VERITAS NetBackup™ 4.5 for Microsoft Exchange Server

System Administrator's Guide

for Windows

Feature Pack

January 2003

VERITAS

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Revision History

The following table summarizes the revisions made to this manual.These revisions are noted in this manual with revision marks in the left margin.

Release	Date	Description
NetBackup 4.5	March 2002	Original publication.
Feature Pack	January 2003	This document version describes new features provided for NetBackup for Microsoft Exchange Server in NetBackup Feature Pack 4.5_3_F. Ensure that you are installing this feature pack for use with this document. New Features: - Differential-incremental- and cumulative-incremental backups can now be performed of mailboxes. - Backups and restores can be performed of folders and messages in the Microsoft Exchange Public store. - The Microsoft Exchange Site Replication Service and the Microsoft Exchange Key Management Server databases can now be backed up and restored. - The NetBackup for Microsoft Exchange Server Agent is now installed with the server and client software. It is no longer necessary to perform a separate installation of this agent. - Users can enable Single Instance Storage for message attachments so only one copy of an attachment is written to the backup.

Contents

About This Guide

This guide explains how to configure and use NetBackup for Microsoft Exchange Server to perform online backups and restores of Microsoft Exchange Server.

This document is the same as `NetBackup_AdminGuide_MSExchg_NT.pdf` distributed with the NetBackup for Microsoft Exchange Server software.

Audience

This guide is intended for system administrators responsible for configuring and maintaining systems using Microsoft Exchange Server.

This guide assumes that you have:

- A basic understanding of system administration.
- A working understanding of the NetBackup client and server software and are familiar with the information covered in the following NetBackup manuals:
  - *NetBackup User's Guide for Windows*
  - *NetBackup System Administrator's Guide for Windows* or *NetBackup System Administrator's Guide for UNIX*
  - *NetBackup Troubleshooting Guide for UNIX* or *NetBackup Troubleshooting Guide for Windows*
- A thorough understanding of the following Microsoft Exchange Server topics:
  - Database file types and their relationships at recovery time
  - Data recovery scenarios

Organization

This guide is organized as follows:

- The "Introduction" chapter describes the features of NetBackup for Microsoft Exchange Server.
- The "Requirements and Installation" chapter describes how to install the NetBackup for Microsoft Exchange Server.
- The "Configuration" chapter provides details for configuring NetBackup for Microsoft Exchange Server.
- The "Operating Instructions" chapter describes NetBackup backup and restore options for NetBackup for Microsoft Exchange Server.
- The "Troubleshooting NetBackup" chapter describes the debug logs NetBackup creates that can be used for troubleshooting.
- The "Troubleshooting the Exchange Server" chapter describes the common, however infrequent, problems encountered with the daily operations and management of the Exchange Servers.
- The Appendix "ESEUTIL and ISINTEG Line Switches" provides an in-depth discussion of the ESEUTIL and ISINTEG command line switches.

- The Appendix “Sample Server Configuration Worksheets” contains sample worksheets to use when preparing a disaster recovery kit.

Related Documents

The following documents provide related information. For a more detailed listing of NetBackup documents, refer to *NetBackup Release Notes*.

If you have a UNIX server, refer to these documents:

- *NetBackup System Administrator’s Guide for UNIX*

  Explains how to configure and manage NetBackup on a UNIX server.

- *NetBackup Media Manager System Administrator’s Guide for UNIX*

  Explains how to configure and manage the storage devices and media on UNIX NetBackup servers. Media Manager is part of NetBackup.

- *VERITAS NetBackup Troubleshooting Guide for UNIX and Windows*

  Provides troubleshooting information for UNIX- and Windows-based NetBackup DataCenter and BusinesServer products, including Media Manager.

If you have a Windows server, refer to these documents:

- *NetBackup System Administrator’s Guide for Windows*

  Explains how to configure and manage NetBackup on a Windows server.

- *NetBackup Media Manager System Administrator’s Guide for Windows*

  Explains how to configure and manage the storage devices and media on Windows NetBackup servers. Media Manager is part of NetBackup.

- *VERITAS NetBackup Troubleshooting Guide for UNIX and Windows*

  Provides troubleshooting information for UNIX- and Windows-based NetBackup DataCenter and BusinesServer products, including Media Manager.

You may also need the following resources from Microsoft Corporation:

Microsoft Exchange Server white papers and FAQs (go to `http://www.microsoft.com/exchange` and search for “Disaster Recovery”)

Microsoft Exchange Administrator's Guide

Microsoft Exchange Concepts and Planning Guide

Microsoft TechNet

Microsoft BackOffice Resource Kit

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http://www.msexchange.org
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Glossary

If you encounter unfamiliar terminology, consult the NetBackup online glossary. The glossary contains terms and definitions for NetBackup and all additional NetBackup options and agents.

The NetBackup online glossary is included in the NetBackup help file.

▼ **To access the NetBackup online glossary**

1. In the NetBackup Administration Console (or from the Backup, Archive, and Restore client interface), click **Help** > **Help Topics**.
2. Click the **Contents** tab.
3. Click **NetBackup Glossary of Terms**.

The glossary displays in a help window. Use the scroll function to navigate through the glossary.

Accessibility Features

NetBackup contains features that make the user interface easier to use by people who are visually impaired and by people who have limited dexterity. Accessibility features include:

- Support for assistive technologies such as screen readers and voice input (Windows servers only)
- Support for keyboard (mouseless) navigation using accelerator keys and mnemonic keys

For more information, see the *NetBackup System Administrator's Guide*.

Conventions

The following section explains typographical and other conventions used in this guide.

Type Style

The table below describes type face and type style conventions.

Typographical Conventions

Typeface	Usage
`Bold fixed width`	Input typed at the keyboard. For example, you might see, “Type **`cd`** to change directories.”
`Fixed width`	Paths, commands, filenames, or output. For example, you might see, “The default installation directory is `/opt/openv`.”
Italics	Book titles, new terms, or terms used for emphasis. For example, you might see, “Do *not* ignore cautions.” Used for placeholder text or variables, as in, “Replace *filename* with the name of your file.” This font is also used to point out NetBackup product-specific or platform-specific differences. For example: *This option is only applicable for NetBackup DataCenter.*
Bold type (no italics)	Graphical user interface (GUI) objects, such as fields or menu choices. For example, you might see, “Enter your password in the **Password** field.”

Notes and Cautions

Note This is a Note. Notes are used to call attention to information that makes using the product easier or helps in avoiding problems.

Caution This is a Caution. Cautions are used to warn about situations that could cause data loss.

Key Combinations

Some keyboard command sequences use two or more keys at the same time. For example, holding down the **Ctrl** key while pressing another key. Keyboard command sequences are indicated by connecting the keys with a plus sign, as in the following example:

Press **Ctrl+t**

Command Usage

The following conventions are frequently used in the synopsis of command usage.

brackets [ ]

The enclosed command line component is optional.

Vertical bar or pipe (|)

Separates optional arguments from which the user can choose. For example, when a command has the following format:

command *arg1*|*arg2*

In this example, the user can use either the *arg1* or *arg2* variable.

Navigating Multiple Menu Levels

When navigating multiple menu levels, a greater-than sign (>) is used to indicate a continued action.

The following example shows how the > is used to condense a series of menu selections into one step:

❖ Select **Start** > **Programs** > **VERITAS NetBackup** > **NetBackup Administration Console**.

The corresponding actions could be described in more steps as follows:

1. Click **Start** in the task bar.
2. Move your cursor to **Programs**.
3. Move your cursor to the right and highlight **VERITAS NetBackup**.
4. Move your cursor to the right. First highlight and then click **NetBackup Administration Console**.

Terms

The following term is used in VERITAS NetBackup documentation to increase readability while maintaining technical accuracy.

◆ Microsoft Windows, Windows

Terms used to describe a specific product or operating system developed by Microsoft, Inc. Some examples are, Windows 2000, Windows .NET, Windows servers, Windows clients, Windows platforms, or Windows GUI. For more information on the Windows operating systems that NetBackup supports, refer to the *VERITAS NetBackup Release Notes for UNIX and Windows* or go to the VERITAS support web site at `http://www.support.veritas.com`.

Note When a specific Windows product is identified in the documentation, only that particular product is valid in that instance.

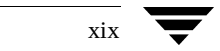
Getting Help

For updated information about this product, including system requirements, supported platforms, supported peripherals, and a list of current patches available from Technical Support, visit our web site:

`http://www.support.veritas.com/`

VERITAS Customer Support has an extensive technical support structure that enables you to contact technical support teams that are trained to answer questions to specific products. You can contact Customer Support by sending an e-mail to support@veritas.com, or by finding a product-specific phone number from the VERITAS support web site. The following steps describe how to locate the proper phone number.

1. Open `http://www.support.veritas.com/` in your web browser.
2. Click **Contact Support**. The *Contacting Support Product List* page appears.
3. Select a product line and then a product from the lists that appear. The page will refresh with a list of technical support phone numbers that are specific to the product you just selected.



Introduction 1

NetBackup for Microsoft Exchange Server extends the capabilities of NetBackup to include online backups and restores of MS Exchange databases when MS Exchange Server has been installed. This capability is provided as an add-on or extension to the NetBackup for Windows client software. Because this product is tightly integrated with the Backup, Archive, and Restore interface for Windows, this document only gives an overview of NetBackup functionality. In general, backup and restore operations for MS Exchange files are identical to other NetBackup file operations, except where noted in this document.

Features

Online Backup	Microsoft Exchange Server data and transaction logs can be backed up without taking the Microsoft Exchange Server offline. This ensures the availability of Microsoft Exchange services and data during the Microsoft Exchange Server backup.
Minimal Back Up Time	An administrator has the choice of performing full or incremental backups (differential-incremental backup or cumulative-incremental backup). A full backup may take considerable time, so it may be performed infrequently. In the interim, updates that have occurred since the full backup can be quickly and incrementally backed up by backing up only the transaction logs. In the event of a failure, the full and incremental backups would be restored. During recovery, the Microsoft Exchange Server will update the databases, applying each of the logged transactions to the database. After the Microsoft Exchange Server recovery has completed, the system will have been brought back to the state as it existed when the last incremental backup was performed.
Microsoft Exchange Server Backup Methods	NetBackup supports all Microsoft Exchange Server backup methods: full backup, cumulative-incremental backup, differential-incremental backup and copy.

Tight NetBackup Integration	Tight integration with NetBackup means two things: **1.** An administrator already familiar with NetBackup procedures and software can easily configure and use NetBackup to perform Microsoft Exchange Server backup and restore operations. **2.** Features and strengths of the NetBackup product suite are available to the Microsoft Exchange Server backup user. These features include software data compression and encryption, scheduled and user-directed operations, multiple data stream backups, in-line tape copy, etc. Many of these features are described, in detail, in the *NetBackup System Administrator's Guide for Windows*.
Central Administration	Administrators can define, back up, and restore Microsoft Exchange Servers and other NetBackup client machines from a central location.
Media Management	Microsoft Exchange Server backups are saved directly to a wide variety of storage devices supported by the NetBackup master server.
Automated Backups	Administrators can set up schedules for automatic, unattended backups for local or remote clients across the network. These backups can be full or incremental and are managed entirely by the NetBackup server from a central location. The administrator can also manually back up clients.
Restore Operations	An administrator using the Backup, Archive, and Restore interface can browse backups and select the ones to be restored.
Redirected Restores	In a redirected restore, you restore an object (database, mailbox, folder, or message) to a new location.
Individual Mailbox Backup and Restore	Administrators can perform backup and restore operations on individual mailboxes and folders. The capabilities of this feature are: ◆ Scheduled backups of individual mailboxes and folders ◆ User-directed backups of individual mailboxes and folders ◆ Restore of individual mailboxes, folders, or messages, which can be performed using the Backup, Archive, and Restore interface (on the server or on the client) or the Remote Administration Console for Windows or UNIX

Microsoft Exchange 2000 Backup and Restore Features	NetBackup can back up and restore storage groups, as well as back up and restore databases within the storage group. The capabilities of this feature are: ◆ Scheduled backups of individual storage groups and databases ◆ User-directed backups of individual storage groups and databases ◆ Restore of individual storage groups and databases, which can be performed using the Backup, Archive, and Restore interface (on the server or on the client) or the Remote Administration Console for Windows or UNIX NetBackup can also perform backups and restores of the Microsoft Exchange Key Management Server (KMS) and Microsoft Exchange Site Replication Service (SRS) databases.
Backup and Restore of the Exchange Public Store	NetBackup can backup and restore the Exchange Public Store. The capabilities of this feature are: ◆ Scheduled backups of individual folders ◆ User-directed backups of individual folders ◆ Restore of individual folders or messages, which can be performed using the Backup, Archive, and Restore interface (on the server or on the client) or the Remote Administration Console for Windows or UNIX
Single Instance Storage (SIS) of message attachments	- Users can enable Single Instance Storage for message attachments so only one copy of an attachment is written to the backup.

Backup Operations

This section presents overview information on NetBackup for Microsoft Exchange Server backup operations.

Limitations

The following limitations exist for NetBackup for Microsoft Exchange Server.

Individual Mailbox Operations

When performing an individual mailbox backup and restore, be aware of the following limitations:

- Only backups of mailboxes or folders or both are allowed. You cannot specify the backup of an individual message.

NetBackup Java Policy Wizard

Mailboxes and Exchange 2000 storage groups cannot be added to the Files list when using the Java Administration Console's NetBackup Policy Wizard to create a policy. In order to backup individual mailboxes or storage groups, add no entries on the Files screen and continue through the Wizard. Once the policy has been created, manually add the mailboxes or storage groups you wish to back up to the Files list.

Exchange 2000 Backups

When performing an Exchange 2000 backup, be aware of the following limitations:

- Incremental and differential backups are ONLY supported at storage group level. Incremental and differential backups of individual databases within storage group are not supported.

Methods

NetBackup provides three methods to perform backups: automatic, manual, and user-directed. This section contains an overview of these methods. For more information on these backup methods and other administrator-directed activities, refer to the *NetBackup System Administrator's Guide for UNIX* if you are using a UNIX server or to the *NetBackup System Administrator's Guide for Windows* if you are using a Windows server.

Automatic Backups

The NetBackup administrator can schedule full backup and incremental backups (differential incremental backup or cumulative incremental backup) that occur automatically and unattended, under the control of the NetBackup server. Automatic backups will meet most of your backup requirements.

Manual Backups

NetBackup allows the administrator to perform immediate manual backups of files associated with any policy, client, or schedules. The manual backup option can be useful for the following situations:

- Testing a configuration
- When workstations miss their regular backups

- Before installing new software (to preserve the old configuration)
- Preserving records before a special event such as when companies split or merge

In some cases, it may be useful to create a policy and schedule that you use only for manual backups. You can do this by creating a policy with a single schedule that has no backup window defined (and therefore never executes automatically).

User-Directed Backups

User-directed backups require a User Backup schedule type to be defined in the MS-Exchange-Server policy. Performing user-directed backups of MS Exchange databases is similar to using the Backup, Archive, and Restore interface to back up normal files. The example described in “Performing User-Directed Backups of Exchange Server” on page 68 uses the Backup, Archive, and Restore interface to perform an online backup of the Microsoft Exchange Server Information Store database.

Microsoft Exchange Server Files That are Backed Up

This section describes the set of files that may be backed up during a backup operation.

Database Files

MS Exchange 5.x

There are three Microsoft Exchange Server database files, one for the Directory and two for the Information Store. The following table gives the database names and their default locations.

Default locations for MS Exchange 5.x database files

Database	File Name	Default Directory
Directory	`Dir.edb`	`...\exchsrvr\dsadata`
Information Store - Public	`Pub.edb`	`...\exchsrvr\mdbdata`
Information Store - Private	`Priv.edb`	`...\exchsrvr\mdbdata`

MS Exchange 2000

There can can be up to 16 database stores, each consisting of 2 database files. The following table gives the database names and their default locations for the first Exchange 2000 Storage group.

Default locations for MS Exchange 2000 database files

Database	File Name	Default Directory
Mailbox Store	`Priv1.edb`	`...\exchsrvr\mdbdata`
	`Priv1.stm`	`...\exchsrvr\mdbdata`

Note Subsequent storage groups and databases may have different locations and names (user-defined).

Database Patch Files

Database patch files are used to handle transactions being written to the database during a backup. During the backup operation, data is read from the `.edb` file. If a transaction causes an update to a part of the `.edb` file that has already been backed up, then it is written to the patch file for that database. Patch files only exist during the backup process. These patch files are used during the Microsoft Exchange Server recovery process to update the restored database file with the transactions that were in progress during the backup. The following table gives the names of the patch files and their default locations.

Default locations for patch files

Database Patch File	File Name	Default Directory
Directory	`Dir.pat`	`...\exchsrvr\dsadata`
Information Store - Public	`Pub.pat`	`...\exchsrvr\mdbdata`
Information Store - Private	`Priv.pat`	`...\exchsrvr\mdbdata`

Transaction Logs

For performance and recoverability, the Microsoft Exchange database uses transaction logs to accept, track, and maintain data. All transactions are first written to transaction logs and memory, and then to their respective databases. Transaction logs can be used to

recover Directory or Information Store databases in the event that a failure has corrupted the database. The Information Store has two separate databases but transaction logs are kept in a single set.

Since transactions are first written to the `edb.log` file and then later written to the database, the current actual or effective database is a combination of the uncommitted transactions in the transaction log file and the actual `.edb` database file. When the `edb.log` file is filled with transaction data, it is renamed and a new `edb.log` file is created. When an `edb.log` file is renamed, the renamed log files are stored in the same subdirectory. The renamed log files are named in a sequential numbering order (for instance: `edb00014.log`, `edb00015.log`, etc. using hexadecimal).

The following table gives the names of the transaction logs and their default locations.

Default locations for transaction logs

Database Transaction Log	File Name	Default Directory
Directory	`edbXXXXX.log`	`...\exchsrvr\dsadata`
Information Store	`edbXXXXX.log`	`...\exchsrvr\mdbdata`

Where *XXXXX* is a five digit hexadecimal number that is incremented each time an `edb.log` file is renamed.

For full backups and differential incremental backups, the committed transaction logs are truncated (deleted) by MS Exchange after a successful backup.

Note After every 5MB of transaction log data is written, a new log is created, even though the transaction data may not be committed to the database. There may be several transaction logs containing uncommitted data, and therefore they will not be purged.

Transactions in log files are committed to the respective `edb` file when the service is shut down normally. For example, when the Information Store service experiences a normal shutdown (service shuts down with no errors), any transactions that existed in log files and not in the `priv.edb` and or `pub.edb` files are committed to the `edb` files. Log files should not be manually purged; it is best to purge logs through the backup process.

The following process takes place during a full backup:

- Database files are written to the backup media.
- Patch files are created to accommodate updates to the database during the backup.
- Transaction logs are written to the backup media.

- Patch files are written to the backup media.
- Committed transaction logs are truncated (deleted) by MS Exchange. These logs are no longer required since they have been committed to the database file and they have been written to the backup media.

Restore Operations

Using a few simple operations, an administrator using the Backup, Archive, and Restore interface can browse Microsoft Exchange Server backups and select the ones to be restored.

Limitations with Exchange 2000 restores

The following limitations exist for NetBackup for Microsoft Exchange Server when performing Exchange 2000 restore operations.

- A restore of more than one storage group at a time (per job) will fail.

Methods

NetBackup provides three methods to perform restores:

- server-directed
- redirecting a restore to a different client
- redirecting a restore to a different path

An overview of these methods is given in the following sections. For more information on these restore methods and other administrator-directed activities, refer to the *NetBackup System Administrator's Guide for UNIX* or *NetBackup System Administrator's Guide for Windows*.

Server-Directed Restore

An administrator can browse NetBackup for Microsoft Exchange Server files and select the ones to be restored. When the administrator initiates the restore, the request is passed from the client to the NetBackup master server. Once the server validates the request, the restore operation becomes fully managed by the server, which identifies the storage device and the volume containing the MS Exchange databases by querying the NetBackup database. The server then transmits the data back to the client.

NetBackup restores MS Exchange databases and transaction log extents from a range of backups. By default, this range includes the last full backup and all user-directed and incremental backups appropriate since that full backup.

NetBackup will allow you to select the NetBackup server from which files will be restored, to view the backup history, and to select items to restore for:

- a specific client
- other clients that were backed up by the selected NetBackup server

Redirecting a Restore to a Different Client

Files or folders can be restored to a client other than the one from which they were backed up. This is possible only if the NetBackup administrator sets up the configuration to allow it and the NetBackup for Lotus Notes agent has been installed on the alternate client. The administrator using the NetBackup Administration Console on the master server or using the Remote Administration Console can direct restores to any NetBackup client (regardless of which client the files came from). Please see the appropriate NetBackup manuals for the configuration needed for this type of redirected restore.

Because the Microsoft Exchange Directory database contains machine and security information, it can only be restored to the original computer or a clone of the original computer. The Microsoft Exchange Information Store databases may be restored to a different Microsoft Exchange Server.

Additional Requirements for MS Exchange 2000

Before redirecting the restore of storage groups or individual databases:

- The storage groups and databases must exist on the target server.
- The storage groups and databases must have the same names as the original storage groups or databases.
- The target databases must be configured so that they can be overwritten. Using the Exchange System Manager, right-click the database you want to overwrite, click **Properties**, and then on the **Database** tab, select **This database can be overwritten by a restore**.
- The target server must have the same **Organization and Administrative Group** name as the source server.

Redirecting a Restore to a Different Path

A user can restore mailbox objects and Public folder objects to folders that are different from the folders from which the objects were backed up. Database objects should not be redirected to different paths.

Requirements and Installation 2

This chapter describes the requirements for using NetBackup for Microsoft Exchange Server and how to install the agent.

Requirements

The following are the requirements for using NetBackup for Microsoft Exchange Server.

- Version 4.5 Feature Pack of the NetBackup client for Windows, Remote Administration Console for Windows, or the NetBackup Server for Windows, installed on the Microsoft Exchange Server.
- Microsoft Exchange Server, version 5.0 or greater.
- To back up messages or mailboxes, a MAPI email client must be installed on the Microsoft Exchange Server.

Exchange Cluster Environment

In an Exchange cluster environment, the virtual Exchange name is used as the client name for performing backup and restore operations of Exchange objects (databases, mailboxes, and folders).

The following requirements need to be met for each Exchange node in the cluster:

- The NetBackup Windows client installed.
- The NetBackup Client Service Account configured for the Mailbox feature.
- The Mailbox for NetBackup Client Service configured for the Mailbox feature.

Backup Operations

The following are the requirements to perform an online backup of Microsoft Exchange Server databases and mailboxes.

Mailboxes

The following Exchange Server services must be running on the target Microsoft Exchange Server computer that will be used to back up individual mailbox objects or to which individual mailbox objects will be restored.

- System Attendant (MSEXCHANGESA)
- For Exchange 5.x, Directory (MSEXCHANGEDS)
- Information Store (MSEXCHANGEIS)

Microsoft Exchange 5.x

- The following services must be running on the NetBackup client machine:
  - Microsoft Exchange System Attendant (MSEXCHANGESA)

- Microsoft Exchange Directory (MSEXCHANGEDS)
- Microsoft Exchange Information Store (MSEXCHANGEIS)

◆ NetBackup client for Windows installed.

Microsoft Exchange 2000

◆ The following services must be running on the NetBackup client machine:

- Microsoft Exchange System Attendant (MSEXCHANGESA)
- Microsoft Exchange Information Store (MSEXCHANGEIS)

◆ NetBackup client for Windows installed.

◆ All Databases being backed up must be mounted.

Microsoft Key Management Service

◆ A functioning KMS database

◆ The Microsoft Exchange Key Management Service must be running on the NetBackup Client machine. (MSEXCHANGEKMS)

Microsoft Site Replication Service

◆ A functioning SRS database

◆ The Microsoft Exchange Site Replication Service must be running on the NetBackup Client machine. (MSEXCHANGESRS)

Restore Operations

This section explains any special requirements you may need to consider before performing Microsoft Exchange Server restores.

Mailbox Restores

The requirements for restoring mailbox objects are the same as for mailbox backups. Refer to “Mailboxes” on page 12 for more information.

Permissions

To restore a Microsoft Exchange Server backup, the account used by the NetBackup client services must be added to the local computer’s Administrators group. It is not necessary to add the account to the domain Administrators or domain Admins groups. The

Administrator privilege is necessary because only administrators can shut down services in Windows NT. Microsoft Exchange services need to be shut down in order to restore Microsoft Exchange Server.

Microsoft Exchange Services

Microsoft Exchange System Attendant (MSEXCHANGESA) must be running on the NetBackup client machine.

Existing Transaction Logs

Depending upon the data recovery scenario you are attempting, you have to take existing transaction logs into consideration.

Example considerations:

- Keeping existing transaction logs, overwriting any transaction logs that exist.

  After you restore the files and the service starts up, the database will commit the transactions in the logs you have restored. If contiguous logs exist on the server beyond the log with the highest number you have restored, those transactions will also be committed.

  If there is any gap in the numeric sequence of log names, no further transactions will be committed beyond the gap. This scenario is useful when the transaction logs are intact but you require the database to be restored. By keeping existing transaction logs, Microsoft Exchange Server will be able to recover to the point of the failure instead of the time of the last full backup or an incremental backup (differential incremental backup or cumulative incremental backup).

- Delete the existing transaction logs.

  Certain situations—such as restoring the Information Store to a different server, restoring to a previous date without recommitting all the logs that are still on the disk, or performing a full restore—require existing transaction logs to be deleted.

Additional Requirements For Exchange 2000

- All databases being restored must be dismounted prior to the start of restore operation.
- The location where the associated log and patch files are to be kept until the database is restored is the MS Exchange working directory (`...\exchsrvr\mdbdata`). If storage groups are being restored, a subdirectory is created under the working directory for each storage group.

- After the database is restored, the log and patch files in the temporary location are applied to the database, and then the current log files are applied. After the restore is complete, the log and patch files are automatically deleted from the temporary location (including any subdirectories).

Note Make sure the temporary location for log and patch files is empty before you start a restore job. If a restore job fails, check the temporary location (including subdirectories) to make sure any previous log and patch files from a previous restore job were deleted.

Registering NetBackup for Microsoft Exchange Server

NetBackup for Microsoft Exchange Server is installed with the server and client software. To use this agent you need to register a valid license key for it on the master or media server.

▼ To register a license key

❖ Open the NetBackup Administration Console on the master or media server and choose **Help** > **License Keys**.

Refer to the *NetBackup System Administrator's Guide* for full details on adding license keys.

Configuration 3

This section provides an overview of how to configure NetBackup to perform backup and restore operations.

- “Configuring NetBackup for Individual Mailbox Operations”
- “Configuration Using the NetBackup Administration Console”
- “Configuring a NetBackup Policy”
- “Testing NetBackup for Microsoft Exchange Server Configuration Settings”

Configuring NetBackup for Individual Mailbox Operations

This section provides the configuration information necessary for NetBackup to perform backup and restore operations of individual mailboxes and folders and of items in the Public Folders.

NetBackup Client Service Account

By default, the NetBackup Client service uses LocalSystem as the account on which to log on. To perform individual mailbox backups or restores, the service account needs to be changed to valid Windows NT domain account.

▼ **To verify or modify the Log On account for the NetBackup Client service**

1. Open the Windows NT Services control panel application.
2. Double-click on the **NetBackup Client Service** entry.
3. If the **Log On As** account is not configured as System Account, proceed with step 6.
4. Change the **Log On As** account to the account you wish to use for backups and restores on this client.

Note To change this account, you must have administrator group privileges.

5. Stop and start the NetBackup Client Service.
6. Close the Windows NT Services control panel application.

Creating a Mailbox for the NetBackup Client Service

In order for NetBackup to gain access to the mailboxes and folders to perform backup and restore operations, the NetBackup Client service account needs to be associated with a valid Exchange mailbox. It is recommended that you create a uniquely named mailbox for the NetBackup Client service account.

Exchange 5.x

For Exchange 5.x, if a mailbox is not created for the NetBackup Client service, you can use any existing mailbox on the Exchange Server to which the NetBackup Client service account is granted logon rights.

▼ To create a mailbox for the NetBackup Client service account

1. Using Exchange Administrator, create a new mailbox with a unique name.

   A unique name is one that does not already exist within the Exchange Organization. This name cannot be contained as a set of characters in an existing name.

   For example, if EXCH1 has been entered as the unique mailbox name, and there are other mailbox names such as EXCH1BACKUP or BACKUPEXCH1, backups or restores of individual mailboxes, or both, will fail.

   If you cannot create a unique mailbox name, you must enter the fully qualified name when configuring the mailbox for the NetBackup Client service account (see "Configuring NetBackup to Use the Mailbox Associated with the NetBackup Client Service Account" on page 22). For example:

   ```
   /O=Org_Name/OU=Site_Name/CN=Server_Name/CN=EXCH1
   ```

   or

   Create a new mailbox and assign a unique alias to the mailbox. Then, when configuring the mailbox for the NetBackup Client service account, enter only the alias. (See "Configuring NetBackup to Use the Mailbox Associated with the NetBackup Client Service Account" on page 22.)

2. On the **General** tab in the Properties dialog box for the new mailbox:

   a. Click **Primary Windows NT Account**.

   b. Select the **NetBackup Client** service account.

   c. Click **Add**.

   d. Click **OK**.

3. Select either a site container or recipient container that contains the mailboxes you want to back up.

   a. Click the property button to display the Properties dialog box.

   b. Click the **Permissions** tab.

   c. Select the NetBackup Client service account, add it to Windows NT accounts with Permissions, select the **Admin Role**, and click **OK**.

Note The minimum rights required for backing up and restoring a mailbox are Modify User Attributes and Modify Administrator Attributes. By default, the Admin role includes Add Child, Modify User Attributes, Modify Administrator Attributes, and

Delete and Logon rights. The Admin role can be edited as a Custom role with only the minimum rights.

If you elect to grant permissions individually to each mailbox rather than to grant access to all mailboxes at the site or recipient container level, you can assign the User role, which allows backing up and restoring mailboxes to which permissions have been given. This role can also be edited to include only the Modify User Attributes and the Modify Administrator Attributes.

Exchange 2000

▼ To create a mailbox for the NetBackup Client service account

1. Using Active Directory Users and Computers, create a mailbox with a unique name.

   A unique name is one that does not already exist within the Exchange Organization. This name cannot be contained as a set of characters in an existing name.

   For example, if EXCH1 has been entered as the unique mailbox name, and there are other mailbox names such as EXCH1BACKUP or BACKUPEXCH1, backup or restore of individual mailboxes or both will fail.

2. Make this account a member of Domain Admins group.

3. Using the Exchange Administration Delegation Wizard, select the NetBackup Client service account and grant the Exchange Administrator access to the account.

   a. Start the Exchange System Manager program.

   b. Select the appropriate Administrative Group.

   c. Right-click on the Administrative Group and select **Delegate Control**.

4. In the first dialog box, click **Next**.

5. In the second dialog box, click **Add**.

6. In the Delegate Control dialog box, click on the **Browse** button to select the NetBackup Client service account created in step 1.

   d. From the **Role** list, select **Exchange Full Administrator**.

   e. Click **OK**.

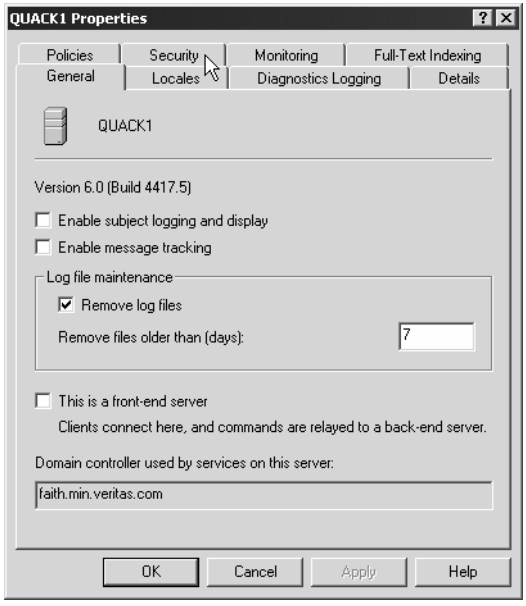
f. Click **Next**.

g. Click **Finish**.

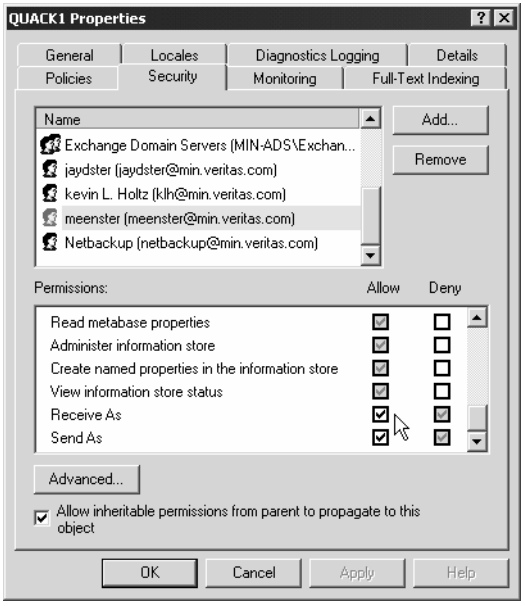
7. *For Active/Active configuration only* Using the Exchange System Manager, for *each* virtual server in the cluster, grant the NetBackup Client service account "Receive As" and "Send As" advanced permission by performing the following steps:

a. Select the Virtual Exchange Server name.

b. Right-click on the virtual name and select **Properties**.



c. Click on the **Security** tab.



d. Select the NetBackup Client service account under the Name pane.

e. Under Permissions, select **Receive As** and **Send As.**

f. Click **OK**.

g. Repeat the above steps for each Virtual Exchange Server in the cluster.

Configuring NetBackup to Use the Mailbox Associated with the NetBackup Client Service Account

This configuration can be performed with the NetBackup Adminstration Console for Windows or for UNIX or through the Remote Administration Console.

▼ To configure the mailbox for the NetBackup Client service account

1. Open the NetBackup Adminstration Console or the Remote Administration Console.

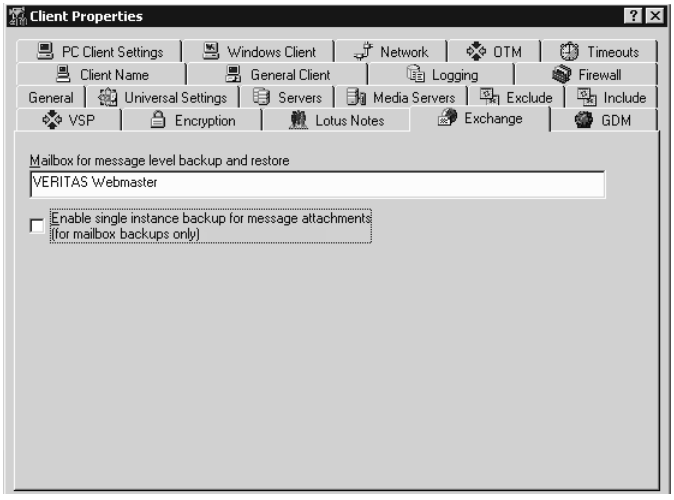
2. In the left pane, expand **Host Properties**.

3. Click **Clients**.

4. In the right pane, right-click on the client you wish to configure and choose **Properties**.

5. Click on the **Exchange** tab.

6. In the **Mailbox for message level backup and restore** box, specify the mailbox. The mailbox may be specified as:
   - An Exchange mailbox name
   - A fully-qualified name:
   - /O=*Org_Name*/OU=*Site_Name*/CN=*Server_Name*/CN=*Mailbox_Name*
   - A mailbox alias



7. Click **OK**.

Configuration Using the NetBackup Administration Console

Although the database agent is installed on the NetBackup client, some configuration procedures are performed using the NetBackup Administration Console on the server.

These procedures include:

- Configuring a NetBackup policy
- Testing NetBackup for Microsoft Exchange Server configuration settings

See the next section for instructions on starting the NetBackup Administration Console.

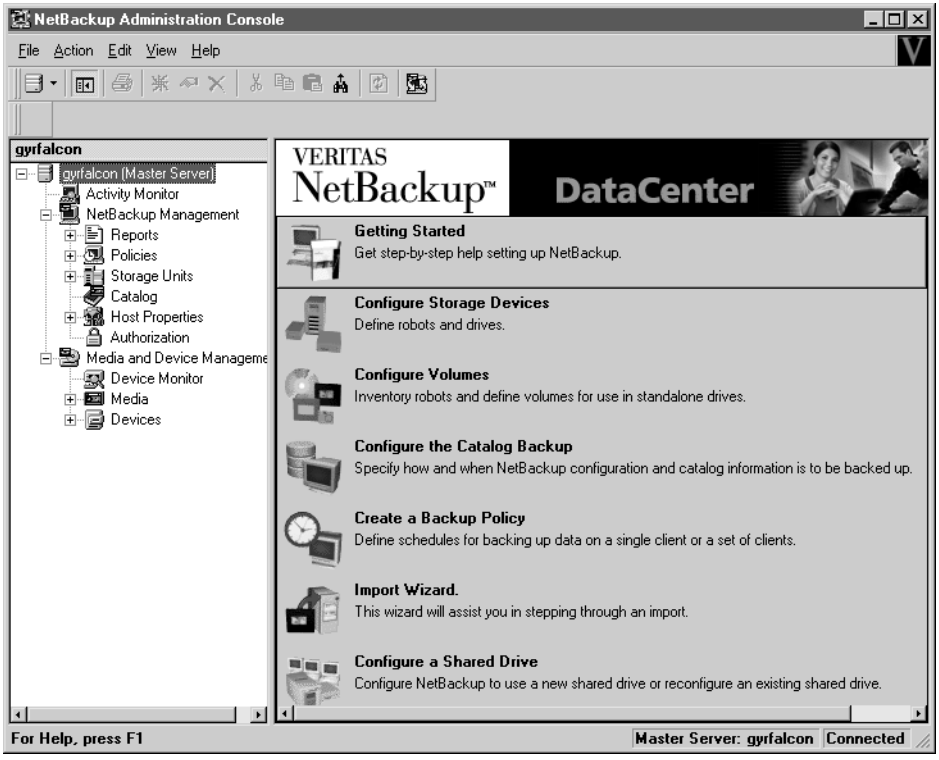
Starting the NetBackup Administration Console for Windows

This section contains information on launching the Windows server version of the NetBackup Administration Console.

