



hp storage solutions

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implementation
blueprint

hp StorageWorks rapid restore solution for Lotus Domino R5.0.8

using hp StorageWorks enterprise volume manager V2.0D and hp StorageWorks enterprise virtual array V2

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executive summary

The HP StorageWorks Rapid Restore for Lotus Domino solution is a quick and complete method of recovering Lotus Domino databases with minimal disruption to services. The solution uses **snapclones** as a source for recovery and automated offline backups. A snapclone is a complete physical point-in-time copy of a data volume. Snapclones can be used to perform an **extremely rapid restoration** of application environments. The Rapid Restore for Lotus Domino solution provides 24 x 7 application availability for users. Using HP StorageWorks Enterprise Volume Manager (EVM) V2.0D and HP StorageWorks Enterprise Virtual Array (EVA) V2.0, customers can create snapclones of their Lotus databases and resume full operation of their environment in minutes. By using the information in this solution, 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

The intended audience is made up of experienced Lotus Domino administrators who understand how to work with snapclones using array controllers. Performance testing provided numerous insights into the best ways to use snapclones with EVA for rapid recovery of Lotus Domino data.

Administrators face lengthy delays when restoring a Lotus environment from tape. This solution, which is based on creating snapclones with EVM in a Storage Area Network (SAN)-based configuration, reduces the restore time from hours to minutes and causes minimal disruption to Lotus users. These timesavings can be dramatic, as illustrated in Figure 1.

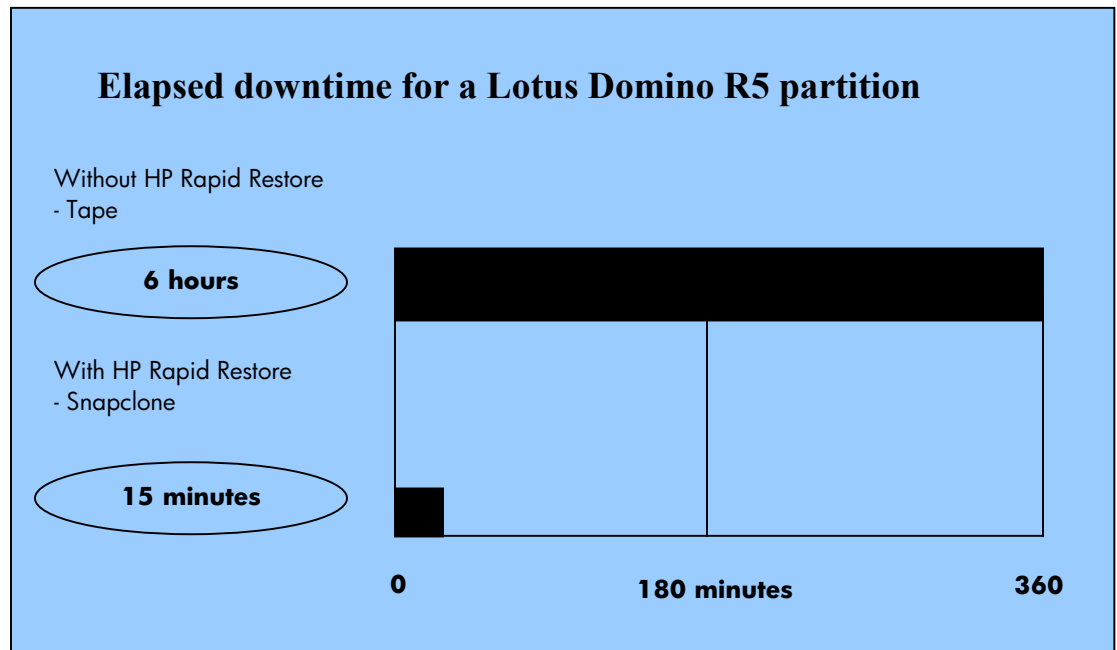


figure 1. 175-GB database with 10,000 users, 8,000 active

about snapshots and snapclones

With EVA, you can create fully allocated snapshots and snapshots that normalize into **snapclones**. The traditional snapshot requires that you reserve 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. Snapclones 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 backup, 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, after 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.

