

Symantec NetBackup™ for VMware Administrator's Guide

Release 7.5

Symantec NetBackup™ for VMware Guide

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Introduction

This chapter includes the following topics:

- [About NetBackup for VMware](#)
- [NetBackup for VMware components](#)
- [Media servers as backup or discovery hosts](#)
- [Overview of the VMware backup process](#)
- [NetBackup for VMware license requirement](#)
- [NetBackup for VMware terminology](#)

About NetBackup for VMware

NetBackup for VMware provides backup and restore of the VMware virtual machines that run on VMware ESX servers. NetBackup for VMware takes advantage of VMware vStorage APIs for data protection. The backup process is off-loaded from the ESX server to a VMware backup host.

NetBackup for VMware does the following:

- Performs off-host backup of virtual machines (NetBackup client software is not required on the virtual machine). Off-host backup reduces the backup processing load on the VMware host.
- Increases the backup speed as compared to standard file-order backup methods, if the virtual machine is heavily populated with small files.
- Automatically creates quiesced snapshots using VSS (Windows only). Creates quiesced snapshots on Linux if the SYMCquiesce utility is installed.
- Uses snapshot technology to keep virtual machines 100% available to users.
- Supports VMware vSphere.

- Performs full backups and incremental backups, including block-level incrementals.
- Backs up the full virtual machine.
- Backs up the virtual machines even when they are turned off.
- Can restore selected files from the backup.

New features for VMware in NetBackup 7.5

The following features are new in NetBackup 7.5:

- Streamlined policy configuration for VMware
NetBackup includes a VMware policy type that simplifies policy configuration. Backup options for VMware are now combined on a new VMware policy tab. See [“Upgrade guidelines for the new VMware policy type”](#) on page 15.
The new VMware policy type uses vStorage to perform the backup (not VCB). Support for VCB-based backups is still available for NetBackup 7.1 or earlier clients by means of the FlashBackup-Windows policy type. See [“Support for VCB in NetBackup 7.5”](#) on page 16.
If you upgrade to 7.5 from an earlier NetBackup release and do not use VCB, you should convert your policies to the new VMware type. You can use the `nbplupgrade` command (see next item).
- New command (`nbplupgrade`) to convert a batch of policies from earlier 7.x to 7.5.
For details, see the `nbplupgrade` man page in the *NetBackup Commands Reference Guide*.
- Backup media server
NetBackup supports the use of a Windows media server as the backup host or discovery host. This feature can provide host redundancy and faster backups. See [“Media servers as backup or discovery hosts”](#) on page 20.
- Extended capabilities for the Virtual Machine Intelligent Policy
For automatic selection of virtual machines for backup, the policy's Query Builder adds several new datastore and network keywords for filtering virtual machines. These keywords provide better integration with NFS and cloud environments. See [“Query Builder field reference”](#) on page 94.
- The Host Properties Resource Limits dialog adds several resource types for datastore. See [“Setting global limits on the use of VMware resources”](#) on page 44.
- NetBackup can send backup related events to the vCenter server.

- See “[Viewing NetBackup activity in vSphere Client](#)” on page 119.
- Support for vSphere version 5, including datastore clusters and Storage DRS affinity rules.
See “[Query Builder field reference](#)” on page 94.
See “[Virtual Machine Options dialog box](#)” on page 132.
 - Application Aware VMware Backup
During virtual machine backup, NetBackup can map the database files that reside in the virtual machine. This feature enables recovery of individual database files from the backup. This feature supports Microsoft Exchange Server, SQL Server, and SharePoint Server.
See “[About the virtual machine backups that include database data](#)” on page 16.
See “[Application protection options \(VMware\)](#)” on page 56.
For details on restoring database files from a virtual machine backup, refer to the NetBackup database agent guide for your application.
 - Extended support for restore of individual files from Linux virtual machine backups
Supports ext4 file systems for individual file recovery.
Details are available in the following tech note:
<http://www.symantec.com/docs/TECH127089>

Upgrade guidelines for the new VMware policy type

Note these guidelines for upgrading to the 7.5 VMware policy type:

- For VCB backups with the ESX servers that are older than 3.5 U2:
 - The FlashBackup-Windows policy is required.
 - The VCB backup host (NetBackup Windows client) must be a pre-7.5 version, for example 7.1.0.x.
See “[Support for VCB in NetBackup 7.5](#)” on page 16.
- To use the new VMware policy type, all master servers, media servers, and clients must be upgraded to 7.5.
- Do not convert any FlashBackup-Windows policies until you have verified that the current policies work correctly with 7.5.
FlashBackup-Windows policies can be converted in either of the following ways:
 - The NetBackup Administration Console policy editor, by changing the policy type to VMware.

- The `nbplupgrade` CLI can be used to convert policies in a batch. For details, see `nbplupgrade` in the *NetBackup Commands Reference Guide*.

Support for VCB in NetBackup 7.5

For NetBackup 7.5 environments (master server, media server, and backup host all at 7.5), VCB backups are not supported. VCB backups are supported only when the backup host (NetBackup client) is 7.1 or earlier. For VCB-based backups with 7.1 or earlier backup hosts, you can use the FlashBackup-Windows policy type as described in the *NetBackup for VMware Administrator's Guide*, version 7.1 or 7.0.

VCB restores are still supported for 7.5 clients, but will be discontinued in a future release.

NetBackup will discontinue all VCB support in a future release. Upgrading to vStorage is recommended.

File-level backup of Windows virtual machines

NetBackup 7.5 backs up the entire VMware virtual machine as virtual disk files. The backup includes all data files as well as operating system files and VMware virtual disk files. From the backup, you can recover the guest OS and the entire virtual machine. Depending on the type of backup and the guest OS file system type, you can also recover individual files from the same backup.

NetBackup 7.5 environments (master server, media server, and backup host all at 7.5) do not support file-level backup of Windows virtual machines. Windows file-level backup of a VMware virtual machine requires VCB. VCB is supported only for 7.1 and earlier backup hosts (clients).

To use VCB to back up individual Windows files, the backup host must contain a NetBackup client at 7.1 or earlier. For more information on Windows file-level backup, refer to the 7.0 or 7.1 version of the *NetBackup for VMware Administrator's Guide*.

About the virtual machine backups that include database data

When NetBackup backs up a VMware virtual machine, database data in the virtual machine is backed up with the rest of the virtual machine. A new feature in NetBackup 7.5 allows the recovery of individual database files from the backup. This feature supports Microsoft Exchange Server, SQL Server, and SharePoint Server.

Note the following:

- To enable restore of individual database files, a NetBackup Windows client must be installed in the virtual machine during the backup.
- NetBackup uses Windows Volume Shadow Copy Service (VSS) to quiesce the database before it creates a snapshot of the virtual machine.
- A full backup is performed of the database data with each backup job, even if the policy schedule is incremental.

See [“Application protection options \(VMware\)”](#) on page 56.

Features for VMware added in NetBackup 7.1

The following features were added in NetBackup 7.1:

- **Virtual Machine Intelligent Policy**
NetBackup can automatically select virtual machines for backup by means of filtering rules in the policy. The policy **Clients** tab includes a Query Builder for creating the rules. Requires vStorage.
See [“About automatic virtual machine selection for NetBackup for VMware”](#) on page 72.
- **Limits on NetBackup use of virtual resources**
You can limit the number of simultaneous backups that NetBackup performs on VMware resources, such as vCenter servers or datastores. Applies only to policies that use automatic selection of virtual machines.
See [“Setting global limits on the use of VMware resources”](#) on page 44.
- In addition to host name, VMware display name, or UUID, NetBackup can now back up virtual machines by their DNS host name.
- The Browse for Virtual Machines screen allows manual selection of virtual machines within VMware clusters and vApps.
- Restore of individual files from Linux virtual machine backups.
See [“NetBackup for VMware: notes on Linux virtual machines”](#) on page 34.

NetBackup for VMware components

[Table 1-1](#) describes the components that NetBackup for VMware uses.

Table 1-1 Components of NetBackup for VMware

Component	Description
Backup host	<p>NetBackup for VMware uses a special Windows host that is called a VMware backup host (formerly called the VMware backup proxy server). The backup host is a NetBackup client that performs backups on behalf of the virtual machines. The backup host must have access to the datastores of the virtual machines.</p> <p>The backup host is the only host on which NetBackup client software is installed. No NetBackup client software is required on the VMware virtual machines.</p> <p>Note that the backup host is referred to as the recovery host when it performs a restore.</p> <p>The backup host can be configured in either of the following ways:</p> <ul style="list-style-type: none"> ■ As a NetBackup Windows client with a connection to separate master and media servers. The master servers and media servers can be Windows, UNIX, or Linux. ■ Or, the NetBackup Windows client and a Windows master and media server can all reside on the same backup host. In this case, all NetBackup components (servers and client) must be Windows.
Discovery host	<p>Used for the automatic selection of virtual machines for backup. This host discovers virtual machines and filters them by means of the selection rules in the policy Query Builder. The resulting list determines which virtual machines are backed up.</p> <p>The discovery host can be on any platform that NetBackup supports for master or media servers. It can also be the same host as the backup host.</p> <p>You specify this host on the policy Clients tab: Click Select automatically through query, then NetBackup host to perform automatic virtual machine selection.</p>
Backup media server	<p>A Windows media server that can operate as the backup host.</p> <p>See “Media servers as backup or discovery hosts” on page 20.</p>
NetBackup client	<p>Installed on the backup host (Windows).</p>
NetBackup master server	<p>Manages the backups of virtual machines, by means of the NetBackup client that is installed on the backup host.</p>
NetBackup media server	<p>Performs the backups to storage on behalf of the NetBackup client.</p>
Virtual machine	<p>Virtual machines provide complete guest operating systems on virtualized hardware. In a NetBackup policy, a virtual machine is configured as a NetBackup client, even though NetBackup client software is not installed on the virtual machine.</p>
ESX server	<p>The VMware ESX server presents a virtualized hardware environment to multiple virtual machines; each virtual machine runs an independent operating system. Users can run applications in the virtualized OS as if the OS was installed in its own physical computer.</p>

Table 1-1 Components of NetBackup for VMware (continued)

Component	Description
vCenter Server	<p>The VMware vCenter Server (or VirtualCenter server) coordinates multiple ESX servers and workloads. It can migrate virtual machines from one ESX server to another. It also provides the ability to back up the virtual machines that are turned off.</p> <p>The vCenter Server is optional in the NetBackup for VMware environment.</p>
Converter server	<p>For the backups that were made with VCB, the VMware Converter server assists in full virtual machine restores to the ESX server. The Converter must be installed on the same host as the backup host.</p>

Note that the VMware NetBackup Integration Module (VNIM) is not required. Conflicts can occur between NetBackup for VMware policies and any older script-based policies that use VNIM.

Figure 1-1 shows a NetBackup for VMware environment on a local network. The backup host accesses the VMware datastore through the ESX servers.

Figure 1-1 NetBackup for VMware: components on local network

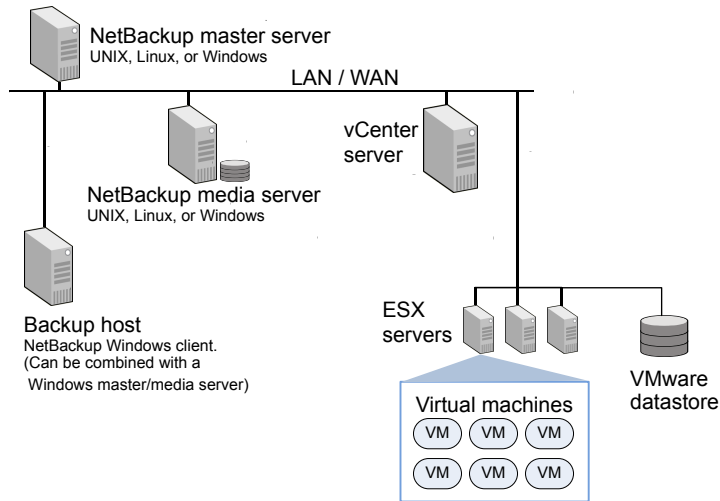
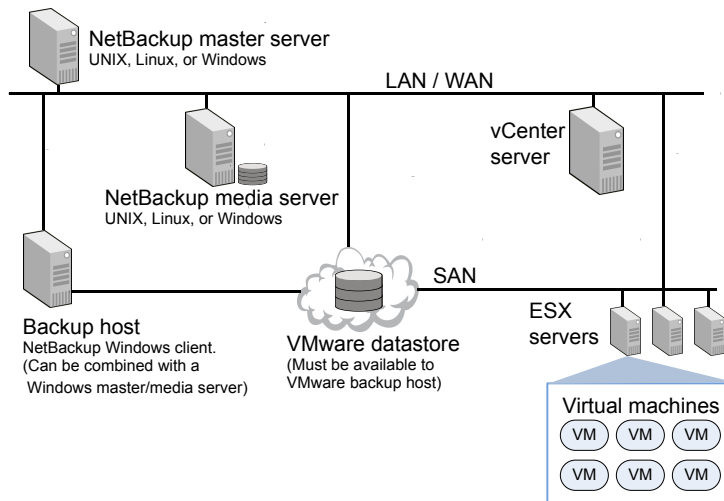


Figure 1-2 shows a NetBackup for VMware environment on a SAN. The backup host accesses the VMware datastore directly over the SAN.

Figure 1-2 NetBackup for VMware: components on SAN

Media servers as backup or discovery hosts

NetBackup for VMware uses a special Windows host that is called a VMware backup host. The backup host is a NetBackup client that performs off-host backups of the virtual machines. The backup host must have access to the datastores of the virtual machines. The backup host reads the data from the datastore and sends it over the network to the media server. The media server backs up the data to storage.

For the policies that automatically select virtual machines, the discovery host filters virtual machines according to the rules in the policy Query Builder. The discovery host returns a list of virtual machines to be selected for backup.

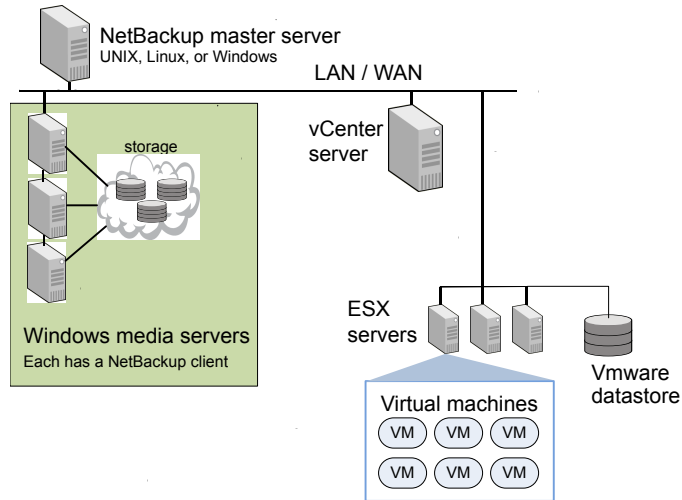
As a new feature in NetBackup 7.5, NetBackup can use media servers as backup hosts and as discovery hosts.

Media servers acting as backup or discovery hosts can provide the following advantages:

- **Host redundancy:** If one media server goes down, another media server takes over.
- **Faster backup:** The media server can read the data from the datastore and send the data straight to the storage device. Without media server access to storage devices, an ordinary backup host must send the backup data over the local network to the media server.

Figure 1-3 shows a group of Windows media servers that can also act as backup or discovery hosts. The media servers can discover virtual machines for automatic selection, and perform off-host backups and send the backup data directly to storage.

Figure 1-3 Windows backup media servers



You can combine the flexibility of backup media servers with a standard feature of NetBackup: storage unit groups. Create a storage unit group that contains the storage units that your Windows media servers can access. Any of the media servers can operate as a backup host.

Note the following requirements:

- To configure media servers as backup hosts: Set the policy **VMware backup host** field on the **VMware** tab to **Backup Media Server**.
See “[VMware backup host selection](#)” on page 52.
- To configure media servers as discovery hosts: Set the policy **NetBackup host to perform automatic virtual machine selection** field on the **Clients** tab to **Backup Media Server**.
See “[Options for selecting VMware virtual machines](#)” on page 78.

Overview of the VMware backup process

The following tables describe the phases in the NetBackup backup process (for vStorage).

Table 1-2 NetBackup backup process with vStorage

Phase	Description
Phase 1	The NetBackup master server initiates the backup.
Phase 2	The NetBackup client on the VMware backup host initiates a VMware snapshot on the virtual machine.
Phase 3	Windows: VSS synchronizes the file system on the virtual machine. Linux: The SYMCquiesce utility can quiesce the file system on supported Linux operating systems. See “About the SYMCquiesce utility” on page 179.
Phase 4	The VMware server creates a snapshot on the virtual disk datastore.
Phase 5	The NetBackup client reads the snapshot from the datastores and writes the data to the NetBackup storage unit.

NetBackup for VMware license requirement

NetBackup for VMware requires an Enterprise Client license for each ESX Server.

To protect an application or database, note: an additional license for the appropriate NetBackup package is needed for each ESX server that hosts the application or database.

NetBackup for VMware terminology

[Table 1-3](#) lists the terminology that is used in NetBackup for VMware.

For further explanations of VMware terminology, refer to your VMware documentation.

Table 1-3 NetBackup for VMware terms

Term	Definition
backup host	<p>The backup host is a NetBackup client that performs backups on behalf of the virtual machines. (This host was formerly known as the VMware backup proxy server.) The backup host is the only host on which NetBackup client software is installed.</p> <p>As an option, the backup host can also be configured as a NetBackup master server or media server.</p> <p>The backup host is referred to as the recovery host when it performs a restore.</p> <p>See “NetBackup for VMware components” on page 17.</p>
backup media server	A media server that operates as a backup host.
datastore	In NetBackup for VMware, the datastore is a disk that contains the virtual machines files.
datastore cluster	A collection of datastores that can be managed as a single unit. VMware Storage DRS manages the storage resources of the cluster.
discovery host	<p>Discovers the virtual machines, filters them according to the rules in the Query Builder, and returns a list of machines to be selected for backup. The discovery host is used only for automatic selection of virtual machines.</p> <p>Can be the same host as the VMware backup host.</p> <p>See “NetBackup for VMware components” on page 17.</p>
guest OS	An operating system that runs on a virtual machine.
hypervisor	A software virtualization layer that lets different operating systems run simultaneously on the same physical computer. The VMware hypervisor is vSphere, which runs on the ESX server host.

Table 1-3 NetBackup for VMware terms (*continued*)

Term	Definition
independent disk	<p>A virtual disk that cannot be captured with a snapshot. An independent disk can be configured as either persistent or temporary.</p> <p>Note: NetBackup for VMware cannot back up the data on an independent disk. The backup succeeds but the backup image contains no data for the independent disk. If you restore the disk from the backup, the independent disk is restored to its original allocation size but contains no data. For example, the Windows swap file can reside on an independent disk, and is consequently not included in the virtual machine backup.</p> <p>To back up the data on an independent disk, install a NetBackup client on the virtual machine.</p> <p>See “NetBackup for VMware: notes and restrictions” on page 32.</p>
query	<p>The combination of rules in the policy’s Query Builder, by which NetBackup selects virtual machines for backup. A query consists of one or more rules.</p>
Query Builder	<p>For creating filtering rules for automatic selection of virtual machines for backup. The Query Builder is on the Clients tab of the NetBackup policy.</p>
query rule	<p>A single statement in a query, by which NetBackup selects virtual machines for backup.</p> <p>An example of a query rule is: <code>Displayname Contains "finance"</code></p>
Raw device mapping (RDM)	<p>Allows a virtual machine to directly access physical disks (on Fibre Channel or iSCSI). RDM allows the OS and applications in the virtual machine to have pass-thru access to raw devices.</p> <p>NetBackup for VMware cannot back up an RDM disk. NetBackup client software must be installed in the virtual machine.</p> <p>See “About VMware raw device mapping (RDM)” on page 173.</p>
recovery host	<p>See backup host.</p>
virtual machine	<p>An execution environment that the hypervisor creates for the computer hardware. The resulting virtualized environment allows different operating systems to run simultaneously on the same physical computer.</p>

Table 1-3 NetBackup for VMware terms (*continued*)

Term	Definition
virtual network	A logical network that allows the exchange of data between virtual machines. A virtual network uses a virtual switch (VMware vSwitch). A virtual network can be connected to a physical network.
vmdk file	In a VMware ESX server, one or more vmdk files make up the disk image or virtual drive in a virtual machine. The .vmdk files contain the operating system, applications, and data in the virtual machine.
VMware Consolidated Backup	An off-host backup application programming interface (API) created by VMware. Designed to off load backups from the ESX server. Supported only on NetBackup 7.1 clients and earlier.
VMware Tools	Installed inside each VMware virtual machine. Enhances the virtual machine performance and adds backup-related functionality.
VMX datastore	Sometimes called the vmx directory or configuration datastore. Contains the configuration files that describe the virtual machine, such as .vmx files. During a backup of a virtual machine snapshot, vmdk writes are also cached on this datastore. Note that a separate vmx datastore is not a VMware requirement.
vStorage	VMware vStorage APIs enable data protection features for more efficient use of storage capacity. NetBackup can use vStorage to back up the latest vSphere environments as well as to back up earlier VMware environments.

Required tasks: overview

This chapter includes the following topics:

- [Overview of VMware tasks](#)
- [Overview of NetBackup tasks](#)

Overview of VMware tasks

The VMware components including ESX servers and virtual machines must be set up before you configure NetBackup.

[Table 2-1](#) briefly describes these VMware-specific tasks; further assistance with these tasks may be found in your VMware documentation.

Table 2-1 VMware tasks

Sequence	Tasks
Phase 1	Set up disk storage on Fibre Channel or iSCSI. The VMware backup host must be able to access the disk storage.
Phase 2	Install the VMware ESX server and virtual machines.
Phase 3	Install VMware Tools on the virtual machines that you plan to back up.
Phase 4	Optional: install a vCenter (or VirtualCenter) server.
Phase 5	For recovery of VCB backups: Install the VMware Converter server on the VMware restore host. The VMware Converter server is not required for vStorage.

Notes:

- Ensure that the hardware and the SAN are configured properly. The VMware datastore where the target virtual machine files exist must be accessible to the VMware backup host.
 Note: A SAN connection between the backup host and the datastore is optional if you use the NBD transfer type or NBDSSL transfer type.
- VMware has specific hardware and configuration requirements. VMware SAN requirements can be found in the appropriate VMware SAN Configuration guide.
- VMware requires that ESX server names resolve to an IP address. Symantec highly recommends the use of DNS for the naming resolution among VMware servers. For DNS configuration instructions for VMware servers, please refer to the following VMware site:
[VMware vSphere Online Library](#)

Overview of NetBackup tasks

Table 2-2 lists the NetBackup configuration tasks for VMware. These tasks are described in other NetBackup topics and guides, as indicated.

Table 2-2 NetBackup tasks

Sequence	Tasks
Phase 1	Install the NetBackup 7.5 master server and media server. See the <i>NetBackup Installation Guide</i> . Symantec recommends that the NetBackup media server and the VMware backup host be installed on the same host.
Phase 2	Install the NetBackup 7.5 Enterprise Client license on the master server, and install NetBackup client 7.5 software on the VMware backup host.
Phase 3	Add the VMware backup host to your NetBackup configuration. See “Adding the VMware backup host to NetBackup” on page 39.
Phase 4	Set NetBackup access credentials for the VMware vCenter or VirtualCenter (if any), or for VMware ESX servers. See “Adding NetBackup credentials for VMware” on page 40.
Phase 5	Create a NetBackup policy for VMware. See “Configuring a VMware policy from the Policies utility” on page 48.

Table 2-2 NetBackup tasks (*continued*)

Sequence	Tasks
Phase 6	Perform a backup or restore. See “Backing up virtual machines” on page 115. See “Restoring individual files” on page 145. See “Restoring the full VMware virtual machine” on page 128.
Phase 7	Recheck the configuration. See “NetBackup for VMware best practices” on page 151. See “NetBackup status codes related to VMware” on page 162.

Notes and prerequisites

This chapter includes the following topics:

- [NetBackup for VMware prerequisites](#)
- [NetBackup for VMware: notes and restrictions](#)
- [NetBackup for VMware: notes on Linux virtual machines](#)
- [NetBackup character restrictions for virtual machine display names](#)
- [Notes on the hotadd transport mode](#)
- [Creating a helper virtual machine for hotadd transport](#)

NetBackup for VMware prerequisites

The following prerequisites apply to NetBackup for VMware:

- The VMware components including ESX servers and virtual machines must be set up before you configure NetBackup.
See [“Overview of VMware tasks”](#) on page 27.
- The VMware backup host must run Windows 2003, 2008, or 2008 R2. The supported hardware types are the same as for any NetBackup Windows client. For further information on supported guest operating systems and VMware components and versions, refer to the following Symantec tech note:
[Support for NetBackup 7.x in virtual environments:](#)
<http://www.symantec.com/docs/TECH127089>
- To use the hotadd transfer type for backup or restore, the VMware backup or restore host is installed in a virtual machine.
For ESX 3.5 and earlier: You must set up a shadow virtual machine that has the same name as the backup host but with the `(VCB-HELPER)` suffix.
See [“Creating a helper virtual machine for hotadd transport”](#) on page 37.

See [“Notes on the hotadd transport mode”](#) on page 35.

NetBackup for VMware: notes and restrictions

Note the following about NetBackup for VMware:

- NetBackup for VMware does not work with the VMware NetBackup Integration Module (VNIM). Conflicts can occur between NetBackup for VMware policies and any older script-based policies that use VNIM.
See [“Notes on troubleshooting NetBackup for VMware”](#) on page 160.
- NetBackup for VMware does not support the NetBackup Instant Recovery feature.
- NetBackup for VMware cannot back up the data on an independent disk, because an independent disk cannot be captured with a snapshot. The backup succeeds but the backup image contains no data for the independent disk.
To back up the data on an independent disk, install a NetBackup client on the virtual machine. You can configure NetBackup to back up the virtual machine and any independent disks as if the client was installed on a physical host. You can restore the virtual machine and then restore the independent disk as a separate job.
- If a Windows virtual machine includes Veritas Storage Foundation volumes, the **Enable file recovery from VM backup** option is not supported.
See [“Volume Manager volumes in the virtual machine”](#) on page 69.
- VMware virtual machine templates are for cloning virtual machines: They cannot be powered on and used as functioning VMs. As a result, VMware has imposed the following restrictions on backup and restore of virtual machine templates:
 - A virtual machine template cannot be captured in a snapshot. A NetBackup backup of the template skips the snapshot portion of the job and backs up the template to the designated storage unit.
 - Block level incremental backup (BLIB) cannot be used when backing up a virtual machine template.
 - A virtual machine template cannot be backed up over a SAN. You must configure the NetBackup policy to use a local network transfer type, such as nbd. Likewise, the restore of a template must be conducted over a local network.

Note: You can use the Query Builder in the NetBackup policy to create rules for automatic selection of virtual machine templates.

- VMware does not support non-ASCII characters in virtual machine display names or in other objects that are associated with the virtual machine. (Examples are annotations, floppy image name, parallel port or serial port file name, and CD-ROM ISO name.) For the complete list of objects that VMware does not support with non-ASCII characters, see the following VMware article: *Troubleshooting errors resulting from non-ASCII names (1003866)*
<http://kb.vmware.com/kb/1003866>
In keeping with VMware's position, NetBackup does not support non-ASCII characters in display names or in other vSphere objects. Symantec recommends that you follow VMware's guidelines in naming vSphere objects.
In addition, NetBackup has its own restrictions on characters in display names. See "[NetBackup character restrictions for virtual machine display names](#)" on page 35.

Note: If the virtual machine display name contains non-ASCII characters, the backup may succeed but the restore fails. To restore the virtual machine, configure a restore to an alternate location. On the **Recovery Options** dialog, change the display name to contain ASCII characters only.

- Several notes and limitations apply to the automatic selection of virtual machines for backup (Virtual Machine Intelligent Policy).
See "[NetBackup requirements for automatic virtual machine selection](#)" on page 77.
- Several notes and limitations apply to Linux virtual machines.
See "[NetBackup for VMware: notes on Linux virtual machines](#)" on page 34.
- For hotadd backup or restore: The virtual machine to back up (or restore) and the virtual machine that contains the hotadd backup host must reside in the same VMware datacenter.
See "[Notes on the hotadd transport mode](#)" on page 35.
- NetBackup for VMware does not support the **Enable file recovery from VM backup** option for the virtual machines that contain encrypted drives. For backups of the virtual machines that contain encrypted drives, disable that option.
- Storage optimization cannot be used if a snapshot exists on the virtual machine when VMware Changed Block Tracking is turned on.
See "[Using VMware's Changed Block Tracking for full backups only](#)" on page 112.
See "[About reducing the size of VMware backups](#)" on page 109.

- If the policy's **Primary VM identifier** option is set to **VM hostname**, note: NetBackup cannot select a VMware virtual machine for backup if it cannot obtain an IP address for the virtual machine.
- See [“Restore notes and restrictions”](#) on page 123.

NetBackup for VMware: notes on Linux virtual machines

The following notes apply to virtual machines with Linux guest operating systems:

- On Linux virtual machines, NetBackup requires a special utility (SYMCquiesce) to quiesce the file system in preparation for taking the snapshot. Without SYMCquiesce, NetBackup cannot guarantee that data in the file system is in a consistent state when the snapshot occurs.
See [“About the SYMCquiesce utility”](#) on page 179.
See [“Installing the SYMCquiesce utility”](#) on page 180.
For the Linux virtual machines that do not have the SYMCquiesce utility: To guarantee that the file system is consistent at the time of backup, consider powering down the virtual machine before the backup. When the virtual machine is powered down, data buffers are flushed to disk and the file system is consistent.
For a description of file system quiesce, see the *NetBackup Snapshot Client Administrator's Guide*.
- If the Linux file system was not quiesced before the snapshot, some files may be inconsistent. Such files can be recovered from the NetBackup.lost+found directory.
See [“About the NetBackup.lost+found directory on Linux”](#) on page 147.
- Unmounted LVM2 volumes must start with /dev
If the path of an unmounted LVM2 volume does not start with /dev, the backup of the virtual machine fails. Note: The path of the volume is set with the "dir" parameter on the LVM volume configuration file. An example of this configuration file is /etc/lvm/lvm.conf.
- For Linux files or directories, NetBackup for VMware has the same path name restriction as NetBackup on a Linux physical host. Files or directories with path names longer than 1023 characters cannot be individually backed up or restored. Such files can be restored when you restore the entire virtual machine from a full virtual machine backup.
- See [“Restore notes and restrictions on Linux”](#) on page 126.

