hp storage

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technical blueprint

hp StorageWorks Rapid Recovery for Exchange 2000

Using hp StorageWorks business copy EVA and the hp StorageWorks Enterprise Virtual Array 5000

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executive summary

The HP StorageWorks Rapid Recovery for Exchange 2000 solution is a quick and complete method of recovering Microsoft Exchange 2000 databases with minimal disruption to Exchange services. The solution uses **snapclones** as a source for recovery and automated offline backups. A snapclone is a physical point-in-time copy of a data volume that can be used to perform an **extremely rapid restoration** of Exchange Information Stores.

Using the HP StorageWorks business copy EVA v2.1a and the HP StorageWorks Enterprise Virtual Array 5000 (eva5000), customers can create snapclones of their Exchange Server databases and resume full operation of their Exchange Server environments in minutes.

By using the information in this solution, customers can perform the following tasks:

- Create snapclones of Exchange 2000 databases
- Restore data from snapclones
- Create scripts to implement automated tape backups from snapclones
- Use either clustered or stand-alone Exchange servers

Administrators face lengthy delays when restoring an Exchange environment from tape. This solution, which is based on creating snapclones with Business Copy EVA in a Storage Area Network (SAN)-based configuration, reduces the restore time from hours to minutes and reduces disruption to Exchange users. These time savings can be dramatic, as illustrated in the following diagram.

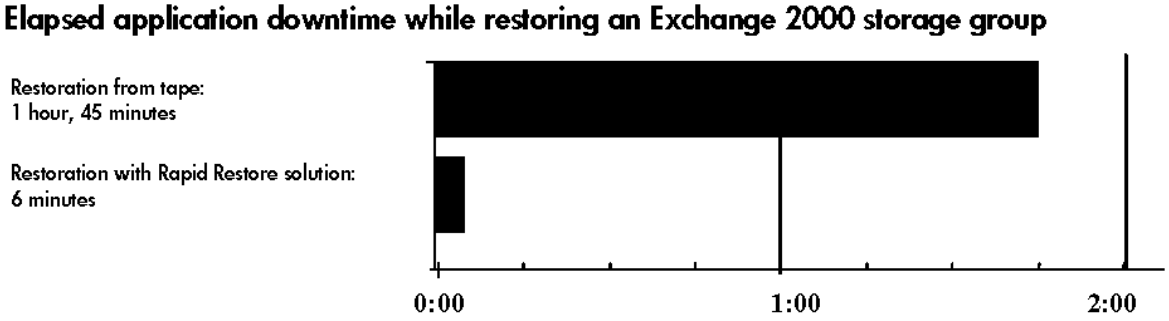

figure 1. comparative restoration times—Rapid Recovery for Exchange 2000 solution as it compares to tape-based restoration (single Exchange 2000 storage group with two databases, 3000 user load, logs not applied).

By using this solution to augment your tape-based recovery plan, you can recover your Exchange Information Stores rapidly, decreasing the amount of application downtime. Because a snapclone provides a copy of your production data, you can offload operations, such as tape backups, testing, and maintenance, from the production server to a backup server. The entire solution is engineered within Microsoft support guidelines.

"By partnering with companies like Hewlett-Packard, the worldwide prime integrator for Exchange 2000, we are able to deliver highly beneficial storage solutions to our customers. The **Rapid Recovery for Exchange 2000** and Virtualized Storage Management for Exchange 2000 solutions take advantage of highly scalable and easy-to-manage storage systems and management software, and the company's expertise in designing, deploying, and managing Exchange 2000 infrastructures. These HP StorageWorks solutions provide a great way for customers to maximize the availability of their Exchange 2000 environment."

Kevin McCuistion
Microsoft Corporation Group Product Manager
Exchange

business needs

Businesses need reliable and continuously available Exchange data to serve customers and maintain productivity. Downtime that results from lengthy backup and restore processes promote lost revenue, poor customer satisfaction, and missed competitive opportunities. In addition, backing up Exchange databases can degrade Exchange performance for an extended period of time. A restore from the last-known good tape backup of the database can also result in an unacceptable period of downtime.

