

SnapManager® 3.1 for Microsoft® Exchange

Technical Overview

Network Appliance™ Data Management Solution for Microsoft Exchange

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Abstract

Network Appliance provides a complete data management solution for Microsoft Exchange that addresses the entire spectrum of Exchange data management operations, including data availability, disaster recovery, storage capacity, performance, ease of administration, backup, restoration, and configuration.

1. Versions

SnapManager for Exchange (SME) supports all versions of Microsoft's popular messaging application including Microsoft Exchange Server 2003, Microsoft Exchange 2000 and Microsoft Exchange 5.5. New to SnapManager for Exchange 3.1 is the support of Microsoft Exchange 5.5 data stores over block protocols such as Fibre Channel and iSCSI. While SME works on both Windows Server 2003 and Windows Server 2000, it is important to understand that Microsoft's Volume Shadow Copy Service (VSS) is only supported on platforms running Exchange 2003 on Windows Server 2003. For Exchange 2003 running on Windows 2000 and for Exchange 2000 or Exchange 5.5, SME will use the Exchange backup API for online backups.

2. Introduction

The management of Microsoft Exchange information store data requires considerable diligence on behalf of today's Exchange administrators to ensure the proper operation, performance, and recoverability of Exchange data. Common concerns of Exchange administrators include a number of daunting tasks. Storage group and database volume layouts must be planned to ensure optimal performance. A plan must be defined and executed to provide backups of ever-growing Exchange information stores while at the same time considering shrinking backup windows. Perhaps most important, a strategy must be devised to provide rapid recovery of Exchange information stores in the event of a disaster or system failure.

Network Appliance provides a complete Microsoft Exchange data management solution that addresses all core data management functions. The solution leverages the Snapshot™, performance, and

availability features of Network Appliance™ filers; the storage virtualization features of SnapDrive; and the integration of Microsoft's VSS framework. High availability and disaster recovery solutions include the support of Microsoft Cluster Services and Network Appliance filer clusters, SnapMirror® to provide on-site or off-site SnapManager backup-set mirroring, and PowerControls® Single Mailbox Recovery to restore single messages into a production Exchange server with zero downtime.

This paper provides a technical overview of the SnapManager for Microsoft Exchange solution and how it leverages NetApp filer capabilities and of SnapDrive to provide a complete Microsoft Exchange data management solution.

3. Network Appliance SnapManager for Microsoft Exchange Solution

Network Appliance SnapManager for Microsoft Exchange addresses core Microsoft Exchange data management tasks, including storage configuration, database and log file migration, backup, restore, and database integrity checking. The physical storage and instantaneous Snapshot files of Exchange data are delivered by Network Appliance file-serving appliances and Data ONTAP software. The storage virtualization, logical disk management, and Snapshot operations are provided by Network Appliance SnapDrive storage virtualization software. The configuration, migration, and online backup and restore of Microsoft Exchange data are delivered by SnapManager for Microsoft Exchange. Each product is tightly integrated with the others to provide Microsoft Exchange with an easy-to-manage storage platform with the highest availability.

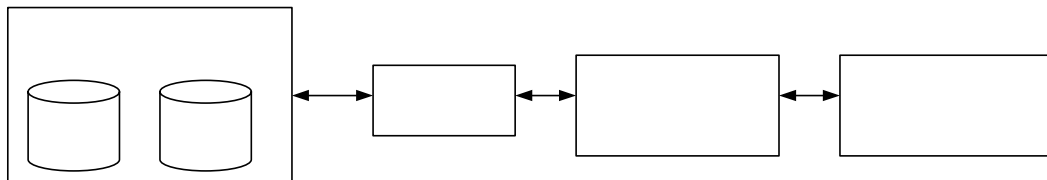


Figure 1) SnapManager for Microsoft Exchange architecture.

To understand the benefits of deploying this solution, a quick overview of each Network Appliance product and the value it brings to Microsoft Exchange deployments is beneficial.