▼ To launch the NetBackup Administration Console for Windows

1. Log on to the server as administrator.
2. Choose **Start** > **Programs > VERITAS NetBackup** > **NetBackup Administration Console**.

The NetBackup Administration Console appears.



Starting the NetBackup Administration Console for UNIX

This section contains information on launching the UNIX version of the NetBackup Administration Console.

▼ To launch the NetBackup Administration Console for UNIX

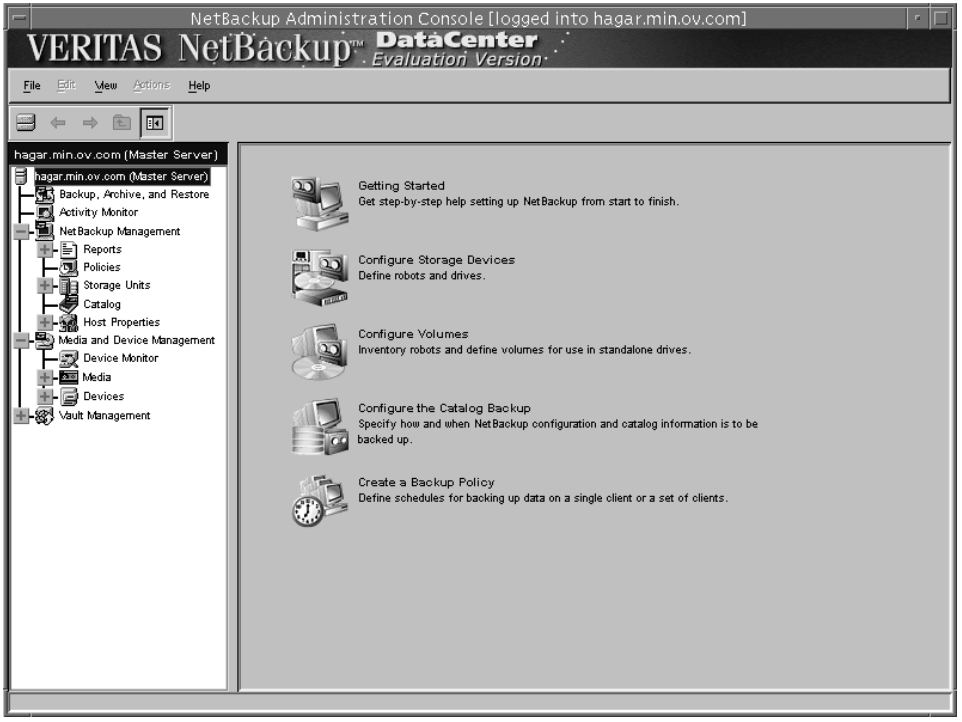
1. Log onto the UNIX server as root.
2. Start the NetBackup Administration Console by executing:

   install_path`/netbackup/bin/jnbSA &`

The Login dialog is displayed.

3. Type the name of the master server where you initially want to manage NetBackup. You can specify any NetBackup master server. Indicate the User and Password.

4. Click **Login**. The NetBackup Administration Console appears.



Configuring a NetBackup Policy

A NetBackup policy defines the backup criteria for a specific group of one or more clients. These criteria include:

- storage unit and media to use
- backup schedules
- items (database objects) to be backed up
- clients to be backed up

To use NetBackup for Microsoft Exchange Server, at least one MS-Exchange-Server policy with the appropriate schedules needs to be defined. A configuration can have a single policy that includes all clients or there can be many policies, some of which include only one client.

Most requirements for MS-Exchange-Server policies are the same as for file system backups. In addition to the attributes described here, there are other attributes for a policy to consider. Refer to the *NetBackup System Administrator's Guide* for detailed configuration instructions and information on all the attributes available.

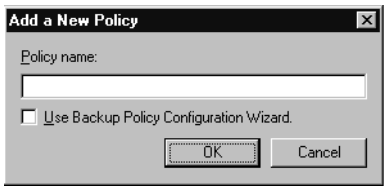
NetBackup Administration Console for Windows

Use this procedure when configuring a policy from a Windows server or from a NetBackup Remote Administration Console host.

▼ To add a new policy

1. Log on to the server as administrator.
2. Start the NetBackup Administration Console.
3. If your site has more than one master server, choose the one where you want to add the policy.
4. In the left pane, right-click **Policies** and choose **New Policy**.

   The Add a New Policy dialog is displayed.



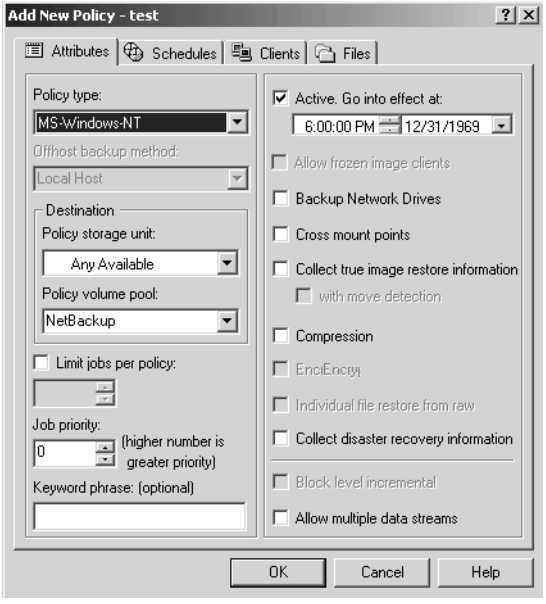
a. In the **Policy name** box, type a unique name for the new policy.

b. Choose whether to use the wizard for configuring the policy. The wizard guides you through most of the setup process and simplifies it by automatically choosing default values that are good for most configurations. If necessary, you can change the defaults later by editing the policy. You will need to manually add entries to the Files list after completing the wizard.

- To use the wizard, select the **Use Backup Policy Configuration Wizard** box and click **OK**. The wizard starts and you create the policy by following the prompts. When prompted, select the MS-Exchange-Server policy type.
- If you require more control over the settings than the wizard provides, then do not select the **Use Backup Policy Configuration Wizard** box and proceed to step 5.

5. Click **OK**.

A dialog is displayed in which you can specify the general attributes for the policy.



6. From the **Policy Type** box, select the MS-Exchange-Server policy type.

7. Complete the entries on the **Attributes** tab as explained in "Description of Attributes."

8. Add other policy information:

- To add schedules, see "Adding New Schedules."
- To add Exchange objects to the File list, see "Specifying the Exchange Objects to Back Up."
- To add clients, see "Adding Clients to a Policy."

9. Click **OK**. The new policy will be created.

Description of Attributes

With a few exceptions, NetBackup manages a database backup like a file system backup. Policy attributes that are different for MS Exchange backups are explained below.

Your other policy attributes will vary according to your specific backup strategy and system configuration. Consult the *NetBackup System Administrator's Guide* for detailed explanations of the policy attributes.

Description of Policy Attributes

Attribute	Description
Policy type	Determines the type of clients that can be in the policy and in some cases the types of backups that can be performed on those clients. To use NetBackup for Microsoft Exchange Server, you must have defined at least one MS-Exchange-Server policy.
Keyword phrase	A textual description of a backup. Useful for browsing backups and restores.
Encryption	Protects sensitive data by encoding it during the backup process. The data is decoded during the restore process. See the *NetBackup Encryption System Administrator's Guide* for details.
Allow multiple data streams	Specifies that, depending on directives in the file list, NetBackup can divide automatic backups for each client into multiple jobs, with each job backing up only a part of the file list. The jobs are in separate data streams and can occur concurrently. The number of available storage units, multiplex settings, and the maximum jobs parameters determines the total number of streams and how many can run concurrently.

Adding New Schedules

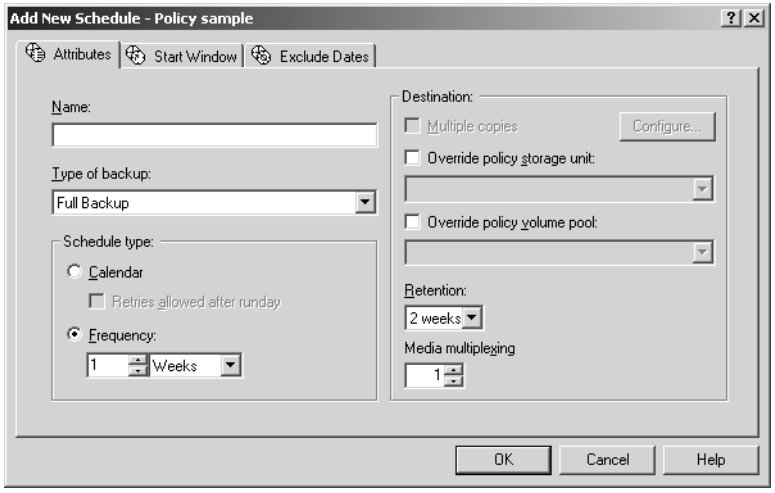
Each policy has its own set of schedules. These schedules control initiation of automatic backups and also specify when user operations can be initiated.

Note It is recommended that you develop a backup policy schedule that includes both full and differential-incremental backups. Including both backup types will reduce backup time, since differential-incremental backups back up only the transaction logs. Also, this will help to avoid low disk capacity caused by the creation of too many transaction logs.

▼ To add a schedule

1. In the left pane, right-click on the name of the policy and select **New Schedule**.

   A dialog is displayed. The title bar shows the name of the policy to which you are adding the schedules.



2. Specify a unique name for the schedule.

3. Select the **Type of backup**.

   For information on the types of backups available for this policy, see “Types of Backups” on page 31.

4. Specify the other properties for the schedule as explained in “Schedule Properties.”

5. Click **OK**.

Types of Backups

Description of Types of Backups

Type of Backup	Description
Full Backup	For server backups, this schedule type will back up the Microsoft Exchange Server database and associated transaction logs. All committed transaction logs will be truncated (deleted) after they are successfully backed up. For mailbox backups, this schedule type will back up the entire mailbox, including all the folders and messages in that mailbox. For the Public Store, this schedule type will backup the entire Public Store, including all the folders and messages within the Public Store.
Differential-incremental backup	A differential-incremental backup will only back up changes since the last full or differential-incremental backup. Differential-incremental backups can be performed of databases, the KMS and SRS services, mailboxes and of the Public Share. When using this method to back up a database, only transaction logs are backed up. After the successful backup of the transaction logs, all committed logs will be truncated (deleted). The truncation of the transaction logs sets the context for the next backup. To perform a full restore the data needed is contained in multiple NetBackup images. One image for the full backup and another image for each differential-incremental that was performed.
User Backup	A user backup is not automatically scheduled and is initiated on the target client machine. A user-directed backup of a database is identical to a full backup except that the transaction logs are not truncated. Because of this, user backups are like taking a snapshot of the databases at a given point in time without impacting the content of ongoing full and incremental backups. You may want to consider creating a separate policy for User Backup schedule types. This will allow you to easily separate user-directed and scheduled backups when restoring files. If you decide to create separate policies for User Backup schedule types, the considerations are similar to those for automatic backups. A Files list is not needed because users select the files before starting the operation.

Description of Types of Backups (continued)

Type of Backup	Description
Cumulative-incremental backup	A cumulative-incremental backup backs up all changes since the last full backup or differential-incremental backup (However, it is not standard practice to mix cumulative- and differential-incremental backups between full backups). Cumulative-incremental backups can be performed of databases, the KMS and SRS services, mailboxes and of the Public Share. When using this method to back up databases, only transaction logs are backed up and they are not truncated upon completion of the backup. When performing a full restore the data is contained in two NetBackup images. When restoring databases, transaction logs remain intact since the last full backup. In a Microsoft Exchange Server data recovery scenario where it has been determined that the transaction logs are all intact, you only need to restore the database from the last full backup. During recovery, Microsoft Exchange Server will replay all the load in the log folder. This will bring the Microsoft Exchange Server database back to the current date instead of to the time of the last full or incremental backup.

Caution Differential-incremental and cumulative-incremental backup types will fail if Database Circular Logging is configured for the Microsoft Exchange Server. By disabling Circular Logging, incremental backups may then be performed. See your *Exchange Server Administration Guide* for more information on configuring Circular Logging.

Note You are allowed to configure incremental schedule types, but incremental backups will not be performed for individual databases within storage groups. The backup job will still run according to the configured incremental schedules, but the job will log warnings for attempted incremental backups of these objects.

Schedule Properties

Some of the schedule properties have a different meaning for database backups than for a regular file system backup. These properties are explained below.

Other schedule properties will vary according to your specific backup strategy and system configuration. Consult the *NetBackup System Administrator's Guide* for detailed explanations of the schedule properties.

Description of Schedule Properties

Property	Description
Type of backup	Specifies the type of backup that this schedule will control. The selection list shows only the backup types that apply to the policy you are configuring. For more information see "Types of Backups."
Frequency	This setting is used only for scheduled backups, and not for user-directed backups. **Frequency** specifies the period of time that will elapse until the next backup operation can begin on this schedule. For example, if the frequency is seven days and a successful backup occurs on Wednesday, the next full backup will not occur until the following Wednesday. Normally, incremental backups will have a shorter frequency than full backups.
Calendar	This setting is used only for scheduled backups, and not for user-directed backups. The **Calendar** option allows you to schedule backup operations based on specific dates, recurring week days, or recurring days of the month.
Retention	Specifies a retention period for keeping backup copies of files before deleting them. The retention level also denotes a schedules priority within the policy, with Level 9 schedules having the highest priority and Level 0 the lowest.

Specifying the Exchange Objects to Back Up

The Files list defines the Exchange objects (databases, mailboxes, and mailbox folders) to be backed up and the grouping of Exchange objects for multiple data streams. When specifying Exchange objects and multiple data streams, the Files list is entered in the same manner as for regular file system backups.

Note Directives from different directives sets should not be added to the same policy. For example, `Microsoft Exchange Server:\Information Store\`, an Exchange 5.5 directive, and `Microsoft Information Store:\First Storage Group\`, an Exchange 2000 directive, should not be added to the same policy. Nor should `Microsoft Exchange Mailboxes:\*`, a mailbox directive, and `Microsoft Information Store:\`, an Exchange 2000 directive, be added to the same policy.

Enabling Multiple Data Streams

When **Allow multiple data streams** is enabled (on the **Attributes** tab for a specific policy), automatic backups are divided into multiple jobs, with each job backing up only a part of the Files list. Exchange mailboxes or storage groups defined in the Files list with wildcard characters will be backed up in multiple streams.

You can choose to have NetBackup automatically determine where to begin new streams, or you can control where each stream begins by inserting the NEW_STREAM directive at a certain point or points in the Files list. For example, if you enable multiple datastreams and specify the following in the Files list, NetBackup will create a new stream for each mailbox.

```
Microsoft Exchange Mailboxes:\[a-m]*
Microsoft Exchange Mailboxes:\[n-z]*
```

If instead you specify the following in the Files list, NetBackup will create only two streams, one for mailboxes “a-m” and one for mailboxes “n-z”.

```
NEW_STREAM
Microsoft Exchange Mailboxes:\[a-m]*
NEW_STREAM
Microsoft Exchange Mailboxes:\[n-z]*
```

For more information on the multiple data streams feature, refer to the *NetBackup System Administrator’s Guide for Windows* or *NetBackup System Administrator’s Guide for UNIX*.

Wildcards in Exchange Path Names

Wildcard characters can be used to define groups of mailboxes, storage groups, or Public folders. This way multiple objects can be backed up without having to specify the objects individually in the Files list. This will only be successful if multiple data streams have been enabled. If this feature has not been enabled, the backup will fail.

The supported wildcard characters for MS-Exchange-Server policy Files lists are described below.

Supported wildcard characters

Wildcard character	Action
Asterisk (*)	Use as a substitute for zero or more characters. To specify all objects that start with an ‘a’ use “a*”.
Question Mark (?)	Use as a substitute for a single character in a name. For example, “s?z” would process all objects that had ‘s’ for a first character, any character for a second character, and ‘z’ for a third character.

Supported wildcard characters (continued)

Wildcard character	Action
Left & Right Brackets ([…])	Use to match any one character enclosed in square brackets. A minus (-) may be used to indicate a range of consecutive characters; for example, [0-9] is equivalent to [0123456789]. **Note** The - loses this special meaning if it occurs last in the string. **Note** The right square bracket (]) does not terminate such a string when it is the first character within it; for example, [] a-f] matches either a right square bracket (]) or one of the ASCII letters a through f inclusive. Asterisk (*) and Question Mark (?) stand for themselves within such a string of characters.

The following rules apply when using wildcard characters in the Files list.

- Only one wildcard pattern per Files list entry is allowed.
- Wildcard patterns will only be honored in the final segment of the path name.
- Wildcard patterns in Exchange 2000 directives will only be honored in the Storage Group segment of the path.
- If a wildcard pattern is not honored it will be treated literally.
- For an Exchange Mailbox path any segment of the path may contain wildcard characters, including mailbox names, folders, or messages within the Mailbox hierarchy, as long as the wildcard characters are the last characters in the segment.
- For Exchange Public folders any segment of the path may contain wildcard characters, including workspace names or workspace folders, as long as the wildcard characters are the last characters in the segment.

Adding Exchange Mailbox Objects

This section describes how to back up mailbox objects by adding these objects to the Files list of a policy.

▼ To add a mailbox or mailbox folder to the Files list

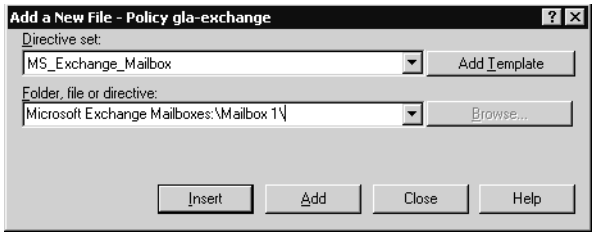
1. In the left pane of the NetBackup Administrative Console, right-click the policy name and click **New File**.

   The Add a New File dialog box is displayed.

2. From the **Directive set** list, select **MS_Exchange_Mailbox**.

3. From the **Folder, file, or directive** box, select **Microsoft Exchange Mailboxes:**.

4. Click in the **Folder, file, or directive** box and, after the directive name, specify the mailbox(es) or mailbox folder(s) to back up.



See the Table “Example mailbox entries in the Files list” for example entries.

- For an individual mailbox or mailbox folder, append the name of the mailbox or folder.
- For multiple mailboxes or folders, use the supported wildcard characters to specify the names of the mailboxes or folders. Multiple data streams must be enabled in order for backups to be successful.

  For information on the supported wildcard characters, see “Wildcards in Exchange Path Names” on page 34. For information on using multiple data streams, see “Enabling Multiple Data Streams” on page 34.

5. Click **Add**.

6. Click **Close**.

Example mailbox entries in the Files list

To back up	Example path
An individual mailbox	Microsoft Exchange Mailboxes:\Mailbox 1\
A mailbox folder	Microsoft Exchange Mailboxes:\Mailbox 1\Top of Information Store\Inbox
Multiple mailboxes, using two datastreams*	NEW_STREAM Microsoft Exchange Mailboxes:\[a-m]* NEW_STREAM Microsoft Exchange Mailboxes:\[n-z]*
Multiple mailboxes, using one stream for each mailbox*	Microsoft Exchange Mailboxes:*

Example mailbox entries in the Files list (continued)

To back up	Example path
Multiple folders using two datastreams*	NEW_STREAM Microsoft Exchange Mailboxes:\Mailbox 1\Top of Information Store\[a-m]* NEW_STREAM Microsoft Exchange Mailboxes:\Mailbox 1\Top of Information Store\[n-z]*

* **Allow multiple data streams** must be enabled in order for this Files list to be backed up successfully.

Adding the Microsoft Exchange Public Folders

This section describes how to back up the MS Exchange Public folders by adding the appropriate directive to the Files list of a policy.

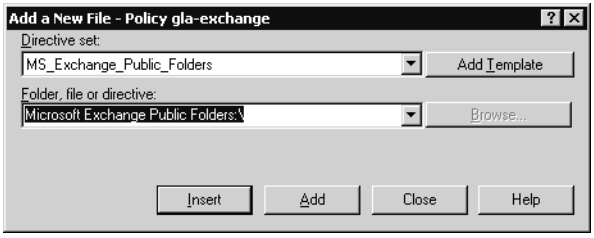
▼ To add the Microsoft Exchange Public folders to the Files list

1. In the left pane of the NetBackup Administrative Console, right-click the policy name and click **New File**.

   The Add a New File dialog box is displayed.

2. From the **Directive set** list, select **Microsoft_Exchange_Public_Folders**.

3. From the **Folder, file, or directive** box, select **Microsoft Exchange Public Folders:**.



4. To specify a specific folders or folders, click in the **Pathname or directive** box, and append the name of the folder(s) as follows:

   See the Table “Example Public folder entries in the Files list” for example entries.

   - For an individual folder, append the name of the folder.
   - For multiple folders, use the supported wildcard characters to specify the names of the folders. Multiple data streams must be enabled in order for backups to be successful.

For information on the supported wildcard characters, see “Wildcards in Exchange Path Names” on page 51. For information on using multiple data streams, see “Enabling Multiple Data Streams” on page 51

Example Public folder entries in the Files list

To back up	Example path
An individual Folder	Microsoft Exchange Public Folders:\Folder1\
A Public subfolder	Microsoft Exchange Public Folders:\Folder1\Subfolder1\
Multiple folders, using two datastreams*	NEW_STREAM Microsoft Exchange Public Folders:\Folder1\ NEW_STREAM Microsoft Exchange Mailboxes:\Folder2\
Multiple folders, using one stream for each folder*	Microsoft Exchange Public Folders:*

* **Allow multiple data streams** must be enabled in order for this Files list to be backed up successfully.

5. Click **Add**.

6. Click **Close**.

Adding the Microsoft Information Store to the Files list

This section describes how to back up the Microsoft Information Store by adding it to the Files list of a policy.

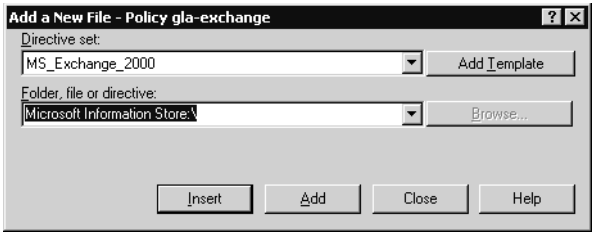
▼ To add the Microsoft Information Store to the Files list

1. In the left pane of the NetBackup Administrative Console, right-click the policy name and click **New File**.

   The Add a New File dialog box is displayed.

2. From the **Directive set** list, select **MS_Exchange_2000**.

3. From the **Folder, file, or directive** box, select **Microsoft Information Store:**.



4. Click **Add**.

5. Click **Close**.

Adding a Storage Group or database to the Files list

This section describes how to back up a Storage Group or Storage Group database by adding these object to the Files list of a policy. See the Table “Example Storage Group entries in the Files list” for example entries.

- For an individual Storage Group or database, append the name of the Storage Group or database.
- For multiple Storage Groups or databases, use the supported wildcard characters to specify the names. Multiple data streams must be enabled in order for backups to be successful.

  For information on the supported wildcard characters, see “Wildcards in Exchange Path Names” on page 34. For information on using multiple data streams, see “Enabling Multiple Data Streams” on page 34.

▼ To add a Storage Group or database to the Files list

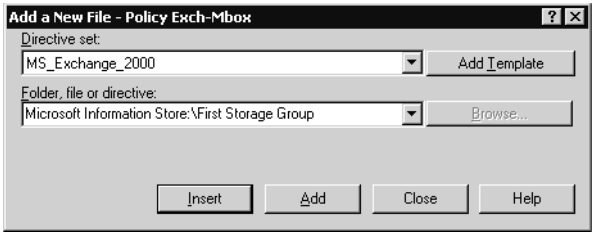
1. In the left pane of the NetBackup Administrative Console, right-click the policy name and click **New File**.

   The Add a New File dialog box is displayed.

2. From the **Directive set** list, select **MS_Exchange_2000**.

3. From the **Folder, file, or directive** list, select **Microsoft Information Store:**.

4. Click in the **Folder, file, or directive** box, and append the name of the Storage Group or database.



Example Storage Group entries in the Files list

To back up	Example path
An individual Storage Group	Microsoft Information Store:\First Storage Group\
A database within a Storage Group	Microsoft Information Store:\First Storage Group\Mailbox Store\
Multiple Storage Groups, using two datastreams*	NEW_STREAM Microsoft Information Store:\Storage Group[1-3] NEW_STREAM Microsoft Information Store:\Storage Group[4-6]
Multiple Storage Groups, using one stream for each Storage Group*	Microsoft Information Store:\Storage Group*

* **Allow multiple data streams** must be enabled in order for this Files list to be backed up successfully.

5. Click **Add**.

6. Click **Close**.

Adding the Site Replication Service to the Files list

This section describes how to back up the Site Replication Service by adding it to the Files list of a policy.

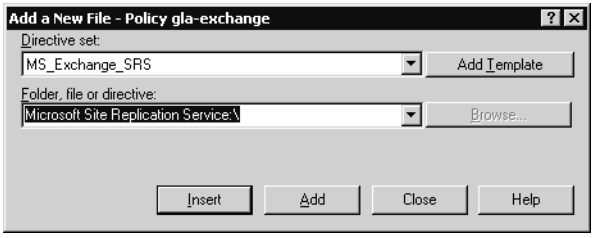
▼ To add the Site Replication Service to the Files list

1. In the left pane of the NetBackup Administrative Console, right-click the policy name and click **New File**.

   The Add a New File dialog box is displayed.

2. From the **Directive set** list, select **MS_Exchange_SRS**.

3. From the **Folder, file, or directive** box, select **Microsoft Site Replication Service:**.



4. Click **Add**.

5. Click **Close**.

Adding the Key Management Service

This section describes how to back up the Key Management Service by adding it to the Files list of a policy.

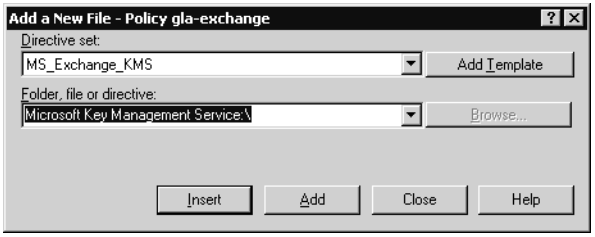
▼ To add the Key Management Service to the Files list

1. In the left pane of the NetBackup Administrative Console, right-click the policy name and click **New File**.

   The Add a New File dialog box is displayed.

2. From the **Directive set** list, select **MS_Exchange_KMS**.

3. From the **Folder, file, or directive** box, select **Microsoft Key Management Service:**.



4. Click **Add**.

5. Click **Close**.

Adding Exchange 5.x Objects

This section describes how to back up Exchange 5.x objects by adding these objects to the Files list of a policy.

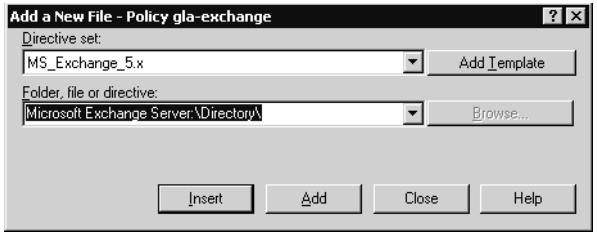
▼ To add Exchange 5.x objects to the Files list

1. In the left pane of the NetBackup Administrative Console, right-click the policy name and click **New File**.

   The Add a New File dialog box is displayed.

2. From the **Directive set** list, select **MS_Exchange_5.x**.

3. From the **Folder, file, or directive** box, select the appropriate directive:



   - To backup the Directory Store, select **Microsoft Exchange Server:\Directory** and click **Add**.
   - To backup the Information Store, select **Microsoft Exchange Server:\Information Store** and click **Add**.

- To backup the Exchange 5.x Server, add both the **Microsoft Exchange Server:\Directory** and **Microsoft Exchange Server:\Information Store** directives.

4. Click **Close**.

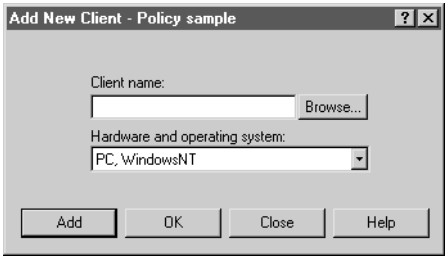
Adding Clients to a Policy

The client list is the list of clients that will be backed up during an automatic backup. A NetBackup client must be in at least one policy but can be in more than one.

▼ To add clients to a policy

1. In the left pane of the NetBackup Administration Console, right-click on the policy name and click **New Client**.

   The Add New Client dialog is displayed. The title bar shows the name of the policy to which you are adding the clients.



2. In the **Client name** text box, type the name of the client that you are adding.

   For a clustered MS Exchange server, specify the virtual Exchange Server name to be the client.

   On the client the following should be installed:

   - MS Exchange
   - NetBackup client or server

3. Choose the hardware and operating system type.

4. Click **Add**.

5. To add another client, repeat step 2 through step 4. If this is the last client, click **Close** to close the dialog.

NetBackup Administration Console for UNIX

Use this procedure when configuring a policy from a UNIX server.

▼ To add a new policy

1. Log onto the server as root.
2. Start the NetBackup Administration Console.
3. If your site has more than one master server, choose the one to which you want to add the policy.
4. In the left pane, click on **Policies**. The right pane splits into an All Policies pane and a details pane.
5. In the All Policies pane, right-click on the Master Server, and click **New**.

   The Add a New Policy dialog is displayed.

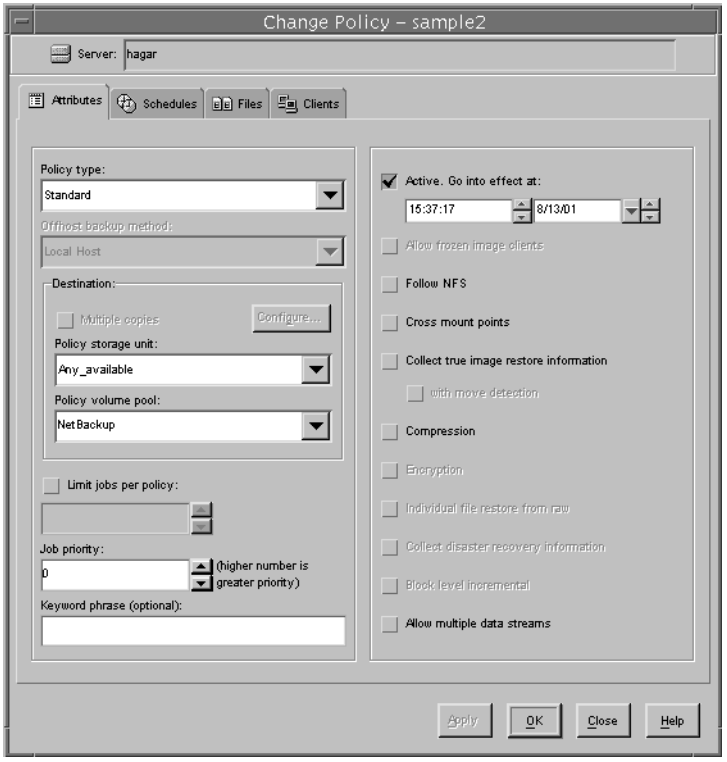
   a. In the **Policy name** box, type a unique name for the new policy.

   b. Choose whether to use the wizard for configuring the policy. The wizard guides you through most of the setup process and simplifies it by automatically choosing default values that are good for most configurations. If necessary, you can change the defaults later by editing the policy. You will need to manually add entries to the Files list after completing the wizard.

      - To use the wizard, select the **Use add policy wizard** box and click **OK**. The wizard starts and you create the policy by following the prompts. When prompted, select the MS-Exchange-Server policy type.
      - If you require more control over the settings than the wizard provides, do not select the **Use add policy wizard** box and proceed to step 6.

6. Click **OK**.

A dialog is displayed in which you can specify the general attributes for the policy.



7. From the **Policy type** box, select the MS-Exchange-Server policy type.

8. Complete the entries on the **Attributes** tab as explained in "Description of Attributes" and click **Apply** to save the attribute entries.

9. Add other policy information:
   - To add schedules, see "Adding New Schedules."
   - To add Exchange objects to the File list, see "Specifying the Exchange Objects to Back Up."
   - To add clients, see "Adding Clients to a Policy."

10. Click **OK**. The new policy is created.

Description of Attributes

With a few exceptions, NetBackup manages a database backup like a file system backup. Policy attributes that are different for MS Exchange backups are explained below.

Your other policy attributes will vary according to your specific backup strategy and system configuration. Consult the *NetBackup System Administrator's Guide* for detailed explanations of the policy attributes.

Description of Policy Attributes

Attribute	Description
Policy type	Determines the type of clients that can be in the policy and in some cases the types of backups that can be performed on those clients. To use NetBackup for Microsoft Exchange Server, you must have defined at least one MS-Exchange-Server policy.
Keyword phrase	A textual description of a backup. Useful for browsing backups and restores.
Encryption	Protects sensitive data by encoding it during the backup process. The data is decoded during the restore process. See the *NetBackup Encryption System Administrator's Guide* for details.
Allow multiple data streams	Specifies that, depending on directives in the file list, NetBackup can divide automatic backups for each client into multiple jobs, with each job backing up only a part of the file list. The jobs are in separate data streams and can occur concurrently. The number of available storage units, multiplex settings, and the maximum jobs parameters determines the total number of streams and how many can run concurrently.

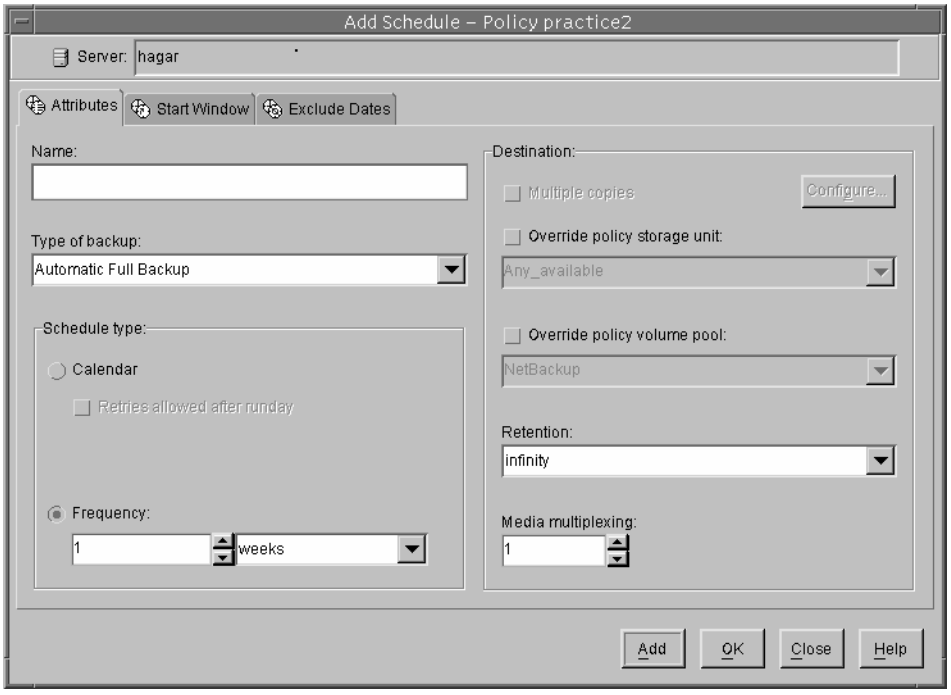
Adding New Schedules

Each policy has its own set of schedules. These schedules control initiation of automatic backups and also specify when user operations can be initiated.

▼ To add a schedule

1. In the left pane, click **Policies**.
2. In the All Policies pane, expand the policy you wish to configure. Right-click on **Schedules** and choose **New**.
3. Specify a unique name for the schedule.

A dialog is displayed. The title bar shows the name of the policy to which you are adding the schedules.



4. Select the **Type of backup**.

   For information on the types of backups available for this policy, see “Types of Backups” on page 48.

5. Specify the other properties for the schedule as explained in “Schedule Properties.”

6. If this is the last schedule, click **OK**. To add more schedules, click **Add** and repeat step 3 through step 5. Click **Close** to cancel changes that you have not yet added and close the dialog.

Types of Backups

Description of Types of Backups

Type of Backup	Description
Full Backup	For server backups, this schedule type will back up the Microsoft Exchange Server database and associated transaction logs. All committed transaction logs will be truncated (deleted) after they are successfully backed up. For mailbox backups, this schedule type will back up the entire mailbox, including all the folders and messages in that mailbox. For the Public Store, this schedule type will backup the entire Public Store, including all the folders and messages within the Public Store.
Differential-incremental backup	A differential-incremental backup will only back up changes since the last full or differential-incremental backup. Differential-incremental backups can be performed of databases, the KMS and SRS services, mailboxes and of the Public Share. When using this method to back up a database, only transaction logs are backed up. After the successful backup of the transaction logs, all committed logs will be truncated (deleted). The truncation of the transaction logs sets the context for the next backup. To perform a full restore the data needed is contained in multiple NetBackup images. One image for the full backup and another image for each differential-incremental that was performed.
User Backup	A user backup is not automatically scheduled and is initiated on the target client machine. A user-directed backup of a database is identical to a full backup except that the transaction logs are not truncated. Because of this, user backups are like taking a snapshot of the databases at a given point in time without impacting the content of ongoing full and incremental backups. You may want to consider creating a separate policy for User Backup schedule types. This will allow you to easily separate user-directed and scheduled backups when restoring files. If you decide to create separate policies for User Backup schedule types, the considerations are similar to those for automatic backups. A Files list is not needed because users select the files before starting the operation.