By making snapclones part of your backup and restore strategy, you can achieve the following results:

- Restore databases in minutes, as opposed to the hours usually required when restoring from backup tapes.
- Back up to tape directly or across the SAN. Since the backups are performed offline, users do not experience Exchange performance degradation.

The following additional solution details are documented in the Rapid Recovery for Exchange 2000 implementation blueprint, which is available from your HP sales representative.

- Procedures for restoring an Exchange environment from snapclones, including special considerations for restoring in cluster environments
- Information regarding performance, sizing, and characterization
- Best practices specific to Exchange environments
- Scripts for automating the snapclone creation and backup process
- Procedures for integrating with backup applications, such as hp OpenView storage data protector and VERITAS NetBackup

features and benefits

This solution provides the following benefits to the Exchange administrator:

- Dramatically improves restoration times for Exchange 2000 databases
- Includes best practices for maximizing Exchange 2000 availability during database recovery
- Simplifies implementation and management, includes automation examples
- Engineered within Microsoft guidelines to maintain data integrity
- Protects investment by leveraging existing HP hardware and software, supporting multiple configurations, and providing interoperability with future products
- Integrates with the leading tape backup applications for Exchange—HP OpenView storage data protector 5.0 and VERITAS NetBackup V3.4 and V4.5
-

about clones, snapshots, vsnaps, and snapclones

With the Enterprise Virtual Array, you can create traditional snapshots, demand-allocated snapshots (vsnaps), and snapshots that normalize into snapclones. Virtually instantaneous snapclones are the powerful recovery technology used in this Rapid Recovery for Exchange 2000 solution.

snapclones

Snapclones are complete physical point-in-time copies of data volumes and are ideal for reducing I/O loads on the production volumes. Snapclones are snapshots that unshare (function similar to normalization) into clones. A snapclone has properties that are similar to a snapshot, so it is instantly available. The unsharing process of copying the data from the original LUN occurs in the background. Similar to a snapshot, snapclones can instantly be mounted or backed up to tape by administrators.

With snapclones, when the unsharing process is complete, you have a physical copy of the database or LUN you cloned. This is especially useful for fast restores from data corruption or catastrophic failure. Snapclones can be taken from any redundancy level (VRAID 0, 1, or 5) and do not require extensive advanced preparation. Resynchronization times are also eliminated with snapclones since a current snapshot copy is available immediately while the clone building process occurs.

snapshots

The traditional snapshot requires that you reserve and set aside space equal to the size of the original active virtual disk (vdisk). Data is not written into this reserved space until necessary. As data changes in the original active vdisk, the original data is written to the snapshot. Snapshots can be created quickly and are immediately available for use. Since snapshot volumes share data with the original production volume (those blocks that have not changed), they can only be used to recover from data loss or corruption as a result of writes to the original database.

virtual snapshots

A vsnap is a space-efficient point-in-time copy of the production data. You can create a vsnap without first reserving storage capacity equal to the production volume. With vsnaps, storage capacity is only used as the original virtual disk data changes. As users write to the database, the vsnap grows as the vdisk changes. With vsnaps, the amount of disk capacity used by the copy only grows as data in the production volume changes over time, resulting in the most cost-efficient use of storage space.

clones

A clone is a complete physical copy of the original data. Clones require the allocation of storage capacity that is at least equal to the size of the production volume. Clone creation is not immediate, as the original data must be copied to the clone volume.

