 2	disk 3	disk 4	disk 5	disk 6	disk 7	disk 8	disk 9	disk 10	disk 11	disk 12	disk 13	disk 14
shelf 1	databases and public folder RAID 1+0 (Storage Group 1)				hot spare	log files RAID 1+0 (SG1)		databases RAID 1+0 (Storage Group 2)				hot spare	log files RAID 1+0 (SG2)	
shelf 2	databases RAID 1+0 (Storage Group 3)				hot spare	log files RAID 1+0 (SG3)		databases RAID 1+0 (Storage Group 4)				hot spare	log files RAID 1+0 (SG4)	
shelf 3	quorum disk	quorum disk												

EVA3000

- Two HSV110 Virtual Storage Array Controllers.
- Disk capacities are calculated using virtual RAID (vRAID) 1+0.

Eight LUNs (virtual disks) are created for use by Exchange (four for Storage Group log files, four for Storage Group databases).

table 4. EVA3000 storage configuration options using 36 GB disk drives

Note: The EVA3000 will optimize physical disk allocations. There is no direct relationship between physical disks and disk layout.						
databases and public folder vRAID 1+0 (Storage Group 1)	databases vRAID 1+0 (Storage Group 2)	databases vRAID 1+0 (Storage Group 3)	databases vRAID 1+0 (Storage Group 4)	virtual hot spare		
Disk Group 1 (32 disks)						
log files vRAID 1+0 (SG1)	log files vRAID 1+0 (SG2)	log files vRAID 1+0 (SG3)	log files vRAID 1+0 (SG4)	virtual hot spare	quorum disk	quorum disk
Disk Group 2 (8 disks)					Disk Group 3 (8 disks)	

Using the smallest capacity disk drives attainable is recommended to maximize the number of spindles within a disk group, directly improving performance. In an EVA3000 implementation, you can assemble the same number of disk drives into a *disk group*, and within this disk group, create any number of virtual RAID volumes, leveled across all the spindles making up the disk group. While each volume has the same capacity, the actual number of I/O per second that each volume can support is larger, because more spindles are involved in creating the volume. The ability to level across more disk members for a given volume size allows you to better handle peak I/O on a particular volume.

tape

- HP StorageWorks MSL6060 tape library with 4 Ultrium 320 tape drives.

design rules

Exchange-specific design rules

- Storage Group log files and mailbox stores reside on separate LUNs within separate disk groups.
- Active/Passive cluster configuration is highly recommended.
- Multiple mailbox stores (databases) are used inside a Storage Group to minimize the impact of restoring a single mailbox store.
- Multiple paths to storage for each server provide additional availability.
- For best backup and restore performance, one tape drive per Storage Group is recommended.
- Circular logging is turned off. Log files are not overwritten after they are applied to a database. This allows the log files to be used with the last full database backup to recover a database. If you enable circular logging, you can restore data only up to the last backup. You might not be able to restore data from the last backup to the point of the failure because the required log files might not be available.
- Because circular logging is disabled, it is possible for the log file to reach a max limit. As a result, a reasonable window between full backups should be developed to prevent system downtime.
- The /3GB switch was added to the boot.ini file. If your Exchange server has more than 1 GB of RAM, you need to add the /3GB switch to the startup line of the Windows boot.ini file. This change is required so that virtual memory for Exchange 2000 can take advantage of the additional RAM.

  See Microsoft Knowledge Base article "266096 (Exchange Server Requires /3GB Switch with More Than 1 Gigabyte of Physical RAM)" for detailed instructions.

  http://support.microsoft.com/default.aspx?scid=kb;en-us;266096

Note: Some software applications will fail during installation because of the /3GB switch. The error message displays **out of memory**. If the administrator receives this message during installation of an application, the /3GB switch should be turned off until the software can be installed. Because the switch is configured in the Boot.ini file, Windows 2000 will need to be rebooted before the software can be installed.