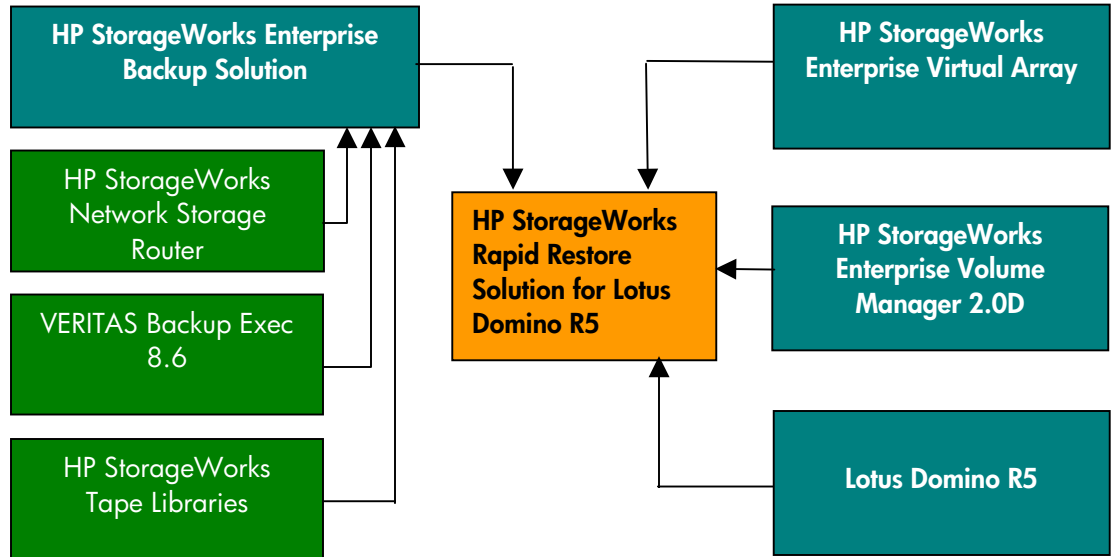


figure 2 . Rapid Restore for Lotus Domino building blocks

solution components

The following diagram illustrates the details of the solution.

