Symantec NetBackup™ for Hyper-V Administrator's Guide

Release 7.7

Symantec

Symantec NetBackup™ for Hyper-V Guide

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Mountain View, CA 94043

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Contents

Chapter 1

Introduction

This chapter includes the following topics:

About Hyper-V

NetBackup for Hyper-V provides snapshot-based backup of the virtual machines that run on Windows 2008, 2008 R2, 2012, and 2012 R2 Hyper-V servers.

The principal features of NetBackup for Hyper-V are the following:

- NetBackup for Hyper-V uses snapshot technology to keep virtual machines 100% available to users. NetBackup for Hyper-V creates quiesced Windows snapshots using Volume Shadow Copy Service (VSS).
- NetBackup for Hyper-V performs full backups and file-level incremental backups of the virtual machine.
- Can restore the full virtual machine or selected virtual machine files.
- Can restore selected files from a full virtual machine backup.

- Can restore to the original virtual machine, to other locations on the Hyper-V server, or to a different Hyper-V server.

New feature in NetBackup 7.7 for Hyper-V

The following is new in the 7.7 release of NetBackup for Hyper-V:

- Hyper-V Intelligent Policy
  NetBackup for Hyper-V can automatically select virtual machines for backup by means of filtering rules in the policy. The policy **Clients** tab now includes a Query Builder for creating the rules.
  See "About Hyper-V Intelligent Policy (automatic selection of virtual machines for backup)" on page 42.

FlashBackup-Windows policy type no longer supported for Hyper-V backups

A new policy type, **Hyper-V**, was introduced for Hyper-V backups in NetBackup release 7.5. Before that release, Hyper-V backups used the **FlashBackup-Windows** policy type exclusively. For NetBackup releases 7.5 and 7.6, you can use either policy type for Hyper-V backups. With NetBackup release 7.7, the **FlashBackup-Windows** policy type is no longer supported for Hyper-V backups. All Hyper-V backup policies must be upgraded to use the **Hyper-V** policy type before you upgrade to NetBackup release 7.7.

FlashBackup-Windows policies can be converted in either of the following ways:

- Use the NetBackup Administration Console to change the policy type to **Hyper-V**.
- Use the `nbplupgrade` command to convert policies in a batch. For details, see `nbplupgrade` in the *NetBackup Commands Reference Guide*:
  Http://www.symantec.com/docs/DOC5332

NetBackup for Hyper-V environment

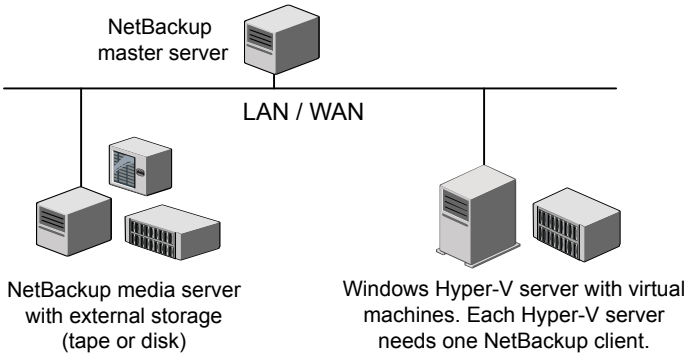
The following table describes the components that are required for NetBackup 7.7 to back up and restore a Hyper-V virtual machine.

Table 1-1 Components required for NetBackup for Hyper-V

Component	Description and requirements
NetBackup master server	Creates the backup policies and starts backups and restores. The NetBackup master server must be at 7.7 or later. It must include the NetBackup Enterprise Client license.
NetBackup media server	Reads and writes backup data and manages NetBackup storage media. The NetBackup media server must be at 7.7 or later. The NetBackup media server can be installed on the Hyper-V host or on a different host. For a more efficient backup, install the NetBackup media server on the same host as the Hyper-V server.
NetBackup client (and optional alternate client)	Processes backup and restore requests. The NetBackup client must be installed on the Hyper-V host. **Note:** In most cases, the client does not need to be installed on any virtual machine. For exceptions, refer to the following topics. See "About restoring individual files" on page 91. See "About Hyper-V pass-through disks with NetBackup" on page 136. For an alternate client backup, a NetBackup client must be installed on the alternate client host. The alternate client host must run the same Windows OS and storage stack as the Hyper-V host.
Hyper-V server	A Windows hypervisor virtualization system, for creating the virtual machine guests that run in a Windows Server host computer. Additional requirements may apply. Refer to your Microsoft Hyper-V documentation.
Hyper-V integration services (integration components)	Provides the integration between the Hyper-V server and the virtual machines. **Note:** The Hyper-V backup integration service must be enabled. For installation instructions, refer to the *Microsoft Hyper-V Getting Started Guide*: http://technet.microsoft.com/en-us/library/cc732470(v=ws.10).aspx#BKMK_step4

The following figure shows the NetBackup for Hyper-V environment.

Figure 1-1 NetBackup for Hyper-V backup environment



Basic phases in a NetBackup backup of a Hyper-V virtual machine

The following table describes the phases of the NetBackup for Hyper-V backup process.

Table 1-2 Phases of NetBackup for Hyper-V backup

Phase	Description
Phase 1	The NetBackup master server initiates the backup.
Phase 2	The NetBackup client on the Hyper-V server initiates a snapshot.
Phase 3	The VSS Hyper-V writer quiesces the Windows virtual machine and creates the snapshot on the host volume. If the Hyper-V writer cannot quiesce the virtual machine, the virtual machine is placed in the Saved state before creation of the snapshot.
Phase 4	If the virtual machine was placed in the Saved state, Hyper-V returns the virtual machine to its original state.
Phase 5	The NetBackup client reads the data from the snapshot of the virtual machine and transfers the data to the media server. The media server writes the data to the NetBackup storage unit.

Hyper-V terminology related to backup

The following table describes the Hyper-V terminology that is related to backup.

Table 1-3 Hyper-V terminology related to backup

Term	Description
avhd, avhdx file	A snapshot file that Windows Hyper-V creates, for point-in-time recovery of the virtual machine. This snapshot-and-recovery mechanism is entirely separate from the one used by NetBackup for Hyper-V. NetBackup creates its own snapshots when it backs up virtual machines. NetBackup does not create Hyper-V avhd or avhdx files.
Common vhd, vhdx files	Refers to a virtual disk (vhd or vhdx file) that contains the files that multiple virtual machines require. Instead of copies of the same file existing at multiple places, the virtual machines share a single vhd or vhdx file (the parent). See "About restoring common files" on page 104.
CSV	A cluster-shared volume in a failover cluster. Refer to your Microsoft documentation for more details regarding CSV.
Differencing disk	A differencing disk is in a child relationship to the parent disk (see common vhd, vhdx files). The parent and child virtual disks may be on the same physical drive or on different physical drives. This mechanism enables common files to be shared across virtual machines.
Failover cluster	A Windows Server failover cluster (formerly known as a Microsoft Cluster Server).
HA (high availability)	Describes a virtual machine that is configured in a cluster. If the virtual machine's Hyper-V host goes down, the virtual machine automatically moves to another Hyper-V host in the cluster. Users perceive little or no downtime on the virtual machine. Refer to your Microsoft documentation for more details.
pass-through disk	Any disk that the Hyper-V server can access. It can be locally attached to the Hyper-V server, or on a SAN. The pass-through disk is attached to a virtual machine, but the disk is not in vhd or vhdx format.

Table 1-3 Hyper-V terminology related to backup *(continued)*

Term	Description
vhd, vhdx file	A file in a Windows Hyper-V installation that contains the virtualized contents of a hard disk. vhd or vhdx files can contain an entire virtual operating system and its programs. Hyper-V supports several kinds of these files, such as fixed, dynamic, and differencing. Refer to your Microsoft Hyper-V documentation for more information.
virtual machine configuration files: xml, bin, vsv	NetBackup backs up these files as part of a full virtual machine backup. The bin and the vsv files are visible only when the virtual machine is running.
virtual machine GUID	A globally unique identifier of the virtual machine.

NetBackup administrator tasks for Hyper-V

The following are the tasks for the NetBackup administrator:

- Install the NetBackup 7.7 master server and media server. Add the NetBackup 7.7 Enterprise Client license on the master server.
  See the *NetBackup 7.7 Installation Guide*.
  Symantec recommends that the NetBackup media server and the Hyper-V server be installed on the same host. For alternate client off-host backup, install the media server on the alternate client host.
- Install a NetBackup 7.7 or later client on the Hyper-V server. Only one NetBackup client is required on each Hyper-V server. As an option for restore, a client may be installed on a virtual machine.
- Add the name of the NetBackup master server to the client's server list. In the NetBackup Backup, Archive, and Restore interface, click **File > Specify NetBackup Machines and Policy Type**. Add the master server to the **Server to use for backups and restores** list.
- Read the notes on NetBackup for Hyper-V.
  See "NetBackup for Hyper-V notes and restrictions" on page 19.
  See "Notes on full virtual machine restore" on page 88.
  See "Notes on individual file restore" on page 86.
- Read the best practices.
  See "Best practices" on page 108.
- Create a NetBackup policy for Hyper-V.

