



hp storage solutions

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technical
blueprint

hp StorageWorks rapid restore solution for Lotus Domino R5.0.8

using hp StorageWorks enterprise volume manager and
hp StorageWorks enterprise virtual array

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executive summary

This technical blueprint describes a quick and complete method of recovering Lotus Domino databases with minimal disruption. Using HP StorageWorks Enterprise Volume Manager (EVM) v2.0D and HP StorageWorks Enterprise Virtual Array (EVA) v2, customers can create virtual snapclones of their Lotus Domino databases and resume full operation of their Domino environments in minutes. A snapclone is a complete physical point-in-time copy of a data volume, which can perform an extremely rapid restoration of application environments.

Performance testing provided numerous insights into the best ways to use snapclones with EVA for rapid recovery of Lotus Domino data. By using the information in this guide, customers will be able to:

- Create snapclones of the Lotus databases.
- Restore data from snapclones.
- Create scripts to implement automatic backups from snapclones.
- Back up from snapclones to tape.

Administrators face lengthy delays when restoring a Lotus Domino environment from tape. The HP StorageWorks Rapid Restore for Lotus Domino Solution, which is based on creating snapclones with EVM in a Storage Area Network (SAN) configuration, reduces the restore time from hours to minutes and causes minimal disruption to end users. You can achieve a highly available Lotus Domino environment with a complete set of hardware and software. In addition, the time savings can be dramatic when restoring your Domino environment, as illustrated in figure 1.

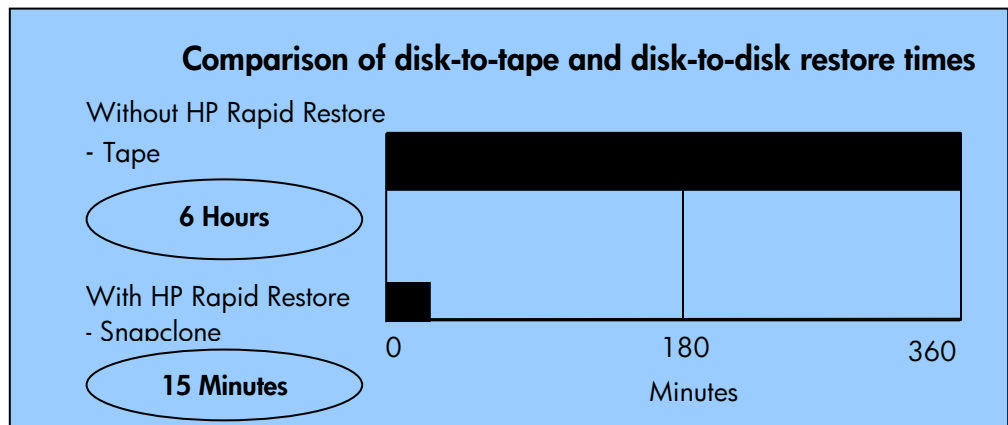


figure 1. 175 GB database with 10,000 users, 8,000 active

By using this solution to augment your tape-based recovery plan, you can recover your entire application environment rapidly, decreasing the amount of application downtime. When you create a snapclone of your database, you have an exact point-in-time copy of your production data. In addition, you can offload operations from the production server. These operations include tape backup, which is discussed in this guide, as well as testing, data mining, and system maintenance.

“We’ve seen speed improvements of 50 percent because of Domino, ProLiant CPU speeds, and SAN storage. And the clustered configuration ensures that this business-critical application is always up and running.”

Thomas Bullinger
IT Communications Manager
Carl Zeiss

about snapclones

With EVA, you can create fully allocated snapshots and snapshots that normalize into snapclones. 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.

The snapclones used in this solution are complete, physical, point-in-time copies of data volumes and are ideal for reducing I/O loads on the production volumes. These copies can be used for backups to tape, disk-based backups, or application testing and data mining that will not impact production data.