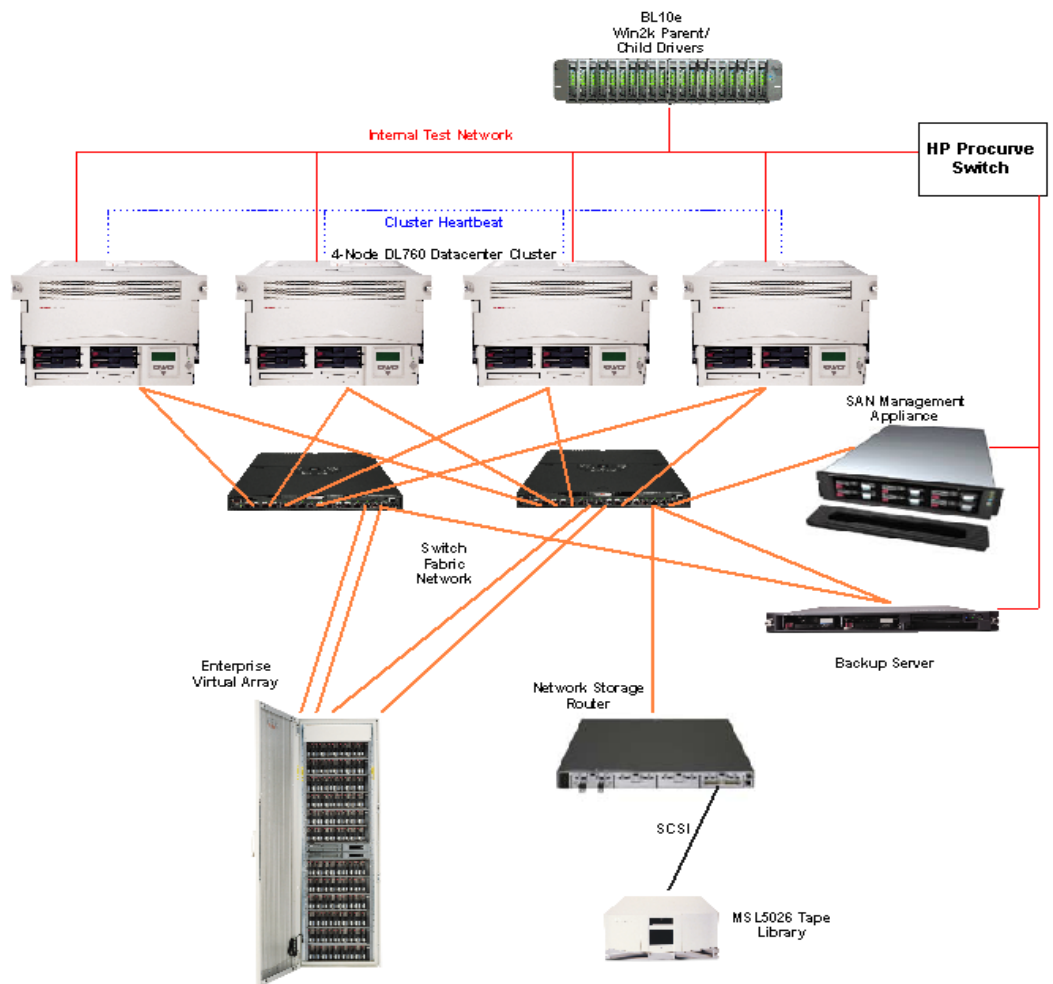


figure 3. details of the Rapid Restore for Lotus Domino solution

The Rapid Restore Solution for Lotus Domino R5 consists of these 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. (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 the Secure Path V4.0A release, contact LotusStorageSolutions@hp.com)
- Enterprise Virtual Array V2
The Lotus Domino mail and log databases are located on the Enterprise Virtual Array. 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
Enterprise Volume Manager 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.

EBS 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.

best practices

- Traditional configuration rules apply when planning storage requirements for your Lotus Domino partitions. Use vraid 1 for mail database vdisks that have high read and write activity to balance the combination of reliability and performance.
- If utilizing transactional logging with Lotus Domino, it is an HP best practice to use different disk groups for log files and data files. Using this strategy, the log files will always be located on different physical disks than the data files.
- Keep log files on vdisks that have been configured using vraid 1 or vraid 1 because of heavy write activity and disk failure recovery concerns.
- HP recommends that you set the protection level to a minimum of single redundancy in all disk groups. Plan on using as much space as the parent vdisk can hold, and if possible add two extra spindles for single redundancy.
- If you are expecting very heavy user activity, use preferred paths whenever possible to direct I/O flow across both controllers.
- EVM 2.0D Host Agent Release Notes recommend logging out of the backup host when running EVM scripts that mount volumes. When the volume is mounted, a confirmation window displays, prompting a restart of the server. You do not have to restart the server, but you must acknowledge the pop-up window. If you are logged out, the window does not display and you do not have to acknowledge it. By logging out, you can be sure that the script runs and is not waiting for you to respond to the window. (If you do not log out, you must answer the question in the window.)

test environment

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

test configuration

Four ProLiant DL760 8-way servers were used as Lotus Domino R5 mail servers in a four-node 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:

- One 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.

The four-node cluster configuration supports a simulated 40,000-user environment with an 80% active user ratio. (With this ratio, 80% of the users are actively sending and receiving mail while the other 20% are subscribed users who are only receiving mail.) The four nodes were divided into 12 Lotus Domino partitions with three partitions per server and 10,000 users per node.

In the test environment, limited disk space was available for mail databases and clones. Therefore, to represent a real-world backup and restore scenario, only node 1 in the cluster was fully populated with mail and able to process a fully simulated workload. The other nodes in the cluster only routed and received mail messages. The actual tests were conducted on the

three partitions of node 1, which included 10,000 users. Of the 3.5 TB of total storage, 582 GB was used for the initial eight-disk default disk group required by EVA. The quorum disk, which is necessary for the cluster, was created in the default disk group on the array. The remaining disks were grouped into one disk group to distribute I/O across the maximum number of Fibre Channel disks for performance. Each mail database for users on node 1 was 50 MB with the following breakdown of mail messages:

table 1. example of one user's mailbox on node 1

number of messages	size of message	total storage
1	5 MB	5 MB
6	1 MB	6 MB
10	500 KB	5 MB
100	100 KB	10 MB
300	50 KB	15 MB
Total: 417		Total: 41 MB*

Notes:

- *(what does this * reference?)The R5 mail template used to create the 50 MB mail databases is approximately 9 MB.
- Users on the other three nodes in the cluster (users 10,001–40,000) have mail databases that are approximately 5 MB and only received mail.
- Each partition on node 1 included 3,333 users (175 GB each) for a total of 10,000 users.
- Each partition LUN, created with the HSV Element Manager, was 175 GB and configured as Vraid1.
- Partitions 4–12 were much smaller Vraid1 LUNs at 20 GB each.

This document does not discuss Lotus Domino server performance or sizing considerations. Lotus Domino performance can be affected by a number of factors, such as the size and type of mail sent, the size of the mail databases, the volume of mail sent and received, and the type of mail routing. These factors directly impact processor, memory, and storage subsystem requirements.

For a full, four-node implementation of 40,000 Lotus Domino users, you also need to consider the types of users that are supported. You will likely need additional disk space. Fortunately, with the virtualization and dynamic growth capabilities of EVA, you can easily add additional disks into the storage subsystem.