See "Creating a Hyper-V policy from the NetBackup Policies utility" on page 28.
See "Creating a Hyper-V policy for automatic virtual machine selection" on page 50.

- Run a Hyper-V backup.
  See "Backing up Hyper-V virtual machines" on page 84.
- Perform a restore.
  See "About restoring individual files" on page 91.
  See "Restoring the full Hyper-V virtual machine" on page 99.
- To troubleshoot your configuration:
  See the Troubleshooting chapter.

Quick reference for troubleshooting

Consult the following topics for troubleshooting tips and pointers:

- See "NetBackup status codes related to Hyper-V" on page 117.
- See "NetBackup logs and how to create them" on page 110.

Chapter 2

Notes and prerequisites

This chapter includes the following topics:

NetBackup for Hyper-V prerequisites

The following prerequisites apply to NetBackup for Hyper-V:

- For a list of supported Hyper-V servers, see the *Symantec NetBackup Enterprise Server and Server 7.7 - 7.7.x OS Software Compatibility List* available from the following location:
  NetBackup Master Compatibility List
- For Hyper-V servers on Windows 2008, apply the following hot fixes:
  - http://support.microsoft.com/kb/959962
    This hot fix is an update for Windows Server 2008-based computers to address issues with backing up and restoring Hyper-V virtual machines.
  - http://support.microsoft.com/default.aspx/kb/956697
    This hot fix is an update for an unsuccessful virtual machine restore. The unsuccessful restore causes an invalid link to the virtual machine configuration XML file that was created at the following:
    `%SystemDrive%\ProgramData\Microsoft\Windows\Hyper-V\Virtual Machines`
  - http://support.microsoft.com/KB/959978

An update for the VSS hardware provider snapshot for Hyper-V, to avoid a Hyper-V writer crash during backup.

- Check with Microsoft to see if additional hot fixes have been released: http://technet.microsoft.com/en-us/library/dd430893.aspx

- Before starting a backup of a virtual machine, verify that the NetBackup master server and media server can communicate with the Hyper-V server. Add the name of the NetBackup master server to the server list on the NetBackup client and (optional) alternate client.
- On a virtual machine, Windows shadow storage for a volume (such as C:) does not have to be configured on the same volume. For instance, shadow storage for the C:\ volume can be configured on D:\. If the Hyper-V server is Windows 2008 R1 and shadow storage for a volume is not configured on the same volume, note: Windows hot fix KB959962 must be installed to perform an online backup of the virtual machine. In this case, if the Hyper-V server is 2008 R1 and the hot fix has not been applied, the backup is performed offline.
  Windows 2008 R2 contains all required hot fixes.
  Windows shadow storage is required whenever the Windows Volume Shadow Copy Service (VSS) creates point-in-time snapshots.

NetBackup for Hyper-V notes and restrictions

The following notes and restrictions apply to NetBackup for Hyper-V:

- If a virtual machine is Paused when the backup starts, the virtual machine is placed in the Saved state after the backup completes.
- For VSS with disk arrays:
  To use a hardware array snapshot, make sure that the hardware array's VSS provider supports the snapshots that involve the Hyper-V writer. Check the release notes of the array vendor or VSS provider.
- More information about NetBackup for Hyper-V support is available in the following Symantec tech note:
  http://www.symantec.com/docs/TECH127089
- NetBackup for Hyper-V does not support the NetBackup Instant Recovery feature.
- To perform Hyper-V backups with the SAN Client feature, install SAN Client on the Hyper-V server. Do not install SAN Client on the virtual machines. For more information on SAN Client with Hyper-V, see the *NetBackup SAN Client and Fibre Transport Guide*.

- NetBackup for Hyper-V supports Windows NTFS file encryption and compression, for backup and restore. However, it does not support NetBackup's compression or encryption options (in the NetBackup policy attributes).
  For UNIX or Linux guest operating systems: NetBackup for Hyper-V does not support any type of compression or encryption, whether they are set in NetBackup or in the guest OS.

  Note: The compressed Windows NTFS files are backed up and restored as compressed files.

- (The following is due to a Microsoft limitation.) NetBackup for Hyper-V does not support backup of encrypted vhd or vhdx files.
- (The following is due to a Microsoft limitation.) For the virtual machines that have a FAT or FAT32 file system, NetBackup supports only Hyper-V offline backup.
  See "About Hyper-V online and offline backups" on page 133.
- NetBackup for Hyper-V has certain character restrictions for virtual machine display names.
  See "NetBackup character restrictions for virtual machine display names" on page 20.
- NetBackup for Hyper-V does not support restores with the Fibre Transport data transfer method.
- More information is available on the restore of Hyper-V virtual machines.
  See "Notes on individual file restore" on page 86.
  See "Notes on full virtual machine restore" on page 88.

NetBackup character restrictions for virtual machine display names

When Hyper-V virtual machines are included in a NetBackup policy, certain characters are not allowed in the virtual machine display name.

If the 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 (.)
  Note however that a display name cannot end with a period.
- Hyphen (-)
- Underscore (_)
- Plus sign (+)
- Percent sign (%)
- Left and right parentheses ()
- Spaces

Note: No other characters are allowed.

For the policies that select virtual machines automatically: A space in a display name is converted to "%20" in the test query results if the virtual machine is listed as included.

See "Primary VM identifier option (Hyper-V)" on page 33.

Notes on Linux virtual machines

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

- Windows Hyper-V provides no mechanism for quiescing file system activity on Linux virtual machines.
  As a result, NetBackup has no way to guarantee that data in the file system is in a consistent state when the snapshot occurs. If data has not been flushed to disk before the snapshot is created, that data is not included in the snapshot.
  To guarantee that Linux files are consistent at the time of backup, turn off the virtual machine before backing it up. When the virtual machine is turned off, 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*.
- Linux files that are inconsistent at the time of the backup can be recovered from the NetBackup.lost+found directory.
  See "About the NetBackup lost and found directory on Linux" on page 90.
- 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 Hyper-V 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.

  For more information on the files that NetBackup does not back up, refer to the topic on excluding files from backups in the *NetBackup Administrator's Guide for UNIX and Linux, Vol I*.

- More information is available on the restore of Hyper-V virtual machines.

  See "Notes on individual file restore" on page 86.
  See "Notes on full virtual machine restore" on page 88.

Chapter 3

Configure NetBackup communication with Hyper-V

This chapter includes the following topics:

Changing the NetBackup Legacy Network Service logon (vnetd.exe) to the domain user account

You can configure a NetBackup Hyper-V Intelligent Policy to search for VMs in all the nodes of a Hyper-V failover cluster.

Important! To allow the policy to discover all cluster nodes, you must set the NetBackup Legacy Network Service (vnetd.exe) logon to the domain user account. The logon must not be left at its default (the local system account). If the logon is not changed, the policy does not search the VMs on other nodes of the cluster.

Note: Because VMs can automatically migrate from one cluster node to another, it is important to allow the policy to search the entire cluster. The node where the VM currently resides may have changed since the VM was last backed up.

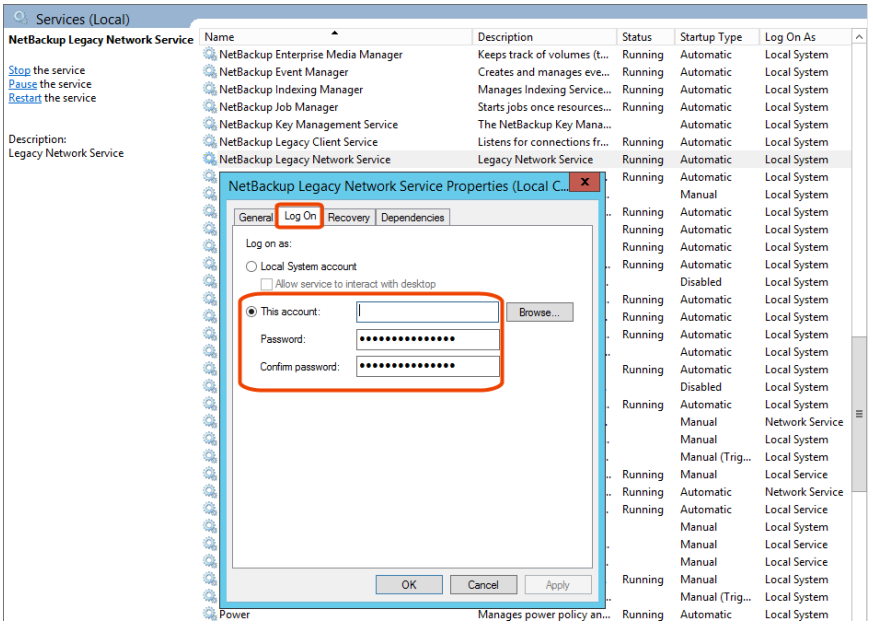
To verify the privileges that are needed to discover the failover cluster

- Run the Failover Cluster Manager as the Failover Cluster Manager user.

