hp storage solutions

september 2002

solutions blueprint

rapid restore for Microsoft Exchange 2000

using hp StorageWorks enterprise volume manager and HSG80 array controllers
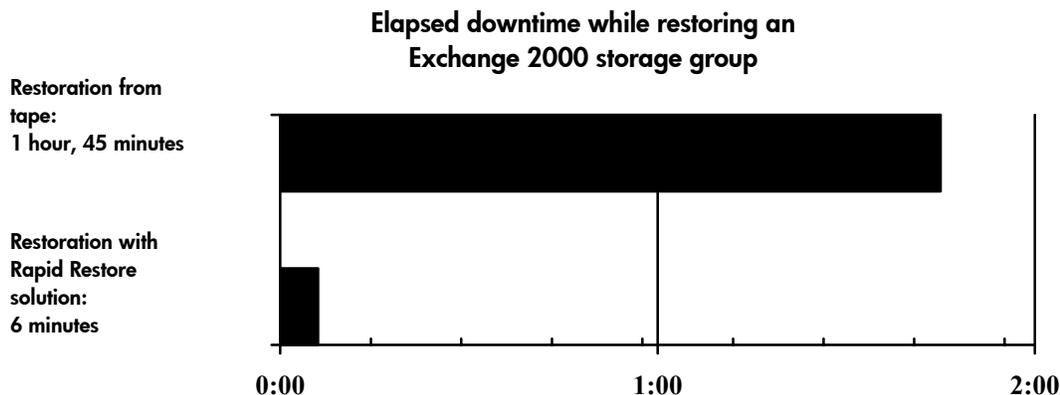
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abstract

This guide describes a quick and complete method of recovering Microsoft Exchange 2000 databases with minimal disruption to Exchange services. Using HP StorageWorks Enterprise Volume Manager (EVM) V2.0 and customizable scripts, customers can create clones of their Exchange databases and resume full operation of their Exchange environments in minutes. A clone is a physical copy of a disk volume that can be used to perform an **extremely rapid restoration** of application environments.

The intended audience includes experienced Exchange administrators, who understand how to work with clones using array controllers in non-clustered environments. By using the information in this guide, Exchange administrators will be able to do the following:

- Create a clone of the Exchange database.
- Restore data from the clone.
- Create scripts to implement automatic backups from clones.
- Backup from the clone to tape.

executive summary

Administrators face lengthy delays when restoring an Exchange environment from tape. This solution, which is based on creating clones with EVM in a SAN configuration, reduces the restore time from hours to minutes and causes minimal disruption to end users. You can achieve a highly available Exchange environment with a complete set of hardware, software, and supporting utilities. In addition, your time savings can be dramatic when restoring your Exchange environment, as illustrated in the following diagram:

Elapsed downtime while restoring an Exchange 2000 storage group

Restoration from tape:
1 hour, 45 minutes

Restoration with Rapid Restore solution:
6 minutes

0:00   1:00   2:00

figure 1 Comparative restoration times using an Exchange storage group consisting of two bases and one public folder store with a 3000 user load.

Here's what Microsoft says….

"By partnering with companies like HP, the worldwide prime integrator for Exchange 2000, we are able to deliver highly beneficial storage solutions to our customers. The **Rapid Restore 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

about clones and backup and recovery strategies

Businesses require that Exchange data be reliably and continuously available so they can serve customers and maintain productivity. Downtimes that result from lengthy backup and restore processes are costly in terms of 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 file can also result in an unacceptable period of downtime.

To reduce downtime, you can use EVM to create clones and resume full operation of the Exchange environment in minutes. Because clones provide an exact copy of your production data, you can offload operations, such as backups, testing, and maintenance, from the production server to a backup server.

By making clones part of your backup and restore strategy, you can perform the following:

- Backup to tape directly or across the SAN. Since clones are offline, users are protected from Exchange performance degradation.
- Restore the Exchange Information Store in minutes, as opposed to the hours usually required when restoring from backup tapes.

This guide includes procedures for using clones to backup and restore Exchange storage groups. The guide also includes the results of extensive testing and specific procedures for integrating with VERITAS Backup Exec V8.6 and CommVault Galaxy V3.7.1 backup products.

Administrators can use this information to create clones of their databases, perform clone backups to tape and clone-based recoveries, automate the implementation with scripts, and make recovery policy decisions. In addition, the guide provides the following:

- Validated scripts for the clone creation of an Exchange 2000 database.
- Performance, sizing, and characterization information.
- Best practices for working in Exchange environments.

solution description

This solution includes the features of EVM cloning technology and customizable scripts to automate recovery operations of Microsoft Exchange 2000 environments. In fact, by restoring from clones of Exchange storage groups, you can resume full operation of the Exchange environment in minutes and reduce the amount of application downtime.

Exchange administrators can learn how to use EVM to create clones and protect Exchange 2000 data. Clones let you recover application environments in less time than conventional tape restore methods. This solution uses HP StorageWorks RAID arrays configured with HSG80 controllers and Enterprise Volume Manager, along with HP StorageWorks Enterprise Backup Solution, which includes backup software, such as CommVault Galaxy V3.7.1 or VERITAS Backup Exec V8.6 as illustrated in Figure 2.
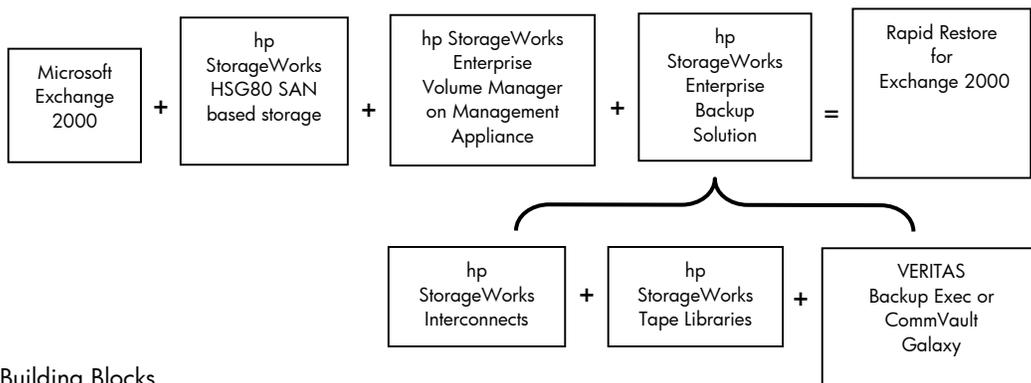

figure 2 Solution Building Blocks

solution components and descriptions

Here is a list of required components for the Rapid Restore for Exchange solution.