Refer to the HP Active Answers Web site for more information on Lotus Domino server sizing, performance, and consolidation.

www.hp.com/go/activeanswers/lotus

hardware and software components

The following is a list of the hardware and software components used in the test configuration. Keep in mind that new versions of these components frequently become available and the listed parts may not be orderable.

table 2. 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/sec FC-AL 1-inch drive	(48) 238921-001
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

table. 3. 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 Web site
HP StorageWorks Secure Path V4.0A (5 licenses) ¹	Available March 2003 or contact LotusStorageSolutions@hp.com
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 4.0/2000)	250195-B22
Snapshot License for VCS V2.0 Dual HSV Controllers up to 3.1 TB	253256-B22
VCS PKGV2.0 Dual HSV Controller (base controller software)	250203-B23
Lotus Notes bench R5 mail workload generator	Third party
VERITAS Backup Exec V8.6	Third party

¹ 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 SecurePath 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 about two minutes, which includes the one minute it took to stop and start the Lotus Domino cluster task under no load, and the one minute it took 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	N/A
175-GB Data	128 min	224 min

There was slight performance degradation on the server under test 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 will vary 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 upon 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. This is described in detail later in this document.

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 required for different restore methods

Lotus Domino restore method	time (hrs)
Lotus Domino Snapclone Restore	15 min
Windows File Drag and Copy	Dependent on size of database
Lotus Domino Tape Restore	6 hrs and 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

solution setup and installation instructions

Caution: Many of the commands and procedures described require Lotus Domino and Windows administrator privileges and could disrupt operations if used incorrectly. If you are not familiar with these commands and functions, consult your Lotus Domino and Windows Datacenter documentation before proceeding. As with any changes to your Lotus Domino configuration or backup plan, be sure to test these changes thoroughly before implementing them in a production environment.

The following components must be installed and configured before implementing this solution (shown in proper order of installation):

- Set up the Storage Area Network with the following components:
 - HP OpenView Storage Management Appliance software V2.0
 - HSV Element Manager V2
 - Snapshot licenses for HSV V2 controllers
 - EVM V2.0D Server
 - HP StorageWorks Secure Path Manager V4.0A
(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 SecurePath V4.0A, you can use Windows Service Pack 3. For more information about Secure Path V4.0A, contact LotusStorageSolutions@hp.com.)
 - Enterprise Virtual Array V2
- Create and configure necessary disk groups. This will include the quorum vdisk that was created on the default disk group along with the 12 Lotus Domino partition data LUNs in their own separate disk group. In a customer environment, HP recommends splitting transaction logs from the data files across multiple disk groups to spread out I/O across spindles.
- Set up the servers appropriately:
 - Dual NICs for network connectivity (cluster heartbeat and public network)
 - FC2101 HBAs
 - Windows 2000 Kit for EVA V2
 - EVM 2.0D Host Agent for Windows 2000
 - Secure Path V4.0A server on hosts

One subnet will be used as the private cluster heartbeat to allow communication between the cluster nodes off the main network. The second subnet is configured for the public network and includes the dual-NIC cluster nodes along with the backup server, the Storage Management Appliance and applications, along with the client and parent test drivers to drive the test.

- Connect SAN components:
 - Connect hosts to the SAN switch.
 - Add host connections to hosts folder on the HSV Element Manager.
 - Present vdisks to Node 1 (cluster quorum disk and 12 Lotus Domino data partitions)
 - i. For best results and to avoid data corruption, power down nodes 2, 3, and 4 while presenting the vdisks to host 1.
 - ii. Perform a full format on all the basic disks (quorum and 12 data LUNs).
 - iii. Power down node 1 and power on node 2. Present LUNs to node 2 and ensure that the logical drives are visible and that the drive letters match those from node 1. To add LUNs as cluster resources, each host must see them as the same drive letter.
 - iv. Repeat step iii for each node, until the LUNs have been presented to every node in the cluster.
 - v. Power down node 4 and turn on node 1 in preparation for MSCS cluster installation.

- Set up the cluster and Lotus Domino.

Step-by-Step Guide to Installing Cluster Services:

www.microsoft.com/windows2000/techinfo/planning/server/clustersteps.asp

Install MSCS. Choose Start > Control Panel > Add/Remove Programs > Add/Remove Windows Components on the first node.

Install Lotus Domino in a clustered environment.

Lotus Domino partition install for high-availability cluster solution:

<http://activeanswers.compaq.com/ActiveAnswers/Render/1,1027,367-6-100-225-1,00.htm>

- Configure Secure Path and EVM.

Note: For naming purposes, add an entry in your DNS table for the Storage Management Appliance.

- a. Configure the Secure Path logon and client table on each host. Select

Start > Programs > Secure Path > SecurePathCfg.