- On the Failover Cluster Manager host, click **Start**, click **Administrative Tools**, and then right-click **Failover Cluster Manager**.
- Click **Run as different user**, and provide the user name and password for the Failover Cluster Manager.

To change the NetBackup Legacy Network Service (vnetd.exe) logon to the domain user account

1. On a Hyper-V server node that you want the policy to search, open **Services** (run `services.msc`).
2. Double-click the **NetBackup Legacy Network Service**. This service is vnetd.exe.



3. Click the **Log On** tab, and click **This account**.
4. Enter the user name and password for the domain user account.
5. Click **OK**.
6. Restart the NetBackup Legacy Network Service.
7. Repeat these steps for each cluster node that you want the policy to search.

Setting global limits on the use of Hyper-V resources

You can use the NetBackup Resource Limit dialog to control the number of simultaneous backups that can be performed on a Hyper-V resource type. The settings apply to all NetBackup policies for the currently selected master server.

For example, to avoid overloading the Hyper-V server, you can place a limit on the number of concurrent snapshots per server.

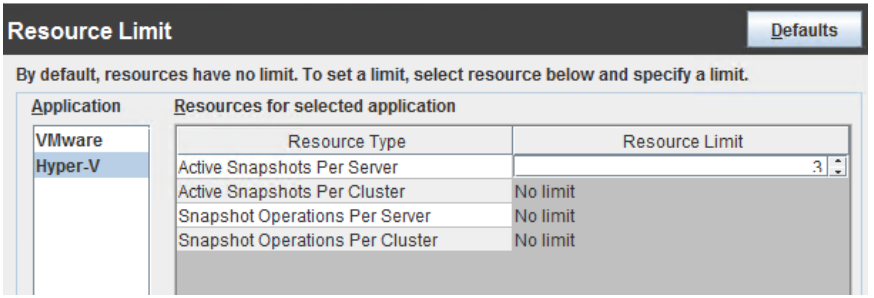
Note: The Resource Limit screen applies only to policies that use automatic selection of virtual machines (Query Builder). If virtual machines are selected manually on the Browse for Virtual Machines screen, the Resource Limit settings have no effect.

Note: To limit the number of simultaneous jobs per policy, use the **Limit jobs per policy** setting on the policy **Attributes** tab. The effect of this option depends on how the policy selects virtual machines.

See "Limit jobs per policy on the Attributes tab (for Hyper-V)" on page 32.

To set limits on the use of Hyper-V resources

1. In the NetBackup Administration Console, click **Host Properties > Master Servers** and double-click the NetBackup master server.
2. Under **Properties**, click **Resource Limit**.
3. Click **Hyper-V**.
4. Click in the **Resource Limit** column to set a limit for the resource type. The settings apply to all policies.



For each resource type, the default is 0, No limit.

Table 3-1 describes the limits:

Table 3-1 Resource types and limits

Resource type	Resource limit
Active Snapshots Per Server	This option controls the number of active snapshots on local volumes (including CSV volumes). It therefore controls the number of active backup jobs per Hyper-V server. All volumes are treated as a single resource.
Active Snapshots Per Cluster	This option controls the number of active snapshots on CSV volumes. It therefore controls the number of active backup jobs per cluster. If the cluster has multiple CSV volumes, the CSV volumes are treated as one resource.
Snapshot Operations Per Server	The maximum number of snapshot jobs per Hyper-V server.
Snapshot Operations Per Cluster	The maximum number of snapshot jobs per Windows failover cluster.

See "Best practices" on page 108.

Chapter 4

Configure NetBackup policies for Hyper-V

This chapter includes the following topics:

Creating a Hyper-V policy from the Policy Configuration Wizard

The following procedure describes how to create a backup policy with the **Policy Configuration Wizard**.

To create a backup policy with the Policy Configuration Wizard

1. In the **NetBackup Administration Console** (on the NetBackup master server), click the name of the master server.
2. Click the **Create a Policy** wizard.

3 Click **VMware and Hyper-V**.

4 Click **Next**.

5 Enter a name for the policy.

6 Click **Hyper-V** as the virtual machine type, and enter the name of the Hyper-V server.

7 Follow the remaining panels in the wizard.

The wizard creates the policy according to your selections. Backups run according to the choices that you make on the wizard's **Frequency and Retention** and schedule panels.

Creating a Hyper-V policy from the NetBackup Policies utility

Before you configure a policy, make sure that the Hyper-V server is online. NetBackup must be able to communicate with the Hyper-V server.

Use the following procedure to create a policy to back up the Hyper-V virtual machines that you select manually.

To create a policy that selects virtual machines automatically:

See "Creating a Hyper-V policy for automatic virtual machine selection" on page 50.

To create a Hyper-V policy through manual selection of virtual machines

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

2 Select **Hyper-V** as the policy type.

To configure policies for 7.1 clients, you can use the **FlashBackup-Windows** policy type. For more information on FlashBackup-Windows and Hyper-V backup, see the *NetBackup 7.1 for Hyper-V Administrator's Guide*.

3 Select a policy storage unit or storage unit group (or **Any Available**).

4 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*.

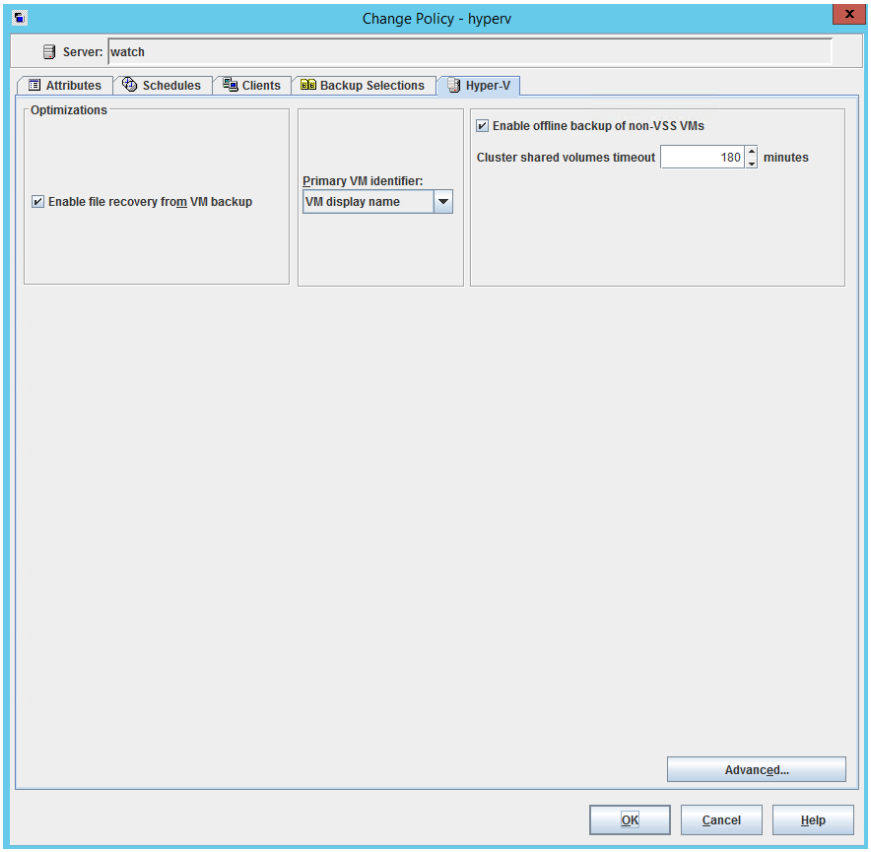
5 Use the **Schedules** tab to define a schedule.

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

Note that incremental backups require selection of the **Enable file recovery from VM backup** option on the **Hyper-V** tab.

6 Use the **Hyper-V** tab to set Hyper-V options.

See "Backup options on the Hyper-V tab" on page 32.