Description of Types of Backups (continued)

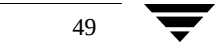
Type of Backup	Description
Cumulative-incremental backup	A cumulative-incremental backup backs up all changes since the last full backup or differential-incremental backup (However, it is not standard practice to mix cumulative- and differential-incremental backups between full backups). Cumulative-incremental backups can be performed of databases, the KMS and SRS services, mailboxes and of the Public Share. When using this method to back up databases, only transaction logs are backed up and they are not truncated upon completion of the backup. When performing a full restore the data is contained in two NetBackup images. When restoring databases, transaction logs remain intact since the last full backup. In a Microsoft Exchange Server data recovery scenario where it has been determined that the transaction logs are all intact, you only need to restore the database from the last full backup. During recovery, Microsoft Exchange Server will replay all the load in the log folder. This will bring the Microsoft Exchange Server database back to the current date instead of to the time of the last full or incremental backup.

Caution Differential-incremental and cumulative-incremental backup types will fail if Database Circular Logging is configured for the Microsoft Exchange Server. By disabling Circular Logging, incremental backups may then be performed. See your *Exchange Server Administration Guide* for more information on configuring Circular Logging.

Note You are allowed to configure incremental schedule types, but incremental backups will not be performed for individual databases within storage groups. The backup job will still run according to the configured incremental schedules, but the job will log warnings for attempted incremental backups of these objects.

Schedule Properties

Some of the schedule properties have a different meaning for database backups than for a regular file system backup. These properties are explained below.



Other schedule properties will vary according to your specific backup strategy and system configuration. Consult the *NetBackup System Administrator's Guide* for detailed explanations of the schedule properties.

Description of Schedule Properties

Property	Description
Type of backup	Specifies the type of backup that this schedule will control. The selection list shows only the backup types that apply to the policy you are configuring. For more information see "Types of Backups."
Frequency	This setting is used only for scheduled backups, and not for user-directed backups. **Frequency** specifies the period of time that will elapse until the next backup operation can begin on this schedule. For example, if the frequency is seven days and a successful backup occurs on Wednesday, the next full backup will not occur until the following Wednesday. Normally, incremental backups will have a shorter frequency than full backups.
Calendar	This setting is used only for scheduled backups, and not for user-directed backups. The **Calendar** option allows you to schedule backup operations based on specific dates, recurring week days, or recurring days of the month.
Retention	Specifies a retention period for keeping backup copies of files before deleting them. The retention level also denotes a schedules priority within the policy, with Level 9 schedules having the highest priority and Level 0 the lowest.

Specifying the Exchange Objects to Back Up

The Files list defines the Exchange objects (databases, mailboxes, and mailbox folders) to be backed up and the grouping of Exchange objects for multiple data streams. When specifying Exchange objects and multiple data streams, the Files list is entered in the same manner as for regular file system backups.

Note Directives from different directives sets should not be added to the same policy. For example, `Microsoft Exchange Server:\Information Store\`, an Exchange 5.5 directive, and `Microsoft Information Store:\First Storage Group\`, an Exchange 2000 directive should not be added to the same policy. Nor should `Microsoft Exchange Mailboxes:\*`, a mailbox directive, and `Microsoft Information Store:\`, an Exchange 2000 directive, be added to the same policy.

Enabling Multiple Data Streams

When **Allow multiple data streams** is enabled (on the **Attributes** tab for a specific policy), automatic backups are divided into multiple jobs, with each job backing up only a part of the Files list. Exchange mailboxes or storage groups defined in the Files list with wildcard characters will be backed up in multiple streams.

You can choose to have NetBackup automatically determine where to begin new streams, or you can control where each stream begins by inserting the NEW_STREAM directive at a certain point or points in the Files list. For example, if you enabled multiple datastreams and specified the following in the Files list, NetBackup would create a new stream for each mailbox.

```
Microsoft Exchange Mailboxes:\[a-m]*
Microsoft Exchange Mailboxes:\[n-z]*
```

If instead you specified the following in the Files list, NetBackup would create only two streams, one for mailboxes “a-m” and one for mailboxes “n-z”.

```
NEW_STREAM
Microsoft Exchange Mailboxes:\[a-m]*
NEW_STREAM
Microsoft Exchange Mailboxes:\[n-z]*
```

For more information on the multiple data streams feature, refer to the *NetBackup System Administrator’s Guide for Windows* or *NetBackup System Administrator’s Guide for UNIX*.

Wildcards in Exchange Path Names

Wildcard characters can be used to define groups of mailboxes, storage groups, or Public folders. This way multiple objects can be backed up without having to specify the objects individually in the Files list. This will only be successful if multiple data streams have been enabled. If this feature has not been enabled, the backup will fail.

The supported wildcard characters for MS-Exchange-Server policy Files lists are *, ?, and [ ]. The following rules apply when using wildcard characters in the Files list.

Supported wildcard characters

Wildcard character	Action
Asterisk (*)	Use as a substitute for zero or more characters. To specify all objects that start with an ‘a’ use “a*”.
Question Mark (?)	Use as a substitute for a single character in a name. For example, “s?z” would process all objects that had ‘s’ for a first character, any character for a second character, and ‘z’ for a third character.

Supported wildcard characters (continued)

Wildcard character	Action
Left & Right Brackets ([…])	Use to match any one character enclosed in square brackets. A minus (-) may be used to indicate a range of consecutive characters; for example, [0-9] is equivalent to [0123456789]. **Note** The - loses this special meaning if it occurs last in the string. **Note** The right square bracket (]) does not terminate such a string when it is the first character within it; for example, [] a-f] matches either a right square bracket (]) or one of the ASCII letters a through f inclusive. Asterisk (*) and Question Mark (?) stand for themselves within such a string of characters.

- Only one wildcard pattern per Files list entry is allowed.
- Wildcard patterns will only be honored in the final segment of the path name.
- Wildcard patterns in Exchange 2000 directives will only be honored in the Storage Group segment of the path.
- If a wildcard pattern is not honored it will be treated literally.
- For an Exchange Mailbox path any segment of the path may contain wildcard characters, including mailbox names, folders, or messages within the Mailbox hierarchy, as long as the wildcard characters are the last characters in the segment.
- For Exchange Public folders any segment of the path may contain wildcard characters, including workspace names or workspace folders, as long as the wildcard characters are the last characters in the segment.

Adding Exchange Mailbox Objects

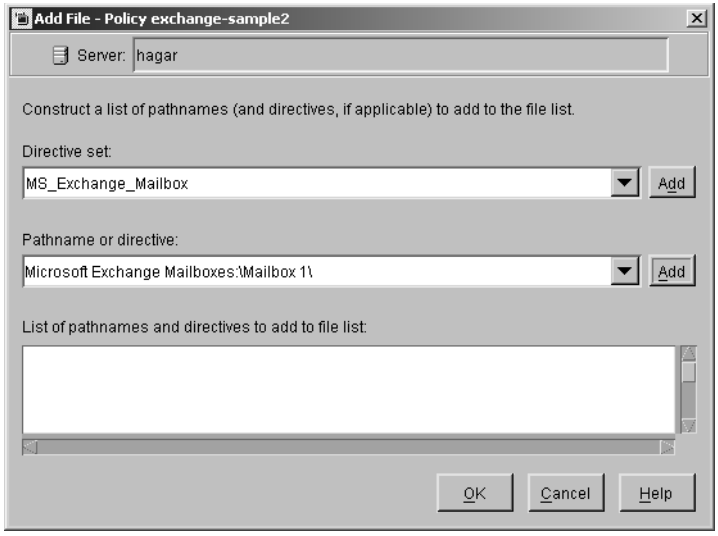
This section describes how to back up mailbox objects by adding these objects to the Files list of a policy.

▼ To add a mailbox or mailbox folder to the Files list

1. In the left pane, click **Policies**.
2. In the center pane, expand the policy where you want to add the mailbox to backup.
3. Under the policy name, right-click **Files** and choose **New**.

   The Add File dialog is displayed. The title bar shows the name of the policy to which you are adding the mailbox.
4. From the **Directive set** list, select **MS_Exchange_Mailbox**.

5. From the **Directive set** list, select **Microsoft Exchange Mailboxes:**.



6. Click in the **Pathname or directive** box and specify the mailbox(es) or mailbox folder(s) to back up.

   See the Table “Example mailbox entries in the Files list” for example entries.

   - For an individual mailbox or mailbox folder, append the name of the mailbox or folder.
   - For multiple mailboxes or folders, use the supported wildcard characters to specify the names of the mailboxes or folders. Multiple data streams must be enabled in order for backups to be successful.

     For information on the supported wildcard characters, see “Wildcards in Exchange Path Names” on page 51. For information on using multiple data streams, see “Enabling Multiple Data Streams” on page 51.

Example mailbox entries in the Files list

To back up	Example path
An individual mailbox	Microsoft Exchange Mailboxes:\Mailbox 1\
A mailbox folder	Microsoft Exchange Mailboxes:\Mailbox 1\Top of Information Store\Inbox

Example mailbox entries in the Files list (continued)

To back up	Example path
Multiple mailboxes, using two datastreams*	NEW_STREAM Microsoft Exchange Mailboxes:\[a-m]* NEW_STREAM Microsoft Exchange Mailboxes:\[n-z]*
Multiple mailboxes, using one stream for each mailbox*	Microsoft Exchange Mailboxes:*
Multiple folders using two datastreams*	NEW_STREAM Microsoft Exchange Mailboxes:\Mailbox 1\Top of Information Store\[a-m]* NEW_STREAM Microsoft Exchange Mailboxes:\Mailbox 1\Top of Information Store\[n-z]*

* **Allow multiple data streams** must be enabled in order for this Files list to be backed up successfully.

7. Click the **Add** button to the right of the **Directive set** box.

   The new entry appears in the list.

8. If there are no more items to add, click **OK**.

Adding the Microsoft Exchange Public Folders

This section describes how to back up the MS Exchange Public folders by adding the appropriate directive to the Files list of a policy.

▼ To add the Microsoft Exchange Public folders to the Files list

1. In the left pane, click **Policies**.

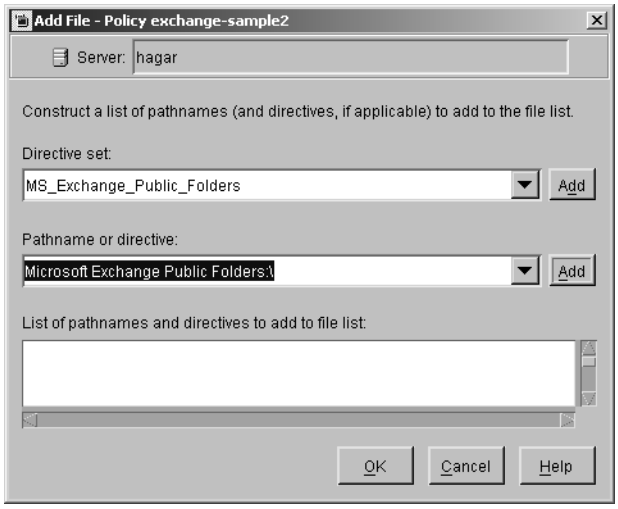
2. In the center pane, expand the policy where you want to add the Public folders to backup.

3. Under the policy name, right-click **Files** and choose **New**.

   The Add File dialog is displayed. The title bar shows the name of the policy to which you are adding the Public folders.

4. From the **Directive set** list, select **Microsoft_Exchange_Public_Folders**.

5. From the **Directive set** list, select **Microsoft Exchange Public Folder:**.



6. To specify a specific folders or folders, click in the **Pathname or directive** box, and append the name of the folder(s) as follows:

   See the Table “Example Public folder entries in the Files list” for example entries.

   - For an individual folder, append the name of the folder.
   - For multiple folders, use the supported wildcard characters to specify the names of the folders. Multiple data streams must be enabled in order for backups to be successful.

   For information on the supported wildcard characters, see “Wildcards in Exchange Path Names” on page 51. For information on using multiple data streams, see “Enabling Multiple Data Streams” on page 51

Example Public folder entries in the Files list

To back up	Example path
An individual Folder	Microsoft Exchange Public Folders:\Folder1\
A Public subfolder	Microsoft Exchange Public Folders:\Folder1\Subfolder1\
Multiple folders, using two datastreams*	NEW_STREAM Microsoft Exchange Public Folders:\Folder1\ NEW_STREAM Microsoft Exchange Mailboxes:\Folder2\

Example Public folder entries in the Files list (continued)

To back up	Example path
Multiple folders, using one stream for each folder*	Microsoft Exchange Public Folders:*

* **Allow multiple data streams** must be enabled in order for this Files list to be backed up successfully.

7. Click the **Add** button to the right of the **Pathname or directive** box.

   The new entry appears in the list.

8. If there are no more items to add, click **OK**.

Adding the Microsoft Information Store to the Files list

This section describes how to back up the Microsoft Information Store by adding it to the Files list of a policy.

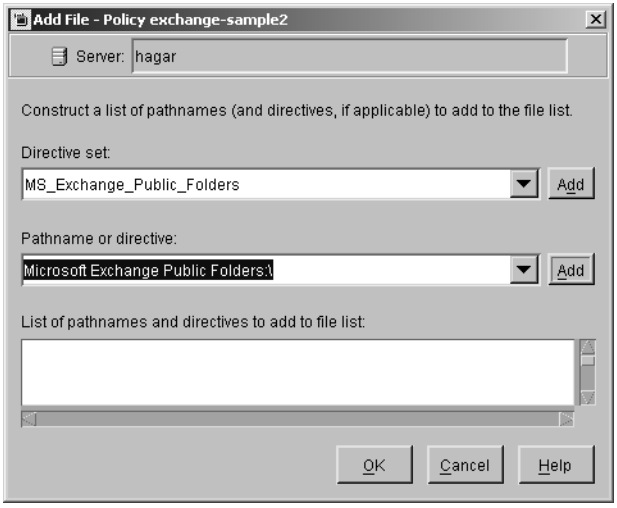
▼ To add the Microsoft Information Store to the Files list

1. In the left pane, click **Policies**.
2. In the center pane, expand the policy where you want to add the Exchange 2000 objects.
3. Under the policy name, right-click **Files** and choose **New**.

   The Add File dialog is displayed.

4. From the **Directive set** list, select **MS_Exchange_2000**.

5. From the **Pathname or directive** list, select **Microsoft Information Store:**.



6. Click the **Add** button to the right of the **Pathname or directive** box.

   The new entry appears in the list.

7. If there are no more items to add, click **OK**.

Adding a Storage Group or database to the Files list

This section describes how to back up a Storage Group or Storage Group database by adding these object to the Files list of a policy. See the Table “Example Storage Group entries in the Files list” for example entries.

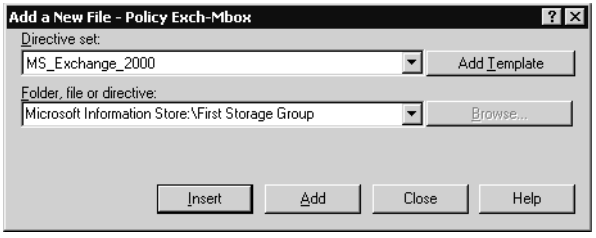
- For an individual Storage Group or database, append the name of the Storage Group or database.
- For multiple Storage Groups or databases, use the supported wildcard characters to specify the names. Multiple data streams must be enabled in order for backups to be successful.

  For information on the supported wildcard characters, see “Wildcards in Exchange Path Names” on page 51. For information on using multiple data streams, see “Enabling Multiple Data Streams” on page 51.

▼ To add a Storage Group or database to the Files list

1. In the left pane, click **Policies**.
2. In the center pane, expand the policy where you want to add the Exchange 2000 objects.
3. Under the policy name, right-click **Files** and choose **New**.

   The Add File dialog is displayed.
4. From the **Directive set** list, select **MS_Exchange_2000**.
5. From the **Pathname or directive** list, select **Microsoft Information Store:**.
6. Click in the **Folder, file, or directive** box, and append the name of the Storage Group or database.



Example Storage Group entries in the Files list

To back up	Example path
An individual Storage Group	Microsoft Information Store:\First Storage Group\
A database within a Storage Group	Microsoft Information Store:\First Storage Group\Mailbox Store\
Multiple Storage Groups, using two datastreams*	NEW_STREAM Microsoft Information Store:\Storage Group[1-3] NEW_STREAM Microsoft Information Store:\Storage Group[4-6]

Example Storage Group entries in the Files list (continued)

To back up	Example path
Multiple Storage Groups, using one stream for each Storage Group*	Microsoft Information Store:\Storage Group*

* **Allow multiple data streams** must be enabled in order for this Files list to be backed up successfully.

7. Click the **Add** button to the right of the **Pathname or directive** box.

   The new entry appears in the list.

8. If there are no more items to add, click **OK**.

Adding the Site Replication Service to the Files list

This section describes how to back up the Site Replication Service by adding it to the Files list of a policy.

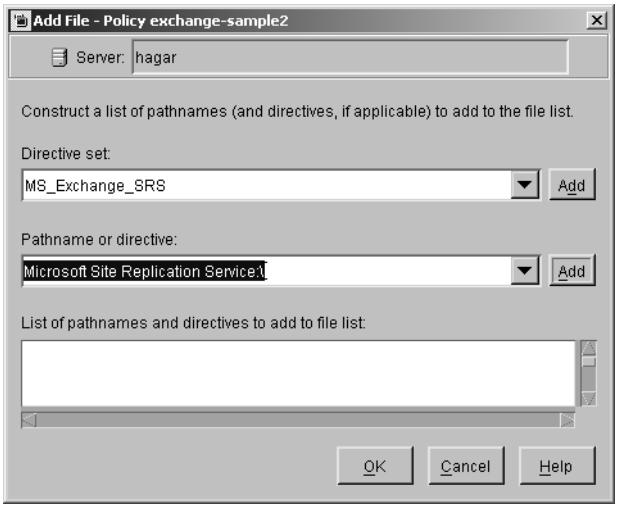
▼ To add the Site Replication Service to the Files list

1. In the left pane, click **Policies**.
2. In the center pane, expand the policy where you want to add the Exchange 2000 objects.
3. Under the policy name, right-click **Files** and choose **New**.

   The Add File dialog is displayed.

4. From the **Directive set** list, select **MS_Exchange_SRS**.

5. From the **Pathname or directive** list, select **Microsoft Site Replication Service:**.



6. Click the **Add** button to the right of the **Pathname or directive** box.

   The new entry appears in the list.

7. If there are no more items to add, click **OK**.

Adding the Key Management Service

This section describes how to back up the Key Management Service by adding it to the Files list of a policy.

▼ To add the Key Management Service to the Files list

1. In the left pane, click **Policies**.

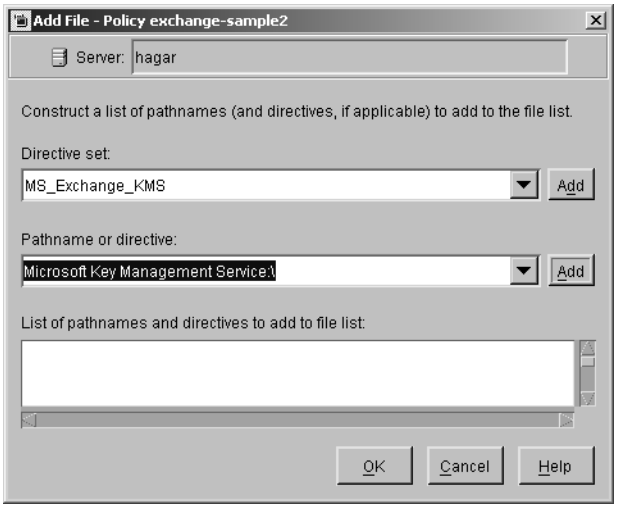
2. In the center pane, expand the policy where you want to add the Exchange 2000 objects.

3. Under the policy name, right-click **Files** and choose **New**.

   The Add File dialog is displayed.

4. From the **Directive set** list, select **MS_Exchange_KMS**.

5. From the **Folder, file, or directive** box, select **Microsoft Key Management Service:**.



6. Click the **Add** button to the right of the **Pathname or directive** box.

   The new entry appears in the list.

7. If there are no more items to add, click **OK**.

Adding Exchange 5.x Objects

This section describes how to back up Exchange 5.x objects by adding these objects to the Files list of a policy.

▼ To add Exchange 5.x objects to the Files List

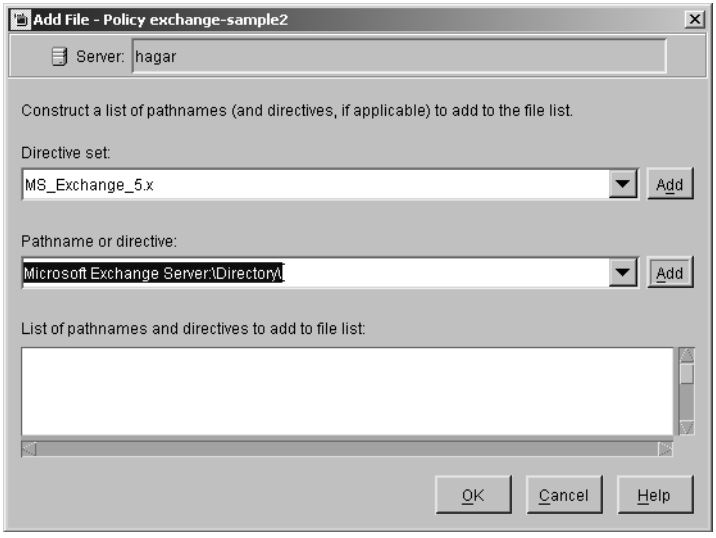
1. In the left pane, click **Policies**.

2. In the center pane, expand the policy where you want to add the Exchange 5.x objects.

3. Under the policy name, right-click **Files** and choose **New**.

   The Add File dialog is displayed. The title bar shows the name of the policy to which you are adding the Exchange 5.x objects.

4. From the **Directive set** list, select **MS_Exchange_5.x**.



5. From the **Pathname or directive** box, select the appropriate directive:
   - To backup the Directory Store, select **Microsoft Exchange Server:\Directory** and click **Add**.
   - To backup the Information Store, select **Microsoft Exchange Server:\Information Store** and click **Add**.
   - To backup the Exchange 5.x Server, add both **Microsoft Exchange Server:\Directory** and **Microsoft Exchange Server:\Information Store** directives.
6. If there are no more items to add, click **OK.**

Adding Clients to a Policy

The client list is the list of clients that will be backed up during an automatic backup. A NetBackup client must be in at least one policy but can be in more than one.

▼ To add clients to a policy

1. In the left pane, expand **Policies**.
2. In the All Policies pane, expand the policy you wish to configure.
3. Right-click on **Clients** and choose **New**.

The Add Client dialog is displayed. The title bar shows the name of the policy where you are adding clients.

4. In the **Client name** text box, type the name of the client that you are adding.

   For a clustered MS Exchange server, specify the virtual Exchange Server name to be the client.

   On the client the following should be installed:

   - MS Exchange
   - NetBackup client or server

5. Choose the **Hardware and Operating System** type and click **Add**.

6. If this is the last client, click **OK**. If you are going to add more clients, repeat step 4 and step 5.

Testing NetBackup for Microsoft Exchange Server Configuration Settings

After you have configured the master server for NetBackup for Microsoft Exchange Server, you should test the configuration settings. For a description of status codes, refer to the *NetBackup Troubleshooting Guide for UNIX and Windows.*

NetBackup Administration Console for Windows

Use this procedure to test a policy configuration from a Windows server or from the Remote Administration Console.

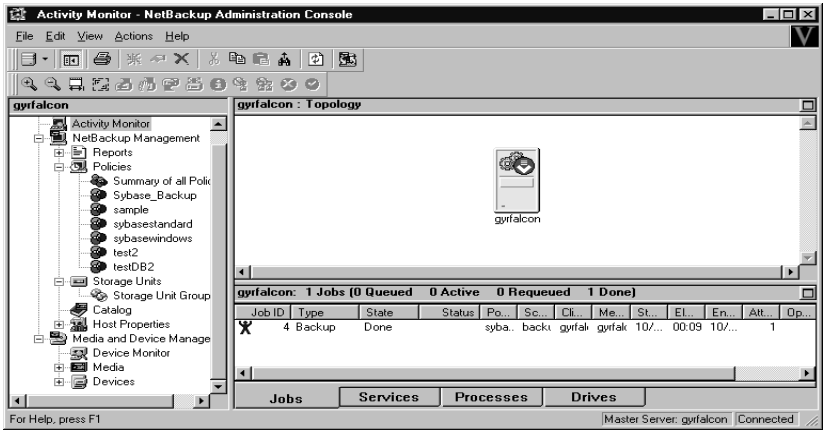
▼ To test the configuration settings on a Windows server

1. Log onto the server as administrator.
2. Start the NetBackup Administration Console.
3. In the left pane, click **Policies**. The policy list appears in the right pane.
4. Click on the policy you wish to test.
5. Choose **Actions** > **Manual Backup**.

   The Manual Backup dialog is displayed.

   The Schedules pane contains the name of a schedule (or schedules) configured for the policy you are going to test. The Clients pane contains the name of the client(s) listed in the policy you are going to test.
6. Follow the instructions on the dialog.

7. Click **Activity Monitor** on the NetBackup Administration Console.



If the manual backup does not exit with a successful status, refer to the Troubleshooting chapter.

NetBackup Administration Console for UNIX

Use this procedure to test a policy configuration on the NetBackup Administration Console for UNIX.

▼ To test the configuration settings on a UNIX server

1. Log onto the server as root.
2. Start the NetBackup Administration Console.
3. In the left pane, click **Policies**.

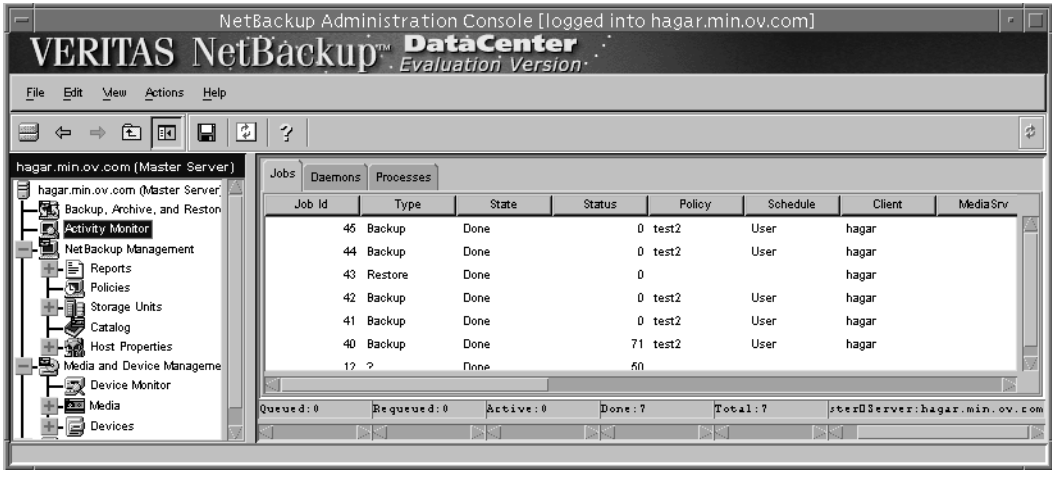
   The right pane splits into an All Policies pane and a details pane.
4. In the All Policies pane, click the policy you wish to test.
5. Choose **Actions** > **Manual Backup**.

The Manual Backup dialog is displayed.

The Schedules pane contains the name of a schedule (or schedules) configured for the policy you are going to test. The Clients pane contains the name of the client(s) listed in the policy you are going to test.

6. Follow the instructions on the dialog.

7. Click **Activity Monitor** on the NetBackup Administration Console.



If the manual backup does not exit with a successful status, refer to the Troubleshooting chapter.

Operating Instructions 4

After completing the configuration, you can use the Backup, Archive, and Restore interface to back up MS Exchange databases, mailboxes or folders. This chapter contains the following information:

- “Performing User-Directed Backups of Exchange Server”
- “Restoring Exchange Server”
- “Individual Mailbox Operations”
- “Performing Single Instance Store Backups”
- “Backing Up and Restoring the Microsoft Exchange Public Folders”
- “Specifying the Virtual Exchange Server”
- “Redirecting a Restore to a Different Client”

Performing User-Directed Backups of Exchange Server

Note To ensure consistent and accurate backups, always check database consistency before backing up a database.

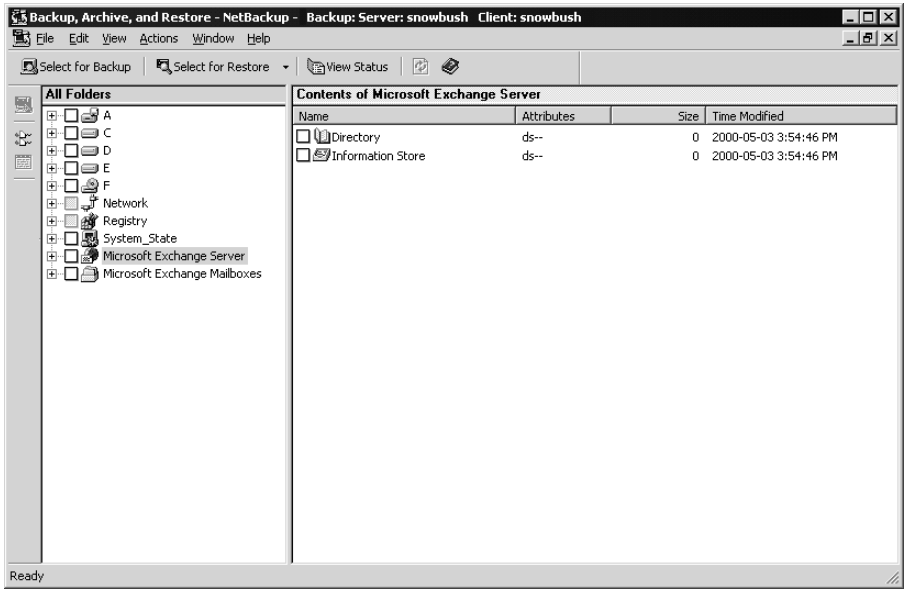
Exchange 5.x

This section describes how to perform a user-directed backup of Exchange 5.x objects.

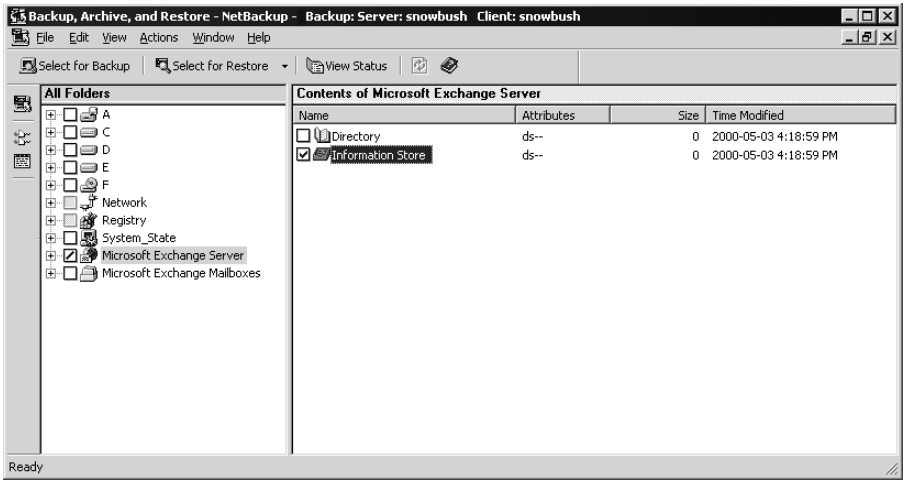
▼ **To perform a user-directed backup of Exchange 5.x objects**

1. Open the Backup, Archive, and Restore interface.
2. On the **File** menu, click **Select Files and Folders to Backup**.

   The Backup window is displayed.
3. If you are in a cluster environment, specify the name of the Virtual Exchange Server as described in “Specifying the Virtual Exchange Server” on page 103.
4. In the All Folders pane expand the Microsoft Exchange Server object.



5. Select the Information Store or Directory objects to back up.



6. On the **Actions** menu, click **Start Backup of Marked Files**.

   The Specify Backup Options dialog box is displayed.

7. Click **Start Backup**.

   A dialog box is displayed informing you that the backup was successfully initiated.

8. If you want to view the progress of the backup, click **Yes**. If you do not want to view the progress of the backup, click **No**.

Exchange 2000

This section describes how to perform a user-directed backup of Exchange 2000 objects.

▼ To perform a user-directed backup of Exchange 2000 objects

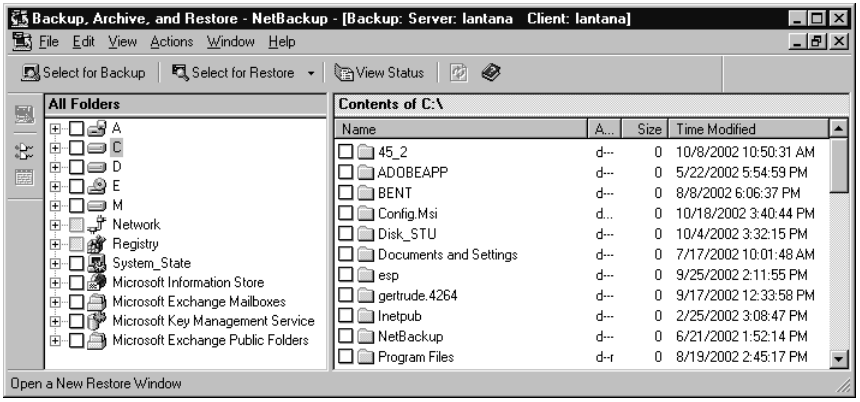
1. Open the Backup, Archive, and Restore interface.

2. On the **File** menu, click **Select Files and Folders to Backup**.

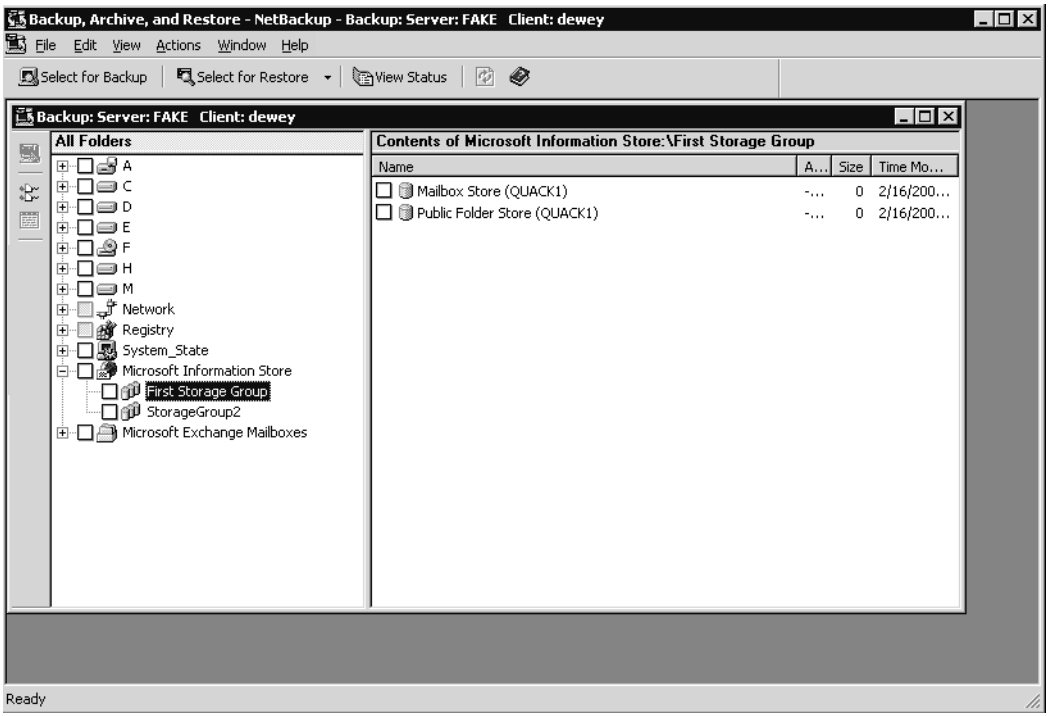
   The Backup window is displayed.

3. If you are in a cluster environment, specify the name of the Virtual Exchange Server as described in “Specifying the Virtual Exchange Server” on page 103.

Browsing Exchange 2000 objects



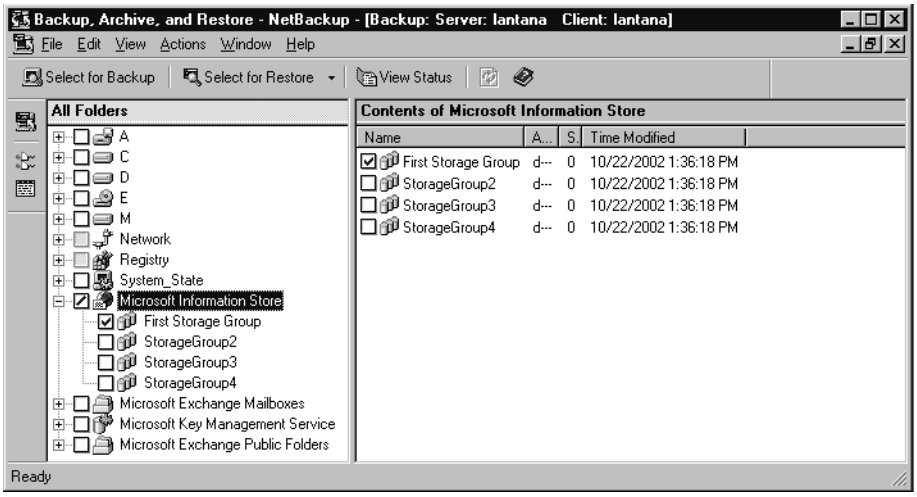
Browsing Exchange objects in a cluster environment



4. In the All Folders pane, select the objects you wish to back up. The following objects can be backed up.

   - Storage groups. Expand the Microsoft Information Store node and select the storage group to back up.