You can improve the clone creation time by creating a triple mirror set (RAIDset with an additional mirror copy) up front so as to eliminate the time required to create the original clone volume. However, resynchronizing the RAIDset with the clone volume requires time for updating with the production volume.

table 1. comparison of clones, snapshots, vsnaps, and snapclones

	clones	**snapshots**	**vsnaps**	**snapclones**
Array (controller) support	EMA (HSG80)	EMA (HSG80) EVA (HSV110)	EVA (HSV110)	EVA (HSV110)
Storage capacity allocation	Equal to the production volume	Equal to the production volume	Storage allocation based on writes to the production volume	Equal to the production volume
RAID level	RAID 0, 1, 5	VRAID 1, 5	VRAID 0, 1, 5	VRAID 0, 1, 5
Data recovery	Physical copy of the production volume, available for point-in-time recovery. Requires re-synchronization.	Virtual copy of the production volume, available immediately for point-in-time recovery. Not available to restore in cases where production volume is lost.	Similar to snapshot. Only uses storage capacity required to save changes, more capacity efficient.	Physical copy of the production volume, available immediately for point-in-time recovery. Does not require re-synchronization.

solution overview

The Rapid Recovery for Exchange 2000 solution, a validated and fully integrated configuration, provides a SAN-based backup and restore infrastructure for end-to-end data protection. This solution leverages the capabilities of eva5000, Business Copy software, and the HP StorageWorks Enterprise Backup Solution (EBS) as illustrated in Figure 2.

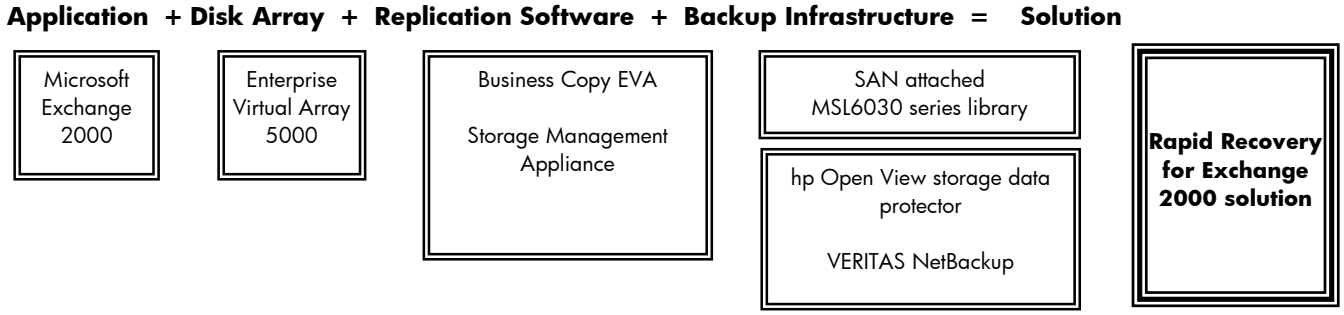

figure 2. Rapid Recovery for Exchange 2000 solution building blocks

solution components

Rapid Recovery for Exchange 2000 consists of the following core components:

- Microsoft Exchange 2000
  You can configure the Exchange 2000 application on any Windows 2000 server and use a Microsoft Cluster Server (MSCS) configuration for improved application availability.
- Enterprise Virtual Array 5000 (eva5000)
  The Enterprise Virtual Array contains the Exchange 2000 database and log volumes. Snapclones are created on the virtual array using Virtual Controller Software (VCS) v3.0, which operates the storage subsystem. Based on the HSV110 controller, eva5000 is a high-performance, high-capacity, and high-availability "virtual" RAID storage solution that eliminates the time, space, and cost boundaries of traditional storage.
- Business Copy EVA
  Business Copy EVA is a browser-based storage management software that facilitates controller-based clone operations to make block-to-block copies of storage volumes. With Business Copy, you can create, run, and manage automated storage replication jobs, as well as link them with external jobs. You must have a Business Copy host agent on each database server to utilize controller-based database cloning. The hp OpenView storage management appliance II is the operating platform for Business Copy, which offloads the processing from the host systems.
- SAN-Based Backup Infrastructure
  Enterprise Backup Solution with hp OpenView storage data protector 5.0 or VERITAS NetBackup V3.4 or V4.5 provides SAN-based backup-and-restore operations for snapclone-based tape backups. You must use a SAN-attached backup configuration when using this solution for snapclone-based offline tape backups. You must use a separate backup host with the backup application loaded and viewable to the storage subsystem to act as the dedicated backup server. For granular backups and restores, a copy of the Exchange 2000 application must exist on the backup server.