NetBackup character restrictions for virtual machine display names

When VMware virtual machines are included in a NetBackup policy, certain characters are not allowed in the virtual machine display name. These restrictions apply only if the policy **Primary VM identifier** option is set to **VMware display name**.

If the display name contains the wrong characters, the backup may fail.

For NetBackup, the following characters are allowed in virtual machine display names:

- Uppercase and lowercase ASCII characters
- Numbers
- Period (.)
- Hyphen (-)
- Underscore (_)
- Plus sign (+)
- Percent sign (%)
- Left and right parentheses ()
- Spaces

Note: No other characters are allowed.

See [“Primary VM identifier options \(VMware\)”](#) on page 53.

Notes on the hotadd transport mode

NetBackup supports several transport modes for sending snapshot data between the VMware datastore and the VMware backup host during a backup or restore. One of those transport modes (**hotadd**) is used when the VMware backup host is installed in a virtual machine.

Note the following about the hotadd transport mode:

- For a backup or restore, the hotadd transport mode does not support the vmdk files that are larger than 1 TB. If the .vmdk file is larger than 1 TB, the file cannot be mounted.
- The VMware backup host must be installed in a virtual machine.

- For ESX versions 3.5 and earlier: You must configure a shadow (helper) virtual machine before the backup starts. The helper virtual machine must have at least as many SCSI controllers as exist on the virtual machine that you want to back up.
The helper virtual machine is used internally by the VMware VDDK to attach the disks temporarily during hotadd backup or restore.

Note: A helper virtual machine is not required for backups of ESX 4.0 (or later) virtual machines. For earlier ESX versions, a helper virtual machine is required.

See [“Creating a helper virtual machine for hotadd transport”](#) on page 37.

- The following is a VMware requirement: The virtual machine to back up and the virtual machine that contains the hotadd backup host must reside in the same VMware datacenter. The same VMware requirement applies to virtual machine restore: The virtual machine to restore and the virtual machine that contains the hotadd restore host must reside in the same VMware datacenter. For hotadd backup, Symantec recommends at least one hotadd backup host for each datacenter.
- NetBackup does not support IDE disks on the virtual machine.
- On the virtual machine to back up, no two disks should have the same name. (Identical names can occur if the disks reside on different datastores.)
- The ESX server (where the backup-host virtual machine resides) must have access to the datastore of the virtual machines that you want to back up.
- The datastore for the backup-host virtual machine must have some free space before the hotadd backup begins. Otherwise, the backup may fail.
- For additional hotadd information, see the following VMware document: [VDDK 5.0 Release Notes](#)
- The **Enable file recovery from VM backup** option does not work with the hotadd transport mode in the following case: The virtual machine that contains the backup host is a clone of the virtual machine that is backed up (or vice versa). In this case, a backup that uses the hotadd transfer mode may appear to succeed. However, some of the virtual machine volumes may be incorrectly mapped and cannot be restored.
The converse is also true. The virtual machine that you back up with the hotadd transport mode cannot be a clone of the virtual machine that contains the backup host. Furthermore, the two virtual machines must not be clones of the same parent.
VMware has identified this issue as software defect SR#1442259141. To use the hotadd transport mode with your backup, do the following: Make sure the

virtual machine that contains the VMware backup host and the virtual machine you back up are not clones of each other.

Creating a helper virtual machine for hotadd transport

This procedure applies only to ESX versions 3.5 (and earlier) with use of the hotadd transport mode.

To create a helper virtual machine for hotadd backup or restore

- 1 Create a virtual machine.

You do not need to assign any drives to the virtual machine.

- 2 Give the helper virtual machine the same VMware display name as the virtual machine where the backup host is installed. Add the (VCB-HELPER) suffix to the name.

For example, if the virtual machine that contains the backup host is called `bu_host_VM`, the name of the helper virtual machine must be the following:

```
bu_host_VM (VCB-HELPER)
```

Note that the complete name including the suffix must not exceed 32 characters.

- 3 For more information on helper virtual machines, see the following VMware document:

VMware *Virtual Machine Backup Guide* (Update 2 and later for ESX Server 3.5, ESX Server 3i version 3.5, VirtualCenter 2.5).

Configure NetBackup access to VMware

This chapter includes the following topics:

- [Adding the VMware backup host to NetBackup](#)
- [Adding NetBackup credentials for VMware](#)
- [Changing the host name of a VMware server in NetBackup](#)
- [Setting privileges for posting events to vCenter](#)
- [Setting global limits on the use of VMware resources](#)

Adding the VMware backup host to NetBackup

You must add the VMware backup host to your NetBackup configuration.

Note: This procedure is not required for any backup host that is also a master server or media server.

In the NetBackup Administration Console, do the following.

To add the VMware backup host

- 1 Click **Host Properties > Master Servers**, double click the NetBackup master server, and click **VMware Access Hosts**.
- 2 Click **Add**.
- 3 Enter the fully qualified domain name of the VMware backup host, and click **Add**.

- 4 When you are finished adding hosts, click **Close**.
- 5 Click **Apply** and then **OK**.

Adding NetBackup credentials for VMware

To back up or restore virtual machines, the NetBackup server requires logon credentials to the VMware ESX servers or the VMware vCenter servers. In the NetBackup Administration Console, do the following.

To add NetBackup credentials

- 1 Click **Media and Device Management > Credentials > Virtual Machine Servers**.
- 2 Click **Actions > New > New Virtual Machine Server**.
- 3 On the **Add Virtual Machine Server** dialog, enter the name of a virtual machine server (vCenter server or ESX server).

Note: Enter the server name in the same format in which it is registered in DNS and in the VMware server (whether short or fully-qualified).

NetBackup needs access to this server for either of the following reasons:

- To browse the server's virtual machines and back them up.
 - To use the server as a target for restoring virtual machines.
Use the next dialog to identify the type of this server (vCenter, ESX, or ESX for restore only).
- 4 In the **Credentials** pane of the **Virtual Machine Server** dialog, enter the following:

Virtual machine server type

Select the type of VMware server that NetBackup needs to access:

- **VMware Virtual Center server**
Designates a vCenter (or VirtualCenter) server that manages ESX servers. When you create a policy to back up this server's virtual machines, NetBackup can browse this server and list its virtual machines. If the credentials provide full access privileges to the vCenter server, you can restore virtual machines to this server.

Note: Do not enter logon credentials for the individual ESX servers that this vCenter server manages. NetBackup needs credentials for the vCenter only.

■ **VMware ESX Server**

Designates a standalone ESX server that is not managed by a vCenter server. NetBackup can browse the ESX server to present a list of its virtual machines for backup. You can also restore virtual machines to this ESX server. To use the server as a target for restores, enter the credentials that provide full access privileges to the ESX server.

■ **VMware Restore ESX Server**

Designates an ESX server to which NetBackup can restore virtual machines. You must enter the credentials that provide full access privileges to the server.

Note: NetBackup accesses this type of server for restores only, not for backups.

Note: For restore, VMware vStorage cannot communicate with the ESX servers that are earlier than version 3.5 update 2. To restore the virtual machines that were backed up with vStorage: The target ESX server must be 3.5 update 2 or later or must be managed by a vCenter server 2.5 update 1 or later.

The restore ESX server type has the following advantages:

- For large environments with hundreds of hosts, NetBackup may not need full access to the vCenter server. With the restore ESX server type, you can give NetBackup full access to a single ESX server that is dedicated to restore.
- SAN-based restores that go directly to a restore ESX server are faster than restores that go through the vCenter server.

For further information on the restore ESX server, refer to the following Symantec tech note:

<http://www.symantec.com/docs/TECH128513>

User name

Enter the user name for the virtual machine server. Note that spaces in user names are not allowed.

Password

Enter the password (and confirm it) for the virtual machine server.

You can use the **For backup host** pull-down to select a particular backup host for which to validate the credentials. Note that a backup host appears in the pull-down list if it was added to the master server's Host Properties dialog.

See [“Adding the VMware backup host to NetBackup”](#) on page 39.

If **For backup host** is set to <Any> (the default), NetBackup attempts to validate the credentials using each backup host in turn. NetBackup continues checking only until validation succeeds for a particular backup host or the list of backup hosts is exhausted.

During validation: An invalid user name or password is deleted if you have entered it for the first time and you do not select a backup host. If validation fails for any reason, the entry is removed.

If your VMware backup host is running a version of NetBackup that is earlier than 6.5.4, the credentials cannot be validated. An error message is displayed. You must verify that the credentials you entered are correct for the VMware server. If the credentials are correct, you can ignore the error message.

Connect using port number

If the default port number has not been changed on the VMware server, no port specification is required. In that case, make sure that the **Connect using port number** box is not checked.

If the VMware server has been configured to use a different port, click the **Connect using port number** box and specify that port number.

- 5 Click **OK**.
- 6 If your site has multiple standalone ESX servers, use the **Virtual Machine Server** dialog to enter credentials for each ESX server.

See [“Setting global limits on the use of VMware resources”](#) on page 44.

Changing the host name of a VMware server in NetBackup

Use the following procedure if you need to change a VMware server's host name as it is stored in NetBackup.

Example reasons for changing the VMware server name are the following:

- You used a short host name for the server for its NetBackup credentials, and need to replace that name with the fully qualified host name.
- Two hosts currently resolve to the same IP address, and one of them must be renamed and assigned a new IP address.

To change the host name of a VMware host in NetBackup

- 1 Remove the current credentials that were entered for the VMware host.
Do the following:

- In the NetBackup Administration Console, click on **Media and Device Management > Credentials > Virtual Machine Servers**.
 - Right-click on the credentials definition for the VMware server and select **Delete** (or press the Delete key).
- 2 Remove the VMware host from the NetBackup EMM database.
Enter the following command:

```
nbeimmcmd -deletehost -machinename VMware_server_name  
-machinetype virtual_machine
```
 - 3 In the NetBackup Administration Console, re-enter NetBackup's credentials for the VMware server.
See [“Adding NetBackup credentials for VMware”](#) on page 40.
Make sure to enter the correct host name for the VMware server.
See [“Setting global limits on the use of VMware resources”](#) on page 44.

Setting privileges for posting events to vCenter

With the **Post events to vCenter** option, NetBackup can send backup related events to the vCenter server, to view in vSphere Client.

Note the following requirements:

- You must enter the credentials that give NetBackup access to the vCenter server.
See [“Adding NetBackup credentials for VMware”](#) on page 40.
- Make sure that the **Post events to vCenter** option is enabled in the policy.
See [“VMware - Advanced Attributes dialog”](#) on page 57.
- You must set the correct role privileges in vCenter, as explained in this topic.

Note: If your vCenter role is configured for all privileges, you can skip the following procedure.

To set privileges for posting events to vCenter

- 1 Go to the vSphere Client Home page on the vCenter server and click **Roles**.
- 2 Right-click on the role for the vCenter user that was entered for the NetBackup credentials, and click **Edit Role**.
See [“Adding NetBackup credentials for VMware”](#) on page 40.

- 3 In the Edit Role screen, place a check mark on the **Extension** privilege, to include all three extension privileges (Register extension, Unregister extension, Update extension).
- 4 Click **OK**.

Setting global limits on the use of VMware resources

You can use the NetBackup Resource Limit dialog to control the number of simultaneous backups that can be performed on a VMware resource type. The settings apply to all NetBackup policies.

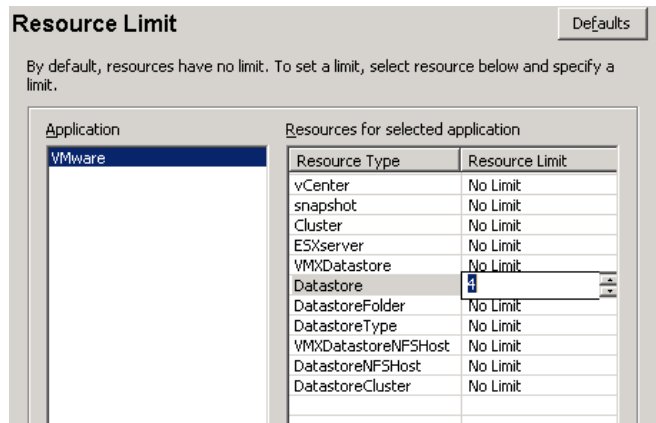
For example, to avoid overloading the ESX server, you can place a limit on the number of concurrent backup jobs per ESX server. To control I/O overhead on the datastore's array, you can limit the number of concurrent backups per datastore.

Note: The Resource Limit screen applies only to policies that use automatic selection of virtual machines (Query Builder). If virtual machines are selected manually on the Browse for Virtual Machines screen, the Resource Limit settings have no effect.

Note: To limit the number of simultaneous backups per policy, use the **Limit jobs per policy** setting on the policy **Attributes** tab.

To set limits on the use of VMware resources

- 1 In the NetBackup Administration Console, click **Host Properties > Master Servers** and double click the NetBackup master server.
- 2 In the Properties screen, scroll down in the left pane and click **Resource Limit**.
- 3 Click in the **Resource Limit** column to set the maximum NetBackup usage for the resource type. The settings apply to all policies.



For each resource type, the default is 0, (No Limit). A resource limit of 4 for datastore means that NetBackup policies can perform no more than four simultaneous backups on any particular datastore.

Table 4-1 describes the limits:

Table 4-1 Resource types and limits

Resource type	Resource limit
vCenter	The maximum number of simultaneous backups per vCenter server.
snapshot	The maximum number of simultaneous snapshot operations (create or delete) per vCenter.
Cluster	The maximum number of simultaneous backups per VMware cluster.
ESXserver	The maximum number of simultaneous backups per ESX server.

Table 4-1 Resource types and limits (*continued*)

Resource type	Resource limit
VMXDatastore	The maximum number of simultaneous backups per vmx datastore. See “NetBackup for VMware terminology” on page 22.
Datastore	The maximum number of simultaneous backups per datastore.
DatastoreFolder	The maximum number of simultaneous backups per datastore folder.
DatastoreType	The maximum number of simultaneous backups per datastore type.
VMXDatastoreNFSHost	The maximum number of simultaneous backups per NFS host of the vmx datastore.
DatastoreNFSHost	The maximum number of simultaneous backups per NFS host of the datastore.
DatastoreCluster	The maximum number of simultaneous backups per datastore cluster.

Other resource-related considerations may be of interest.

See [“NetBackup for VMware best practices”](#) on page 151.

Configure NetBackup policies for VMware

This chapter includes the following topics:

- [Configuring a VMware policy from the Policy Wizard](#)
- [Configuring a VMware policy from the Policies utility](#)
- [Backup options on the VMware tab](#)
- [Browse for VMware Virtual Machines](#)
- [Limiting the VMware servers that NetBackup searches when browsing for virtual machines](#)
- [Virtual machine host names and display names must be unique in a master server's policies](#)
- [Primary VM identifier option and manual selection of virtual machines](#)
- [About incremental backups of virtual machines](#)
- [Configuring incremental backups](#)
- [Volume Manager volumes in the virtual machine](#)
- [About older NetBackup policies and pre-7.x backup hosts](#)

Configuring a VMware policy from the Policy Wizard

Use the following procedure.

To create a backup policy by means of the Policy Configuration Wizard

- 1 In the NetBackup Administration Console (on the NetBackup master server), click on the name of the master server.
- 2 Click **Create a Policy**.
- 3 Under **Create a backup policy for**, click **VMware and Hyper-V**.
- 4 Enter a name for the policy.
- 5 Click **VMware** as the virtual machine type.
- 6 Select the backup host from the **VMware backup host** drop-down list.

Instead of a particular host, you can select **Backup Media Server**. This option enables the use of one or more Windows media servers as the backup host, for host redundancy and faster backups.

Note: The individual backup hosts (not the media servers) are defined in the Administration Console in the following location:

Host Properties > Master servers > double-click the master server > Master Server Properties > VMware Access Hosts.

- 7 Click **Next**.
- 8 Follow the remaining panels in the wizard.

The wizard creates the policy according to your selections.

Configuring a VMware policy from the Policies utility

You can create a NetBackup policy (full or incremental) to back up the virtual machine in either of two ways:

- Use the **Policies** utility of the NetBackup Administration Console (described in this topic).
- Use the Policy Configuration Wizard.
See [“Configuring a VMware policy from the Policy Wizard”](#) on page 47.

To configure a policy to back up the virtual machine

- 1 In the NetBackup Administration Console, click **Policies** and select **Actions > New > New Policy**.

- 2 Select the **VMware** policy type.

The VMware policy type uses vStorage to perform the backup (not VCB). For VCB-based backup, select the **FlashBackup-Windows** policy type. Note that NetBackup 7.5 supports VCB backup only for NetBackup 7.1 clients and earlier. For more information on FlashBackup-Windows and VCB backup, see the *NetBackup 7.1 for VMware Administrator's Guide*:

<http://www.symantec.com/docs/DOC3663>

- 3 If you are using the Java Administration Console, click **Apply**.

VMware backup options are available on the **VMware** tab (described later in this procedure).

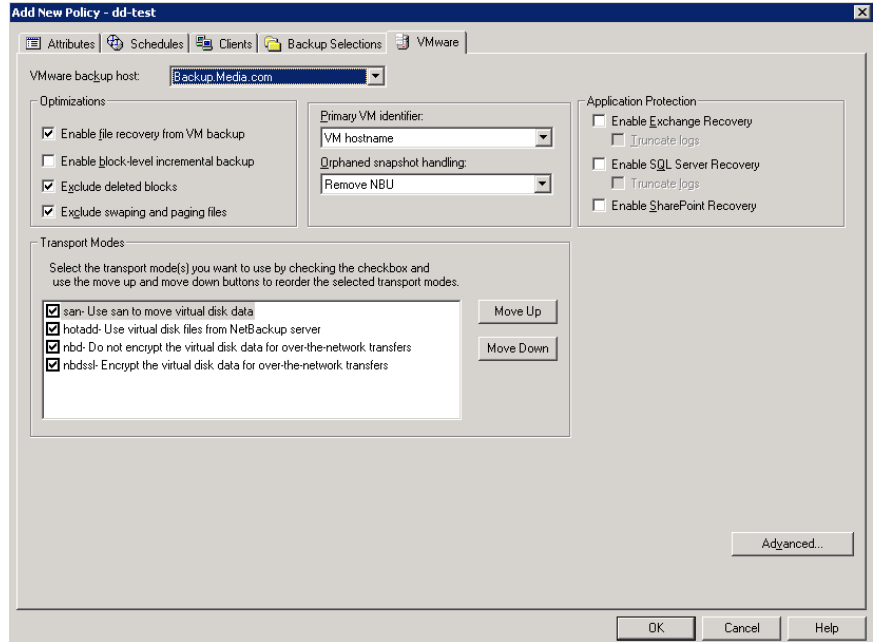
- 4 Select a policy storage unit or storage unit group.

Storage unit groups are described in the *NetBackup Administrator's Guide, Volume I*.

- 5 In most cases, you can leave the **Disable client-side deduplication** option at the default (unchecked).

The **Disable client-side deduplication** option is described in the *NetBackup Administrator's Guide, Volume I*.

6 Click the **VMware** tab.



Use this dialog to set VMware-related options.

See [“Backup options on the VMware tab”](#) on page 51.

7 Use the **Schedules** tab to define a schedule (click **New**).

On the **Schedules Attributes** tab, you can select **Full backup**, **Differential Incremental Backup**, or **Cumulative Incremental Backup**.

Note that incremental backups require one of the following selections on the policy **VMware** tab:

- **Enable file recovery from VM backup**, or

- **Enable block-level incremental backup.**

Enable block-level incremental backup requires an ESX server 4.0 and a virtual machine at vmx-07 or later.

The following topic contains additional information.

See [“About incremental backups of virtual machines”](#) on page 68.

8 Use the **Clients** tab to select the virtual machines to back up.

You can specify virtual machines in either of two ways:

Use **Select manually**, and click **New**. The Browse for VMware Virtual Machines screen appears. You can type the host name in the **Enter the VMware hostname** field, or click **Browse and select virtual machine**.

Note: The **Backup Selections** tab is set to ALL_LOCAL_DRIVES. Individual drives cannot be specified.

See [“Browse for VMware Virtual Machines”](#) on page 61.

Use **Select automatically through query**

With this option, NetBackup can automatically select virtual machines for backup based on the filtering criteria that you enter. The following topics explain how to specify the criteria:

See [“About automatic virtual machine selection for NetBackup for VMware”](#) on page 72.

See [“Configuring automatic virtual machine selection”](#) on page 81.

Note: The **Backup Selections** tab is filled in with the filtering rules from the query. NetBackup uses the ALL_LOCAL_DRIVES directive to back up the virtual machines.

Note: In the NetBackup Java Administration Console, the **Install Software** option is for installing NetBackup client software on trusting UNIX clients. This option does not apply to virtual machines.

9 When you click **Apply** or **OK** on the policy Attributes tab, a validation process checks the policy and reports any errors. If you click **Close**, no validation is performed.

Backup options on the VMware tab

In the Administration Console, the VMware tab appears when you select VMware as the policy type.

The following options apply to the VMware policy type.

VMware backup host selection

The VMware backup host is a NetBackup client that performs backups on behalf of the virtual machines.

Table 5-1 VMware backup host selection

Option	Description
Backup Media Server	<p>This option allows a Windows media server that is selected in the policy to operate as the backup host. (Selection of the media server is determined by the specified storage unit.) To operate as the backup host, the Windows media server must contain NetBackup client software.</p> <p>Note: The storage unit that is specified in the policy must be unique to your Windows media servers. If the storage unit is also available on a UNIX media server, the snapshot cannot succeed.</p> <p>Note: When the Backup Media Server option is selected, NetBackup cannot determine a host to perform policy validation. To validate the policy, temporarily select one of the possible media servers as the backup host (do not select Backup Media Server). When the policy validates successfully, reset the backup host to Backup Media Server.</p> <p>See “Media servers as backup or discovery hosts” on page 20.</p>
<i>backup_host_name</i>	<p>Select a particular backup host to perform the backup. (See the note after this table.)</p>

Note: The backup hosts (but not backup media servers) must be identified in the Administration Console as follows: Go to **Host Properties > Master servers >** double-click the master server **> Master Server Properties > VMware Access Hosts**.

See [“Adding the VMware backup host to NetBackup”](#) on page 39.

Optimizations options (VMware)

The following options set the type and scope of the VMware virtual machine backup.

Table 5-2 Optimizations

Option	Description
Enable file recovery from VM backup	<p>This option allows restore of individual files from the backup. With or without this option, you can restore the entire virtual machine.</p> <p>You can also use this option for incremental backups: in the policy schedule, select differential incremental backup or cumulative incremental backup.</p> <p>To perform a VMware backup to a deduplication storage unit, select this option. This option provides the best deduplication rates.</p> <p>To back up a virtual machine that contains Veritas Storage Foundation Volume Manager volumes, disable this option. Also make sure that the Exclude deleted blocks option is disabled.</p>
Enable block-level incremental backup	<p>For block-level backups of the virtual machine. This option reduces the size of the backup image.</p> <p>See “Block-level backup (BLIB): full vs incremental” on page 110.</p>
Exclude deleted blocks	<p>Reduces the size of the backup image by excluding any unused or deleted blocks within the file system on the virtual machine. This option supports the following file systems: Windows NTFS, and Linux ext2, ext3, and ext4.</p> <p>This option uses proprietary mapping technology to identify vacant sectors (allocated but empty) within the file system.</p> <p>See “About reducing the size of VMware backups” on page 109.</p> <p>To back up a virtual machine that contains Veritas Storage Foundation Volume Manager volumes, disable this option. Also make sure that the Enable file recovery from VM backup option is disabled.</p>
Exclude swapping and paging files	<p>Reduces the size of the backup image by excluding the data in the guest OS system paging file (Windows) or the swap file (Linux).</p> <p>Note: This option does not exclude the swapping and paging files from the backup: it only excludes the data in those files. If the files are restored, they are restored as empty files.</p>

Primary VM identifier options (VMware)

This setting specifies the type of name by which NetBackup recognizes virtual machines when it selects them for backup.

Table 5-3 Primary VM identifier

Option	Description
VM hostname	<p>The network host name for the virtual machine. (This option is the default.) NetBackup obtains the host name by means of a reverse lookup on the virtual machine's IP address. If no host name can be found, the IP address is used as the host name.</p>
VMware display name	<p>The name of the virtual machine as displayed in the VMware interface. A display name is assigned to the virtual machine when the virtual machine is created.</p> <p>When virtual machines are included in a NetBackup policy, restrictions apply to the characters that are allowed in the virtual machine display name.</p> <p>See “NetBackup character restrictions for virtual machine display names” on page 35.</p> <p>Note: The restrictions also apply to other vSphere objects, such as floppy image name, parallel port or serial port file name, and CD-ROM ISO name.</p> <p>Each display name must be unique in your VMware environment.</p> <p>See “NetBackup for VMware: notes and restrictions” on page 32.</p> <p>See “Restoring individual files” on page 145.</p>
VMware BIOS UUID	<p>The ID assigned to the virtual machine when the virtual machine is created. This ID may or may not be unique, depending on whether the virtual machine has been duplicated. This option is included for compatibility with the existing policies that use the older VM UUID identifier.</p>
VM DNS Name	<p>The VMware DNS Name of the virtual machine. In vSphere Client, this name appears on the virtual machine's Summary tab.</p> <p>Note: This name may or may not be associated with the virtual machine's IP address. VMware Tools obtains this name from the host name that is configured in the virtual machine. For further information on this name, refer to the documentation for the guest operating system.</p>
VM instance UUID	<p>The globally unique ID assigned to the virtual machine when the virtual machine is created. This ID uniquely identifies the virtual machine within a vCenter server. Even if the virtual machine has been duplicated (such as within a vCloud), only the original virtual machine retains this instance ID. (The virtual machine duplicates are assigned different instance UUIDs.)</p> <p>This option applies only to backup hosts (NetBackup clients) at 7.5 or later. If your backup host is 7.5 or later, this option is recommended instead of the VMware BIOS UUID option.</p> <p>Note: VM instance UUIDs are not available for standalone ESX 3.5 or ESXi 3.5 servers or for servers that VirtualCenter 2.5 manages.</p>

Orphaned snapshot handling options (VMware)

This option specifies the action that NetBackup takes when a snapshot is discovered before NetBackup creates a new snapshot for the virtual machine backup. After it creates a snapshot, NetBackup usually deletes the snapshot when the backup completes. If snapshots are not automatically deleted (whether created by NetBackup or not), the performance of the virtual machine may eventually decline.

Undeleted snapshots can cause restore failures due to lack of disk space. If the virtual machine was configured on multiple datastores and a leftover snapshot existed on the virtual machine when it was backed up, note: NetBackup tries to restore all .vmdk files to the snapshot datastore. As a result, the datastore may not have enough space for the .vmdk files, and the restore fails. (For a successful restore, you can restore the virtual machine to an alternate location. Use the Storage Destination dialog in the **Virtual Machine Recovery** dialogs to select a datastore for the .vmdk files.)

Table 5-4 Orphaned snapshot handling: Options

Option	Description
Ignore	NetBackup ignores any existing virtual machine snapshots (including snapshots previously created by NetBackup) and proceeds with snapshot creation and the backup.
Abort	If any snapshot exists on the virtual machine, NetBackup aborts the job for that virtual machine only.
Remove NBU	If a virtual machine snapshot exists that a NetBackup backup previously created: NetBackup removes the old snapshot, creates an updated snapshot, and proceeds with the virtual machine backup. (This option is the default.)

Transport modes options (VMware)

The transport modes determine how the snapshot data travels from the VMware datastore to the VMware backup host. The appropriate mode depends in part on the type of network that connects the VMware datastore to the VMware backup host.

By default, all modes are selected. NetBackup tries each transport mode in order, from top to bottom. It uses the first mode that succeeds for all disks in the virtual machine.

Table 5-5 Transport Modes

Mode	Description
san	For unencrypted transfer over Fibre Channel (SAN) or iSCSI.
hotadd	Lets you run the VMware backup host in a virtual machine. This feature requires ESX 3.5 Update2 or later. See “Notes on the hotadd transport mode” on page 35. For instructions on this transport mode and on installing the backup host in a VMware virtual machine, refer to your VMware documentation.
nbid	For unencrypted transfer over a local network that uses the Network Block Device (NBD) driver protocol. This mode of transfer is usually slower than Fibre Channel.
nbidssl	For encrypted transfer (SSL) over a local network that uses the Network Block Device (NBD) driver protocol. This mode of transfer is usually slower than Fibre Channel.
Move Up, Move Down	Use these buttons to change the order in which NetBackup tries each selected mode. Highlight a mode and click Move Up or Move Down. For example: assume that all four transport modes are selected, and the order is san, hotadd, nbid, and nbidssl. If one of the virtual disks cannot be accessed using san, the san transport mode is not used for any of the virtual machine’s disks. NetBackup then tries to use the hotadd mode for all the disks. NetBackup continues to try each mode until it finds one that succeeds for all the disks.

Application protection options (VMware)

To enable file-level recovery of database data that resides in the virtual machine, select from the following options. These options apply to full backups of the virtual machine; they do not apply to incremental backups.

Table 5-6 Application Protection options

Database option	Description
Enable Exchange Recovery	This option enables recovery of the Exchange databases or mailbox messages from the virtual machine backups. If this option is disabled, you can recover the entire virtual machine from the backup, but you cannot recover the databases or mailbox messages individually. To use the Enable Exchange Recovery option, note: <ul style="list-style-type: none"> ■ The Enable file recovery from VM backup option must be enabled. ■ The Enable block-level incremental backup option must be disabled. For more information, refer to the <i>NetBackup for Microsoft Exchange Server Administrator's Guide</i> .