3.1. Network Appliance Filers and Data ONTAP Software

Network Appliance filers provide highly scalable, high-performance, and reliable data storage for a wide variety of applications. Filer systems are disk storage arrays capable of scaling to multiterabytes of RAID-protected data. NetApp filers run the Data ONTAP microkernel operating system, which implements the WAFL® (Write Anywhere File Layout) file system. Data ONTAP allows data to be accessed and shared by a variety of storage access protocols, including FCP (Fibre Channel Protocol), iSCSI, CIFS, NFS, HTTP, and FTP. Perhaps one of the most important features of Data ONTAP and the WAFL file system is the ability to create Snapshot files. Snapshot files are taken in seconds regardless of whether the data volume is 3GB or 3TB. Each volume can store up to 255 Snapshot files, and each Snapshot file's data can be restored by a simple file copy, a volume-wide reset (SnapRestore®), or a single-file reset (single-file SnapRestore). Filers can also be configured with a number of options, including data mirroring (SnapMirror) and clustering (clustered failover).

3.2. SnapDrive

Network Appliance SnapDrive software provides storage virtualization of filer volumes via the iSCSI or Fibre Channel file access protocol. The software allows administrators to define virtual disks that are presented to the Windows Server 2003 or Windows Server 2000 operating system as basic logical disks. Once created, the virtual disks can be completely managed by the SnapDrive MMC plug-in and the Microsoft Windows Disk Administrator MMC plug-in.

In the event of a low disk space situation, SnapDrive provides the ability to expand virtual disks on demand and instantly present the new disk space to Windows. This capability assists in storage planning by allowing the administrators to add storage as needed without negatively affecting the Exchange services.

Finally, SnapDrive integrates with Microsoft Cluster Services to provide highly available storage solutions in clustered Microsoft Windows environments. Virtual disks stored on a NetApp filer can host the quorum drive in a Microsoft cluster as well as other cluster resources.

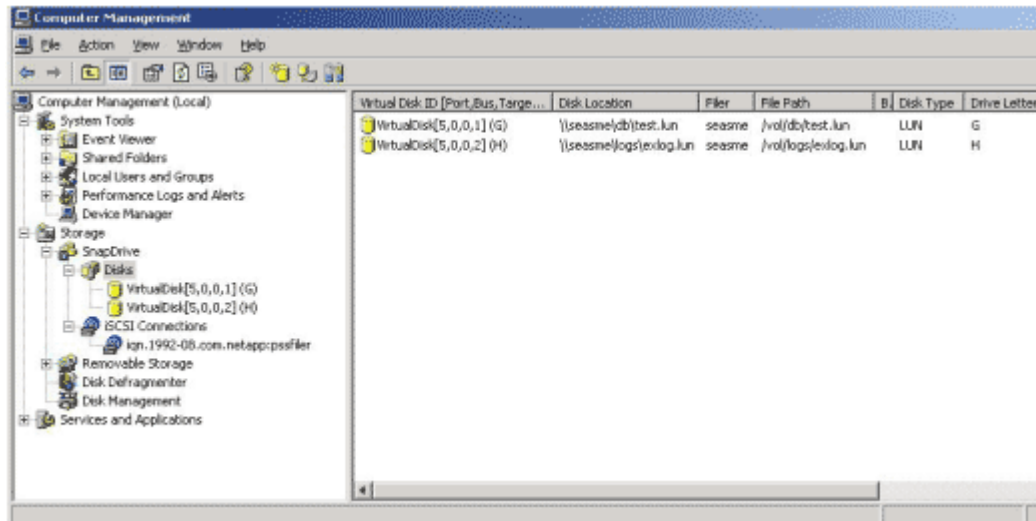


Figure 2) SnapDrive management interface/MMC plug-in.

3.3. SnapManager for Microsoft Exchange

SnapManager for Microsoft Exchange integrates with Microsoft's VSS or API technologies along with many of the features of Network Appliance filers and SnapDrive to provide fast backup and recovery of Exchange databases. The rapid Snapshot capabilities of the filer and the virtual disk management of SnapDrive are leveraged to provide easy Microsoft Exchange storage group configuration and migration, near-instantaneous backup of hundreds of gigabytes of data, and rapid restoration and recovery of that data. SnapManager for Microsoft Exchange also includes an option to perform application-level database verification, which ensures that SnapManager backup sets will be restored successfully.