- Individual databases. To back up an individual database within a specific storage group, expand the Microsoft Information Store, then the storage group, and select the database to back up.
- Key Management Services database. Select the KMS node to back up this database.
- Site Replication Services database. Select the SRS node to back up this database.



5. On the **Actions** menu, click **Start Backup of Marked Files**.

   The Specify Backup Options dialog box is displayed.

6. Click **Start Backup**.

   A dialog box is displayed informing you that the backup was successfully initiated.

7. If you want to view the progress of the backup, click **Yes**. If you do not want to view the progress of the backup, click **No**.

Restoring Exchange Server

This section describes how to restore Exchange Server objects.

Before Performing Restores

- When restoring individual databases or transaction logs, the administrator should have a thorough working knowledge of Microsoft Exchange Server databases, transaction logs, and utilities. If the correct files have not been restored, the Microsoft Exchange Server will fail to start.
- Do not restore both Microsoft Exchange Mailbox and Microsoft Exchange Server objects at the same time. Either the restore of the mailbox objects will fail because the Exchange services are down to perform a restore of Exchange server databases or, if the restore of the Exchange mailbox items finish before the restore of the Exchange databases starts, the mailbox objects restored will be overwritten by the restore of the Exchange databases.

Restoring Exchange 5.x Server Objects

This section contains instructions for restoring Exchange 5.x Server objects.

Notes on Restoring Exchange 5.x Objects Backed Up With Backup Exec

- "Copy" backups in Backup Exec appear as "Full" backups in NetBackup. "Incremental" backups appear as "Differential" backups. "Differential" backups appear as "Cumulative Incremental" backups.

▼ To restore Exchange 5.x Server objects

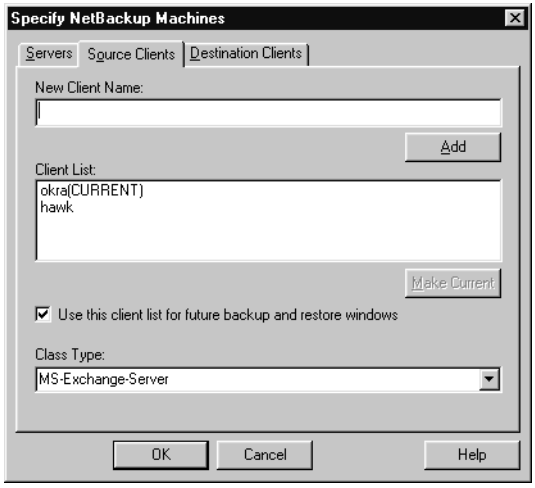
1. Log on as Administrator.
2. Open the Backup, Archive, and Restore interface.
3. Select the type of restore to perform.
   - To restore from NetBackup backup images, choose **File** > **Select Files and Folders to Restore** > **from Normal Backup**.
   - To restore from Backup Exec backup images, choose **File** > **Select Files and Folders to Restore** > **from Backup Exec Backup**.

Note Do not choose the Restore type **from Normal and Backup Exec backups**. This may leave the database in an inconsistent state and may lead to loss of data.

The Restore window is displayed.

4. Choose **File** > **Specify NetBackup Machines**.

   The Specify NetBackup Machines dialog box is displayed.



5. Click the **Source Clients** tab.

6. From the **Policy Type** list, select **MS-Exchange-Server**.

7. Click **OK**.

   NetBackup browses for Microsoft Exchange Server backup images.

   The NetBackup History pane displays Microsoft Exchange Server backup information. The top split windows show individual image information and the bottom split gives file and folder information and also allows the user to select what files are to be restored.

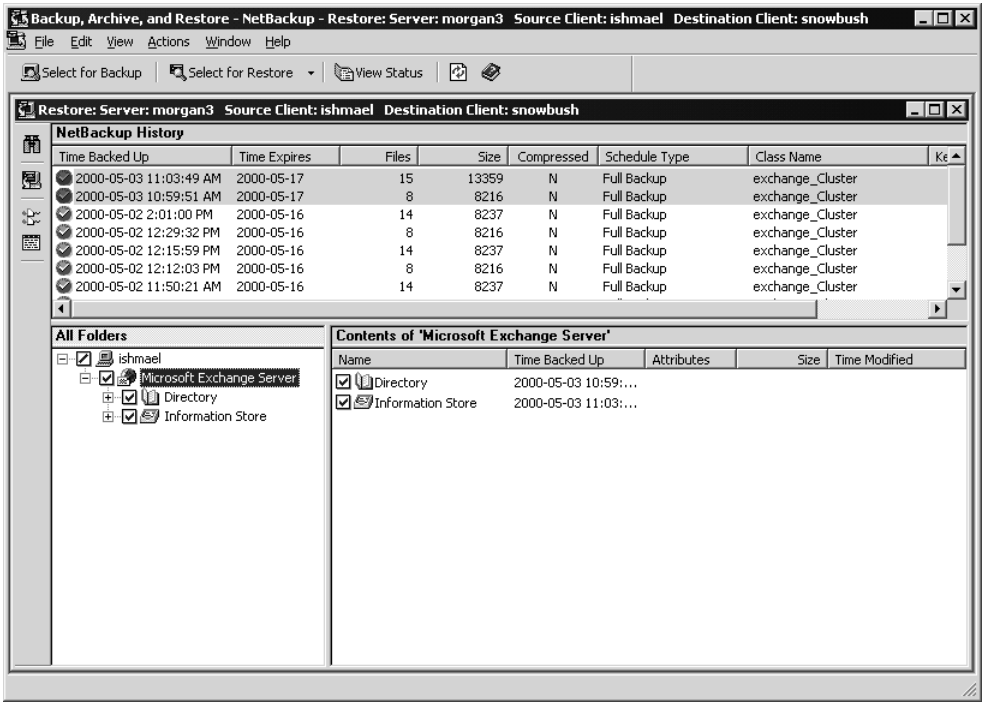
8. From the NetBackup History pane, select the image containing the objects you wish to restore.

9. In the All Folders pane, select the checkbox next to the machine name or Microsoft Information Store. This will restore the entire content of the selected backup image. You can also select individual databases that needs to be restored.

Note If you wish to restore the public or private databases from a Backup Exec backup image, see “Restoring the Public and Private Databases Backed Up by Backup Exec” on page 76.

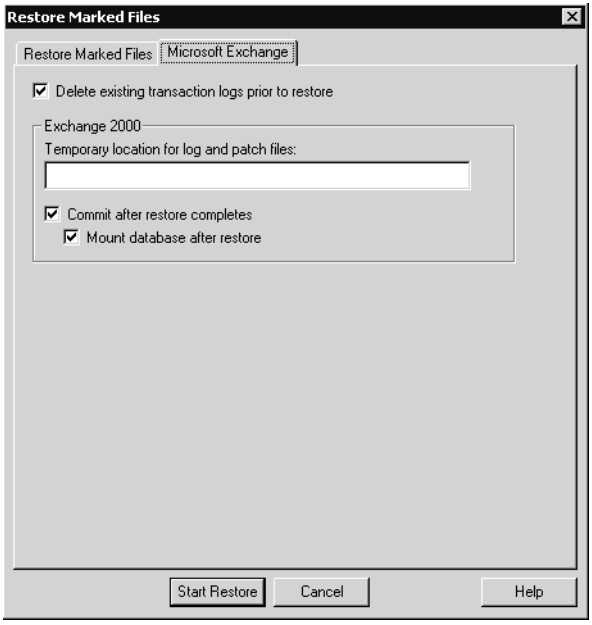
Note A full backup of an Exchange database includes the database patch file and the database transaction log files. When restoring a database, you must, *at a minimum*, also restore the database patch file and the transaction log files.

Selecting Exchange 5.x objects to restore



10. On the **Actions** menu, click **Start Restore of Marked Files**.

The Restore Marked Files dialog box is displayed.



The **Delete existing transaction logs prior to restore** option allows the user to retain or delete existing transaction logs. See “Existing Transaction Logs” on page 14 for further information. Transaction logs will be deleted only for the Exchange database being restored. If the user was only restoring the Information Store, the transaction logs for the Information Store would be deleted and the Directory transaction logs would remain intact.

Note A restore of Microsoft Exchange Server files will always overwrite existing files (if `pub.edb` already exists on the target machine, it will be replaced with the copy from the backup).

11. Click **Start Restore**.

12. After a successful restore, restart the Exchange 5.x services.

If not in an Exchange cluster, you can restart the services by rebooting the system or manually restarting the services through the Control Panel or a batch file.

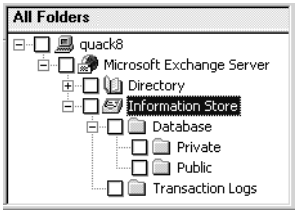
In an Exchange cluster, use the Control Panel to start the services from the node owning the Exchange resources. Then, from the Cluster Administrator, bring the Exchange resources online.

Restoring the Public and Private Databases Backed Up by Backup Exec

With Backup Exec, you can choose to “Restore the public folder” (restore the public database) or “Restore private mailboxes” (restore the private database). These databases can also be restored separately when using NetBackup.

The databases appear as folders within the `Microsoft Exchange Server\Information Store\Database` folder as shown in the figure below.

Backup Exec public and private mailboxes (or databases) as displayed in NetBackup



The following table specifes what you should select in order to restore the public database, private database, or both:

Restoring public and private databases

To restore	Select the following in the All Folders pane
Both the public and private database	Information Store or Public
Public database	Public
Private database	Private

Restoring Exchange 2000 Server Objects

Notes on Restoring Exchange 2000 Objects Backed Up With Backup Exec

- When restoring Backup Exec Exchange 2000 images, more than one "Storage Group" should not be selected for restore in the same NetBackup restore job. If, for example, you wish to restore "Storage Group 1" and "Storage Group 2," launch two separate NetBackup restore jobs, one corresponding to "Storage Group 1" and the other corresponding to "Storage Group 2."
- The following Exchange 2000 objects, when backed up by Backup Exec, cannot be restored using NetBackup:
  - KMS database
  - SRS database
- "Copy" backups in Backup Exec appear as "Full" backups in NetBackup. "Incremental" backups appear as "Differential" backups. "Differential" backups appear as "Cumulative Incremental" backups.
- Make sure the temporary location for log and patch files is empty before you start a restore job. If a restore job fails, check the temporary location (including subdirectories) to make sure any previous log and patch files from a previous restore job were deleted.

▼ To restore the Information Store, Storage Groups, or Storage Group databases

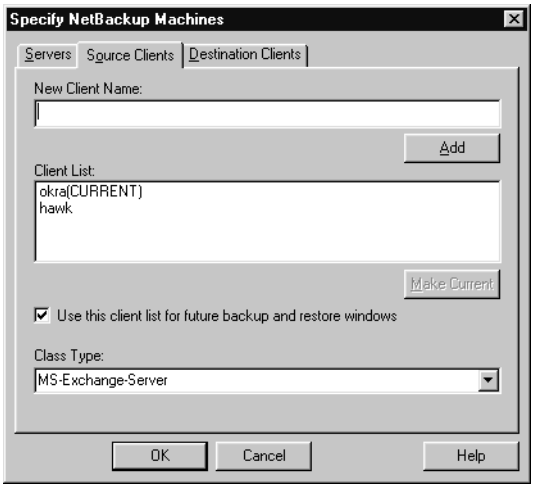
1. Log on as Administrator.
2. Dismount all Exchange 2000 databases that need to be restored.
3. Open the Backup, Archive, and Restore interface.
4. Select the type of restore to perform.
   - To restore from NetBackup backup images, choose **File** > **Select Files and Folders to Restore** > **from Normal Backup**.
   - To restore from Backup Exec backup images, choose **File** > **Select Files and Folders to Restore** > **from Backup Exec Backup**.

Note Do not choose the Restore type **from Normal and Backup Exec backups**. This may leave the database in an inconsistent state and may lead to loss of data.

The Restore window is displayed.

5. From the **File** menu, select **Specify NetBackup Machines**.

The Specify NetBackup Machines dialog box is displayed.



6. Click the **Source Clients** tab.

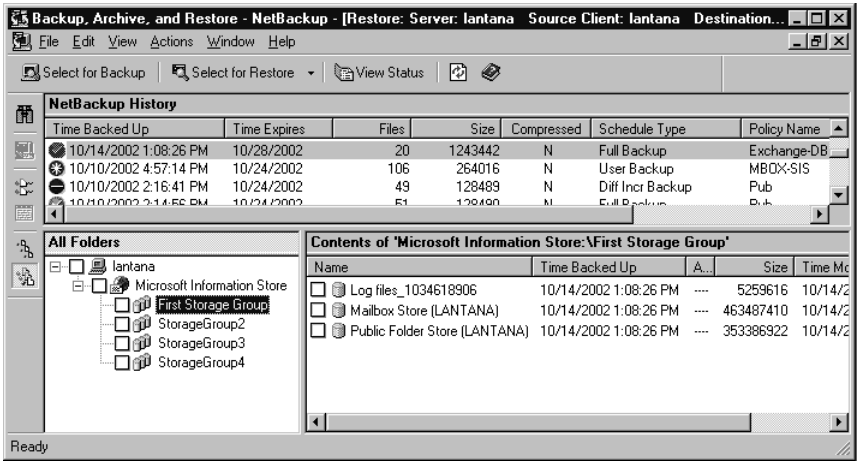
7. From the **Policy Type** list, select **MS-Exchange-Server**.

8. Click **OK**.

   NetBackup browses for Microsoft Exchange Server backup images.

   The NetBackup History pane displays Microsoft Exchange Server backup information. The top split window shows individual image information and the bottom split gives file and folder information and also allows the user to select what files are to be restored.

Browsing an Exchange 2000 backup image



9. From the NetBackup History pane, select the image containing the objects you wish to restore.

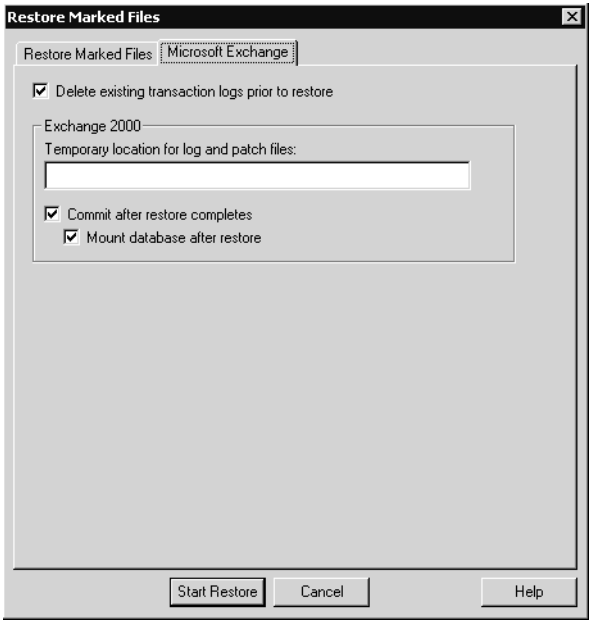
10. In the All Folders pane, select the objects you wish to restore.

- The Microsoft Information Store. To restore the entire content of the selected backup image, select the checkbox next to the machine name or Microsoft Information Store.
- Storage groups. Expand the Microsoft Information Store node and select the storage group to restore.
- Individual databases. To restore an individual database within a specific storage group, expand the Microsoft Information Store, then the storage group, and select the database.

Note A full backup of an Exchange database includes the database patch file and the database transaction log files. When restoring a database, you must, *at a minimum*, also restore the database patch file and the transaction log files.

11. On the **Actions** menu, click **Start Restore of Marked Files**.

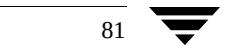
The Restore Marked Files dialog box is displayed.



12. Refer to the following table for information on the restore options available.

Microsoft Exchange tab options

Option	Description
The **Delete Existing Transaction Logs Prior To Restore**	Allows the user to retain or delete existing transaction logs. See "Existing Transaction Logs" on page 14 for further information. Transaction logs will be deleted only for the Exchange database being restored. If the user was only restoring the Information Store, the transaction logs for the Information Store would be deleted and the Directory transaction logs would remain intact.
Exchange 2000, KMS, and SRS **Note** The following do not apply when restoring Exchange 5.x objects, mailboxes, or public folders.	
Temporary location for log and patch files	Enter a location where the associated log and patch files are to be kept until the database is restored. The default location is `c:\temp`. If storage groups are being restored, a subdirectory in `c:\temp` is created for each storage group. The log and patch files for each storage group are kept in the corresponding subdirectory. If **Commit after restore completes** is selected during restore, the log and patch files in the temporary location are applied to the database, and then the current log files are applied. After the restore is complete, the log and patch files are automatically deleted from the temporary location (including any subdirectories). **Note** Make sure the temporary location for log and patch files is empty before you start a restore job. If a restore job fails, check the temporary location (including subdirectories) to make sure any previous log and patch files from a previous restore job were deleted.
Commit after restore completes	Use this option if your selection contains the last backup set to be restored. This enables the restore operation to play through log files and roll back any uncompleted transactions. If this option is not selected, the database is left in an intermediate state and is not yet usable. If **Commit after restore completes** is selected when an intermediate backup is being applied, you cannot restore further backups. You will need to restart the restore operation from the beginning.
Mount database after restore	Mounts the database so that it is available to users. This option is only available if **Commit after restore completes** is selected.



Note A restore of Microsoft Exchange Server files will always overwrite existing files (if `pub.edb` already exists on the target machine, it will be replaced with the copy from the backup).

13. Click **Start Restore**.

14. If you chose to restore storage groups and you did not select **Mount database after restore** (after the restore), be sure to mount the storage group databases that were restored.

▼ To restore the Key Management Service or Site Replication Service

1. Log on as Administrator.

2. Stop the KMS or SRS service.

   The KMS service can be stopped using Exchange System Manager; see "Stopping and Starting KMS" on page 84 for more information. The SRS service can be stopped using the Services applet in the Control Panel.

Note Before stopping the KMS service, be sure that you have the KMS service password.

3. Delete content of the `kmsdata` or `srsdata` directory, located under the default Exchange Server installation path.

4. Start the KMS or SRS service.

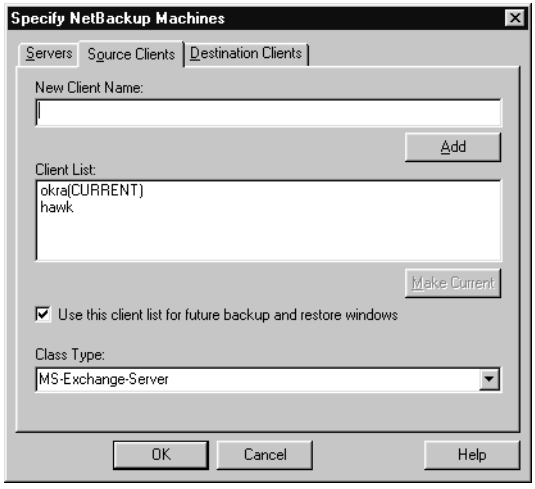
5. Open the Backup, Archive, and Restore interface.

6. Choose **File** > **Select Files and Folders to Restore** > **from Normal Backup**.

   The Restore window is displayed.

7. Choose **File** > **Specify NetBackup Machines**.

The Specify NetBackup Machines dialog box is displayed.



8. Click the **Source Clients** tab.

9. From the **Policy Type** list, select **MS-Exchange-Server**.

10. Click **OK**.

    NetBackup browses for Microsoft Exchange Server backup images.

    The NetBackup History pane displays Microsoft Exchange Server backup information. The top split window shows individual image information and the bottom split gives file and folder information and also allows the user to select what files are to be restored.

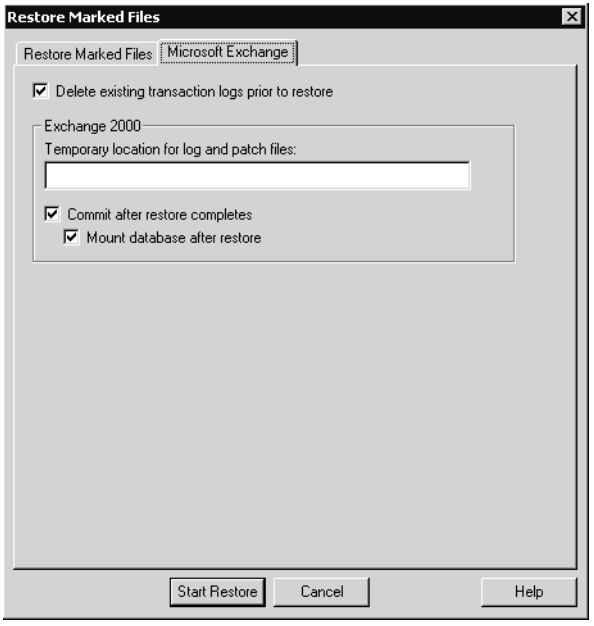
11. From the NetBackup History pane, select the image containing the objects you wish to restore.

12. In the All Folders pane, select the objects you wish to restore.

    - To restore the Key Management Services database, select the KMS node.
    - To restore the Site Replication Services database, select the SRS node.

13. On the **Actions** menu, click **Start Restore of Marked Files**.

The Restore Marked Files dialog box is displayed.



Refer to the Table “Microsoft Exchange tab options” on page 81 for information on the restore options available.

14. Click **Start Restore**.

15. If restoring the KMS, stop and start this service.

Stopping and Starting KMS

The following section describes how to stop and start the KMS using the Exchange System Manager.

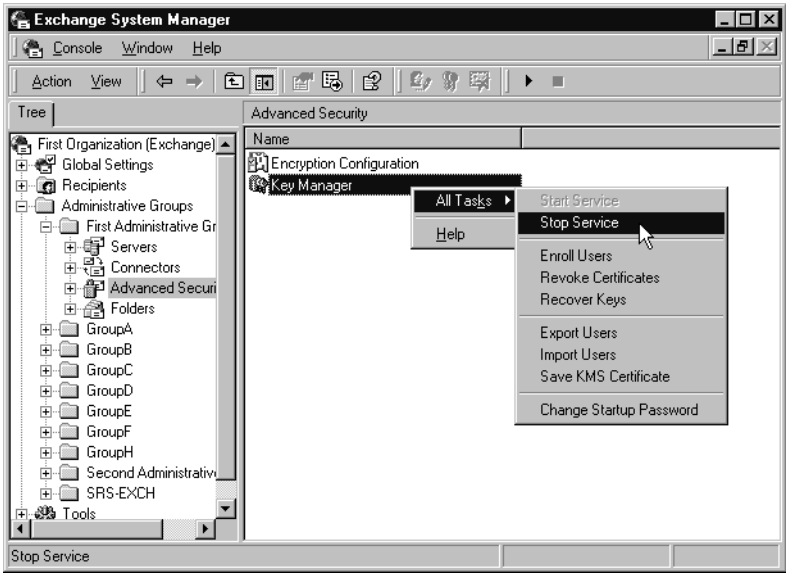
Note Before stopping or starting the KMS, be sure that you have the KMS password.

▼ To stop or start the KMS

1. Choose **Start** > **Programs** > **Microsoft Exchange** > **System Manager**.

2. In the left pane, open the appropriate Administrator Group and click on **Advanced Security**.

3. In the right pane, right-click on **Key Manager** and choose **All Tasks**, then **Stop Service** or **Start Service**.



Individual Mailbox Operations

This section describes how to perform individual mailbox backup and restore operations.

Notes

- The root path of an Exchange Mailbox object ("Microsoft Exchange Mailboxes:") is case-sensitive.
- Mailbox folders or message subjects containing the characters "~", "\", or "/" are translated as follows:

Character	Translation
~	~0
/	~1
\	~2

Performing a User-Directed Mailbox Backup

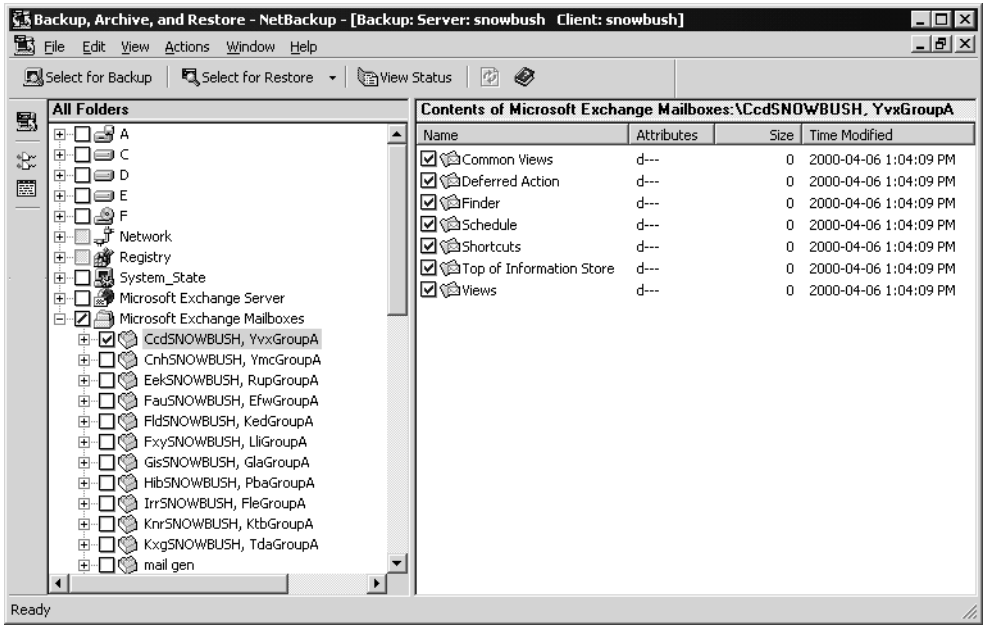
▼ **To perform a user-directed mailbox backup**

1. Log onto the server as Administrator.

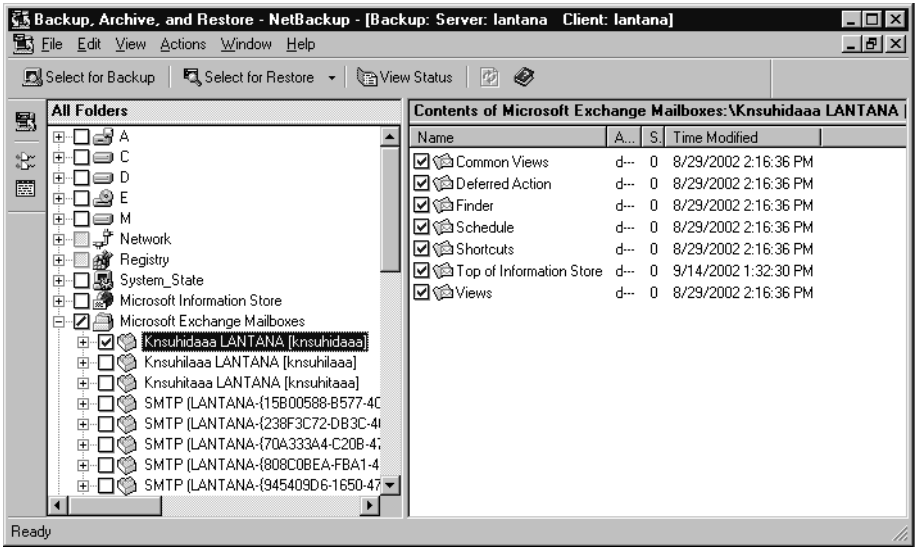
Note The administrator *must* have the same Exchange privileges as the NetBackup Client Service Account. For Exchange 2000, the NetBackup Client Service Account must also have the advanced privileges "Send As" and "Receive As." Refer to "NetBackup Client Service Account" on page 18 for more information about assigning privileges.

2. Open the Backup, Archive, and Restore interface on the Exchange Server.
3. On the **File** menu, click **Select Files and Folders to Backup**.
4. If you are in a cluster environment, specify the name of the Virtual Exchange Server as described in "Specifying the Virtual Exchange Server" on page 103.
5. In the All Folders pane, expand the Microsoft Exchange Mailboxes node.

Browsing Exchange 5.x mailbox objects



Browsing Exchange 2000 mailbox objects



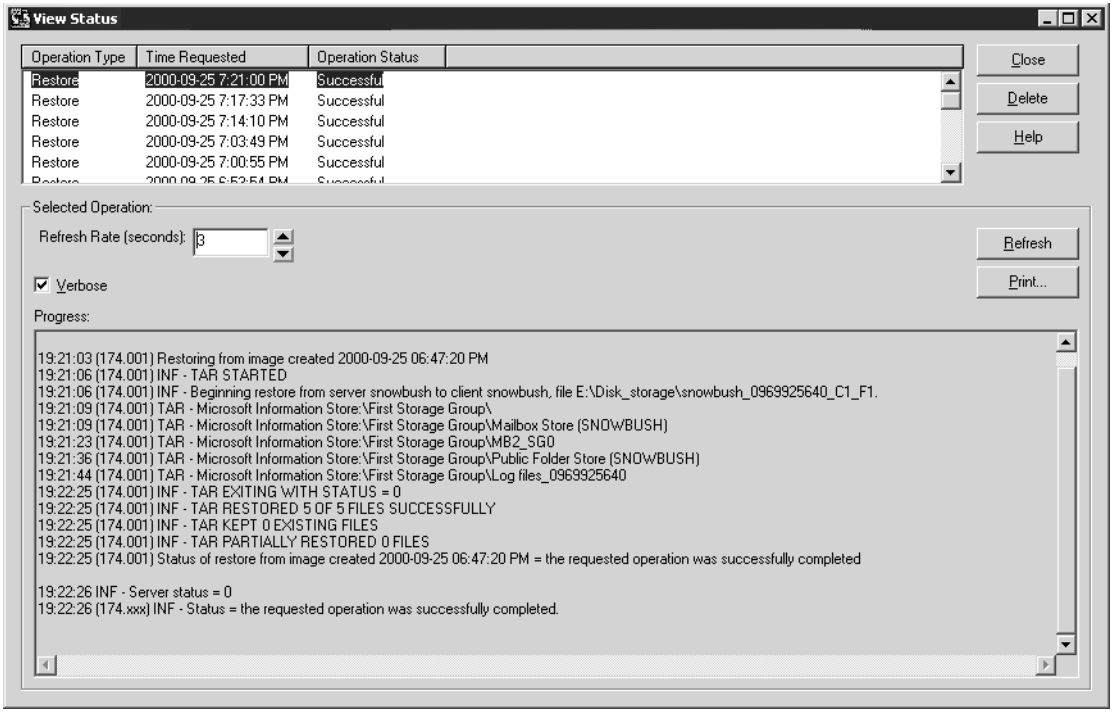
6. Select the mailbox you wish to back up.

To back up a folder of a specific mailbox, expand the appropriate mailbox and select the the folder that needs to be backed up.

7. Click **Start Backup**.

   A NetBackup message will indicate that the restore was successfully started. Click **Yes** if you wish to open the View Status dialog box and view the progress report of the NetBackup operation.

   The following is an example of a status report for an Exchange 2000 client.



Restoring Individual Mailboxes, Folders, or Messages

NetBackup can restore individual mailboxes, mailbox folders, or mailbox messages. NetBackup can also restore mailboxes backed up by Backup Exec.

Notes

- When messages in folders are restored to a location where a message with the same name already exists, the restored message does not replace the existing message, but is added to the destination folder. Therefore, duplicate messages may exist in the destination folder.

  For example, if the Inbox folder contained two messages, “Subject A” and “Subject B”, and the backup image for the Inbox contained the same two messages, after the restore of backup is completed, the Inbox folder would contain four messages, two for “Subject A” and two for “Subject B”.

- The destination mailbox must exist to successfully restore a mailbox.
- When a mailbox is restored, all folders and messages contained in the mailbox are restored. You can choose to restore specific folders or messages or both from the mailbox backup image.
- When a folder is restored, all subfolders and messages contained in the folder are restored. You can also choose to restore specific subfolders or messages or both from the folder backup image.

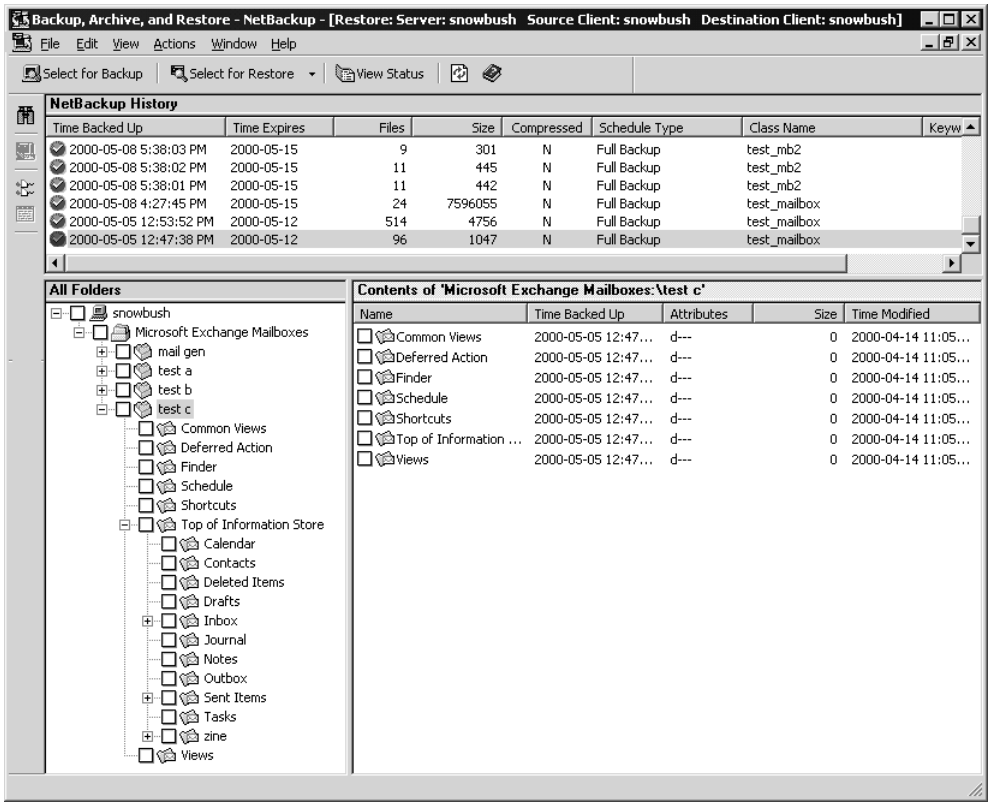
▼ To restore a mailbox, folder or message

1. Log on as Administrator.
2. Open the Backup, Archive, and Restore interface.
3. Select the type of restore to perform.
   - To restore from NetBackup backup images, choose **File** > **Select Files and Folders to Restore** > **from Normal Backup**.
   - To restore from Backup Exec backup images, choose **File** > **Select Files and Folders to Restore** > **from Backup Exec Backup**.

Note Do not choose the Restore type **from Normal and Backup Exec backups**. This may leave the database in an inconsistent state and may lead to loss of data.

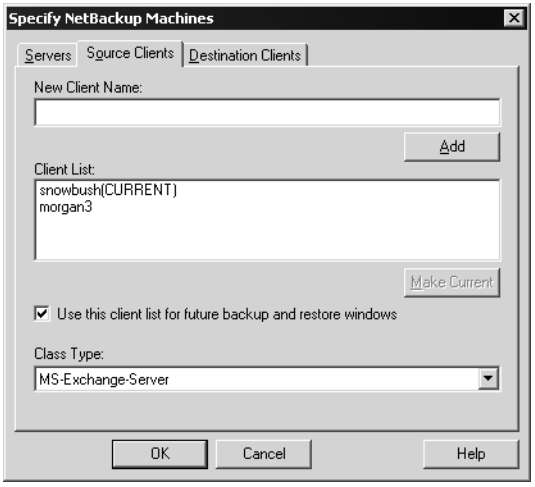
The Restore window is displayed.

The top pane of the NetBackup Restore window shows individual backup image information. The bottom pane shows file and folder information for the select image from the top pane and allows for selection of Exchange objects to be restored.



4. Choose **File** > **Specify NetBackup Machines**.

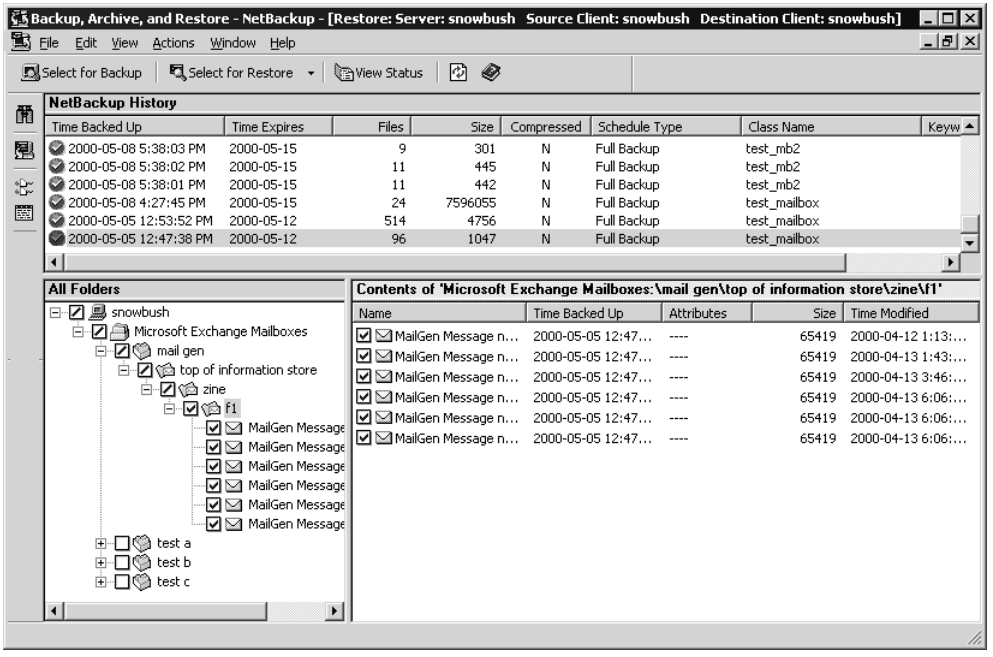
The Specify NetBackup Machines dialog box is displayed.