- Microsoft Exchange 2000. You can install Exchange 2000 on any supported Windows 2000 server and use a Microsoft Cluster Server (MSCS) configuration for improved application availability (MSCS was not tested with this solution).
- HSG80-based storage subsystem. The solution is based on configurations where the Exchange database volumes are located on HSG80 array controllers.
- HP StorageWorks Enterprise Volume Manager V2.0 to create clones of a storage volume. With EVM, you can create, run, and manage automated storage replication jobs, as well as link them with external jobs. EVM eliminates the need for a backup window by backing up from the clone independent of application processing.
- Management Appliance to provide a centralized point for managing and monitoring SAN elements, including switches and storage arrays, to simplify management tasks and reduce management costs. Using the Element Manager for the HSG80 array controller, the Management Appliance is a monitoring and management solution for the multiple-platform SAN. Designed to connect directly to the SAN fabric, the management appliance performs management functions without involving host computers. For example, EVM runs on the Management Appliance.
- VERITAS Backup Exec V8.6, which provides SAN-based backup and restore operations for clone-based tape backups or CommVault Galaxy V3.7.1, which enables automated backup and integrates with EVM.
- HP StorageWorks tape libraries within an Enterprise Backup Solution infrastructure.

features/benefits

This solution provides the following benefits to administrators:
- Dramatically improved restoration times for Exchange 2000 databases.
- Simplified management of data and storage with easy-to-use, automated tools that increased productivity of IT staff.
- Protection of your investment by maximizing use of existing hardware and software. Additional products and services are not required, except for those required for StorageWorks Enterprise Volume Manager in a SAN-based infrastructure.
- Sample scripts that you can customize for your environment for rapid implementation.
- Integration with third-party tape backup applications—specifically tested with VERITAS Backup Exec and CommVault Galaxy

business value

An administrator can rely on full and incremental backups to tape as a recovery method. However, even online backups using the Microsoft Exchange interface compete with user reads and writes to the database. This can result in lengthened user response times and longer backup windows. During restoration, a tape-based restore is limited by the tape transfer rate, which can also result in unacceptable restore times. With this solution, administrators can improve restore times by a factor of 140 times.

Most importantly, you have the choice of customizing the scripts yourself or engaging the expertise of HP Services. Administrators who usually rely on tape restores for recovery can integrate a clone recovery strategy into their existing tape backup policy to improve full restoration times and application availability.

customer profile

You can implement this solution in any organization where Exchange 2000 is installed within a SAN environment using HSG80-based disk arrays and where customers want to improve application availability, backup functionality, recovery capability, performance, and flexibility of their Exchange environment.

The solution is specifically targeted towards businesses that require improved access to data and quick recovery, and it is particularly useful for administrators who have a limited backup window. In addition, this solution is best applied in situations that require the following:

- Quick restores or recovery from data corruption, lost or deleted data, or frequent user restore requests.
- An additional data protection scheme to provide 24-hour database protection, when the time to perform more frequent tape backups is unavailable, or when frequent tape backups compete with application availability.
- Separation of data backup management and application server management. In this way, the database administrator can present clone volumes to the backup administrator for scheduled or automated backups.

best practices

For Exchange administrators, these best practices have been identified during the course of testing:

- For best I/O performance, configure multiple Exchange storage groups on separate volumes. In Exchange 2000, it is not necessary to bring down all of the Exchange databases if you need to service a single database. In addition any log maintenance activities will affect all databases within that storage group. Keeping all databases within a single storage group on the same volume allows for better maintenance.
- Separate the database (.EDB, .STM) files from the transaction logs (.LOG) by placing them on separate disks. Since database files are random reads and writes and log files are sequentially written, separating these two file types will improve performance.
- All of the databases in a storage group should be dismounted at one time so that the transaction logs remain consistent. All of the transaction logs for the databases in a single Storage Group are interleaved.
- A clone based recovery methodology should not be a stand-alone solution and should be incorporated as part of a larger data protection scheme that includes regular on-line backups.
- Consider grouping Exchange user mailboxes into databases based on the criticality of the user data so that cloning schedules can be customized based on this attribute. Also consider grouping users based on work schedules so that cloning and clone-based backups can be performed during off-shift hours.
- Institute a rolling clone process, where multiple clone copies are cycled, so as to provide for continuous availability of clone volumes for recovery.

working with HP services

You can work with HP Services to prepare and test your own recovery methods using clone technology. In addition to helping you design a recovery strategy, HP has a full spectrum of services available for your consideration. Some of these include evaluating your environment, preparing pilot programs for review, and designing and implementing customized Exchange environments. Here is a list of services for you to review:

- As you prepare your existing infrastructure for a Microsoft Exchange 2000 implementation, "ExpertCheck for Exchange 2000" provides an opportunity to evaluate your environment, identifying ways to achieve a more economical and secure messaging environment. See http://www.compaq.com/services/messaging/mg_expertcheck.html.

- With "Preparation Asssessment for Exchange 2000," our service professionals analyze and review your current messaging strategy, business requirements, network and operating environment, and email usage. These professionals will recommend options and estimate the effort to migrate to Exchange 2000 and maximize your return on investment. For more information, see http://www.compaq.com/services/messaging/mg_expertcheck.html.

- As part of the complete portfolio of proven lifecycle services, "Evaluation Pilot for Exchange 2000" can be used to develop and customize applications, test new versions, and back up production environments. For more details, see http://www.compaq.com/services/messaging/mg_pilot.html.

- "Planning & Design for Exchange 2000" provides a well-designed plan for your new messaging environment, mapping Exchange 2000 capabilities to your objectives. See http://www.compaq.com/services/messaging/mg_design.html for more information.

- If you're looking to simplify the complexities of managing your messaging environment, "Customized Management" is tailor-made for you. See http://www.compaq.com/services/messaging/mg_manage.html for more information.

- "Help Desk Support" provides you with expert help desk support resources for your Microsoft Exchange environment, as described at http://www.compaq.com/services/messaging/mg_helpdesk.html.

- If you're just getting started with Windows 2000, see "Deployment Services for Windows 2000" at http://www.compaq.com/services/messaging/mg_helpdesk.html.

- For installation and startup for the storage in your environment, see "CarePaq Services for Storage" at http://www.compaq.com/services/carepaq/us/install/cp_storage.html.

- HP offers standard, high-availability, and business critical levels of support for Windows 2000 environments. Support is provided for more than 150 Windows NT, Windows 2000, and NetWare products, including SQL Server and Exchange. For more information, see http://www.compaq.com/services/windows2000/w2_hardware.html

- http://www.hp.com/hps/tech/software/ms/ provides information on HP Microsoft services, including exchange consulting and support services. More information specific to Microsoft Exchange can be found at http://www.hp.com/hps/tech/software/ms/exchange.htm

HSG80 array controller test case

On a production level Exchange 2000 server, testing was conducted using two storage groups, with two Exchange databases within each storage group, containing 1500 mailboxes. Tests included measuring the impact of the backup and restore cloning process on the Exchange server.

These tests used LoadSim with the MAPI Messaging Benchmark (MMB2) profile to simulate 3000 users. Specifically, proof-of-concept and performance characterization tests were conducted in order to:

- Create a clone of the databases and associated transaction logs within a storage group
- Split the clones from the Exchange server and mount them to a remote backup server
- Backup the clone to tape using VERITAS Backup Exec and CommVault Galaxy
- Restore from the clones to the Exchange server
- Create scripts to automate the clone creation and backup processes

components for the HSG80 solution

The following table illustrates the tested components of the Rapid Restore for Exchange 2000 solution.