SME does not completely eliminate the need for other archive technologies. SnapManager for Microsoft Exchange stores its Snapshot files on the same volumes that contain the production Exchange data files. In the event of a disaster that disabled the use of a volume, restoration from another archive technology would be required. Complementary archive technologies such as the use of NetApp SnapMirror data-mirroring technology, the NetApp NearStore® near-online data storage product line, and tape backup technology are valid options for disaster recovery of SME backup sets.

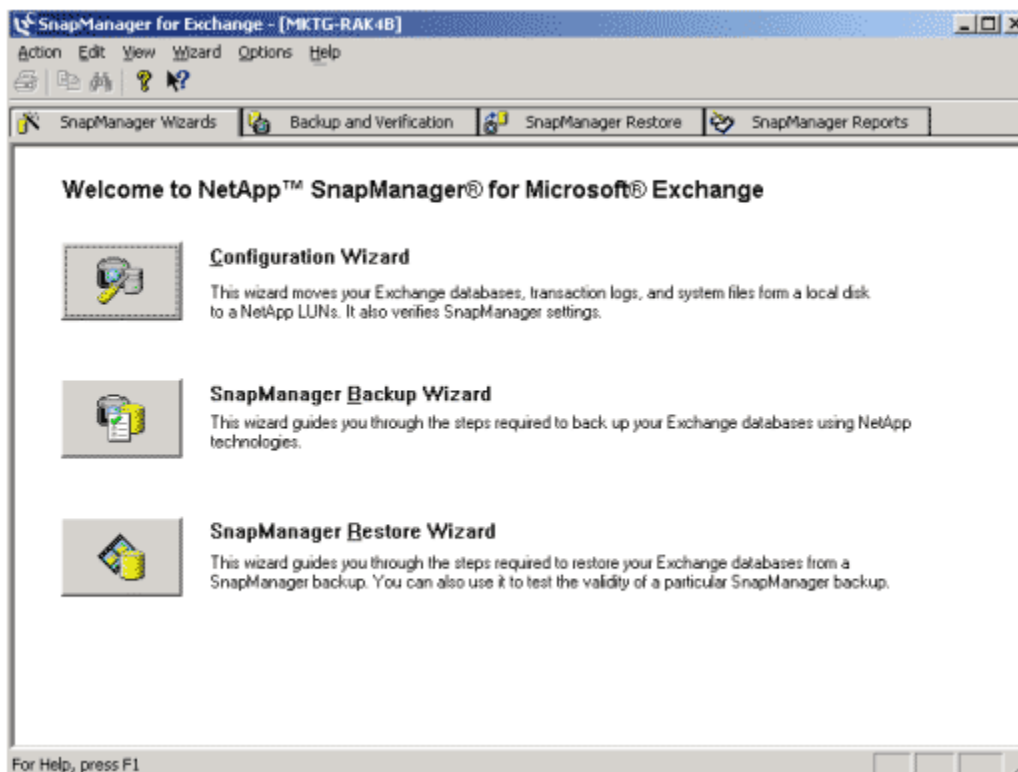


Figure 3) SnapManager for Exchange main menu.

4. SnapManager for Microsoft Exchange Components

A description of the technical aspects of SnapManager for Exchange would not be complete without a brief discussion of Microsoft Exchange data storage concepts. The following section will provide a fundamental understanding of Exchange storage concepts to help provide a context for the functions and features within SnapManager for Microsoft Exchange.

4.1. Microsoft Exchange Data Storage Concepts

The primary goals for Microsoft Exchange administrators when designing Exchange storage systems are manageability, scalability, and recoverability while maintaining high performance. In order to accomplish these goals, Microsoft Exchange includes the ability to partition data into smaller, more manageable data units called databases. Beginning in Exchange 2000, multiple databases may then be grouped together in a "storage group." All databases within a storage group share a common transaction log file set. Exchange Enterprise server allows for the deployment of a maximum of four storage groups, yielding the potential of having to manage up to 20 databases on a single Microsoft Exchange server. For environments with Microsoft Exchange 5.5, the term storage group represents the Information Store (IS) or Directory Store (DS) although there can be only one per Exchange server.