5. Click the **Source Clients** tab.
6. From the **Policy Type** list, select **MS-Exchange-Server**.
7. Click **OK**.

   NetBackup browses for Microsoft Exchange Server backup images.
8. Select an image from the NetBackup History pane.

9. In the All Folders pane, select the mailbox, folder, or message to restore.



When selecting objects from the Microsoft Exchange Mailbox tree, all objects are displayed as folders and messages. Some non-message objects can be identified by the subject line. For example, if you create a Calendar event named Appointment1, that name is displayed in the subject line for that object.

However, some objects such as Forms and Views do not have a subject line (even though they can be named) and may not be easily identified.

Note Do not restore Microsoft Exchange Mailbox and Microsoft Exchange Server objects at the same time. Either the restore of the mailbox objects will fail because the Exchange services are down to perform a restore of Exchange server databases or, if the restore of the Exchange mailbox items finish before the restore of the Exchange databases starts, the mailbox objects restored will be wiped out by the restore of the Exchange databases.

10. On the **Actions** menu, click **Start Restore of Marked Files**.

Note The options on the Exchange tab do not apply to restores of individual mailboxes, folders or messages or to restores of Public Folders.

11. Click **Start Restore**.

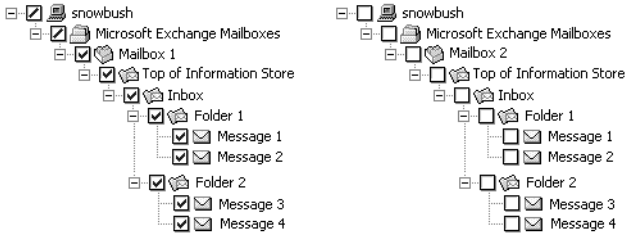
For information on restoring to different locations, see “Redirecting Mailbox Objects to a Different Path.”

Redirecting Mailbox Objects to a Different Path

NetBackup can restore Exchange mailbox objects from NetBackup and Backup Exec images to different locations. Following are examples of how mailbox objects are redirected.

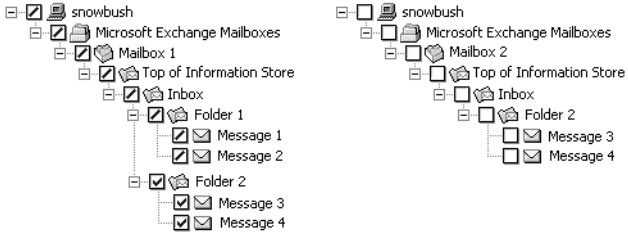
For example, if you back up Mailbox 1, which consists of Top of Information Store, Inbox, and Folders 1 and 2, each containing some mail messages, and then you restore Mailbox 1 to the existing Mailbox 2, then all of Mailbox 1, including the Top of Information Store, Inbox, Folders 1 and 2, and messages, are restored to Mailbox 2. Note that Mailbox 1 itself is not created under Mailbox 2.

Redirecting the restore of Mailbox 1 to Mailbox 2



If you redirect the restore of Mailbox 1\Top of Information Store\Folder 2 to Mailbox 2, the contents of Mailbox 1\Top of Information Store\Folder 2, Message 5 and Message 6, are placed in Mailbox 2 in the same folder as they were in Mailbox 1.

Redirecting the restore of Folder 2 to Mailbox 2



Requirements

- The NetBackup Directive (Microsoft Exchange Mailboxes:\) of the destination path cannot be changed. NetBackup will not recognize that this is an Exchange mailbox restore and will attempt to restore the objects as normal files.
- If the destination path's mailbox name is changed from the original, the destination mailbox must already exist and must have an associated user account.
- If the third segment of the destination path is modified (the Exchange folders "Top of Information Store," "Views," "Finder"), the selected object will be restored to that specified folder name. The new folder can be seen when browsing for backups and will be backed up on subsequent backups of that mailbox. However, the folder and any subfolders and messages in that folder cannot be viewed using Outlook.

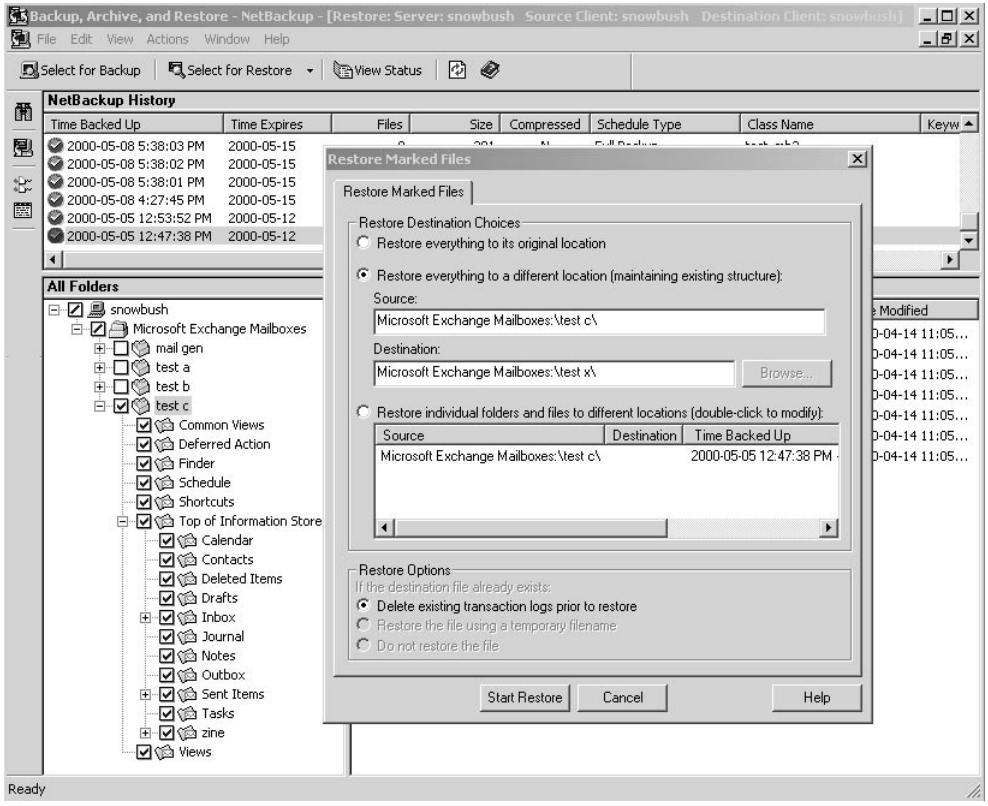
▼ To restore a mailbox to a different mailbox

1. Open a Restore window.
2. Select a mailbox to restore.
3. Choose **Actions** > **Start Restore of Marked Files**.
4. In the Restore Marked Files dialog, select **Restore everything to a different location**.

Note The **Browse** button does not browse Exchange mailboxes or folders and should not be used. It is only useful for browsing file systems.

5. In the **Destination** box, change the destination to restore to.
   - When restoring from NetBackup images, change the mailbox portion of the **Destination** field to another existing mailbox to restore to. For example, if you wish to restore the contents of Mailbox 1 to Mailbox 2, specify **`Microsoft Exchange Mailboxes:\Mailbox 2\`** in the **Destination** box.
   - When restoring from Backup Exec images, specify another existing mailbox you wish to restore to. For example, if you wish to restore the contents of Mailbox 1 to Mailbox 2, specify **`Mailbox 2`** in the **Destination** box.

Note When restoring from NetBackup images, you must indicate an explicit path (or full path) in the **Restore everything to a different location** box for this option to be successful.



6. Click **Start Restore**.

▼ To restore a mailbox folder to a different location

Note Individual mailbox items cannot be restored to different locations when restoring from Backup Exec images.

1. Open a Restore window.
2. Select a folder to restore.
3. Choose **Actions** > **Start Restore of Marked Files**.

4. In the Restore Marked Files dialog, select the **Restore individual folders and files to different locations** option.

   Each row under **Restore individual folders and files to different locations** is associated with a selected folder to restore.

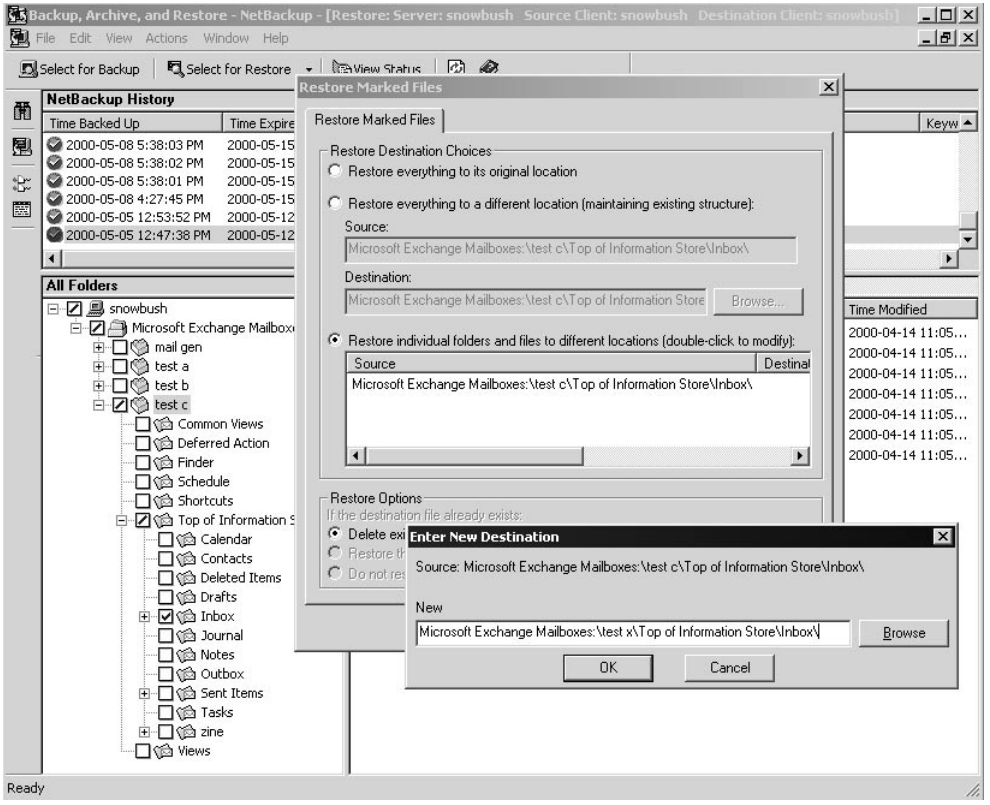
5. Double-click on a row to modify the folder destination.

   The Enter New Destination dialog is displayed.

6. In the **New** box, change the destination to restore to.

   The destination can be any valid existing Exchange folder path.

Note The **Browse** button cannot be used to browse for Exchange mailboxes or folders. It is only useful for file system backups.



7. Click **OK**.

8. Click **Start Restore**.

▼ To restore a mailbox message to a different location

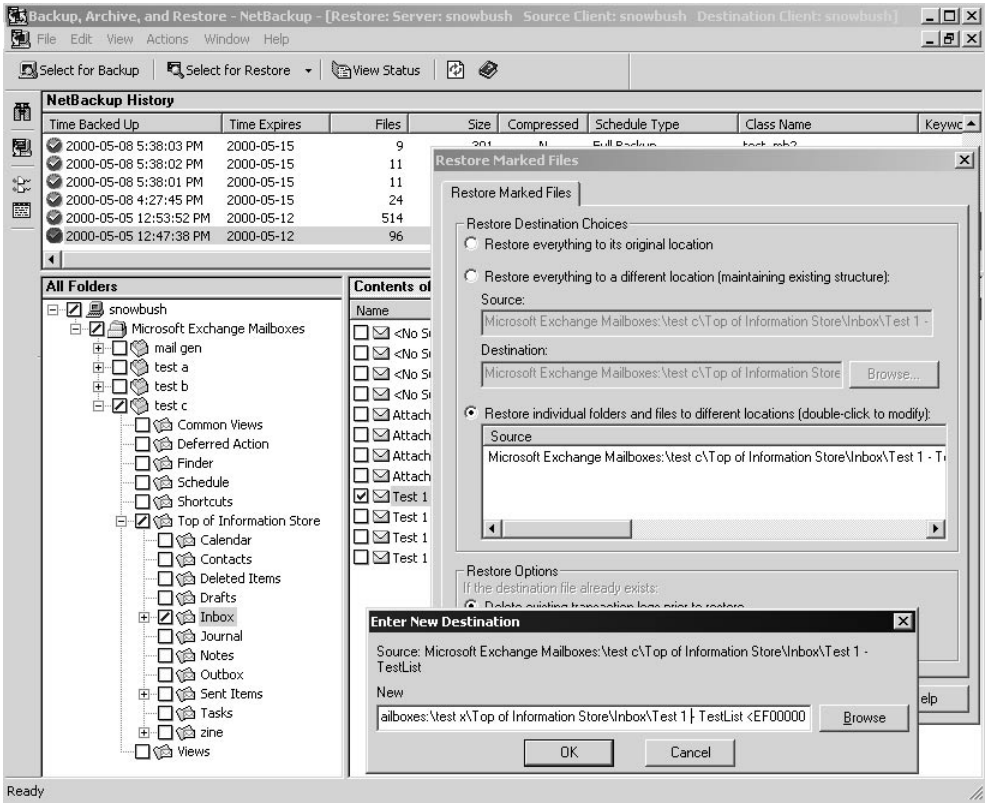
Note Individual mailbox items cannot be restored to different locations when restoring from Backup Exec images.

1. Open a Restore window.
2. Select a message to restore.
3. Choose **Actions** > **Start Restore of Marked Files**.
4. In the Restore Marked Files dialog window, select the **Restore individual folders and files to different locations**.

   Each row under **Restore individual folders and files to different locations** is associated with a selected message to restore.
5. Double-click on a row to modify the message destination.

   The Enter New Destination dialog box is displayed.
6. In the **New** box, change the destination to restore to.

The destination can be any valid existing Exchange folder path.



7. Click **OK**.

8. Click **Start Restore**.

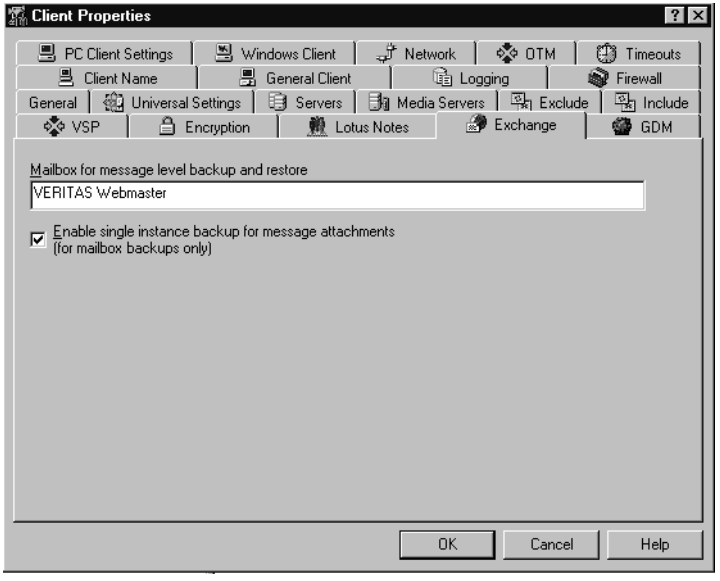
Performing Single Instance Store Backups

Microsoft Exchange Server uses single-instance storage (SIS) to store mail messages. This capability in Exchange Server allows the database to keep one copy of a message attachment sent to multiple users on the same server. To perform SIS backups, this feature must be enabled on the client where Exchange Server is installed.

Note Only attachments larger than 100K are backed up as SIS objects. Attachments smaller than 100K are backed up with each individual message.

▼ To enable SIS backups

1. Open the NetBackup Adminstration Console or the Remote Administration Console.
2. In the left pane, expand **Host Properties**.
3. Click **Clients**.
4. In the right pane, right-click on the client you wish to configure and choose **Properties**.
5. Click on the **Exchange** tab.



6. Select **Enable single instance backup for message attachments**.

7. Click **OK**.

Backing Up and Restoring the Microsoft Exchange Public Folders

The Public Folders and individual folders within Public Folders can be backed up and restored like a mailbox. NetBackup needs to be configured for these types of operations before backups and restores of individual folders in the Public Folders can be performed. If NetBackup has already been configured for individual mailbox operations, no further configuration for Public Folders is necessary. If not, refer to “Configuring NetBackup for Individual Mailbox Operations” on page 18.

Notes

- When messages in folders are restored to a location where a message with the same name already exists, the restored message does not replace the existing message, but is added to the destination folder. Therefore, duplicate messages may exist in the destination folder.

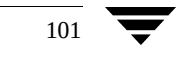
  For example, if the Inbox folder contained two messages, “Subject A” and “Subject B”, and the backup image for the Inbox contained the same two messages, after the restore of backup is completed, the Inbox folder would contain four messages, two for “Subject A” and two for “Subject B”.

- When a mailbox is restored, all folders and messages contained in the mailbox are restored. You can choose to restore specific folders or messages or both from the mailbox backup image.

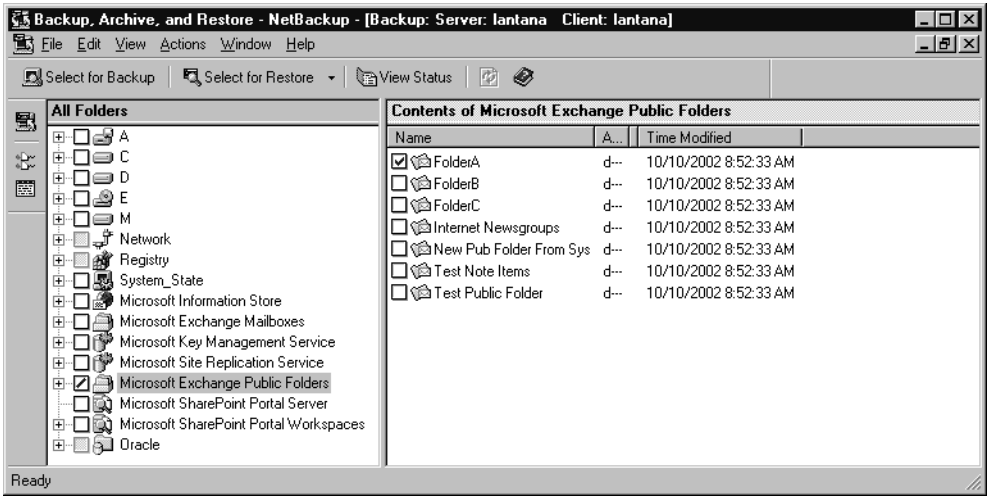
- When a folder is restored, all subfolders and messages contained in the folder are restored. You can also choose to restore specific subfolders or messages or both from the folder backup image.

Backups and Restores of Public Folders

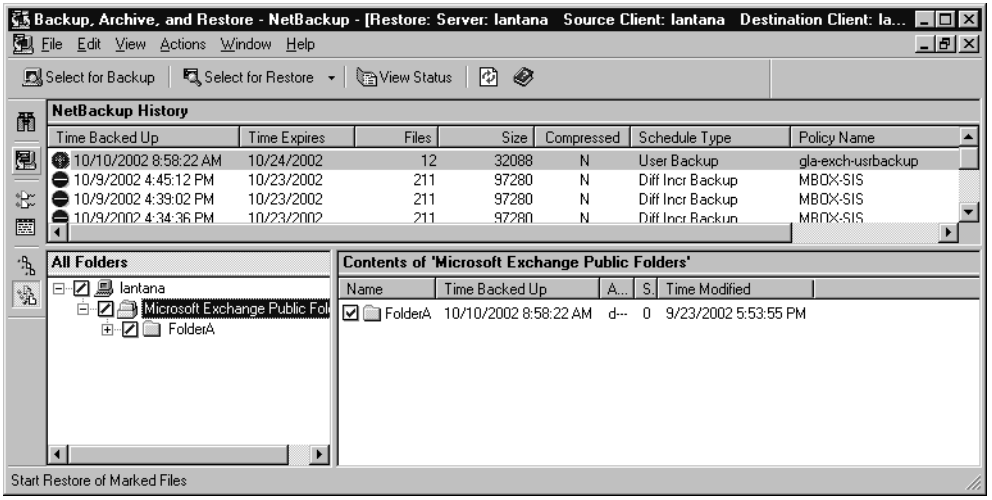
To perform backups and restores, follow the instructions in “Individual Mailbox Operations” on page 86, but when instructed to select the objects to backup or restore, select the `Microsoft Exchange Public Folders` node or the desired folders within that node.



Selecting items to backup in the Microsoft Exchange Public Folders node.



Selecting items to restore in the Microsoft Exchange Public Folders node.



Redirecting Restores of Public Folders

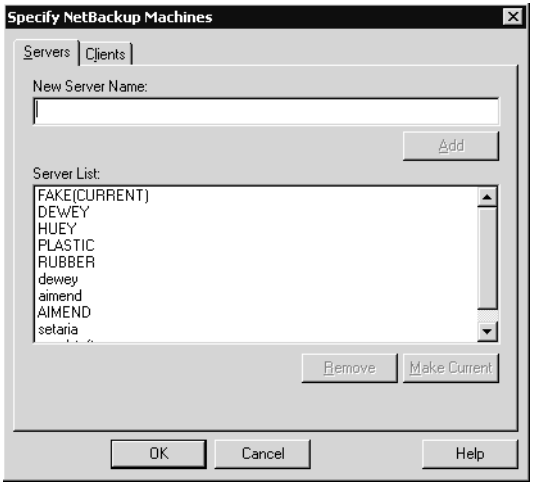
To perform backups and restores, follow the instructions in “Redirecting Mailbox Objects to a Different Path” on page 93, but when instructed to select the objects to restore, select the `Microsoft Exchange Public Folders` node or the desired folders within that node.

Note When redirecting a restore of a Public folder, the folder does not have to exist in the new path.

Specifying the Virtual Exchange Server

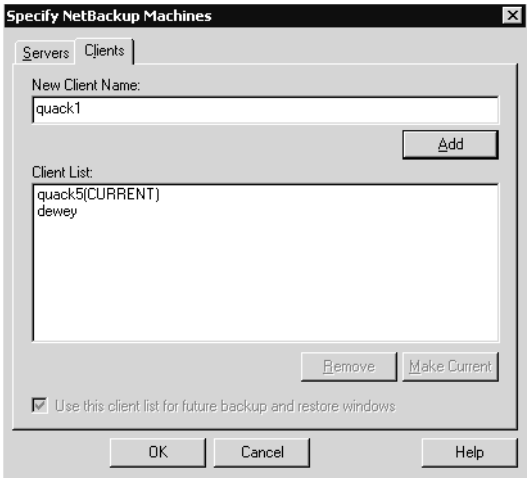
1. Choose **File** > **Specify NetBackup Machines**.

   The following dialog box is displayed.



2. Click on the **Clients** tab.

If the Virtual Exchange server name is displayed under Client List, continue with step 5.



3. Under **New Client Name**, type the name of the Virtual Exchange server.
4. Click **Add**.
5. Under **Client List**, select the Virtual Exchange server name and click **Make Current**.
6. Click **OK**.

Redirecting a Restore to a Different Client

This section describes how to redirect a restore to a different client. Most Exchange objects that have been backed up can be redirected to a different client.

Note Because the Microsoft Exchange Directory and SRS databases contain machine and security information, they can only be restored to the original computer or a clone of the original computer. The Microsoft Exchange Information Store databases may be restored to a different Microsoft Exchange Server.

Requirements for Exchange 2000

The following requirements must be met for Exchange 2000 before redirecting the restore of storage groups or individual databases.

- The storage groups and databases must exist on the target server.
- The storage groups and databases must have the same names as the original storage groups or databases.
- The target databases must be configured so that they can be overwritten. (Using the Exchange System Manager, right-click on the database you want to overwrite and choose **Properties**. On the Database tab, select **This database can be overwritten by a restore**.)
- The target server must have the same Organization and Administrative Group name as the source server.
- If redirecting the KMS or SRS, this service must be installed on the destination client.

A restore redirected to a different client is performed just like a regular restore, except that a different destination client, and, possibly, a different source client is selected. For complete information on performing restores, see the following topics:

For information on restoring...	See the following
Exchange 5.x Server Objects	“To restore Exchange 5.x Server objects” on page 72
the Information Store, Storage Groups, or Storage Group databases	“To restore the Information Store, Storage Groups, or Storage Group databases” on page 77
the KMS or SRS	“To restore a mailbox, folder or message” on page 89

For information on restoring...	See the following
a mailbox, folder, or message	"To restore a mailbox, folder or message" on page 89
a Public folder	"Backups and Restores of Public Folders" on page 101

▼ To select a different destination (and source) client

1. If a restore window is not already open, open a restore window.
2. Choose **File** > **Specify NetBackup Machines**.

   The Specify NetBackup Machines dialog box is displayed.
3. Click on the **Source Clients** tab.
   a. Enter the source client in the **Client List** box.

      The source client is the Exchange Server machine name whose backup images you would like to browse.

   b. From the **Policy Type** drop-down list, select **MS-Exchange-Server**.
4. Click on the **Destination Clients** tab.
   a. In the **Client List** box, enter the client to which to redirect the restore.
5. Click **OK**.

   NetBackup will browse NetBackup Catalog for Microsoft Exchange Server backup images.

Troubleshooting NetBackup 5

The NetBackup master server and client software offers a comprehensive set of debug logs for troubleshooting problems that may occur during NetBackup operations. Debug logs are covered in detail in the *NetBackup Troubleshooting Guide for Windows and UNIX*.

If you are experiencing problems backing up or restoring databases or transaction logs, and the cause of the problem cannot be determined from standard NetBackup progress reports, you may enable NetBackup debug logs to aid in determining the cause of the problem. Debug logging is enabled by creating certain folders under the NetBackup `Logs` folder.

The following topics cover troubleshooting of NetBackup:

- Backup Operation Debug Logging
- Restore Operation Debug Logging
- Changing the Debug Level
- Verifying Exchange Online Backups
- Viewing the Status of a NetBackup Operation
- Transaction Logs

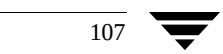
Backup Operation Debug Logging

To turn on debug logging for backup operations, create the following folder:

`install_path``\NetBackup\logs\bpbkar`

After creating this folder and performing a backup, debug logging information will be placed in the following file:

`install_path``\NetBackup\logs\bpbkar\mmddyy.log`



Restore Operation Debug Logging

To turn on debug logging for restore operations, create the following folder:

install_path\NetBackup\logs\tar

After creating this folder and performing a restore, debug logging information will be placed in the following file:

install_path\NetBackup\logs\tar\mmddyy.log

For details on the contents of these debug logs, refer to the *NetBackup Troubleshooting Guide for Windows and UNIX*. After the cause of the problem has been determined, debug logging can be disabled by removing the previously created debug logging folders.

Note When debug logging is enabled, the files can become large. The same files are used by normal file backups.

Changing the Debug Level

You can control the amount of information written to the debug log in the *install_path*\NetBackup\logs\bpbkar folder by changing the General debug level. The higher the value, the more information is logged. In everyday normal operations, the default value of 0 is sufficient. However, VERITAS technical support may ask you to set the value higher when a problem is being analyzed.

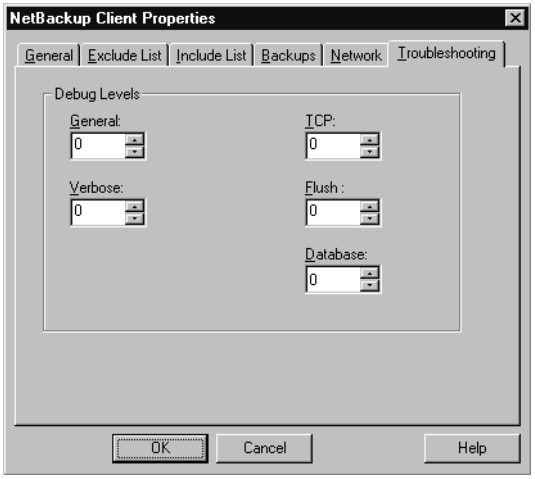
▼ To change the Debug Level

1. Choose **Start** > **Programs** > **VERITAS NetBackup** > **Backup, Archive, and Restore**.

   The Backup, Archive, and Restore - NetBackup window appears.

2. Choose **File** > **NetBackup Client Properties**.

3. Click the **Troubleshooting** tab.



By default, the settings are zero.

4. Set the **General** debug level.

5. Click **OK** to save your changes.

Verifying Exchange Online Backups

To verify that the Microsoft Exchange Server online backup contains a usable copy of the database, perform the following steps:

1. Perform an online backup.

2. Set up a test server and restore the backup.

3. Stop the Exchange services.

4. Perform an integrity check of the databases and verify that no errors are reported when you run the following commands:

   a. `Eseutil /g /ispriv`

   b. `Eseutil /g /ispub`

   c. `Eseutil /g /ds`

5. Restart the Exchange services.

If the services start at this point, the database is usable and contains no errors.

Viewing the Status of a NetBackup Operation

NetBackup provides many standard status reports to verify the completion of backup and restore operations. In addition, users and the administrator can set up additional reports if a site requires them.

Operational Reports

The administrator has access to operational progress reports through the NetBackup Administration Console. Reports may be generated for Status of Backups, Client Backups, Problems, All Log Entries, Media Lists, Media Contents, Images on Media, Media Logs, Media Summary, and Media Written. These reports may be generated for a specific time frame, client, or master server. Refer to *NetBackup System Administrator's Guide for UNIX* or *NetBackup System Administrator's Guide for Windows* for details.

Progress Reports

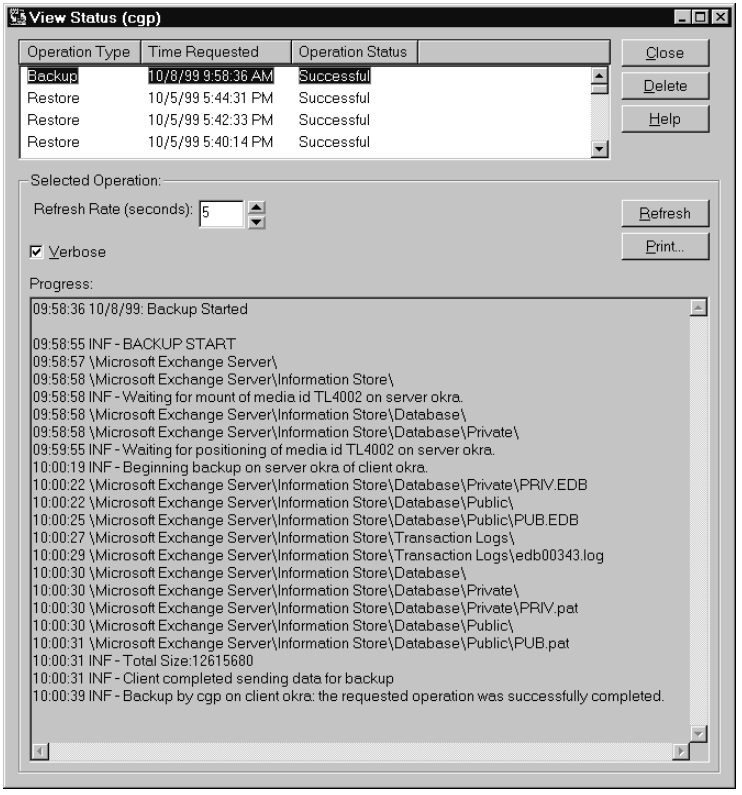
Progress reports on the client allow easy monitoring of user operations. When reports are created by the NetBackup client for each user-directed backup or restore operation, administrators can monitor these operations and detect any problems that may occur.

▼ **To view the status of an operation**

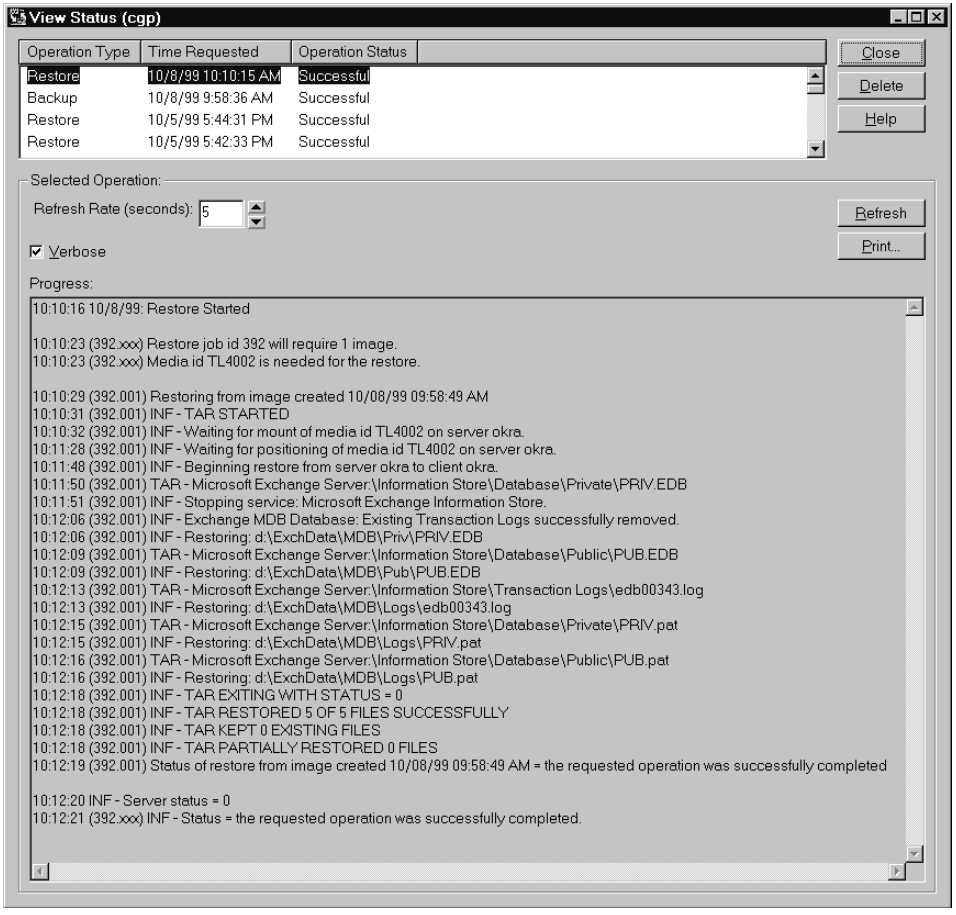
1. Choose **File** > **View Status**.
2. Click on the task for which you want to check the progress.
3. Click **Refresh**.

   The status of the operation is displayed in the lower pane.

Status of a backup operation



Status of restore operation



When `the requested operation was successfully completed` message appears, the NetBackup operation is finished. (See your *NetBackup User's Guide for Windows* for further information on the progress report and the meanings of the messages.)

Transaction Logs

Transaction logs are deleted by the Exchange server after a successful backup (for full and differential backup types). If there are any errors encountered by the Exchange server during the deletion process, the NetBackup for Exchange agent will log this information.

Since the actual backup was successful, NetBackup will exit with a status 0 (successful backup). Refer to the Microsoft Exchange Server documentation for information on any errors encountered with the transaction logs.

Troubleshooting the Exchange Server 6

This section describes the common, however infrequent, problems encountered with the daily operations and management of the Exchange Server. These problems range from accidental deletion and restoration of a mailbox to the full recovery of a failed server. The information contained here is complementary to the Exchange Disaster Recovery white papers, Parts I and II, and administration guides. The purpose of this chapter is to isolate and resolve server related problems as soon as they are detected.

VERITAS NetBackup with its Exchange Extensions will be the backup application for all of the Exchange servers. It is an enterprise solution for and will use the StorageTek 9710 DLT tape silo for storage. Backups and restores will be managed centrally from a UNIX host. Tape management will be handled directly by the Backup Systems Group.

Preparation Before a Disaster

Perform the following in preparation for a possible disaster:

Note Any procedure illustrated here should be followed with the assistance of PSS.

Create a Disaster Recovery Kit

Build a kit that includes items such as:

- Operating configuration sheet
- Hard drive partition configuration sheet
- RAID configuration, hardware configuration sheet
- Windows NT server configuration
- DELL configuration disks
- Microsoft Exchange configuration sheet (including all connector configurations and location of log files, working directory check point files and database files)
- Windows NT emergency repair diskette
- Microsoft Exchange Performance Optimizer settings sheet

The goal is to minimize the time to recovery. See “Sample Server Configuration Worksheets” on page 221 for sample configuration sheets.

Perform Tape Backups

- Standardize on tape formats. Ensure tapes used to back up all servers are the same format and are interchangeable.
- Online full backups of the Directory and Information Stores performed daily.
- Verify backups by reviewing backup logs and event viewer, noting any error messages. These backup logs will be sent to the BackOffice team on a daily basis by the Backup Systems Group for review.
- Perform periodic file-based backups to capture all configuration information just as a precautionary measure. This requires services to be shut down.
- Ensure tapes are readily available on site or can be retrieved from off-site locations very quickly.

Create Transaction Logs

Perform the following before creating Transaction Logs:

Physical Drive Configuration

Transaction logs must be written to a separate mirrored physical FAT-formatted drive. This separate physical drive is not part of a logical drive on a RAID5 array.

Note For performance and redundancy, it is critical that this design be adhered to.

Disable Circular Logging

While Circular Logging can help conserve disk space, the drawbacks are (1) Incremental and Differential Backups are disabled and (2) transaction log history is cyclical and cannot be played back. Implementing a full online daily backup strategy, transaction log files will be purged on a regular basis thus freeing up disk space.

Ensure Quick Access to Software and Hardware

Check or implement the following to ensure quick access to software and hardware:

Software and Utilities

Ensure that all software is readily accessible. This includes the system software, service packs and hot fixes such as the Windows NT operating system, Microsoft Exchange, and VERITAS NetBackup with Exchange Extensions. All software will be stored on the D: drive (Exch Bin Partition).