Table 1 – Solution components

Exchange Application and Backup Server Configuration	Part number
hp ProLiant 8500 Server, Pentium III, 700 MHz, 8 processors	216127-001
Memory 4 GB RAM	328809-B21
4 internal 18.2GB, 10K RPM disk drives	142673-B22
HP NC3164 Gigabit Ethernet NIC	174818-B31
HP NC3131 Fast Ethernet NIC	338456-B21
HP KGPSA LP8000, 64 bit PCI HBA	176479-B21

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Enterprise Volume Manager 2.0C Client	263670-B21
HP StorageWorks Secure Path 3.1A	165989-B21
Windows 2000 Advanced Server with Service Pack 2	Microsoft
VERITAS Backup Exec v8.6 Advanced Server Edition for Windows NT and Windows 2000 with associated agents (optional)	VERITAS
CommVault Galaxy V3.7.1 with associated agents (optional)	CommVault
Client Server Configuration	
HP ProLiant DL380 G2, Pentium III, 1.2 GHz, single processor	235438-001
Integrated Gigabit Ethernet NIC NC6136	235438-001
Memory 4GB RAM, (2) 2048 MB upgrade kit	201695-B21
(2) Internal mirrored 18.2 GB, 10K RPM disk drives	142673-B22
Windows 2000 Advanced Server with Service Pack 2	Microsoft
Microsoft Outlook 2000, SR-1	Microsoft
Microsoft Exchange Server Load Simulator (Loadsim) Version 6.0.4612.0	Microsoft
Active Directory/ Domain Server	
HP ProLiant ML370, Pentium III, 1.26 GHz processor	188547-001
Memory 4 GB RAM (2GB Standard + 2GB upgrade kit)	201695-B21
(2) Internal 36 GB disk drives	176496-B22
Compaq NC6136 Gigabit Ethernet NIC (embedded PCI)	235438-001
Windows 2000 Advanced Server, SP2	Microsoft
SAN components	
SANworks Management Appliance	189715-001
HP StorageWorks Enterprise Volume Manager (EVM) Version 2.0C	263670-B21
Compaq Fibre Channel SAN Switch, 16 port	158223-B21
Fibre Channel cables	234457-B2x
Enterprise Storage	
HP StorageWorks EMA 12000	175993-B21
HSG80 dual controllers, 512MB mirrored cache	Included in EMA 12000
ACS V8.6-4 Firmware	222364-B21
HP StorageWorks Windows 2000 V8.6 platform kit	222322-B21
(28) 36GB Ultra3 SCSI 10K Disk Drives	176496-B22
(14) 18GB Ultra3 SCSI 10k Disk Drives	142673-B22
Tape Library	
HP StorageWorks SSL2020 AIT Tape Library (2 AIT 50/100 drives)	175196-B22
HP StorageWorks Modular Data Router	163083-B21

solution diagram

The following diagram, Figure 3, illustrates the architecture of the test configuration.
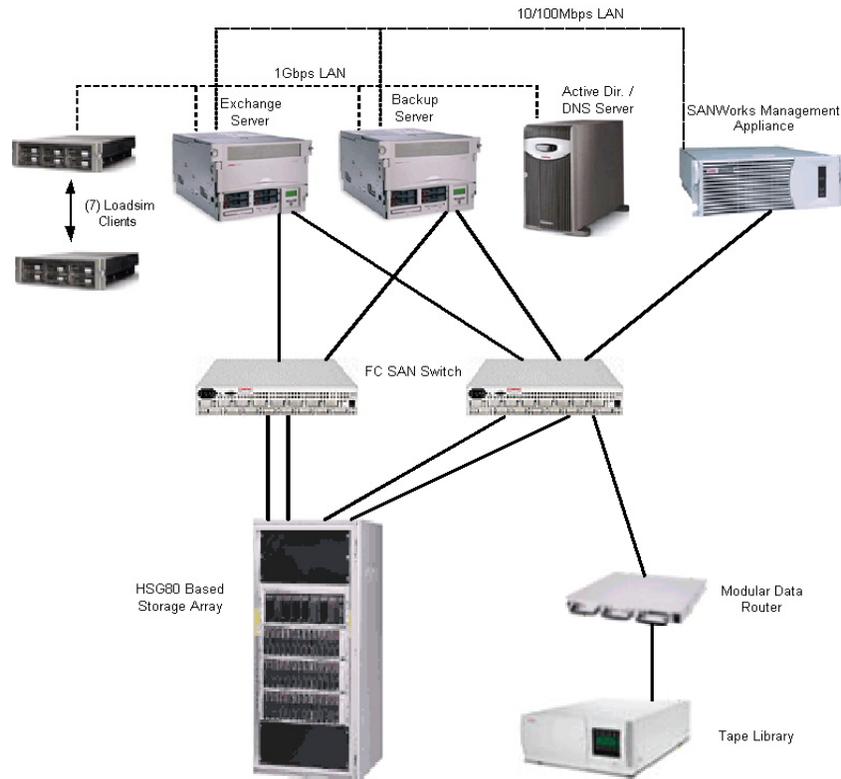
figure 3- Exchange / EVM Solution Configuration on HP StorageWorks HSG80

HSG80 test environment

This section describes the configurations used for the characterization testing.

Exchange server

The tests were conducted using Microsoft Load Simulator (LoadSim) load generator with a MMB2 profile. MMB2 measures throughput in terms of a specific profile of user actions, executed over an 8-hour working day. This benchmark uses a workload designed for Exchange 2000 server performance measurement using the LoadSim tool.
Two Exchange storage groups, SG1 and SG2 were created. The first storage group contained two databases (1priv1, 1priv2) and a public folder store (Public Folder Store (EXCHSERV)). The second storage group contained 2 databases (2priv1, 2priv2). With LoadSim, 3000 MMB2 users were generated and were equally distributed in each database. Each storage group contains 1500 mailboxes (750 mailboxes in each database).

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

The /3GB switch was added to the boot.ini file. If your Exchange server has more than 1GB of RAM, you need to add the /3GB switch to the startup line of the Windows boot.ini file. This change is required so that Virtual Memory is handled properly on servers with more than 1GB of RAM.

See Microsoft Knowledge Base article Q266096 (Exchange 2000 Requires /3GB Switch with More Than 1 Gigabyte of Physical RAM) for detailed instructions. http://support.microsoft.com/default.aspx?scid=kb;en-us;Q266096

client servers

Seven client servers were configured with LoadSim to generate an MMB2 workload on a database of 3000 users. MMB2 represents typical mail traffic from an email user (over an 8-hour working day), including common tasks such as send, browse, read, forward, and scheduling tasks.

300 users were configured on client 1 and 450 users each were configured on clients 2 through 7.
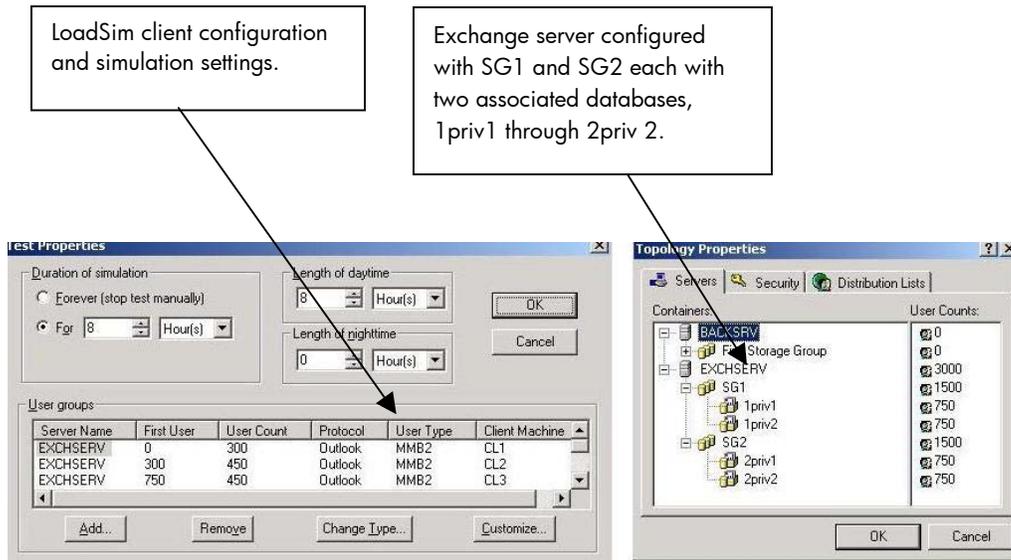

figure 4 - Configuring LoadSim clients

management appliance

The Management Appliance is the operating platform for the Enterprise Volume Manager application. The SAN appliance was connected to the Exchange server and backup server over a 10/100 Mbps network. This was a separate network from the client workload, which in the test configuration was a gigabit Ethernet network.

storage array

Dual HSG-80 array controllers were configured in multi-bus failover mode. Write-back cache was enabled. The array consisted of three split bus disk shelves with (28) 36GB and (14) 18GB disk drives.

database and log configuration

This solution followed Microsoft's recommendation of separating the EDB and STM files from the transaction logs by placing them on separate disks. Two volumes were created for each storage group's database files, and two volumes were created for each storage group's log files.