1. Set a common password that Secure Path Manager will use to poll each client machine.
2. If the client is a cluster member, in the Clients Configuration Table (in no particular order), add the name of the Storage Management Appliance, and then enter the cluster node name for each Secure Path client followed by the cluster name as follows: node_name:cluster_name.
3. If the client is not a member of the cluster, then just add the host name and the Storage Management Appliance names in the Client Config Table.
4. From the Storage Management Appliance, start Secure Path from the Network Utilities folder and create a profile. Add the name, password, and each host as they were listed in the Client Config Table and save the profile.

- b. Configure EVM.

Important: Read EVM 2.0D Server and Host Agent Release Notes before configuring EVM. There are configuration limitations that must be acknowledged in order for the EVM configuration to work.

1. Install EVM host agents on all client machines and choose the cluster option for all cluster nodes.
2. From the Storage Management Appliance, use Windows Explorer and select **Start > Program Files > HP > SANworks > Enterprise Volume Manager > bin > hosts.**
3. Make sure you see all your host and cluster entries in the hosts folder. There should be a .HST and .VOL file for each host in your EVM network.
4. Initially after the EVM Switchboard service is restarted (on the client machines), the EVM Server will acquire the information from the host machines and there will be a .DATA file in the hosts folder. After all the data from the hosts has been collected, the .DATA files will disappear.
5. Start EVM from the Volume Management folder.
6. Under the Resources tab, your hosts and cluster should display in the top view pane and the HSV subsystem should display in the bottom view pane. If the Resources window hangs, EVM might not be able to log on to the HSV subsystem.
7. To verify that EVM is using the correct logon, open up the evm.cfg file in the EVM bin folder and verify the correct Storage ID and Storage Password. If either is incorrect, make the appropriate changes and restart the Switchboard service on the Storage Management Appliance. The ID and password should match that of the Storage Management Appliance logon.

working with EVM

This section describes how to perform the following tasks:

- Preparing to back up and restore the Lotus Domino partition
- Creating snapclones with EVM
- Cleaning up EVM jobs
- Backing up to tape
- Restoring Lotus Domino using snapclones

preparing to back up and restore

By design, Lotus Domino partitions allow corporations to spread users over multiple data directories on one server. In this way, when you perform backup and restore operations, a single partition can be taken offline without impacting the rest of the users on the server. Because of this functionality, this rapid restore solution focuses on creating snapclones of one partition at a time, which minimizes the impact of downtime on the end users.

A batch script was written that brings the cluster service task offline and stops the Lotus Domino partition. This is a graceful shutdown, which minimizes the number of database consistency checks that are required when the partition restarts. Another batch file was written that starts the cluster service task and the Lotus Domino partition.

The following two files were used to start and stop partition 1 on node 1.

start.bat

stop.bat

<pre>cluster domino-eva res "Lotus Domino Server (DOMINOPARTITION4)" /on</pre>	<pre>cluster domino-eva res "Lotus Domino Server (DOMINOPARTITION4)" /off</pre>
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When you work with clusters and EVM, there are some special access considerations that you need to keep in mind. When you start and stop the Lotus Domino partition, you must access the cluster resource task, and not just the Window NT service task. You must run the EVM switchboard service from an account that has access rights to cluster administration. To enable the account to access the cluster, follow these steps:

- 1** Select **Start > Programs > Administrative Tools > Services**.
- 2** Right-click the **Switchboard** service task and select **Properties**.
- 3** Select the **Logon** tab.
- 4** Select an account to run the switchboard service that has administrative service to the cluster.
- 5** Select **Programs > Administrative Tools > Cluster Administrator** and then right-click the name of the cluster.
- 6** Select **Properties > Security** and then add access for the account that is running the switchboard service.

HP recommends that backup operations take place during off hours and overnight when utilization is lowest to further reduce end user impact.

creating snapclones with EVM

Snapclones can be created with EVM 2.0D and EVA to guarantee safe data storage. After opening EVM, create a new job name and owner in the New Job window. Be sure to include comments in your scripts to let others know the purpose of the commands. The EVM commands are listed in the left side of the New Job window. The most common commands are SUSPEND, SNAP, RESUME, MOUNT, and UNDO. In this solution, the LAUNCH and DELAY commands are also used.

The following EVM command sequence was used in this solution:

- SUSPEND — The first command in the job, the SUSPEND command calls the stop.bat file that stops and shuts down the Lotus Domino partition.
- SNAP — The SNAP command is the command available to replicate volumes on an EVA. Within the SNAP command are options for the type of snapshot for the job. For this solution, the SNAPCLONE snap option was used.
- RESUME — After the SNAP process has completed, the RESUME command must be run to call the start.bat file to start the Lotus Domino partition.
- MOUNT — When the volumes have been replicated, the snapclone can be mounted on a backup host for tape backup or an offline server for test purposes.
- DELAY — The DELAY command provides time in seconds for the Windows host to recognize the new volumes.
- LAUNCH — The LAUNCH command starts a backup to tape using the backup application's command line utility.