Snapclones are snapshots that normalize into clones. A snapclone has the same properties as a snapshot, so it is instantly available. The normalization process of copying the data from the original LUN happens in the background. Similar to a snapshot, a snapclone can be instantly mounted or backed up to tape. However, with snapclones, when the normalization process is complete, you have an exact copy of the database or LUN you wanted to clone. This is especially useful for fast restores if a catastrophic failure happens. Snapclones can be taken in any redundancy level (Vraid 0, 1, or 5) and they do not require extensive advanced preparation. Long “re-sync” times are also eliminated with snapclones since a current clone copy can be available for use in moments rather than hours.

features and benefits

This solution provides the following benefits to administrators:

- Dramatically improved backup and restore times for Lotus Domino R5 mail databases
- Best practices for maximizing Lotus Domino R5 availability during database recovery scenarios
- Simplified implementation and management, including script examples
- Investment protection by leveraging existing HP hardware and software supporting multiple configurations and providing interoperability with future products
- Automated task scheduling of backup activity with HP OpenView Storage Management Appliance software V2.0
- Integration with third-party tape backup applications—specifically tested with VERITAS Backup Exec V8.6

business needs

The Rapid Restore for Lotus Domino solution is best suited for the following types of environments:

- Customers who require the highest level of availability for Lotus Domino environments
- Centralized Lotus Domino environments with more than 5,000 mailboxes
- Customers who have experienced significant costs as a result of downtime caused by database recovery
- Customers whose current recovery methods are time-consuming and inaccurate

solution overview

The Rapid Restore Solution for Lotus Domino R5 is a validated and fully integrated configuration that provides a clustered SAN-based backup and restore infrastructure for end-to-end data protection. This solution leverages the capabilities of EVA V2, EVM V2.0D, and the HP StorageWorks Enterprise Backup Solution (EBS), as illustrated in Figure 2.

solution components

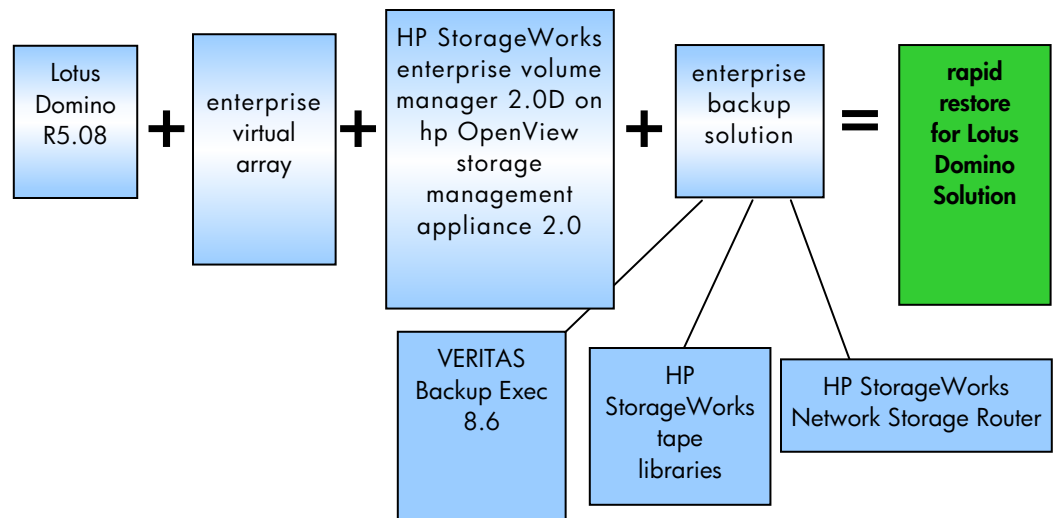


figure 2. diagram of components

solution configuration

The Rapid Restore for Lotus Domino R5 Solution consists of four basic components:

- Lotus Domino R5
You can configure the Lotus Domino server on any Windows 2000 server and use a Microsoft Cluster Server (MSCS) configuration for improved application availability. This solution documents a four-node MCSC cluster on Windows 2000 Datacenter with SP3.
- Enterprise Virtual Array V2
The Lotus Domino mail and log databases are located on the EVA. Based on the HSV controller, EVA is a high-performance, high-capacity, and high-availability “virtual” RAID storage solution that eliminates the time, space, and cost boundaries of traditional storage.

By using snapclones as part of your backup and restore strategy, EVA can save Lotus Domino customers significant time. Administrators can mount the clone on a secondary server and perform tape backup operations offline, while the production Domino server is up and running. Administrators can also restore full databases by mounting the clone on the production server and using the snapclone as the new data volume.