Behind this logical partitioning of Microsoft Exchange information store data are a number of physical files. Each database consists of two physical files: the property store file and the streaming store file. The property store file has a .EDB file extension. This file contains the data for each user's mailbox, such as headers, message content, and attachments that are sent from other internal Exchange servers. The streaming store file contains raw file attachments that are sent to Microsoft Exchange via Internet protocols such as SMTP. This file carries a .STM file extension. The property and streaming store data files constitute the largest files found in a Microsoft Exchange server. These files may grow to be tens or hundreds of gigabytes in size as Exchange users collect and send e-mail. Therefore, large disk volumes capable of supporting highly random access patterns must be available to ensure capacity, scalability, and performance.

The database files by themselves do not provide enough protection from system failures or transaction rollbacks. To address this need, Microsoft Exchange implements a transaction-logging mechanism. The transaction-logging mechanism uses a write-ahead algorithm, ensuring that every transaction is logged to a transaction log file set before being considered for addition into the property or streaming stores. If a system failure occurs before a transaction is completely written to the data store, the transaction log file set provides the information to complete the transaction once the system failure is corrected.

Each transaction log file set has a direct correlation to a single storage group. Since each storage group has the ability to support up to five databases, the transaction log files contain interleaved log entries from all databases within the storage group. These interleaved entries are stored in a set of 5MB files with a .LOG file extension. An Exchange administrator can also assign a file name designation code at the beginning of each transaction log file to ease the process of identifying a particular storage group's transaction log file set.

Transaction log files are very rarely read by Microsoft Exchange because they are only used in the event of a recovery. Because of their critical use in recovery, log files should be placed on RAID-protected or mirrored volumes capable of withstanding high sequential write activity.

4.2. SnapManager for Microsoft Exchange Configuration Wizard

SME includes the configuration wizard, designed to significantly ease the configuration and migration of Microsoft Exchange information stores. This tool provides wizard-based navigation to assist an Exchange administrator through the steps of migrating Exchange storage groups, databases, and transaction log files from their existing location to NetApp storage.

Figures 4 through 8 illustrate a complete configuration wizard session and show the ease with which it configures and migrates Microsoft Exchange data. The wizard breaks the process down into four main steps: assign database files to virtual disks, assign transaction log file sets to virtual disks, define a location for SnapManager for Microsoft Exchange to store backup and restore operation files, and finally proceed with the migration operation. Additional screens may be seen during the initial configuration, such as selecting the Exchange verification server and adding the Microsoft iSCSI service to the Microsoft Exchange System Attendant service (in Microsoft iSCSI initiator environments).

Figures 4 and 5 show selecting the new location for the Exchange database and transaction log files.

Configuration Wizard

Where to Move Databases

Select a storage group or database to move to a LUN.

Select a storage group or a database in the left pane, and a LUN in the Disk List, then click the <=> button to associate them.

Storage Group	Disk	Status

<=>

Disk List:

LUN H:

Database location results:

Storage Group	From	To
[-] First Storage Group	LUN G	LUN G
Mailbox Sto...	G:	G:
Public Folde...	G:	G:

Reconfigure

Details...

Help < Back Next > Cancel

Figure 4) The storage group configuration wizard.

Configuration Wizard

Where to Move Transaction Logs

Select a set of logs from one or more storage groups to move to a LUN.

Select a storage group in the left pane, and a LUN in the Disk List, then click the <=> button to associate the transaction logs for that storage group with that LUN.

Storage Group	Disk	Status

<=>

Disk List:

LUN H:

Transaction logs location results:

Log file	From	To
First Storage Group	LUN H:	LUN H:

Reconfigure

Details...

Help < Back Next > Cancel

Figure 5) The transaction log configuration wizard.

Configuration Wizard

Where to Move SMTP and MTA System File

Place the SMTP and MTA files on a local disk or LUN that does not contain Exchange databases.

Select a service in the left pane, and a LUN in the Disk List, then click the <=> button to set the new location of the specified service files.

Service File Name	Disk	Status

Disk List:
LUN H:

<=>

Service file location results:

Service System Files	From	To
SMTP System Files Vs - 1	D:	D:
MTA System Files	D:	D:

Reconfigure

Details...

Help < Back Next > Cancel

Figure 6) The SMTP & MTA configuration wizard.

Figure 7 shows the options for configuring automatic event notification.