Table 5-6 Application Protection options (*continued*)

Database option	Description
Truncate logs	<p>For Exchange, this option truncates the transaction logs when the snapshot of the virtual machine is complete. Truncating the logs frees up disk space in the virtual machine.</p> <p>Note: To use this option, install the Symantec VSS provider on the virtual machine. For instructions on how to install the Symantec VSS provider, refer to the <i>NetBackup for Microsoft Exchange Server Administrator's Guide</i>.</p> <p>If you do not select Truncate logs, the logs are not truncated.</p>
Enable SQL Server Recovery	<p>This option enables recovery of individual files from Microsoft SQL data in the virtual machine backup. If this option is disabled, you can recover the entire virtual machine from the backup, but you cannot recover the SQL files individually.</p> <p>To use the Enable SQL Server Recovery option, note:</p> <ul style="list-style-type: none"> ■ The Enable file recovery from VM backup option must be enabled. ■ The Enable block-level incremental backup option must be disabled. <p>For more information, refer to the <i>NetBackup for Microsoft SQL Server Administrator's Guide</i>.</p>
Truncate logs	<p>For SQL Server, this option truncates the transaction logs when the backup occurs. Truncating the logs frees up disk space in the virtual machine.</p> <p>If you do not select Truncate logs, the logs are not truncated.</p>
Enable SharePoint Recovery	<p>This option enables recovery of SharePoint objects from the virtual machine backup. If this option is disabled, you can recover the entire virtual machine from the backup, but you cannot recover the SharePoint objects individually.</p> <p>To use the Enable SharePoint Recovery option, note:</p> <ul style="list-style-type: none"> ■ The Enable file recovery from VM backup option must be enabled. ■ The Enable block-level incremental backup option must be disabled. <p>For more information, refer to the <i>NetBackup for Microsoft SharePoint Server Administrator's Guide</i>.</p>

VMware - Advanced Attributes dialog

This dialog appears when you click **Advanced** on the **VMware policy** tab.

You can use the VMware Advanced Attributes dialog to set the following additional parameters for VMware backup. In most situations, the best settings are the defaults.

Table 5-7 VMware Advanced Attributes

Configuration parameter	Description
Virtual machine quiesce	<p>This option is enabled by default. In the great majority of cases, you should accept the default. I/O on the virtual machine is quiesced before NetBackup creates the snapshot. Without quiescing file activity, data consistency in the snapshot cannot be guaranteed. If not consistent, the backed up data may be of little or no value.</p> <p>If this option is disabled, the snapshot is created without quiescing I/O on the virtual machine. In this case, you must perform your own checks for data consistency in the backup data.</p> <p>Caution: Symantec does not recommend that you disable quiesce. In most cases, this option should be enabled.</p> <p>Note: To use this option, VMware Tools must be installed on the virtual machine.</p> <p>Note: To use this option with Linux virtual machines, you must also install the SYMCquiesce utility.</p> <p>See “Installing the SYMCquiesce utility” on page 180.</p>
Virtual disk selection	<p>Determines the kind of disks on the virtual machine that are included in the backup. This option can reduce the size of the backup, but should be used with care. These options are intended only for the virtual machines that have multiple virtual disks.</p> <p>The following options are available:</p> <ul style="list-style-type: none"> ■ Include all disks Backs up all virtual disks that are configured for the virtual machine. ■ Exclude boot disk The virtual machine's boot disk (for example the C drive) is not included in the backup. Any other disks (such as D) are backed up. Consider this option if you have another means of recreating the boot disk, such as a virtual machine template for boot drives. See “About the Exclude disk options for Virtual disk selection” on page 60. Note: A virtual machine that is restored from this backup cannot start up. Data files are available in the restored data disks. ■ Exclude data disks The virtual machine's data disks (for example the D drive) are not included in the backup for this policy. Only the boot disk is backed up. Consider this option only if you have a different policy that backs up the data disks. See “About the Exclude disk options for Virtual disk selection” on page 60.

Table 5-7 VMware Advanced Attributes (*continued*)

Configuration parameter	Description
Ignore diskless VMs	<p>This option directs NetBackup not to back up any virtual machine that has no vmdk file assigned to it.</p> <p>Note that virtual machines without vmdk files can occur in a VMware vCenter Site Recovery Manager (SRM) environment. In an SRM environment, a replicated virtual machine in passive mode may have no vmdk file. If NetBackup attempts to back up a replicated virtual machine that has no vmdk file, the backup fails (status 156). This error indicates that the virtual machine is in an unusual state and backup is impossible.</p>
Post events to vCenter	<p>Enables NetBackup to send backup related events to the vCenter server. The events appear in vSphere Client under Home > Inventory > Hosts and Clusters, Tasks & Events tab. More information is available on how to view the events:</p> <p>Note: To post events to vCenter, NetBackup must perform the backup through a vCenter server. If NetBackup accesses the ESX server directly, the backup information cannot be displayed in vSphere Client.</p> <p>See “Viewing NetBackup activity in vSphere Client” on page 119.</p> <p>You must set the required permissions in vCenter:</p> <p>See “Setting privileges for posting events to vCenter” on page 43.</p> <p>This option also records the date and time of the last successful backup of the virtual machine. The date and time appear in vSphere Client on the Summary tab as a custom attribute under Annotations. The attribute is labeled NB_LAST_BACKUP.</p> <p>For Post events to vCenter, the following options are available:</p> <ul style="list-style-type: none"> ■ All Events NetBackup posts an event to vCenter server on each backup success or failure. This setting is the default. ■ No Events Disables the Post events to vCenter option. NetBackup does not post any events to the vCenter server. ■ Error Events NetBackup posts an event to the vCenter server only for backup failures. <p>Note: If a vSphere administrator created an attribute named NB_LAST_BACKUP of type Global, NetBackup cannot post backup events to that attribute. You must remove the NB_LAST_BACKUP attribute from vSphere. Make sure that Post events to vCenter is set to All Events or Error Events. At the next backup, NetBackup creates a NB_LAST_BACKUP attribute of type Virtual Machine and posts events to that attribute.</p>

About the Exclude disk options for Virtual disk selection

The VMware - Advanced Attributes dialog has an option called **Virtual disk selection**. The default setting is **Include all disks**. You should use this setting in most cases.

The other options are **Exclude boot disk** and **Exclude data disks**. These options are intended for the virtual machines that have multiple virtual disks. You should use these options with care.

To exclude a boot disk or data disk, note the following requirements:

- The virtual machine must have more than one disk.
- NetBackup must be able to identify the boot disk.
- The boot disk must not be part of a managed volume (Windows LDM or Linux LVM). The boot disk must be fully contained on a single disk.

The boot disk must include the following:

- The boot partition.
- The system directory (Windows system directory or Linux boot directory).
- The full swap file (Windows pagefile.sys or Linux swap partition).

Important! The exclude disk options are meant only for the following cases:

- **Exclude boot disk**: Consider this option if you have another means of recreating the boot disk, such as a virtual machine template for boot drives. If **Exclude boot disk** is enabled, the policy does not back up the boot disk.

Note: When the virtual machine is restored from the backup, the virtual machine data for the boot disk may be missing or incomplete.

Note the following about **Exclude boot disk**:

- If the virtual machine has a boot disk but has no other disks, the boot disk is backed up. It is not excluded.
- If the virtual machine's boot disk is an independent disk, but the virtual machine has no other disks, the boot drive is backed up. The restored boot drive however contains no data, because NetBackup cannot back up the data in an independent disk.
- If the virtual machine has a boot drive and an independent drive, the boot drive is not backed up. Only the independent drive is included in the backup. Since NetBackup cannot back up the data in an independent disk, the restored independent disk contains no data. Refer to the explanation on independent disks in the following topic:

See [“NetBackup for VMware terminology”](#) on page 22.

- Adding a virtual disk and changing this option before the next backup can have unexpected results.

See [“Virtual disk selection options: examples to avoid”](#) on page 61.

- **Exclude data disks:** Consider this option if you have a different policy or other backup program that backs up the data disks. If **Exclude data disks** is enabled in a policy, that policy does not back up the data disks.

Note the following about **Exclude data disks**:

- If the virtual machine has only one disk, such as C, the C drive is backed up. It is not excluded.
- If the virtual machine's boot disk is an independent disk, and the virtual machine has a separate data disk, the boot disk is backed up. The restored boot disk however contains no data, because NetBackup cannot back up the data in an independent disk.

Caution: Use of the exclude disk options can have unintended consequences if these rules are not followed.

The following topic contains important guidance on the exclude disk options:

See [“Virtual disk selection options: examples to avoid”](#) on page 61.

Virtual disk selection options: examples to avoid

You should use the **Virtual disk selection** option with care. For example, if you add a disk to the virtual machine and change the **Virtual disk selection** setting, note: The next backup may not capture the virtual machine in the state that you intended. You should back up the entire virtual machine (**Include all disks**) before using **Virtual disk selection** to exclude a disk from future backups.

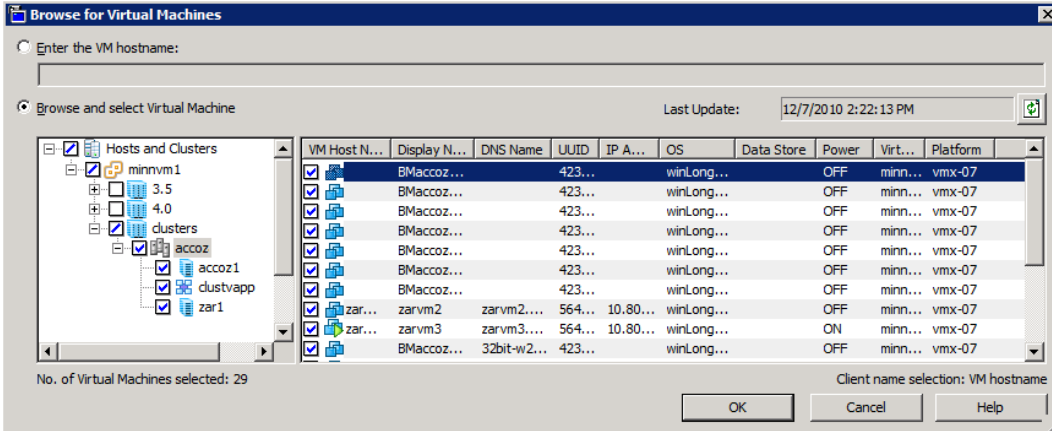
Note: When you change an exclude disk option to disabled, do a full backup (**Virtual disk selection** set to **Include all disks**) before the next incremental or differential backup.

Browse for VMware Virtual Machines

When you configure a NetBackup policy, you can use the Browse for Virtual Machines screen to select virtual machines for backup. You can enter the virtual machine's host name manually or browse and select it from a list.

As an alternative, NetBackup can automatically select virtual machines based on a range of criteria.

See [“About automatic virtual machine selection for NetBackup for VMware”](#) on page 72.



- **Enter the VM hostname**

Click this option if you want to manually enter the name of a virtual machine. The format of the name depends on your system. It may be the fully qualified name or another name, depending on your network configuration and how the name is defined in the guest OS. If NetBackup cannot find the name you enter, policy validation fails.

To enter a host name, make sure that **Browse and select Virtual Machine** is not selected.

- **Browse and select Virtual Machine**

Click this option to discover vCenter servers, clusters, datacenters, vApps, and ESX servers (shown in the left pane). You can select virtual machines from a list (in the right pane).

NetBackup uses the following icons for vSphere objects:



vCenter server



Datacenter



Cluster



vApp



ESX server



Virtual machine

The virtual machines that are contained in a VMware vApp are displayed in the right pane along with other virtual machines.

The virtual machine names that are listed may be derived from a cache file. Use of the cache file is faster than rediscovering the virtual machines on the network if your site has a large number of virtual machines.

If NetBackup cannot obtain the IP address of the virtual machine, the host name and IP address are displayed as NONE.

Note that virtual machine host names or display names must be unique within a master server's policies:

See [“Virtual machine host names and display names must be unique in a master server's policies”](#) on page 66.

■ Last Update

To update the cache file and re-display virtual machines, click the refresh icon to the right of the **Last Update** field. This field shows the date and time of the most recent cache file that contains the names of virtual machines.

For NetBackup to access the virtual machines, note the following:

- The NetBackup master server must have credentials for the VMware vCenter or ESX server(s).
See [“Adding NetBackup credentials for VMware”](#) on page 40.
- DNS problems may prevent or slow down discovery of the virtual machines.
See [“Preventing browsing delays caused by DNS problems”](#) on page 158.
- To limit the search to particular vCenter or ESX servers, you can create a `BACKUP` registry entry as an exclude list. Excluding unneeded servers can dramatically speed up the search for virtual machines.
See [“Limiting the VMware servers that NetBackup searches when browsing for virtual machines”](#) on page 65.
- The browsing timeout value must not be set too low.
See [“Changing the browsing timeout for virtual machine discovery”](#) on page 159.

■ **VM Host Name, Display Name, UUID, etc.**

When you select an ESX server in the left pane, information about its virtual machines appears in columns in the right pane. You can change the settings and arrangement of these columns by right-clicking on any of the column headers.

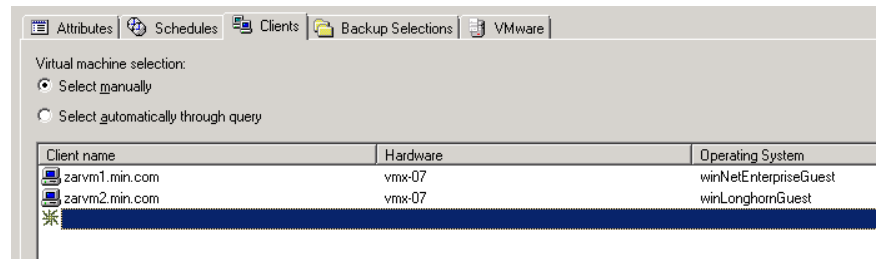
The columns are the following:

VM Host Name	The host name of the virtual machine.
Display Name	The display name of the virtual machine.
UUID	The UUID of the virtual machine.
VM DNS Name	The VMware "DNS Name" of the virtual machine. In vSphere Client, this name appears on the virtual machine's Summary tab. See "Primary VM identifier options (VMware)" on page 53.
IP Address	The IP address of the virtual machine.
OS	The guest OS system as defined when the virtual machine was created.
Data Store	The datastore where the virtual machine configuration files are stored. If the datastore is in a datastore cluster, NetBackup displays the name of the datastore (not the name of the cluster).
Power	The power on/off status of the virtual machine when it was last discovered.
RDM Status	Shows whether the virtual machine has a physical disk in raw device mapping mode (RDM) or has an independent drive.
Platform	The VMware release version of the virtual machine (vmx-04, vmx-07, or vmx-08).
Discovered Timestamp	The time and date at which the virtual machine's UUID was initially discovered and cached.
Change Tracking Support	Shows whether the virtual machine supports the VMware Changed Block Tracking feature (for BLIB). Changed Block Tracking requires ESX server 4.0 and a virtual machine at vmx-07 or later.
ESX Host	The ESX server in which the virtual machine resides (also appears in the left pane).

Limiting the VMware servers that NetBackup searches when browsing for virtual machines

Data Center	The datacenter that contains the virtual machine (also appears in the left pane).
Virtual Center Name	The vCenter server that manages the ESX server (also appears in the left pane).

The virtual machines you selected are listed in the **Clients** tab.



Limiting the VMware servers that NetBackup searches when browsing for virtual machines

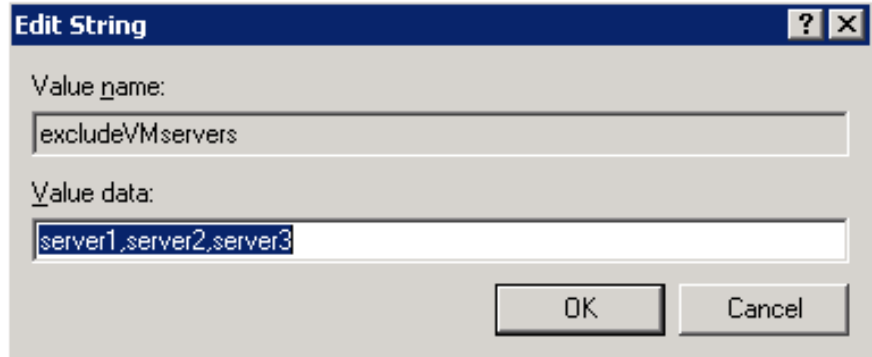
As part of creating a NetBackup policy, you must specify which virtual machines to back up. One approach is to let NetBackup search the network and list all available virtual machines. However, if your VMware environment contains many VMware servers and virtual machines, it may take too long to search and list all of them. For example, consider an environment with 10 vCenter servers. To back up the virtual machines on one of the 10 vCenter servers, browsing virtual machines on all 10 servers is unnecessary.

To speed up browsing, you can exclude particular VMware servers from the search. When it probes the network for virtual machines, NetBackup queries only the VMware servers that are not named in the exclude list for the backup-host.

To limit the VMware servers that NetBackup discovers, per backup host

- 1 On the Windows desktop of the backup host, click **Start > Run** and enter `regedit`.
- 2 To be on the safe side, make a backup of the current registry (**File > Export**).
- 3 Go to **HKEY_LOCAL_MACHINE > SOFTWARE > Veritas > NetBackup > CurrentVersion > Config** and create a key called `BACKUP`.
- 4 Right-click in the right pane and click **New > String Value**. Enter `excludeVMservers` as the name.

- 5 Right-click the `excludeVMservers` name and click **Modify**.
- 6 In the **Edit String** dialog, enter a comma-delimited list of the VMware servers that are NOT to be queried when NetBackup browses the network. Do not enter spaces. You can enter vCenter servers and individual ESX servers.



Note: The exclude list is used on the next backup. If any bpfis processes are running, the exclude list has no effect on them.

The exclude list applies only to this backup host. The servers are not queried when NetBackup browses for virtual machines to list on the policy's **Browse for Virtual Machines** dialog of the NetBackup Administration Console.

As an alternative, NetBackup can automatically select virtual machines based on a range of criteria.

See [“About automatic virtual machine selection for NetBackup for VMware”](#) on page 72.

Virtual machine host names and display names must be unique in a master server's policies

Certain VMware environments do not require unique names for virtual machines. For instance, virtual machines within a vCenter server can have the same host or display names as virtual machines in another vCenter server. The same is true of datacenters, which are logical groupings of virtual resources within a vCenter server. Virtual machine host names or display names must be unique within a datacenter, but need not be unique between two datacenters on the same vCenter. A virtual machine named VM1 can exist in datacenter A. Another virtual machine (also named VM1) can exist in datacenter B, on the same vCenter server.

Identically named virtual machines however present a problem in the following case: the same NetBackup master server is configured to back up the virtual machines by means of the same host name or display name. The virtual machines that are backed up by a particular NetBackup master server must be uniquely identified across all of its policies.

To back up the two virtual machines named VM1, do one of the following:

- Change their VMware names so they are unique in the master server's policies.
- Configure the policies to identify the virtual machines by their UUIDs. Use the type of UUID that is appropriate for your virtual machine environment. See [“Primary VM identifier options \(VMware\)”](#) on page 53.

Primary VM identifier option and manual selection of virtual machines

This topic applies to the manual selection of virtual machines on the NetBackup **Browse for VMware Virtual Machines** screen.

A change to the policy's **Primary VM identifier** value can affect backups. If you change this option, you may have to delete the virtual machine selections on the **Clients** tab and re-enter them. Otherwise, NetBackup may no longer be able to identify the virtual machines to back up.

For example, the host names in the **Clients** tab cannot be used and the virtual machines are not backed up in the following case:

- If you change the **Primary VM identifier** from **VM hostname** to **VM display name**, and
- The display names of the virtual machines are different from the host names.

In this case, delete the host name entries on the **Clients** tab and browse the network to select the virtual machines by display name.

See [“Browse for VMware Virtual Machines”](#) on page 61.

Note: When creating virtual machines, use the same name for both host name and display name. If the **Primary VM identifier** is changed, the existing entries on the **Clients** tab still work.

If the policy selects virtual machines automatically, refer to the following topic:

See [“Effect of Primary VM identifier parameter on Selection column in Test Query results”](#) on page 104.

About incremental backups of virtual machines

NetBackup enables full virtual machine and file-level incrementals in the same backup (the **Enable file recovery from VM backup** option).

Better support for incremental backup is available when you use vStorage and BLIB (**Enable block-level incremental backup**). BLIB requires ESX 4.x and virtual machines at vmx-07 or later.

Note: Individual file recovery is supported from full backups and from incremental backups, as long as the **Enable file recovery from VM backup** policy option is enabled.

Note: In earlier releases of NetBackup for VMware, incremental backups had to be based on timestamps, not on archive bit. This requirement has been removed from NetBackup 7.5. For incremental backups, you do not have to configure the client on the VMware backup host for timestamps .

Configuring incremental backups

Use the following procedure for virtual machine backup.

To configure incremental backup of a virtual machine (vStorage)

- 1 In the NetBackup policy **Attributes** tab, select the **VMware** policy type.
- 2 On the **VMware** tab, select the VMware backup host.
- 3 Optional: for BLIB, select **Enable block-level incremental backup**.
- 4 Select **Enable file recovery from VM backup**.

More information is available on the VMware options.

See [“Backup options on the VMware tab”](#) on page 51.

- 5 Click **OK**.
- 6 On the **Schedules** tab, select **Differential Incremental Backup** or **Cumulative Incremental Backup**.
- 7 Fill in the **Clients** tab.

Volume Manager volumes in the virtual machine

To back up a virtual machine that contains Veritas Storage Foundation Volume Manager volumes, make sure the following options on the policy's VMware tab are disabled:

Enable file recovery from VM backup

Exclude deleted blocks.

Note: Restore of selected files from a backup of the full virtual machine is not supported if the virtual machine contains Storage Foundation Volume Manager volumes.

See [“NetBackup for VMware: notes and restrictions”](#) on page 32.

About older NetBackup policies and pre-7.x backup hosts

A NetBackup 7.x master server can use the policies that were created for NetBackup 6.5.x. NetBackup however does not convert the 6.5.x options to 7.x options. It uses the policies as is, without modification or conversion.

Even if the policies are updated to the 7.x options, a 6.5.x backup host ignores those options. The backup host must be updated to 7.x to recognize and use the 7.x policy options.

Configure automatic selection of virtual machines for backup

This chapter includes the following topics:

- [About automatic virtual machine selection for NetBackup for VMware](#)
- [The basics of a NetBackup query rule](#)
- [Important notes on automatic virtual machine selection](#)
- [NetBackup requirements for automatic virtual machine selection](#)
- [Automatic virtual machine selection: Task overview](#)
- [Options for selecting VMware virtual machines](#)
- [Configuring automatic virtual machine selection](#)
- [Editing an existing query in Basic Mode](#)
- [Using the Query Builder in Advanced Mode](#)
- [AND vs OR in queries](#)
- [Examples for the NetBackup Query Builder](#)
- [The IsSet operator in queries](#)
- [Multiple VMware policies that work together](#)
- [Order of operations in queries \(precedence rules\)](#)
- [Parentheses in compound queries](#)

- [Query rules for resource pools](#)
- [Query rules for datacenter folders \(HostFolder\)](#)
- [Query Builder field reference](#)
- [Test Query screen](#)
- [Test Query: Failed virtual machines](#)
- [Effect of Primary VM identifier parameter on Selection column in Test Query results](#)
- [Effect of Primary VM identifier parameter on VM Name column in Test query results](#)

About automatic virtual machine selection for NetBackup for VMware

Instead of manually selecting the virtual machines for backup, you can configure NetBackup to automatically select virtual machines based on a range of criteria. You specify the criteria (rules) in the **Query Builder** on the NetBackup policy **Clients** tab. NetBackup creates a list of the virtual machines that currently meet the rules and adds those virtual machines to the backup.

This feature is called the Virtual Machine Intelligent Policy.

Automatic selection of virtual machines has the following advantages:

- Simplifies the policy configuration for sites with large virtual environments. You do not need to manually select virtual machines from a long list of hosts: NetBackup selects all the virtual machines that meet the selection rules in the policy's Query Builder.
- Allows the backup list to stay up-to-date with changes in the virtual environment. Eliminates the need to revise the backup list whenever a virtual machine is added or removed.
- Virtual machine selection takes place dynamically at the time of the backup.

Examples of automatic virtual machine selection are the following:

Table 6-1 Examples for automatic virtual machine selection

Example	Description
Add new virtual machines	At the next backup, the policy can automatically discover the virtual machines that have recently been added to the environment. If the virtual machines match the query rules that you configure in the policy, they are automatically backed up.
Limit the backup list to the virtual machines that are currently powered on	If some of your virtual machines are occasionally powered off, NetBackup can be configured to automatically exclude those from the backup list. Among the virtual machines it discovers, NetBackup backs up only the virtual machines that are powered on.
Back up virtual machines based on physical boundaries	Examples of physical boundaries are vCenter servers, ESX servers, datastores, and clusters. For example, a query rule can select all the virtual machines in a particular ESX server, so the policy backs up only those virtual machines.
Back up virtual machines based on logical boundaries	Examples of logical boundaries are folders, vApps, templates, and resource pools. For example, a query rule can select all the virtual machines in a particular folder, so the policy backs up only those virtual machines.

The basics of a NetBackup query rule

For automatic virtual machine selection, NetBackup uses query rules to determine which VMware virtual machines to select for backup. You create the rules in the Query Builder, on the **Clients** tab of the policy.

A query rule consists of the following:

- A keyword, such as **Displayname** or **Datacenter** (many keywords are available). For example: For automatic selection of the virtual machines with the display names that contain certain characters, you need the **Displayname** keyword in the rule.
- An operator, such as **Contains**, **StartsWith**, or **Equal**. The operator describes how NetBackup analyzes the keyword. For example: **Displayname StartsWith** tells NetBackup to look for the display names that start with particular characters.

- Values for the keyword.
For the **Displayname** keyword, a value might be "prod". In that case, NetBackup looks for the virtual machines that have the display names that include the characters prod.
- An optional joining element (AND, AND NOT, OR, OR NOT) to refine or expand the query.

The policy uses these elements to discover and select virtual machines for backup.

[Table 6-2](#) contains examples of rules.

Table 6-2 Examples of rules

Rule	Description
Displayname Contains "vm"	NetBackup selects the virtual machines that have the characters <code>vm</code> anywhere in their display names.
Displayname EndsWith "vm"	NetBackup selects the virtual machines that have the characters <code>vm</code> at the end of their display names.
Datacenter AnyOf "datacenter1","datacenter2"	NetBackup selects the virtual machines that use <code>datacenter1</code> or <code>datacenter2</code> .
Powerstate Equal poweredOn	NetBackup selects only the virtual machines that are currently powered on.

Important notes on automatic virtual machine selection

The Virtual Machine Intelligent Policy feature in NetBackup is a different approach to VMware virtual machine selection in the policy. It represents a paradigm shift in the way you select virtual machines for backup. As with all major changes, the effective use of this feature requires forethought, preparation, and care.

Table 6-3 Important notes on automatic virtual machine selection!




Note!	Explanation
<p>Create rules carefully...</p> 	<p>Instead of manually selecting virtual machines for backup, you create guidelines for automatic selection of virtual machines. The guidelines are called rules; you enter the rules in the policy's query builder.</p> <p>You make the rules, and NetBackup follows them.</p> <p>If the rules state: Back up all virtual machines with a host name that contains "prod", NetBackup does that. Any virtual machine that is added to the environment with a host name containing "prod" is automatically selected and backed up when the policy runs. Virtual machines with the names that do not contain "prod" are not backed up. To have other virtual machines automatically backed up, you must change the query rules (or create additional policies).</p>
<p>Changes to the virtual environment can affect backup times.</p> 	<p>If many virtual machines are temporarily added to your environment and happen to fall within the scope of the query rules, they are backed up. The backups can therefore run much longer than expected.</p>
<p>Test the query rules.</p> 	<p>Test the query rules ahead of time. The policy includes a Test Query function for that purpose. It's important to verify that your query operates as expected. Otherwise, the query may inadvertently select too many or too few virtual machines.</p> <p>As an alternative, you can use the <code>nbdiscover</code> command to test a query. Refer to the <i>NetBackup Commands Reference Guide</i>.</p> <p>Note also: The policy's Primary VM identifier parameter can affect the automatic selection process.</p> <p>See "Effect of Primary VM identifier parameter on Selection column in Test Query results" on page 104.</p>

Table 6-3 Important notes on automatic virtual machine selection! *(continued)*

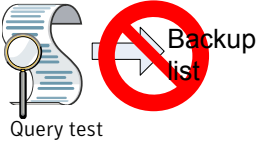
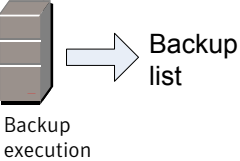

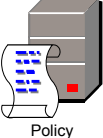
Note!	Explanation
<p>A query test does not create the backup list. NetBackup creates the backup list when the backup runs.</p>  	<p>The automatic selection process is dynamic. Changes in the virtual environment may affect which virtual machines the query rules choose when the backup runs.</p> <p>Note: If virtual machine changes occur, the virtual machines that are selected for backup may not be identical to those listed in your query test results.</p>
<p>The policy does not display a list of the virtual machines that are to be backed up.</p> <p>Use the Activity Monitor or OpsCenter.</p> 	<p>If you select virtual machines manually (with the Browse for Virtual machines screen), the selected virtual machines are listed on the policy Clients tab. But when you use the query builder for automatic selection, the selected virtual machines are not listed on the Clients tab.</p> <p>For a list of the virtual machines that were backed up, use the NetBackup Activity Monitor or the OpsCenter web interface.</p> <p>See “Using the Activity Monitor to monitor virtual machine backups” on page 117.</p> <p>See “Using OpsCenter to report on virtual machine backups” on page 122.</p>

Table 6-3 Important notes on automatic virtual machine selection! (*continued*)

Note!	Explanation
<p>When you save the policy, the query rules are not validated.</p> 	<p>When you save a policy, policy validation does not consult the query rules and select virtual machines for backup. Because of the potential for changes in the virtual environment, virtual machine selection must wait until the backup runs. As a result, when you save the policy, NetBackup does not check the policy attributes against a backup list. If the query rules select the virtual machines that are incompatible with a policy attribute, policy validation cannot flag that fact. The incompatibility becomes apparent when NetBackup determines the backup list at the time of the backup.</p> <p>Take for example a policy that is configured for Enable block-level incremental backup (BLIB). BLIB works only with ESX 4.0 virtual machines at version vmx-07 or later. If the query rules select a virtual machine at a version earlier than vmx-07, the policy cannot back up that virtual machine. The mismatch between the policy and the virtual machine is revealed when the backup runs, not when the policy is validated. The Activity Monitor's job details log indicates which virtual machines can or cannot be backed up.</p>

NetBackup requirements for automatic virtual machine selection

Note the following requirements for automatic selection of VMware virtual machines:

- vStorage is required for automatic discovery of virtual machines.
- Automatic virtual machine selection requires no additional license beyond the NetBackup Enterprise Client license.
- Refer to the following Symantec document for updates on NetBackup support requirements:
 Support for NetBackup 7.x in virtual environments
<http://www.symantec.com/docs/TECH127089>

Automatic virtual machine selection: Task overview

This topic is a high-level overview of how to set up a NetBackup policy for automatic selection of VMware virtual machines. Follow the links in the table for more details.