Utilities such as ESEUTIL and ISINTEG are found in the `\winnt\system32` and `\exchsrv\bin` directory, respectively. See “ESEUTIL and ISINTEG Line Switches” on page 149 for detailed command switches.

Build a Spare Server

A spare server can be used for either a single mailbox restore server or a full server recovery. Dedicate a Windows NT Server-based machine with twice the disk capacity of the largest store, to restore the entire private Information Store database.

Configure the server hardware as closely as possible to the production server configurations, both hardware and software: array controller, RAID5 array (make sure the transaction log drive is a separate mirrored physical spindle), NIC, etc.

Install Windows NT 4.0 with the same service packs and hot fixes as the production servers and make it a member server or a backup domain controller. One advantage of making it a backup domain controller is that you can start up the services without being on the production network. It will use the SEGEXCHANGE SAM to authenticate the EXSERVICE account. This will not be the case if you use a service account that is not the EXSERVICE. There is no need to use EXSERVICE if you are just performing a single mailbox restore. In this case, the intent is just to get access to the Information stores.

Since this server can be used in two roles, the server name is irrelevant as long as it does not duplicate an existing name. Have it join the SEGEXCHANGE domain and then configure the server software.

Install the Microsoft Exchange Server software and when prompted to **Join an Existing Site** or **Create a new Site**, ensure that you choose the option to **Create a New Site** and name it. (Installing Exchange in this way will allow you to perform a faster single mailbox restore, since it requires the Exchange server to have a different machine name which this server will have. Otherwise, it could not join the domain.)

Run the Performance Optimizer and move the Exchange files to the appropriate drives and directories. After Exchange completes its installation, install any Exchange 5.5 service packs or hot-fixes or both. This is now ready for any single mailbox restore request.

Note Although Exchange has already been installed, a reinstall for a full server restore can easily be performed.

Note For ease of installation, copy the installation code, for Exchange 5.5, NT-SP3, Outlook 98, NT 4.0 on the spare server (i.e. `D:\support` directory.)

Note When this server is brought into production mode as a full restore server, the IP address must change to match the downed server. The server name must also match exactly. With the failed server shut down, remove the server from Server Manager, then change the name of the spare server to that of the production server. Re-join the domain to re-establish a new SID, and remove and reinstall Exchange to acquire the new server name.

Build a Recovery/Test Lab

Perform Periodic Disaster Recovery Drills

Conduct this drill in a test environment and simply attempt a complete recovery. Be sure to use data from production backups. During this time it is best to record the time it takes to recover. This information will assist you in determining time to recover in a real disaster recovery situation.

Verify integrity of the backed-up data by periodically restoring it and logging into random mailboxes.

Back Up Active Directory (Exchange 2000)

Make sure that Active Directory, which contains most of the server configuration information, is backed up. You should spread multiple domain controllers throughout each domain for efficient Active Directory replication so that if one domain controller fails, redundancy is still provided.

Back Up Internet Information Services (Exchange 2000)

Make sure the Internet Information Services (IIS) metabase is backed up. If the entire server must be restored, the IIS metabase must be restored to the Windows 2000 server before Exchange Server can be restored.

Backup the Microsoft Certificate of Authority

If you are using the KMS, be sure to backup the Certificate of Authority (CA). The CA is included in the backup of system_state of the server.

Common Exchange Server Problems

The following are common Exchange Server problems and recommended solutions for them.

Directory (MSExchangeDS) or Information Store (MSExchangeIS) Service Does Not Start

Check the Event Viewer for Errors

The following are some common error messages found in the Event Viewer.

`-529` = JET_errLogDiskFull

Needs more disk space for the transaction logs. Relocate transaction log location to another drive or purge log files. Refer to the section “Ran out of disk space – Error -1808” on page 128.

`-530` = JET_errBadLogSignature

Log file(s) are bad, move them out and restart service. Refer to the section “ERROR -550” on page 130.

`-550` = JET_errDatabaseInconsistent

Database is corrupted. Run eseutil /mh, then eseutil /r, then move all log and `edb.chk` files to a temporary directory, then restore from tape and as the last resort, eseutil /p. Refer to the section “Information Store Corruption” on page 130.

`-1018` = JET_errReadVerifyFailure

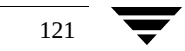
Occurs when the online backup fails to complete. Indication of a corrupted database. Restore from tape, if unsuccessful, run eseutil /p. Refer to the section “Tape Backup Problems” on page 122.

`-1201` = JET_errDatabaseDuplicate

A duplicate database is detected. The store detects a duplicate database based on the paths recorded in the registry. This error could be caused by the server crashing or loss of power. In either case, the server was not shutdown properly. Attempt to restore the database from tape first. Run eseutil /p as the last resort. Refer to the section “ERROR -1201” on page 132.

`-1206` = JET_errDatabaseCorrupted

Database is corrupted. Run eseutil /mh, then eseutil /r, then move all log and `edb.chk` files to a temporary directory, then restore from tape and as the last resort, eseutil /p. Refer to the section on “ERROR -550” on page 130.



`-1808` = JET_errDiskFull

The disk where the information stores are located is full. Relocate the store(s) to another drive via the Admin program or use Performance Optimizer. Refer to the section “Ran out of disk space – Error -1808” on page 128.

Uninstall Fails (Manual Method)

Remove the Exchange Server

1. Stop all services.
2. Close all applications.
3. Delete the Exchange Server Setup Log file from the root of the D:\ drive.
4. Delete all \exchsrvr directories from all drives.
5. Delete all MSExchange registry entries in:
   `HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services`
6. Delete the **EDB, ESE97** key from:
   `HKEY_LOCAL_MACHINE\Software\Microsoft\Exchange`

Tape Backup Problems

When the online tape backup fails to complete, perform the following procedures.

Check the Application Event Log for Errors

```
Event ID: 23 ; Source: EDB; Type: Error; Category: Database Page
Cache; Description: MSMicrosoft ExchangeIS ((458) Direct read found
corrupted page error -1018 ((-1:550144) (0-589866), 486912  1162627398
3480849804). Please restore the database from a previous backup.

The -1018 error is a JET_errReadVerifyFailure message where the backup
could not read the corrupted page in the IS database. This type of
error is related to hardware failure or device driver failure. Run
diagnostics to isolate the failing hardware or device driver.
```

Check Backup Logs

Each Exchange server when backed up by VERITAS does not create individual log files on the server. VERITAS creates a summary log file on kal-el, the UNIX host that manages all the backup jobs. The Backup Systems Group will mail a copy of the logs nightly.

VERITAS Status Codes

Status code	Description
0	Backup or restore completed successfully
9	Extension not installed, Exchange API is not installed
12	File Open failed, that means Exchange Services were off
40 or 51	Network unreachable, either system network busy causing collisions, and such, or system off, or Network down.

There are no backup logs on the Exchange server that can be viewed other than the Event Viewer.

Example Backup Status Message

The following is an example of a backup status message sent by kal-el UNIX host:

```
-----Original Message-----
To: Bakh, Bob
Subject: Exchange
Wed May 27 20:14:16 PDT 1998 ----------------------------
Wed May 27 20:14:16 PDT 1998        CLIENT:  pfsp01-bak
Wed May 27 20:14:16 PDT 1998         POLICY:  Exchange
Wed May 27 20:14:16 PDT 1998      SCHEDULE:  daily
Wed May 27 20:14:16 PDT 1998 SCHEDULE TYPE:  FULL
Wed May 27 20:14:16 PDT 1998        STATUS:  0
Wed May 27 20:14:16 PDT 1998 ----------------------------

If the STATUS is other than 0 look at the web page at
Look under Status Codes to determine the error and then report it to
the Backup team if there are any questions.
```


Perform an Offline Backup

Users, from their perspective, may not see any problems accessing the server or their mailbox since the corruption is not severe enough. To ensure that a backup is performed, since the current one failed, an offline backup is required.

1. Shut down all Exchange services.
2. Copy the `dir`, `priv` and `pub.edb` files to a temporary directory on that server.

   Perform this function to ensure that the information store, although corrupted, is backed up in the event the `.edb` could not be restored from tape and a repair may be required against it.

Note Be aware of space availability in the event ESEUTIL /P, repair, is required. ESEUTIL /P requires additional space equal to that of each `.edb` file.

Restore the Affected Information Store from the Previous Day's Tape Backup

1. When restoring from tape, select **Do Not Erase all existing data**.

   The purpose for doing this is to allow the transaction logs to play back, bringing the database up to the time of the shutdown.
2. Run the DS/IS Consistency Adjustment.
3. From the Exchange Administrator program, highlight the server and select **FILE**, **PROPERTIES**, **ADVANCED TAB**, **CONSISTENCY ADJUSTER**, **Private Information Store: Synchronize with the Directory....**, **ALL INCONSISTENCIES**.
4. Click **OK**.
5. Review Mailboxes for Windows NT Account Association.
6. Highlight the Recipients container under the site.
7. Double-click the user.
8. Review the **Primary Windows NT Account** field to see if the Windows NT account matches the mailbox. Repeat this for several users.
9. Test User Logon From Client Workstations to validate access to mailboxes.

10. Perform an online backup.

11. Check the event viewer and backup logs to confirm an error-free backup.

12. In the event the online backup fails on the newly restored `priv.edb`, stop the service, copy the `priv.edb` from the temporary directory back to the `\exchsrvr\mdbdata` directory, then run `eseutil /p /ispriv` to repair the private information store database.

    The system will attempt to remove all bad pages in the database (considered low-level repair).

13. Run `ISINTEG -fix -pri -test alltests`.

14. All tests will run. ISINTEG will find and repair high-level errors in the database. (See "ISINTEG" on page 158 for more information).Restart System Attendant and Directory Services.

15. Run `ISINTEG -patch`.

16. Restart IS service.

17. Perform an online backup.

18. Check logs and event viewer for errors.

Server Failure Scenarios - Hardware Problems

This section contains details for server failure scenarios involving hardware problems.

Two drives crash in the RAIDs array (entire subsystem is down), but the mirrored transaction log drive is still running

Perform a full server restoration using the hot spare server that has been previously built, and relocate the transaction log drives from the production server to the spare server.

Copy the transaction log drives from the E: drive on the production server to another server (the same result can be realized if the files are backed up to tape and restored back to the hot-spare)

1. After determining that the database drive (F:) is inoperative and the information stores have been lost, stop all MSExchange services.

2. Copy the directories where all the transaction log files reside, \exchsrvr\dsadata and \exchsrvr\mdbdata, from the E:\ drive to another NT file server, such as a BDC, as a temporary location.

3. Shut down the server.

4. Boot the hot-spare server.

5. Change the IP address of the hot-spare server to that of the crashed production server.

Note Do not forget to change the Backup Group IP address as well.

6. Change the netBIOS name of the server to that of the crashed production server. Remove the original name from the domain and rejoin it in order to obtain a new SID.

7. Install Exchange 5.5 (remove it if previously installed). The binaries are in the D:\Support\Exchange5.5 directory. Install Exchange according to the Design Documents.

8. Create a new site, Org = xxx, SITE = xxxx or xxxxx. Do not join in a site.

9. Use the correct Exchange service account, EXSERVICE.

10. Run Performance Optimizer. (Locate all Log files to the E: drive and all others to the F: drive.)

11. Once the server is up, use the Exchange Admin.exe and open the Server Properties page.

12. Go to the DataBase Path tab and verify that the logs are on the E: drive, and all else is on the F: drive.

    You will notice that there are two other parameters, Directory Store Working Path and Information Store Working Path. This is the location of the check-point files, `edb.chk`. Make sure the location is `D:\exchsrvr\dsadata` and `D:\exchsrvr\mdbdata` respectively. This is the default location.

13. Turn off (uncheck) Circular Logging from the Server properties, Advanced tab.

14. From **Control Panel, Services**, change all Exchange services, except for System Attendant, to manual.

15. Delete all files from the transaction log drive, `E:\exchsrvr\mdbdata`. Stop all services if still running.

16. Copy the transaction log files from the temporary location on a NT file server to the appropriate directories on the E: drive of the hot-spare server.

17. After the successful copy, check the transaction log drive, E: drive and verify that the same number and name of the logs files are present.

18. Perform a VERITAS Full Restore of the latest full backup, but do not delete existing files.

19. Click on the Windows **Start** menu, point to **Programs** and **VERITAS NetBackup**, then click on **Backup, Archive, and Restore**.

20. On the **Actions** menu, point to **Select Restore Type** and click **Normal Backups**.

21. Perform the restore procedure as documented in “Restoring Exchange Server” on page 72.

22. After a complete Full Restore, check to see that all the files have been restored to their proper locations.

23. Check the Restore In Progress key, found in:

    `HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\MSExchangeDS\RestoreInProgress`

    `HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\MSExchangeIS\RestoreInProgress`

24. Confirm that the paths for the database and logs as indicated in the RestoreInProgress key is exactly where the files must be restored to.

25. Launch Event Viewer, Applications Log.

26. Start Directory services and view Event Viewer. All logs should be played back and service started.

27. Start Information Store. All logs should be played back.

28. Log into random mailboxes and confirm data has been updated to the time of the crash.

29. Change services from manual to automatic.

30. Check to see if the Information Store Working Path was changed from D:\ to E:\. If so, relocate it back to D:\ by using the Server Properties, Database Paths tab.

Ran out of disk space – Error -1808

If the Information Store does not start due to lack of disk space, an application event is logged in the Windows NT Event Viewer. The source is EDB and the error test includes the `Jet Blue error ID -1808`.

Confirm that the transaction logs are not being written to the same drive as the information stores. If they are, relocate the transaction log drive to another drive that has ample space. To change the location where the Information Store or Directory Store Transaction logs are written, from the Exchange Admin program, click the Server object properties page and choose the **Database Paths** tab. Change the path for the Information Store and Directory Store transaction logs and click **OK**.

Pathnames for Transaction Logs

Data	Path Name
Private Information Store	`Exchsrvr\Mdbdata\Priv.edb`
Public Information Store	`Exchsrvr\Mdbdata\Pub.edb`
Directory	`Exchsrvr\Dsadata\Dir.edb`
Information Store Transaction Logs	`Exchsrvr\Mdbdata\*.log`
Directory Transaction Logs	`Exchsrvr\Dsadata\*.log`

Recovering Space Used by Log Files

To recover space used by log files, perform a full or incremental online backup. This will automatically delete the transaction logs.

Recovering Space on Drive F: Where the Exchange Server Store Is Located

Use the following procedure to recover Space on Drive F: Where the Exchange Server Store Is Located

1. Determine if there is space on another drive where the Exchange Information Store or the Directory can be relocated.

2. Run the Exchange Admin program, select the server, FILE, PROPERTIES, DATABASE PATHS and select the object that will be moved.

3. Indicate to which drive and directory the store is to be moved.

4. Click **OK**.

   The service will stop and relocate the files, then restart.

5. Delete unnecessary files such as sample apps, games, client installs, readme files, etc.

Caution As a precaution, place a size limit on the mailboxes and run performance monitor to continually monitor % Free Space and take appropriate steps when free space reaches a set threshold.

Transaction Log Drive Crashes

1. Select another drive with ample disk space. Replace the hard drives, then relocate the transaction logs back.

2. To change the location where the Information Store or Directory Store Transaction logs are written, select the Server object properties page and choose the **Database Paths** tab.

3. Change the path for the Information Store and Directory Store transaction logs and click **OK**. Performance Optimizer can perform this function as well.

Memory, System Board, NIC, Array Controller Failure

Replace with identical configurations. Spare components should be purchased as hot spares. If unavailable, the spare server's components can be used. Be sure to replace those borrowed parts immediately.

Drive Crashes After Creating New Mailboxes but Before a Backup Is Performed

If the RAID5 array concurrently loses more than one drive, the entire subsystem fails. If a backup is not performed prior to the disk crash, you cannot restore those mailboxes from tape. However, by restoring from the previous day's backup of the directory and information stores, the mailboxes can be restored / recreated, since the directory and information transaction log files are intact.

Caution When restoring the DS and IS, do not restore the log files and do not replace existing log files. You will need these log files to recreate the mailboxes that were previously created.

Server Failure Scenarios - Information Store Problems

This section contains details for server failure scenarios involving Information Store problems.

Information Store Corruption

The only way to determine if the information store is corrupted before it crashes and stops the services is during the online backup. That is why the event viewer and backup logs need to be reviewed on a daily basis. Refer to “Tape Backup Problems” on page 122.

ERROR -550

If the computer running Microsoft Exchange Server stops responding or was not shut down gracefully after stopping all the services properly, the following error may be displayed on screen and in the event logs:

`Error -550` may be displayed on screen and in the event logs. The typical Event ID will be `Event ID 1005` and in the body of the event the `-550` error will be displayed and will indicate which store has the problem: directory, private or public.

Cause

This error usually means that the database is in an inconsistent state and cannot start. There may be several causes for this condition. The log file(s) could be damaged, thus preventing transactions from being committed to the database or the database is corrupted due to a bad page. Power loss or a server crash can cause an `ERROR -550`.

Resolution

Before taking any remedial action, back up the affected file, `dir.edb`, `priv.edb` or `pub.edb` to a temporary directory on the server.

1. Confirm that the state of the database is inconsistent by running:

   `ESEUTIL /MH F:\exchsrvr\`*`directory`*`\`*`file`*`.edb > F:\temp\edbdump.txt`

2. Replace `\`*`directory`*`\`*`file`*`.edb` with either `\dsadata\dir.edb`, `\mdbdata\priv.edb` or `\mdbdata\pub.edb`, depending on what is displayed in the Event ID error message.

3. Read the Edbdump.txt file and confirm what state the database is in. The file will indicate whether `State` is consistent or inconsistent. (See Sample Edbdump.txt File.)

4. If the database state is inconsistent, run:

ESEUTIL /R /IS

This is for recovery, not repair mode (/IS for information store, /DS for directory store). This command will attempt to commit transactions, that were not done so automatically, from the log files to the database.

5. If the service will not start:

   - Move all files from `Exchsrvr\Dsadata` directory, except for `dir.edb`, or from the `\Exchsrvr\Mdbdata` directory, except for `priv.edb`, and `pub.edb` to a temporary directory.

     This causes the system to try to determine if the log files are corrupted. Try to restart the services. The new log files will get recreated upon startup.

   - Copy back the files that were moved to a temporary directory, then restore from tape only the information store that is exhibiting the `-550` error.

     Once the IS is restored, it will replay the log files.

   - If `Error -550` is still exhibited and the service does not start, the last recourse is to repair the database by using `ESEUTIL /P /<database options>`.

Sample Edbdump.txt File

```
Microsoft<R> Windows NT<TM>
<C> Copyright 1985-1996 Microsoft Corp.
C:\>eseutil /mh f:\exchsrver/mdbdata/priv.edb >c:\edbdump.txt
C:\>edit edbdump.txt
C:\>_
Microsoft<R> Exchange Server Database Utilities
Version 5.5
Copyright <C> Microsoft Corporation 1991-1997. All Rights Reserved.
Initiating FILE DUMP mode...
             Database: f:\exchsrvr\mdbdata\priv.edb

   Format ulMagic: 0x89abcdef
   Engine ulMagic: 0x89abcdef
 Format ulVersion: 0x620,2
 Engine ulVersion: 0x620,2
     DB Signature: Create time:4/21/1998 12:53:34 Rand:67798 Computer:
           dbtime:  75997
            State: Consistent
         Shadowed: Yes
       Last Objid: 214
     Repair Count: 0
  Last Consistent: (3,468,470) 4/22/1998 12:1:21
      Last Attach: (1,6071,445) 4/21/1998 13:42:48
      Last Detach: (3,468,470) 4/22/1998 12:1:21
```

ERROR -1201

The Information Store does not start due to an error message DuplicateDatabase. This error means that when the store is started up it goes down to the registry to find the paths to the `priv.edb` and `pub.edb`. Once it retrieves this information, it goes to that directory and looks for the files. If it retrieves an invalid path or the registry is corrupt, it will default to creating a new `priv.edb` and `pub.edb`. When it tries to do this, the file system does not allow it because these files actually do exist and, thus, the DuplicateDatabase error is returned.

Cause

This points to the cause as being (1) registry corruption, (2) access problems to the registry or (3) invalid paths in the registry. This error can be caused by power loss or a server crash, similar to the ERROR –550.

Resolution

Before taking any remedial action, back up the affected file, `dir.edb`, `priv.edb` or `pub.edb` to a temporary directory on the server. Attempt to restore the database from tape first. Run **`eseutil /p`** as the last resort.

Server Restoration Procedures

Server Restoration Procedures are covered in the following topics:

Single Mailbox Restore

This feature is designed for when you need to restore a mailbox because it was accidentally deleted or a user deleted a message and needs to recover it.

Note A user can recover any deleted items (mailbox or public folder) from the server for up to three days without any administrator intervention. This new feature in Exchange 5.5 is called the *Deleted Item Recovery*. Outlook client has a new feature called *Recover Deleted Items*, which enables the user to recover any deleted items. The messaging team has agreed to set the maximum days to keep deleted items to three days.

The hot-spare server should already have been configured with Windows NT and Exchange Server (Org and Site) to receive the restoration of the private information store. If not, Windows NT Server needs to be installed and configured, the server name must be unique (EXSP99, EXRC99), and it must join the SEGEXCHANGE NT domain.

Install the Exchange Server software and when prompted to **Join an Existing Site** or **Create a new Site**, ensure that you choose the option to **Create a New Site** and name it accordingly, Org:xxx and Site:xxxx or xxxx as in the production system. The server should also be on the production network for ease of transferring the recovered PST file to the target host. Also, install the Outlook client on this recovery server.

Note The server name of the restore machine must be unique for the single mailbox restore procedure. Also, the `dir.edb` will not be restored from tape, only the `priv.edb`.

In the event that the `dir.edb` is restored, no replication will occur, since the spare server will have a different server name than the server from which the tape is being restored. The worse case if this happens is the `dir.edb` will sense that the server name and the Exchange server name from the `dir.edb` is different and the DS service will not start.

Caution As an ultimate precaution to prevent unwanted directory replication, administrators can unhook the cabling linking the restore server to the network until the restore is complete and the mailbox is recovered.

Restore the Information Store from Tape

1. Restore the private information store to the server. (Include the `priv.edb`, patch files and transaction logs)
2. Click **Erase all existing data**.
3. After the restore, start the DS and IS services and then perform the DS/IS Consistency Adjustment.

Recover User Mailbox

1. Log onto the recovery server as the Windows NT Administrator.
2. Open the Microsoft Exchange Administrator.
3. Select the recipient's container and double-click on the desired user's mailbox name.
4. On the General tab, click **Primary Windows NT Account**.
5. Select **Select an Existing Windows Account**.
6. Click **OK**.
7. In the **Add User or Group** screen, select **Administrator**.
8. Click **Add**, then **OK**.
9. On the User Property screen, click **OK** .

10. Configure a profile for the desired user.

11. Add a Personal folder file to the profile.

12. On the recovery server, run the Microsoft Outlook client.

13. In the left panel, highlight **Mailbox - USERNAME**.

14. Select the first folder or item in the list on the right panel.

15. From the pull-down menu, select **EDIT, SELECT ALL**.

16. From the pull-down menu, select **FILE, COPY**.

17. In the Copy screen, highlight the **PERSONAL FOLDER** and click **OK**. All data will be copied to this PST file.

18. Copy the PST file to the destination location. This can be done via tape backup and restore if necessary.

19. Add this PST to the user's profile on the production server and send the PST to the end-user with instructions. You may need to send this on a tape. If you have network access, you might copy this recovered PST to the desired server.

Full Server Restore (Exchange NT)

This section describes what is necessary to perform a full server recovery of Exchange NT.

Using the Hot Spare Server

Assuming the entire server is not operational, the preconfigured hot server must be implemented. Replace the downed server with the hot-spare. Use the original server's IP address and the original server's netbios name and rejoin the SEGEXCHANGE NT domain but only after a new SID is created. To create a new SID, remove the old server name from Server Manager. Re-joining the domain from the hot-spare, which is using the original server's name, will create a new SID.

In the case of full server recovery, keep installation code on the recovery server (i.e. D:\support).

Note Refer to the Server Configuration sheet that was prepared for the original server to replicate all configurations.

▼ Install Exchange Server

1. Install Microsoft Exchange Server on the hot-spare server and create a new site.

Caution Do not attempt to join an existing site. Give the server its original organization and site name (Org:xxx, Site:xxxxx or xxxxx).

2. Run through Performance Optimizer and select the appropriate locations for the files.

3. Check the working Path for the directory and Information stores via the database path property page on the server object that it is set for the D: drive.

4. Install Microsoft Outlook Client on the recovery server.

5. Perform a Full Restore, which will include the Directory, Information Store and transaction logs / patch files from the latest tape backup.

Note Be sure to erase all existing data.

6. Start all Exchange services (System Attendant first, then the Directory, IS, MTA and Event Services) and review the Event Viewer for any errors.

7. Run a DS / IS Consistency Adjustment (from the Server properties, choose Advanced).

8. To verify that your users' mailboxes have a Windows NT account associated with them, follow these steps.

   a. In the Microsoft Exchange Administrator program, select a server, and choose **Recipients**.

   b. Double-click a user's name.

   c. Review the Primary Windows NT Account box to verify that the Windows NT account matches the mailbox. Repeat this procedure as needed for each user.

▼ Testing a User's Logon from a Client Workstation

To test a user's logon from a Microsoft Outlook Client workstation, perform these steps.

1. Start the Microsoft Outlook Client.

2. Verify that the user's password is accepted.

3. Confirm that the data has been restored.

Full Server Restore (Exchange 2000)

This section describes what is necessary to perform a full server recovery of Exchange 2000.

Requirements

The following are required before an Exchange 2000 restoration can be performed:

- If the Exchange 2000 server you are restoring is a member server in a domain, the Active Directory must be running. If Active Directory does not exist, you must restore it before restoring Exchange 2000.
- If the Exchange 2000 server you are restoring is a domain controller, you must restore Active Directory on the machine before you can restore Exchange 2000.

Steps

For detailed information about Exchange 2000 disaster recovery, refer to the Microsoft Exchange 2000 Database recovery white paper at http://www.microsoft.com/exchange.

1. Install Windows 2000 on the new or repaired server.
2. Restore the IIS Metabase.
3. Restore Exchange 2000.
4. Restore the Information Stores.
5. If you have KMS or SRS, these have to be restored independently of an Exchange 2000 server restore.
6. If you have KMS, restore the Certificate of Authority. The CA can be restored from a backup of the system_state of the server.

Backup Tapes Are Unreadable or Non-Existent

Cannot Restore From Tape, None Available

There are no valid tapes available. The only alternative is to repair the existing database. Perform an offline backup to tape or to a temporary directory.

To repair the information store, run **`ESEUTIL /P F:\exchsrvr\mdbdata\priv.edb`**.

How Many Tape Rotations Back to Find a Good Tape to Restore?

Previous day's backup vs. ESEUTIL /P

This scenario depicts a situation where either the backup tape media is damaged or the data is unreadable and due to a disaster the database (`priv`, `pub` or `dir.edb`) needs to be restored with the most current data immediately.

If you restore the previous day's backup, the log files for the current day will play back and bring the store up to date. However, if the tape is bad from the previous day, should a tape be used from two days ago or should ESEUTIL /P be used to repair the current database be implemented? This is the immediate question that needs to be answered. The trade-offs are the time it takes to perform an ESEUTIL /p for repair.

Going back two days to find a good tape is a solution. However, the information store will only contain the current day's transactions due to the existing log files, and messages from two days ago. No messages will be available from the previous day. For example, if the store became corrupted on Wednesday afternoon, Tuesday's backup would be used for restoration but if that tape was bad Monday's tape would be used.

If Monday's tape was good and was restored, the current transaction logs for Wednesday, which contain logs from the time a full online backup was performed to the time the store stopped, would be rolled into the Monday database. The result would be a database missing Tuesday's transactions. Essentially, Tuesday's messages would be lost.

The alternative is to repair the Wednesday database by using ESEUTIL /P, as follows:

1. If the private store was affected, back up the `priv.edb` to a temporary directory. The IS service must be stopped in order to do this.

2. Run **`\winnt\system32\ESEUTIL /P F:\exchsrvr\mdbdata\ priv.edb`** from the \mdbdata directory.

3. After it completes, run **`ESEUTIL /MH F:\exchsrvr\mdbdata\priv.edb d:\esedump.txt`**.

4. Edit the ESEDUMP.TXT file and confirm that the state of the database is consistent.

5. If it is not consistent, re-run **`ESEUTIL`** until it is consistent.

6. Run **`ISINTEG -pri -test alltests`** (refer to the Appendix for details on ISINTEG switches)

7. After this completes, run **`ISINTEG –patch`**, then start the service.

8. Run **`DS/IS Consistency Adjustment`**.

9. Test access to mailboxes.

Administrative Errors

Refer to the following topics for details on resolving administrative errors:

Authoritative Restore

Due to an administrative error, a considerable number of mailboxes or configuration data was deleted. What do you do?

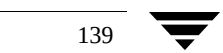
Once mailboxes or configuration data is deleted from Exchange, the directory replication process occurs quickly and all the servers in the organization update their directories to reflect this change. To restore the deleted mailboxes is not a problem but to restore the directory information for the mailboxes is. Authoritative Restore tool (Authrest.exe) allows you to force a restored directory database to replicate to other servers after restoring from a backup. You can receive assistance using this tool from Microsoft Product Support Services.

Normally, a restored database is assumed to be more out-of-date than the collective information held on all the other directory replicas in the organization. A restored directory would normally replace its own in formation with the more recent data held by other servers. This functionality is correct when the reason for the restore is that a database or server was destroyed, but it is not correct in all cases. For example, if an administrative error deleted thousands of mailboxes or vital configuration information, the goal of restoring from backup is not to restore one server to functionality, but to move the entire system back to before the undesired changes were made.

Without Authoritative Restore, you would need to restore every server in the organization from a backup that predates the error or restore every server in the site, and then force all bridgeheads in other sites to resynthesize from scratch. If only one server were restored, or if servers were restored one at a time, the restored server would quickly overwrite its restored data with the more recent (incorrect) information held by all other servers in the site.

Using the Authoritative Restore tool, object versions and USNs can be advanced on all writable objects held by that directory so that the data held on the backup appears to be more recent than any copy held by other servers. Normal replication, therefore, causes the restored information to spread to all servers throughout the organization. This tool allows you to restore one server (presumably the one server with the most recent premistake backup) rather than all servers.

If Authres is not used, the restored mailboxes are automatically deleted.



Installing Authoritative Restore

Copy `Authrest.exe` from the `Support\utils\`*`platform`* directory of the Microsoft Exchange Server CD-ROM to the `Exchsrvr\bin` directory of the Microsoft Exchange Server computer that has had its directory restored.

Using Authoritative Restore

Run Authoritative Restore from a command prompt. You can specify two parameters on the command line. The first is the object version increment and the second is the USN increment. These numbers specify how many versions ahead to increment the version numbers of objects in the directory so that they appear to be later versions than the objects in other replicas of the directory in your organization. A reasonable number to enter for both of these parameters is 1000.

After running the Authoritative Restore tool, restart the directory. Its objects replicate to the rest of your organization, superseding objects in the other replicas.

Recommendations

The following are recommendations for optimal performance.

Use Hardware RAID5 and Mirroring

Use hardware RAID5 so that a disk drive failure can be remedied real-time by plugging in a replacement drive. System partitions should be mirrored or RAID5 for redundancy.

Enable Write-Back Cache on the Controller

Leave write-back cache on hard disk array controllers enabled if the controller has ECC memory and battery backup. If the controller has no battery backup, disable the cache. Hard drives that have caching enabled must be disabled regardless of the cache status of the controller.

Perform Online Backups Using Software That Uses Exchange APIs

Perform online backups using VERITAS NetBackup with Exchange Extensions. The online backup using the Exchange Agents will read every 4K page from the database as it is being backed up, thus ensuring the integrity of the database.

Locate Transaction Log Files on Separate Dedicated Physical Disk

This is the single most important aspect of Microsoft Exchange-based server performance. However, there are recovery implications as well. Transaction logs provide an additional mechanism for recovery. For optimal redundancy, mirror (Raid1) the transaction log drive.

Disable Circular Logging

While Circular Logging can help conserve disk space, the drawbacks are (1) Incremental and Differential Backups are disabled and (2) transaction log history is cyclical and cannot be played back. Implementing a full online daily backup strategy, transaction log files will be purged on a regular basis thus freeing up disk space.

Dedicate Spare Recovery Servers, Replacement Server Components and Build a Recovery Lab

It is important to have a server dedicated for emergencies. This hot-spare must be equal to or greater than its configuration to the largest production server. It must have a dedicated tape drive identical to those in production. This server will be used for single mailbox restores, full server recovery, testing of tape backup integrity and simulated fire drills for server restorations. This server will also be used for testing of new upgrades, configurations, service packs and hot fixes.

Don't fall into the trap of allowing test equipment to become production equipment without replacement. Make sure that the recovery equipment is always in working order and available at a moments notice. What tends to happen is that companies purchase recovery equipment, install some test only software and then become dependent on this equipment for production use. In short, keep recovery equipment in a dedicated mode.

Note that up to 2X the disk space of the largest production server Information Store database is required for recovery and database defragmenting using the ESEUTIL utility. It is more cost-effective for an organization to maintain one recovery server with sufficient disk space.

Create and Verify Daily Backups

This is a very critical step in disaster recovery. It sounds simplistic but you can only recover data if you have a valid backup. It is often assumed that backup tapes are being swapped and that data is being properly backed up. It should be a daily routine to review all back up logs and to follow up on any errors or inconsistencies. Furthermore, full (normal) backups reset and remove transaction logs. This results in free disk space (this is less of an issue if circular logging is enabled). If circular logging is not enabled and daily full backups are failing, transaction logs will not be purged and can fill up the entire transaction log disk drive. Failure to verify backups is one of the most common mistakes made.

Perform Periodic File-Based Backup

To capture all configuration data, it is best to perform a full file-based backup periodically. Services should be shut down so that open files can be backed up. Shutting down sevices will ensure that you have backed up all possible Microsoft Exchange-related files. This might be performed during the scheduled maintenance window. Note that file-based backup is not required for backing up the Information Store and Directory databases. Online backups are recommended for backing up the Information Store and Directory.

Standardize Tape Backup Formats

Recovery equipment must be compatible with production tape equipment. If you deploy a new type of tape drive, make sure that you equip recovery equipment with a compatible model. You should also test reading and restoring production tape backups on the tape drive used for recovery.

Deploy a UPS and Test It Periodically

Don't take the approach that if the Microsoft Exchange-based server goes due to a power outage, all other servers will go, too. Make sure that you are UPS protected. Many computer rooms are supposedly UPS protected. Even though this may be the case, it is very possible that not all outlets are UPS protected. Also note that server class UPS system batteries can wear out every 3 years or so and require replacement.

Perform Periodic Fire Drills

The purpose of performing periodic fire drills is to measure your ability to recover from a disaster and to certify your disaster recovery plans. Conduct these drills in a test environment and simply attempt a complete recovery. Be sure to use data from production backups. During this process, it is best to record the time it takes to recover. This information will assist you in determining time to recovery in a real disaster recovery situation. Performing these drills will be the most valuable experience that you will have in your disaster recovery planning.

Check Windows NT Event Logs Daily

It is best to take a proactive approach and review logs regularly. This can help you identify problems before they have an impact. Extensive logging is available in Microsoft Exchange and this should be leveraged. Logging tools such as Evtscan.exe, that will monitor for specific events and send notifications, are available on the Microsoft Exchange Server Technical Resource CD-ROM.

Create a Disaster Recovery Kit

Planning ahead will reduce the time to recovery. It is critical to build a kit that includes items such as the following:

- operating system configuration sheet
- hard drive partition configuration sheet
- RAID configuration

- hardware configuration sheet
- configuration disks
- Microsoft Exchange configuration sheet
- Windows NT emergency repair diskette
- Microsoft Exchange Performance Optimizer settings sheet

The goal is to minimize the time to recovery. In order to account for configuration changes, this information should be reviewed and updated on a monthly or quarterly basis.

Publish a Microsoft Exchange Maintenance Window

Unlike mainframes, servers often get overlooked when it comes to scheduling downtime for maintenance. It is a simple formula: planned maintenance generally reduces unplanned downtime. It is important, however, to set user expectation levels by publishing a maintenance window especially when users expect 7x24 service. Maintenance is inevitable since the nature of the data processing business includes service pack updates, software upgrades, and hardware upgrades.

Maintain Off-Site Tapes

Send tapes off-site to a secure location in the event of a disaster at the local site. Ensure quick retrieval of these tapes in event that an emergency restore is required.

Keep Solid Records of All Configuration Done to the Production Server

This will be necessary when configuring the recovery server. Records include Windows NT tuning settings, path information, protocol addresses, Microsoft Exchange connector configuration, etc. These records should be part of the disaster recovery kit discussed above.

Take a Proactive Approach to Monitoring the Information Store

Monitor the growth of the Information Store and server performance and be prepared with a plan to remedy these issues. Windows NT disk space alerts can be set up as well to monitor remaining disk space. Performance Monitor objects exist for the Information Store and should be used.

Exchange Server Problem Summary

Problem	Symptom	Cause	Remedial Action	Comments
Error –529, IS or DS Services stop	IS or DS service stops and do not restart	Drive where the transaction logs are being written to is full. JET_errLogDiskFull	Relocate transaction log location to another drive. Remove logs Enable circular logging to remove logs except for the four latest.	Refer to the section on “Ran out of disk space, Error –1808”
Error –530, IS or DS Services stop	IS or DS service stops and do not restart	Log file(s) and / or database is possibly corrupt. JET_errBadLogSignature	Relocate transaction logs and `edb.chk` to a temporary directory, then restart services.	Refer to the section on “Information Store Corruption, Error -550”
Error –550, IS or DS Services stop	IS or DS service stops and do not restart	Log file(s) and / or database is possibly corrupt. JET_errDatabaseInconsistent	Relocate transaction logs and `edb.chk` to a temporary directory, then restart services.	Refer to the section on “Information Store Corruption, Error -550”
Online tape backup does not complete successfully.	Event Viewer displays ID 23, source EDB, Description: MSMicrosoft ExchangeIS corrupted page error –1018. Backup log indicates backup failed.	A page or pages in the database have become corrupted and the tape backup could not read it. JET_errReadVerifyFailure	Restore database from previous good tape backup and test accounts and mailboxes.	Refer to the section on “Tape Backup Problems”.