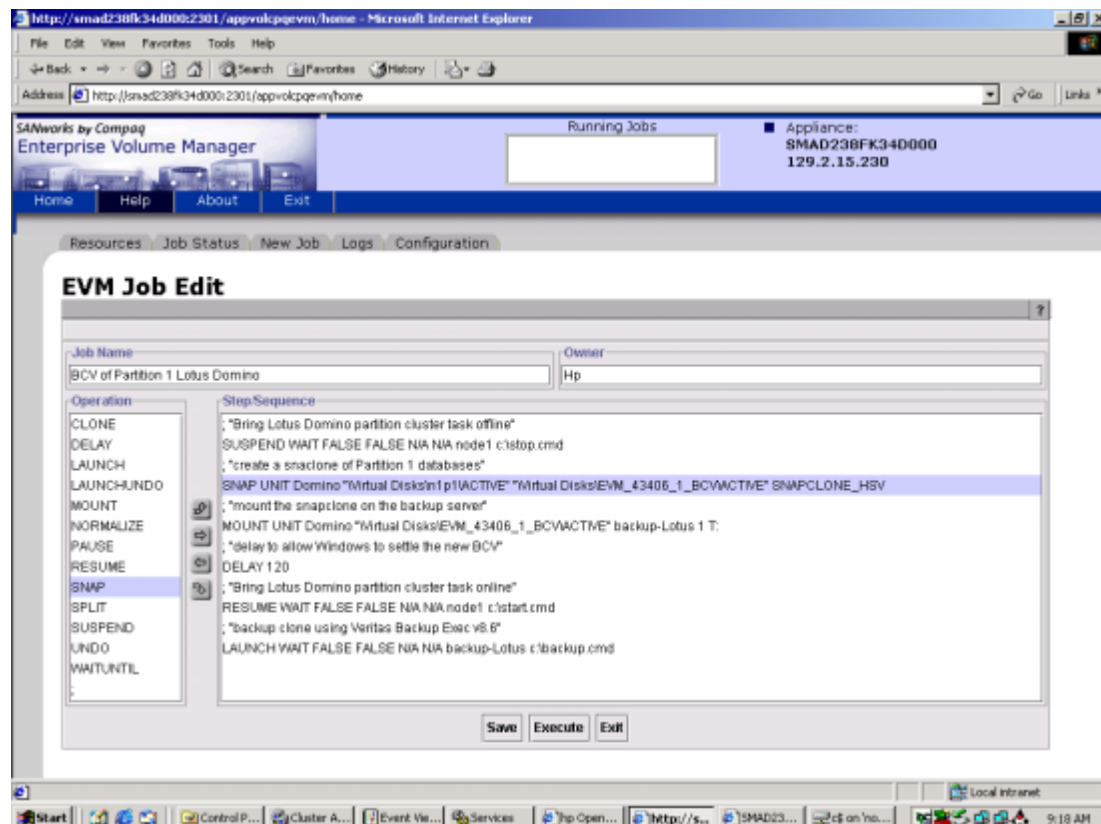


figure 4. sample EVM script

This EVM job shuts down the Lotus Domino partition, takes a snapclone of the partition data volume, mounts the snapclone to a backup host, starts the Lotus Domino partition, and then launches a backup job to tape. The same job can be modified to create a snapclone and subsequent tape backup of any partition by changing the start.bat and stop.bat files to point to the appropriate partition and by issuing the SNAP command on the new data volume.

Note:

If there is an EVA hardware failure during the period when the snapclone is building or normalizing, the snapclone data can become corrupt or lost.

Best Practice: EVM 2.0D Host Agent Release Notes recommend logging out of the backup host when running EVM scripts that mount volumes.

cleaning up EVM jobs

EVM jobs must be recycled to keep the job list as clean as possible, so it will be easier to manage job schedules and perform restore operations in the fastest amount of time. To minimize the number of EVM jobs in the job list, create, save, and schedule only the number of jobs needed to have two copies of the Lotus Domino partition constantly available. After you have created the jobs, you can schedule them to run so that the first job is deleted before it is scheduled to run again. See the "Sample backup plan" section.

To undo an EVM job:

- 1 Click the **Job Status** tab.
- 2 Right-click the job name and click **UNDO**.

After the UNDO completes, you can run the job again to create another copy.