EVA-specific design rules

- Four storage enclosures with 56 drives are available (4 shelves maximum for EVA 3000). If more capacity is required, larger capacity disk drives or an EVA5000 should be considered.
- Minimum of 8 drives per disk group.
- Disk groups should have an even number of drives.
- Configure two separate disk groups (one for databases, one for logs) in order to maximize performance.

specifications

servers

operating system	server	host bus adapter	processors	ECC SDRAM	disk drives	network interface card
Windows 2000 Advanced Server, SP 3	DL580 G2	FCA 2101 2 GB FC HBA	4 x 2 GHz	4 GB	4 x 72 GB	NC7770 PCI-X Gigabit Server Adapter (1 Built In, 1 expansion card)

storage

Note: Grayed areas represent the hardware configuration used in the example configuration.

disk storage, MSA1000

features	36 GB drives	72 GB drives	146 GB drives
number of drives	configuration not available using RAID 1+0	28	20
usable capacity per Storage Group, with RAID 1+0 and 1 hot spare		database: 145.6 GB log: 72.8 GB	database: 145.6 GB log: 145.6 GB (not an optimal configuration)
raw capacity		2038 GB	2912 GB

disk storage, EVA3000

features	36 GB drives	72 GB drives	146 GB drives
number of drives	40	28	20
usable capacity per Storage Group, with RAID 1+0 and 1 hot spare	database: 125 GB log: 30 GB	database: 125 GB log: 30 GB	database: 125 GB log: 30 GB (not an optimal configuration)
raw capacity	1456 GB	2038 GB	2912 GB

tape storage

features	MSL5060 tape library	MSL6060 tape library	multi-unit MSL6060 tape library with pass-through
drive type	LTO Ultrium 230	LTO Ultrium 460	LTO Ultrium 460
number of drives	4	4	scalable up to 16 drives
number of slots	58+2	58+2	scalable up to 240 slots
max native storage capacity	6 TB	12 TB	48 TB
max native data transfer rate	15 MB/sec per drive	30 MB/sec per drive	30 MB/sec per drive

software

software name	description
Microsoft Windows 2000 Advanced Server	Server operating system.
Microsoft Exchange 2000 Enterprise Server	Messaging application supporting multiple Storage Groups.
HP OpenView Storage Data Protector	Provides data protection through automated backups.
HP StorageWorks Secure Path v4.0A	Maintains storage connections in redundant SAN environments. Windows Workgroup Edition version is required for redundant communication with MSA1000.
HP OpenView Storage Virtual Replicator	Provides server-based storage virtualization for Windows 2000 environments.
HP StorageWorks Business Copy EVA	Provides controller-based cloning and snapshot capabilities for the EVA array family.
HP OpenView Storage Area Manager Host Agent (optional)	Allows Exchange server to be managed as part of a Storage Area Network (SAN). Host agent was loaded on Exchange server during solution testing. (Requires separate Management Server or Storage Management Appliance.)
HP OpenView Storage Area Manager Storage Node Manager Storage Builder Storage Optimizer	Simplifies and automates the management of your storage resources and infrastructure. Manages both tape and disk and direct-attached and network storage across multi-vendor devices, operating systems, and distributed environments. Allows for the effective monitoring and management of storage availability, performance, usage, and growth.

services

HP consultants can help you build an always-on messaging infrastructure that your organization can depend on. Available consulting services include:

- readiness assessment
- planning and design
- migration planning
- implementation

HP can help you address your requirements for availability, manageability, server consolidation, storage and capacity planning, backup and restoration, coexistence with other messaging systems, global deployment, definition of service level objectives, and implementation of management policies.

Exchange consulting services	HP can help you assess your current and future messaging and collaboration solution requirements and then design a solution that leverages the full power of Microsoft Exchange to meet those needs enterprise-wide.
Microsoft education services	HP has fully certified and integrated education solutions that get your IT professional and end users up-to-speed quickly on your Exchange server system.
Microsoft software licensing services	HP can help you manage Microsoft licensing on a worldwide basis, optimizing software procurement and deployment for your entire organization.
global deployment services	HP onsite installation services are fully coordinated with our integration services to get your Microsoft Exchange solution up and running quickly and reliably.
support services	Once HP has helped you build the messaging and collaboration solution, we keep it running strong with industry-leading software, hardware, and network support services. These comprehensive services provide a single point-of-contact for both HP and multi-vendor products.

bill of materials

The following are two bills of materials (BOMs) representing the hardware and software used in the example Exchange solution configurations shown in figure 2and figure 3 of this blueprint.