Storage Group 1 (SG1):
  Database (EDB, STM) files: (6) 36GB disks (RAID1+0)
  Log Files: (4) 18GB disks (RAID1+0)

Storage Group 2 (SG2):
  Database (EDB, STM) files: (6) 36GB disks (RAID1+0)
  Log Files: (4) 18GB disks (RAID1+0)

The amount of used space on each storage group's database volumes was approximately 41GB (includes two database files and a public folder store).

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backup server

A dedicated tape backup server was used for SAN-based clone backups. Exchange 2000 Server was also installed on the backup server for integrity and consistency checks. By mounting the clones on the backup server, the clones can be backed up to a tape library without impacting the Exchange application server. VERITAS Backup Exec V8.6 and CommVault Galaxy V3.7.1 were installed and used as the backup applications. An HP StorageWorks SSL2020 AIT tape library was used as the backup device.

mount and dismount Visual Basic program

Exchange databases within a storage group must be briefly dismounted when splitting off a clone. You can use the Mount.vbs program to mount and dismount databases within a storage group. EVM allows SUSPEND and RESUME scripting commands to be used in the job process.

The SUSPEND command calls the Dismountsg1.cmd script to dismount the databases (EDB, STM files) in storage group 1, and the RESUME command calls the Mountsg1.cmd to mount each database after the clone has been split off.

visual basic program (Mount.VBS)

```
Set oServer = CreateObject("CDOEXM.ExchangeServer")
Set oFirstStorageGroup = CreateObject("CDOEXM.StorageGroup")
Set oMailboxStoreDB = CreateObject("CDOEXM.MailBoxStoreDB")
Set oPublicStoreDB = CreateObject("CDOEXM.PublicStoreDB")

'Set up Params
        if WScript.Arguments.Count = 4 then
                strServer = WScript.Arguments(0)
                strStorageGroup = WScript.Arguments(1)
                strMDB = WScript.Arguments(2)

                if WScript.Arguments(3) = "Mount" then
                        bMount = true
                elseif WScript.Arguments(3) = "Dismount" then
                        bMount = false
                else
                        WScript.echo "4th pararmeter must be either Mount or Dismount"
                end if
        else
                WScript.echo "Usage Error, must enter 4 parameters"
                Call Usage
                WScript.quit
        end if

        'Open up the server
        oServer.DataSource.Open (strServer)

        'Get an array of StorageGroup objects
        oStorageGroups = oServer.StorageGroups

        'Get the count of SGs
        cSGs = UBound(oStorageGroups) - LBound(oStorageGroups)

        'Go through the SGs and look for the Storage group the user wants
        bFound = false
        for iSGs = 0 to cSGs
                oFirstStorageGroup.DataSource.Open (oStorageGroups(iSGs))
                if oFirstStorageGroup.Name = strStorageGroup then
                        bFound = true
                        exit for
                end if
        next
        if not bFound then
                WScript.echo "Storage group not found"
                WScript.quit
        end if

        'Get an array of MBX DBs
```

```
        oDBs = oFirstStorageGroup.MailboxStoreDBs

        'Get count of DBs
        cDBs = UBound(oDBs) - LBound(oDBs)

        'Go through the MBX DBs and look for the one the user wants to dis/mount
        bFound = false
        for iDBs = 0 to cDBs
                oMailboxStoreDB.DataSource.Open (oDBs(iDBs))
                if oMailboxStoreDB.Name = strMDB then
                        bFound = true
                        exit for
                end if
        next

        'If we found the DB the user wants to Mount/Dismount
        'If not found try the PF DBs
        if bFound then
                if bMount then
                        oMailboxStoreDB.Mount
                        strActionDone = "Mounted"
                else
                        oMailboxStoreDB.Dismount
                        strActionDone = "Dismounted"
                end if

                WScript.echo oFirstStorageGroup.Name +  " - " + oMailboxStoreDB.Name + " " + strActionDone
        else
                'Get an array of PF DBs
                oDBs = oFirstStorageGroup.PublicStoreDBs

                'Get count of DBs
                cDBs = UBound(oDBs) - LBound(oDBs)

                'Go through the PF DBs and look for the one the user wants to dis/mount
                for iDBs = 0 to cDBs
                        oPublicStoreDB.DataSource.Open (oDBs(iDb))
                        if oPublicStoreDB.Name = strMDB then
                                bFound = true
                                exit for
                        end if
                next
                if bFound then
                        if bMount then
                                oPublicStoreDB.Mount
                                strActionDone = "Mounted"
                        else
                                oPublicStoreDB.Dismount
                                strActionDone = "Dismounted"
                        end if
                        WScript.echo oFirstStorageGroup.Name +  " - " + oPublicStoreDB.Name + " " + strActionDone
                else
                        WScript.echo "The DB was not found in the Storage group"
                end if
        end if

sub Usage
        Wscript.echo "Usage: Mount <Server> <Storage Group> <MDB> <Mount or Dismount>"
        Wscript.echo "Usage: The parameters are case sensitive"
        Wscript.echo "Usage: Parameters with a space must be enclosed in double quotes."
End sub
```

figure 5 - Visual basic program (Mount.vbs)

```
Mount command or batch file   (Mountsg1.cmd)

cscript mount.vbs <exchange_server_name> <storage_group_name>
<database name> Mount
cscript mount.vbs <exchange_server_name> <storage_group_name>
<database name> Mount
cscript mount.vbs <exchange_server_name> <storage_group_name>
<Public Folder Store> Mount

Example command file (as provided in script kit):
cscript mount.vbs EXCHSERV SG1 1priv1 Mount
cscript mount.vbs EXCHSERV SG1 1priv2 Mount
cscript mount.vbs EXCHSERV SG1 "Public Folder Store (EXCHSERV)" Mount

Dismount command or batch file   (Dismountsg1.cmd)

cscript mount.vbs <exchange_server_name> <storage_group_name>
<database name> Dismount
cscript mount.vbs <exchange_server_name> <storage_group_name>
<database name> Dismount
cscript mount. <exchange_server_name> <storage_group_name>  <Public
Folder Store (EXCHSERV)>  Dismount

Example command file (as provided in script kit):
cscript mount.vbs EXCHSERV SG1 1priv1 Dismount
cscript mount.vbs EXCHSERV SG1 1priv2 Dismount
cscript mount.vbs EXCHSERV SG1 "Public Folder Store (EXCHSERV)"
Dismount
```

figure 6 - Mount and dismount command files

The Mount.vbs, mountsg1.cmd, and dismountsg1.cmd files can be downloaded from the Rapid Restore for Exchange 2000 Script Kit at:
http://www.compaq.com/products/storageworks/solutions/rrex2k/scriptkit.html

HSG80 test results

The configuration was tested under load for eight hours using LoadSim on seven client machines. Two sets of baseline performance data were collected, one with the SAN appliance turned off and another where the SAN appliance was active with EVM installed but not running.