Table 6-4 Automatic selection of virtual machines: overview of the tasks

Steps to configure automatic selection	Description and notes
Configure a VMware policy	Use the policy Attributes tab. See “Configuring a VMware policy from the Policies utility” on page 48.
Set rules for virtual machine selection in the policy Query Builder	On the policy Clients tab, click Select automatically through query . Choose a host for virtual machine selection (default is the VMware backup host). To add rules, use the Query Builder drop-down fields. See “Configuring automatic virtual machine selection” on page 81. See “Options for selecting VMware virtual machines” on page 78.
Test the rules	Click Test Query in the Query Builder on the Clients tab. Virtual machines are labeled as included or excluded, based on the rules. Note: The list of virtual machines is not saved in the Clients tab. Note: The query rules are also displayed in the Backup Selections tab. The backup selections are pre-set to <code>All_LOCAL_DRIVES</code> (not displayed). As an alternative, you can use the <code>nbdiscover</code> command to test a query. Refer to the <i>NetBackup Commands Reference Guide</i> .
Execute a backup	When the policy executes, NetBackup consults the rules in the Query Builder, creates a list of virtual machines, and backs them up.
Check the backup	To see which virtual machines were backed up, use the Activity Monitor, or run a Virtual Client Summary report in OpsCenter. See “Using the Activity Monitor to monitor virtual machine backups” on page 117. See “Using OpsCenter to report on virtual machine backups” on page 122.

Options for selecting VMware virtual machines

This topic describes the options on the policy **Clients** tab or on the **Automatic Discovery Options** panel of the Policy Wizard.

You can use these options to manually select virtual machines, or to configure NetBackup to select virtual machines automatically. For automatic selection, you specify the selection criteria (rules) in the policy's Query Builder. When the backup job runs, NetBackup discovers the virtual machines that currently meet the criteria and backs up those virtual machines.

A procedure is available.

See [“Configuring automatic virtual machine selection”](#) on page 81.

Table 6-5 Virtual machine selection (not available on the **Automatic Discovery Options** wizard panel)

Option	Description
Select manually	<p>Click this option and click New to manually enter virtual machines names, or to browse and select them from a list.</p> <p>See “Browse for VMware Virtual Machines” on page 61.</p> <p>Note: The rest of the fields and options are for automatic selection of virtual machines.</p>
Select automatically through query	<p>Click this option to allow NetBackup to automatically select virtual machines for backup based on the rules that you enter in the Query Builder.</p>
NetBackup host to perform automatic virtual machine selection	<p>This host discovers virtual machines and automatically selects them for backup based on your query rules. The resulting list determines which virtual machines are backed up.</p> <p>To designate your media servers as discovery hosts, select Backup Media Server from the pull-down.</p>

Table 6-6 Query Builder

Option	Description
Query Builder (Join, Field, Operator, Values)	<p>Use these pull-down fields to define rules for automatic selection of virtual machines. From left to right, each pull-down refines the rule.</p> <p>Click the plus sign to add the rule to the Query pane.</p> <p>Click the reset icon (curved arrow) to blank out the pull-down fields.</p> <p>See “Query Builder field reference” on page 94.</p> <p>See “Examples for the NetBackup Query Builder” on page 86.</p>
Advanced	<p>Places the Query Builder in Advanced Mode for manual entry of rules.</p> <p>See “Using the Query Builder in Advanced Mode” on page 84.</p> <p>See “Query Builder field reference” on page 94.</p> <p>See “Examples for the NetBackup Query Builder” on page 86.</p>
Basic	<p>Returns the Query Builder from Advanced Mode to Basic Mode.</p> <p>See “Query Builder field reference” on page 94.</p>

Table 6-6 Query Builder (*continued*)

Option	Description
Edit	<p>Use this option to change an existing query rule when in Basic Mode, as follows:</p> <ul style="list-style-type: none"> ■ Click the rule and then click Edit. ■ Make new selections in the Query Builder pull-down fields. ■ Click the save option (diskette icon).
Remove	<p>Deletes a query rule when in Basic Mode. Click on the rule and then click Remove.</p>
Test Query	<p>Click this option to test which virtual machines NetBackup selects based on the rules in the Query Builder.</p> <p>Note: This test option does not create the backup list for the policy. When the next backup runs from this policy, NetBackup re-discovers virtual machines and consults the query rules. At that time, NetBackup backs up the virtual machines that match the rules.</p> <p>See “Test Query screen” on page 101.</p> <p>As an alternative, you can use the <code>nbdiscover</code> command to test a query. Refer to the <i>NetBackup Commands Reference Guide</i>.</p>
Reuse VM selection query results for:	<p>Sets the refresh rate of an internal cache of the query results. NetBackup uses the cache to determine which virtual machines to select at the time of the backup. The cache speeds up the selection of virtual machines without burdening the vCenter server at each scheduled backup.</p> <p>A faster cache refresh rate synchronizes the cache with the changes recorded in vCenter, such as the addition or removal of virtual machines. However, each cache refresh consumes vCenter resources.</p> <p>With a slower refresh rate, new virtual machines may not be included immediately in the next backup. New or changed virtual machines are included when the cache is refreshed. Note that fewer vCenter resources are consumed with a slower refresh rate.</p> <p>The default is eight hours. For eight hours, NetBackup uses the cache and does not attempt to rediscover virtual machines. Changes to the virtual environment do not affect the cache during that period. After eight hours, the next execution of the policy causes NetBackup to rediscover virtual machines. If any changes match a rule in the query, the list of selected virtual machines is modified accordingly.</p> <p>Note: The cache is refreshed before the next scheduled backup whenever the policy is changed and saved.</p> <p>More information is available on the Reuse VM selection query results for: option: See “About the Reuse VM selection query results option” on page 171.</p>

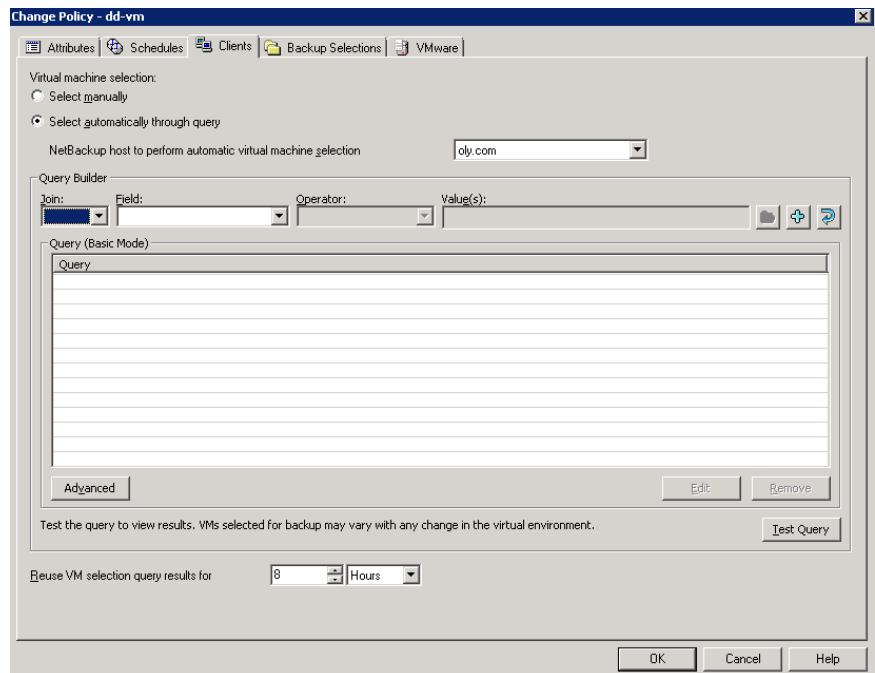
Configuring automatic virtual machine selection

NetBackup can automatically select VMware virtual machines for backup based on the criteria that you enter. You specify the criteria (rules) in the Query Builder on the NetBackup policy **Clients** tab. You can set up rules to include certain virtual machines for backup, or to exclude virtual machines.

When the backup job runs, NetBackup creates a list of the virtual machines that currently meet the query rules and backs them up.

The following is an initial view of the policy Clients tab with **Select automatically through query** selected.

Figure 6-1 Policy Clients tab for automatic selection of virtual machines

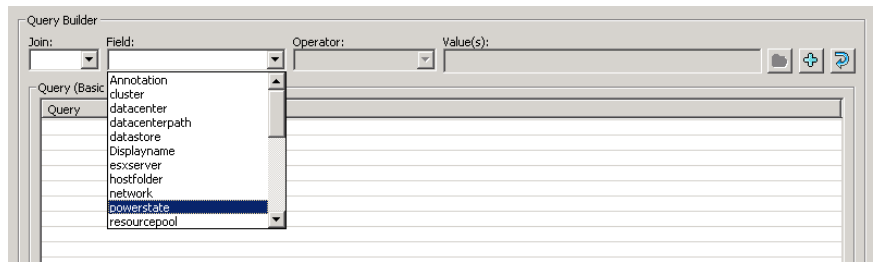


The Query Builder can operate in Basic Mode or in Advanced Mode.

To configure automatic virtual machine selection in Basic Mode

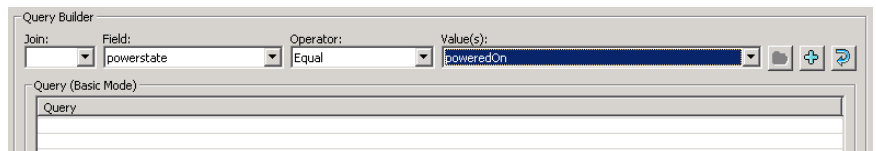
- 1 On the policy Attributes tab, specify the following:
 - **VMware** for the policy type.

- On the **VMware** policy tab, select a VMware backup host.
- 2 Review the other options on the **VMware** tab.
See “[Backup options on the VMware tab](#)” on page 51.
- 3 Make other policy selections as needed (for example, create a Schedule).
- 4 Click the **Clients** tab, and click **Select automatically through query**.
If you selected virtual machines in the **Browse for Virtual Machines** dialog, those virtual machines are removed from the policy.
- 5 To create a rule, make selections from the pull-down menus.
For the first rule, you can start with the **Field** pull-down, depending on the type of rule. (For the first rule, the only selections available for the **Join** field are blank (none), or NOT.)

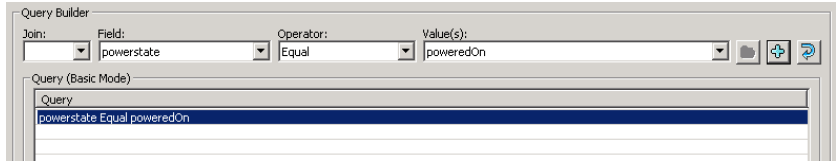


For the **Value(s)** field: you can click the folder icon to browse for values, enter the value manually, or in some cases use the **Value(s)** drop-down. The characters you enter in the **Values** field must be enclosed in single quotes or double quotes. Note that browsing for values may take some time in large virtual environments.

See “[Query Builder field reference](#)” on page 94.



- 6 Click the plus sign to add the rule to the **Query** pane.



- 7 Create more rules as needed.

See [“Query Builder field reference”](#) on page 94.

See [“Examples for the NetBackup Query Builder”](#) on page 86.

- 8 To see which virtual machines NetBackup currently selects based on your query, click **Test Query**.

On the Test Query screen, the Virtual machines in your current environment that match the rules for selection in the policy are labeled INCLUDED. Note however that the Test Query option does not create the backup list for the policy. When the next backup runs from this policy, NetBackup re-discovers virtual machines and consults the query rules. At that time, NetBackup backs up the virtual machines that match the query rules.

The list of virtual machines is saved but the virtual machines are not displayed in the policy's **Clients** tab.

See [“Test Query screen”](#) on page 101.

- 9 You can specify how long NetBackup uses the latest query results as the backup list for future executions of the policy. Set the time period in **Reuse VM selection query results for**.

The default is eight hours.

More information is available on this setting:

See [“About the Reuse VM selection query results option”](#) on page 171.

- 10 To create queries manually (Advanced Mode) instead of using the pull-down menus, click **Advanced**.

See [“Using the Query Builder in Advanced Mode”](#) on page 84.

Editing an existing query in Basic Mode

To edit an existing query in Basic Mode

- 1 Click on the query rule you want to change and click **Edit**.
- 2 Make selections in the pull-down menus.
- 3 Click the save option (diskette icon).
- 4 To delete a rule, click on it and click **Remove**.

See [“Using the Query Builder in Advanced Mode”](#) on page 84.

Using the Query Builder in Advanced Mode

The Query Builder's Advanced Mode provides more flexibility in crafting rules for virtual machine selection, including the use of parentheses for grouping.

To use the Query Builder in Advanced Mode

- 1 Set up a VMware policy and specify a VMware backup host or backup media server.

For assistance, you can refer to the first few steps of the following procedure:

See [“Configuring automatic virtual machine selection”](#) on page 81.

- 2 Click the **Clients** tab.
- 3 Click **Select automatically through query**.
- 4 Beneath the Query Builder pane, click **Advanced**.

Note that the following appears at the start of the query:

```
vmware:/?filter=
```

This string must be the first entry in the query. It should appear only once, no matter how many rules are added in the **Query** pane.

- 5 You can use the Query Builder drop-down menus to add query rules. You can also type in rules manually.

Here are a few example queries:

```
vmware:/?filter=VMFolder Contains "mango"
```

```
vmware:/?filter=Datastore StartsWith "Acc" OR Datastore StartsWith "Prod"
```

```
vmware:/?filter=vCenter Contains "ROS" AND ESXserver Equal "VM_test1"  
AND Powerstate Equal poweredOn
```

- 6 To insert a rule between existing rules, place the cursor where you want the new rule to start and type it in.

When you create a rule with the drop-down menus, it appears at the end of the query. You can cut and paste it into the proper location.

- 7 To establish the proper order of evaluation in compound queries, use parentheses to group rules as needed. Compound queries contain two or more rules, joined by AND, AND NOT, OR, or OR NOT.

More information is available on the use of parentheses and on the order of precedence.

See [“AND vs OR in queries”](#) on page 85.

See [“Order of operations in queries \(precedence rules\)”](#) on page 89.

See [“Parentheses in compound queries”](#) on page 91.

AND vs OR in queries

The **Join** field in the Query Builder provides connectors for joining rules (AND, AND NOT, OR, OR NOT). The effect of AND versus OR in the Query Builder may not be obvious at first glance.

In essence, AND and OR work in this way:

- AND limits or restricts the scope of the query.
- OR opens up the query to an additional possibility, expanding the scope of the query.

Note: Do not use AND to join the rules that are intended to include additional virtual machines in the backup list. For instance, AND cannot be used to mean “include virtual machine X AND virtual machine Y.”

For example: To include the virtual machines that have either “vm1” or “vm2” in their names, use OR to join the rules:

```
Displayname Contains "vm1"  
OR Displayname Contains "vm2"
```

If you use AND to join these rules:

```
Displayname Contains "vm1"  
AND Displayname Contains "vm2"
```

the result is different: the backup list includes only the virtual machines that have both vm1 and vm2 in their names (such as “acmevm1vm2”). A virtual machine with the name “acmevm1” is not included in the backup.

Table 6-7 provides examples with AND and OR.

Table 6-7 Queries with AND, OR

Query	Description
Displayname Contains "vm1" OR Displayname Contains "vm2"	This query selects any virtual machine that has either vm1 or vm2 in its display name. For example, this query selects both "seabizvm1" and "seabizvm2" for backup.
vCenter Equal "vCenterServer_1" AND Datacenter Equal "dc_A" AND ESXserver Equal "prod" AND VMHostName Contains "manu"	This query is very specific. Virtual machines with the host names that contain "manu" are included in the backup only if: they reside in vCenter server "vCenterServer_1", datacenter "dc_A", and ESX server "prod". The virtual machines that do not reside in that hierarchy are not included. For example: if a virtual machine resides in "vCenterServer_1" and datacenter "dc_A", but not in ESX server "prod", that virtual machine is not included.
vCenter Equal "vCenterServer_1" OR Datacenter Equal "dc_A" OR ESXserver Equal "prod" OR VMHostName Contains "manu"	This query uses the same keywords and values, but combines them with OR. The result may be a much larger list of virtual machines. A virtual machine that meets any of these rules is included: <ul style="list-style-type: none"> ■ Any virtual machines in vCenter "vCenterServer_1". Their host names, datacenter, or ESX server do not matter. ■ Any virtual machines in datacenter "dc_A". Their host names or server do not matter. ■ Any virtual machines in ESXserver "prod". Their host names, datacenter, or vCenter server do not matter. ■ Any virtual machines with a host name that contains "manu". Their server or datacenter do not matter.

Examples for the NetBackup Query Builder

The following table provides example query rules.

To use the Query Builder, you must click **Select automatically through query** on the **Client** tab.

Table 6-8 Query Builder examples

Example query	Query result when backup job executes
No query rules specified (Query pane is empty)	All virtual machines are added to the backup list. Exceptions are those that do not have a host name, or that have invalid characters in the display name. See “Effect of Primary VM identifier parameter on Selection column in Test Query results” on page 104.
Displayname Contains "prod"	All virtual machines with the display names that contain the string "prod" are added to the backup list. See “Effect of Primary VM identifier parameter on Selection column in Test Query results” on page 104.
powerstate Equal "poweredOn"	Any virtual machine that is powered on is added to the backup list.
VMGuestOS Equal "windows7Guest"	All virtual machines with a guest OS of Windows 7 are added to the backup list.
DisplayName AnyOf "grayfox7","grayfox9"	The virtual machines named "grayfox7" and "grayfox9" are added to the backup list. (Note that each value must be enclosed in its own quotes, with a comma in between.)
powerstate Equal "poweredOn" AND Datastore Equal "Storage_1" AND VMGuestOS Equal "rhel4Guest"	In datastore Storage_1: any virtual machine that is powered on and has a guest OS of Red Hat Linux 4 is added to the backup list.
vCenter Equal "vCenterServer_1" AND ESXserver Contains "prod"	In the vCenter server vCenterServer_1, virtual machines that are in ESX servers with names containing "prod" are added to the backup list.
Cluster Equal "VMcluster_1" AND ESXserver AnyOf "ESX_1","ESX_2","ESX_3" AND VMHostName Contains "Finance"	In cluster VMcluster_1, all virtual machines with the host names that contain "Finance", in ESX servers ESX_1, ESX_2, ESX_3, are added to the backup list.
VMFolder StartsWith "Prod" OR VMFolder NotEqual "VM_test"	For any folder whose name starts with "Prod" or whose name is not "VM_test", add its virtual machines to the backup list.
Examples with IsSet	See “The IsSet operator in queries” on page 88.

Click **Advanced** to see the query rule in Advanced Mode. Only Advanced Mode supports the use of parentheses for grouping sets of rules.

See [“Using the Query Builder in Advanced Mode”](#) on page 84.

The IsSet operator in queries

In a query, you can use the IsSet operator to ensure that certain virtual machines are included or excluded from the backup.

For example: if the **Primary VM identifier** parameter is set to VM hostname, NetBackup is unable to identify virtual machines for backup that do not have a host name. You can use IsSet to exclude such virtual machines from the backup list.

Table 6-9 Examples of queries with the IsSet operator

Query rules with IsSet operator	Effect of the query on virtual machine selection
Cluster Contains "dev" AND VMDNSName IsSet	<p>INCLUDED: Any virtual machine in a cluster that has a name that contains the string "dev" if the virtual machine also has a VMware DNS name.</p> <p>EXCLUDED: Any virtual machines that do not have a VMware DNS Name.</p> <p>Without VMDNSName IsSet in this query, virtual machines without a DNS name cannot be excluded. They would be listed as FAILED.</p>
Displayname Contains "prod" AND VMHostName IsSet	<p>INCLUDED: Any virtual machine with a display name that contains the string "prod" if the virtual machine also has a host name.</p> <p>EXCLUDED: Any virtual machines that do not have host names.</p> <p>Without VMHostName IsSet in this query, virtual machines without a host name cannot be excluded. They would be listed as FAILED.</p>

The policy's **Primary VM identifier** parameter has an important effect on which virtual machines NetBackup can back up. This parameter affects the test query results.

See [“Effect of Primary VM identifier parameter on Selection column in Test Query results”](#) on page 104.

Multiple VMware policies that work together

If your virtual environment has many virtual machines with inconsistent naming conventions, you may need multiple policies working in tandem. It may be difficult to create a single policy that automatically selects all the virtual machines that you want to back up.

For this situation, configure several policies such that each policy backs up a portion of the environment. One policy backs up a particular set or group of virtual machines, such as those that have host names. A second policy backs up a different

group of virtual machines that were not backed up by the first policy, and so forth. When all the policies have run, all the virtual machines are backed up.

The following table describes policies that are designed to back up the virtual environment in three phases. Note that each policy relies on a different setting for the **Primary VM identifier** parameter.

Table 6-10 Three policies that back up virtual machines in phases

Policy	Query Builder rules	Backup result
First policy Primary VM identifier parameter: VM hostname	VMHostName IsSet	This policy backs up all virtual machines that have a host name. Any virtual machines that do not have a host name are excluded from the backup.
Second policy Primary VM identifier parameter: VM display name	NOT VMHostName IsSet AND VMHasVDSName Equal 'TRUE'	This policy backs up all virtual machines that do not have a host name but that do have a valid display name. Any virtual machines that do not have a host name or a valid display name are excluded from the backup. See “NetBackup character restrictions for virtual machine display names” on page 35.
Third policy Primary VM identifier parameter: VM UUID	NOT VMHostName IsSet AND NOT VMHasVDSName Equal 'TRUE'	This policy backs up the virtual machines that were not backed up by the first two policies. This policy selects the virtual machines that do not have a host name or a valid display name, but that do have a UUID.

More information is available on the **Primary VM identifier** parameter and its effect on virtual machine selection.

See [“Effect of Primary VM identifier parameter on Selection column in Test Query results”](#) on page 104.

Order of operations in queries (precedence rules)

The information in this topic is for advanced users who understand precedence in programming languages. In the Query Builder, the order in which operations occur can determine which virtual machines are selected and backed up.

The following table lists the order of operations, or precedence, from highest to lowest (7 is the highest). For example, an operation with a precedence of 6 (such as Contains) is evaluated before an operation with a precedence of 5 (such as Greater).

Table 6-11

Operation	Description	Precedence
!x	Produces the value 0 if x is true (nonzero) and the value 1 if x is false (0).	7
x Contains y	Does y exist somewhere in x	6
x StartsWith y	Does x start with y	6
x EndsWith y	Does x end with y	6
x AnyOf list	Does x appear in list	6
x Greater y	Is x greater than y	5
x GreaterEqual y	Is x greater than or equal to y	5
x Less y	Is x less than y	5
x LessEqual y	Is x less than or equal to y	5
x Equal y	Is x equal to y	4
x NotEqual y	Is x not equal to y	4
Not x	operator produces the value 0 if x is true (nonzero) and the value 1 if x is false (0).	3
x And y	True if both x and y are true	2
x OR y	True if either x or y are true	1

Note the following:

- AND has a higher precedence than OR.
 In the Query Builder's Advanced Mode, you can use parentheses to change the order of evaluation in the rules that use AND or OR.
 See [“Parentheses in compound queries”](#) on page 91.
- In the Query Builder's Advanced Mode, you can combine two or more operations in a single rule without AND or OR to join them. Precedence determines the order in which the operations are evaluated within the rule.

Example of a rule that includes three operations:

```
Displayname StartsWith "L" NotEqual Displayname contains "x"
```

This rule selects the following virtual machines:

Virtual machines with the names that start with L.

Virtual machines with the names that do not start with L but that do contain x.

Explanation: The StartsWith and Contains operations have a precedence of 6, whereas NotEqual has a lower precedence of 3. Starting on the left, the StartsWith operation is evaluated first and the Contains operation is evaluated next. The last operation to be evaluated is Not Equal.

See [“Using the Query Builder in Advanced Mode”](#) on page 84.

Parentheses in compound queries

You can use the Query Builder to make precise queries containing as many rules as necessary to identify the appropriate virtual machines. In a query such as powerstate Equal "poweredOn", the result of the query is easy to predict: only the virtual machines that are powered on are included in the backup. But if several rules are combined with AND and OR, the result may not be obvious. This kind of query is called a compound query. Compound queries contain two or more rules, joined by AND, AND NOT, OR, or OR NOT.

The order in which the Query Builder evaluates compound rules affects the outcome of the query. Grouping the rules with parentheses can change the order of evaluation and thus the outcome of the query.

The examples in the following table demonstrate how the Query Builder evaluates compound queries with and without parentheses.

Note: Only the Query Builder's Advanced Mode supports the use of parentheses.

Table 6-12 Examples of compound queries with and without parentheses

Example query	The following virtual machines are selected
ESXServer Equal "ESX001" OR Folder Equal "FolderEngA" AND powerstate Equal ON	All virtual machines under ESX001 (regardless of power state), and virtual machines under FolderEngA that are powered on. To select only the virtual machines that are powered on in the ESX server and in the folder, use parentheses (see next example).
(ESXServer Equal "ESX001" OR Folder Equal "FolderEngA") AND powerstate Equal ON	All the virtual machines that are powered on in ESX001 and in FolderEngA.

Query rules for resource pools

If the resource pool that you query is nested, the choice of Operator determines which virtual machines in the resource pool hierarchy are discovered.

For example, assume the following hierarchy of resource pools that contain virtual machines:

```

Res/ResourcePool_1
    VM1
    VM2
  /ResourcePool_2
    VM3
    VM4
  /ResourcePool_3
    VM5
    VM6
  
```

where ResourcePool_1 contains virtual machines VM1 and VM2, and so forth.

The following table shows the query results with the Contains, Equal, StartsWith, and EndsWith operators. (Other operators can be used.)

Note: If you want the query to include all virtual machines in a hierarchy of nested resource pools, do not use Equal as the Operator.

Table 6-13 Example rules for nested resource pools

Query rule	Included virtual machines
Resourcepool Contains "Res/ResourcePool_1"	Includes all the virtual machines in the three resource pools (VM1 through VM6).
Resourcepool Equal "Res/ResourcePool_1"	Includes only the virtual machines that are in ResourcePool_1 (VM1, VM2). Virtual machines in the sub-pools are not included (VM3 through VM6).
Resourcepool Equal "Res/ResourcePool_1/ResourcePool_2"	Includes only the virtual machines that are in ResourcePool_2 (VM3, VM4).
Resourcepool StartsWith "Res/ResourcePool"	Includes all the virtual machines in the three resource pools (VM1 through VM6).
Resourcepool StartsWith "Res/ResourcePool_1/ResourcePool_2"	Includes only the virtual machines that are in ResourcePool_2 and 3. Virtual machines in ResourcePool_1 are not included.

Table 6-13 Example rules for nested resource pools (*continued*)

Query rule	Included virtual machines
Resourcepool EndsWith "ResourcePool_2"	Includes the virtual machines in ResourcePool_2 (VM3, VM4) but not in ResourcePool_1 or 3.

These examples also apply to host folders.

See “[Query rules for datacenter folders \(HostFolder\)](#)” on page 93.

Query rules for datacenter folders (HostFolder)

In NetBackup terminology, a host folder is a folder that has been defined within a VMware datacenter. A host folder can contain ESX servers or clusters, as well as other folders. For example:

```
Folder_1
  ESX1
  ESX2
  subfolder_A
    ESX3
    ESX4
  subfolder_B
    ESX_5
    ESX_6
```

If you want NetBackup to select all the virtual machines within the top-level folder and any subfolders, use the Contains or StartsWith operator. For example:

```
HostFolder Contains "Folder_1"
```

Note: If you want the query to include all virtual machines in the hierarchy of folders, do not use Equal as the Operator.

If you want NetBackup to select the virtual machines within a subfolder only (such as subfolder_A), use the Contains or Equal operator. For example:

```
HostFolder Equal "Folder_1/subfolder_A"
```

In this case, NetBackup includes only the virtual machines that reside on servers ESX3 and ESX4.

For host folders, these operators work the same as they do for resource pools. For further query builder examples, refer to the following topic (substitute host folder for resource pool in the examples):

See [“Query rules for resource pools”](#) on page 92.

Query Builder field reference

[Table 6-14](#) describes the drop-down fields and options for creating rules in the Query Builder.

Table 6-14 Query Builder drop-down options: Join, Field, Operator, Value(s)




Query Builder drop-down fields	Description
Join	<p>Selects a connector to join rules.</p> <p>For the first rule, choices are blank (none) or NOT. After you add a rule, the available connectors are AND, AND NOT, OR, OR NOT.</p>
Field	<p>Selects a parameter on which to build the rule. Select one from the list (scroll down for additional parameters).</p> <p>You can type the first character to speed up selection. For example, on entering “d”, the list moves to first entry starting with “d”. Another entry of “d” moves through the list to the next entry starting with “d”. The selected entry is automatically filled in.</p> <p>See Table 6-15 on page 95.</p>
Operator	<p>Selects an operator. The available operators depend on the parameter that is selected for Field.</p> <p>See Table 6-16 on page 100.</p>
Value(s)	<p>Specifies a value for the Field parameter.</p> <p>The Value field allows manual entry. It may also be a drop-down, depending on the selections that are made in the other fields.</p> <p>For manual entry, you can specify multiple comma-separated values.</p> <p>See Table 6-17 on page 101.</p>
	<p>Allows browsing for specific values, depending on the selections that are made in the other drop-down fields.</p>
	<p>Adds the current drop-down selections to the Query pane as a new rule.</p>

Table 6-14 Query Builder drop-down options: Join, Field, Operator, Value(s)
 (continued)

Query Builder drop-down fields	Description
	Blanks out the drop-down fields.