7 Click the **Clients** tab.

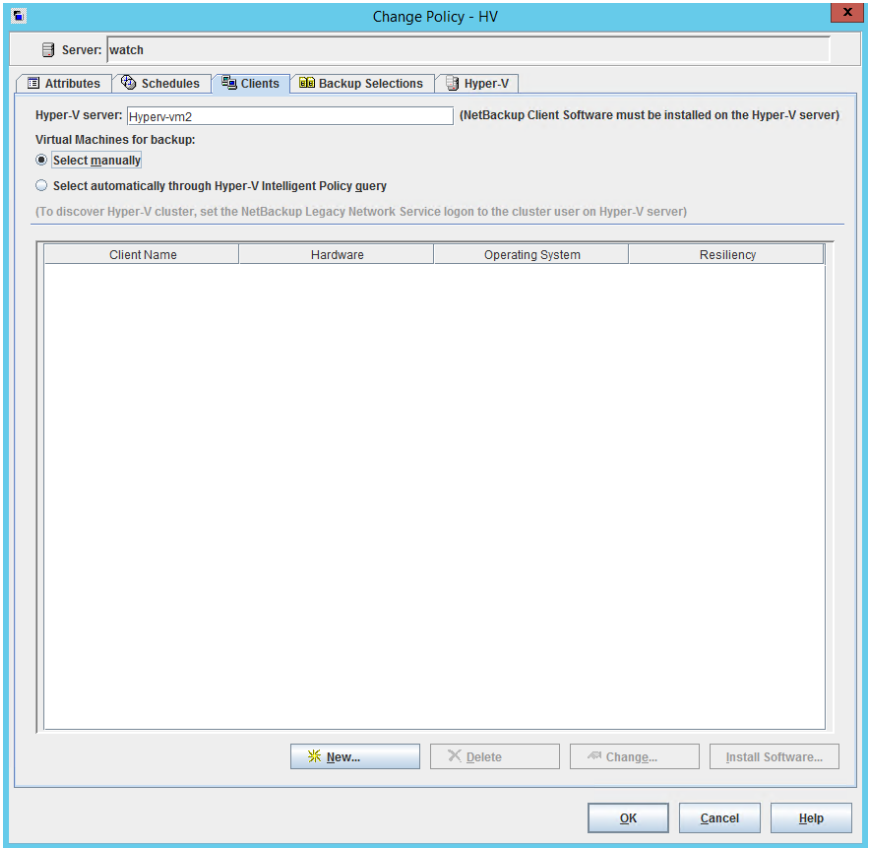
- Enter the name of the Hyper-V server in the **Hyper-V server** field. This host must contain a NetBackup client to perform backups of the virtual machines.
- To manually select the virtual machines to back up, click **Select manually**, then click **New...**.

The option **Select automatically through Hyper-V Intelligent Policy query** is explained in different topics:

See "Creating a Hyper-V policy for automatic virtual machine selection" on page 50.

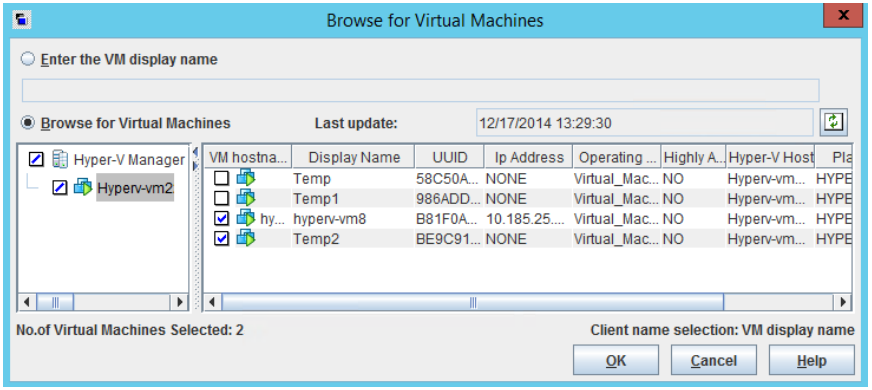
See "Options for selecting Hyper-V virtual machines" on page 48.

See "About Hyper-V Intelligent Policy (automatic selection of virtual machines for backup)" on page 42.



8 In the **Browse for Virtual Machines** dialog, do the following:

- Under **Enter the VM display name**, type the name of the virtual machine to back up.
- Or, click **Browse for Virtual Machines**, and click the appropriate check boxes to select the virtual machines to back up.



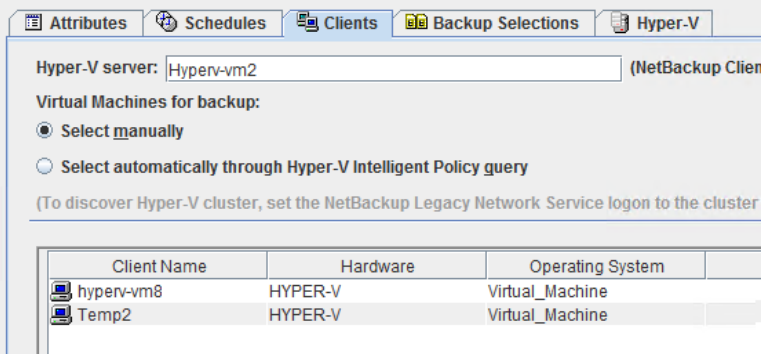
If NetBackup cannot obtain the IP address of the virtual machine, the IP address is displayed as NONE.

More information is available on these fields:

See "Browse for Hyper-V virtual machines" on page 36.

- Click **OK**.

The virtual machines you selected appear in the **Clients** tab.



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

9 Click **OK** to save the policy.

A validation process checks the policy and reports any errors. If you click **Cancel**, no validation is performed.

Limit jobs per policy on the Attributes tab (for Hyper-V)

The **Limit jobs per policy** option operates as follows, depending on how the policy selects virtual machines.

For the policies that select virtual machines automatically (Query Builder)

The **Limit jobs per policy** option controls the number of parent (discovery) jobs that run simultaneously for the policy. This option does not limit the number of snapshot jobs and backup (bpbkar) jobs that the parent job launches. For example, if this option is set to 1 and you begin a backup of a policy that discovers 100 virtual machines: all the snapshot jobs and backup jobs for each of the 100 virtual machines are allowed to execute simultaneously. Only the initial discovery job counts against **Limit jobs per policy**. If you begin a second backup of the policy, its discovery job cannot start until all the child jobs from the first backup are complete.

For the policies that use manual selection of virtual machines

Limit jobs per policy controls the number of virtual machines that the policy can back up simultaneously. Because no discovery job is needed, each virtual machine backup begins with a snapshot job. Each snapshot counts against the **Limit jobs per policy** setting. If this option is set to 1: the backup of the next virtual machine that is specified in the policy cannot begin until the first snapshot job and its backup are complete.

See "Setting global limits on the use of Hyper-V resources" on page 25.

Backup options on the Hyper-V tab

In the NetBackup Administration Console, the Hyper-V tab appears when you select Hyper-V as the policy type.

The following options apply to the Hyper-V policy type.

Optimizations option (Hyper-V)

Enable file recovery from VM backup

This option allows the restore of individual files from the backup. With or without this option, you can restore the entire virtual machine.

Use this option for incremental backups (differential incremental backup or cumulative incremental backup).

To perform a Hyper-V backup to a deduplication storage unit, select this option. This option provides the best deduplication rates.

Primary VM identifier option (Hyper-V)

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

Table 4-1 Primary VM identifier options

Option	Description
VM hostname	Specifies the network host name for the virtual machine. The host name is available only when the virtual machine is running. If you select **VM hostname** but the virtual machine is not running at the time of the backup, the backup may fail.
VM display name	Specifies the name of the virtual machine as it appears in the Hyper-V Manager console. **Note:** NetBackup for Hyper-V does not currently support the virtual machine display names that contain non-US-ASCII characters. If the display name contains such characters, select **VM hostname** or **VM GUID**. **Note:** When virtual machines are included in a NetBackup policy, restrictions apply to the characters that are allowed in the virtual machine display name. **Note:** See "NetBackup character restrictions for virtual machine display names" on page 20.
VM GUID	Specifies the unique ID assigned to the virtual machine when the virtual machine was created.

Note: If you create a policy and then change the **Primary VM identifier**, you may have to delete the virtual machine selections on the **Clients** tab. Otherwise, NetBackup may no longer be able to identify the virtual machines to back up.

For example: 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, note: The host names in the **Clients** tab cannot be used and the virtual machines are not backed up. You must delete the host name entries on the **Clients** tab and browse the network to select the virtual machines by their display names.

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

Enable offline backup for non-VSS VMs (Hyper-V)

This option determines whether or not NetBackup is allowed to perform an offline backup of a virtual machine. This option is intended for the guest operating systems that do not support VSS (such as Linux).

Note: Online vs. offline backup are Microsoft backup types and are not configured in NetBackup.

If this option is enabled, NetBackup can perform an offline backup of a virtual machine.

In certain situations, if the virtual machine cannot be quiesced for an online backup, the virtual machine must be placed in the Saved state. The backup is thus performed offline. User access to the virtual machine may be interrupted during the backup. After the backup is completed, the virtual machine is returned to its original state.

If this option is disabled, NetBackup is not allowed to perform an offline backup of a virtual machine. Only an online backup can be done (user access to the virtual machine is not interrupted). If an online backup cannot be done, the backup job fails with status 156.

More information is available about online and offline backups.

See "About Hyper-V online and offline backups" on page 133.

See "Snapshot error encountered (status code 156)" on page 118.