The results are listed in Table 2. The following tests were conducted:

creating clones with EVM

Two separate tests were conducted. One test created a clone of the databases and a clone of the transaction logs, and the second test created a clone of the databases only. In the second case, the transaction logs were copied to a disk folder after the database clone was split off.

A "quick" clone volume of one Exchange storage group consisting of 2 databases and a public folder store was created with EVM. With quick cloning, three members of each mirrorset are already present at the start of the EVM job. EVM splits the third member off to form an independent LUN.

Results: The performance counters in table 3 shows the impact of the cloning process on the Exchange server. The storage group was dismounted temporarily while EVM executed the split clone command. The storage group was down for approximately 5 minutes when splitting off a clone of the databases and transaction logs. The storage group was down for approximately 2.5 minutes when splitting off a clone of just the databases. Exchange mailboxes within the affected storage groups are not accessible during this period.

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online SAN tape backup

For comparison purposes, an online backup of one storage group was performed while the Exchange server was under load. The storage group and its transaction logs were backed up across the SAN using third-party backup applications running on the Exchange server.

Results: Online backup affected Exchange server performance, particularly message delivery times. Because of the long length of time needed to complete an online backup, there is a higher potential for contention with user activity than with clone-based backups.

clone-based backup

A clone of one storage group was created, split off, mounted on a remote backup server, and backed up to tape. Third-party backup applications were used to backup the clone from the backup server to a tape library. A separate zone was created on the SAN switch so that only the backup server had access to the tape library.

Results: The clone-based backup was completed in slightly less time than the online backup. See Table 2. However, the clone-based backup was not associated with the Exchange application server.

clone-based restore

The time it takes to restore one storage group (SG1) by cloning 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 (SG1) while the other storage group (SG2) was under load. Data was transferred from the tape library to the Exchange server over the SAN.

Results: Restoring a storage group using clones is significantly faster than restoring from tape. See Table 2.

Table 2 – Comparison of the times for backing up and restoring a storage group from tape and clones.

Backup Performance Results	Time
Online Backup to tape (SAN) using third-party backup applications	2 hours, 52 min., 48 sec.
Clone Backup to tape	2 hours, 49 min., 17 sec.
Restore Performance Results	
Restore from Clone	6 minutes
Restore from tape	1 hour, 45 min., 16 sec.

Table 3 – Performance Results

	Baseline 1 / EVM Not Installed	Baseline 2 / EVM Installed	EVM Quick Clone (Db + logs)	EVM Quick Clone (Db) / Disk Copy Logs	Online backup (SG1) to Tape
Users	3000	3000	3000	3000	3000
Benchmark Profile	MMB2	MMB2	MMB2	MMB2	MMB2
Protocol	Outlook MAPI	Outlook MAPI	Outlook MAPI	Outlook MAPI	Outlook MAPI
Length of Test	8 hours	8 hours	8 hours	8 hours	8 hours
Length of Steady State	4 hours	4 hours	4 hours	4 hours	4 hours
Response Time (milliseconds)	105	112	187	178	187
Average local delivery Time	0	0	0	0	0
Transaction Load (hourly)					
Messages Submitted	19,142	19,086	18,541	19,051	19,167
Message Recipients Delivered	71,705	70,823	67,958	70,102	71,116
Messages Sent	19,164	19,057	18,535	19,050	19,165
Transaction Load (per second)					
Message Opens/Sec	29.3	29.2	28.1	28.9	29
Folder Opens/Sec	12.6	12.5	12.9	13.2	13
RPC Read Bytes/Sec	66,589	65,927	65,602	71,131	67,344
RPC Write Bytes/Sec	547,991	517,376	501,045	605,084	520,290

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Transaction Queues					
IS Send Queue Average Length	2.5	3	4.6	5.5	7.4
Processor Utilization					
System Processor Utilization (%)	13	13	13	13	16.9
System Processor Queue Length	0.004	0.001	0.02	0.03	0.05
System Context Switches/Sec	4,634	4,533	4,699	4,824	5,937
Process % CPU Time – Store	92	88	89	94	113
Memory Utilization					
Available Bytes	1.7GB	1.8GB	1.8GB	1.7GB	1.9GB
Pages/Sec	0.232	0.191	0.408	0.405	0.297
Process Working Set Bytes – Store	1.2GB	1.2GB	1.2GB	1.2GB	1.12GB
Process Virtual Bytes – Store	2.1GB	2.0GB	2.1GB	2.1GB	1.9GB
Logical Drive Utilization					
IS Database Disk Reads/Sec	180	181	173	183	208
IS Database Disk Writes/Sec	118	119	115	120	123
IS Database Average Disk Queue Length	3.12	3.47	3.6	3.5	3.8
IS Log Disk Writes/Sec	285	280	262	270	266
IS Log Average Disk Queue Length	0.1	0.1	0.1	0.1	0.148

Database Avg. Disk Secs / Read	0.01	0.009	0.01	0.01	0.01
Log Avg, Disk Secs / Read	0.009	0	0.01	0.01	0.009
Database Avg. DIsk Secs/ Write	0.016	0.019	0.02	0.019	0.019
Log Avg. Disk Secs / Write	0.001	0.001	0.001	0.001	0.001

Table 4 – Response Times (Latencies)

Client Actions	Baseline 1 / EVM Not Installed	Baseline 2 / EVM Installed	EVM Quick Clone (DB & Logs)	EVM Quick Clone (DB) / Disk Copy Logs	Online Backup (SG1) to Tape
Response Time	95th Percentile (milliseconds)	95th Percentile (milliseconds)	95th Percentile (milliseconds)	95th Percentile (milliseconds)	95th Percentile (milliseconds)
Send	94	110	484	406	453
Read	63	63	93	94	94
Reply	32	47	63	63	63
Reply All	47	47	78	78	78
Forward	47	62	78	78	78
Move	110	125	171	172	157
Delete	47	47	62	62	62
S+ Change	140	156	265	234	235
Deliver	1265	1406	3624	2437	4296
Load IMSG	16	16	31	32	32
Resolve Name	16	16	16	16	16
Submit	47	47	78	78	78
Load Attach	250	250	281	312	297
Empty Folder	1375	1562	3094	2922	2766
Open MSG Store	47	47	47	47	47
Logon	5328	5328	5641	5672	5516
Browse Calendar	172	187	219	234	219
Make Appointment	407	438	687	594	719
Request Meeting	532	578	1031	1000	1046
Handle Meeting Request	312	328	405	406	407
Handle Meeting Response	110	110	140	141	140
Journal Applications	171	188	5328	5296	5250
Create Contact	109	125	203	203	266
Browse Contacts	313	344	594	734	609
Weighted Average Score	105	112	187	178	187

HSG80 solution guidelines

This section describes how the following activities were implemented in the HSG80 test case:

- Cloning an Exchange storage group

- Setting up a clone-based backup strategy

- Creating scripts

- Performing clone-based backups with VERITAS Backup Exec

- Automating clone-based backups using CommVault Galaxy

- Restoring storage groups from clones

cloning an Exchange storage group

This solution used the "quick clone" option with EVM. Exchange administrators can use the HSG80 Element Manager (see figure 7) to manually configure the storage groups on the HSG80 controller with three-member mirror sets. When configured with three-member mirrors, EVM automatically breaks off the clone (the third mirror) and mounts it onto the backup server.