Field (keywords)

[Table 6-15](#) describes the keywords available in the **Field** drop-down. The table also indicates whether the values for each keyword (in the **Values** field) are case-sensitive.

Note that the inclusion or exclusion of virtual machines is not determined by the **Field** keyword alone, but depends on the rule you construct: the combination of Join, Field, Operator, and Value(s).

Table 6-15 Keywords in the **Field** drop-down

Field keyword	Data type	Description
Annotation	Alphanumeric string	The text that is added to virtual machine annotations in vSphere Client. Values are case-sensitive.
Cluster	Alphanumeric string	The name of the cluster (a group of ESX servers) that the virtual machine is configured in. Values are not case-sensitive. Note: A virtual machine may be assigned to an ESX server that is not in a cluster. Note also that in VMware, a cluster name need only be unique within a datacenter path.
Datacenter	Alphanumeric string	The name of the VMware datacenter. Values are not case-sensitive.
DatacenterPath	Alphanumeric string	The folder structure that defines the path to a datacenter. Use this option if the datacenter name that you want to filter on is not unique in your environment. Values are case-sensitive.

Table 6-15 Keywords in the **Field** drop-down (*continued*)

Field keyword	Data type	Description
Datstore	Alphanumeric string	The name of the datstore. Values are case-sensitive. Note: Multiple ESX servers can share access to the same datstore. Also, a datstore name can be duplicated between multiple ESX servers. Use DatacenterPath or ESXserver to uniquely identify the datacenter.
DatstoreCluster	Alphanumeric string	The name of the datstore cluster that contains the datstores. Values are not case-sensitive.
DatstoreFolder	Alphanumeric string	The name of the folder that contains the datstores. Values are not case-sensitive.
DatstoreNFSHost	Alphanumeric string	The name of the datstore's NFS host. Values are not case-sensitive.
DatstoreNFSPath	Alphanumeric string	The folder structure that defines the path to an NFS datstore. Use this option if the NFS host name of the datstore that you want to filter on is not unique in your environment. Values are not case-sensitive.
DatstoreType	Alphanumeric string	The type of the datstore. Values are NFS or VMFS. Values are not case-sensitive.
Displayname	Alphanumeric string	The virtual machine's display name. Values are not case-sensitive.
ESXserver	Alphanumeric string	The name of the ESX server. Values are not case-sensitive. The ESX host name must match the name as defined in the vCenter server.
HostFolder	Alphanumeric string	The folder path between the datacenter level and a cluster, ESX hosts, or a subfolder. Values are not case-sensitive. See “Query rules for datacenter folders (HostFolder)” on page 93.

Table 6-15 Keywords in the **Field** drop-down (continued)

Field keyword	Data type	Description
Network	Alphanumeric string	The name of the network switch (on an ESX server) or distributed switch. Values are not case-sensitive.
NetworkFolder	Alphanumeric string	The name of the folder that contains the network. Values are not case-sensitive.
Powerstate	Alphabetic	The power state of the virtual machine. Values are poweredOff, poweredOn, suspended.
Resourcepool	Alphanumeric string	The name of the resource pool. (A resource pool is similar to a vApp.) Values are not case-sensitive. If a resource pool contains other resource pools (sub-pools), the choice of Operator determines whether virtual machines in the sub-pools are included. See “Query rules for resource pools” on page 92.
Template	Boolean	TRUE if the virtual machine is a virtual machine template.
vApp	Alphanumeric string	The name of the vApp. Values are not case-sensitive. A vApp is a collection of virtual machines. vApps can also contain resource pools and other vApps. vApps are components of standalone ESX servers or of clusters. Like vSphere Client, NetBackup refers only to the top level of a vApp that contains sub vApps. For the following rule: <code>vApp Equal "vapp1"</code> if vapp1 has a sub vApp named "vapp2", any virtual machines in vapp1 or vapp2 are included. You cannot make a rule that refers specifically to vapp2.

Table 6-15 Keywords in the **Field** drop-down (*continued*)

Field keyword	Data type	Description
vCenter	Alphanumeric string	<p>The name of the vCenter server.</p> <p>Values are not case-sensitive.</p> <p>The vCenter name that is specified in the Query Builder must match the name as entered in the Administration Console for NetBackup credentials. (Media and Device Management > Credentials > Virtual Machine Servers.)</p> <p>Note that a fully qualified domain name is recommended.</p>
VMDNSName	Alphanumeric string	<p>The virtual machine DNS name in vSphere Client.</p> <p>Values are not case-sensitive.</p>
VMFolder	Alphanumeric string	<p>The folder structure (within a datacenter) to a virtual machine folder, including all subfolders.</p> <p>Values are not case-sensitive.</p> <p>Examples are:</p> <p>/clusters/discovered virtual machine</p> <p>/standalone/folder1/folder2</p>
VMGuestOS	Alphanumeric string	<p>The virtual machine guest OS type that is recorded in vSphere Client.</p> <p>Values are case-sensitive.</p>
VMHasIDE	Boolean	TRUE if the virtual machine has IDE drives.
VMHasMDS	Boolean	<p>TRUE if the virtual machine has multiple datastores.</p> <p>You can use this keyword to select any virtual machine that is configured to use more than one datastore.</p>
VMHasRDM	Boolean	TRUE if the virtual machine uses Raw Device Mapping (RDM).
VMHasSnap	Boolean	TRUE if a VMware snapshot of the virtual machine is currently active.
VMHasVDSName	Boolean	TRUE if the virtual machine has a display name that is valid for use as the host name.
VMHostName	Alphanumeric string	<p>The virtual machine name that is derived from a reverse lookup of its IP address.</p> <p>Values are not case-sensitive.</p>

Table 6-15 Keywords in the **Field** drop-down (continued)

Field keyword	Data type	Description
VMIsConn	Boolean	TRUE if the virtual machine is connected and available. For example: If a virtual machine's ESX server is down, that virtual machine is not connected.
VMVersion	Alphanumeric string	The VMware version of the virtual machine. Values are case-sensitive. For example: vmx-04, vmx-07, vmx-08.
VMXDatastore	Alphanumeric string	The name of the vmx datastore (sometimes called the vmx directory or configuration datastore). Values are case-sensitive. More information on the vmx datastore is available. See “NetBackup for VMware terminology” on page 22.
VMXDatastoreFolder	Alphanumeric string	The name of the folder that contains the vmx datastores. Values are not case-sensitive.
VMXDatastoreNFSHost	Alphanumeric string	The name of the vmx datastore's NFS host. Values are not case-sensitive.
VMXDatastoreNFSPath	Alphanumeric string	The folder structure that defines the path to a vmx NFS datastore. Use this option if the NFS host name of the datastore that you want to filter on is not unique in your environment. Values are not case-sensitive.
VMXDatastoreType	Alphanumeric string	The type of the vmx datastore. Values are NFS or VMFS. Values are not case-sensitive.
[vSphere custom attributes]	Alphanumeric string	The value of a custom attribute that is set in vSphere Client for one or more virtual machines. Note: in vSphere Client, the attribute must have a value for at least one virtual machine. The attribute type must be Virtual Machine. The values are case-sensitive.

Operators

[Table 6-16](#) describes the operators available in the **Operator** drop-down.

Table 6-16 Operators in the **Operator** drop-down

Operator	Description
AnyOf	Matches any of the specified values in the Value(s) field. For example: If the ESX servers in the Value(s) field are "ESX01", "ESX02," "ESX03", AnyOf matches any ESX server that has one of those names. If the names of your servers are not identical to any of the specified values, no match occurs. A server named ESX01A is not a match.
Contains	Matches the value in the Value(s) field wherever that value occurs in the string. For example: If the Value(s) entry is "dev", Contains matches strings such as "01dev", "01dev99", "devOP", and "Development_machine".
EndsWith	Matches the value in the Value(s) field when it occurs at the end of a string. For example: If the Value(s) entry is "dev", EndsWith matches the string "01dev" but not "01dev99", "devOP", or "Development_machine".
Equal	Matches only the value that is specified in the Value(s) field. For example: If the display name to search for is "VMtest27", Equal matches virtual machine names such as VMTest27 or vmtest27 or vmTEST27, and so forth. The name VMtest28 is not matched.
Greater	Matches any value that is greater than the specified Value(s), according to the ASCII collating sequence.
GreaterEqual	Matches any value that is greater than or equal to the specified Value(s), according to the ASCII collating sequence.
IsSet	Determines whether a value is returned for the Field keyword. Use IsSet with another rule as a condition, to ensure that the query selects the appropriate virtual machines. Note that you do not make an entry under Value(s) for a rule that uses IsSet. See “The IsSet operator in queries” on page 88. See “Effect of Primary VM identifier parameter on Selection column in Test Query results” on page 104. See “Test Query: Failed virtual machines” on page 103.
Less	Matches any value that is less than the specified Value(s), according to the ASCII collating sequence.
LessEqual	Matches any value that is less than or equal to the specified Value(s), according to the ASCII collating sequence.
NotEqual	Matches any value that is not equal to the value in the Value(s) field.

Table 6-16 Operators in the **Operator** drop-down (*continued*)

Operator	Description
StartsWith	Matches the value in the Value(s) field when it occurs at the start of a string. For example: If the Value(s) entry is "box", StartsWith matches the string "box_car" but not "flatbox".

Value(s)

[Table 6-17](#) describes the characters that can be entered in the **Value(s)** field. The **Field** keyword determines case sensitivity.

Note: The character string you enter in the **Value(s)** field must be enclosed in single quotes or double quotes.

Table 6-17 Characters you can enter for Value(s)

Character types	String characters allowed
Alphanumerics	A to Z, a to z, 0 to 9, - (minus sign), and special characters. Note: Decimal numbers only.
Wildcards	* (asterisk) matches everything. For example: "*prod*" matches the string "prod" preceded or followed by any characters. ? (question mark) matches any single character. For example: "prod??" matches the string "prod" followed by any two characters.
Escape character	\ (backslash) escapes the wildcard or meta-character that follows it. For example: To search for a string that contains an asterisk (such as test*), enter "test*"
Quotation marks	Note: The characters you enter in Value(s) must be enclosed in single or double quotes. To search for a string that contains quotation marks, either escape each quote (\") or enclose the entire string in the opposite type of quotes. For example: To search for a string that includes double quotes (such as "name"), enter "'name'" (enclosing it in single quotes) or "\"name\""

Test Query screen

This screen lists the virtual machines that NetBackup discovered in your virtual environment when you clicked **Test Query**. Later changes in the virtual environment may affect which virtual machines match the query rules. For

example: if virtual machines are added, the test results may not be identical to the virtual machines that are selected for backup when the backup runs.

When the next backup runs from this policy, the following occur: NetBackup re-discovers virtual machines, consults the query rules, and backs up the virtual machines that match the rules.

The list of backed up virtual machines is saved but the virtual machines are not displayed in the policy's **Clients** tab. You can use the Activity Monitor to view the virtual machine jobs, or you can run a **Virtual Client Summary** report in OpsCenter.

Note: An alternative to the Test Query screen is the `nbdiscover` command. For more information, see the *NetBackup Commands Reference Guide*.

See [“Using the Activity Monitor to monitor virtual machine backups”](#) on page 117.

See [“Using OpsCenter to report on virtual machine backups”](#) on page 122.

The **Test Query** function runs in the background. You can continue to configure the policy while the test runs. Any changes you make in the Query Builder however are not included in the currently running test. You must re-initiate the test to see the results of your Query Builder changes.

Testing query for policy Lists the rules in the Query Builder that were used in this test. The rules are specified in the Query Builder on the policy **Clients** tab.

Test query results **VM Name:** Shows the display name of all discovered virtual machines.

Selection: Lists the virtual machines that were discovered, as follows:

- **INCLUDED:** The virtual machine matches the rules in the query.
- **EXCLUDED:** The virtual machine does not match the rules in the query.
- **FAILED:** The virtual machine cannot be selected for backup because of a host name problem or other error. Also, the query cannot exclude the virtual machine. An explanation appears at the bottom of the **Test Query** screen. For example:

```
VM does not have a host name to use as a  
client name, display name =
```

See [“Test Query: Failed virtual machines”](#) on page 103.

The operator `IsSet` can be used to filter out such virtual machines. More information is available on `IsSet`.

See [Table 6-16](#) on page 100.

See [“The `IsSet` operator in queries”](#) on page 88.

Included: The bottom of the screen gives a tally of how many virtual machines were included, excluded, or failed in the test.

Excluded:

Failed:

See [“Using the Activity Monitor to monitor virtual machine backups”](#) on page 117.

See [“About automatic virtual machine selection for NetBackup for VMware”](#) on page 72.

See [“Configuring automatic virtual machine selection”](#) on page 81.

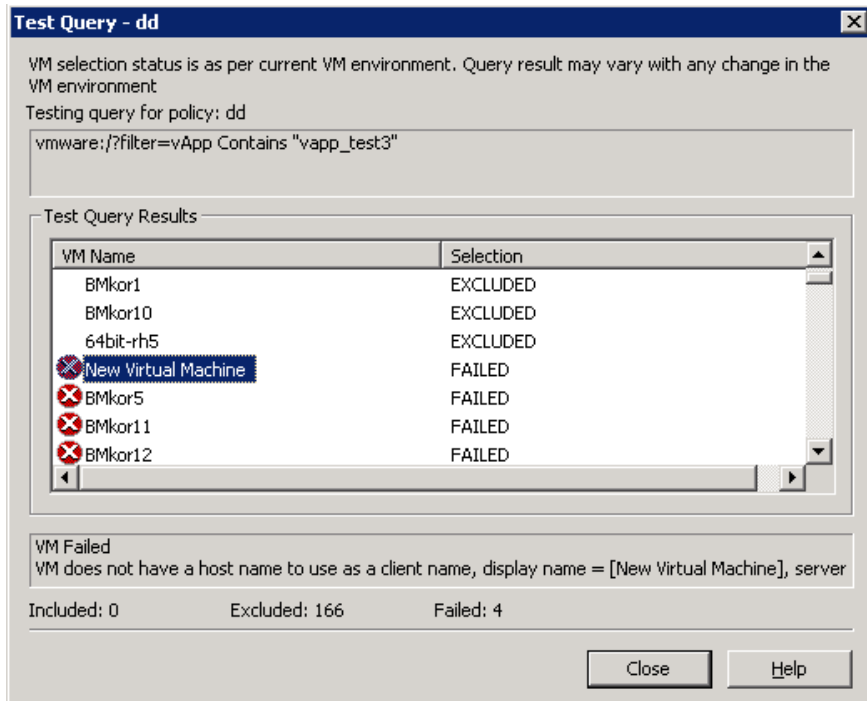
Test Query: Failed virtual machines

If the query rules cannot exclude a virtual machine, and that virtual machine cannot be selected for backup, it is marked as FAILED. The virtual machine is listed as not run in the job details log.

For example: the virtual machine does not have the type of name specified by the **Primary VM identifier** parameter (such as host name or display name). Or the virtual machine name contains invalid characters. In any case, a virtual machine that is listed as FAILED should be investigated: it may be one that you want to back up.

To see the reason for the failure, click on the virtual machine in the Test Query Results. An explanation appears at the bottom of the screen.

For example:



Explanation: The virtual machine that is listed as **New Virtual Machine** in the example does not have a VMware host name. In the NetBackup policy, on the **VMware** tab, the **Primary VM identifier** parameter may be set to **VM hostname**. In that case, NetBackup cannot refer to the virtual machine by its host name and thus cannot back it up.

You can fix this problem in a couple of ways:

- Use vSphere Client to configure a host name for the virtual machine.
- To exclude the virtual machines that have no host name, construct a query with the IsSet operator.

See [“The IsSet operator in queries”](#) on page 88.

Effect of Primary VM identifier parameter on Selection column in Test Query results

The NetBackup policy's **Primary VM identifier** parameter tells NetBackup how to identify virtual machines. For example, if the parameter is set to **VM hostname**,

NetBackup identifies virtual machines by their host names. If they do not have a host name, the policy cannot back them up.

The **Primary VM identifier** parameter has a direct effect on the query test results. Note that for each virtual machine, the query test result is one of three possibilities: INCLUDED, EXCLUDED, or FAILED.

If NetBackup cannot identify a virtual machine according to the **Primary VM identifier** parameter, one of two test results can occur:

- If the virtual machine is filtered out by the query rules, it is listed as EXCLUDED.
- If the virtual machine is not filtered out by the query rules, it is listed as FAILED.

The following table gives the test query results from example combinations of the **Primary VM identifier** parameter and a query rule.

Table 6-18 Effect of Primary VM identifier parameter and query rules on test query results

Primary VM identifier setting on VMware policy tab	Query rule in Query Builder	Test query result
VM hostname	VMHostName Contains "VM"	INCLUDED: Any virtual machines with a host name that contains "VM". Since the Primary VM identifier parameter tells NetBackup to select the virtual machine by host name, it can back up the virtual machines. EXCLUDED: All other virtual machines.
VM hostname	Displayname Contains "VM"	INCLUDED: Any virtual machines that have a host name and that have a display name that contains "VM". EXCLUDED: Any virtual machines that have a host name, but that do not have a display name containing "VM". FAILED: Any virtual machines that do not have a host name. Since the Primary VM identifier parameter is set to VM hostname, NetBackup cannot select the virtual machine for backup.
VM hostname	Displayname Contains "VM" AND VMHostName IsSet	INCLUDED: Any virtual machines that have a host name and that have a display name that contains "VM". EXCLUDED: All other virtual machines. The IsSet rule means that if a virtual machine does not have a host name, it is excluded.

Table 6-18 Effect of Primary VM identifier parameter and query rules on test query results (*continued*)

Primary VM identifier setting on VMware policy tab	Query rule in Query Builder	Test query result
VM hostname	Displayname Contains "VM" AND VMHostName IsSet OR Annotation Contains "test" AND NOT VMHostName IsSet	INCLUDED: <ul style="list-style-type: none"> Any virtual machines that have a host name and that have a display name that contains "VM". Any virtual machines without a host name that have an annotation that contains "test". EXCLUDED: All other virtual machines.
VM display name	Displayname Contains "VM"	INCLUDED: Any virtual machines with the display names that contain "VM". Since the Primary VM identifier parameter tells NetBackup to select the virtual machine by display name, it can back up the virtual machines. EXCLUDED: All other virtual machines.
VM display name	VMHostName Contains "VM"	INCLUDED: Any virtual machines that have a display name and that have a host name that contains "VM". EXCLUDED: Any virtual machines that have a display name, but that do not have a host name containing "VM". FAILED: Any virtual machines that do not have a display name. Since the Primary VM identifier parameter is set to VM display name, NetBackup cannot select those virtual machines for backup.

Effect of Primary VM identifier parameter on VM Name column in Test query results

The policy's **Primary VM identifier** parameter affects the type of virtual machine name that appears in the **VM Name** column of the Test Query screen, as follows:

- If a virtual machine is EXCLUDED or FAILED, it is listed according to its virtual machine display name. The **Primary VM identifier** parameter does not matter.
- But if a virtual machine is listed as INCLUDED, note: The name that appears under **VM Name** is the type of name that is specified on the **Primary VM identifier** parameter.

For example: If the **Primary VM identifier** parameter is VM hostname, the included virtual machine is listed according to its host name. Even if the query

rule specified Display name (such as `Displayname Equal "vm1"`), the virtual machine appears on the Test Query screen by its host name.

See [“Primary VM identifier options \(VMware\)”](#) on page 53.

108 | Configure automatic selection of virtual machines for backup
| **Effect of Primary VM identifier parameter on VM Name column in Test query results**

Reduce the size of backups

This chapter includes the following topics:

- [About reducing the size of VMware backups](#)
- [Block-level backup \(BLIB\): full vs incremental](#)
- [Deleting a vSphere Client snapshot](#)
- [Using VMware's Changed Block Tracking for full backups only](#)

About reducing the size of VMware backups

NetBackup provides the following options for reducing the backup size for a VMware virtual machine:

Block level
incremental backup
(BLIB)

BLIB reduces the size of backups (full and incremental) by tracking block-level changes. Only the blocks that have changed since the last full or incremental are included in the backup. For incremental backups, this option applies to cumulative and to differential backups.

BLIB works with VMware's Changed Block Tracking in vSphere to track block-level changes in the virtual machine.

To enable BLIB, click **Enable block-level incremental backup** in the NetBackup policy **VMware** tab. NetBackup uses BLIB for storage optimization when the backup runs.

Note: The first backup you run with BLIB must be a full backup.

See "[Block-level backup \(BLIB\): full vs incremental](#)" on page 110.

Note the following about block level incremental backups:

- Works only with ESX 4.0 or later virtual machines at version vmx-07 or later.
- Requires vStorage (cannot be used in VCB-based backups).

Note: If you have used the vSphere Client interface to manually create a snapshot of the virtual machine and that snapshot is currently active, you may have to delete the snapshot.

See "[Deleting a vSphere Client snapshot](#)" on page 111.

See "[Using VMware's Changed Block Tracking for full backups only](#)" on page 112.

Exclusion of deleted
blocks.

Reduces the size of virtual machine backups by excluding any deleted sectors in the file system on the virtual machine.

To enable this option, click **Exclude deleted blocks** on the policy **VMware** tab.

Refer to **Exclude deleted blocks** in the following topic:

See "[Optimizations options \(VMware\)](#)" on page 52.

Block-level backup (BLIB): full vs incremental

When you use the **Enable block-level incremental backup** option in the policy, NetBackup uses VMware's Changed Block Tracking feature to reduce the backup size. Since this option works at the block level (not at the file level), it applies only to backups of the entire virtual machine. It cannot be used when the policy backup selections list specifies individual files.

This option reduces the size of full backups as well as the size of incremental backups, as follows.

Table 7-1 Block-level backup of the virtual machine: full vs incremental schedule

Type of backup	Optimization that is used in backup
Backup of entire virtual machine, with full schedule	Backs up only the blocks that have changed since the .vmdk was created.
Backup of entire virtual machine, with incremental schedule	Backs up only the blocks that have changed since the last backup, as follows: <ul style="list-style-type: none"> ■ For cumulative incrementals, BLIB backs up only the blocks that changed since the last full backup. ■ For differential incrementals, BLIB backs up only the blocks that changed since the previous backup of any kind.

Deleting a vSphere Client snapshot

To use BLIB with NetBackup for VMware, you must delete an existing vSphere Client snapshot if both of the following are true:

- You used the vSphere Client interface to manually create a snapshot of the virtual machine and that snapshot is currently active.
- A NetBackup policy with the **Enable block-level incremental backup** feature had never been used to back up the virtual machine before you started the vSphere Client snapshot.

In this case, NetBackup cannot enable BLIB for the virtual machine. You must delete the vSphere Client snapshot. Then, when the NetBackup policy runs, BLIB is enabled.

More information is available on NetBackup block-level backups:

To delete a vSphere Client snapshot

- 1 In the vSphere Client interface, right-click on the virtual machine and select **Snapshot > Snapshot Manager**.
- 2 Select the snapshot and click **Delete**.
- 3 To back up the virtual machine with BLIB, you can now run a NetBackup policy that uses **Enable block-level incremental backup**.

NetBackup backups from this policy continue to use storage optimization, even if you manually create a snapshot of the virtual machine using vSphere Client.

Using VMware's Changed Block Tracking for full backups only

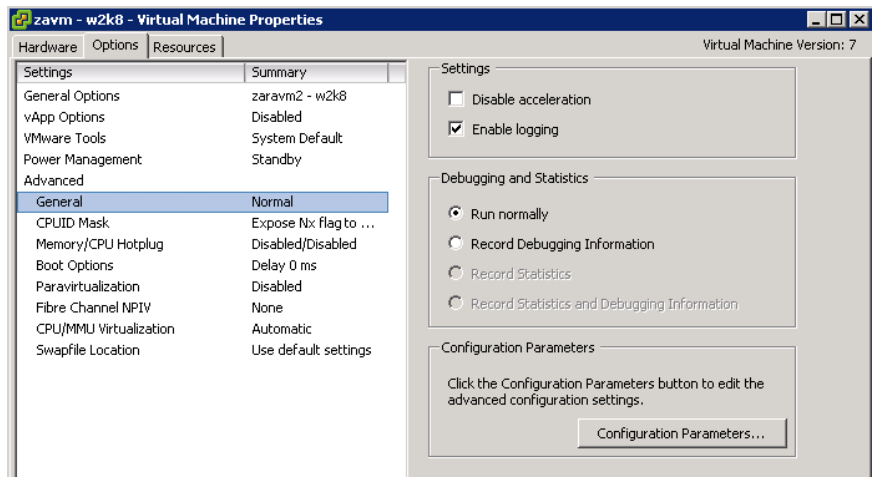
The **Enable block-level incremental backup** option (BLIB) in the NetBackup VMware policy applies to full backups and incremental backups. BLIB skips blocks on the virtual disk that are unmodified since the last backup. If you want to skip unmodified blocks during full backups but not incrementals, do not configure the policy for BLIB. Instead, enable changed block tracking by means of the vSphere Client interface.

To enable changed block tracking for full backups only (vSphere Client interface)

- 1 In the vSphere Client interface, power off the virtual machine.
- 2 Select the virtual machine, then click **Edit settings**.
- 3 Obtain the hard drive controller and disk numbers (SCSI and IDE) for each virtual drive on the virtual machine.

To find the controller number and disk numbers, do the following:

- Click the **Hardware** tab.
 - Click on each hard disk. Its controller number and disk number (SCSI or IDE) appear under **Virtual Device Node**, in the form `SCSI (X.X)` or `IDE (X.X)`. Make a note of each.
- 4 Click the **Options** tab. Under **Advanced, General**, click **Configuration Parameters**.



- 5 On the **Configuration Parameters** screen, click **Add Row**.

- 6 Enter `ctkEnabled` in the **Name** column and enter `true` for the **Value**.
- 7 For each virtual drive on the virtual machine, enter a **Name** in the form:

```
scsiX:X.ctkEnabled
```

or

```
ideX:X.ctkEnabled
```

where `X:X` represents the controller number and disk number of each disk as found on the **Hardware** tab.

For example: `scsi0:0.ctkEnabled` for the first disk and `scsi0:1.ctkEnabled` for the second disk. (The numbers for your disks may be different.)

- 8 Enter `true` for the **Value** of each disk entry.
- 9 Click **OK**.
- 10 Power on the virtual machine.

Now you can use vSphere Client to take a snapshot of the virtual machine. NetBackup can apply vStorage optimization (changed block tracking) to future backups of the virtual machine.

114 | Reduce the size of backups
| **Using VMware's Changed Block Tracking for full backups only**

Back up virtual machines

This chapter includes the following topics:

- [Backing up virtual machines](#)
- [Using the Activity Monitor to monitor virtual machine backups](#)
- [Viewing NetBackup activity in vSphere Client](#)
- [Using OpsCenter to report on virtual machine backups](#)

Backing up virtual machines

Virtual machine backups initiate from a NetBackup policy. You can start the backup manually from a policy, or have it run automatically according to a schedule that is defined in the policy.

To create the policy, you can use the **Policies** utility in the NetBackup Administration Console, or the Policy Configuration Wizard .

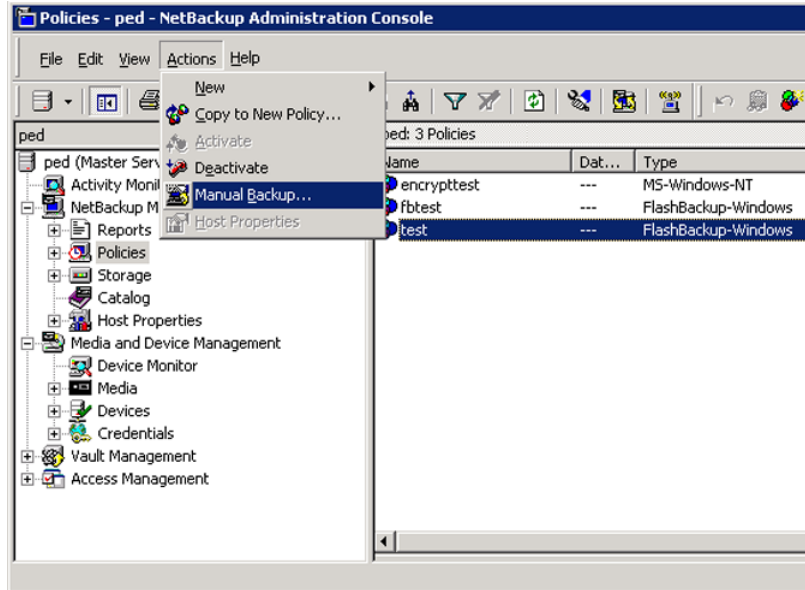
See “[Configuring a VMware policy from the Policies utility](#)” on page 48.

See “[Configuring a VMware policy from the Policy Wizard](#) ” on page 47.

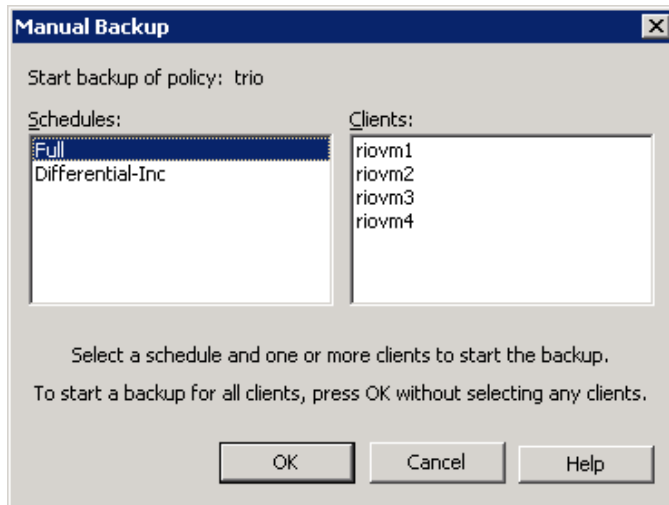
For further information on policies and backup schedules, see the "Creating backup policies" chapter of the *NetBackup Administrator's Guide, Volume I*.

To back up a virtual machine manually from an existing policy

- 1 Click on **Policies** in the NetBackup Administration Console, select the policy, and click **Actions > Manual Backup**.



The Manual Backup dialog appears.



- 2 Select the type of schedule for the backup.
- 3 Select the clients (virtual machines) to back up.
 If the policy was configured for automatic selection of virtual machines, the **Clients** pane shows the VMware backup host rather than the virtual machines.
- 4 Click **OK** to start the backup.
- 5 To see the job progress, click **Activity Monitor** in the NetBackup Administration Console.