Cluster shared volumes timeout (Hyper-V)

For clusters on Windows server 2008 R2: This option applies to backups of the virtual machines that are configured in a Microsoft Cluster that uses cluster shared volumes (CSV). The timeout determines how long the backup job waits, in case another cluster node backs up the same shared volume at the same time.

The default is 180 (wait for 3 hours). A wait of 3 hours is recommended if you have multiple virtual machines on one CSV. The Windows 2008 R2 cluster node owns the CSV for the entire duration of the backup.

If you do not want NetBackup to wait for another backup to release the shared volume, set the value to 0. If at the same time another cluster node backs up a shared volume that this backup requires, the backup fails with status 156.

The appropriate value for this timeout parameter depends on the following factors:

- The average backup job duration for the virtual machines that reside on the same CSV. The job duration depends on the size of the virtual machines and the I/O speed.
- The number of virtual machines on the same CSV.

Note: On Windows server 2012, cluster nodes can back up the same cluster-shared volume simultaneously. As a result, NetBackup does not use the **Cluster shared volumes timeout** option if the cluster is on Windows 2012 or later.

More information is available on NetBackup support for the virtual machines that use CSVs.

See "About virtual machines on Windows 2008 and 2012 failover clusters" on page 76.

Hyper-V - Advanced Attributes

This dialog appears when you click **Advanced** on the **Hyper-V** policy tab.

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

Table 4-2 Hyper-V Advanced Attributes

Configuration parameter	Description
Provider Type	See "Provider Type configuration parameter" on page 35.
Snapshot Attribute	See "Snapshot Attribute configuration parameter" on page 36.

Provider Type configuration parameter

The **Provider Type** configuration parameter determines the type of VSS snapshot provider that creates the snapshot.

Auto Attempts to select the available provider in this order: hardware, software, system.

System	Uses the Microsoft system provider, for a block-level copy on write snapshot. Unlike the **Hardware** type, the **System** provider does not require any specific hardware.
Software	Not certified in this release.
Hardware	Uses the hardware provider for a disk array. A hardware provider manages the VSS snapshot at the hardware level by working with a hardware storage adapter or controller. For example: To back up the data that resides on an EMC CLARiiON or HP EVA array by means of the array's snapshot provider, select **Hardware**. Depending on your array and on the snapshot attribute you select, certain preconfiguration of the array may be required. See the chapter on configuration of snapshot methods for disk arrays in the *NetBackup Snapshot Client Administrator's Guide*.

Snapshot Attribute configuration parameter

The **Snapshot Attribute** configuration parameter determines the type of VSS snapshot that is created.

Unspecified	Uses the default snapshot type of the VSS provider.
Differential	Uses a copy-on-write type of snapshot. For example, to back up an EMC CLARiiON array with an EMC CLARiiON SnapView Snapshot, select **Differential**.
Plex	Uses a clone snapshot or mirror snapshot. For example, to back up an HP EVA array with an HP EVA Snapclone snapshot, select **Plex**.

Browse for Hyper-V virtual machines

On the **Clients** tab, click **New** to select virtual machines.

The following table describes the options that you can use to select Hyper-V virtual machines.

Table 4-3 Options for selecting Hyper-V virtual machines

Option	Description
Enter the VM display name (or VM hostname or VM GUID)	**Note:** The type of name to enter depends on the **Primary VM identifier** setting on the **Hyper-V** tab of the policy. Enter the host name, display name, or GUID of the virtual machine. The format of the host name or display 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 or GUID you enter, the policy validation fails. Make sure the **Browse for Virtual Machines** option is unchecked.
Browse for Virtual Machines	Click this option to discover Hyper-V servers or cluster nodes (shown in the left pane). You can select virtual machines from a list (in the right pane). 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 the virtual machine is turned off but was turned on when the cache file was last created, its name appears in the list. If the display name of the virtual machine was recently changed in the Hyper-V Manager, note: The virtual machine name that was used for the backup does not change. If NetBackup cannot obtain the IP address of the virtual machine, the IP address is displayed as NONE. See "About cached names for virtual machine backup" on page 37.
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.

About cached names for virtual machine backup

The NetBackup policy maintains a cache file of virtual machine names. The names are shown in the **Browse for Virtual Machines** dialog box. You can select a virtual machine from the cached list in the dialog box, rather than waiting to rediscover them on the network. This approach can save time if your site has a large number of virtual machines.

If you change the VM display name in the Hyper-V Manager, the new name may not be used for backups until the cache is renewed. On the policy's **Browse for Virtual Machines** dialog box, click the refresh icon to the right of the **Last Update** field to update the list of virtual machines.

See "Creating a Hyper-V policy from the NetBackup Policies utility" on page 28.

Prerequisites for alternate client backup of a virtual machine

You can back up a virtual machine with a NetBackup client that is installed on a host other than the Hyper-V server. The separate host is called an alternate client. Although a NetBackup client must reside on the Hyper-V server, that client does not perform the virtual machine backup. The alternate client handles the backup I/O processing, to save computing resources on the Hyper-V server.

Note that the NetBackup media server can be installed on the alternate client instead of on the Hyper-V server. In this configuration, the alternate client host performs the media server processing.

Note the following prerequisites for the alternate client backup of a virtual machine:

- The VSS snapshot provider must support transportable snapshots with the Hyper-V writer. A transportable snapshot is one that can be imported to the alternate client.
  Check with the vendor of the VSS provider, or use the `vshadow` command.
  See "Verifying support for transportable snapshots by using the `vshadow` command" on page 124.
- The VSS provider should be installed on both the primary client (the Hyper-V server) and the alternate client.
- All virtual machine files must reside on Hyper-V host volume(s) that the VSS provider supports for transportable snapshots involving the Hyper-V writer.
- The primary client (Hyper-V server) and alternate client must run the same Windows operating system, volume manager, and file system. For each of these I/O system components, the alternate client must be at the same version as the primary client, or at a higher version.
- The primary client and alternate client must run the same version of NetBackup. For example, the use of a later version of NetBackup on the primary client and an earlier version on the alternate client is not supported.
  For more information on alternate client requirements, see "Alternate client backup" in the *NetBackup Snapshot Client Administrator's Guide*.

Configuring alternate client backup of virtual machines

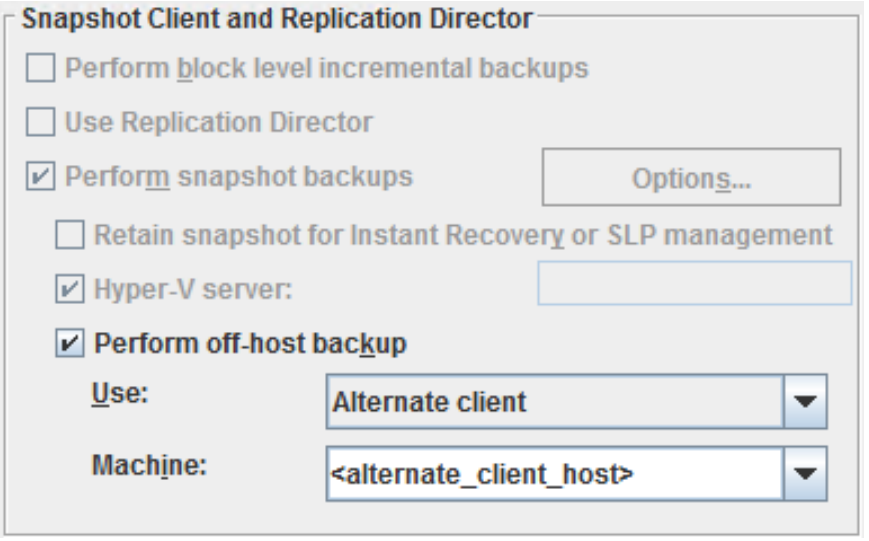
This topic describes the details unique to setting up a policy for alternate client backup. This topic is a supplement to a larger procedure. For further instructions on creating a policy, see the following:

See "Creating a Hyper-V policy from the NetBackup Policies utility" on page 28.

To configure an alternate client backup of a virtual machine

1 On the NetBackup policy **Attributes** tab, select **Hyper-V** as the policy type.

2 Under **Snapshot Client and Replication Director**, click **Perform off-host backup** and select **Alternate client** from the pull-down. Enter the name of the alternate client in the **Machine** field.



3 Click the **Hyper-V** tab and review the options.

See "Backup options on the Hyper-V tab" on page 32.

Note the following:

Enable file recovery from VM backup	This option supports full and incremental schedules.

4 Create a schedule for the backup.

5 On the **Clients** tab, click **New** to select the virtual machine(s) to back up.

See “Browse for Hyper-V virtual machines” on page 36.

Note: The **Backup Selections** tab is set to **ALL_LOCAL_DRIVES**.

6 Click **OK** to validate and save the policy.

After you start the backup, the Detailed Status log should include the following line:

```
... snapshot backup using alternate client <host_name>
```

Troubleshooting assistance is available.

See “Problems with alternate client backup” on page 124.