Caution: If you use the snapclones for a restore operation and the snapclones are running as the recovered partition, do not click UNDO. If you run UNDO while the snapclones are running, you will lose the partition. See the "Restoring Lotus Domino server using snapclones" section for more information.

backing up to tape

Tape backup remains an integral part of the backup process and VERITAS Backup Exec V8.6 was the tape backup application for this solution. VERITAS Backup Exec was installed on the backup server to manage the tape backup and restore operations for the environment. Lotus Domino Data Agents were also installed on each Lotus Domino server running in the four-node cluster.

Along with VERITAS Backup Exec v8.6, the Backup Exec Command Line Applet was installed and can be utilized to perform many Backup Exec functions from a DOS prompt. The Command Line Applet can be used to launch a backup operation from the command line with switch parameters or by calling a predefined script file containing the backup job variables. With EVM, you can execute a batch file on the backup server that initiates a tape backup of the clone that was just previously mounted. The following command was used in testing to generate a backup of the cloned partition and call a script file for the backup variables:

```
CD "\Program Files\Veritas\Backup Exec\NT"  
bemcmd -o90 -f"F:\eva testing\scripts\backuptest.txt"
```

The following is an example of the script file that is run by the Command Line Applet for Backup Exec. Several bolded groups with different variable options are used for the backup.

Notes:

- All the options are not displayed in this script. For further information about the parameters for Backup Exec Command Line Applet scripting, read the VERITAS Backup Exec for Windows NT and Windows 2000 Administrator's Guide.
- The backup path under SELECTIONS must be the same as the directory that the EVM script references to mount the clone.

[General]

```
JOB_TYPE=Backup  
JOB_NAME=Testscriptedbackup1
```

[Backup_Options]

```
BK_METHOD=0  
DEVICE_NAME=Shared Storage Drives  
OVERWRITE_JOB=no
```

[Media_Options]

MEDIA_NAME=test scripted backup
MEDIA_SET=Media Set 1
APPEND=yes
APPEND_NO_OVERWRITE=yes
VERIFY=yes
COMPRESSION_TYPE=0
CHECKSUM=yes
EJECT_MEDIA=yes

[Miscellaneous]

[Schedule]

RUN_IMMEDIATE=yes

[W2K]

BACKUP_LOCAL_MOUNT_POINTS=yes

[Selections]

PATH1=T:\Domino*.*
INCLUDE1=yes
SUBDIRS1=yes

sample backup plan

A solid backup plan is the key ingredient to successful recovery in the event of a Lotus Domino disaster. The backup plan depends on the Lotus Domino administrator and the operating environment. HP recommends keeping a minimum of two clones available at all times and cycling every 48 hours. With this approach, disks recycle automatically and provide rapid restoration for up to 48 hours. Here is a sample backup plan:

Monday

Undo Clonejob1
Run Clonejob1
Tape backup optional
Log backups throughout day

Tuesday

Undo Clonejob2
Run Clonejob2
Tape backup optional
Log backups throughout day

Wednesday

Undo CloneJob1
Run Clonejob1
Tape backup optional
Log backups throughout day

Thursday

Undo Clonejob2
Run Clonejob2
Tape backup optional
Log backups throughout day

Friday

Undo Clonejob1
Run Clonejob1
Tape backup optional
Log backups throughout day

Saturday

Undo CloneJob2
Run Clonejob2
Tape backup optional
Log backups throughout day

Sunday

Full tape backup of Lotus Domino databases

Keep in mind that this backup strategy is sufficient for only one partition in the environment and that this must be applied to each partition for full disaster recovery and rapid restoration. Available snapclones can also be used in the following ways:

- As a backup for the Lotus Domino databases
- To run offline testing or analysis

restoring Lotus Domino server using snapclones

This section describes how to use a snapclone to quickly restore a Lotus Domino partition and databases. The restore scenario varies depending on the type of transactional logging that is enabled on the server.

Restore options include:

- With transaction logging disabled, a snapclone can only be used to restore to the point in time when the snapclone was created.
- If circular logging is enabled and there is a clone of the log or the log file is uncorrupted, then the snapclone can be restored and the log will be applied automatically to update the server.
- If archive logging is enabled, then third party backup software compatible with the R5 API (VERITAS Backup Exec V8.6) is necessary to "roll forward" the log files and apply the changes since the last tape backup of the mounted snapclone and archived logs. Keep in mind that you can also perform a full restore of the databases from tape backups. This option is best when time is not an issue.

Scenario: Lotus Domino partition disk has crashed and circular transaction logs are intact or the cloned transaction logs are current. You decide to restore the databases from a snapclone.