- Enterprise Volume Manager V2.0D
EVM is browser-based storage management software that facilitates controller-based clone operations to make a block-to-block copy of a storage volume. With EVM, you can create, run, and manage automated storage replication jobs, as well as link them with external jobs. The snapclones are also created using EVM 2.0D scripts.

You must have an EVM host agent on each database server to utilize controller-based database cloning. The HP OpenView Storage Management Appliance is the operating platform for EVM, which offloads the processing from the user host systems.

- Enterprise Backup Solution (EBS)—optional
EBS provides a consolidated backup infrastructure that includes multiple servers connected over a high-speed Fibre Channel SAN to centrally attached SCSI tape libraries. This solution includes the NSR N1200 network storage router and the MSL5026 SDLT Tape Library as the EBS components.

Enterprise Backup Solution with VERITAS Backup Exec V8.6 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 clone-based offline tape backups. An approved third-party backup application, with associated Lotus Domino agents and SAN agents, provides backup management. A separate backup host, with the backup application loaded and visible to the storage subsystem and the EBS components, is required.

test environment

This section describes the baseline configuration and provides listings of the hardware and software components used in the solution.

test configuration

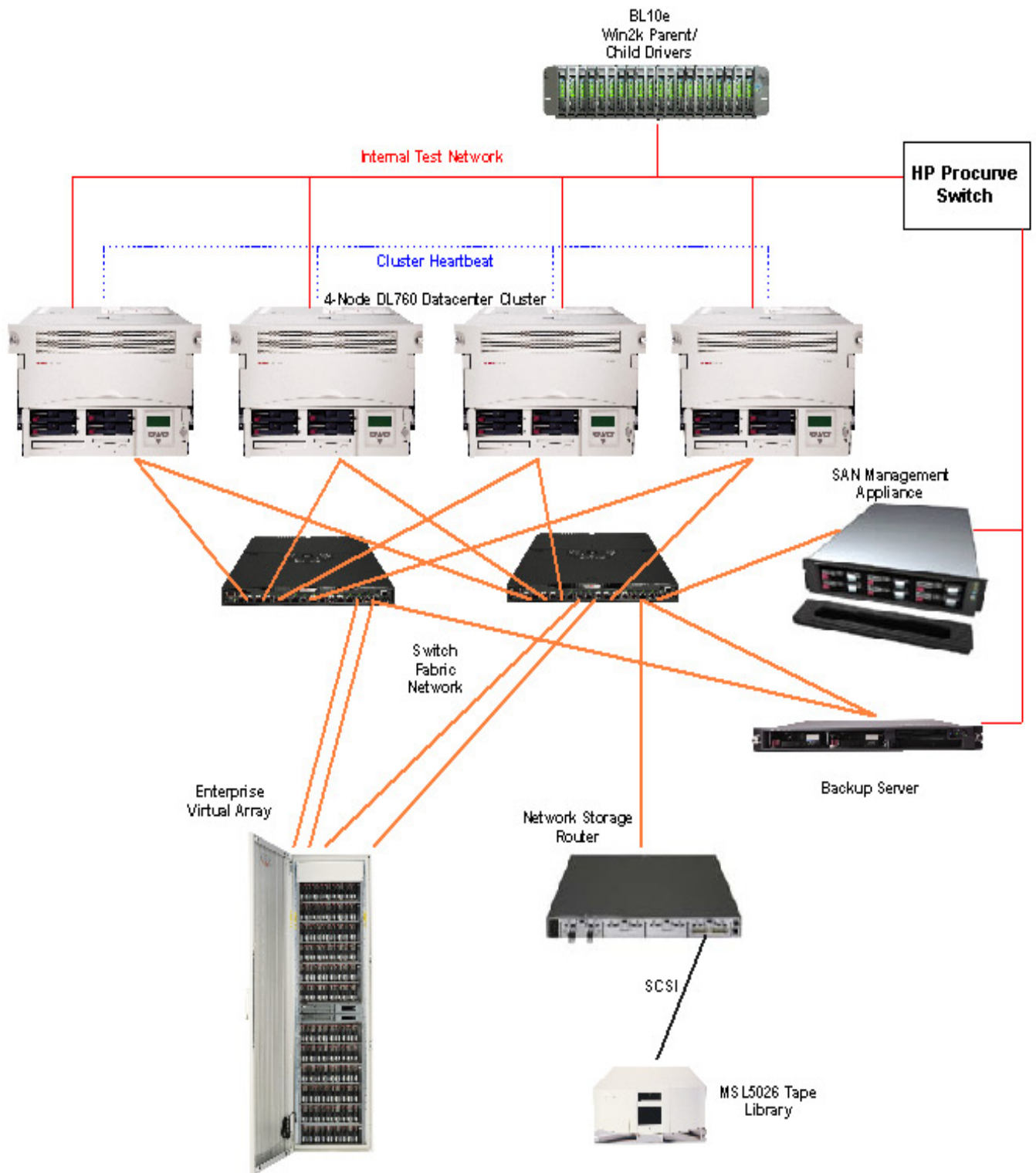


figure 3. test configuration

Four ProLiant DL760 8-way servers were used as Lotus Domino R5 mail servers in a four-node Microsoft Cluster Server (MSCS) cluster configuration. Each node had two FCA2101 (2-GB HBA) adapters, which were connected to the fabric switch network. A ProLiant DL360 was used as the backup server and hosted the backup application, VERITAS Backup Exec V8.6. The ProLiant DL360 also served as the domain controller for the environment.

EVA V2 provided storage for the Lotus Domino environment in a 2C6D configuration, which includes two HSV110 controllers and six disk cabinets (48–72.8 GB 15k rpm disks) for a total of 3.5 TB for disk storage. An MSL5026 SDLT Tape Library provided tape backup and restore support. The fabric switch network consisted of two redundant 2/16 EL SAN switches, housed in the EVA cabinet for enhanced cable management.