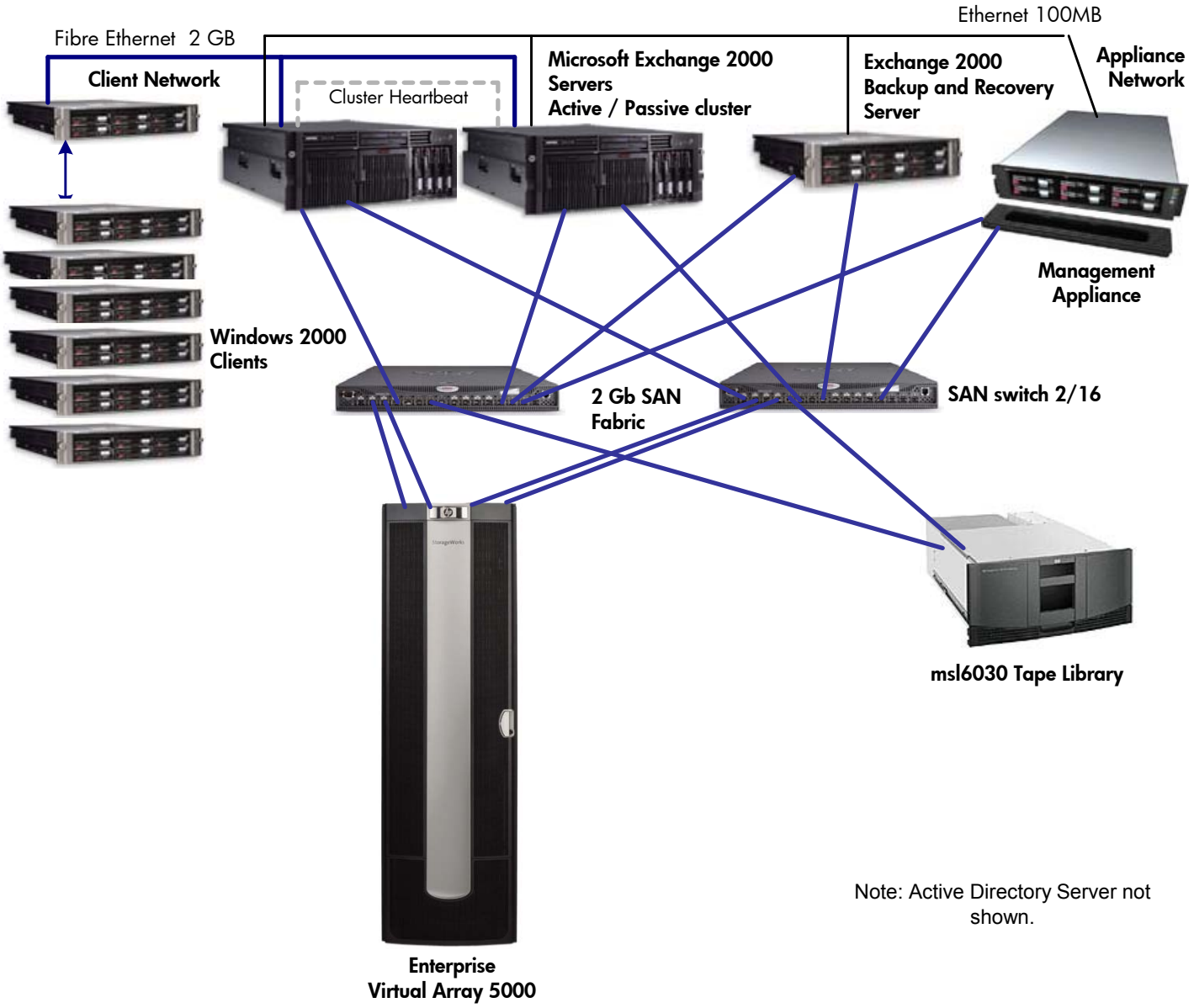

figure 3. Rapid Recovery for Exchange 2000 solution configuration

hardware and software components

The configuration detailed in figure 4 and table 2 provides a list of components for a typical baseline solution. This suggested configuration may be modified based on individual requirements. The configurations described in this blueprint do not necessarily represent the specific Exchange configuration that was developed as part of the solution validation process. All component names and part numbers are accurate as of the printing of this document but are subject to change.