When splitting off the clone for backup, the Exchange storage group files (EDB, STM, and logs) must be in a consistent state. This state is achieved by dismounting the storage group momentarily until the clone is split off. Once the clone is split off, the storage group can be remounted.

The following figure illustrates how to use the HSG80 Element Manager to create mirror sets for quick cloning:
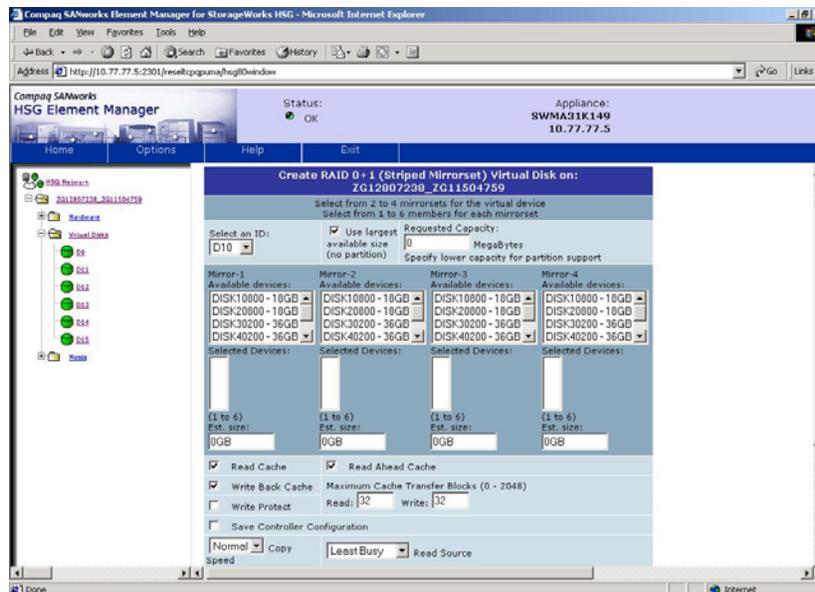
figure 7- Using Element Manager to create three-member mirror sets for quick cloning

setting up a rolling clone-based backup strategy

A recommended clone-based backup strategy is to maintain a minimum of two sets of rolling clones that cycle every 48 hours, a full clone each day. In this way, the disks recycle automatically and provide rapid restoration of data for up to 48 hours. Using this strategy, one clone is available for restoration at all times, even during the clone creation process.

When you use two clone sets, you need to recycle the clones (undo and re-execute the clone job) every two days. You can run an "undo" job to release clone disks. With EVM, every clone job automatically creates an undo job. The Automation Manager application recognizes the need to run an undo job, if the original job has not been undone.

You can either run an EVM undo job manually or you can schedule it.

- To run a manual undo job, right-click on a completed job in the EVM Job Status screen and select UNDO.
- To schedule an undo job, use Automation Manager or Task Scheduler. Use the evmcl.exe command to create a batch script, which launches an EVM job. You can determine the correct job syntax name by viewing the c:\program files\Compaq\Sanworks\Enterprise Volume Manager\bin\jobs\ directory on the EVM server.

You can use the evmcl.exe command to execute EVM jobs from the command line of any node on the network. With Task Scheduler, you can schedule all required operations, including the daily cycling or "rolling" of clones:

```
C:\evmcl.exe <san_appliance_ip_address> execute <Job name>
C:\evmcl.exe <san_appliance_ip_address> undo <Undo Job name>
```

You should maintain a minimum of two sets of clones. Suppose you have created two clone sets with EVM — clone1 and clone2. Each time clone1 is scheduled, run an undo of the clone1 job to release the disks and make them available for a new job or a repeat of the clone1 job.

Here's a sample rolling clone schedule:

Monday, Wednesday, Friday

1. Mount clone1 to backup server.
2. Check database integrity using ESEUTIL/g.
3. Check log files with ESEUTIL/ml E0n.
4. Run tape backup clone1.
5. Undo clone1 job.
6. Run clone1 job.

Tuesday, Thursday, Saturday

1. Mount clone2 to backup server.
2. Check database integrity using ESEUTIL/g.
3. Check log files with ESEUTIL/ml E0n.
4. Run tape backup clone2.
5. Undo clone2 job.
6. Run clone2 job.

Sunday

Run a full online tape backup of the Exchange storage group and log files. This will also provide the required log maintenance.

Figure 8 shows an example of scheduling a job with Windows 2000 Task Scheduler. Task Scheduler is set up to launch a batch file containing an undo job and a clone job, 3 days a week.

Setting up an EVM clone job to run every other day as part of a rolling clone strategy
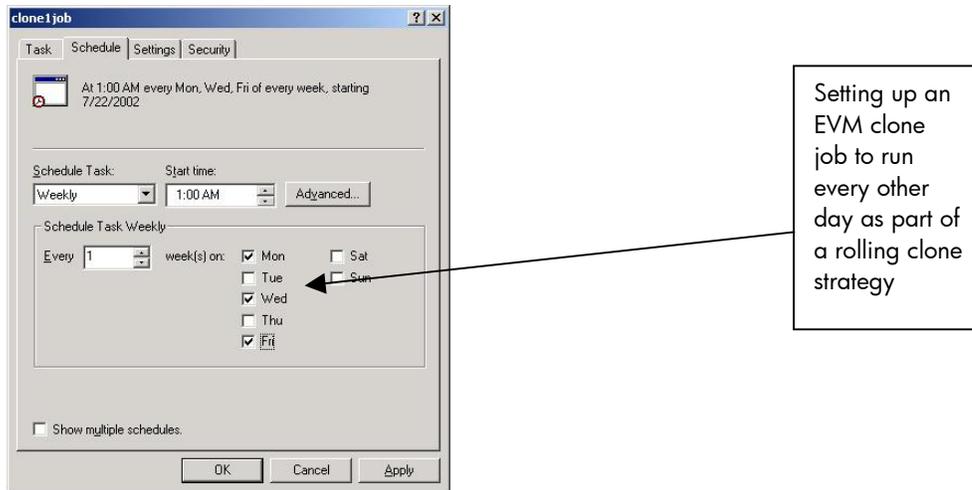
figure 8- Windows Task Scheduler with job saved as clone1job

creating scripts

The scripts used in this solution can be easily adapted to work in your Exchange environment. Here are three sample scripts:

scripts to mount and dismount an Exchange storage group

You can run the mountsg1.cmd and dismountsg1.cmd files from the command line as either a .cmd or .bat file. The files can also be called from EVM. Figure 6 is a copy of the mountsg1.cmd and dismountsg1.cmd files. The command can either mount or dismount an Exchange storage group based on the parameters passed to the MOUNT.VBS file.

In this solution, the database files "1priv1", "1priv2", and public folder store "Public Folder Store (EXCHSERV)" in the first storage group "SG1" are dismounted and mounted before and after an EVM split command. Use " " around names that include spaces. The syntax of the command line scrips follows:

```
cscript mount.vbs  <exchange server> <storage group> <database > <Mount or Dismount>
```

scripts to run a tape backup job (VERITAS Backup Exec)

You can also create a backup job in BackupExec from the user interface or the command line (BEMCMD.EXE). Once the backup job has been created and saved, it can be executed at a later time from Windows Task Scheduler or EVM. The following syntax can be used to execute a Backup Exec job from the command line.