Requirements for a NetBackup client inside the virtual machine

Although a NetBackup client is required on the Hyper-V server, it is not required in the virtual machine except in the following cases:

- To back up the individual virtual drives that are inside the virtual machine. For example, the virtual drives that are on vhd (or vhdx) files as though on a physical host.
- To back up the physical disks that the virtual machine accesses in a pass through configuration.
  To back up disks in a pass through configuration by means of a VSS hardware snapshot provider, an alternate client configuration is required.
  See “About Hyper-V pass-through disks with NetBackup” on page 136.
- To back up databases or applications using NetBackup agents.

Chapter 5

Configure Hyper-V Intelligent Policies

This chapter includes the following topics:

- Query Builder field reference
- Test Query screen for Hyper-V
- 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
- Restoring a VM that was backed up with a Hyper-V Intelligent Policy and that has a pass-through disk

About Hyper-V Intelligent Policy (automatic selection of virtual machines for backup)

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 Hyper-V Intelligent Policy.

For a list of supported Hyper-V servers and related requirements for Hyper-V Intelligent Policy, see the *Symantec NetBackup Enterprise Server and Server 7.7 - 7.7.x OS Software Compatibility List* available from the following location:

NetBackup Master Compatibility List

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 5-1 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.

The basics of a NetBackup query rule

For automatic virtual machine selection, NetBackup uses query rules to determine which Hyper-V 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** (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 5-2 contains the examples of rules.

Table 5-2 Examples of rules

Rule	Description
`Displayname Contains "vm"`	NetBackup selects the virtual machines that have the characters `vm` anywhere in their display names.
`Displayname EndsWith "vm"`	NetBackup selects the virtual machines that have the characters `vm` at the end of their display names.

Table 5-2 Examples of rules *(continued)*

Rule	Description
`HypervServer AnyOf "hv1","hv2"`	NetBackup selects the virtual machines that reside on Hyper-V servers `hv1` or `hv2`.
`Powerstate Equal poweredOn`	NetBackup selects only the virtual machines that are currently turned on.

Important notes on Hyper-V Intelligent Policy

The Hyper-V Intelligent Policy in NetBackup is a different approach to Hyper-V 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 5-3 Important notes on automatic virtual machine selection!

Note!	Explanation
Create rules carefully.... 	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. You make the rules, and NetBackup follows them. 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).
Changes to the virtual environment can affect backup times. 	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.

Table 5-3 Important notes on automatic virtual machine selection! *(continued)*

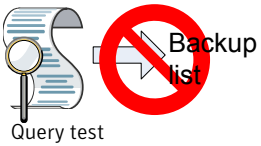
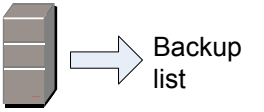
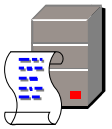
Note!	Explanation
Test the query rules. 	Test the query rules ahead of time. The policy includes a Test Query function for that purpose. It's important to verify that your query operates as expected. Otherwise, the query may select too many or too few virtual machines. As an alternative, you can use the `nbdiscover` command to test a query. Refer to the *NetBackup Commands Reference Guide*. Note also: The policy's **Primary VM identifier** parameter can affect the automatic selection process. See "Effect of Primary VM identifier parameter on Selection column in Test Query results" on page 71. See "Effect of Primary VM identifier parameter on VM Name column in Test query results" on page 72.
A query test does not create the backup list. NetBackup creates the backup list when the backup runs.  Query test  Backup execution	The automatic selection process is dynamic. Changes in the virtual environment may affect which virtual machines the query rules choose when the backup runs. **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.

Table 5-3 Important notes on automatic virtual machine selection! *(continued)*

Note!	Explanation
The policy does not display a list of the virtual machines that are to be backed up. Use the Activity Monitor or OpsCenter. 	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. For a list of the backed up virtual machines, use the NetBackup Activity Monitor or the OpsCenter web interface.
When you save the policy, the query rules are not validated.  Policy	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. 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.

NetBackup requirements for Hyper-V Intelligent Policy

Note the following requirements for automatic selection of Hyper-V virtual machines:

- The system where the NetBackup Administration Console runs must have access to the Hyper-V server.
- For the policies that back up VMs that reside in a Hyper-V cluster: The NetBackup master server should not be installed on any Hyper-V nodes of the cluster. If the master server resides on one of the nodes, you cannot log on to the NetBackup Administration Console.
  See "Unable to log in to the NetBackup Administration Console" on page 123.
- If the policy's **Primary VM identifier** option is set to **VM display name**, certain special characters are not supported in the name.

The following characters are supported: ASCII letters a through z (uppercase and lowercase), numbers 0 through 9, hyphen (-), period (.), underscore (_), plus sign (+), percent sign (%), left and right parentheses (), spaces.
If the display name contains unsupported characters, set the **Primary VM identifier** to **VM GUID**, or to **VM hostname** if a host name is available.

- Automatic virtual machine selection requires no additional license beyond the NetBackup Enterprise Client license.
- Refer to the following Symantec document for support information and additional requirements for Hyper-V Intelligent Policy:
"Support for NetBackup 7.x in virtual environments"

Setting up Hyper-V Intelligent Policy: Task overview

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

Table 5-4 Automatic selection of virtual machines: overview of the tasks

Steps to configure automatic selection	Description and notes
Configure a Hyper-V policy	Use the policy Attributes tab. See "Creating a Hyper-V policy from the NetBackup Policies utility" on page 28.
Set rules for virtual machine selection in the policy Query Builder	On the policy **Clients** tab, click **Select automatically through Hyper-V Intelligent Policy query**. Choose a host for virtual machine selection (the default is the Hyper-V server). To add the rules, use the Query Builder drop-down fields. See "Creating a Hyper-V policy for automatic virtual machine selection" on page 50. See "Options for selecting Hyper-V virtual machines" on page 48.
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 All_LOCAL_DRIVES (not displayed). As an alternative, you can use the `nbdiscover` command to test a query. Refer to the *NetBackup Commands Reference Guide*.

Table 5-4 Automatic selection of virtual machines: overview of the tasks *(continued)*

Steps to configure automatic selection	Description and notes
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.

Options for selecting Hyper-V virtual machines

This topic describes the options on the policy **Clients** tab for Hyper-V policies.

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 "Creating a Hyper-V policy for automatic virtual machine selection" on page 50.

Table 5-5 Virtual machine selection options (not available on the **Backup Policy Configuration Wizard** panel)

Option	Description
Hyper-V server	Enter the name of the Hyper-V server. For a clustered environment, note: ■ Enter the name of the cluster (or one of the Hyper-V cluster nodes). ■ Set the NetBackup Legacy Network Service logon to the cluster user. See "Changing the NetBackup Legacy Network Service logon (vnetd.exe) to the domain user account" on page 23. ■ The NetBackup master server should not be installed on any Hyper-V nodes in the cluster. If the master server resides on one of the nodes, you cannot log on to the NetBackup Administration Console.
Select manually	Click this option and click **New** to manually enter virtual machines names, or to browse and select them from a list. See "Browse for Hyper-V virtual machines" on page 36. **Note:** The rest of the fields and options are for automatic selection of virtual machines.

Table 5-5 Virtual machine selection options (not available on the **Backup Policy Configuration Wizard** panel) *(continued)*

Option	Description
Select automatically through Hyper-V Intelligent Policy query	Click this option to allow NetBackup to automatically select virtual machines for backup based on the rules that you enter in the Query Builder.

Table 5-6 Query Builder

Option	Description
Query Builder (Join, Field, Operator, Values)	Use these pull-down fields to define rules for automatic selection of virtual machines. From left to right, each pull-down refines the rule. Click the plus sign to add the rule to the **Query** pane. Click the reset icon (curved arrow) to blank out the pull-down fields. See "Query Builder field reference" on page 64. See "Examples for the NetBackup Query Builder" on page 57.
Advanced	Places the Query Builder in Advanced Mode for manual entry of rules. See "Using the Query Builder in Advanced Mode" on page 55. See "Query Builder field reference" on page 64. See "Examples for the NetBackup Query Builder" on page 57.
Basic	Returns the Query Builder from Advanced Mode to Basic Mode. See "Query Builder field reference" on page 64.
Edit	Use this option to change an existing query rule when in Basic Mode, as follows: ■ Click the rule and then click **Edit**. ■ Make new selections in the Query Builder pull-down fields. ■ Click the save option (diskette icon).
Remove	Deletes a query rule when in Basic Mode. Click on the rule and then click **Remove**.

Table 5-6 Query Builder *(continued)*

Option	Description
Test Query	Click this option to test which virtual machines NetBackup selects based on the rules in the Query Builder. **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. See "Test Query screen for Hyper-V" on page 68. As an alternative, you can use the `nbdiscover` command to test a query. Refer to the *NetBackup Commands Reference Guide*.