- 1** Back up transaction logs.
- 2** Stop the Lotus Domino cluster service by taking the service offline using Cluster Administrator.
- 3** Remove physical disk volumes as Lotus Domino service dependencies in Cluster Administrator and delete the physical disk resource.
- 4** Swap the corrupt disk with the snapclone volume by unrepresenting the volume using the HSV Element Manager on the Storage Management Appliance. Open the corrupt active vdisk and click the **Unrepresent** tab. Unrepresent the corrupt active disks from the cluster nodes.
- 5** To present the snapclone to the cluster hosts, open the snapclone active vdisk and click the **Present** tab. Select the cluster nodes one at a time.
- 6** Change the drive letter on the new volume to reflect the drive letter of the original database volume using Computer Manager – Disk Management. (In cluster configurations, the fastest way to restore the Lotus Domino partition disks is to use the same drive letters as the original disks.)
- 7** If the transaction logs are intact, then retain the original log disk and mount the snapclone of the Lotus Domino partition directory (.nsf files). If the transaction logs are damaged, go back to step 4 to swap the snapclone of the log files.
- 8** Add the snapclone volume as a cluster resource and Lotus Domino cluster dependency.
- 9** Start the Lotus Domino cluster service.
- 10** Once the partition starts, the transaction logs will be applied automatically.
- 11** Go back to EVM. On the **Job Status** screen, delete the job that originally created the snapclone. It is important that you delete this job so that it can never be undone.

Caution: Clicking UNDO will delete the volumes and you will lose your database.

This process can be repeated for each partition that needs to be restored and can be run separately or concurrently. Figure 5 shows the Lotus Domino partition cluster resources.

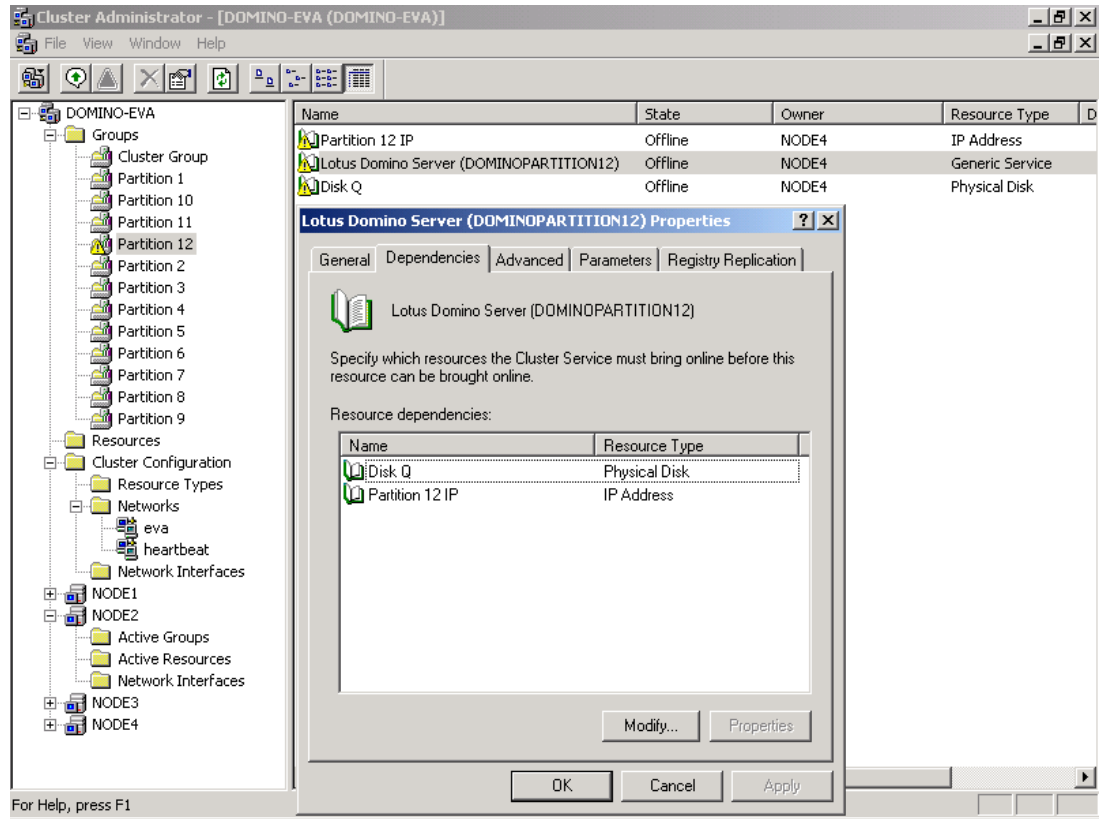


figure 5. cluster administrator

related solutions

For Lotus solutions for storage and servers:

www.hp.com/solutions/lotus

www.hp.com/go/activeanswers/lotus

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:

<http://www.veritas.com/products/category/ProductDetail.jhtml?productId=bews>

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