BEMCMD –01 –j<job name> –w –n<user> –p<password> -l<filename>

For detailed information on using Backup Exec, refer to the Backup Exec Administrators Guide. Or use the online help by typing "bemcmd" from the path the Backup Exec program resides on.

scripts to run an EVM clone job

An EVM job can be executed from the command line or from within a batch file. Using Windows Task scheduler, you can schedule the job to run at any specific time. The following steps were used to create and automate an EVM cloning job:

1. The EVM job called "QuickClone_DB_LOGS" (shown in Figure 9) was created and saved.

2. A batch file called clone1.bat was created and saved in the \program files\Compaq\sanworks\enterprise volume manager\bin directory on an EVM server, which was the backup server. The batch file can be saved anywhere as long as you specify a path to the evmcl.exe command. The batch file contains the following command, which executes the EVM clone job:

```
evmcl swma31k149 execute QuickClone_DB_LOGS
```

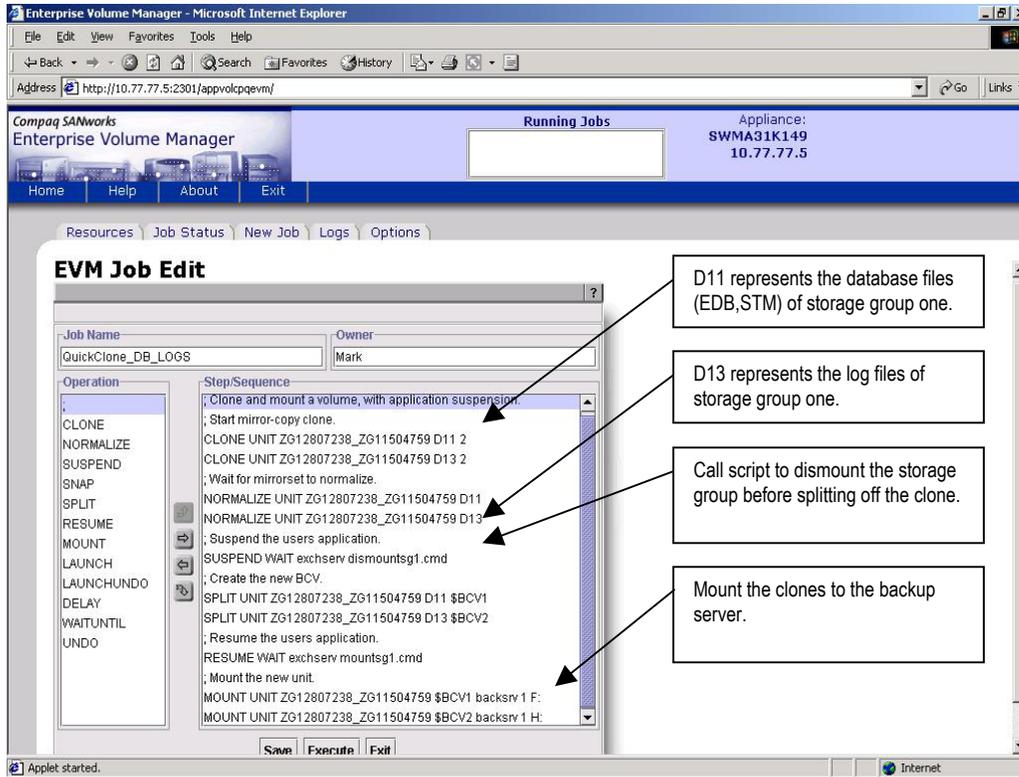The batch file clone1.bat can be called from Windows Task Scheduler.

figure 9- Sample EVM Clone & Mount Job

performing clone-based backups with VERITAS Backup Exec V8.6

In this solution, VERITAS Backup Exec V8.6 was used to back up the clones from the backup server to a tape library. Since Backup Exec can execute from the command line, you can set up and schedule a backup job to run automatically from Windows Task Manager. The backup job can also be called from within an EVM job. Figure 10 shows an example of selecting the files to backup.
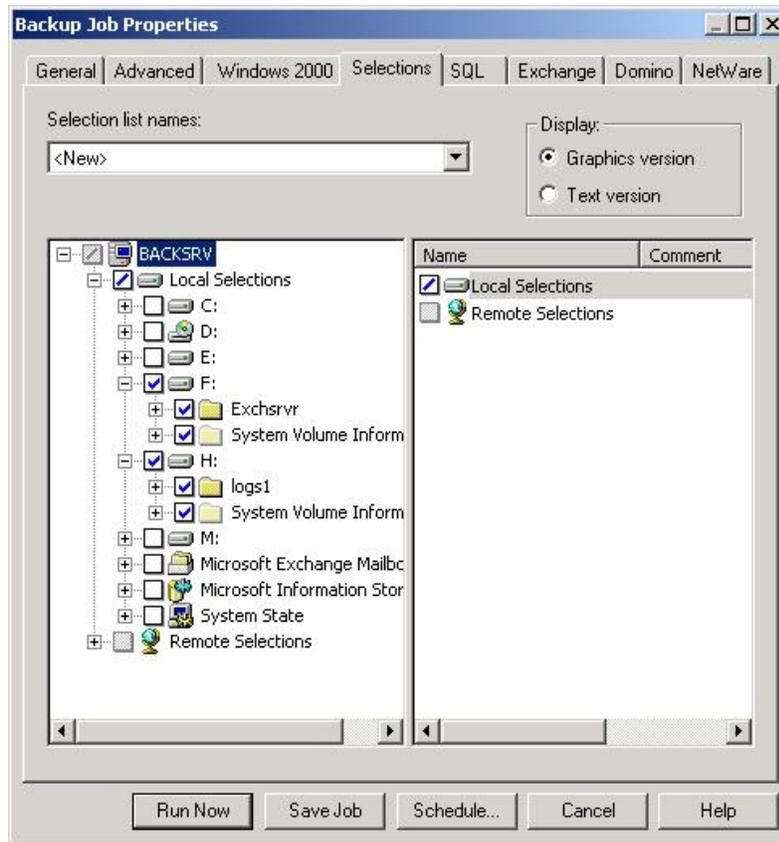
figure 10-Selecting files to back up using Backup Exec

Depending on how an EVM job is executed it's often useful to initiate the beginning of a job from the command line. When using a scheduler or a third-party backup application, you must use the command line.

You can create a batch file and have the scheduler (Task Scheduler, CommVault Galaxy V3.7.1, or VERITAS Backup Exec V8.6) call the batch job when you want it to run. The batch job you create must exist on the Management Appliance or the backup server. Here are the steps to follow:

1.   Create a clone job on the EVM server.

2.   Copy or provide a path to the evmcl.exe command from a directory from where you want to run your batch job. evmcl.exe exists on the EVM server.