Exchange 2000 Server **hp ProLiant DL580 G2**		2-Way Xeon 1.6 GHz, 4 GB ECC SDRAM (4) 36 GB, universal disk drives Integrated Gigabit Ethernet NIC NC6136 StorageWorks FCA2101 2 Gb FC HBA Windows 2000 Advanced Server SP3 Exchange 2000 Enterprise Edition SP3 Business Copy EVA v2.1a Client StorageWorks secure path v4.0A for Windows
Backup Server **hp ProLiant DL380 G3**		2.4 GHz processor, 1 GB SDRAM (2) 36 GB, universal disk drives Integrated Gigabit Ethernet NIC NC6136 NC3164 Gigabit Ethernet NIC StorageWorks FCA2101 2 Gb FC HBA Windows 2000 Advanced Server SP3 Exchange 2000 Server SP3* Business Copy EVA v2.1a Client StorageWorks secure path 4.0A for Windows Backup Application Software and associated agents (choose one): hp OpenView storage data protector v5.0 VERITAS Backup Exec v8.6 VERITAS NetBackup v3.4,v4.5 CommVault Galaxy 3.7.1 * Allows for individual mailbox restores and / or offline integrity chacks.
SAN Management Appliance **hp OpenView storage management appliance**		OpenView storage management appliance II OpenView storage management appliance software V2.0 SP3 StorageWorks Business Copy EVA v2.1a
Fibre Channel Switch **hp StorageWorks SAN switch 2/16**		(16) 1 Gb / 2 Gb universal auto-sensing ports
Enterprise Storage **hp StorageWorks enterprise virtual array 5000**		**Enterprise Virtual Array 5000** HSV110 dual controllers, 512MB mirrored cache VCS V3.0 Firmware Windows 2000 Server Edition Kit v3.0 (84) 36GB Ultra3 SCSI 10K Disk Drives
Tape Library **hp StorageWorks msl6030**		StorageWorks msl6030 tape library (2) StorageWorks SDLT 110/220 tape drives StorageWorks network storage router n1200

figure 4. Rapid Recovery for Exchange 2000 solution components

table 2. hardware and software components

	Quantity	Part Number
Exchange Server		
HP ProLiant DL580 G2 server—Intel Xeon 2.0 GHz RAM upgrade, 2-GB ECC SDRAM HP NC6136 Gigabit Server NIC	2 1 ea 1 ea	201203-001 202171-B21 203539-B21
36.4-GB Wide Ultra3 SCSI 15,000-rpm Universal Disk Drives	4 ea	232916-B22
FCA 2101 2-Gb FC HBA	2 ea	245299-B21
Windows 2000 Advanced Server with SP3	1 per server	Microsoft reseller
Microsoft Cluster Server (MSCS)	1 per server	Microsoft reseller
Microsoft Exchange 2000 Server 2000 Enterprise Edition with SP3	1 per server	Microsoft reseller
hp StorageWorks business copy eva 2.1a client	1 per server	included in business copy license pack
hp StorageWorks Secure Path 4.0 for Windows Secure Path 4.0A for Windows software update http://h18006.www1.hp.com/products/sanworks/softwaredrivers/securepath/spwinv40a.html	1 license 5 licenses	165989-B23 231292-B23 requires web download
Backup/Recovery Server		
hp ProLiant DL380 G3 server—Intel Xeon 2.4 GHz RAM Memory Upgrade, 512-MB ECC SDRAM hp NC6136 Gigabit Server NIC	1 1 1	257917-001 300678-B21 203539-B21
36.4-GB Wide Ultra3 SCSI 15,000-rpm Universal Disk Drives	2	232916-B22
FCA 2101 2-Gb FC HBA	2	245299-B21
Windows 2000 Advanced Server with SP3	1	Microsoft reseller
Microsoft Exchange 2000 Server SP3	1	Microsoft reseller
hp StorageWorks business copy eva client	1	included in business copy license pack
hp StorageWorks Secure Path for Windows	1	included in Secure Path - 5 license pack
Management Appliance		
hp OpenView storage management appliance II	1	189715-002
storage management appliance software V2.0 SP3 http://h18000.www1.hp.com/products/sanworks/softwaredrivers/managementappliance/index.html		requires web download
hp StorageWorks business copy eva V2.1a (or) hp StorageWorks business copy upgrade UI eva v2.1a	1	326719-B22 331246-B22