Configuration Wizard

Configure Automatic Event Notification

Configure SMTP email, filer Syslog and AutoSupport for event notification.

☒ Send email notification

SMTP Server: exchange.netapp.com Advanced...

From: SMEAutoSender Send a Test Email

To: Administrator

Subject: SnapManager for Exchange

Note: Text will be added to default subject string.

☒ Log SnapManager events to filer Syslog

☒ Send AutoSupport Notification

If AutoSupport is enabled on the filer, SnapManager can alert NetApp of SnapManager errors and events.

< Back Next > Cancel

Figure 7) Automatic event notification screen.

Upon completion of the configuration wizard, the user is prompted to review the settings and begin the migration by clicking Finish, as seen in Figure 8.

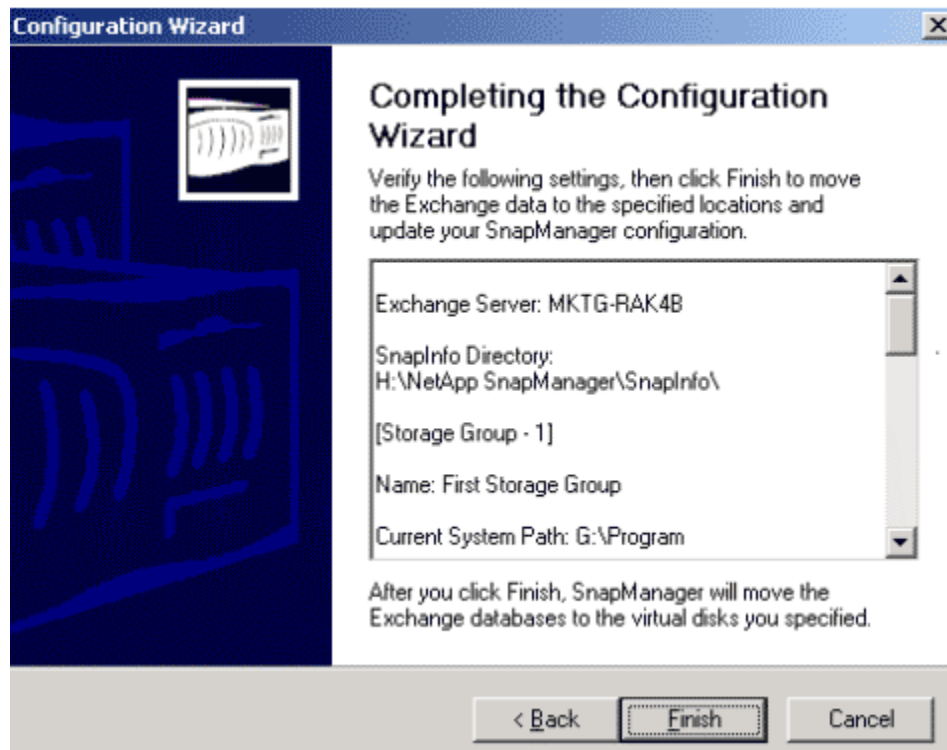


Figure 8) Completing the configuration wizard.

The user will be prompted that the Exchange databases will be taken offline temporarily as the database locations are changed, with an option of canceling the migration instead. If the user continues, the migration is completed and a success message appears.

4.3. SnapManager for Microsoft Exchange Backup

Microsoft Exchange servers are deemed mission critical in many enterprises. Therefore, careful consideration must be taken when deciding on an appropriate backup strategy. Many deployments of Microsoft Exchange utilize backup technology that measures the completion of whole Exchange server backup jobs in terms of hours. While such deployments provide the benefits of being easy to deploy, they inevitably don't scale to information stores that grow to hundreds of gigabytes or aren't capable of supporting shorter and shorter backup windows. Other deployments utilize copy-out mechanisms within the storage subsystem to provide quick backup jobs that provide higher scalability due to the shortened backup window. Unfortunately, some of these solutions require that the Exchange server be taken offline while the backup is created, causing an Exchange service outage.