Two subnets were set up for the test environment:

- The first subnet served as the cluster heartbeat to allow communication between the cluster nodes on the main network. This subnet was set up as a private network and was dedicated to cluster communication.
- The second subnet was configured as the public network and included the dual-NIC cluster nodes along with the backup server, Storage Management Appliance and applications, and the drivers.

hardware and software components

Following are the hardware and software components used in the test configuration.

table 1. hardware components

ProLiant Servers Hardware	Part Number
ProLiant DL760, Pentium III, 700 MHz, 8 way	(4) 177657-B21
8 GB–2048 MB 100 MHz ECC SDRAM DIMMs Memory Expansion Kit (per server)	(16) 328809-B21
36.4 GB Ultra 3, 15K rpm drives (4 per server)	(16) 176496-B22
FCA 2101 (LP952) HBA	(8) 245299-B21
Backup Server	
ProLiant DL360 server, Pentium III, 1-GHz Processor	233271-B21
FCA 2101 (LP952) HBA	(2) 245299-B21
Management Appliance	
HP OpenView Storage Management Appliance II	189715-002
Primary Storage Hardware	
HP StorageWorks Enterprise Virtual Array — 2C6D-B 42U M3220 Controller assembly with dual HSV110 controllers and 6 M5214 dual fiber loop 14-bay drive enclosures	283198-B21
72 GB 10K rpm dual-port 2 Gb/s FC-AL 1-inch drive	(48) 238921-001

table 1. hardware components (continued)

SAN/Network Infrastructure	
SAN Switch 2 GB/16 Port EL	(2) 283056-B21
5 m LC-LC Multi-Mode Fibre Channel Cable	(16) 221692-B22
15 m LC-SC Multi-Mode Fibre Channel Cable	(2) 221691-B23
30 m LC-SC Multi-Mode Fibre Channel Cable	221691-B26
15 m LC-LC Multi-Mode Fibre Channel Cable	221692-B23
Secondary Storage Hardware	
NSR N1200 Network Storage Router	(1) 280823-B21
MSL5026SL RM SDLT Minilibrary (2 drives)	302512-B22
ProLiant Servers Hardware	
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15 m LC-LC Multi-Mode Fibre Channel Cable	221692-B23
Secondary Storage Hardware	
NSR N1200 Network Storage Router	(1) 280823-B21
MSL5026SL RM SDLT Minilibrary (2 drives)	302512-B22