table 2. hardware and software components (continued)

Storage – Enterprise Virtual Array		
Enterprise Virtual Array 5000—2C6D-B 42U M3220 Controller assembly with dual HSV110 controllers and (6) M5214 dual Fibre loop 14-bay drive enclosures	1	283198-B21
VCS PKGV3.0 Dual HSV Controller, base controller software (or) VCS HSV110 v2.0 to v3.0 Upgrade License (upgrade license only, VCS v2.0 prior version license *required*)	1	250203-B25 291542-B21
36GB 10K rpm dual-port 2Gb/sec FC-AL 1in drive	84	238590-B21
Windows NT, Windows 2000, Windows 2003 Server Edition Kit v3.0 for Enterprise Virtual Array	1	333685-B21
Fibre Channel Cables	As required	234457-B2x
StorageWorks business copy eva5000 4 TB LTU, license only (or) Business Copy VCS Snapshot License upgrade VCS2 to VCS3, 3.1TB	1 1	326724-B21 333152-B21
Backup		
hp StorageWorks msl6030 Tape Library (2 LTO Ultrium 460 tape drives)	1	330731-B23
e1200-160 Fibre Channel Interface Card MSL embedded fibre option kit	1	330728-B21
hp OpenView storage data protector 5.0, starter pack SAN drive extension Online backup extension	1 1 per drive 1 per server	B6961AA B6953AA B6965BA
VERITAS Net Backup V3.4 or V4.5 with associated agents (optional)		VERITAS

test environment

This section describes the baseline configuration used in the validation testing of the solution
.

network configurations

The Ethernet is configured for cluster operations using three different network segments. The heartbeat between the two cluster nodes requires the first network segment. The heartbeat is configured as a private network for cluster communication only. A second network segment is required for client access to the application servers. It was configured as a public network. The third network segment is set up for the Management Appliance and its applications. This network is set up as a mixed network, so the applications running on the Management Appliance can operate corresponding agents on the hosts connected to the SAN. Three additional IP addresses are created for the virtual cluster environment.

The SAN is configured with two redundant 2-Gb 16-port SAN switches and managed by the hp OpenView storage management appliance. Two fibre channel paths are required for each server for a fully redundant configuration.

Exchange backup/recovery server

A dedicated ProLiant DL380 G3, loaded with Microsoft Windows 2000 Advance Server SP3, was used for SAN-based tape backups. Exchange 2000 Server SP3 was installed on the backup/recovery server. This method provided individual Exchange 2000 mailbox restores, offline integrity checks, and the ability to test new versions of software.

By mounting the snapclones on the backup/recovery server, the database and logs can be backed up to a tape library without impacting the production Exchange 2000 server. HP OpenView storage data protector V5.0, VERITAS NetBackup V3.4, and VERITAS NetBackup V4.5 were separately installed and used as the backup applications. The databases and logs were backed up to an HP MSL5026 Tape Library using SDLT 110/220 tape drives.