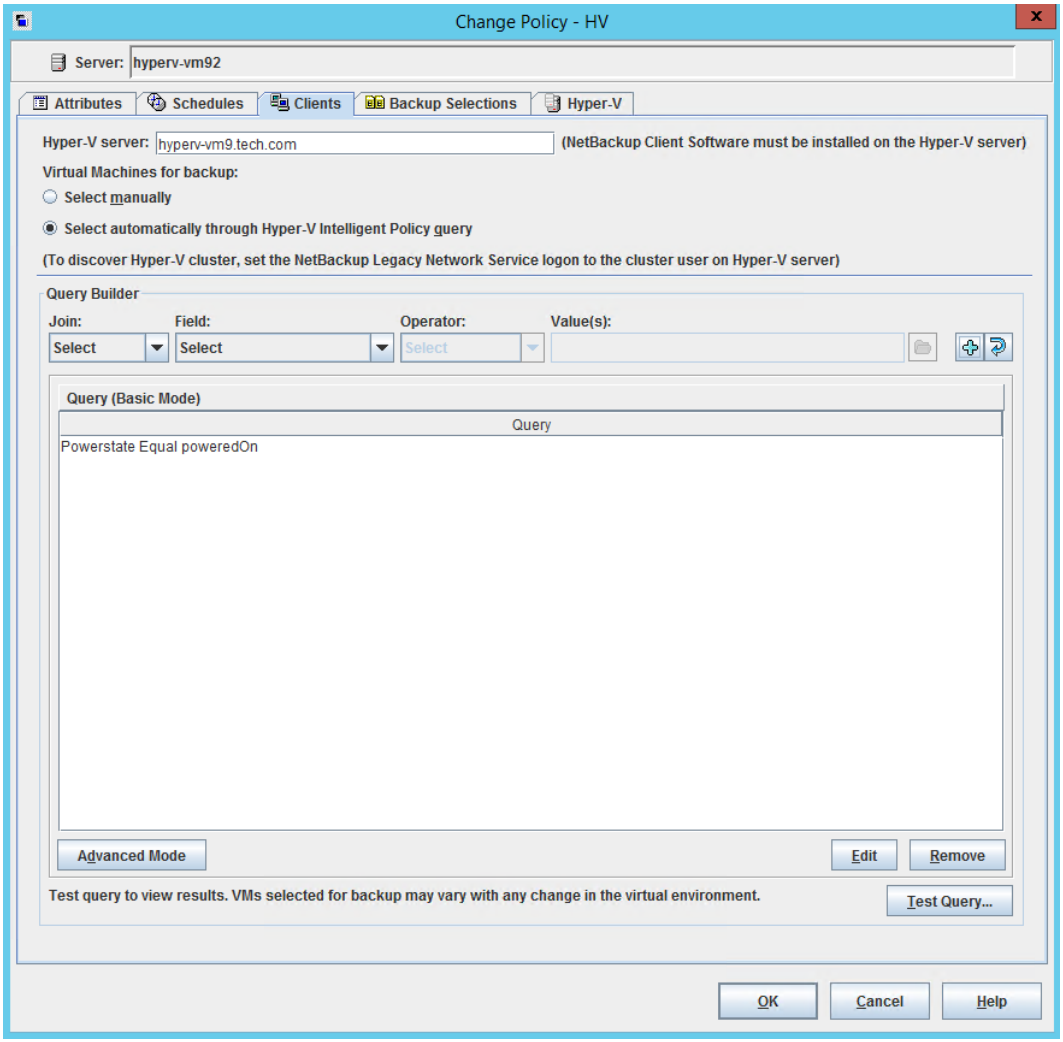
Creating a Hyper-V policy for automatic virtual machine selection

NetBackup can automatically select Hyper-V 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 the policy **Clients** tab with the option **Select automatically through Hyper-V Intelligent Policy query**. It has a query rule to back up all virtual machines that are powered on.

Figure 5-1 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, select **Hyper-V** for the policy type.
2. Make other policy selections as needed (for example, create a Schedule).

3 Click the **Clients** tab, and select **Select automatically through Hyper-V Intelligent Policy query**.

If you selected virtual machines in the **Browse for Virtual Machines** dialog, those virtual machines are removed from the policy.

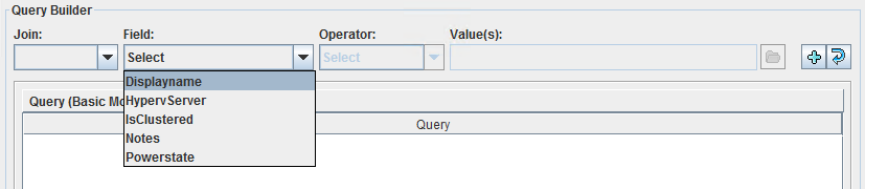
4 Enter the name of the Hyper-V server in the **Hyper-V server** field.

For a clustered environment, note the following:

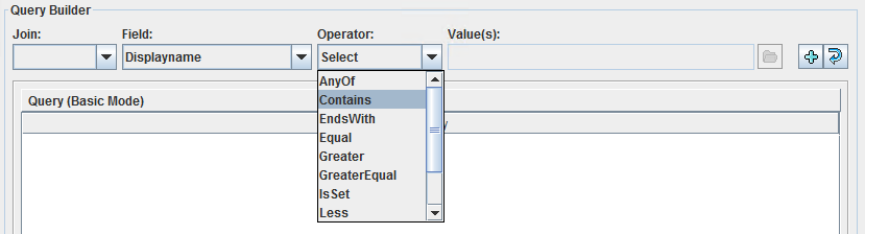
- Enter the name of the cluster (or one of the Hyper-V cluster nodes) in the **Hyper-V server** field.
- Set the NetBackup Legacy Network Service logon to the domain user account:
  See "Changing the NetBackup Legacy Network Service logon (vnetd.exe) to the domain user account" on page 23.
- The NetBackup master server should not be installed on any Hyper-V nodes in the cluster. If the master server resides on one of the nodes, you cannot log on to the NetBackup Administration Console.
  See "Unable to log in to the NetBackup Administration Console" on page 123.

5 To create a rule, make selections from the Query Builder pull-down menus.

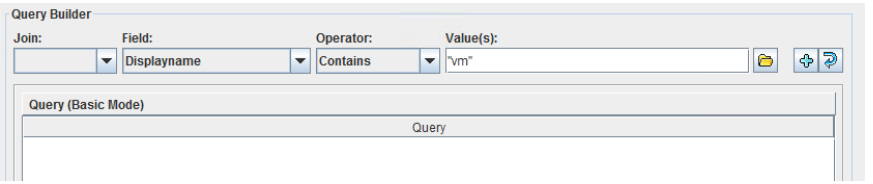
- For the first rule, you can start with the **Field** pull-down, depending on the type of rule. For the first rule, the only selections available for the **Join** field are blank (none), or NOT.
  Select a keyword for **Field**:



- Select an **Operator**:

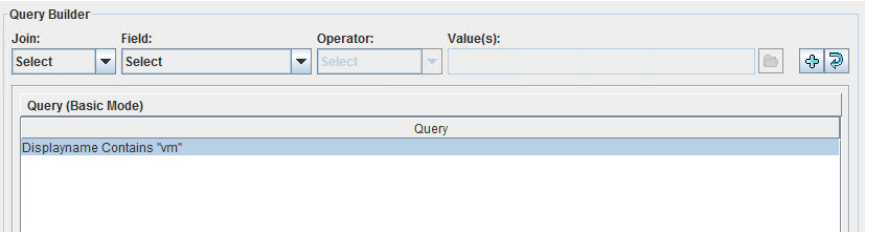


- For the **Value(s)** field:
  You can enter the value manually (enclose the value in single quotes or double quotes).
  As an alternative, you can click the folder icon to browse for values. Depending on the **Field** keyword, you can use the **Value(s)** drop-down to select the value.
  Note that browsing with the folder icon may take some time in large environments.
  See "Query Builder field reference" on page 64.



  The arrow icon resets the **Join, Field, Operator, and Value(s)** fields to blank.

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 64.

See "Examples for the NetBackup Query Builder" on page 57.

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 for Hyper-V" on page 68.

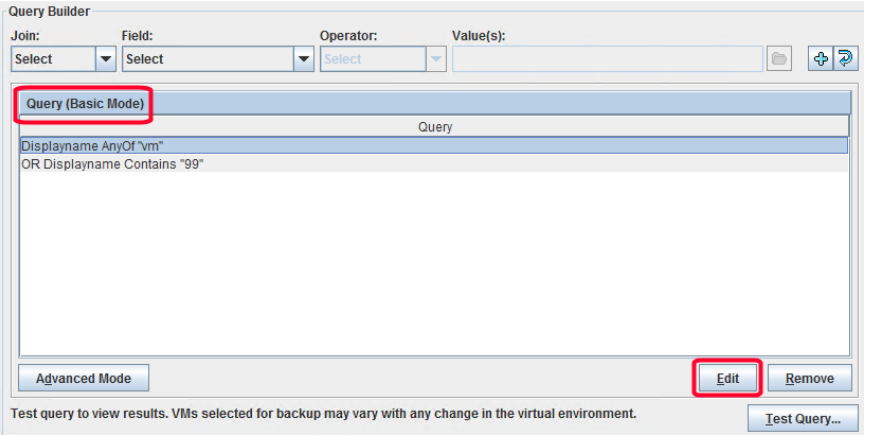
9 To create queries manually (Advanced Mode) instead of using the pull-down menus, click **Advanced**.