It may take a few moments for the job to appear in the Activity Monitor. Do not start another backup if a job does not immediately appear. If the job does not show up after a few moments, close and restart the NetBackup Administration Console.

Note that your VMware backup request launches more than one job. The first job automatically creates and deletes snapshots. This job has a dash (-) in the Schedule column. The second job backs up the virtual machine files from the snapshot.

Using the Activity Monitor to monitor virtual machine backups

You can use the NetBackup Activity Monitor to keep track of the VMware virtual machines that a policy backs up.

To monitor the virtual machines that a policy backs up

- 1 Click **Activity Monitor** in the left pane of the Administration Console.
- 2 Note each job as it appears by row.
 If the policy selects virtual machines automatically (based on a query), the backup consists of three generations of jobs:
 - The first job is the discovery of the virtual machines.
 - The discovery job starts one or more child jobs to take a snapshot of each virtual machine.
 - Each snapshot job starts a child job to back up each virtual machine.
 So the job flow is as follows:

```
discovery job --> snapshot job --> backup job
```

- 3 To trace the discovery job to the virtual machine backup jobs, note the Job ID and the Parent Job ID columns.

Due: 109 Jobs (3 Queued 9 Active 0 Waiting for Retry 0 Suspended 0 Incomplete 97 Done)									
Job ID	Parent Job ID	Type	Job S...	S...	Status	Policy	Schedule	Client	
115	108	Backup	Done		0	tacco	incr	BMacc...	
114	107	Backup	Done		0	tacco	incr	BMacc...	
113	106	Backup	Done		0	tacco	incr	BMacc...	
112	103	Backup	Done		0	tacco	incr	BMacc...	
111	105	Backup	Done		0	tacco	incr	BMacc...	
110	102	Backup	Done		0	tacco	incr	BMacc...	
109	104	Backup	Done		0	tacco	incr	BMacc...	
108	101	Backup	Done		0	tacco	-	BMacc...	
107	101	Backup	Done		0	tacco	-	BMacc...	
106	101	Backup	Done		0	tacco	-	BMacc...	
105	101	Backup	Done		0	tacco	-	BMacc...	
104	101	Backup	Done		0	tacco	-	BMacc...	
103	101	Backup	Done		0	tacco	-	BMacc...	
102	101	Backup	Done		0	tacco	-	BMacc...	
101	101	Backup	Done		0	tacco	-	luebeck	

In this sample screen, job 113 is a virtual machine backup (grandchild). (Note that each virtual machine backup job includes the name of its schedule in the Schedule column.) Its parent job was 106, the snapshot job. Job 101 (the discovery job) was the parent of 106.

In this example, any job with a parent ID of 101 is a snapshot job for 101. Jobs 109 through 115 are the virtual machine backups that originated from 101.

- 4 Right-click on the job row and click **Details**.

On the Job Details screen, click the **Detailed Status** tab for more information on the job.

- 5 If the Job ID or the Parent Job ID column is not displayed in the Activity Monitor, display them as follows:

- Right click anywhere in the column header row and click **Columns > Layout**.
- Click the row for the heading that you want to display (such as Job ID).
- Use the following icons at the top of the screen to show the heading:



Sets the **State** to **Show**.



Moves the row up or down in the list (farther to the left or right in the Activity Monitor).

- Click **OK**. The Job ID and Parent Job ID columns should now be visible in the Activity Monitor.

Viewing NetBackup activity in vSphere Client

NetBackup can record backup activity for virtual machines in VMware vCenter. You can view the events in vSphere Client at the level of any parent object (such as folder, datacenter, cluster, or host). You can also view the events for the entire virtual machine.

Make sure that the policy's **Post events to vCenter** option is enabled:

See [“VMware - Advanced Attributes dialog”](#) on page 57.

To view backup events and the last backup time in vSphere Client

- 1 Open vSphere Client and connect to the VMware server.
- 2 Go to **Home > Inventory > Hosts and Clusters**.
- 3 Select the object (such as datacenter, host, or virtual machine) and click the **Tasks & Events** tab.
- 4 Click the **Events** view.

- To see the date and time of the last backup for a particular virtual machine, select the virtual machine and click the **Summary** tab.

The timestamp of the last backup is listed for the NB_LAST_BACKUP attribute, under Annotations:

The screenshot shows the vSphere Client interface with the Summary tab selected. The Annotations section contains the following text:

Attribute	Value
NB_LAST_BACKUP...	Sat Oct 29 22:23:07 2011
test:preview:	
Notes:	

- To see the date and time of the last backup for all virtual machines, click the **Virtual Machines** tab.

To change the events display limit in vSphere Client

- In vSphere Client, click the **Edit > Client Settings > Lists** tab.
 Use the **Page size** field to change the size.

Using OpsCenter to report on virtual machine backups

To use OpsCenter to obtain a backup report on VMware virtual machines

- 1 Start the OpsCenter console in a Web browser.

On a system that has a network connection to the OpsCenter server, enter the following in a browser:

```
http://host.domain/opscenter
```

where `host.domain` is the fully qualified domain name or IP address of the OpsCenter server.

- 2 Click the **Reports** tab.
- 3 Click **Client Reports > Virtual Client Summary**.

The **Virtual Client Summary** report is described in the *Symantec OpsCenter Administrator's Guide*.

Restore virtual machines

This chapter includes the following topics:

- [Restore notes and restrictions](#)
- [Restore notes and restrictions on Linux](#)
- [Restoring the full VMware virtual machine](#)
- [About restore of individual files](#)
- [Restoring individual files](#)
- [About the NetBackup.lost+found directory on Linux](#)
- [If the recovery host is not at the same NetBackup release level as the backup host](#)

Restore notes and restrictions

Before you begin the restore, note the following:

- Unless a NetBackup client is installed on the virtual machine, you must do the restore from the NetBackup master server.
- To restore files to the original virtual machine location, the destination must be specified as the virtual machine's host name (not display name or UUID).
- To restore directly to an ESX server, the name that is specified for the restore must match the ESX server's official host name. The name must be in the same format in which it is registered in DNS and in the VMware server (whether short or fully-qualified).
See [“Adding NetBackup credentials for VMware”](#) on page 40.
- The restore fails if ESX servers are configured with short host names and the backup and restore are done through a vCenter server.

See [“The restore fails if ESX servers use short host names and backups and restores use a vCenter server”](#) on page 166.

- Cross-platform restore of individual files is not supported. You can restore Windows files to Windows guest operating systems but not to Linux. You can restore Linux files to supported Linux guest operating systems but not to Windows.
- If the virtual machine was backed up by its display name or UUID, and the display name differs from the host name, note: You must specify the correct destination client for the restore. Use the **Specify NetBackup Machines and Policy Type** dialog in the NetBackup Backup, Archive, and Restore interface. See [“Invalid client error when you restore files using NetBackup BAR interface installed on the virtual machine”](#) on page 170.
- Restore of individual files from a backup of the full virtual machine is not supported if the virtual machine contains Storage Foundation Volume Manager volumes.
- To restore Windows NTFS-encrypted files individually, you must install a NetBackup client on the virtual machine. See [“NetBackup for VMware best practices”](#) on page 151.
- For virtual machine restores, VMware supports the NBDSSL transport mode only for vStorage backups of vSphere 4.1 and later environments. Backups of the VMware systems that are earlier than vSphere 4.1 cannot be restored using the NBDSSL transport mode.
- If the attempt to restore a full virtual machine fails while using the SAN transport type, try the NBD transport type instead.
- VMware does not support the restore of virtual machines directly to an ESX 5.x server that vCenter manages. To restore the virtual machine, select the vCenter server as the destination.
As an alternative, you can set up an independent ESX server to be used for restores. You must add NetBackup restore credentials for that ESX server by means of the **VMware restore ESX server** server type. See [“Adding NetBackup credentials for VMware”](#) on page 40.
- For the SAN transport mode, the job may be slow when you restore to a vCenter Server. For greater speed, designate a VMware restore ESX server as the destination for the restore. See [“Adding NetBackup credentials for VMware”](#) on page 40.
- A restore by means of the SAN transport mode may be slow in other circumstances. The following VMware article provides details: [Best practices when using SAN transport for backup and restore](#)

- The APIs in VMware's Virtual Disk Development Kit (VDDK) contain the following limitation: the maximum write speed during virtual machine restore is roughly one third of the hardware's maximum speed. The following Symantec tech note contains further information:
Two causes of slow NetBackup for VMware restore performance
<http://www.symantec.com/docs/TECH169860>
- If the restore host is on Windows Server 2008 and you use the SAN transport mode for the restore, the SAN luns must be online. Refer to the information on status code 5 in the following section:
See "[NetBackup status codes related to VMware](#)" on page 162.
- When restoring large files, make sure that no snapshots are active on the destination virtual machine. Otherwise, the files are restored to the VMware configuration datastore, which may be too small to contain the files you want to restore. In that case, the restore fails.
The configuration datastore (sometimes called the vmx directory) contains the configuration files that describe the virtual machine, such as *.vmx files. Note that active snapshots of vmdk files are also stored on the configuration datastore.
- If you cancel the virtual machine restore before it completes, the not-fully-restored virtual machine remains at the target location. NetBackup does not delete the incomplete virtual machine when the restore job is canceled. You must manually remove the incomplete virtual machine.
- If the virtual machine display name contains non-ASCII characters, the backup may succeed but the restore fails. To restore the virtual machine, you must change the display name to contain ASCII characters only and retry the restore.
- To restore a virtual machine that was backed up with VCB, you must use the VMware Converter and a staging host in the following case:
 - The virtual machine was backed up through a vCenter 4.0 or later server, and
 - The folder structure on the vCenter server has changed since the time of the backup.
Because of the changed folder structure on the vCenter server, the automated restore procedure does not work. Restore the virtual machine files to a staging computer and use the VMware Converter to manually restore the files.
- Note the following limitations regarding VCB and VMware Converter Standalone:
 - VMware Converter Standalone 4.0.1 is the last revision to support VCB.

- For a virtual machine that was backed up with VCB, VMware Converter Standalone cannot restore the VM to a vCenter server that contains vApps. To use Converter Standalone, you must restore the virtual machine directly to an ESX or ESXi server. For more information, refer to the VMware knowledge base:
[VMware Knowledge Base \(1034316\)](#)
NetBackup support for VCB will be discontinued in a future release.
- See “[NetBackup for VMware: notes and restrictions](#)” on page 32.

Restore notes and restrictions on Linux

Before you begin the restore, note the following:

- Cross-platform restore of individual files is not supported. You can restore Linux files to supported Linux guest operating systems but not to Windows.
- If the Linux file system was not quiesced before the snapshot, some files may be inconsistent. Such files can be recovered from the NetBackup.lost+found directory.
See “[About the NetBackup.lost+found directory on Linux](#)” on page 147.
See “[About the SYMCquiesce utility](#)” on page 179.
- To migrate an ext2 or ext3 file system to ext4, note: Make sure to follow the instructions under "Converting an ext3 filesystem to ext4" on the following page of the Ext4 wiki:
https://ext4.wiki.kernel.org/index.php/Ext4_Howto#Converting_an_ext3_filesystem_to_ext4
If you do not follow these instructions, data in a newly created ext4 file is not promptly flushed from memory to disk. As a result, NetBackup cannot back up the data of recently created files in the ext4 file system. (The NetBackup snapshot captures the file as zero length.)
As a workaround for the file systems that were not correctly migrated, do one of the following:
 - Run the Linux sync command on the ext4 file system before starting each backup.
 - Install the NetBackup SYMCquiesce utility for VMware. This utility is described in the "SYMCquiesce utility for Linux virtual machines" appendix. The SYMCquiesce utility quiesces the Linux file system, to guarantee that all data has been flushed from memory to disk.
- For Linux virtual machines, NetBackup cannot restore individual files from software RAID volumes. The files are restored when you restore the entire virtual machine.

- The Linux ext4 file system includes a persistent pre-allocation feature, to guarantee disk space for files without padding the allocated space with zeros. When NetBackup restores a pre-allocated file (to any supported ext file system), the file loses its preallocation and is restored as a sparse file. The restored sparse file is only as large as the last byte that was written to the original file. Note also that subsequent writes to the sparse file may be non-contiguous.
- NetBackup supports backup and restore of Linux LVM2 volumes, including individual file restore from an LVM2 volume. Note however that NetBackup does not support individual file restore from a snapshot that was created by means of the snapshot feature in LVM2. If an LVM2 snapshot exists at the time of the backup, the data in the snapshot is captured in the backup. The data can be restored along with the rest of the virtual machine data when you recover the entire virtual machine.
- NetBackup supports backup of Linux FIFO files and socket files. NetBackup does not support restoring FIFO files and socket files individually. FIFO files and socket files can be restored along with the rest of the virtual machine data when you recover the entire virtual machine.
- For Linux virtual machines, the ext2, ext3, and ext4 file systems are supported for individual file restore. If a partition uses some other file system, the backup succeeds but files in that partition cannot be individually restored. To allow NetBackup to present mount points for restore in the Backup, Archive, and Restore interface, note: The "/" (root) partition must be formatted with ext2, ext3, or ext4.
See [“Mount points not available when restoring files from a Linux virtual machine”](#) on page 169.
- When you restore Linux files individually to an NFS-shared device on a Linux virtual machine, NetBackup can only restore the file data and attributes. The extended attributes cannot be restored to NFS-shared devices.
- For a virtual machine that is running a Linux guest operating system: When you restore a virtual machine (to its original location or different location), the ESX server assigns the virtual machine a new (virtual) MAC address. After you restart the virtual machine, you may have to configure its MAC address. For instance, the original MAC address of the virtual machine may be in a configuration file that has to be updated.
Refer to your VMware documentation for more details.
- For Linux, additional notes apply.
See [“NetBackup for VMware: notes on Linux virtual machines”](#) on page 34.

Restoring the full VMware virtual machine

To restore the full virtual machine

- 1 Start the NetBackup Backup, Archive, and Restore interface (BAR).
- 2 Specify the source client and destination client and type of policy:

In the Java interface, on the **Restore Files** tab, click the restore icon (hand symbol in the upper right).

In the Windows interface: Click **Files > Specify NetBackup Machines and Policy Type**.

- 3 Specify the following:

Server to use for backup and restores The NetBackup master server that directed the backup

Source client for restores The VMware virtual machine that was backed up.
Enter the type of name that was selected for the **Primary VM identifier** option on the policy **VMware** tab. For example, if the **Primary VM identifier** option is set to VM host name, enter the virtual machine's host name.

Destination client for restores This field is ignored. The destination for the restore is specified in a different screen as explained in a later procedure.

Policy type for restores The type of policy that made the backup.

- 4 Select the type of restore:

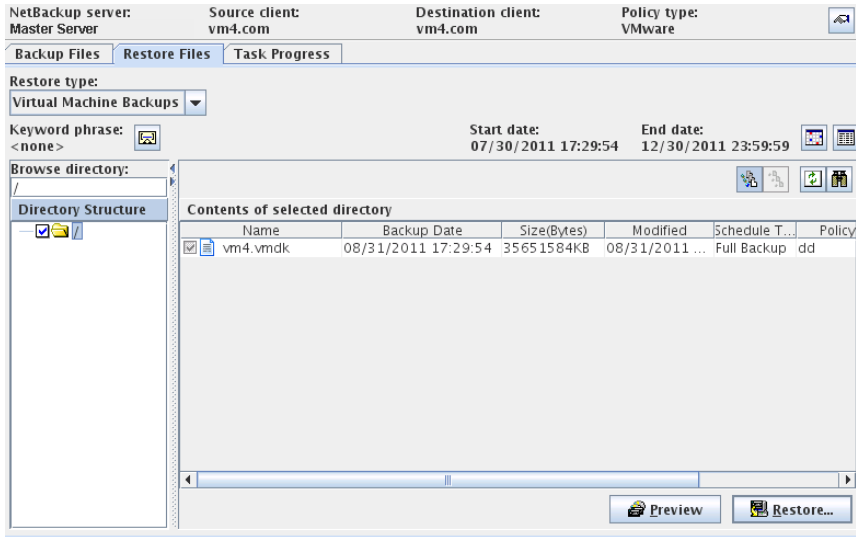
In the Java interface, on the **Restore Files** tab, select **Restore type > Virtual Machine Backups**.

In the Windows interface, click the down arrow on the **Select for Restore** option. Select **Restore from Virtual Machine Backup**. A restore window displays the backups available for restore.

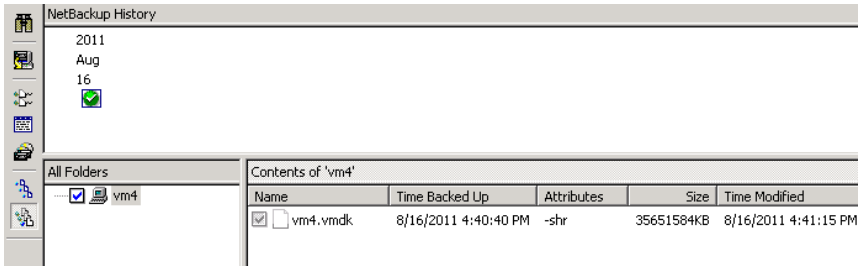
- 5 Select the virtual machine backup to restore.

In the Java interface, do the following:

- On the **Restore Files** tab, specify the **Start date** and **End date** within which to search for the backup. Click either of the calendar options.
- Specify root (/) in the **Browse directory** field and press Enter.
- Click on the root directory that is displayed under **Directory Structure**.



In the Windows interface, in the **NetBackup History** pane, click on the VMware backup. Then click on the item that is displayed under **All Folders**. You cannot select individual files. You must select the entire virtual machine.



6 Select restore options.

In the Java interface, click **Restore**.

In the Windows interface, click **Actions > Restore**.

The type of dialog that appears next depends on how NetBackup performed the backup (by means of vStorage or VCB).

See [“Virtual Machine Recovery dialog boxes \(restore to original location\)”](#) on page 130.

See [“Virtual Machine Recovery dialogs boxes \(restore to alternate location\)”](#) on page 134.

See [“Restore Marked Files dialog box \(VMware with VCB\)”](#) on page 141.

See [“About restore of the virtual machine from a VCB backup”](#) on page 140.

Virtual Machine Recovery dialog boxes (restore to original location)

If NetBackup used VMware vStorage to back up the virtual machine, the Virtual Machine Recovery dialog boxes appear when you start the restore.

Recovery Destination dialog box

You can select the type of destination for the virtual machine recovery: the original location or alternate location.

This dialog includes the following:

■ **Original settings of the virtual machine when it was backed up**

Shows the configuration of the virtual machine at the time of the backup.

When you restore the virtual machine to its original location, these configuration settings are used and cannot be changed.

When you restore to an alternate location (not to the original location), you can change these settings after you click **Next**.

■ **Recover virtual machine to**

Select **Original location** or **Alternate location**.

Recovery Options dialog box

Select the recovery host and transport mode, as follows:

■ Destination setting

Shows the configuration of the virtual machine at the time of backup. These settings are applied to the virtual machine when it is restored.

■ NetBackup Recovery Host

The host that performs the recovery. The default is the host that performed the backup (the backup host).

In most cases, you can use the host that performed the backup. Selecting a different host as the recovery host can result in a slow restore or a failed restore, depending on the transport mode. For example, if the host that performed the backup used a SAN connection to access the datastore, but the host you select as recovery host does not have SAN access to the datastore, the restore fails if you select the SAN transport mode.

■ Transport Modes

Determines how the restore data is sent from the recovery host to the VMware datastore. The appropriate option depends in part on the type of network that connects the VMware datastore to the recovery host.

The default is the type that the backup used.

san	For unencrypted transfer over Fibre Channel (SAN) or iSCSI.
nbd	For unencrypted transfer over a local network that uses the Network Block Device (NBD) driver protocol. This mode of transfer is usually slower than Fibre Channel.
nbdssl	For encrypted transfer (SSL) over a local network that uses the Network Block Device (NBD) driver protocol. This mode of transfer is usually slower than Fibre Channel.
hotadd	Requires that the recovery host is in a virtual machine. This feature requires ESX 3.5 Update2 or later. For instructions on this transport mode and on installing the recovery host in a VMware virtual machine, refer to your VMware documentation.

Move Up, Use these buttons to change the order in which NetBackup tries each selected mode. Highlight a mode and click Move Up or Move Down.
Move Down

For example: Assume that all four transport modes are selected, and the order is san, hotadd, nbd, and nbdssl. If one of the virtual disks cannot be accessed using san, the san transport mode is not used for any of the virtual machine's disks. NetBackup then tries to use the hotadd mode for all the disks. NetBackup continues to try each mode until it finds one that succeeds for all the disks.

Virtual Machine Options dialog box

Virtual Machine Options:

- **Restore UUID xxx instead of creating a new UUID**

Retains the UUID of the original virtual machine (note that the UUID is a globally unique identifier). The virtual machine is restored with the same UUID that it had before the restore.

Note the following:

- If a virtual machine with the same display name but with a different UUID exists at the target restore location, the restore fails. You must either delete the existing virtual machine and run the restore, or keep the existing virtual machine and abandon the attempt to restore.
- If you do not want to keep the existing virtual machine, you can do one of the following: Remove the existing virtual machine, or log into the ESX server and remove the directory where the virtual machine resides.

- **Overwrite the existing virtual machine**

If a virtual machine with the same display name exists at the destination, that virtual machine must be deleted before the restore begins. Otherwise, the restore fails. Select this option to have the virtual machine deleted.

- **Remove backing information for devices like DVD/CD-ROM drives, serial or parallel ports**

If a virtual machine had an iso file that was mounted on a CD when the virtual machine was backed up, note: the iso file must be available on the target ESX server when you restore the virtual machine. If the iso file is not available on the ESX server, the restore fails.

This option restores the virtual machine without restoring an iso file that was mounted when the virtual machine was backed up.

- **Remove network interfaces**

Removes any network interfaces from the restored virtual machine. Select this option if the network connections on the destination virtual machine have changed since the backup was made.

- **Power on virtual machine after recovery**

Select this option to have the recovered virtual machine automatically powered on when the recovery is complete.

- **Override default job priority**

Place a check mark in this box to override the default priority.

- **Job Priority**

Use this field to set a higher priority.

- **Restore storage DRS configuration**

If the virtual machine resided in a datastore cluster and was configured with VMware DRS, this option restores the DRS configuration. If this option is not selected, the DRS configuration is not restored. (Examples of DRS configuration are vmdk affinity rules and anti-affinity rules.)

If the virtual machine was not in a datastore cluster and was not configured with VMware DRS, this option is grayed out.

- **Allow partial configuration update**

Allows some of the DRS configuration to be restored even if other portions of that configuration cannot be restored.

If problems exist with portions of the DRS configuration and this option is not enabled, NetBackup does not restore any of the DRS configuration.

- **Retain original hardware version**

This option restores the virtual machine with its original hardware version (such as 4). It retains the original version even if the target ESX server by default uses a later hardware version (such as 7 or 8).

If this option is disabled, the restored virtual machine is converted to the default hardware version that the ESX server uses.

If the virtual machine is hardware version 7 or 8 and you restore to a vSphere pre-4.0 server, note: The restore fails if you enable this option. If you disable this option, the restore succeeds if VMware Tools is able to convert the virtual machine's hardware version to an earlier version.

Format of restored virtual disks:

- **Original provisioning**

Restores the virtual machine's virtual disks with their original provisioning.

- **Thick Provision Lazy Zeroed**

Configures the restored virtual disks in the thick format. The virtual disk space is allocated when the disk is created. This option restores the populated blocks, but initializes vacant blocks with zeros later, on demand.

- **Thick Provision Eager Zeroed**

Configures the restored virtual disks in the thick format. Restores the populated blocks and immediately initializes vacant blocks with zeros (eager zeroed).

Creation of the virtual disks may take more time with this option. However, if the restore occurs over a SAN, the eager zeroed feature may speed up the restore by reducing network communication with the vCenter server.

- **Thin Provisioning**

Configures the restored virtual disks in the thin format. Restores the populated blocks but does not initialize vacant blocks or commit them.

Thin provisioning saves disk space through dynamic growth of the vmdk file. The vmdk files are no larger than the space that the data on the virtual machine requires. The virtual disks automatically increase in size as needed.

Refer to the following Symantec document for more support details on thin provisioned disks:

[Support for NetBackup 7.x in virtual environments](#)

For more information on virtual disk provisioning, refer to VMware's documentation.

Perform Recovery dialog box

Review the settings that are to be applied to the restored virtual machine.

- **Recovery settings**

Lists several settings that are used for the recovery.

- **Run Pre-Recovery Check**

Click this option to verify credentials, available space on the datastore, and other important requirements.

- **Start Recovery**

Starts the recovery of the virtual machine.

Virtual Machine Recovery dialogs boxes (restore to alternate location)

If NetBackup used vStorage to back up the virtual machine, the Virtual Machine Recovery dialog boxes appear when you start the restore.

Recovery Destination dialog box (restore to alternate location)

- **Original settings of the virtual machine when it was backed up**

Shows the configuration of the virtual machine at the time of the backup. When restoring to an alternate location (not to the original location), you can change these settings after you click **Next**.

- **Recover virtual machine to**
Select **Alternate location**.

Recovery Options dialog box (restore to alternate location)

The Recovery Options dialog initially displays the original virtual machine settings that were recorded in the NetBackup catalog when the virtual machine was backed up. Before accepting any default values, you may have to verify that the original hosts or servers are still available.

The dialog contains the following fields:

- **NetBackup Recovery Host**

The recovery host transfers the virtual machine files to the VMware destination that is specified in other fields on this dialog. The default for the recovery host is the backup host that backed up the virtual machine.

Consider the following when selecting a recovery host:

- To use the original VMware backup host for the recovery, verify that the backup host still exists. The original backup host may have been removed or reconfigured after the backup occurred.
- The current processing load on the host that you want to use may be a factor. The recovery host undergoes significant I/O activity when it restores a virtual machine.
- The network connection between the recovery host and the destination datastore may limit the type and speed of data transmission. For example, to use the SAN transport mode, the recovery host must have access to the appropriate luns in the datastore.

- **Transport Modes**

Determines how the data is sent from the recovery host to the VMware datastore. The appropriate mode depends on the type of connection between the NetBackup recovery host and the VMware datastore.

More information is available about these options.

See [“Recovery Options dialog box”](#) on page 131.

- **vCenter Server**

Specifies the vCenter server for the restored virtual machine. To use the original vCenter Server (the default), verify that the original vCenter server still exists.

To use a different vCenter Server, consider whether it is compatible with the virtual machine you want to restore. For example: If you attempt to restore a vmx-07 virtual machine to a vSphere server that is earlier than 4.0, note: VMware Tools converts the virtual machine to an earlier hardware version. In other cases, you can use the **Retain original hardware version** option on the **Virtual Machine Options** dialog.

The restore may finish faster if you use the SAN transport mode with a restore ESX server (bypassing any vCenter servers).

When choosing a target host for the restore, note the following:

- If NetBackup has credentials to access a vCenter server (but does not have credentials to access a VMware restore ESX server), note: You can restore the virtual machine through the vCenter server. In this case, the data movement for the restore passes through the vCenter server. Passing the virtual machine data through the vCenter server may increase the amount of time that is needed to complete the restore.

The credentials must give NetBackup full access privileges to the vCenter server.

See [“Adding NetBackup credentials for VMware”](#) on page 40.

- If NetBackup has credentials to access a vCenter server as well as a VMware restore ESX server, the restore may complete faster. In this case, by default NetBackup passes the virtual machine data directly to the restore ESX server, bypassing the vCenter server. You can select a vCenter folder in which to place the restored virtual machine.

The credentials must give NetBackup full access privileges to the restore ESX server.

- If NetBackup has credentials to access an ESX server, you can designate that server as the target for the restore. The credentials must give NetBackup full access privileges to the ESX server.

Select **None** for the vCenter Server, and click **Search** to select the ESX server.

Note: Due to VMware limitations, NetBackup cannot restore a vStorage virtual machine backup directly to an ESX server that is earlier than version 3.5.

- **ESX Server**

Specifies the ESX server on which the restored virtual machine is to reside. To use the original ESX server (the default), verify that the original ESX server still exists.

Click the **Search** option to browse for a different ESX server.

See [“Select ESX server dialog box \(restore to alternate location\)”](#) on page 138.

- **Datacenter**

Shows the VMware datacenter containing the selected ESX server.

- **Folder**

A folder is a logical entity within the vCenter that contains VMware objects, such as datastores, networks, and virtual machines.

By default, this field shows the VMware folder that contained the virtual machine when the virtual machine was backed up. If you select a different ESX server to which to restore the virtual machine, this field changes to None. You must then click **Browse** to select a folder within the datacenter for the restored virtual machine.

See “[Select Folder dialog box \(restore to alternate location\)](#)” on page 138.

- **Display Name**

Specifies the VMware display name for the restored virtual machine. The default is the display name that the virtual machine had when it was backed up.

The display name must be unique for the vCenter Server where the virtual machine is restored.

Note: If a virtual machine with this display name already exists at this location (or at the original location), you are prompted to click **Overwrite the existing virtual machine**. You cannot restore the virtual machine if the result is two virtual machines with the same display name on the same vCenter server.

- **Resource Pool/vApp**

Use this option to have the restored virtual machine assigned to either a VMware resource pool or to a vApp. Resource pools manage the host's CPU and memory. vApps are logical containers for virtual machines, and also share some functionality with virtual machines.

- **Datastore/Datastore Cluster**

Specifies the VMware datastore or datastore cluster that contains the virtual machine configuration files. Click **Change** to make a selection.

This datastore (sometimes called the vmx directory) contains the configuration files that describe the virtual machine, such as *.vmx files. Active snapshots of vmdk files are also stored on this datastore.

Note: The Datastore field shows the name of the datastore that contained the virtual machine data when the virtual machine was backed up. Even if the datastore was in a datastore cluster, the field shows the name of the datastore, not the datastore cluster. When the virtual machine is restored, NetBackup determines how the datastore is currently configured (in a cluster or not) and configures the virtual machine accordingly.

■ **Use the same datastore/datastore cluster for all VMDKs**

This option assigns all restored virtual machines to the datastore or datastore cluster that is selected in the **Datastore/Datastore Cluster** field.