Exchange Server Problem Summary

Problem	Symptom	Cause	Remedial Action	Comments
Error –1201, IS or DS Services do not start	IS or DS service stops and do not restart	Store cannot find correct path to database. Possible corrupted registry or access problems to the registry or invalid paths in the registry. JET_errDatabaseDuplicate	Copy affected database to a temporary directory as a backup. Restore from tape, run eseutil /d /r as a last resort.	Refer to the section on "Information Store Corruption, Error –1201"
Error –1206, IS or DS Services stop	IS or DS service stops and do not restart	Log file(s) and/or database is possibly corrupt. JET_errBadLogSignature	Relocate transaction logs and edb.chk to a temporary directory, then restart services.	Refer to the section on "Information Store Corruption, Error -550"
Error –1808, IS or DS Services stop	IS or DS service stops and do not restart	Drive where the information store(s) are located are full. No disk space available. JET_errDiskFull	Relocate transaction log location to another drive if it is sharing the same drive as the IS or DS. Remove logs Enable circular logging to remove logs except for the four latest. Relocate the IS or DS location via the Exchange Admin program or use Performance Optimizer.	Refer to the section on "Ran out of disk space, Error –1808"

Exchange Server Problem Summary

Problem	Symptom	Cause	Remedial Action	Comments
RAID5 Array fails, drives crash	Server does not start, services stopped, drive lights indicate drives inoperative	Hardware failure either controller and / or disk drives.	Replace controller. Replace entire array from the spare server or completely replace server with hot spare and perform a full serer restore.	
Transaction log drive crashes, may get Error –529 in the Event Viewer	IS and DS services stop and do not restart.	Hardware failure	Relocate the IS and DS log location via the Exchange Admin program or use Performance Optimizer. Replace drive(s)	Refer to the section on “Transaction Log Drive Crashes”. Replace Transaction Log hard drives
Server does not boot	Server does not boot	Hardware problems	Inform NT server engineers	Hardware problems with possible NT Server issues to follow.
Server boots but does not completely boot to NT.	Incomplete NT boot sequence.	Damaged NT configuration or missing files.	Inform NT Server engineers	May have to reinstall NT or restore configuration.
Other hardware related errors such as memory, NIC, system board, etc.	Hardware related errors displayed upon bootup.	Hardware failure or misconfiguration.	Inform NT Server engineers	

ESEUTIL and ISINTEG Line Switches A

This appendix provides detailed information on the ESEUTIL and ISINTEG command line switches.

ESEUTIL

Note Call PSS before using this tool.

ESEUTIL is a multifunctional database utility for the Microsoft Exchange Server information store and directory. Unlike ISINTEG, which is sensitive to the use and content of data in the information store, ESEUTIL operates at the level of the architecture, scanning for unreadable records in messaging databases with no knowledge of their application. It can be used on Microsoft Exchange Server directory service and information store.

ESEUTIL is in \WINNT\SYSTEM32. It is run from the Windows NT Server command line. The database service must be stopped for the utility to run. It runs on one database at a time.

Most often you will use ESEUTIL in consultation with Microsoft Product Support, but you can use several of its functions.

Defragmentation	Compacts, defragments, and reduces the size of the database. Performs offline compaction of database.
Upgrade	Upgrades the database architecture if it is incompatible with the current version of Microsoft Exchange Server. This is intended for future use and is to be used only at the advice of a Microsoft Product Support Specialist.
Integrity	Scans the database for unreadable records and eliminates them, restoring database functions. Does not repair any errors it finds.
Recovery	Commits entries in the transaction log files to an offline database. It is to be used only at the advice of a Microsoft Product Support Specialist. Brings all databases to a consistent state.
File Dump	Writes the database header record or checkpoint file to a file. This is to be used only at the advice of a Microsoft Product Support Specialist.
Defragmentation	Repairs a damaged or corrupted database.

Defragmenting a Database

The ESEUTIL defragmentation utility makes used storage contiguous, eliminates unused storage, compacts the database, and reduces its size. It can be run on the directory or information store.

The amount of free disk space needed to defragment a database (Eseutil /d) is 110 percent of the size of the file being defragmented.

When you repair a database (Eseutil /p), the amount of free disk space required depends on the number of corrupt pages in the database. This is different from how the older Edbutil.exe program repaired databases. Normally, 25 percent of the file being repaired is a conservative estimate of the amount of free disk space required.

ESEUTIL copies database records to a new database. When the defragmention is complete, the original database is deleted or saved elsewhere and the new version renamed as the original. In normal mode, if it encounters a bad record, the utility stops and displays an error. However, in repair mode, bad records are not copied to the new version of the database and the utility is not interrupted.

Caution ESEUTIL defragmentation with repair eliminates unreadable data from the database. Some of this data may be required for the operation of the service and may not be recoverable. It may take 30 minutes to an hour per gigabyte to complete. If it concludes with an error message, consult Microsoft Product Support for assistance

Note ESEUTIL requires disk space equal to twice the size of the database being processed.

1. Stop the information store or directory.

2. At the command prompt, type **`eseutil /d`**, a database switch, and any desired options.

   For example:

   ```
   C:\WINNT\SYSTEM32> eseutil /d /ds /t c:\dbback
   ```

   runs the standard defragmentation utility on the directory service and saves the copy in the user-defined file.

   ```
   C:\WINNT\SYSTEM32> eseutil /d /ispriv
   ```

   runs the defragmentation utility on the private information store and discards the original.

Select a database switch to run ESEUTIL on that database. ESEUTIL runs on one database at a time.

/ds	Directory
/ispriv	Private information store
/ispub	Public information store

Select one or more options to determine the disposition of the old and new copies of the database.

/b pathname	Makes a backup copy of the original uncompacted database at the specified location
/p	Retains the old uncompacted database in its original location and stores the new compacted database in the default file, \EXCHSRVR\BIN\TEMPDFRG.EDB
/t filename	Renames the new compacted database as specified in filename

Checking Database Integrity

The ESEUTIL integrity checker is a read-only utility that searches the database for damaged or unreadable records and reports its results to the console. It verifies the integrity of the database but does not repair any errors it finds. Checking database integrity (Eseutil /g) is an in-place operation and does not require any additional free disk space.

In the case of the defrag or repair operations, the /t command line switch should be used to specify the location of a temporary file. This should be located on a drive that has the required free disk space. This can be a local or a network drive.

To save the displayed messages to a file, use the standard MS-DOS redirection convention, > *filename*.

1. Stop the information store or directory.
2. At the command prompt, type **`eseutil /g`** followed by a database switch and any desired options and press Enter.

   For example:

   ```
   C:\WINNT\SYSTEM32> eseutil/g /ispub
   ```

runs the integrity check on the public information store of the server.

/ds Directory (DO NOT ATTEMPT TO USE THIS - CALL PSS)

/ispriv Private information store

/ispub Public information store

The following information applies to Microsoft Exchange Server 5.5 Utility)

DESCRIPTION: Maintenance utilities for Microsoft® Exchange Server databases.

MODES OF OPERATION:

- Defragmentation: ESEUTIL /d *database name* [options]
- Recovery: ESEUTIL /r [options]
- Integrity: ESEUTIL /g *database name* [options]
- Upgrade: ESEUTIL /u *database name* /d*previous .DLL* [options]
- File Dump: ESEUTIL /m[mode-modifier] *filename*
- Repair: ESEUTIL /p *database name* [options]

DEFRAGMENTATION/COMPACTION: (D)

DESCRIPTION: Performs offline compaction of a database.

SYNTAX: ESEUTIL /d *database name* [options]

PARAMETERS: *database name* - filename of database to compact, or one of /ispriv, /ispub, or /ds (see NOTES below)

OPTIONS: zero or more of the following switches, separated by a space:

/l*path* - location of log files (default: current directory)

/s*path* - location of system files (e.g., checkpoint file)
(default: current directory)

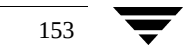
/b*db* - make backup copy under the specified name

/t*db* - set temporary database name (default: TEMPDFRG.EDB)

/p - preserve temporary database (i.e., don't instate)

/o - suppress logo

NOTES:



- The switches /ispriv, /ispub, and /ds use the Registry to automatically set the database name, log file path, and system file path for the appropriate Microsoft Exchange store
- Before defragmentation begins, soft recovery is always performed to ensure the database is in a consistent state.
- If instating is disabled (i.e., /p), the original database is preserved uncompacted, and the temporary database will contain the defragmented version of the database.

RECOVERY: (R)

DESCRIPTION: Performs recovery, bringing all databases to a consistent state.

SYNTAX: ESEUTIL /r [options]

OPTIONS: zero or more of the following switches, separated by a space:

/is or /ds - see NOTES below

/l*path* - location of log files

(default: current directory)

/s*path* - location of system files (e.g., checkpoint file)

(default: current directory)

/o - suppress logo

NOTES:

- The special switches /is and /ds use the Registry to automatically set the log file path and stem file path for recovery of the appropriate Microsoft Exchange stores.

INTEGRITY: (G)

DESCRIPTION: Verifies integrity of a database.

SYNTAX: ESEUTIL /g *database name* [options]

PARAMETERS: *database name* - filename of database to verify, or one of /ispriv, /ispub, or /ds (see NOTES below)

OPTIONS: zero or more of the following switches, separated by a space:

/t*db*- set temp database name (default: INTEG.EDB)

/v - verbose

/x - give detailed error messages

/o - suppress logo

NOTES:

- The consistency-checker performs no recovery and always assumes that the database is in a consistent state, returning an error if this is not the case.
- The special switches /ispriv, /ispub, and /ds use the Registry to automatically set the database name for the appropriate Microsoft Exchange store.

UPGRADE: (U)

DESCRIPTION: Upgrades a database (created using a previous release of Microsoft® Exchange Server) to the current version.

SYNTAX: ESEUTIL /u *database name* /d*previous .DLL* [options]

PARAMETERS: *database name* - filename of the database to upgrade. /d*previous .DLL* - path filename of the .DLL that came with the release of Microsoft® Exchange Server from which you're upgrading.

OPTIONS: zero or more of the following switches, separated by a space:

/b*db* - make backup copy under the specified name

/t*db* - set temporary database name (default: TEMPUPGD.EDB)

/p - preserve temporary database (i.e., don't instate)

/o - suppress logo

NOTES:

- This utility should only be used to upgrade a database after an internal database format change has taken place. If necessary, this will usually only coincide with the release of a major, new revision of Microsoft® Exchange Server.
- Before upgrading, the database should be in a consistent state. An error will be returned if otherwise.
- If instating is disabled (i.e., /p), the original database is preserved unchanged, and the temporary database will contain the upgraded version of the database.

FILE DUMP: (M)

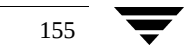
DESCRIPTION: Generates formatted output of various database file types.

SYNTAX: ESEUTIL /m[mode-modifier] *filename*

PARAMETERS: [mode-modifier] - an optional letter designating the type of file dump to perform. Valid values are:

h - dump database header (default)

k - dump checkpoint file *filename* - name of file to dump.



The type of the specified file should match the dump type being requested (e.g., if using /mh, then *filename* must be the name of a database).

REPAIR: (P)

DESCRIPTION: Repairs a corrupted or damaged database.

SYNTAX: ESEUTIL /p v [options]

PARAMETERS: *database name* - filename of database to compact, or one of /ispriv, /ispub, or /ds (see NOTES below)

OPTIONS: zero or more of the following switches, separated by space:

/t*db* - set temp database name (default: REPAIR.EDB)

/d- don't repair the database, just scan for errors

/v- verbose output

/x- give detailed error messages

/o- suppress logo

NOTES:

- The switches /ispriv, /ispub, and /ds use the registry to automatically set the Database name for the appropriate Exchange store.
- Recovery will not be run.

Output of ESEUTIL /d /ispriv

```
Microsoft <R> Exchange Server Database Utilities
Version 5.5
Copyright <C> Microsoft Corporation 1991-1997. All Rights Reserved.

Initiating DEFRAGMENTATION mode...
        Database: F:\exchsrvr\MDBDATA\PRIV.EDB
       Log files: e:\exchsrvr\MDBDATA
    System files: d:\exchsrvr\MDBDATA
  Temp. Database: TEMPDFRG.EDB

       Defragmentation Status  ( % complete )

0    10   20   30   40   50   60   70   80   90  100
|----|----|----|----|----|----|----|----|----|----|
..................................................

Note:
  It is recommeded that you immediately perform a full backup
```

```
  of this database. If you restore a backup made before the
  defragmentation, the database will be rolled back to the state
  it was in at the time of that backup.

Operation completed successfully in 5.156 seconds.

C:\>
```

Output of ESEUTIL /r /ds

```
Microsofta(R) Windows NT(TM)
(C) Copyright 1985-1996 Microsoft Corp.

C:\>eseutil /r /ds

Microsoft(R) Exchange Server Database Utilities
Version 5.5
Copyright (C) Microsoft Corporation 1991-1997. All Rights Reserved.

Initiating RECOVERY mode...
       Log files: e:\exchsrvr\DSADATA
    System files: d:\exchsrvr\DSADATA

Performing soft recovery...

Operation completed successfully in 1.594 seconds.

C:\>_
```

Output of ESEUTIL /g /ispriv

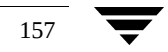
```
C:\>eseutil /g /ispriv

Microsoft(R) Exchange Server Database Utilities
Version 5.5
Copyright (C) Microsoft Corporation 1991-1997. All Rights Reserved.

Initiating INTEGRITY mode...
        Database: F:\exchsrvr\MDBDATA\PRIV.EDB
  Temp. Database: INTEG.EDB

checking database integrity

          Scanning Status ( % complete )
0    10   20   30   40   50   60   70   80   90  100
|----|----|----|----|----|----|----|----|----|----|
```

```
.............................................

integrity check completed.
Operation completed successfully in 2.922 seconds.

C:\>
```

ISINTEG

Note Call PSS before using this tool.

The Information Store Integrity Checker (ISINTEG) utility finds and eliminates errors from the Microsoft Exchange Server public and private information store databases. These errors can prevent the information store from starting or prevent users from logging on and receiving, opening, or deleting mail. ISINTEG is not intended for use as a part of normal information store maintenance. Its purpose is to assist you in situations where the database has become damaged.

Installing ISINTEG

ISINTEG is located in the `Exchsrvr\Bin` directory of the Microsoft Exchange Server compact disc. You can run it from the Windows NT Server command line.

Using ISINTEG

ISINTEG has two main functions:

- It can test, and optionally, fix errors in the information store. When run in Patch mode, ISINTEG repairs information stores that will not start after being restored from an offline backup.
- It can patch the information store after a restore from an offline backup.

In Test mode, ISINTEG searches the information store databases for table errors, incorrect reference counts, and unreferenced objects. During this operation, ISINTEG displays the results and also writes them to a log file.

The Fix option in the Test mode should be used only with the advice of Microsoft Technical Support. In Test and Fix modes, ISINTEG tests the information store database and corrects any errors it finds. It is recommended that you back up the information store before you run this utility to fix errors in the database.

Testing and Fixing Information Store Integrity

ISINTEG validates the referential integrity of the information store database by scanning it and examining all references. The utility creates a temporary database to store the reference counts. At the end of the process, the reference counts collected in the temporary database are compared with those in the information store database. If errors exist, and if you have selected the -fix option ISINTEG corrects the problem. By default, the temporary database is created in the same directory as the existing database. But you can specify different a directory for the location of the temporary database.

In either case, the temporary database is removed upon completion of the test. When run in Test mode, ISINTEG must be run separately on the public and private information stores.

By default, ISINTEG errors are displayed on your screen as well as being saved in a log file. It is recommended that you save the log file created by ISINTEG in case you require the assistance of Microsoft Technical Support to solve any of the problems.

The -fix option instructs ISINTEG to repair any errors it finds. Details of all repairs are recorded in a log file. If a log file name is not specified, the results are written to either `isinteg.pri` or `isinteg.pub`, depending on whether you choose the private or public information store for testing.

Note The -fix option should be used only on the advice of Microsoft Technical Support.

Running ISINTEG in Test Mode

Note To run ISINTEG in Test mode, you must first stop the information store service if it is running.

1. Open the Services application in Control Panel.
2. Select the Microsoft Exchange Information Store service, and click **Stop**.
3. At a command prompt, switch to the `Exchsrvr\Bin` directory.
4. Enter the following command:

   `isinteg -test` *`options`*

   where *options* is one or more of the command-line options listed in the following table.

-? Displays the list of options. Does not run the utility.

-pri	Tests the private information store.
-pub	Tests the public information store.
-fix	Tests and corrects errors in the specified information store. This option should be used only with the advice of Microsoft Technical Support.
-detailed	Performs additional tests beyond what is normally covered in the default test mode.
-verbose	Reports the details of all testing activity.
-l *filename*	Specifies the name of the log file. The default name is Isinteg.pri or Isinteg.pub.
-t *RefDbLocation*	Specifies the location of the temporary reference database that ISINTEG constructs while it is running. If you specify the location for the temporary database on a different disk than the one on which the information store database is stored you can improve the tool's performance.
-test *testname1*, *testname2* . . .	Specifies the specific test(s) to perform. Specific *testname* parameters are covered in the following table. ISINTEG can take a long time to run on large information stores because of the intensive nature of the referential integrity checking operation. Rather than running the entire set of tests, it is strongly recommended that you select tests based upon the specific problem you encounter (as recommended by Microsoft Technical Support). This reduces the amount of time ISINTEG takes to run.

Tip If you are performing multiple tests, indicate all the test names, separated by commas, e.g.:

```
isinteg -pri -test folder,message
```

Tip If you wish to perform all the tests, use the following command:

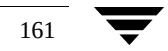
```
isinteg -pri -test alltests
```

ISINTEG Tests

Each of the ISINTEG tests are described in the following table.

ISINTEG Tests

Test Name	Description	Test Length Depends On
aclitemref	Verifies reference counts for access control list items.	Number of folders in the information store and the number of members of each access control list.
acllist	Examines folders and validates access control lists.	Number of folders in the information store.
acllistref	Verifies the access control list reference counts.	Number of folders in the information store.
allacltests	Combines the acllist, acllistref, and aclitemref tests.	(See description for each subtest).
allfoldertests	Combines the folder, fldsub, and search tests.	(See description for each subtest).
alltests	Combines ALL of the tests indicated in this table	
artidx (public store only)	Tests the consistency of the NNTP article index.	Number of NNTP messages and folders.
attach	Validates properties for all attachments.	Number of attachments in the information store.
attachref	Validates attachment reference counts.	Number of messages and attachments in the information store.
deleteextracolumns	Deletes all cached indexes and some extra columns.	Number of folders in the information store.
delfld	Examines deleted folders, validates properties, and accumulates reference counts.	Number of deleted folders and number of messages in each folder.
dumpsterref	Combines the msgref and msgsoftref tests. Also checks the item count of recoverable items and the size of the recoverable items available for Deleted Item Recovery.	(See description for msgref and msgsoftref.)
dumpsterprops	Runs the dumpsterref test and validates the presence of some required columns in the folder table.	(See description for dumpsterref.)



ISINTEG Tests

fldrcv (private store only)	Validates counts of special system folders, including Restrictions, Categorization, Inbox, Outbox, SentMail, Deleted Items, Finder, Views, Common Views, Schedule, and ShortCuts.	Number of mailboxes and folders in the information store.
fldsub	Validates the number of child folders and number of recoverable child folders available for Deleted Item Recovery.	Number of folders in the information store.
folder	Examines folder tables and validates properties. Also examines message tables, validates properties, and accumulates reference counts.	Number of folders and messages in the information store.
mailbox (private store only)	For each mailbox, examines folders, deleted folders, and tables. Also validates properties, special folders (for example, Inbox, Outbox, Sent Items, Deleted Items, and others) in the folder table, and checks the respective sizes.	Number of mailboxes, folders, deleted folders, and messages in the information store.
message	Examines message tables and validates message table properties.	Number of messages in the information store.
morefld	Checks the search links (subset of the search test). In Fix mode, deletes all of the cached categorization and restriction tables.	Total number of cached categorization and total number of restriction tables.
msgref	Validates message reference counts in the messages.	Number of folders, messages, and attachments in the information store.
msgsoftref	Validates message reference counts for messages marked for Deleted Item Recovery in the message table.	Number of folders and messages in the information store.
namedprop	Examines the folder, message, and attachment tables, and also validates the named properties.	Number of folders, messages, and attachments in the information store.
newsfeed (public store only)	Validates newsfeed table properties, including permissions.	Number of folders in the information store.
newsfeedref (public store only)	Validates newsfeed reference counts.	Number of folders in the information store.
oofhist (private store only)	Validates out-of-office history information for all users.	Number of out-of-office rules set.

ISINTEG Tests

peruser	Validates per user read / unread information.	Number of folders per user in the information store
rcvfld (private store only)	Cross-checks receive folders with the folder table.	Number of receive folders in the information store.
rowcounts	Validates the number of rows for all tables.	Number of folders, messages, and attachments in the information store.
search	Validates the search links.	Number of folders in the information store.
timedev	Counts the number of timed events (maintenance, periodic tasks, and so forth).	Number of timed events.

Microsoft Exchange Error Numbers

This information can be obtained by running the ERROR.EXE program located on the Microsoft Exchange CD in `\support\utils\i386`.

For example, to learn what Error 200 means, run the following:

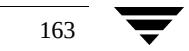
```
D:\server\support\utils\i386\error 200
```

```
Error 200 (0 x C8) = wrnBFNotSynchronous
```

The following is a list of the ESE97 error codes, including Error Number (in Decimal and Hex), Error Message, Description (from source code comments), and Decimal Equivalent.

SUCCESS

Decimal:	**0**
Hex:	0x00000000
Error Message:	JET_errSuccess
Description:	/* Successful Operation */
Decimal from Hex:	ERRORS */



Decimal: **-1**

Hex: 0xFFFFFFFF

Error Message: JET_wrnNyi

Description: /* Function Not Yet Implemented */

Decimal from Hex: 4294967295

SYSTEM errors

Decimal: **-100**

Hex: 0xFFFFFF9C

Error Message: JET_errRfsFailure

Description: /* JET_errRfsFailure */

Decimal from Hex: 4294967196

Decimal: **-101**

Hex: 0xFFFFFF9B

Error Message: JET_errRfsNotArmed

Description: /* JET_errRfsFailure */

Decimal from Hex: 4294967195

Decimal: **-102**

Hex: 0xFFFFFF9A

Error Message: JET_errFileClose

Description: /* Could not close DOS file */

Decimal from Hex: 4294967194

Decimal: **-103**

Hex: 0xFFFFFF99

Error Message: JET_errOutOfThreads

Description: /* Could not start thread */

Decimal from Hex: 4294967193

Decimal: **-105**

Hex: 0xFFFFFF97

Error Message: JET_errTooManyIO

Description: /* System busy due to too many IOs */

Decimal from Hex: 4294967191

BUFFER MANAGER errors

Decimal: **200**

Hex: 0x000000C8

Error Message: wrnBFCacheMiss

Description: /* page latch caused a cache miss */

Decimal from Hex: 200

Decimal: **-201**

Hex: 0xFFFFFF37

Error Message: errBFPageNotCached

Description: /* page is not cached */

Decimal from Hex: 4294967095

Decimal: **-202**

Hex: 0xFFFFFF36

Error Message: errBFLatchConflict

Description: /* page latch conflict */

Decimal from Hex: 4294967094

Decimal: **-250**

Hex: 0xFFFFFF06

Error Message: errBFIPageEvicted

Description: /* page evicted from the cache */

Decimal from Hex: 4294967046

Decimal:	**-251**
Hex:	0xFFFFFF05
Error Message:	errBFIPageCached
Description:	/* page already cached */
Decimal from Hex:	4294967045

Decimal:	**-252**
Hex:	0xFFFFFF04
Error Message:	errBFIOutOfOLPs
Description:	/* out of OLPs */
Decimal from Hex:	4294967044

Decimal:	**-253**
Hex:	0xFFFFFF03
Error Message:	errBFIOutOfBatchIOBuffers
Description:	/* out of Batch I/O Buffers */
Decimal from Hex:	4294967043

Decimal:	**-254**
Hex:	0xFFFFFF02
Error Message:	errBFINoBufferAvailable
Description:	/* no buffer available for immediate use */
Decimal from Hex:	4294967042

Decimal:	**-255**
Hex:	0xFFFFFF01
Error Message:	JET_errDatabaseBufferDependenciesCorrupted
Description:	// buffer dependencies were improperly set
Decimal from Hex:	4294967041

VERSION STORE errors

Decimal: **275**

Hex: 0x00000113

Error Message: wrnVERRCEMoved

Description: /* RCE was moved instead of being cleaned */

Decimal from Hex: 275

DIRECTORY MANAGER errors

Decimal: **-300**

Hex: 0xFFFFFED4

Error Message: errPMOutOfPageSpace

Description: /* Out of page space */

Decimal from Hex: 4294966996

Decimal: **-301**

Hex: 0xFFFFFED3

Error Message: errPMItagTooBig

Description: /* Itag too big */ // XXX -- to be deleted

Decimal from Hex: 4294966995

Decimal: **-302**

Hex: 0xFFFFFED2

Error Message: errPMRecDeleted

Description: /* Record deleted */ // XXX -- to be deleted

Decimal from Hex: 4294966994

Decimal: **-303**

Hex: 0xFFFFFED1

Error Message: errPMTagsUsedUp

Description: /* Tags used up */ // XXX -- to be deleted

Decimal from Hex: 4294966993

Decimal: **304**
Hex: 0x00000130
Error Message: wrnBMConflict
Description: /* conflict in BM Clean up */
Decimal from Hex: 304

Decimal: **-305**
Hex: 0xFFFFFECF
Error Message: errDIRNoShortCircuit
Description: /* No Short Circuit Avail */
Decimal from Hex: 4294966991

Decimal: **-306**
Hex: 0xFFFFFECE
Error Message: errDIRCannotSplit
Description: /* Cannot horizontally split FDP */
Decimal from Hex: 4294966990

Decimal: **-307**
Hex: 0xFFFFFECD
Error Message: errDIRTop
Description: /* Cannot go up */
Decimal from Hex: 4294966989

Decimal: **308**
Hex: 0x00000134
Error Message: errDIRFDP
Description: /* On an FDP Node */
Decimal from Hex: 308

Decimal: **-309**

Hex: 0xFFFFFECB

Error Message: errDIRNotSynchronous

Description: /* May have left critical section */

Decimal from Hex: 4294966987

Decimal: **310**

Hex: 0x00000136

Error Message: wrnDIREmptyPage

Description: /* Moved through empty page */

Decimal from Hex: 310

Decimal: **-311**

Hex: 0xFFFFFEC9

Error Message: errSPConflict

Description: /* Device extent being extended */

Decimal from Hex: 4294966985

Decimal: **312**

Hex: 0x00000138

Error Message: wrnNDFoundLess

Description: /* Found Less */

Decimal from Hex: 312

Decimal: **313**

Hex: 0x00000139

Error Message: wrnNDFoundGreater

Description: /* Found Greater */

Decimal from Hex: 313

Decimal:	**314**
Hex:	0x0000013A
Error Message:	wrnNDNotFoundInPage
Description:	/* for smart refresh */
Decimal from Hex:	314

Decimal:	**-312**
Hex:	0xFFFFFEC8
Error Message:	errNDNotFound
Description:	/* Not found */
Decimal from Hex:	4294966984

Decimal:	**-314**
Hex:	0xFFFFFEC6
Error Message:	errNDOutSonRange
Description:	/* Son out of range */
Decimal from Hex:	4294966982

Decimal:	**-315**
Hex:	0xFFFFFEC5
Error Message:	errNDOutItemRange
Description:	/* Item out of range */
Decimal from Hex:	4294966981

Decimal:	**-316**
Hex:	0xFFFFFEC4
Error Message:	errNDGreaterThanAllItems
Description:	/* Greater than all items */
Decimal from Hex:	4294966980

Decimal: **-317**

Hex: 0xFFFFFEC3

Error Message: errNDLastItemNode

Description: /* Last node of item list */

Decimal from Hex: 4294966979

Decimal: **-318**

Hex: 0xFFFFFEC2

Error Message: errNDFirstItemNode

Description: /* First node of item list */

Decimal from Hex: 4294966978

Decimal: **319**

Hex: 0x0000013F

Error Message: wrnNDDuplicateItem

Description: /* Duplicated Item */

Decimal from Hex: 319

Decimal: **-320**

Hex: 0xFFFFFEC0

Error Message: errNDNoItem

Description: /* Item not there */

Decimal from Hex: 4294966976

Decimal: **321**

Hex: 0x00000141

Error Message: JET_wrnRemainingVersions

Description: /* Some versions couldn't be cleaned */

Decimal from Hex: 321

Decimal: **-322**

Hex: 0xFFFFFEBE

Error Message: JET_errPreviousVersion

Description: /* Version already existed */

Decimal from Hex: 4294966974

Decimal: **-323**

Hex: 0xFFFFFEBD

Error Message: JET_errPageBoundary

Description: /* Reached Page Boundary */

Decimal from Hex: 4294966973

Decimal: **-324**

Hex: 0xFFFFFEBC

Error Message: JET_errKeyBoundary

Description: /* Reached Key Boundary */

Decimal from Hex: 4294966972

Decimal: **-325**

Hex: 0xFFFFFEBB

Error Message: errDIRInPageFather

Description: /* sridFather in page to free */

Decimal from Hex: 4294966971

Decimal: **-326**

Hex: 0xFFFFFEBA

Error Message: errBMMaxKeyInPage

Description: /* used by OLC to avoid cleanup of parent pages */

Decimal from Hex: 4294966970

Decimal: **-327**

Hex: 0xFFFFFEB9

Error Message: JET_errBadPageLink

Description: /* next/previous page link page does not point back to source */

Decimal from Hex: 4294966969

Decimal: **-328**

Hex: 0xFFFFFEB8

Error Message: JET_errBadBookmark

Description: /* bookmark has no corresponding address in database */

Decimal from Hex: 4294966968

Decimal: **329**

Hex: 0x00000149

Error Message: wrnBMCleanNullOp

Description: // BMClean returns this on encountering a page

Decimal from Hex: 329

Description: // deleted MaxKeyInPage [but there was no conflict]

Decimal: **-330**

Hex: 0xFFFFFEB6

Error Message: errBTOperNone

Description: // Split with no accompanying

Decimal from Hex: 4294966966

Description: // insert/replace

Decimal: **-331**

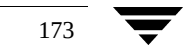
Hex: 0xFFFFFEB5

Error Message: errSPOutOfAvailExtCacheSpace

Description: // unable to make update to AvailExt tree since

Decimal from Hex: 4294966965

Description: // in-cursor space cache is depleted



Decimal:	**-332**
Hex:	0xFFFFFEB4
Error Message:	errSPOutOfOwnExtCacheSpace
Description:	/ / unable to make update to OwnExt tree since
Decimal from Hex:	4294966964
Description:	/ / in-cursor space cache is depleted
Decimal:	**333**
Hex:	0x0000014D
Error Message:	wrnBTMultipageOLC
Description:	/ / needs multipage OLC operation
Decimal from Hex:	333
Decimal:	**-334**
Hex:	0xFFFFFEB2
Error Message:	JET_errNTSystemCallFailed
Description:	/ / can not get OS version
Decimal from Hex:	4294966962
Decimal:	**335**
Hex:	0x0000014F
Error Message:	wrnBTShallowTree
Description:	/ / BTree is only one or two levels deeps
Decimal from Hex:	335
Decimal:	**-336**
Hex:	0xFFFFFEB0
Error Message:	errBTMergeNotSynchronous
Description:	/ / Multiple threads attempting to perform merge / split on same page (likely OLD vs. RCEClean)
Decimal from Hex:	4294966960

RECORD MANAGER errors

Decimal: **400**
Hex: 0x00000190
Error Message: wrnFLDKeyTooBig
Description: /* Key too big (truncated it) */
Decimal from Hex: 400

Decimal: **-401**
Hex: 0xFFFFFE6F
Error Message: errFLDTooManySegments
Description: /* Too many key segments */
Decimal from Hex: 4294966895

Decimal: **402**
Hex: 0x00000192
Error Message: wrnFLDNullKey
Description: /* Key is entirely NULL */
Decimal from Hex: 402

Decimal: **403**
Hex: 0x00000193
Error Message: wrnFLDOutOfKeys
Description: /* No more keys to extract */
Decimal from Hex: 403

Decimal: **404**
Hex: 0x00000194
Error Message: wrnFLDNullSeg
Description: /* Null segment in key */
Decimal from Hex: 404

Decimal: **405**

Hex: 0x00000195

Error Message: wrnFLDNotPresentInIndex

Decimal from Hex: 405

Decimal: **406**

Hex: 0x00000196

Error Message: JET_wrnSeparateLongValue

Description: /* Separated long value */

Decimal from Hex: 406

Decimal: **407**

Hex: 0x00000197

Error Message: wrnRECLongField

Description: /* Separated long value */

Decimal from Hex: 407

Error Message: JET_wrnRecordFoundGreater

Error Message: JET_wrnRecordFoundLess

Error Message: JET_errColumnIllegalNull

Decimal: **408**

Hex: 0x00000198

Error Message: wrnFLDNullFirstSeg

Description: /* Null first segment in key */

Decimal from Hex: 408

Decimal: **-408**

Hex: 0xFFFFFE68

Error Message: JET_errKeyTooBig

Description: /* Key with column truncation still truncated */

Decimal from Hex: 4294966888

Description: /* LOGGING/RECOVERY errors

Decimal: **-500**

Hex: 0xFFFFFE0C

Error Message: JET_errInvalidLoggedOperation

Description: /* Logged operation cannot be redone */

Decimal from Hex: 4294966796

Decimal: **-501**

Hex: 0xFFFFFE0B

Error Message: JET_errLogFileCorrupt

Description: /* Log file is corrupt */

Decimal from Hex: 4294966795

Decimal: **-502**

Hex: 0xFFFFFE0A

Error Message: errLGNoMoreRecords

Description: /* Last log record read */

Decimal from Hex: 4294966794

Decimal: **-503**

Hex: 0xFFFFFE09

Error Message: JET_errNoBackupDirectory

Description: /* No backup directory given */

Decimal from Hex: 4294966793

Decimal: **-504**

Hex: 0xFFFFFE08

Error Message: JET_errBackupDirectoryNotEmpty

Description: /* The backup directory is not empty */

Decimal from Hex: 4294966792

Decimal: **-505**

Hex: 0xFFFFFE07

Error Message: JET_errBackupInProgress

Description: /* Backup is active already */

Decimal from Hex: 4294966791

Decimal: **-506**

Hex: 0xFFFFFE06

Error Message: JET_errRestoreInProgress

Description: /* Restore in progress */

Decimal from Hex: 4294966790

Decimal: **-509**

Hex: 0xFFFFFE03

Error Message: JET_errMissingPreviousLogFile

Description: /* Missing the log file for check point */

Decimal from Hex: 4294966787

Decimal: **-510**

Hex: 0xFFFFFE02

Error Message: JET_errLogWriteFail

Description: /* Fail when writing to log file */

Decimal from Hex: 4294966786

Decimal: **-514**

Hex: 0xFFFFFDFE

Error Message: JET_errBadLogVersion

Description: /* Version of log file is not compatible with Jet version */

Decimal from Hex: 4294966782

Decimal: **-515**

Hex: 0xFFFFFDFD

Error Message: JET_errInvalidLogSequence

Description: /* Timestamp in next log does not match expected */

Decimal from Hex: 4294966781

Decimal: **-516**

Hex: 0xFFFFFDFC

Error Message: JET_errLoggingDisabled

Description: /* Log is not active */

Decimal from Hex: 4294966780

Decimal: **-517**

Hex: 0xFFFFFDFB

Error Message: JET_errLogBufferTooSmall

Description: /* Log buffer is too small for recovery */

Decimal from Hex: 4294966779

Decimal: **-518**

Hex: 0xFFFFFDFA

Description: errLGNotSynchronous

Description: /* retry to LGLogRec */

Decimal from Hex: 4294966778

Decimal: **-519**

Hex: 0xFFFFFDF9

Error Message: JET_errLogSequenceEnd

Description: /* Exceed maximum log file number */

Decimal from Hex: 4294966777

Decimal:	**-520**
Hex:	0xFFFFFDF8
Error Message:	JET_errNoBackup
Description:	/* No backup in progress */
Decimal from Hex:	4294966776

Decimal:	**-521**
Hex:	0xFFFFFDF7
Error Message:	JET_errInvalidBackupSequence
Description:	/* Backup call out of sequence */
Decimal from Hex:	4294966775

Decimal:	**-523**
Hex:	0xFFFFFDF5
Error Message:	JET_errBackupNotAllowedYet
Description:	/* Can not do backup now */
Decimal from Hex:	4294966773

Decimal:	**-524**
Hex:	0xFFFFFDF4
Error Message:	JET_errDeleteBackupFileFail
Description:	/* Could not delete backup file */
Decimal from Hex:	4294966772

Decimal:	**-525**
Hex:	0xFFFFFDF3
Error Message:	JET_errMakeBackupDirectoryFail
Description:	/* Could not make backup temp directory */
Decimal from Hex:	4294966771