table 2. software components

Software	Part Number
Windows 2000 Data Center with SP3*	Third party
Microsoft Cluster Server (MSCS)	Included
Lotus Domino R5	Third party
HP OpenView Storage Management Appliance software V2.0	QB-6M4AA-SH Requires download from website
HP StorageWorks Secure Path V4.0A (5 licenses)*	<i>Available Feb.-Mar., 2003. If required earlier, contact LotusStorageSolutions@hp.com</i>
HP StorageWorks Enterprise Volume Manager V2.0D (Starter kit, 5 host licenses)*	263670-B22
WNT/W2K KIT V2.0 ENT VIR ARY (for Windows NT 4.0/Windows 2000)	250195-B22
Snapshot License for VCS V2.0 Dual HSV Controllers up to 3.1 TB	253256-B22
VCS PKG V2.0 Dual HSV Controller (base controller software)	250203-B23
Lotus Notes bench R5 mail workload generator	Third party
VERITAS Backup Exec V8.6	Third party

*When using HP StorageWorks Secure Path V4.0 and HP StorageWorks Enterprise Volume Manager V2.0x, use Windows Service Pack 2. After you upgrade to Secure Path V4.0A, you can use Windows Service Pack 3. For more information about Secure Path V4.0A, contact LotusStorageSolutions@hp.com.

performance results

A baseline EVA configuration was created with a full install and configuration of software in the Lotus Domino environment, including EVM V2.0D, Secure Path V4.0A, and HP OpenView Storage Management Appliance software V2.0. The following configurations were tested:

Test 1. Baseline with EVM

An 8,000-user baseline test was run in the environment, which created a 37% CPU utilization on Node 1 of the cluster. The load was generated on the cluster using the Lotus Notebench load-driving tool. The baseline test was then compared against other performance tests to determine the impact of creating a snapclone in the Lotus Domino environment. Performance numbers were collected using Windows Performance Monitor and Lotus Notebench.

Results:

Numerical results are displayed in Table 6, "Baseline and Snapclone Performance Results."

Test 2. Creating snapclones

Creating snapclones with EVA uses available disk space in the disk group of the parent vdisk to create the vdisk copy. Using snapclones in this solution consumed 525 GB, including the mirrored data volume of 175 GB. By using Lotus Domino partitions, the size of the snapclones and normalization times were significantly reduced.

The snapclone of partition 1 was created while it was offline. The remaining partitions were online. Partition 1 was brought online while the snapshot was normalizing into a snapclone in the background. Since the snapclone has the same properties as a snapshot, the snapclone of partition 1 was instantly available. When the normalization process was completed, an exact copy of the partition that was being cloned was ready for use.

Results:

Snapclone creation took approximately two minutes—one minute to stop and start the Lotus Domino cluster task under no load and one minute to create the initial snapshot. Without partitions, the snapclones would have been three times larger, and three times as many users would have been affected when the server was brought offline to initiate the snapclone. However, one factor to consider is the time to start and stop the server, which increases as the number of users that are currently connected increases.

Table 4 shows the snapclone building times for different size partition volumes.

table 4. snapclone building times

LUN Size/Type	Normalization Time without/Load	Normalization Time with/Load
20 GB data	17 min	NA
175 GB data	128 min	224 min

There was slight performance degradation on the server being tested while the snapclone was normalizing in the background. The delay caused by creating the snapclone resulted in an increase of disk queues on the server and a decrease of CPU utilization. However, this testing was performed under a heavy load to maximize the negative impact that can occur when creating a snapclone. There also was an active/subscribed user ratio of 80% and 8,000 users were driving load against the server. The impact varies depending on the load in the customer environment.

Test 3. Backing up to tape

For comparison purposes, a tape backup was made of Lotus Domino partition 1, which was offline for the duration of the backup. The remaining partitions were online. The time it took to create the tape backup was compared to the amount of time it took to create a snapclone.

Results:

The time to perform a full tape backup of the Lotus Domino partition was 6 hours and 21 minutes, or five times longer than the time needed to normalize the snapclone (under no load during off hours) and about 190 times longer than the time needed to create the snapclone.

The 6-hour, 21-minute backup window includes the time needed to verify the backup at completion, which was about 2 hours and 10 minutes. This time ensures that the tape backup is readable and uncorrupted and is recommended when performing tape backups.

Note: As an alternative, you can also use VERITAS Backup Exec V8.6 to perform tape backups while the server is online by using Lotus Domino agents residing on the server. This is a recommended approach for limiting server downtime.