Exchange servers

The Exchange 2000 servers used Microsoft Windows 2000 Advanced Server SP3. Two ProLiant DL580 G2 servers, each having two FCA2101 (2-Gb HBA) adapters, powered the Exchange 2000 Server (active/passive) cluster. Each server used Secure Path v4.0A to manage a high-availability multiple path fibre channel connection to the SAN.

clients

Seven clients were loaded with the Business Copy 2.1 client software and connected to the Gigabit Ethernet network. All clients had identical configurations. Microsoft LoadSim was used to generate an MMB2 load. The load was balanced across six clients with 450 users each, and the seventh client acted as a control unit with 300 users.

Exchange configuration

The following example Exchange 2000 configuration was tested during solution development. This information is intended as a guide for configuring a comparable Exchange 2000 Rapid Recovery solution to meet your specific needs and may be modified as required. The assumptions, design rules, and scalability options are provided for further reference.

Two Exchange storage groups, SG1 and SG2, were created. The first storage group contained two databases and a public folder store. The second storage group contained two databases. Each storage group contained 1500 mailboxes (750 mailboxes in each database). For a Microsoft Cluster Server configuration, two virtual Exchange cluster servers were created for improved application availability during the database replication process. Each virtual server owned one of the two storage groups as previously described.

Circular logging was disabled in both storage groups so that the transaction logs could be rolled forward during restoration.

enterprise virtual array configuration

An eva5000 with VCS firmware v2.02 was configured to support the storage requirements for 3000 Exchange users, each with 50-MB mailboxes, equally distributed within each database. The .EDB and .STM files were separated from the transaction logs by placing them on separate virtual disks within the array. Separate virtual disks were created from a single EVA disk group.

Storage Group 1		
G:	Database 1	Data size 21.6 GB, Disk size 75 GB (VRAID1)
G:	Database 2	Data size 21.7 GB, Disk size 75 GB (VRAID1)
I:	Log File	Data size 25 MB, Disk size 25 GB (VRAID1)
Storage Group 2		
H:	Database 1	Data size 21.5 GB, Disk size 75 GB (VRAID1)
H:	Database 2	Data size 21.6 GB, Disk size 75 GB (VRAID1)
J:	Log File	Data size 25 MB, Disk size 25 GB (VRAID1)
Public Folder		Data size 52 MB, Disk size 75 GB

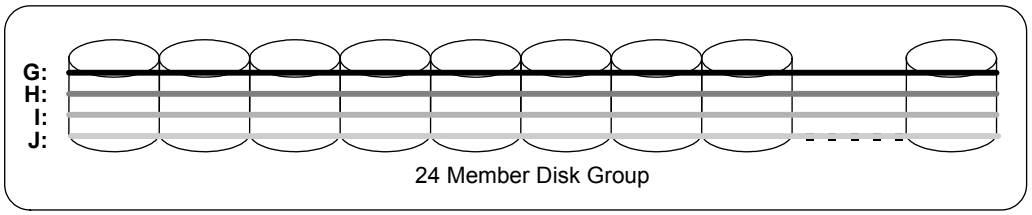

figure 6. disk layout—Enterprise Virtual Array 5000

The following best practices were used when configuring the Exchange environment:

- Traditional Microsoft Exchange 2000 configuration rules apply when planning storage configurations. Use VRAID1 for .EDB, .STM, and log files. Always keep log files on volumes that have been configured using VRAID1 because of heavy write activity.
- When configuring data and log files, it is an HP best practice and Microsoft recommendation to use different disk groups for log files and data files. Using this strategy, the log files will always be located on different volumes than the data files.
- If you are expecting very heavy user activity, use *preferred paths* whenever possible to direct I/O flow across both array controllers.

performance results

A baseline configuration was developed to determine the impact of snapclones on the Exchange Server 2000 database. All performance tests were compared against this baseline configuration.

Test 1. Baseline with Business Copy EVA

Business Copy EVA was installed into the SAN environment and a baseline test was performed to determine the impact of Business Copy on the Exchange 2000 Server and SAN performance.

- Baseline 1a had a single cluster virtual server but did not have Business Copy software installed.
- Baseline 1b had two cluster virtual servers installed and Business Copy agents running.

Results: Introducing Business Copy EVA into the Exchange 2000 Server/SAN environment did not have an impact on the application or network performance. The baseline performance numbers remained acceptable.