If this option is not selected, you assign the VMDKs to specific datastores or datastore clusters in a later dialog (the Storage Destination dialog).

Select ESX server dialog box (restore to alternate location)

On the **Select ESX server** dialog, you can enter the name of the ESX server or drill down in the list to select a server.

■ **Specify ESX server**

Enter the name of the ESX server in this field. As you type a name, the list of available servers automatically expands and the nearest match is highlighted.

■ **Search**

If necessary, click **Search** to locate the server name that you typed.

Note: Some older ESX servers may not support the version of the virtual machine that you want to restore. Verify that the ESX server is compatible with the virtual machine.

Select Folder dialog box (restore to alternate location)

The Select Folder dialog shows the vCenter folders that exist on the datacenter that is shown in the **Datacenter** field.

Pick a folder from the list of available folders. The restored virtual machine is placed in this folder.

If two datacenters of the same name exist in the vCenter server, all folders for the identically named datacenters are displayed. After you select a folder and click OK, verify that the folder on the **Recovery Options** dialog contains the destination ESX server. If the selected folder is on the wrong datacenter, the restore fails.

Select Datastore or Datastore Cluster dialog box (restore to alternate location)

Use this screen to select a datastore or datastore cluster for the restored virtual machine. You can use the search field, or drill down manually into the list.

Note: Only datastores and clusters visible to the ESX server are displayed.

Search

As you type a name, the list of available datastores and datastore clusters automatically expands and the nearest match is highlighted.

Virtual Machine Options dialog box (restore to alternate location)

This dialog is described in a previous topic:

See [“Virtual Machine Options dialog box”](#) on page 132.

Storage Destination dialog box (restore to alternate location)

Select the datastores where the .vmdk files are to be restored.

- **Source VMDK File Name**
Shows the names of the virtual machine .vmdk files that were backed up.
- **Datastore/Datastore Cluster**
Shows the VMware datastore or datastore cluster where the .vmdk files are to be restored. Click in this field to select another datastore.
See [“Select Datastore or Datastore Cluster dialog box \(restore to alternate location\)”](#) on page 139.
If the datastore is in a datastore cluster, NetBackup displays the name of the datastore (not the name of the cluster).
- **Datastore/Datastore Cluster Status**
Indicates whether the datastore or datastore cluster has enough space to contain the selected .vmdk file.

OK The datastore or datastore cluster has enough space to contain the selected .vmdk file.

Insufficient space The datastore or datastore cluster does not have enough space to contain the selected .vmdk file.

Network Connections and other options dialog box (restore to alternate location)

■ Select all network names

This box selects or unselects all the networks that are listed under **Network Names**. If a network is selected, the restored virtual machine is automatically connected to that network.

Place a check mark in this box if you want to select all network connections for the restored virtual machine.

■ Network Names

Select the networks that you want the restored virtual machine to be connected to. Note that virtual networks are displayed in addition to physical networks. When the virtual machine is backed up, its network connections (physical or virtual) are recorded in the NetBackup catalog.

For the restore, NetBackup determines what networks currently exist, and lists the network names as follows:

- If a network that was recorded in the backup catalog for the virtual machine still exists, it is listed on this screen and automatically selected.
- If a network is available that was not listed in the NetBackup catalog, it is listed on this screen but not selected.
- If a network was recorded in the backup catalog but is not currently available, it is not listed.

Perform Recovery dialog box (restore to alternate location)

■ Recovery settings

Lists the settings that are used for the recovery.

■ Run Pre-Recovery Check

Verifies the credentials and appropriate paths and connectivity, determines whether the datastore or datastore cluster has available space, and reviews other important requirements. You must run this check at least once. You can proceed with the restore even if the check fails.

■ Start Recovery

Starts the recovery of the virtual machine.

About restore of the virtual machine from a VCB backup

To restore a virtual machine from a NetBackup backup that was made with VCB, restore all virtual machine files to the VMware recovery host. The recovery host

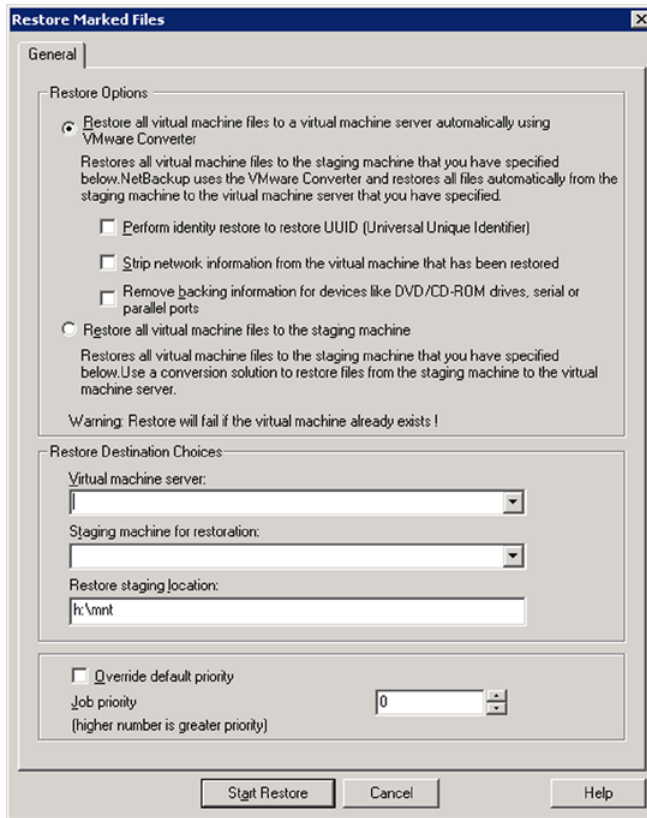
is used as a staging host. You must use this approach if NetBackup 6.5.x made the backup.

After you restore the virtual machine files to the VMware recovery host, do one of the following:

- Use VMware automated restore
NetBackup integrates with VMware vCenter Converter to restore the virtual machine to a designated ESX server. The virtual machine files are then removed from the staging host.
See “[Restore Marked Files dialog box \(VMware with VCB\)](#)” on page 141.
Certain compatibility issues exist between newer and older versions of VMware ESX server and VMware Converter. Refer to the *Support for NetBackup 7.x in virtual environments* tech note for more information:
<http://www.symantec.com/docs/TECH127089>
See “[Restore notes and restrictions](#)” on page 123.
- Use the VMware Converter application to restore the virtual machine from the staging host to the virtual machine server.

Restore Marked Files dialog box (VMware with VCB)

If the backup was made with VCB, the **Restore Marked Files** dialog appears when you click **Restore** in the Backup, Archive, and Restore interface.



The **Restore Options** are as follows:

- **Restore all virtual machine files to a virtual machine server automatically using VMware Converter**

Restores all virtual machine files to the staging area that you specify on this dialog box. NetBackup then issues a VMware-provided script to restore the virtual machine to the virtual machine server you specify. After the restore is complete, the restored virtual machine is powered off. The virtual machine files are then removed from the staging machine.

If the virtual machine display name already exists on the **Virtual machine server**, the restore fails.

Note the following options:

Perform identity restore to restore UUID (Universal Unique Identifier) Retains the UUID of the original virtual machine (note that the UUID is a globally unique identifier). The virtual machine is restored with the same UUID that it had before the restore. This option requires that the previous virtual machine (the one that was backed up) has been deleted, so that the UUID is free.

Note: If the UUID exists, the restore fails.

The default (no identify restore) makes sure that the display name of the new virtual machine (created by the restore) does not already exist. The virtual machine that the restore creates is given a new UUID.

Strip network information from the virtual machine that has been restored Verifies that the virtual machine that the restore creates does not have the same IP address as the virtual machine that was backed up. The network information is deleted at the time of the restore.

The default is to retain the IP information. Use the default if:

- You have already deleted the virtual machine that was backed up, and
- You want the restored virtual machine to keep the same IP information as the original virtual machine.

Remove backing information for devices like DVD/CD-ROM drives, serial or parallel ports Does not restore hardware backing information from the original image. Default settings are substituted.

- **Restore all virtual machine files to the staging machine**
 Restores all virtual machine files to the staging host. NetBackup does not restore the files to the virtual machine server. If not restoring to the original location, you can use the VMware Converter to restore the virtual machine from the staging host to the **Virtual machine server**. See your VMware documentation.

The **Restore Destination Choices** are as follows:

- **Virtual machine server**
 By default, this field shows the server that was stored in the backup image information. You can use that server as the restore destination, or enter a different virtual machine server as the destination.
- **Staging machine for restoration**
 Select or enter the recovery host to which the VMware files are temporarily restored. If you chose **Restore all virtual machine files to a virtual machine**

server automatically using VMware Converter, the files are restored to the Virtual machine server and deleted from this staging server.

The default is the backup host that was used for the backup. The name of that backup host is stored in the backup image information. On this dialog box, the pull-down list for staging hosts includes the VMware backup hosts that are defined in existing NetBackup policies.

Restore staging location

Enter a Windows file path on the staging host to which the virtual machine files are temporarily restored. The default is the VMware backup host mount point that was stored in the backup image information.

The **Override default priority** options are the following:

- **Override default priority**

Place a check mark in this box to override the default priority.

- **Job priority**

Use this field to set a higher priority.

About restore of individual files

You can use either of the following procedures to restore files individually.

One-stage process Restore individual files to the virtual machine by restoring to the recovery host. The virtual machine drives that are the destination for the restore must be configured in one of the following ways:

- **Windows only:** The virtual machine drives must be shared through the guest operating system on the virtual machine. See [“Setting up NetBackup Client Service for restore to a Windows shared virtual machine drive”](#) on page 146.
- NetBackup client software must be installed on the VMware virtual machine.

Two-stage process Restore individual files from the VMware recovery host to a NetBackup client (not to the virtual machine). See the *NetBackup Backup, Archive, and Restore Getting Started Guide* on how to restore to different locations.

Then manually copy the restored files to the virtual machine. (NetBackup does not perform this step.)

Note: Individual file recovery is supported from full backups and from incremental backups, as long as the **Enable file recovery from VM backup** policy option is enabled.

Restoring individual files

If the VMware backup was made with the **Enable file recovery from VM backup** option, you can restore individual files.

See [“Optimizations options \(VMware\)”](#) on page 52.

To restore individual files

- 1 In the NetBackup Backup, Archive, and Restore interface, specify the source client and destination client and the type of policy:

For UNIX systems, on the **Restore Files** tab, click the Restore icon:



For Windows systems, click **Files > Specify NetBackup Machines and Policy Type**.

- 2 Specify the following:

Server to use for backup and restores

The NetBackup master server that directed the backup.

Source client for restores

The VMware virtual machine that was backed up.

Enter the type of name that was selected for the **Primary VM identifier** option on the policy **VMware** tab. For example, if the **Primary VM identifier** option is set to VM host name, enter the virtual machine's host name.

Destination client for restores

Specify one of the following:

- The host name of the VMware virtual machine that was backed up, if NetBackup client software has been installed on the virtual machine.
Specify the host name even if the policy identified the virtual machine by its VMware display name, UUID, or DNS name. Do not enter the VMware display name, UUID, or DNS name.
- The NetBackup recovery host.

Note: The NetBackup Client Service must be logged on as Administrator.

See [“Setting up NetBackup Client Service for restore to a Windows shared virtual machine drive”](#) on page 146.

Policy type for restores The type of policy that made the backup.

- 3 Select the type of restore, as follows:
 - For UNIX systems, on the **Restore Files** tab, select **Normal Backups**.
 - For Windows systems, click **Files > Select Files and Folders to Restore > from Normal Backup**
- 4 For UNIX systems enter the **Browse directory** that contains the directories or files to restore.
See [“About restore of individual files”](#) on page 144.
- 5 Click the files you want to restore.
- 6 Start the restore, as follows:
 - On UNIX systems: Click **Restore**.
 - On Windows systems: Click **Actions > Restore...**
- 7 For Windows systems, if NetBackup client software is not installed on the destination virtual machine, select one of the following:
 - **Restore everything to a different location**
 - **Restore individual folders and files to different locations**
Destinations must be entered as UNC path names that refer to shared drives on the virtual machine.

For example, to restore the file `E:\folder1\file1` on virtual machine `vm1`, enter the following destination:

```
\\vm1\e$\folder1\file1
```

The NetBackup Client Service must be logged on under an account that has Administrator privileges.

See [“Setting up NetBackup Client Service for restore to a Windows shared virtual machine drive”](#) on page 146.

See [“About restore of individual files”](#) on page 144.

Setting up NetBackup Client Service for restore to a Windows shared virtual machine drive

To restore individual files to a Windows virtual machine that has a shared drive, note: the NetBackup Client Service must be logged on under an account that has

Administrator privileges (not as the Local System account). An account with Administrator privileges lets NetBackup write to the directories on the virtual machine to which the data is restored.

If you try to restore files while the NetBackup Client Service is logged on as the Local System account, the restore fails.

To log on the NetBackup Client Service as Administrator

- 1 In Windows Services on the VMware recovery host, double-click the NetBackup Client Service.
- 2 Check the **Log On** tab: if the service is not logged on under an account that has Administrator privileges, stop the service.
- 3 Change the logon to the Administrator account, or to an account that has Administrator privileges.

The account must have Administrator privileges in the domain in which both the virtual machine and the VMware backup host reside.

- 4 Restart the service.
- 5 Retry the restore.

About the NetBackup.lost+found directory on Linux

Note: You can ignore this section if: you have installed the SYMCquiesce utility on your virtual machines, and your virtual machines meet the requirements for the SYMCquiesce utility.

See [“About the SYMCquiesce utility”](#) on page 179.

See [“Installing the SYMCquiesce utility”](#) on page 180.

Without the SYMCquiesce utility, a snapshot of a Linux virtual machine may be in an inconsistent state (sometimes called crash-consistent). In other words, the snapshot data is equivalent to the state of a file system after an abrupt, uncontrolled shutdown. When the virtual machine is restarted, a file system consistency check (`fsck`) reports inconsistencies that need repair.

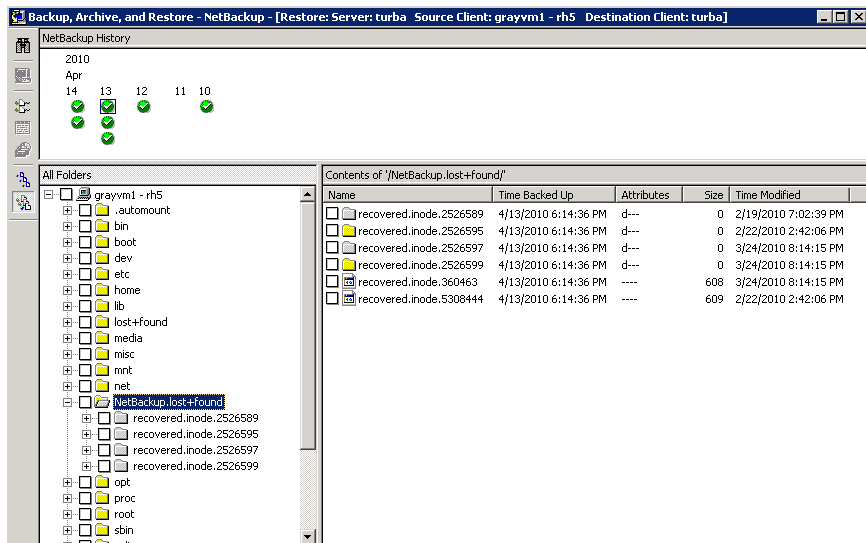
To handle inconsistent data from backups of crash-consistent Linux virtual machine snapshots, NetBackup creates a `NetBackup.lost+found` directory for each Linux volume. This directory is not a physical directory on the volume but a virtual directory in the NetBackup catalog. Any inconsistent directories or files are linked to the `NetBackup.lost+found` directory. The names of the inconsistent directories and files cannot be determined: the items in the `NetBackup.lost+found`

directory are therefore assigned the names that represent the inode numbers of the original directories or files.

If a NetBackup.lost+found directory already exists on the virtual machine, NetBackup appends numbers to the new NetBackup.lost+found directory names, to keep them unique. The directories are named NetBackup.lost+found.1, NetBackup.lost+found.2, and so forth.

Note: The NetBackup.lost+found directory is not the same as the standard Linux lost+found directory that Linux maintains in case of an abnormal system shutdown.

The following Backup, Archive, and Restore screen shows examples of inconsistent directories and files in a NetBackup.lost+found directory. This example also shows the standard Linux lost+found.



In the NetBackup Backup, Archive, and Restore interface, you can search the NetBackup.lost+found directory for any inconsistent items and restore them. Symantec recommends that you restore them to an alternate location (not to the original virtual machine). You can then examine their contents to determine their original names. Any metadata that was captured at the time of the backup may be helpful in identifying the inconsistent files or directories. Examples of such metadata are file size, file owner, and file creation and modification dates.

If the recovery host is not at the same NetBackup release level as the backup host

Note the following about mixed-level backups and restores:

- To restore from a NetBackup 7.x backup
To restore a virtual machine from a backup that a NetBackup 7.x backup host performed, a NetBackup 7.x recovery host is required. You cannot use a NetBackup 6.5.x recovery host to restore a virtual machine that was backed up by a NetBackup 7.x backup host.
- To restore from a NetBackup 6.5.x backup
To restore a virtual machine (or selected files) from a NetBackup 6.5.x backup, the VMware Converter must be installed on the NetBackup recovery host. The recovery host can run NetBackup 6.5.x or 7.x. A staging area is required.

If the recovery host is not at the same NetBackup release level as the backup host

Best practices and more information

This chapter includes the following topics:

- [NetBackup for VMware best practices](#)
- [More information on VMware](#)
- [Further assistance with NetBackup for VMware](#)

NetBackup for VMware best practices

The following are best practices for NetBackup for VMware:

- For a more efficient backup, the NetBackup media server and the VMware backup host should be installed on the same host.
- When creating virtual machines, use the same name for both host name and display name. If the policy's **Primary VM identifier** option is changed, the existing entries on the policy **Clients** tab still work.
- VMware recommends that you run no more than four simultaneous backups of virtual machines that reside on the same datastore.
- Successful VMware snapshots depend on the following:
 - The amount of I/O that occurs on the virtual machine datastore. Backups should be scheduled when relatively little I/O activity is expected. Reducing the number of simultaneous backups can also help.
Limit access to the datastore per policy: Use the **Limit jobs per policy** attribute in the NetBackup policy.
Limit access to the datastore globally (across all policies): Use the Host Properties **Resource Limit** screen.

See “[Setting global limits on the use of VMware resources](#)” on page 44.

- The design of the I/O substructure that is associated with each virtual machine datastore. For correct I/O design and implementation, consult your VMware documentation.
- Make sure that the VMware backup host has enough memory to handle the number of simultaneous backups that occur.
- Include in a single NetBackup policy those virtual machines that use the same datastore. This practice lets you control the amount of backup-related I/O that occurs per datastore, to limit the backup effect on the target virtual machines.
- NetBackup supports multiple backup hosts. When a single backup host is saturated with a backup process, another backup host can be added to increase backup throughput.
- Upgrade to the latest version of VMware vSphere or Virtual Infrastructure.
- See the Symantec white paper titled *NetBackup for VMware Best Practices Guide*.

NetBackup for VMware with deduplication

For a VMware backup to a deduplication storage unit, select the **Enable file recovery from VM backup** option on the **VMware** policy tab. This option provides the best deduplication rates. Without the **Enable file recovery from VM backup** option, the result is a lower rate of deduplication.

More information is available on the VMware options.

See “[Backup options on the VMware tab](#)” on page 51.

More information on VMware

VMware Inc. provides an extensive set of manuals on VMware products.

<http://www.vmware.com/support/pubs/>

Further assistance with NetBackup for VMware

Table 10-1 Sources of information on NetBackup for VMware

Topic	Source
Snapshot Client configuration	Refer to the <i>NetBackup Snapshot Client Administrator's Guide</i> . The guide contains installation and configuration instructions on Snapshot Client.
list of all supported combinations of platforms and snapshot methods	Refer to the NetBackup 7 Snapshot Client Compatibility document: http://www.symantec.com/docs/TECH126901
Support information on NetBackup for VMware	Up-to-date information on NetBackup support in a virtual environment is available in the following tech note: Support for NetBackup 7.x in a virtual environment http://www.symantec.com/docs/TECH127089 This tech note provides a wide range of support information, such as a list of supported guest operating systems, file systems, and required VMware components.

Troubleshooting

This chapter includes the following topics:

- [NetBackup logging for VMware](#)
- [VMware environment—important!](#)
- [Preventing browsing delays caused by DNS problems](#)
- [Changing the browsing timeout for virtual machine discovery](#)
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- [The restore fails if ESX servers use short host names and backups and restores use a vCenter server](#)
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- [NetBackup catalog information for virtual machine backups made by 6.5.4 or earlier may prevent browsing the imported images for restore](#)

- [Invalid client error when you restore files using NetBackup BAR interface installed on the virtual machine](#)
- [VMware virtual machine does not restart after restore](#)

NetBackup logging for VMware

For log messages about VMware backup or VMware restore, see the following NetBackup log directories.

Table 11-1 NetBackup logs that pertain to VMware backup and restore

Log directory	Contains the messages on	Resides on
<i>install_path</i> \NetBackup\logs\bpbrm	Backup and restore	NetBackup master or media server
<i>install_path</i> \NetBackup\logs\bptm	Backup and restore	NetBackup media server
<i>install_path</i> \NetBackup\logs\bpfis	Snapshot creation and backup	VMware backup host
<i>install_path</i> \NetBackup\logs\bpced	Snapshot creation and backup	VMware backup host
<i>install_path</i> \NetBackup\logs\bpbkar	Backup	VMware backup host
<i>install_path</i> \NetBackup\logs\bprrd	Restore	NetBackup master server
<i>install_path</i> \NetBackup\logs\tar	Restore	VMware recovery host
<i>install_path</i> \NetBackup\logs\bpVMutil	Policy configuration and on restore	VMware backup or recovery host
<i>install_path</i> \NetBackup\logs\bpVMreq	Restore	The client where the Backup, Archive, and Restore interface is running.
<i>install_path</i> \NetBackup\logs\bnbproxy	Policy configuration	VMware backup host
<i>install_path</i> \NetBackup\logs\ncfnbcs (originator ID 366) ncfnbcs uses unified logging. See the <i>NetBackup Troubleshooting Guide</i> for information on how to use unified logs.	Automatic virtual machine selection	VMware backup host.

Note: Except for ncfnbcs, these log directories must already exist in order for logging to occur. If these directories do not exist, create them.

To create the log directories, run the following command on the NetBackup servers and backup host:

Windows:

```
install_path\NetBackup\logs\mklogdir.bat
```

UNIX (on master or media servers):

```
/opt/openssl/netbackup/logs/mklogdir
```

More detail is available on snapshot logs and logging levels. See the *NetBackup Snapshot Client Administrator's Guide*.

A broader discussion of NetBackup logging is available. See the *NetBackup Troubleshooting Guide*.

Other logs for troubleshooting NetBackup for VMware

The following may also contain valuable backup information.

Table 11-2 Other logs for VMware

Log directory	Contains the messages on	Resides on
\Program Files\Common Files\VERITAS\VxMS\Logs	File mapping during backup	VMware backup host See “ Enabling VxMS logging for NetBackup for VMware ” on page 157. Note: The use of VxMS logging can reduce the performance of the backup host.

More information is available on VxMS logging:

<http://www.symantec.com/docs/TECH72862>

Enabling VxMS logging for NetBackup for VMware

VxMS logging may require significant resources on the VMware backup host.

To enable VxMS logging

- 1 On the Windows desktop of the backup host, click **Start > Run** and enter `regedit`.
- 2 To be on the safe side, make a backup of the current registry (**File > Export**).

- 3 Go to **HKEY_LOCAL_MACHINE > SOFTWARE > Veritas > VxMS**.
- 4 Change the `Logging` `DWORD` value to 7580 in hexadecimal. The value appears in the Registry as 0x00007580 (30080).

The next time VxMS is run, it creates a log (for example VxMS-1832-MMDDYY.log). The log is in `\Program Files\Common Files\VERITAS\VxMS\Logs`. The Logs directory is created automatically if it does not exist.

VMware environment—important!

Unsupported equipment can cause many problems. Ensure that your VMware environment (including ESX servers, SAN devices, and backup host) conforms to all requirements and recommendations that are spelled out by VMware. For instance, if VMware does not support your HBAs, device drivers, or guest operating systems, NetBackup cannot work.

For support details, see VMware documentation at the VMware support site (for example, the VMware compatibility guides).

Preventing browsing delays caused by DNS problems

NetBackup may be unable to identify virtual machines when you use the **Browse for Virtual Machines** dialog. Virtual machine host names may not be properly configured in your Domain Name Server system (DNS), or the DNS system may be slow. A timeout message may appear, or messages similar to the following may appear in the NetBackup detailed status log:

```
17:25:37.319 [12452.10360] get_vSphere_VMs: Processing vm 002-wcms
17:25:37.319 [12452.10360] get_vSphere_VMs:      uuid
421a8b46-063d-f4bd-e674-9ad3707ee036
17:25:37.319 [12452.10360] get_vSphere_VMs:      vmxdir [san-05] 002-wcms/
17:25:37.319 [12452.10360] get_vSphere_VMs:      datastore san-05
17:25:37.319 [12452.10360] get_vSphere_VMs:      IPAddress 172.15.6.133
17:25:41.866 [12452.10360] get_vSphere_VMs: retry_gethostbyaddr for
172.15.6.133 failed with The requested name is valid, but no data of
the requested type was found.
```

Note: NetBackup may be unable to determine the host names of the virtual machines from their IP addresses (reverse lookup may fail).

To prevent browsing delays caused by DNS problems

- 1 On the Windows desktop of the backup host, click **Start > Run** and enter `regedit`.
- 2 To be on the safe side, make a backup of the current registry (**File > Export**).
- 3 Go to **HKEY_LOCAL_MACHINE > SOFTWARE > Veritas > NetBackup > CurrentVersion > Config** and create a key that is called `BACKUP`.
- 4 Create a new **DWORD** under `BACKUP`, called `disableIPResolution`.
 This registry key causes NetBackup to use the virtual machine's IP address as the virtual machine's host name.
- 5 Use the NetBackup **Browse for Virtual Machines** screen to rediscover the virtual machines to show the host names set to the IP addresses.

See "[Browse for VMware Virtual Machines](#)" on page 61.

Changing the browsing timeout for virtual machine discovery

In the NetBackup Administration Console on Windows, you can adjust the time available for browsing for virtual machines in the NetBackup policy.

To change the browsing timeout value

- 1 In the NetBackup Administration Console on Windows, click on **Policies**.
- 2 From the main menu, click **View > Options**, then click the **Policies** tab.
- 3 Adjust the **VMware connect timeout** value.
- 4 Click **OK**.

Changing timeout and logging values for vSphere

The following are vSphere registry keys and their default values for various timeouts.

Table 11-3 Registry keys and defaults for vSphere timeouts

DWORD registry key name	Default value (in seconds)
jobtimeout	900
poweroptimeout	900

Table 11-3 Registry keys and defaults for vSphere timeouts (*continued*)

DWORD registry key name	Default value (in seconds)
snapshottimeout	900
registertimeout	180
browsetimeout	180
connecttimeout	300

The registry key and default for the vSphere API logging level are the following.

Table 11-4 Registry key and default for vSphere API log level

DWORD registry key name	Default value
vmcloglevel	0 (no logging)

To change vSphere timeouts and logging values

- 1 On the Windows desktop of the backup host, click **Start > Run** and enter `regedit`.
- 2 To be on the safe side, make a backup of the current registry (**File > Export**).
- 3 Go to **HKEY_LOCAL_MACHINE > SOFTWARE > Veritas > NetBackup > CurrentVersion > CONFIG** and create a key that is called `BACKUP`.
- 4 To change a timeout value, create a new DWORD under `BACKUP`, using the appropriate registry name (such as `jobtimeout` or `poweroptimeout`).
Enter a value for the timeout.
- 5 To change the level of vSphere API logging, create a new DWORD called `vmcloglevel` and enter the new logging value.

The allowed values are 0 through 6, where 0 is no logging and 6 is the highest log level.

Notes on troubleshooting NetBackup for VMware

Note the following:

- Make sure that the VMware Tools are installed on each virtual machine. Otherwise, communication problems and other issues can result.
- You cannot restore individual VMware files onto the virtual machine itself, except under certain conditions.

See “[About restore of individual files](#)” on page 144.

- NetBackup for VMware does not work with the VMware NetBackup Integration Module (VNIM).

Note the following:

- If VNIM is installed, do not configure a NetBackup for VMware policy (with the VMware snapshot method) to call any scripts that use VNIM. Such a policy results in a backup that fails.
- Do not run any NetBackup for VMware policy at the same time as a script-based policy that calls VNIM. If the two policies require access to the same virtual machine, a conflict may result and the backup may fail.

Credentials for VMware server are not valid

A number of issues can prevent NetBackup from gaining access to the ESX server or vCenter server. When you add credentials for a VMware server (**Add Virtual Machine Server** dialog), NetBackup validates the credentials when you click OK. If the credentials do not pass validation, a pop-up message appears.

Problems can result for a variety of reasons, including the following:

- An incorrect virtual machine server name. Make sure that the server name is entered correctly.
 More information is available about changing the server name that is stored in NetBackup.
 See “[Changing the host name of a VMware server in NetBackup](#)” on page 42.
- An invalid user name or password. Make sure that a valid user name and password were entered correctly.
- An incorrect port number. Make sure that the port number is correct on the NetBackup **Change Virtual Machine Server** dialog. If the VMware server uses the default port, no port specification is required. You can uncheck the **Connect using port number** box.
- You do not have enough privileges to perform backups or restores. (Note however that lack of sufficient privileges may not cause the credential validation to fail.)

For general guidelines for permissions, see the following:

<http://www.symantec.com/docs/TECH128513>

For the minimum permissions needed to back up and restore with vStorage, see the following:

<http://www.symantec.com/docs/TECH130493>

See “[Adding NetBackup credentials for VMware](#)” on page 40.

NetBackup status codes related to VMware

This topic provides assistance for NetBackup status codes relating to NetBackup for VMware.