Online backups have minimal effect on Lotus Domino performance but are an inefficient method for frequent backups because of the time required for completion and the potential conflict with user activity. Performing tape backups while the server is offline is inefficient, even when conducted during off hours. Snapclones provide limited server downtime and impact on the user.

Test 4. Restore Operations

With snapclones as your restore method, you can use the Windows drag and copy functions to restore particular databases or to mount the entire snapclone as the new data volume. You can also restore the entire data volume by unrepresenting the corrupted vdisk and presenting the snapclone data volume to the server and cluster.

Although you can restore Lotus Domino databases from a tape backup, it is an inefficient method since the server must be down for extended periods of time.

Results:

The use of snapclones with EVA and EVM proves to be the fastest and most reliable means of restoring Lotus Domino databases. See Table 5.

table 5. time needed for different restore methods

Lotus Domino Restore Method	Time
Lotus Domino Snapclone Restore	15 min
Windows File Drag and Copy	Depends on size of database
Lotus Domino Tape Restore	6 hrs 2 min

table 6. baseline and snapclone performance results

	Baseline with EVM	Creating snapclones
User Connections	8000	8000
Benchmark Profile	R5 mail	R5 mail
Length of Test (steady state)	5 hrs	6 hrs
Database downtime	n/a	2 min
Processor Time (%)	37.1	29.7
Process % CPU Time – nserver	67.3	58.8
Process % CPU Time – nrouter	29.1	24.4
Available Bytes (MB)	1350	1238
Pages/Sec	2928	2740
Avg. Disk Queue Length	7.2	12.3
Avg. Disk Sec/read	.015	.025
Avg. Disk Sec/write	.007	.014
Current Disk Queue Length	7.3	12.02
Disk reads/sec	395.3	385
Disk writes/sec	191.3	187.7

**adaptable,
extensible,
controllable**

ENSAextended is an architecture that puts businesses in control of their storage environment and provides ways for them to control complexity, uncertainty, and risk. This Rapid Restore for Lotus Domino Solution supports the ENSAextended strategy in the following ways:

- **adaptable**—You can easily write customized EVM scripts to meet your business needs.
- **extensible**—You can deploy the same storage solutions for Lotus Domino as for other strategic applications, for example, Exchange, SQL, SAP, Oracle
- **controllable**—You have total control over your backup process as the solution allows you to take the guesswork out of deployment, ensuring predictability and control.

summary

Local replication of online disks and volumes is emerging as the technique of choice for protection of critical data. Companies today rely, to an unprecedented extent, on online, frequently accessed, constantly changing Lotus Domino systems for messaging and collaboration. Unplanned events that prevent the availability of data can have negative consequences for business operations. Even with a well-executed backup strategy, administrators face lengthy delays when restoring Lotus Domino environment. The Rapid Restore for Lotus Domino Solution reduces the restore time from hours to minutes and causes minimal disruption to end users. You can achieve a highly available Lotus Domino environment with a complete set of hardware, software, and supporting utilities.

**for more
information**

For more on the HP StorageWorks Rapid Restore for Lotus Domino Solution
<http://h18006.www1.hp.com/storage/solutions/application.html>

For HP Lotus Solutions for Industry Standard Servers:
www.hp.com/solutions/lotus
www.hp.com/go/activeanswers/lotus

For information about Lotus Domino
<http://www.lotus.com/products/r5web.nsf/webhome/nr5serverhp-new>

For HP StorageWorks Enterprise Virtual Array information and documentation:
<http://h18000.www1.hp.com/products/storageworks/enterprise/index.html>

For HP OpenView Storage Management Appliance information and documentation:
<http://h18000.www1.hp.com/products/sanworks/managementappliance/index.html>

For HP StorageWorks Enterprise Volume Manager documentation:
<http://h18000.www1.hp.com/products/sanworks/evm/index.html>

For EVM integration with Enterprise Backup Solutions, including VERITAS Backup Exec
<http://h18000.www1.hp.com/products/storageworks/ebs/documentation.html>

For HP StorageWorks Secure Path information and documentation:
<http://h18000.www1.hp.com/products/sanworks/secure-path/documentation.html>

For VERITAS Backup Exec information and documentation:
www.veritas.com/products/category/ProductDetail.jhtml?productId=bews

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