Decimal: **-526**

Hex: 0xFFFFFDF2

Error Message: JET_errInvalidBackup

Description: /* Cannot incremental backup when circular logging enabled */

Decimal from Hex: 4294966770

Decimal: **-527**

Hex: 0xFFFFFDF1

Error Message: JET_errRecoveredWithErrors

Description: /* For repair, restored with errors */

Decimal from Hex: 4294966769

Decimal: **-528**

Hex: 0xFFFFFDF0

Error Message: JET_errMissingLogFile

Description: /* current log file missing */

Decimal from Hex: 4294966768

Decimal: **-529**

Hex: 0xFFFFFDEF

Error Message: JET_errLogDiskFull

Description: /* log disk full */

Decimal from Hex: 4294966767

Decimal: **-530**

Hex: 0xFFFFFDEE

Error Message: JET_errBadLogSignature

Description: /* bad signature for a log file */

Decimal from Hex: 4294966766

Decimal:	**-531**
Hex:	0xFFFFFDED
Error Message:	JET_errBadDbSignature
Description:	/* bad signature for a db file */
Decimal from Hex:	4294966765

Decimal:	**-532**
Hex:	0xFFFFFDEC
Error Message:	JET_errBadCheckpointSignature
Description:	/* bad signature for a checkpoint file */
Decimal from Hex:	4294966764

Decimal:	**-533**
Hex:	0xFFFFFDEB
Error Message:	JET_errCheckpointCorrupt
Description:	/* checkpoint file not found or corrupt */
Decimal from Hex:	4294966763

Decimal:	**-534**
Hex:	0xFFFFFDEA
Error Message:	JET_errMissingPatchPage
Description:	/* patch file page not found during recovery */
Decimal from Hex:	4294966762

Decimal:	**-535**
Hex:	0xFFFFFDE9
Error Message:	JET_errBadPatchPage
Description:	/* patch file page is not valid */
Decimal from Hex:	4294966761

Decimal:	**-536**
Hex:	0xFFFFFDE8
Error Message:	JET_errRedoAbruptEnded
Description:	/* Redo abruptly ended due to sudden failure in reading logs from log file */
Decimal from Hex:	4294966760

Decimal:	**-550**
Hex:	0xFFFFFDDA
Error Message:	JET_errDatabaseInconsistent
Description:	/* database is in inconsistent state */
Decimal from Hex:	4294966746

Decimal:	**-551**
Hex:	0xFFFFFDD9
Error Message:	JET_errConsistentTimeMismatch
Description:	/* database last consistent time unmatched */
Decimal from Hex:	4294966745

Decimal:	**-552**
Hex:	0xFFFFFDD8
Error Message:	JET_errDatabasePatchFileMismatch
Description:	/* patch file is not generated from this backup */
Decimal from Hex:	4294966744

Decimal:	**-553**
Hex:	0xFFFFFDD7
Error Message:	JET_errEndingRestoreLogTooLow
Description:	/* the starting log number too low for the restore */
Decimal from Hex:	4294966743

Decimal:	**-554**
Hex:	0xFFFFFDD6
Error Message:	JET_errStartingRestoreLogTooHigh
Description:	/* the starting log number too high for the restore */
Decimal from Hex:	4294966742

Decimal:	**-555**
Hex:	0xFFFFFDD5
Error Message:	JET_errGivenLogFileHasBadSignature
Description:	/* Restore log file has bad signature */
Decimal from Hex:	4294966741

Decimal:	**-556**
Hex:	0xFFFFFDD4
Error Message:	JET_errGivenLogFileIsNotContiguous
Description:	/* Restore log file is not contiguous */
Decimal from Hex:	4294966740

Decimal:	**-557**
Hex:	0xFFFFFDD3
Error Message:	JET_errMissingRestoreLogFiles
Description:	/* Some restore log files are missing */
Decimal from Hex:	4294966739

Decimal:	**558**
Hex:	0x0000022E
Error Message:	JET_wrnExistingLogFileHasBadSignature
Description:	/* Existing log file has bad signature */
Decimal from Hex:	558

Decimal:	**559**
Hex:	0x0000022F
Error Message:	JET_wrnExistingLogFileIsNotContiguous
Description:	/* Existing log file is not contiguous */
Decimal from Hex:	559

Decimal:	**-560**
Hex:	0xFFFFFDD0
Error Message:	JET_errMissingFullBackup
Description:	/* The database miss a previous full backup befor incremental backup */
Decimal from Hex:	4294966736

Decimal:	**-561**
Hex:	0xFFFFFDCF
Error Message:	JET_errBadBackupDatabaseSize
Description:	/* The backup database size is not in 4k */
Decimal from Hex:	4294966735

Decimal:	**-562**
Hex:	0xFFFFFDCE
Error Message:	JET_errDatabaseAlreadyUpgraded
Description:	/* Attempted to upgrade a database that is already current */
Decimal from Hex:	4294966734

Decimal:	**-563**
Hex:	0xFFFFFDCD
Error Message:	JET_errDatabaseIncompleteUpgrade
Description:	/* Attempted to use a database which was only partially converted to the current format -- must restore from backup */
Decimal from Hex:	4294966733

Decimal: **564**

Hex: 0x00000234

Error Message: JET_wrnSkipThisRecord

Description: /* Skip this record, used by convert, internal only */

Decimal from Hex: 564

Decimal: **-900**

Hex: 0xFFFFFC7C

Error Message: JET_errInvalidGrbit

Description: /* Grbit is not valid in the context of this API call */

Decimal from Hex: 4294966396

Decimal: **-1000**

Hex: 0xFFFFFC18

Error Message: JET_errTermInProgress

Description: /* Termination in progress */

Decimal from Hex: 4294966296

Decimal: **-1001**

Hex: 0xFFFFFC17

Error Message: JET_errFeatureNotAvailable

Description: /* API not supported */

Decimal from Hex: 4294966295

Decimal: **-1002**

Hex: 0xFFFFFC16

Error Message: JET_errInvalidName

Description: /* Invalid name */

Decimal from Hex: 4294966294

Decimal: **-1003**

Hex: 0xFFFFFC15

Error Message: JET_errInvalidParameter

Description: /* Invalid API parameter */

Decimal from Hex: 4294966293

Decimal: **1004**

Hex: 0x000003EC

Error Message: JET_wrnColumnNull

Description: /* Column is NULL-valued */

Decimal from Hex: 1004

Decimal: **1006**

Hex: 0x000003EE

Error Message: JET_wrnBufferTruncated

Description: /* Buffer too small for data */

Decimal from Hex: 1006

Decimal: **1007**

Hex: 0x000003EF

Error Message: JET_wrnDatabaseAttached

Description: /* Database is already attached */

Decimal from Hex: 1007

Decimal: **-1008**

Hex: 0xFFFFFC10

Error Message: JET_errDatabaseFileReadOnly

Description: /* Attach a readonly database file for read/write operations */

Decimal from Hex: 4294966288

Decimal: **1009**

Hex: 0x000003F1

Error Message: JET_wrnSortOverflow

Description: /* Sort does not fit in memory */

Decimal from Hex: 1009

Decimal: **-1010**

Hex: 0xFFFFFC0E

Error Message: JET_errInvalidDatabaseId

Description: /* Invalid database id */

Decimal from Hex: 4294966286

Decimal: **-1011**

Hex: 0xFFFFFC0D

Error Message: JET_errOutOfMemory

Description: /* Out of Memory */

Decimal from Hex: 4294966285

Decimal: **-1012**

Hex: 0xFFFFFC0C

Error Message: JET_errOutOfDatabaseSpace

Description: /* Maximum database size reached */

Decimal from Hex: 4294966284

Decimal: **-1013**

Hex: 0xFFFFFC0B

Error Message: JET_errOutOfCursors

Description: /* Out of table cursors */

Decimal from Hex: 4294966283

Decimal: **-1014**

Hex: 0xFFFFFC0A

Error Message: JET_errOutOfBuffers

Description: /* Out of database page buffers */

Decimal from Hex: 4294966282

Decimal: **-1015**

Hex: 0xFFFFFC09

Error Message: JET_errTooManyIndexes

Description: /* Too many indexes */

Decimal from Hex: 4294966281

Decimal: **-1016**

Hex: 0xFFFFFC08

Error Message: JET_errTooManyKeys

Description: /* Too many columns in an index */

Decimal from Hex: 4294966280

Decimal: **-1017**

Hex: 0xFFFFFC07

Error Message: JET_errRecordDeleted

Description: /* Record has been deleted */

Decimal from Hex: 4294966279

Decimal: **-1018**

Hex: 0xFFFFFC06

Error Message: JET_errReadVerifyFailure

Description: /* Read verification error */

Decimal from Hex: 4294966278

Decimal: **-1019**
Hex: 0xFFFFFC05
Error Message: JET_errPageNotInitialized
Description: /* Repair Only: Read an unused page */
Decimal from Hex: 4294966277

Decimal: **-1020**
Hex: 0xFFFFFC04
Error Message: JET_errOutOfFileHandles
Description: /* Out of file handles */
Decimal from Hex: 4294966276

Decimal: **-1022**
Hex: 0xFFFFFC02
Error Message: JET_errDiskIO
Description: /* Disk IO error */
Decimal from Hex: 4294966274

Decimal: **-1023**
Hex: 0xFFFFFC01
Error Message: JET_errInvalidPath
Description: /* Invalid file path */
Decimal from Hex: 4294966273

Decimal: **-1024**
Hex: 0xFFFFFC00
Error Message: JET_errInvalidSystemPath
Description: /* Invalid system path */
Decimal from Hex: 4294966272

Decimal: **-1025**

Hex: 0xFFFFFBFF

Error Message: JET_errInvalidLogDirectory

Description: /* Invalid log directory */

Decimal from Hex: 4294966271

Decimal: **-1026**

Hex: 0xFFFFFBFE

Error Message: JET_errRecordTooBig

Description: /* Record larger than maximum size */

Decimal from Hex: 4294966270

Decimal: **-1027**

Hex: 0xFFFFFBFD

Error Message: JET_errTooManyOpenDatabases

Description: /* Too many open databases */

Decimal from Hex: 4294966269

Decimal: **-1028**

Hex: 0xFFFFFBFC

Error Message: JET_errInvalidDatabase

Description: /* Not a database file */

Decimal from Hex: 4294966268

Decimal: **-1029**

Hex: 0xFFFFFBFB

Error Message: JET_errNotInitialized

Description: /* JetInit not yet called */

Decimal from Hex: 4294966267

Decimal: **-1030**

Hex: 0xFFFFFBFA

Error Message: JET_errAlreadyInitialized

Description: /* JetInit already called */

Decimal from Hex: 4294966266

Decimal: **-1031**

Hex: 0xFFFFFBF9

Error Message: JET_errInitInProgress

Description: /* JetInit is underway */

Decimal from Hex: 4294966265

Decimal: **-1032**

Hex: 0xFFFFFBF8

Error Message: JET_errFileAccessDenied

Description: /* Cannot access file */

Decimal from Hex: 4294966264

Decimal: **-1034**

Hex: 0xFFFFFBF6

Error Message: JET_errQueryNotSupported

Description: /* Query support unavailable */ // XXX -- to be deleted

Decimal from Hex: 4294966262

Decimal: **-1035**

Hex: 0xFFFFFBF5

Error Message: JET_errSQLLinkNotSupported

Description: /* SQL Link support unavailable */ // XXX -- to be deleted

Decimal from Hex: 4294966261

Decimal: **-1038**

Hex: 0xFFFFFBF2

Error Message: JET_errBufferTooSmall

Description: /* Buffer is too small */

Decimal from Hex: 4294966258

Decimal: **1039**

Hex: 0x0000040F

Error Message: JET_wrnSeekNotEqual

Description: /* SeekLE or SeekGE didn't find exact match */

Decimal from Hex: 1039

Decimal: **-1040**

Hex: 0xFFFFFBF0

Error Message: JET_errTooManyColumns

Description: /* Too many columns defined */

Decimal from Hex: 4294966256

Decimal: **-1043**

Hex: 0xFFFFFBED

Error Message: JET_errContainerNotEmpty

Description: /* Container is not empty */

Decimal from Hex: 4294966253

Decimal: **-1044**

Hex: 0xFFFFFBEC

Error Message: JET_errInvalidFilename

Description: /* Filename is invalid */

Decimal from Hex: 4294966252

Decimal: **-1045**

Hex: 0xFFFFFBEB

Error Message: JET_errInvalidBookmark

Description: /* Invalid bookmark */

Decimal from Hex: 4294966251

Decimal: **-1046**

Hex: 0xFFFFFBEA

Error Message: JET_errColumnInUse

Description: /* Column used in an index */

Decimal from Hex: 4294966250

Decimal: **-1047**

Hex: 0xFFFFFBE9

Error Message: JET_errInvalidBufferSize

Description: /* Data buffer doesn't match column size */

Decimal from Hex: 4294966249

Decimal: **-1048**

Hex: 0xFFFFFBE8

Error Message: JET_errColumnNotUpdatable

Description: /* Cannot set column value */

Decimal from Hex: 4294966248

Decimal: **-1051**

Hex: 0xFFFFFBE5

Error Message: JET_errIndexInUse

Description: /* Index is in use */

Decimal from Hex: 4294966245

Decimal: **-1052**

Hex: 0xFFFFFBE4

Error Message: JET_errLinkNotSupported

Description: /* Link support unavailable */

Decimal from Hex: 4294966244

Decimal: **-1053**

Hex: 0xFFFFFBE3

Error Message: JET_errNullKeyDisallowed

Description: /* Null keys are disallowed on index */

Decimal from Hex: 4294966243

Decimal: **-1054**

Hex: 0xFFFFFBE2

Error Message: JET_errNotInTransaction

Description: /* Operation must be within a transaction */

Decimal from Hex: 4294966242

Decimal: **1055**

Hex: 0x0000041F

Error Message: JET_wrnNoErrorInfo

Description: /* No extended error information */

Decimal from Hex: 1055

Decimal: **1058**

Hex: 0x00000422

Error Message: JET_wrnNoIdleActivity

Description: /* No idle activity occured */

Decimal from Hex: 1058

Decimal: **-1059**
Hex: 0xFFFFFBDD
Error Message: JET_errTooManyActiveUsers
Description: /* Too many active database users */
Decimal from Hex: 4294966237

Decimal: **-1061**
Hex: 0xFFFFFBDB
Error Message: JET_errInvalidCountry
Description: /* Invalid or unknown country code */
Decimal from Hex: 4294966235

Decimal: **-1062**
Hex: 0xFFFFFBDA
Error Message: JET_errInvalidLanguageId
Description: /* Invalid or unknown language id */
Decimal from Hex: 4294966234

Decimal: **-1063**
Hex: 0xFFFFFBD9
Error Message: JET_errInvalidCodePage
Description: /* Invalid or unknown code page */
Decimal from Hex: 4294966233

Decimal: **1067**
Hex: 0x0000042B
Error Message: JET_wrnNoWriteLock
Description: /* No write lock at transaction level 0 */
Decimal from Hex: 1067

Decimal: **1068**

Hex: 0x0000042C

Error Message: JET_wrnColumnSetNull

Description: /* Column set to NULL-value */

Decimal from Hex: 1068

Decimal: **-1069**

Hex: 0xFFFFFBD3

Error Message: JET_errVersionStoreOutOfMemory

Description: /* lMaxVerPages exceeded (XJET only) */

Decimal from Hex: 4294966227

Decimal: **-1070**

Hex: 0xFFFFFBD2

Error Message: JET_errCurrencyStackOutOfMemory

Description: /* lCSRPerfFUCB * lMaxCursors exceeded (XJET only) */

Decimal from Hex: 4294966226

Decimal: **-1071**

Hex: 0xFFFFFBD1

Error Message: JET_errCannotIndex

Description: /* Cannot index escrow column */

Decimal from Hex: 4294966225

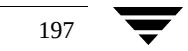
Decimal: **-1072**

Hex: 0xFFFFFBD0

Error Message: JET_errRecordNotDeleted

Description: /* Record has not been deleted */

Decimal from Hex: 4294966224



Decimal: **-1101**
Hex: 0xFFFFFBB3
Error Message: JET_errOutOfSessions
Description: /* Out of sessions */
Decimal from Hex: 4294966195

Decimal: **-1102**
Hex: 0xFFFFFBB2
Error Message: JET_errWriteConflict
Description: /* Write lock failed due to outstanding write lock */
Decimal from Hex: 4294966194

Decimal: **-1103**
Hex: 0xFFFFFBB1
Error Message: JET_errTransTooDeep
Description: /* Xactions nested too deeply */
Decimal from Hex: 4294966193

Decimal: **-1104**
Hex: 0xFFFFFBB0
Error Message: JET_errInvalidSesid
Description: /* Invalid session handle */
Decimal from Hex: 4294966192

Decimal: **-1105**
Hex: 0xFFFFFBAF
Error Message: JET_errWriteConflictPrimaryIndex
Description: /* update attempted on uncommitted primary index */
Decimal from Hex: 4294966191

Decimal:	**-1108**
Hex:	0xFFFFFBAC
Error Message:	JET_errInTransaction
Description:	/* Operation not allowed within a transaction */
Decimal from Hex:	4294966188

Decimal:	**-1109**
Hex:	0xFFFFFBAB
Error Message:	JET_errRollbackRequired
Description:	/* Must rollback current transaction -- cannot commit or begin a new one */
Decimal from Hex:	4294966187

Decimal:	**-1201**
Hex:	0xFFFFFB4F
Error Message:	JET_errDatabaseDuplicate
Description:	/* Database already exists */
Decimal from Hex:	4294966095

Decimal:	**-1202**
Hex:	0xFFFFFB4E
Error Message:	JET_errDatabaseInUse
Description:	/* Database in use */
Decimal from Hex:	4294966094

Decimal:	**-1203**
Hex:	0xFFFFFB4D
Error Message:	JET_errDatabaseNotFound
Description:	/* No such database */
Decimal from Hex:	4294966093

Decimal:	**-1204**
Hex:	0xFFFFFB4C
Error Message:	JET_errDatabaseInvalidName
Description:	/* Invalid database name */
Decimal from Hex:	4294966092

Decimal:	**-1205**
Hex:	0xFFFFFB4B
Error Message:	JET_errDatabaseInvalidPages
Description:	/* Invalid number of pages */
Decimal from Hex:	4294966091

Decimal:	**-1206**
Hex:	0xFFFFFB4A
Error Message:	JET_errDatabaseCorrupted
Description:	/* non-db file or corrupted db */
Decimal from Hex:	4294966090

Decimal:	**-1207**
Hex:	0xFFFFFB49
Error Message:	JET_errDatabaseLocked
Description:	/* Database exclusively locked */
Decimal from Hex:	4294966089

Decimal:	**-1208**
Hex:	0xFFFFFB48
Error Message:	JET_errCannotDisableVersioning
Description:	/* Cannot disable versioning for this database */
Decimal from Hex:	4294966088

Decimal: **-1209**

Hex: 0xFFFFFB47

Error Message: JET_errInvalidDatabaseVersion

Description: /* Database engine is incompatible with database */

Decimal from Hex: 4294966087

Decimal: **-1210**

Hex: 0xFFFFFB46

Error Message: JET_errDatabase200Format

Description: /* The database is in 200 format */

Decimal from Hex: 4294966086

Decimal: **-1211**

Hex: 0xFFFFFB45

Error Message: JET_errDatabase400Format

Description: /* The database is in 400 format */

Decimal from Hex: 4294966085

Decimal: **-1212**

Hex: 0xFFFFFB44

Error Message: JET_errDatabase500Format

Description: /* The database is in 500 format */

Decimal from Hex: 4294966084

Decimal: **1301**

Hex: 0x00000515

Error Message: JET_wrnTableEmpty

Description: /* Open an empty table */

Decimal from Hex: 1301

Decimal:	**-1302**
Hex:	0xFFFFFAEA
Error Message:	JET_errTableLocked
Description:	/* Table is exclusively locked */
Decimal from Hex:	4294965994

Decimal:	**-1303**
Hex:	0xFFFFFAE9
Error Message:	JET_errTableDuplicate
Description:	/* Table already exists */
Decimal from Hex:	4294965993

Decimal:	**-1304**
Hex:	0xFFFFFAE8
Error Message:	JET_errTableInUse
Description:	/* Table is in use, cannot lock */
Decimal from Hex:	4294965992

Decimal:	**-1305**
Hex:	0xFFFFFAE7
Error Message:	JET_errObjectNotFound
Description:	/* No such table or object */
Decimal from Hex:	4294965991

Decimal:	**-1307**
Hex:	0xFFFFFAE5
Error Message:	JET_errDensityInvalid
Description:	/* Bad file/index density */
Decimal from Hex:	4294965989

Decimal: **-1308**

Hex: 0xFFFFFAE4

Error Message: JET_errTableNotEmpty

Description: /* Cannot define clustered index */

Decimal from Hex: 4294965988

Decimal: **-1310**

Hex: 0xFFFFFAE2

Error Message: JET_errInvalidTableId

Description: /* Invalid table id */

Decimal from Hex: 4294965986

Decimal: **-1311**

Hex: 0xFFFFFAE1

Error Message: JET_errTooManyOpenTables

Description: /* Cannot open any more tables (cleanup already attempted) */

Decimal from Hex: 4294965985

Decimal: **-1312**

Hex: 0xFFFFFAE0

Error Message: JET_errIllegalOperation

Description: /* Oper. not supported on table */

Decimal from Hex: 4294965984

Decimal: **-1314**

Hex: 0xFFFFFADE

Error Message: JET_errObjectDuplicate

Description: /* Table or object name in use */

Decimal from Hex: 4294965982

Decimal:	**-1316**
Hex:	0xFFFFFADC
Error Message:	JET_errInvalidObject
Description:	/* object is invalid for operation */
Decimal from Hex:	4294965980

Decimal:	**-1317**
Hex:	0xFFFFFADB
Error Message:	JET_errCannotDeleteTempTable
Description:	/* use CloseTable instead of DeleteTable to delete temp table */
Decimal from Hex:	4294965979

Decimal:	**-1318**
Hex:	0xFFFFFADA
Error Message:	JET_errCannotDeleteSystemTable
Description:	/* illegal attempt to delete a system table */
Decimal from Hex:	4294965978

Decimal:	**-1319**
Hex:	0xFFFFFAD9
Error Message:	JET_errCannotDeleteTemplateTable
Description:	/* illegal attempt to delete a template table */
Decimal from Hex:	4294965977

Decimal:	**-1320**
Hex:	0xFFFFFAD8
Error Message:	errFCBTooManyOpen
Description:	/* Cannot open any more FCB's (cleanup not yet attempted) */
Decimal from Hex:	4294965976

Decimal:	**-1321**
Hex:	0xFFFFFAD7
Error Message:	errFCBAboveThreshold
Description:	/* Can only allocate FCB above preferred threshold (cleanup not yet attempted) */
Decimal from Hex:	4294965975

Decimal:	**-1322**
Hex:	0xFFFFFAD6
Error Message:	JET_errExclusiveTableLockRequired
Description:	/* Must have exclusive lock on table. */
Decimal from Hex:	4294965974

Decimal:	**-1323**
Hex:	0xFFFFFAD5
Error Message:	JET_errFixedDDL
Description:	/* DDL operations prohibited on this table */
Decimal from Hex:	4294965973

Decimal:	**-1324**
Hex:	0xFFFFFAD4
Error Message:	JET_errFixedInheritedDDL
Description:	/* On a derived table, DDL operations are prohibited on inherited portion of DDL */
Decimal from Hex:	4294965972

Decimal:	**-1325**
Hex:	0xFFFFFAD3
Error Message:	JET_errCannotNestDDL
Description:	/* Nesting of hierarchical DDL is not currently supported. */
Decimal from Hex:	4294965971

Decimal:	**-1326**
Hex:	0xFFFFFAD2
Error Message:	JET_errDDLNotInheritable
Description:	/* Tried to inherit DDL from a table not marked as a template table. */
Decimal from Hex:	4294965970

Decimal:	**1327**
Hex:	0x0000052F
Error Message:	JET_wrnTableInUseBySystem
Description:	/* System cleanup has a cursor open on the table */
Decimal from Hex:	1327

Decimal:	**-1328**
Hex:	0xFFFFFAD0
Error Message:	JET_errInvalidSettings
Description:	/* System parameter were set improperly */
Decimal from Hex:	4294965968

Decimal:	**-1329**
Hex:	0xFFFFFACF
Error Message:	JET_errClientRequestToStopJetService
Description:	/* Client has requested stop service */
Decimal from Hex:	4294965967

Decimal:	**-1401**
Hex:	0xFFFFFA87
Error Message:	JET_errIndexCantBuild
Description:	/* Index build failed */
Decimal from Hex:	4294965895

Decimal: **-1402**

Hex: 0xFFFFFA86

Error Message: JET_errIndexHasPrimary

Description: /* Primary index already defined */

Decimal from Hex: 4294965894

Decimal: **-1403**

Hex: 0xFFFFFA85

Error Message: JET_errIndexDuplicate

Description: /* Index is already defined */

Decimal from Hex: 4294965893

Decimal: **-1404**

Hex: 0xFFFFFA84

Error Message: JET_errIndexNotFound

Description: /* No such index */

Decimal from Hex: 4294965892

Decimal: **-1405**

Hex: 0xFFFFFA83

Error Message: JET_errIndexMustStay

Description: /* Cannot delete clustered index */

Decimal from Hex: 4294965891

Decimal: **-1406**

Hex: 0xFFFFFA82

Error Message: JET_errIndexInvalidDef

Description: /* Illegal index definition */

Decimal from Hex: 4294965890

Decimal:	**-1409**
Hex:	0xFFFFFA7F
Error Message:	JET_errInvalidCreateIndex
Description:	/* Invalid create index description */
Decimal from Hex:	4294965887

Decimal:	**-1410**
Hex:	0xFFFFFA7E
Error Message:	JET_errTooManyOpenIndexes
Description:	/* Out of index description blocks */
Decimal from Hex:	4294965886

Decimal:	**-1411**
Hex:	0xFFFFFA7D
Error Message:	JET_errMultiValuedIndexViolation
Description:	/* -unique inter-record index keys generated for a multivalued index */
Decimal from Hex:	4294965885

Decimal:	**-1412**
Hex:	0xFFFFFA7C
Error Message:	JET_errIndexBuildCorrupted
Description:	/* Failed to build a secondary index that properly reflects primary index */
Decimal from Hex:	4294965884

Decimal:	**-1413**
Hex:	0xFFFFFA7B
Error Message:	JET_errPrimaryIndexCorrupted
Description:	/* Primary index is corrupt -- defrag required */
Decimal from Hex:	4294965883

Decimal: **-1414**

Hex: 0xFFFFFA7A

Error Message: JET_errSecondaryIndexCorrupted

Description: /* Secondary index is corrupt -- defrag required */

Decimal from Hex: 4294965882

Decimal: **1415**

Hex: 0x00000587

Error Message: JET_wrnCorruptIndexDeleted

Description: /* Out of date index of the attached db is removed */

Decimal from Hex: 1415

Decimal: **-1501**

Hex: 0xFFFFFA23

Error Message: JET_errColumnLong

Description: /* Column value is long */

Decimal from Hex: 4294965795

Decimal: **-1502**

Hex: 0xFFFFFA22

Error Message: JET_errColumnNoChunk

Description: /* no such chunk in long value */

Decimal from Hex: 4294965794

Decimal: **-1503**

Hex: 0xFFFFFA21

Error Message: JET_errColumnDoesNotFit

Description: /* Field will not fit in record */

Decimal from Hex: 4294965793

Decimal: **-1504**

Hex: 0xFFFFFA20

Error Message: JET_errNullInvalid

Description: /* Null not valid */

Decimal from Hex: 4294965792

Decimal: **-1505**

Hex: 0xFFFFFA1F

Error Message: JET_errColumnIndexed

Description: /* Column indexed, cannot delete */

Decimal from Hex: 4294965791

Decimal: **-1506**

Hex: 0xFFFFFA1E

Error Message: JET_errColumnTooBig

Description: /* Field length is > maximum */

Decimal from Hex: 4294965790

Decimal: **-1507**

Hex: 0xFFFFFA1D

Error Message: JET_errColumnNotFound

Description: /* No such column */

Decimal from Hex: 4294965789

Decimal: **-1508**

Hex: 0xFFFFFA1C

Error Message: JET_errColumnDuplicate

Description: /* Field is already defined */

Decimal from Hex: 4294965788

Decimal: **-1510**

Hex: 0xFFFFFA1A

Error Message: JET_errColumnRedundant

Description: /* Second autoincrement or version column */

Decimal from Hex: 4294965786

Decimal: **-1511**

Hex: 0xFFFFFA19

Error Message: JET_errInvalidColumnType

Description: /* Invalid column data type */

Decimal from Hex: 4294965785

Decimal: **1512**

Hex: 0x000005E8

Error Message: JET_wrnColumnMaxTruncated

Description: /* Max length too big, truncated */

Decimal from Hex: 1512

Decimal: **-1514**

Hex: 0xFFFFFA16

Error Message: JET_errTaggedNotNULL

Description: /* No non-NULL tagged columns */

Decimal from Hex: 4294965782

Decimal: **-1515**

Hex: 0xFFFFFA15

Error Message: JET_errNoCurrentIndex

Description: /* Invalid w/o a current index */

Decimal from Hex: 4294965781

Decimal: **-1516**

Hex: 0xFFFFFA14

Error Message: JET_errKeyIsMade

Description: /* The key is completely made */

Decimal from Hex: 4294965780

Decimal: **-1517**

Hex: 0xFFFFFA13

Error Message: JET_errBadColumnId

Description: /* Column Id Incorrect */

Decimal from Hex: 4294965779

Decimal: **-1518**

Hex: 0xFFFFFA12

Error Message: JET_errBadItagSequence

Description: /* Bad itagSequence for tagged column */

Decimal from Hex: 4294965778

Decimal: **-1519**

Hex: 0xFFFFFA11

Error Message: JET_errColumnInRelationship

Description: /* Cannot delete, column participates in relationship */

Decimal from Hex: 4294965777

Decimal: **1520**

Hex: 0x000005F0

Error Message: JET_wrnCopyLongValue

Description: /* Single instance column bursted */

Decimal from Hex: 1520

Decimal:	**-1521**
Hex:	0xFFFFFA0F
Error Message:	JET_errCannotBeTagged
Description:	/* AutoIncrement and Version cannot be tagged */
Decimal from Hex:	4294965775

Decimal:	**1522**
Hex:	0x000005F2
Error Message:	wrnLVNoLongValues
Description:	/* Table does not have a long value tree */
Decimal from Hex:	1522

Decimal:	**1523**
Hex:	0x000005F3
Error Message:	JET_wrnTaggedColumnsRemaining
Description:	/* RetrieveTaggedColumnList ran out of copy buffer before retrieving all tagged columns */
Decimal from Hex:	1523

Decimal:	**-1524**
Hex:	0xFFFFFA0C
Error Message:	JET_errDefaultValueTooBig
Description:	/* Default value exceeds maximum size */
Decimal from Hex:	4294965772

Decimal:	**-1601**
Hex:	0xFFFFF9BF
Error Message:	JET_errRecordNotFound
Description:	/* The key was not found */
Decimal from Hex:	4294965695

Decimal: **-1602**

Hex: 0xFFFFF9BE

Error Message: JET_errRecordNoCopy

Description: /* No working buffer */

Decimal from Hex: 4294965694

Decimal: **-1603**

Hex: 0xFFFFF9BD

Error Message: JET_errNoCurrentRecord

Description: /* Currency not on a record */

Decimal from Hex: 4294965693

Decimal: **-1604**

Hex: 0xFFFFF9BC

Error Message: JET_errRecordPrimaryChanged

Description: /* Primary key may not change */

Decimal from Hex: 4294965692

Decimal: **-1605**

Hex: 0xFFFFF9BB

Error Message: JET_errKeyDuplicate

Description: /* Illegal duplicate key */

Decimal from Hex: 4294965691

Decimal: **-1607**

Hex: 0xFFFFF9B9

Error Message: JET_errAlreadyPrepared

Description: /* Already copy/clear current */

Decimal from Hex: 4294965689

Decimal: **-1608**

Hex: 0xFFFFF9B8

Error Message: JET_errKeyNotMade

Description: /* No call to JetMakeKey */

Decimal from Hex: 4294965688

Decimal: **-1609**

Hex: 0xFFFFF9B7

Error Message: JET_errUpdateNotPrepared

Description: /* No call to JetPrepareUpdate */

Decimal from Hex: 4294965687

Decimal: **1610**

Hex: 0x0000064A

Error Message: JET_wrnDataHasChanged

Description: /* Data has changed */

Decimal from Hex: 1610

Decimal: **-1611**

Hex: 0xFFFFF9B5

Error Message: JET_errDataHasChanged

Description: /* Data has changed, operation aborted */

Decimal from Hex: 4294965685

Decimal: **1618**

Hex: 0x00000652

Error Message: JET_wrnKeyChanged

Description: /* Moved to new key */

Decimal from Hex: 1618

Decimal:	**-1619**
Hex:	0xFFFFF9AD
Error Message:	JET_errLanguageNotSupported
Description:	/* WindowsNT installation does not support language */
Decimal from Hex:	4294965677

Decimal:	**-1701**
Hex:	0xFFFFF95B
Error Message:	JET_errTooManySorts
Description:	/* Too many sort processes */
Decimal from Hex:	4294965595

Decimal:	**-1702**
Hex:	0xFFFFF95A
Error Message:	JET_errInvalidOnSort
Description:	/* Invalid operation on Sort */
Decimal from Hex:	4294965594

Decimal:	**-1803**
Hex:	0xFFFFF8F5
Error Message:	JET_errTempFileOpenError
Description:	/* Temp file could not be opened */
Decimal from Hex:	4294965493

Decimal:	**-1805**
Hex:	0xFFFFF8F3
Error Message:	JET_errTooManyAttachedDatabases
Description:	/* Too many open databases */
Decimal from Hex:	4294965491

Decimal: **-1808**

Hex: 0xFFFFF8F0

Error Message: JET_errDiskFull

Description: /* No space left on disk */

Decimal from Hex: 4294965488

Decimal: **-1809**

Hex: 0xFFFFF8EF

Error Message: JET_errPermissionDenied

Description: /* Permission denied */

Decimal from Hex: 4294965487

Decimal: **-1811**

Hex: 0xFFFFF8ED

Error Message: JET_errFileNotFound

Description: /* File not found */

Decimal from Hex: 4294965485

Decimal: **1813**

Hex: 0x00000715

Error Message: JET_wrnFileOpenReadOnly

Description: /* Database file is read only */

Decimal from Hex: 1813

Decimal: **-1850**

Hex: 0xFFFFF8C6

Error Message: JET_errAfterInitialization

Description: /* Cannot Restore after init. */

Decimal from Hex: 4294965446

Decimal:	**-1852**
Hex:	0xFFFFF8C4
Error Message:	JET_errLogCorrupted
Description:	/* Logs could not be interpreted */
Decimal from Hex:	4294965444

Decimal:	**-1906**
Hex:	0xFFFFF88E
Error Message:	JET_errInvalidOperation
Description:	/* invalid operation */
Decimal from Hex:	4294965390

Decimal:	**-1907**
Hex:	0xFFFFF88D
Error Message:	JET_errAccessDenied
Description:	/* access denied */
Decimal from Hex:	4294965389

Decimal:	**1908**
Hex:	0x00000774
Error Message:	JET_wrnIdleFull
Description:	/* ilde registry full */
Decimal from Hex:	1908

Decimal:	**-1909**
Hex:	0xFFFFF88B
Error Message:	JET_errTooManySplits
Description:	/* Infinite split. Call PSS */
Decimal from Hex:	4294965387

Decimal:	**-1910**
Hex:	0xFFFFF88A
Error Message:	JET_errSessionSharingViolation
Description:	/* Multiple threads are using the same session */
Decimal from Hex:	4294965386

Decimal:	**-1911**
Hex:	0xFFFFF889
Error Message:	JET_errEntryPointNotFound
Description:	/* An entry point in a DLL we require could not be found */
Decimal from Hex:	4294965385

Decimal:	**2000**
Hex:	0x000007D0
Error Message:	JET_wrnDefragAlreadyRunning
Description:	/* Online defrag already running on specified database */
Decimal from Hex:	2000

Decimal:	**2001**
Hex:	0x000007D1
Error Message:	JET_wrnDefragNotRunning
Description:	/* Online defrag not running on specified database */
Decimal from Hex:	2001

Sample Server Configuration Worksheets B

Use the worksheets in this chapter when preparing a disaster recovery kit. Refer to “Create a Disaster Recovery Kit” on page 116 for additional information that should be included in such a kit.

Hardware

Computer Model	
Display Model	
S / N	
BackPlane	
CPU	
Hard Disk(s)	
Floppy Disk	
RAM	
NIC	
SCSI® Card	
CDROM	
Tape Backup	

Windows Installation

Windows Server Version:	
Windows Server Role:	
Domain Name:	
Computer Name:	
Install Directory:	
Swap File:	
Protocols	
Disk Configuration:	
Licensing	
Printer	
Special Groups	
This Machine IP	
Subnet Mask	
Default Gateway	

Microsoft Exchange Server Installation

Org Name	
Site Name	
Computer Name	
Service Account	
Service Account Password	
Connectors	

Microsoft Exchange Performance Optimizer

This is important during recovery to ensure that the recovery server is tuned properly. Hardware being equal, similar performance can be experienced following a full restore where Microsoft Exchange is reinstalled to a recovery server. Note that the performance optimizer log stored in `c:\winnt35\system32\perfopt.log` does not reveal the specific settings that were chosen during optimization.

Server Name: _____

1-25		Private Store		Less than 100		____MB
26-50		Public Store		100-999		
51-100		Connector / Directory Import		1,000-9,999		
101-250		Multi-Server		10,000 - 99,999		
251-500				100,000 or more		
More than 500						

Private Information Store	F:\exchsrvr\mdbdata
Public Information Store	F:\exchsrvr\mdbdata
Information Store Logs	E:\exchsrvr\mdbdata
Directory Service	F:\exchsrvr\dsadata
Directory Service Logs	E:\exchsrvr\dsadata
Message Transfer Agent	F:\exchsrvr\mtadata
Directory Store Working Path	D:\exchsrvr\dsadata
Information Store Working Path	D:\exchsrvr\mdbdata
Internet Mail Connector Files	\exchsrvr\imcdata

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