standard configuration

mid-range Exchange configuration with MSA1000

description	quantity	part number
Exchange servers		
ProLiant DL580 G2 Intel Xeon processor 2.0 GHz 2048 MB DDR SDRAM (1) NC7770 PCI-X Gigabit NIC (embedded) 10/100/1000	4	202176-001
Intel Xeon MP X2.0 GHz-2MB processor option kit	2 per server	307276-B21
2048 MB PCI1600 Registered ECC SDRAM memory kit (4x512 MB)	1 per server	202171-B21
Compaq NC7770 PCI-X Gigabit server adapter	1 per server	244948-B21
72.8 GB 10,000 rpm U320 Universal hard drive (1”), for operating system	4 per server	286775-B22
Fibre Channel Adapter FCA2101, 2 GB FC HBA	2 per server	245299-B21
Microsoft Windows 2000 Server (Service Pack 3) or Windows Advanced Server 2000 (enables clustering)	1 per server	Microsoft Reseller
Microsoft Exchange 2000 Server (Service Pack 3)	1 per server	Microsoft Reseller
ProLiant Cluster HA/F200 for MSA1000 for NT 4.0 and Windows 2000 (dual server, redundant path) Includes Secure Path v4.0 for Windows Workgroups	1 per cluster	252409-B22
storage array		
StorageWorks Modular SAN Array 1000 (MSA1000)	1	201723-B22
MSA1000 controller, with 256 MB cache	1	218231-B22
256 MB cache module for controller	2	254786-B21
MSA SAN Switch 2/8 (integrated), ships with 4 SFPs installed 2 Gb SFP SW transceiver kit	2 2	288247-B21 221470-B21
HP StorageWorks Enclosure Model 4314R	2	190209-001
72.8 GB Pluggable Ultra320 Universal hard drive, 15,000 rpm (1”)	42	286778-B22

tape backup		
MSL6060 FC 2-drive RM MSL Ultrium 460 upgrade drive in hot plug canister HP Ultrium 460 GB data cartridge HP Ultrium universal cleaning cartridge Library Tape Tool (LTT): http://www.hp.com/support/tapetools	1 2 30 1	331196-B22 330729-B21 C7972A C7978A web download
HP OpenView Storage Data Protector V5.0, Starter pack for Windows SAN drive extension Online backup extension	1 4 4	B6961AA B6953AA B6965BA

mid-range Exchange with EVA3000

description	**quantity**	**part number**
Exchange Servers		
ProLiant DL580 G2 Intel Xeon processor 2.0 GHz 2048 MB DDR SDRAM (1) NC7770 PCI-X Gigabit NIC (embedded) 10/100/1000 Intel Xeon MP X2.0 GHz-2MB processor option kit 2048-MB PCI1600 Registered ECC SDRAM memory kit (4x512 MB) Compaq NC7770 PCI-X Gigabit server adapter 72.8-GB 10,000 rpm U320 Universal hard drive (1"), for operating system	4 2 per server 1 per server 1 per server 4 per server	202176-001 307276-B21 202171-B21 244948-B21 286775-B22
Fibre Channel Adapter FCA2101, 2 GB FC HBA	2 per server	245299-B21
Microsoft Windows 2000 Server (Service Pack 3) or Windows 2000 Advanced Server (enables clustering)	1 per server	Microsoft Reseller
Microsoft Exchange 2000 Server (Service Pack 3)	1 per server	Microsoft Reseller
HP OpenView Secure Path v4.0A for Windows	1 (5 license pack)	231292-B23
SAN hardware		
HP StorageWorks SAN switch 2/8-EL	2	322120-B21
short wave optical transceivers	16	300834-B21

storage array		
one 3U controller assembly with two HSV100 controllers, two M5114 3U dual-redundant FC loop 14-bay disk enclosures, 42U graphite storage cabinet with appropriate mounting rails and power United States Factory Integration Code	1 1	321618-B21 (60 Hz) 325584-888
36 GB 15K rpm dual-port 2 Gb FC-AL 1-inch (2.54 cm) drive	48	236205-B21
HP StorageWorks Virtual Controller Software v2.0 for HSV100	1	330880-B21
Windows NT/Windows 2000 KIT v2.0 ENT VIR ARY	1	250195-B23
M5114 FC drive enclosure Rail Kit for M5114 FC drive enclosure Cable FC Copper SFP .6m	2 2 4	321622-B21 321623-B21 321624-B21
FC cable routing spools	1	293357-B21
Storage Management Appliance II	1	189715-002
tape backup		
MSL6060 FC 2-drive RM MSL Ultrium 460 upgrade drive in hot plug canister HP Ultrium 460 GB data cartridge HP Ultrium universal cleaning cartridge Library Tape Tool (LTT): http://www.hp.com/support/tapetools	1 2 30 1	331196-B22 330729-B21 C7972A C7978A web download
HP OpenView Storage Data Protector V5.0, starter pack for Windows SAN drive extension Online backup extension	1 4 4	B6961AA B6953AA B6965BA

scaling – growth – flexibility

adding messaging users

- This configuration can be expanded beyond 5000 users by installing additional clusters, Fibre Channel switches, and disk storage. Adding additional switches or upgrading 8-port switches to 16-port switches will provide additional ports to connect new clusters to each SAN. Refer to the *Enterprise Exchange Configuration Blueprint for the EVA5000* for more information.