3.   Create a batch job to execute the EVM job remotely. You must save this batch job with a .bat extension in order to call it from a schedule. Below is an example of how to call the EVM job using evmcl.exe:

```
C:\evmcl.exe <san_appliance_ip_address> execute <Job name>
```

You can start EVM jobs from Task Scheduler or a tape backup application in order to create and mount clones to the backup server. You may subsequently schedule tape backups.

automating clone based backups using CommVault Galaxy

CommVault Galaxy software provides very rich job scheduling features that allow users to automate the backup, restore, and administration jobs. Jobs can be scheduled either through the job execution option window (as shown in Figure 11) or through the Schedule Wizard available at various levels of the CommCell Browser. Schedules can be defined as a one-time, daily, weekly, monthly, or yearly schedule with Start and End dates.
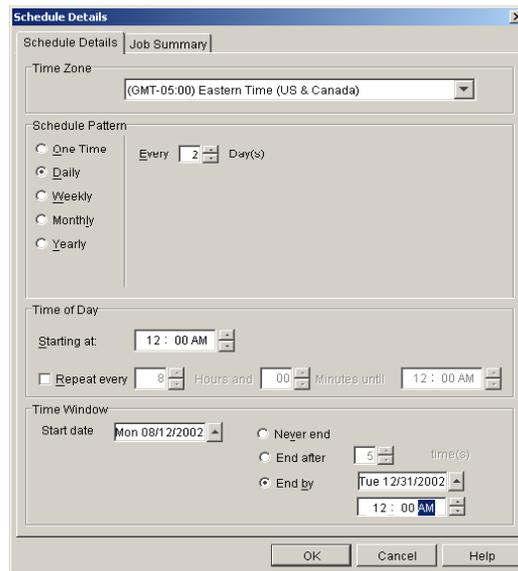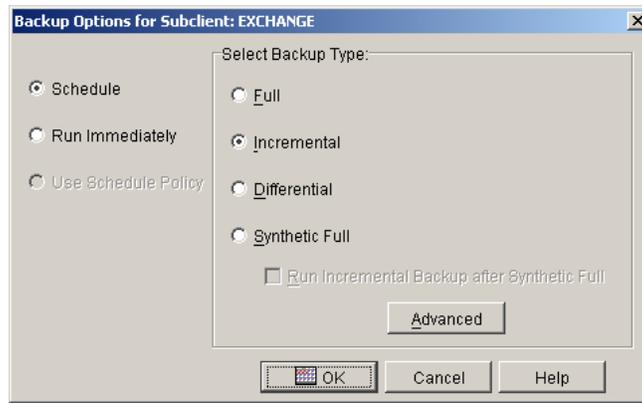
figure 11 Scheduling a backup job through job option window

Since any EVM job can be initialized as either a Galaxy pre-scan process or post-backup process, all kinds of clone-based backup jobs can be automated, including clone rotation. For example, a batch file can be created to call an EVM job using the command line (see "Scripts to run an EVM clone job") The name and path of the batch file can be entered into the "pre-scan" field in the subclient properties menu. A second batch file can be created to run an EVM undo job, which can be called from the "post-backup" field in the subclient properties menu.

Detailed scheduling information can be viewed through the Web-based Galaxy report utility. The filter settings allow the user to view the job schedules for any machine, application, job type, and period of time. Figure 12 shows a typical report for some scheduled jobs.

figure 12-typical job schedule report

restoring storage groups from clones

Two methods of restoring an Exchange storage group were tested in this solution. The first was to restore clones of both the database files and the transaction logs. The second method was to restore just the database and roll forward the transaction logs.

You should apply transaction logs if you want the database to roll forward to a specific period in time. You should not apply transaction logs if you do not want specific transactions to replay.

Method 1: Restore a storage group using database and log clones

Here are the steps to follow for restoring the first storage group (SG1) using clones of the database files and the log files. In this test, the database files for SG1 reside on drive F: and the log files for SG1 reside on drive H:. It is assumed that the two clones have been created and split off at the same time and that the databases are synchronized and consistent.

1. With the HSG80 Element Manager, use selective presentation to mount the clone of the database files and the clone of the log files to the Exchange server. The two volumes are automatically mapped to the next available drive letters.

2. Dismount each database in SG1.

3. Use selective presentation to remove the current volumes (F: and H:).

4. Use Windows Disk Management to remap the mounted clones as F: (database files) and H: (log files).

5. Mount each database in SG1.

Method 2: Restore a storage group using a database clone and applying transaction logs

Here are the steps to follow for restoring the first storage group (SG1) using a clone of the database files and rolling forward the transaction logs. In this test, the transaction logs were copied to a disk folder after the database clone was split off. For more detailed information regarding restoration procedures for Exchange 2000 server, refer to Microsoft knowledge base article Q296788, "Offline Backup and Restoration Procedures for Exchange 2000 Server," at:

http://support.microsoft.com/default.aspx?scid=KB;EN-US;Q296788&

1. Use the HSG80 Element Manager to mount the clone of the database files to the Exchange server. The volume is automatically mapped to the next available drive letter.

2. Dismount each database in SG1

3. Use selective presentation to remove current volume F:, and use Element Manager to remap the database clone to drive letter F:.

4. Run `eseutil /mh database_name |find /i "consistent"` to verify consistency.

5. Verify that the log signature recorded in each database header is the signature of the low anchor log by running `eseutil /mh database_name |find /I "Log Signature" and eseutil /ml low_anchor | find /i "signature"`.

6. Verify that the current database path locations are the same as they were at the time of backup (cloning). Run `eseutil /ml last_consistent_log | find /I "database_name or pattern"`.

7. Gather all the transaction logs and copy them to the current transaction log path.

8. Verify that all logs share the same signature and are in an unbroken sequence by running `eseutil /ml E0n >filename.txt`

9. Make sure the high anchor log is named E0n.log and remove the E0n.chk file from the system path folder.

10. Mount each database in SG1. The transaction logs will begin to replay. In earlier versions of Exchange Server 2000, you may need to run the ISINTEG – patch after you restore to synchronize the database. (See Microsoft Document Q296788.)

related documents

HP StorageWorks

HP StorageWorks Enterprise Backup Solution (EBS): http://www.compaq.com/products/storageworks/ebs/description.html

Virtualized Storage Management for Exchange 2000 Storage Solution: http://www.compaq.com/products/storageworks/solutions/vsm-e2000/index.html

Hot Split Replicated Volumes for Exchange 2000 Backup and Restore:
http://activeanswers.compaq.com/ActiveAnswers/Render/1,1027,5480-6-100-225-1,00.htm
HP has tested the "hot snapshot" methodology for those customers who determine that the Hot Split process will best meet their business needs. This paper may be used in conjunction with Rapid Restore for Exchange 2000.

HP StorageWorks Enterprise Volume Manager: http://www.compaq.com/products/sanworks/evm

HP Messaging and Collaboration Solutions

HP Microsoft Exchange 2000 Solutions:

http://www.compaq.com/messaging/

Messaging and Collaboration Portal / Microsoft Exchange Server — Active Answers

http://activeanswers.compaq.com/ActiveAnswers/Render/1,1027,2366-6-100-225-1,00.htm

HP Storage at Microsoft (Microsoft uses *StorageWorks* for their own internal Exchange 2000 deployment!):
http://www.compaq.com/storage/casestudies/Microsoft.html

Microsoft

Microsoft: Understanding Offline and Snapshot Backups (Microsoft Tech Note: Q237767):
http://support.microsoft.com/view/tn.asp?kb=237767. This article provides information about snapshot backup solutions for Exchange, although it does not address any vendor's specific implementation. The article states that offline and snapshot backups can be performed safely and successfully. However, it is up to the backup solution vendor or Exchange administrator to ensure that all of the needed files are backed up and restored correctly, and that the integrity of all files is preserved at each stage of the process.

Microsoft: Hot Split Snapshot Backups of Exchange (Microsoft Tech note: Q311898):
http://support.microsoft.com/default.aspx?scid=kb;en-us;Q311898. This article contains information, including supportability information, about Hot Split Snapshot Backups.