SnapManager for Microsoft Exchange includes the SnapManager backup component, which provides near-instantaneous online backups of Microsoft Exchange information stores. The component provides an easy-to-use interface for scheduling storage group backups, an enhanced backup-set verification feature that verifies backup sets at the application level, and backup management groups that allow administrators to define and meet backup-set retention policies. Instead of backups completing in hours, whole Exchange server backups may now be performed in minutes or less thanks to the rapid NetApp Snapshot technology.

The operation of SnapManager Backup follows a particular sequence of events resulting in consistent Snapshot copies of Microsoft Exchange data files.

When performing a backup of Microsoft Exchange 2003 on Windows 2003, Exchange uses new backup APIs that rely on the Windows Volume Shadow Copy Service to create a shadow copy (or Snapshot copy) of the LUN. The VSS Service coordinates with Microsoft Exchange, SnapManager for Exchange, and the NetApp VSS hardware provider to prepare for a backup and flush all operations on the disk, allowing for a consistent Snapshot backup. When a backup is initiated in SnapManager for Exchange

(VSS requestor), SME requests VSS to create shadow copies from the Exchange application (VSS writer). VSS freezes Exchange and then tells the NetApp VSS hardware provider to create a shadow copy of the Exchange data residing on Network Appliance storage. Committed Exchange transaction logs are then backed up to the SnapInfo directory for recovery purposes. Once the Snapshot process is complete, VSS thaws the Exchange application, allowing for writes to continue in the Exchange databases.

When performing a backup of Microsoft Exchange on Windows 2000, SnapManager for Exchange utilizes native Microsoft Exchange online backup APIs (ESE98) to prepare the Exchange storage groups for backup. SnapManager Backup coordinates with SnapDrive to flush any outstanding NTFS buffers to the virtual disks that hold storage group data files. Once complete, SME places a request to SnapDrive to coordinate Snapshot backups of the volumes containing Exchange data. After a successful backup, SnapManager backs up the transaction log file sets to the SnapInfo directory and calls the Microsoft Exchange backup APIs to close the prepared storage groups and purge the committed transaction log files.

The final step in either sequence of a SnapManager backup is the verification of the Microsoft Exchange data files that were recently backed up. SnapManager Backup will conduct a complete page-by-page integrity check of the storage group data files using Microsoft's ESEUTIL (or ESEFILE for older versions of Exchange Server) integrity check utility. This utility will inform Exchange administrators that the backup sets are capable of being recovered, not only from the data file level, but also from the Microsoft Exchange application level.