scaling for 2500 users or fewer

- One server cluster from the configuration in figure 2 or figure 3 may be eliminated.
- The second switch in figure 3 must remain, to maintain high availability.
- A MSL6030 tape library may be used in place of the MSL6060 tape library.
- The storage require would be reduced by approximately 50%.

online storage

- Array capacity may be expanded online using existing or added disks. The MSA1000 allows you to add capacity and grow the size of logical volumes without downtime.
- The capacity of the EVA3000 array may be expanded online by adding additional disks and disk enclosures. A single EVA3000 is capable of supporting up to 56 drives per controller pair, or four disk enclosures. These arrays are capable of instantly taking advantage of adding disks to array enclosures. If the Auto Include option is enabled, the array will add disks and, in the case of the EVA3000, redistribute data across their new capacity to provide improved performance.

decreasing the recovery window

- Employing the HP StorageWorks Virtualized Storage Management for Exchange 2000 solution with Storage Virtual Replicator can significantly reduce the Exchange database recovery window, from hours to minutes. Virtual Replicator automates the creation of snapshots for backup and/or recovery purposes.
- The recovery window also can be reduced from hours to minutes using the HP StorageWorks Rapid Recovery for Exchange 2000 solution. The Rapid Recovery Solution automates the creation of snapclones for backup and/or recovery purposes on the EVA array.

why HP

- HP provides tested and supported Exchange Solutions built with world-class servers and storage, supported by a single point of contact—HP.
- HP is a Prime Integrator of Exchange 2000 as designated by Microsoft and has over 4.3 million Exchange 2000 seats deployed or under contract.
- HP servers and storage arrays are Microsoft-certified platforms.
- HP storage supports Microsoft's corporate Exchange infrastructure as well as a development platform for Exchange.

"…HP is as knowledgeable on Exchange as it gets. In fact, HP has more people dedicated to working on Exchange than Microsoft has developing the product. When it comes to deployment—what works and what doesn't for real customers in the real world—they are the clear experts."

Eric Lockard

Former General Manager
Exchange Business Unit
Microsoft Corporation

for more information

HP Solutions

HP Storage Solutions for Microsoft Exchange
http://h18006.www1.HP.com/storage/solutions/application.html#me

HP StorageWorks SAN Consolidation Solutions
http://h18006.www1.HP.com/products/storageworks/solutions/consolidation/index.html

Mid-market and Enterprise Exchange Solution technical blueprints are available at:
http://h18006.www1.hp.com/products/storageworks/solutions/exchange2kconfig/index.html

DAS-to-SAN Exchange Migration Solution
http://h18006.www1.hp.com/products/storageworks/solutions/dassanex2k/index.html

NAS/SAN Fusion with Exchange 2000 White Paper
http://h18006.www1.hp.com/products/storageworks/solutions/request/das2sanex2kwp.html

HP Servers

HP ProLiant DL and ML Servers
http://h18004.www1.hp.com/products/servers/platforms/index-dl-ml.html

HP Server Exchange Solutions
http://h71028.www7.hp.com/HP/render/1,1001,5733-6-100-225-1,00.htm

HP Storage Hardware and Software

HP Modular SAN Array 1000
http://h18006.www1.HP.com/products/storageworks/msa1000/index.html

HP Enterprise Virtual Array 3000
http://h18006.www1.hp.com/products/storageworks/eva3000/index.html

HP Tape Storage Systems
http://h18006.www1.hp.com/storage/tapestorage.html

HP OpenView Storage Data Protector
http://h18006.www1.HP.com/products/storage/software/dataprotector/index.html

HP Open View Storage Area Manager
http://h18006.www1.HP.com/products/storage/software/sam/index.html

HP Services

HP Services for Microsoft Exchange
http://h18005.www1.HP.com/services/messaging/

Microsoft

Microsoft Exchange Server
http://www.microsoft.com/exchange/default.asp

To learn more about HP storage and our Exchange storage solutions, contact your local HP sales representative or visit our Web site at: **www.hp.com/go/storage**.

Let us know what you think about the technical information in this document. Your feedback is valuable and will help us structure future communications. Send your comments to Microsoft_Storage_Solutions@hp.com.

04/2003