Table 11-5 NetBackup status codes related to VMware

NetBackup status code	Explanation and recommended action
6, the backup failed to back up the requested files	<p>This error can occur for the following reasons:</p> <ul style="list-style-type: none"> ■ The virtual machine and the alternate client virtual machine may contain too many disks. If the total is too great for the alternate client SCSI controllers, a backup with the hotadd transport mode fails. The following appears in the job status log: <code>ERR - Error opening the snapshot disks using given transport mode: Status 23.</code> Add more SCSI controllers to the alternate client virtual machine. ■ If the VMware backup host cannot access the datastore over the selected transport mode, the backup fails. The detailed status log on the backup host may contain the following: <code>12/4/2009 1:12:34 PM - Error bpbrm(pid=21376) from client vm4: ERR - Error opening the snapshot disks using given transport mode: Status 23.</code> Select a different transport mode and retry the backup. ■ For the backups that use the hotadd transport mode: The backup host was unable to resolve the host name of the ESX server. This error may occur if DNS is not correctly configured on the virtual machine where the backup host is installed. On the virtual machine, you can enter the IP address of the ESX server into the hosts file: <code>\Windows\System32\drivers\etc\hosts</code> ■ For the backups that use the hotadd transport mode: If the virtual machine to back up and the virtual machine that contains the hotadd backup host do not reside in the same VMware datacenter, the backup fails. For a successful hotadd backup, the two virtual machines must be in the same VMware datacenter. ■ A previous hotadd backup of the virtual machine may have failed. Certain mount directories or cloned disks must be manually removed to allow hotadd backups to succeed, as follows: <ul style="list-style-type: none"> ■ During a hotadd backup, VMware creates a linked clone of the virtual machine's disks and attaches the cloned disks to the backup host. (The attached disks can be seen in the vSphere Client interface.) If a hotadd backup of the virtual machine fails, NetBackup may be unable to remove the cloned disks from the backup host. In the backup host, the presence of the cloned disks prevents subsequent backups from completing. Remove the cloned disks from the VMware backup host and retry the backup. ■ During a virtual machine backup, VMware creates mount directories in the <code>C:\Windows\Temp</code> folder on the backup host. After the backup, VMware automatically removes the mount directories. In some cases, such as when the backup uses the hotadd transport mode, NetBackup may be unable to remove the mount directories. Remove the mount directories from the <code>\Temp</code> folder and retry the backup. The folder name contains a string such as <code>VMware-System</code>.

Table 11-5 NetBackup status codes related to VMware *(continued)*

NetBackup status code	Explanation and recommended action
20, invalid command parameter	For the Backup Media Server option, the storage unit that is specified in the policy must be unique to your Windows media servers. If the storage unit is also available on a UNIX media server, the snapshot job cannot succeed.
156, snapshot error encountered	A number of different issues can cause this error. See " Snapshot error encountered (status code 156) " on page 165.
227, no entity was found	To restore selected files (not the entire virtual machine) to the original location, you must specify the host name of the virtual machine. Do not specify the display name or UUID as the destination.

Table 11-5 NetBackup status codes related to VMware (continued)

NetBackup status code	Explanation and recommended action
2817, 2820	<p>A virtual machine restore may fail in the following cases:</p> <ul style="list-style-type: none"> ■ If an .ISO file was presented to a virtual machine as a virtual CD or DVD during backup, note: The ISO file must be available on the destination host. If the ISO is not available on the host where you restore the virtual machine, the restore fails. The vCenter interface may include the message <code>Invalid configuration for Device '1'</code>. ■ The VMware restore host is on Windows Server 2008 but the SAN LUNs are offline. The detailed status log that is in the NetBackup Activity Monitor includes the message <code>Virtual machine restore: file write failed</code>. If the restore host is on Windows Server 2008 and you use the SAN transport mode, you must manually change the SAN LUNs to be online. ■ For restores that use the hotadd transport mode: If the virtual machine to restore and the virtual machine that contains the hotadd restore host do not reside in the same VMware datacenter, the restore fails. For a successful hotadd restore, the two virtual machines must be in the same VMware datacenter. ■ For vStorage: The restore host cannot access the VMware datastore over the selected transport mode. The job log on the restore host may contain messages such as the following: <p style="margin-left: 20px;"><code>13:27:36 (19400.001) FTL - Virtual machine restore: VxMS initialization failed</code></p> <p>Select a different transport mode and retry the restore.</p> ■ You attempted to restore a file that has a path name longer than 1023 characters. Note that a backup of a Linux virtual machine backs up all files, including those with path names longer than 1023 characters. A restore of the entire Linux virtual machine recovers all files. But you cannot restore the long path-name files individually. ■ If the ESX servers are configured with short host names (not fully qualified), NetBackup may not find the ESX server for the restore. See “The restore fails if ESX servers use short host names and backups and restores use a vCenter server” on page 166. ■ For the restore, the virtual machine's hardware version (such as 7) is later than the hardware version that the target server supports. If VMware Tools cannot convert the virtual machine's hardware version to an earlier version, the restore fails. Messages similar to the following appear in the bpVMutil log: <p style="margin-left: 20px;"><code>09:18:51.717 [5472.4724] <2> createVMwareVM: Create virtual machine failed for acmehost.com with 6</code> <code>09:18:51.717 [5472.4724] <2> bpVMutil main: Create VMware VM failed</code> <code>09:18:51.717 [5472.4724] <2> bpVMutil main: EXIT STATUS 5: the restore failed to recover the requested files</code></p> <p>If possible, restore the virtual machine to a VMware server that supports the virtual machine's hardware version.</p>

Snapshot error encountered (status code 156)

The following table describes the VMware issues that relate to NetBackup status code 156.

Table 11-6 Possible causes of status code 156

Causes of status code 156	Description and recommended action
NetBackup cannot obtain the volume ID of a drive	<p>NetBackup may not be able to obtain the volume ID of a drive. In that case, none of the virtual machine drives are backed up. The backup fails with NetBackup status code 156.</p> <p>The drive may be down.</p>
A backup of the virtual machine is already active	<p>You cannot run more than one backup per virtual machine at a time. If you start a second backup of the virtual machine while the first backup is active, the second job fails with a status 156.</p> <p>Recommended action: Wait until the first job completes, then run the second one.</p>
Cannot find virtual machine name	<p>NetBackup cannot find the host name or VMware display name of a virtual machine that is listed in the backup policy. The detailed status log may include the following error message:</p> <pre>Critical bpbrm (pid=<pid number>) from client <client name>: FTL - snapshot creation failed, status 156.)</pre> <p>If the virtual machines do not have static IP addresses, you can configure NetBackup to identify virtual machines by their VMware display names or UUIDs. Examples of the environments that do not use static IP addresses are clusters, and the networks that assign IP addresses dynamically.</p> <p>Note that NetBackup may have been configured to identify virtual machines by their VMware display names. In that case, make sure that the display names are unique and that they do not contain special characters.</p> <p>See “Primary VM identifier options (VMware)” on page 53.</p>
The virtual machine is powered off	<p>Through a vCenter server, NetBackup can back up the virtual machines that are powered off. You must provide credentials for NetBackup to access the vCenter server.</p> <p>See “Adding NetBackup credentials for VMware” on page 40.</p> <p>If NetBackup uses credentials for an ESX server instead of vCenter, it may not be able to identify a powered off virtual machine. Note the following:</p> <ul style="list-style-type: none"> ■ If the policy uses VM hostname or VM DNS name as the Primary VM identifier, NetBackup may not find the virtual machine. The backup fails. ■ If the policy uses VM display name or VM UUID as the Primary VM identifier, NetBackup can identify the virtual machine. The backup succeeds.

Table 11-6 Possible causes of status code 156 (continued)

Causes of status code 156	Description and recommended action
The virtual machine disk is in raw mode (RDM)	The RDM is ignored (not backed up) and any independent disk is recreated but empty. See “Configurations for backing up RDMs” on page 174.
The attempt to create a snapshot exceeded the VMware timeout	<p>If the attempt to create a snapshot of the virtual machine exceeds the VMware timeout of 10 seconds, the snapshot fails with NetBackup status 156. This timeout may occur if the virtual machine is configured with a large number of volumes. Note that the timeout may be encountered even if the Virtual machine quiesce option was disabled.</p> <p>Do one of the following:</p> <ul style="list-style-type: none"> ■ Reduce the number of volumes within the virtual machine. ■ Install a NetBackup client on the virtual machine and select another backup method for the policy (not the VMware snapshot method).
The virtual machine has no VMDK file assigned	<p>The snapshot fails if the virtual machine has no vmdk file.</p> <p>This situation can occur in a VMware vCenter Site Recovery Manager (SRM) environment. In an SRM environment, a replicated virtual machine in passive mode may have no vmdk file. If NetBackup attempts to back up a replicated virtual machine that has no vmdk file, the snapshot fails.</p> <p>You can enable the Ignore diskless VMs option on the VMware Advanced Attributes tab of the policy. This option tells NetBackup not to attempt a backup of any virtual machine that has no vmdk file.</p>

The restore fails when you restore individual files to a virtual machine that has NetBackup client software

When you restore individual files to a virtual machine that has a NetBackup client, make sure that a firewall does not interfere with the restore. If a firewall stops the restore, turn off the firewall and retry the restore.

The restore fails if ESX servers use short host names and backups and restores use a vCenter server

In the following case, the attempt to restore the virtual machine fails:

- The ESX servers in your VMware environment are configured with short host names (not fully qualified), and

- The backup was performed through a vCenter server, not directly from an ESX server, and
- The restore is directed through a vCenter server, not directly to an ESX server.

In this case, NetBackup cannot find the ESX server for the restore. Restore of the virtual machine fails, and the following message appears in the `bpvmUtil` log:

FAILED_TO_GET_MOR_BY_NAME

To restore virtual machines through a vCenter server in environments with short ESX host names

- 1 On the Windows desktop of the backup host, click **Start > Run** and enter `regedit`.
- 2 To be on the safe side, make a backup of the current registry (**File > Export**).
- 3 Go to **HKEY_LOCAL_MACHINE > SOFTWARE > Veritas > NetBackup > CurrentVersion > Config** and create a key that is named `BACKUP`.
- 4 Right-click in the right pane and click **New > DWORD Value**. Enter `disableFQDN` as the name.

Backup or restore job hangs

NetBackup may have exceeded the maximum number of allowed VMware NFC connections to the ESX server when it used the transport modes `nbd` or `nbdssl`. Note that NetBackup uses one NFC connection per virtual disk on the ESX or ESXi server.

If NetBackup is configured to access the ESX server directly (not through a vCenter or VirtualCenter server), fewer connections are allowed. The following are the maximum connections as set by VMware:

Table 11-7 VMware NFC connection limits for `nbd` or `nbdssl` transfers

ESX version	Type of access to the ESX server	Maximum NFC connections allowed
ESX 3.5	Directly to ESX server	9
ESX 3.5	Through vCenter	27
ESX 4	Directly to ESX server	9
ESX 4	Through vCenter	27
ESXi 4	Directly to ESX server	11

Table 11-7 VMware NFC connection limits for nbd or nbdssl transfers
(continued)

ESX version	Type of access to the ESX server	Maximum NFC connections allowed
ESXi 4	Through vCenter	23
ESXi 5	Directly to ESX server	The maximum total for all NFC connection buffers to an ESXi host is 32 MB
ESXi 5	Through vCenter	52

Try a different transport type (such as SAN or hotadd). If a different transport type is not available and NetBackup accesses the ESX servers directly, set up access through a vCenter (or VirtualCenter) server. Use of a server increases the maximum number of allowed connections. For example: With 27 connections, NetBackup can access a virtual machine that has up to 27 disks, if the ESX 4 server is behind a vCenter server.

Note that the connection limits are per-host (that is, per vCenter or ESX server).

For example, assume the following environment:

- An ESX 4.0 server with three virtual machines.
- Each virtual machine has 10 virtual disks.
- The virtual machines are behind a vCenter 4.0 server.

For a simultaneous backup of the three virtual machines, NetBackup requires 30 NFC connections. With a limit of 27 NFC connections per vCenter server, any of the three backup jobs may hang.

These limits are described in the *VMware Virtual Disk API Programming Guide*:

[VMware Virtual Disk API Programming Guide](#)

See also the following section of the *VMware vSphere 5 Documentation Center*:

[Virtual Disk Transport Methods](#)

Mount point missing on a restored Windows virtual machine

A Windows virtual machine may fail to write its mount point configuration to disk (the mount point configuration remains in RAM). In that case, the mount point information cannot be backed up. When the virtual machine is restored,

the data from the mounted volume is restored, but the mount point is absent from the restored virtual machine.

Reassign the mount point on the restored virtual machine. To make sure the mount point is correctly configured, restart the virtual machine.

Mount points not available when restoring files from a Linux virtual machine

For Linux virtual machines, only the ext2, ext3, and ext4 file systems are supported for individual file restore. If a partition is formatted with some other file system, the backup succeeds but NetBackup cannot map the file system addresses of the files. As a result, NetBackup cannot restore individual files from that partition. Only the files that were on ext2, ext3, or ext4 partitions can be individually restored.

Note also: to restore individual files from their original mount points, the "/" (root) partition must be formatted as ext2, ext3, or ext4. If the "/" (root) partition is formatted with a different file system (such as ReiserFS), the mount points cannot be resolved. In that case, you can restore ext2, ext3, or ext4 files from the /dev level (such as /dev/sda1). You cannot restore the files from their original mount point level.

Remove the Consolidate Helper snapshot

If a datastore is out of space when you attempt to delete snapshots, VMware creates a snapshot named Consolidate Helper. You should manually delete this snapshot before the next backup. Otherwise, change files may accumulate on the datastore. The accumulation of such files can affect both the backup performance and the I/O performance of the virtual machine.

For more information, see the following VMware knowledge base article about deleting the Consolidate Helper snapshot:

<http://kb.vmware.com/kb/1003302>

NetBackup catalog information for virtual machine backups made by 6.5.4 or earlier may prevent browsing the imported images for restore

If you import a NetBackup 6.5.4 or earlier virtual machine backup image to a NetBackup 7.x system, note: the catalog header file of the imported image may

have the wrong value for VM_TYPE. The value of the imported image may be incorrectly reported as 0 even for type 1 (Full VM) and type 2 (Mapped full VM) backups. As a result, you cannot use the Backup, Archive, and Restore interface to browse and restore the virtual machine image.

You must change the VM_TYPE value in the header file of the imported image to correct this problem. For the backups that were made with the Full VM backup option, set VM_TYPE to 1. For the backups that were made with the Mapped full VM backup option, set VM_TYPE to 2.

For instructions, see the following tech note:

<http://www.symantec.com/docs/TECH63525>

Invalid client error when you restore files using NetBackup BAR interface installed on the virtual machine

If the virtual machine was backed up by display name or UUID, and the display name is not the same as the host name, note: You cannot restore individual files by means of the Backup, Archive, and Restore (BAR) interface if the interface is installed on the virtual machine itself. The files can be restored if BAR is installed on the master server or media server. In this case, BAR must not be installed on the virtual machine that you want to restore to.

To restore files, the **Destination client for restores** field in the BAR interface must have a valid host name or IP address.

VMware virtual machine does not restart after restore

The virtual machine may have had SCSI and IDE drives at the time of backup and the guest OS resided on a SCSI drive. In that case, the virtual machine when restored may attempt to boot from the IDE drive. The boot attempt fails with the message "Operating system not found." This problem occurs when NetBackup uses the VMware vStorage APIs.

VMware has identified this problem and will address it in a future release.

As a workaround, you can reconfigure the BIOS on the virtual machine to boot from the correct SCSI device.

The Reuse VM selection query results option

This appendix includes the following topics:

- [About the Reuse VM selection query results option](#)

About the Reuse VM selection query results option

The NetBackup Test Query screen lists the virtual machines that NetBackup discovered in your virtual environment. Because the automatic selection feature is dynamic, later changes in the environment may affect which virtual machines match the query rules. For example: if virtual machines are added, the test results may not be identical to the virtual machines that are selected for backup when the backup runs.

NetBackup caches the current Test Query results for a designated period rather than rediscovering virtual machines at every backup. The option is called **Reuse VM selection query results for**. During the period you specify on this option, NetBackup reuses the current list of virtual machines as the backup list. It does not consult the query builder or rediscover virtual machines.

The less often your virtual machine environment undergoes changes, the more advantageous it may be to reuse the cached list of virtual machines for backups. Note that in large environments, discovery of virtual machines takes time and consumes resources on the vCenter server.

Note the following about the Reuse VM selection query results option:

- Determines how long the query results are reused (that is, how often the cache is refreshed).
- Controls how often NetBackup performs discovery on the vCenter server.

For the environments that contain many virtual machines, the discovery process may place a significant load on the vCenter server.

- Has no effect on the NetBackup policy execution schedule.
- Is invalidated if the query rules are changed or if the policy attributes that affect discovery are changed. In that case, NetBackup rediscovers virtual machines the next time the policy runs, and the cache is refreshed.

The following topic describes the policy attributes that affect discovery:

See [“Effect of Primary VM identifier parameter on Selection column in Test Query results”](#) on page 104.

For example: assume that the **Reuse VM selection query results for** option is set to eight hours. If additional virtual machines are powered on during the eight hour period, they are not added to the policy's backup list. The policy backs up the virtual machines that were last added to the list (such as when the policy was created). After eight hours, at the next execution of the policy, the recently powered on virtual machines are discovered and added to the backup list.

Note: The virtual machines that have been selected for backup are not displayed on the policy Clients tab. To see which virtual machines NetBackup has selected and backed up, refer to the following topics.

See [“Using the Activity Monitor to monitor virtual machine backups”](#) on page 117.

See [“Using OpsCenter to report on virtual machine backups”](#) on page 122.

Backup of VMware raw devices (RDM)

This appendix includes the following topics:

- [About VMware raw device mapping \(RDM\)](#)
- [Configurations for backing up RDMs](#)
- [About alternate client backup of RDMs](#)
- [Requirements for alternate client backup of RDMs](#)
- [Configuring alternate client backup of RDMs](#)

About VMware raw device mapping (RDM)

VMware raw device mapping mode (RDM) allows a virtual machine to directly access physical disks. With raw device mapping, a VMware virtual machine can use large storage devices such as disk arrays. Access to the data on an RDM disk is faster than to a fully virtualized disk (vmdk file). An RDM disk can be locally attached to the ESX server or configured on a Fibre Channel SAN.

NetBackup supports the disk arrays that are configured on a virtual machine as RDMs.

Note: NetBackup cannot back up the RDM by means of a VMware backup host.

For notes and restrictions on NetBackup support for VMware RDM, see the following Symantec tech note:

[Support for NetBackup 7.x in virtual environments](#)

<http://www.symantec.com/docs/TECH127089>

Configurations for backing up RDMs

You can use either of the following NetBackup configurations to back up disk arrays as RDMs:

- **Without Snapshot Client:** Install a NetBackup client on the virtual machine. You can configure NetBackup to back up the virtual machine and any RDMs as if the client was installed on a physical host. Without Snapshot Client software on the virtual machine, the features of Snapshot Client are not available. (This configuration is not discussed in this NetBackup for VMware guide.)
- **With Snapshot Client:** Install a NetBackup client and Snapshot Client software on the virtual machine. Configure an alternate client backup.

About alternate client backup of RDMs

Alternate client backup of an RDM consists of the following:

- The RDM disk array contains the data to be backed up. Another host containing NetBackup client software and Snapshot Client software must have access to the disk array. This host is the alternate client. In this configuration, the virtual machine is called the primary client.
- A snapshot of the data is created on the disk array and is mounted on the alternate client. The alternate client creates a backup image from the snapshot, using original path names, and streams the image to the NetBackup media server.
- The alternate client handles the backup I/O processing; the backup has little or no effect on the virtual machine. The media server reads the snapshot data from the alternate client and writes the data to storage.
- The virtual machine and alternate client must be running the same operating system, volume manager, and file system. For each of these I/O system components, the alternate client must be at the same level as the primary client, or higher level.

For complete requirements on alternate client backup, refer to the Policy configuration chapter of the *NetBackup Snapshot Client Administrator's Guide*.

Requirements for alternate client backup of RDMs

To use NetBackup Snapshot Client to back up an RDM, note the following:

- RDM devices must be configured in physical compatibility mode. You select this mode when you create the RDM. Physical compatibility mode is not configured in NetBackup.
For an introduction to RDM, refer to your VMware documentation. For example, see the following VMware document:
ESX Server 3 Configuration Guide
- NetBackup may require certain OS and array configuration, depending on the guest OS and the array. For details, see the disk arrays chapter of the *NetBackup Snapshot Client Administrator's Guide*.
- NetBackup client software must be installed on the virtual machine.
- The requirements for the NetBackup for VMware feature (a backup host and the VMware snapshot method) do not apply to backups of RDM disk arrays. To back up RDM disk arrays, you must configure a Snapshot Client alternate client backup.

Configuring alternate client backup of RDMs

This procedure highlights key points in creating a NetBackup alternate client backup of a disk array that is configured as an RDM. For broader details on disk array configuration, refer to the *NetBackup Snapshot Client Administrator's Guide*.

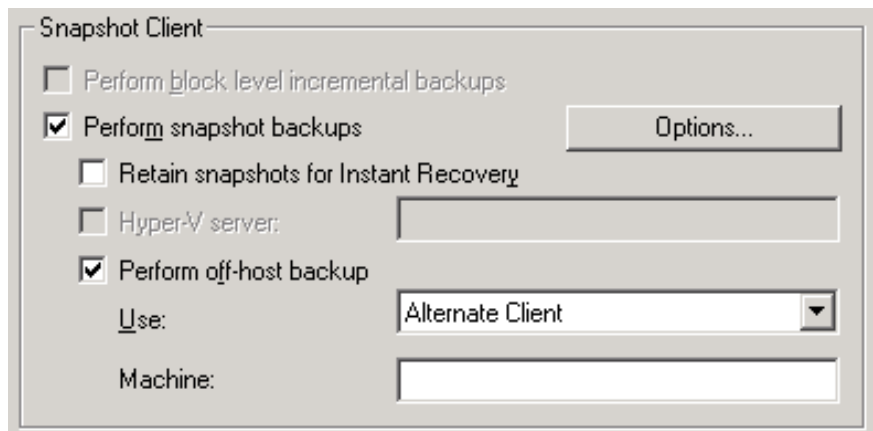
To create an alternate client policy for a disk array that is configured as an RDM

- 1 Select a policy type that is appropriate for the OS of the virtual machine and for the type of data to back up.

Refer to the Policy configuration chapter of the *NetBackup Snapshot Client Administrator's Guide*.

- 2 On the policy **Attributes** tab in the Administration Console, click **Perform snapshot backups** and **Perform off-host backup**.

The following is a detail from the **Attributes** tab.



The screenshot shows the 'Snapshot Client' configuration window. It contains several options: 'Perform block level incremental backups' (unchecked), 'Perform snapshot backups' (checked), 'Retain snapshots for Instant Recovery' (unchecked), 'Hyper-V server:' (unchecked with an empty text field), 'Perform off-host backup' (checked), 'Use:' (a pull-down menu set to 'Alternate Client'), and 'Machine:' (an empty text field). There is an 'Options...' button next to the 'Perform snapshot backups' option.

- 3 Select **Alternate Client** from the **Use** pull-down. Do not select **VMware backup host**.

In the **Machine** field, enter the name of the host that is configured as an off-host backup computer (the alternate client).

- 4 Click **Options**.
- 5 Select a snapshot method.

The VMware method does not apply to alternate client backup and is not available in the list.

Select a snapshot method that is appropriate for the volume or array. For example:

- The HP_EVA_Snapclone method or other EVA method for an HP EVA array.
- The EMC_CLARiiON_Snapview_Clone or other CLARiiON method for an EMC CLARiiON array.

- FlashSnap.

For FlashSnap, the following must be installed: VxVM 3.2 or later for UNIX, VxVM 4.0 or later for Linux and AIX, or VxVM 3.1 or later for Windows. Also, volumes must be configured over the primary host's disks. The VxVM FlashSnap license must also be installed.

- VSS (for Windows guest operating systems only).

The array may require additional OS and NetBackup configuration as described in the disk arrays chapter of the *NetBackup Snapshot Client Administrator's Guide*. The same guide contains more details on snapshot methods.

- 6 If required by an array snapshot method that you selected in the previous step, specify the **Snapshot Resources**.
- 7 In the policy's **Clients** list, select the virtual machine on which the array is configured as an RDM.
- 8 In the policy's **Backup Selections** list, specify the disk that you want to back up, or the files or volumes that reside on the disk.

SYMCquiesce utility for Linux virtual machines

This appendix includes the following topics:

- [About the SYMCquiesce utility](#)
- [Requirements for the SYMCquiesce utility](#)
- [Installing the SYMCquiesce utility](#)
- [Configuration options for the SYMCquiesce utility](#)
- [SYMCquiesce logging and troubleshooting](#)

About the SYMCquiesce utility

The SYMCquiesce utility allows NetBackup to quiesce the Linux file system. Without this utility, NetBackup cannot guarantee that all required data has been flushed to disk when the snapshot occurs. Any data that has not been flushed to disk (still in memory) is not included in a snapshot. In that case, the data that is captured in the snapshot is incomplete.

The SYMCquiesce utility quiesces the Linux file system, to guarantee that all data has been flushed from memory to disk. Quiescing the file system allows any pending data changes to finish before the snapshot occurs. The data in the snapshot is complete.

The latest information on supported platforms and file systems is available in a separate document, *Support for NetBackup 7.x in virtual environments*:

<http://www.symantec.com/docs/TECH127089>

Note: The SYMCquiesce utility is not required for Windows virtual machines.

Requirements for the SYMCquiesce utility

Note the following requirements for the SYMCquiesce utility:

- The SYMCquiesce utility supports the following Linux operating systems:
 - Red Hat Enterprise Linux version 5.4 and later.
 - SUSE Linux Enterprise Server 11 Update 1 and later.
- The SYMCquiesce utility supports the ext3 and ext4 file systems and the LVM2 volume manager.
- VMware Tools must be installed in the virtual machine.
- The VMware Tools services must be running during the backup.
- The NetBackup **Virtual machine quiesce** parameter must be enabled. This option is in the NetBackup policy, Snapshot Client Options dialog, under Configuration parameters.
- The SYMCquiesce utility must be installed in the virtual machine.

Installing the SYMCquiesce utility

To install SYMCquiesce in Linux virtual machines

- 1 Make sure that VMware Tools are installed and that the VMware Tools services are running in the virtual machine.

On the virtual machine, run the `ps` command as follows:

```
ps -e | grep vmttoolsd
```

If VMware Tools are running, the command returns something similar to the following:

```
3068 ? 00:00:00 vmttoolsd
```

For assistance with installation of VMware Tools, refer to your VMware documentation.

- 2 Copy the SYMCquiesce ISO image into the virtual machine's ESX datastore.

On the installed NetBackup packages for Windows (master server and client), the ISO image is located in the following folder:

```
\NetBackup\bin\goodies\vmware-quiesce
```

- 3 Attach the SYMCquiesce ISO as a CD-ROM device on the virtual machine. The guest OS should mount the CD-ROM automatically.
- 4 From the mounted CD-ROM, install the SYMCquiesce rpm version that is appropriate for the virtual machine platform. The SYMCquiesce utility is installed in /opt/SYMCquiesce/.
- 5 In the NetBackup policy for the virtual machine, make sure that the **Virtual machine quiesce** parameter is enabled.

VMware must be selected as the policy type. Then, on the policy **VMware** tab, click **Advanced**.

If the **Virtual machine quiesce** parameter is not enabled, NetBackup cannot quiesce the file system before the snapshot occurs. As a result, the data that is captured in the snapshot may not be complete.

See “[VMware - Advanced Attributes dialog](#)” on page 57.

See “[Configuring a VMware policy from the Policies utility](#)” on page 48.

Configuration options for the SYMCquiesce utility

The SYMCquiesce utility includes a configuration file (/opt/SYMCquiesce/config) that contains the following options. By default, the options are commented out with a # character at the start of the line.

Table C-1 SYMCquiesce configuration options

Configuration option	Description
<code>fail_snapshot_on_failure=true/false</code>	By default, this option is disabled. The snapshot does not fail even if quiescence fails on a volume in the virtual machine. Enable this option to cause the snapshot job and the backup job to fail if quiescence fails.
<code>timeout=timeout value in seconds</code>	By default, this option is disabled. The SYMCquiesce utility freezes the virtual machine volumes for three seconds during the snapshot. Enable this option to change the timeout period. You may need to change this timeout if the virtual machine snapshot on the ESX server does not complete within the 3-second window.

For example:

```
#fail_snapshot_on_failure=true
timeout=20
```

In this example, the `fail_snapshot_on_failure` option is commented out (disabled), and the timeout is set to 20 seconds.

SYMCquiesce logging and troubleshooting

SYMCquiesce logs indicate whether quiescence of the Linux virtual machine volumes was successful. SYMCquiesce logs are written to `/opt/SYMCquiesce/logs`. Logging is enabled by default (no configuration step is required) and cannot be disabled.

Log file names are of the form `mmdyy.log`. When a backup runs, a new log is created if one does not already exist for that date. A backup that runs on the 22nd of October 2010 creates a log named `102210.log`.

An example from a SYMCquiesce log:

```
Stats - Thu Oct 28 18:51:58 2010

Freeze of volume [/] returned status [0]
Thaw of volume [/] returned status [0]
Freeze of volume [/boot] returned status [0]
Thaw of volume [/boot] returned status [0]
```

Where:

`stats` : shows the time of the log entry when volumes were being quiesced.

`status [0]`: no error. The freeze operation or the thaw operation completed successfully.

`status [-1]`: error. The freeze operation or the thaw operation did not complete successfully.

If the freeze and the thaw completed successfully, the volume was successfully quiesced.

Note the following:

- You can use the logs with the `fail_snapshot_on_failure` option in `/opt/SYMCquiesce/config` file. If that option is enabled and snapshots fail, consult the SYMCquiesce logs to see which volume's quiescence fails.
- If the virtual machine has both `ext2` and `ext3` volumes (or `ext2` and `ext4`), and the `fail_snapshot_on_failure` option is enabled, the snapshot fails. `ext2` file systems do not support quiescence. You must disable the `fail_snapshot_on_failure` option to get a successful snapshot of the volumes. Note however that the `ext2` volume cannot be quiesced. As a result, any data

changes to that volume that had not been flushed to disk before the snapshot are not included in the snapshot.

See “[About the NetBackup.lost+found directory on Linux](#)” on page 147.

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