Test 2. Creating snapclones

To remain within Microsoft support guidelines, Exchange suspends services to the storage group whose database is being cloned while the associated snapclone is being created. Note that all other storage groups remain active. The snapclone uses a two-step method of creating an image of a virtual disk (volume). The first step is to create a virtually instantaneous snapshot, which allows immediate access to the image. The second step is an automatic *unsharing* process that creates a clone of the host volume. The snapshot element is then deleted after the unsharing is completed and the clone is available.

Results: The snapclone portion of the Business Copy job took an average of 4.6 minutes. This time will vary depending on the number of logged-on users and current Exchange load. There is a slight performance impact during the normalizing process (disk queue lengths are increased by about 15 percent) as users log back in after re-mounting the storage group. The snapclone unsharing process (normalization) also affects disk performance while the clone volume is being copied.

Test 3. Snapclone-based backup

A snapclone of one storage group was created, split off, mounted on a remote backup server, and backed up to tape. The snapclone was immediately available as a backup source, even while the clone unsharing process is running. Third-party backup applications were used to backup the snapclone from the backup server to tape.

Results: Snapclone-based backups are completed in slightly greater time than Exchange online backups. See Table 3. However, the snapclone-based backup is not associated with the Exchange application server, eliminating any influence of backup on the Exchange performance.

Test 4. Snapclone-based restore

The time it takes to restore one storage group when creating a snapclone of the database and logs was compared to an online restoration from tape. Third-party backup applications were installed on the Exchange server and used to restore one storage group while the other storage group continued to operate under load. Data was transferred from the tape library to the Exchange server over the SAN.

Results: Restoring a storage group using snapclones was significantly faster than restoring from tape. See Table 3. Note that additional time should be included when using the Exchange utilities such as ESEFILE and ESEUTIL, which may be used to check database integrity after restoring from tape. Since a snapclone is a copy of the entire volume, the restore time of a snapclone remains constant even as the size of the datastores is increased, while the tape restore times will increase proportionally.

table 3. backup and restore performance using clones (eva5000/HSV110)

backup performance results	**time**
online backup to tape (SAN) using third-party backup applications	48 min
snapclone backup to tape	55 min
restore performance results	
restore from snapclone	4 min
restore from tape	66 min

Note: Backup times reflect use of SDLT 100/220-GB drives (11 MB/s native).

Test 5. Using HP OpenView Automation Manager to launch Business Copy jobs

In this test HP OpenView Automation Manager v2.0 was used to launch Business Copy EVA jobs.

Results: Automation Manager and Business Copy easily integrate to perform automated backups from snapclones. The Automation Manager policy worked seamlessly, without significant time added to the Business Copy job completion time.

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 the only Prime Integrator of Exchange 2000 as designated by Microsoft and has over 3.7 million Exchange 2000 seats under contract.
- HP servers and storage arrays are Microsoft-certified platforms.
- HP storage is being used to support 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

A companion implementation blueprint is also available for this solution that provides detailed and in-depth information. See your HP sales representative or authorized reseller for more information.

For additional information on the Rapid Recovery for Exchange 2000 solution:
http://h18000.www1.hp.com/products/storageworks/solutions/rrex2k/index.html

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

Microsoft Exchange 2000 information:
http://www.microsoft.com/exchange/default.asp

hp StorageWorks Enterprise Virtual Array 5000 information and documentation:
http://h18006.www1.hp.com/products/storageworks/enterprise/index.html

hp OpenView Storage Management Appliance information and documentation:
http://h18006.www1.hp.com/products/sanworks/managementappliance/index.html

hp StorageWorks business copy EVA information:
http://h18006.www1.hp.com/products/storage/software/bizcopyeva/index.html

hp StorageWorks Exchange Solutions:
http://h18006.www1.hp.com/storage/solutions/application.html#me

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

hp OpenView storage data protector information and documentation:
http://h18006.www1.hp.com/products/storage/software/dataprotector/index.html

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.

04/03