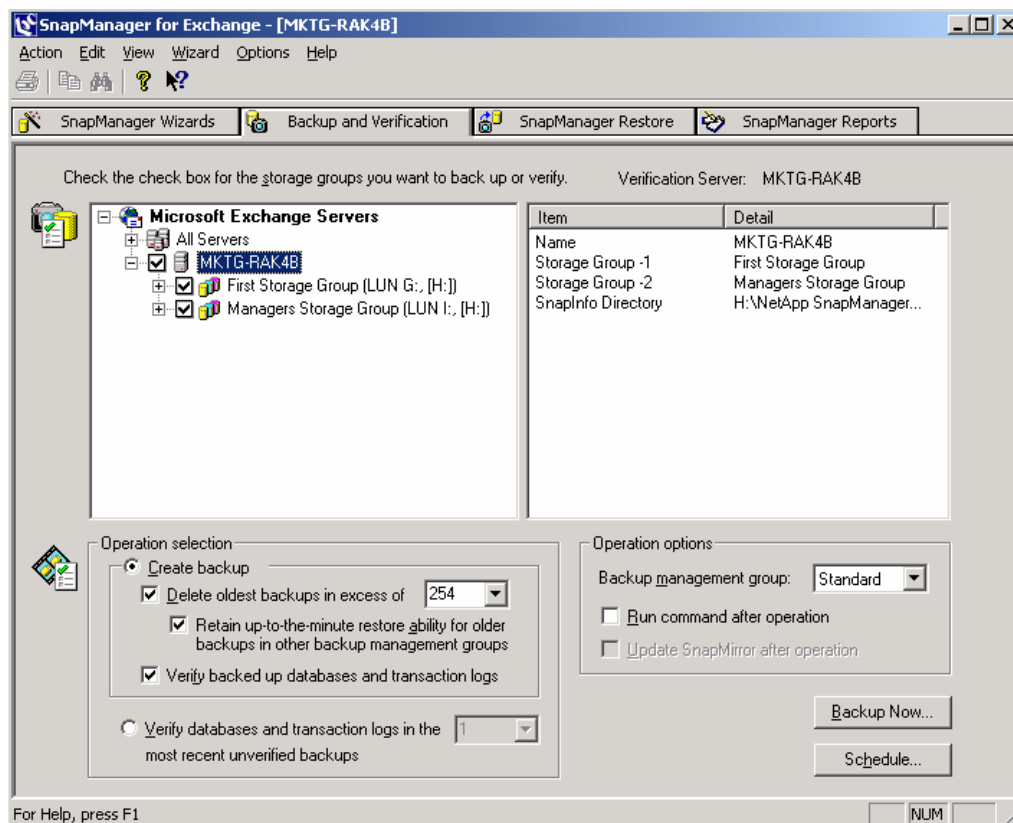


Figure 9) SnapManager for Exchange backup window.

Up to 255 Snapshot copies can be created and kept available for recovery at any point in time. Because the entire SnapManager backup process is typically measured in minutes, it is common to have SnapManager Backup run multiple times throughout the day to enhance protection and availability of Exchange data.

SnapManager for Microsoft Exchange includes the ability to store backups into named groups for greater

management of SME backups. These backup management groups include standard (default), daily, and weekly. Backup management groups are used to determine which backups are targeted for automatic deletion and verification. These new groups also match backup types commonly used in most environments. You can change the backup management group for a backup at any time.

In order to properly address archive and disaster recovery concerns, data-mirroring technologies such as NetApp SnapMirror, NearStore appliances, or tape backups should be used with the SnapManager backup sets for off-site recovery. SnapManager for Microsoft Exchange fully supports SnapMirror for archiving backup sets to off-site filers or NearStore appliances.

4.4. SnapManager for Microsoft Exchange Restore

The rapid restoration capabilities of the SnapManager Restore component of SnapManager for Microsoft Exchange provides Exchange administrators with the ability to deliver on today's demand for minimal Exchange downtime. By using all of the unique capabilities of NetApp filers and SnapDrive, SnapManager for Microsoft Exchange reduces the typical long period of time waiting for a restore operation to complete. Recovery no longer requires finding all of the appropriate tapes in a differential or incremental backup archive. Gone are the days of waiting eight hours for a tape restore to complete, only to find that data corruption on the tape prevents recovery of the backup set.

The SnapManager Restore component provides an easy-to-use interface that allows selection and recovery of Microsoft Exchange storage groups. The component is easy to navigate and requires minimal input from the Exchange administrator to ensure uptime is not limited because of product complexity.

SnapManager Restore provides the option of completing a point-in-time restore or an up-to-the-minute restore. Up-to-the-minute restores provide exactly that: the restore will start by restoring the data files to the time that the backup was completed and then roll forward every log file found up to the minute that Exchange experienced the system outage. A point-in-time restore will literally restore the data files to the point in time that the backup was taken and prevent further transaction logs from being played into the data files. The key consequence of the point-in-time restore method is any transactions that occurred after the backup job was completed will never be applied to the data files and are not recoverable. Therefore, up-to-the-minute restores are used at least 99% of the time.

There are a few instances in which point-in-time restoration is necessary. The most common instance is when an Exchange data store is infected by a virus. In this case, doing an up-to-the minute restore will simply replay the virus infection back into the data files.

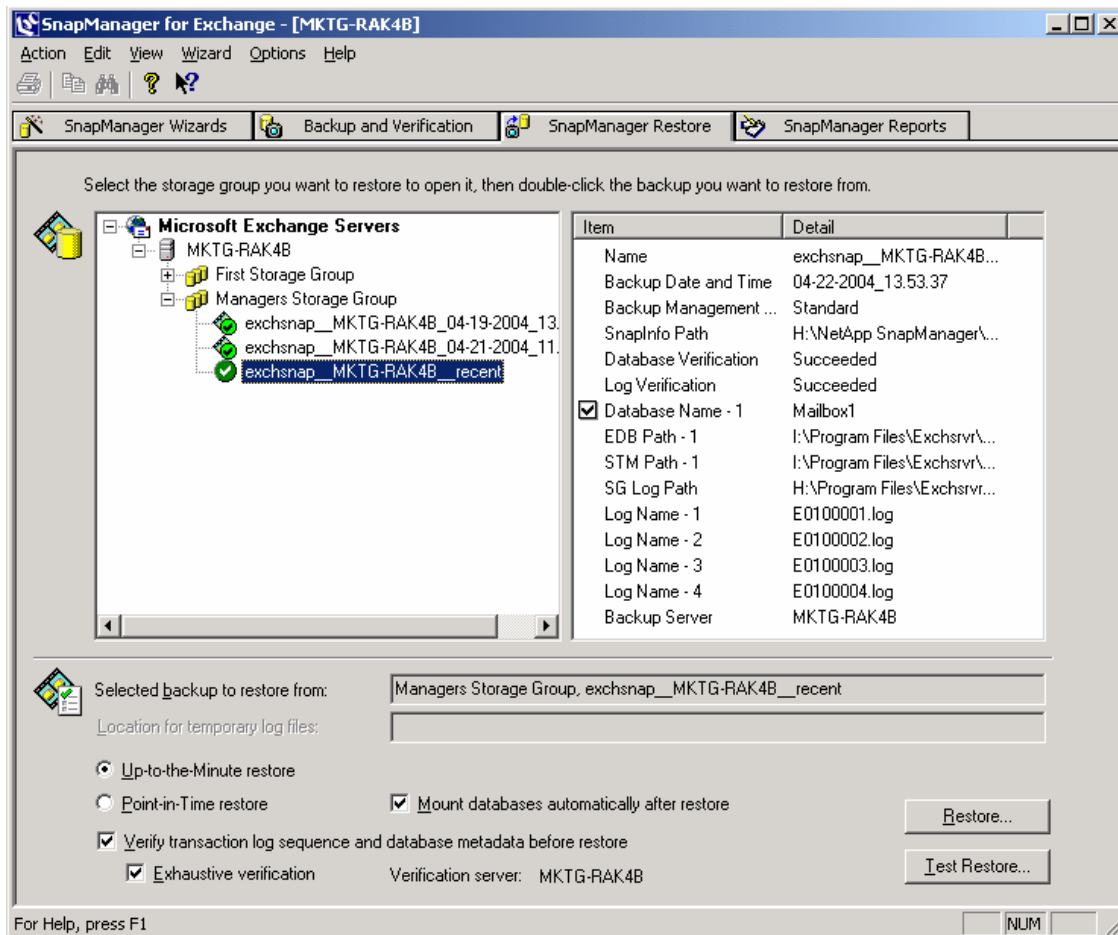


Figure 10) SnapManager for Exchange restore window.

Much like SnapManager Backup, the restore procedure will be slightly different depending on the Windows operating server being used. In Windows 2003 environments, SnapManager for Exchange will communicate with VSS to prepare the system for a restore and copy the data back to the virtual disk. With Windows 2000, SnapManager for Exchange will coordinate with SnapDrive to restore the Exchange data. In either environment, SnapManager for Microsoft Exchange supports a roll-forward recovery using the transaction logs on disk, a point-in-time recovery to restore to a specific point in time, or a full-backup recovery using the last full backup.

SnapManager Restore also provides the ability to recover from tape or other archive media. In the event that the production filer is destroyed in a disaster, a command line option may be used to tell SnapManager Restore to use the files that have already been replaced from tape or other media. SnapManager Restore fully supports the use of NetApp SnapMirror data-mirroring technology, providing quick restoration of service to the original site over the network.

5. Conclusion

The SnapManager for Microsoft Exchange solution from Network Appliance provides the ability to easily manage all versions of Microsoft Exchange and deliver unmatched availability. The solution is based upon tight integration between Network Appliance filers, SnapDrive, SnapManager for Microsoft Exchange, and Microsoft's VSS technology. The benefits of deploying SnapManager for Microsoft Exchange include higher data availability, easier and more effective data management, and rapid recovery in the event of a system failure or disaster.

6. Revision History

Date	Name	Description
6/23/2004	Adrian Simays	Update
2/23/2004	Adrian Simays	Update
10/1/2002	Andrew McCumiskey	Creation