See "Using the Query Builder in Advanced Mode" on page 55.

Editing a query in Basic Mode

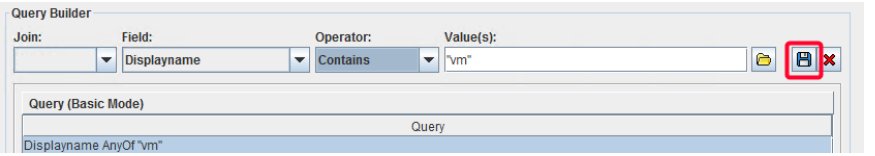
To edit a query rule

1 With the Query Builder in **Basic Mode**, click on the query rule and click **Edit**.



2 Make selections in the pull-down menus.

3 Click the save option (diskette icon).



The rule is updated according to your selections.

To remove a query rule

- With the Query Builder in **Basic Mode**, click on the query rule and click **Remove**.

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 Hyper-V policy and specify a Hyper-V server.

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

   See "Creating a Hyper-V policy for automatic virtual machine selection" on page 50.

2. Click the **Clients** tab.
3. Click **Select automatically through Hyper-V Intelligent Policy query**.
4. In the **Query Builder** pane, click **Advanced Mode**.
5. You can use the Query Builder drop-down menus to add query rules. You can also type in rules manually.

   Here is an example query:

   ```
   Displayname Contains "vm"
   ```

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 drown-down menus, it appears at the end of the query. You can cut and paste it to a different position.

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 56.

   See "Order of operations in queries (precedence rules)" on page 60.

   See "Parentheses in compound queries" on page 62.

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.

Examples for the NetBackup Query Builder

The following table provides example query rules.

To use the Query Builder, you must click **Select automatically through Hyper-V Intelligent Policy query** on the **Client** tab.

Table 5-7 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 71.
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 71.
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"	Any virtual machine that is turned on is added to the backup list.

Table 5-7 Query Builder examples *(continued)*

Example query	Query result when backup job executes
powerstate Equal "poweredOn" AND HypervServer Equal "HV_serv1"	Any virtual machine that is turned on and resides on Hyper-V server `HV_serv1` is added to the backup list.
IsClustered Equal TRUE	Any virtual machine that is in a clustered Hyper-V server is added to the backup list.
Displayname Contains "pre-prod" AND IsClustered Equal FALSE	Any virtual machine with a display name containing "pre-prod" and that is not in a clustered Hyper-V server is added to the backup list.
IsClustered Equal TRUE AND Notes Contains "pre-prod"	Adds to the backup list any virtual machine in a clustered Hyper-V server if the virtual machine has "pre-prod" in its Notes field.
Displayname StartsWith "prod" OR Notes Contains "prod"	Adds to the backup list any virtual machine with a display name starting with "prod" or with Notes that contain "prod."

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

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: You can use IsSet to exclude virtual machines from the backup list that do not have any Notes associated with them.

Table 5-8 Examples of queries with the IsSet operator

Query rules with IsSet operator	Effect of the query on virtual machine selection
Displayname Contains "prod" AND Notes IsSet	INCLUDED: Any virtual machine with a display name that contains the string "prod" if the virtual machine also has Notes. EXCLUDED: Any virtual machines that do not have Notes. Without Notes IsSet in this query, virtual machines without Notes cannot be excluded.

Table 5-8 Examples of queries with the IsSet operator *(continued)*

Query rules with IsSet operator	Effect of the query on virtual machine selection
Cluster Contains "dev" AND Notes IsSet	INCLUDED: Any virtual machine in a cluster that has a name that contains the string "dev" if the virtual machine also has Notes. EXCLUDED: Any virtual machines that do not have Notes, and any virtual machines that have Notes but that are not in a cluster that has a name that contains “dev”. Without Notes in this query, virtual machines without Notes cannot be excluded.

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 71.

About selecting virtual machines by means of multiple policies

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 so 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 the 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 5-9 Three policies that back up the virtual machines in phases

Policy	Query Builder rules	Backup result
First policy **Primary VM identifier** parameter: **VM hostname**	Notes IsSet	This policy backs up all virtual machines that have a host name and any Notes. Any virtual machines that do not have a host name and do not have Notes are either excluded from the backup or listed as FAILED.

Table 5-9 Three policies that back up the virtual machines in phases *(continued)*

Policy	Query Builder rules	Backup result
Second policy **Primary VM identifier** parameter: **VM display name**	NOT Notes IsSet AND IsClustered Equal 'TRUE'	This policy backs up all virtual machines that have a display name, that are clustered, and that do not have any Notes. Any virtual machines that have Notes but are not clustered are excluded from the backup.
Third policy **Primary VM identifier** parameter: **VM GUID**	NOT Notes IsSet AND IsClustered NotEqual '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 any Notes and are not clustered, but that do have a GUID.

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 71.

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 5-10 Order of operations

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

Table 5-10 Order of operations *(continued)*

Operation	Description	Precedence
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 62.
- 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 55.

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 turned 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.

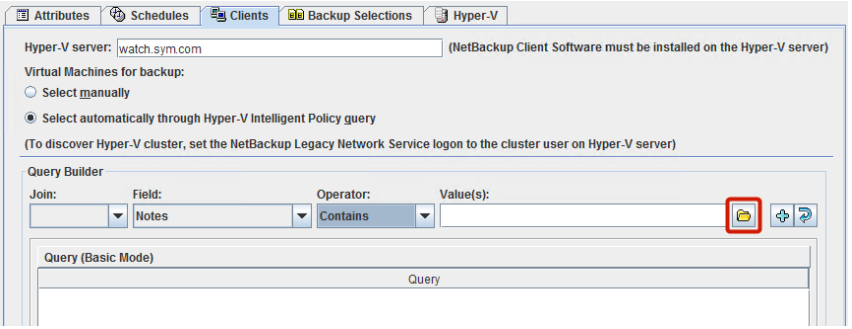
Table 5-11 Examples of compound queries with and without parentheses

Example query	The following virtual machines are selected
HypervServer Equal "HV-serv1" OR IsClustered Equal TRUE AND powerstate Equal ON	All virtual machines in HV-serv1 (regardless of their power state), and any virtual machines that are turned on in a clustered environment. To select only the virtual machines that are turned on both in the Hyper-V server and in clustered environments, use parentheses (see next example).
(HypervServer Equal "HV-serv1" OR IsClustered Equal TRUE) AND powerstate Equal ON	All the virtual machines that are turned on in HV-serv1 and in clustered environments.

Query rules for virtual machine Notes that contain a newline character

If the virtual machine's Notes contain a newline character, the Query Builder's folder icon for browsing may not return the correct values. As a result, the query rule may not select the VM for backup.

The following screen shows the folder icon for browsing for possible values:



For example: If the VM's Notes contain the following words with a newline in between them:

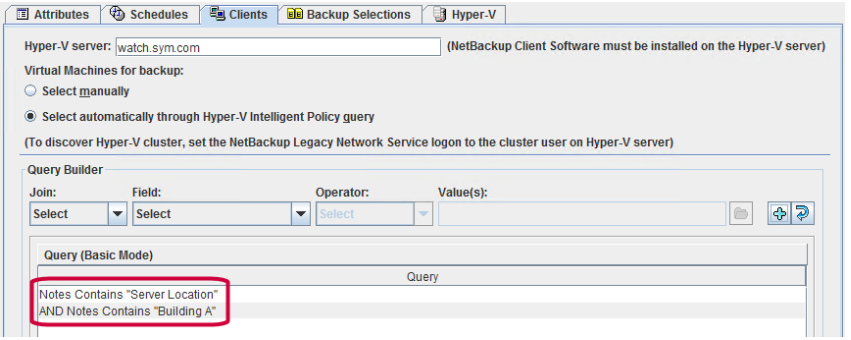
```
Server Location
Building A
```

Then the browsing icon returns “Server Location Building A”. The resulting query rule is:

```
Notes Contains "Server Location Building A"
```

Since the newline character is not included in the query, the VM may not be backed up. To include the VM in the backup, create the query manually without using the browsing icon.

For this example, create the query: `Notes Contains “Server Location” AND Notes Contains “Building A”`:



Query Builder field reference

Table 5-12 describes the drop-down fields and options for creating rules in the Query Builder.

Table 5-12 Query Builder drop-down options: Join, Field, Operator, Value(s)

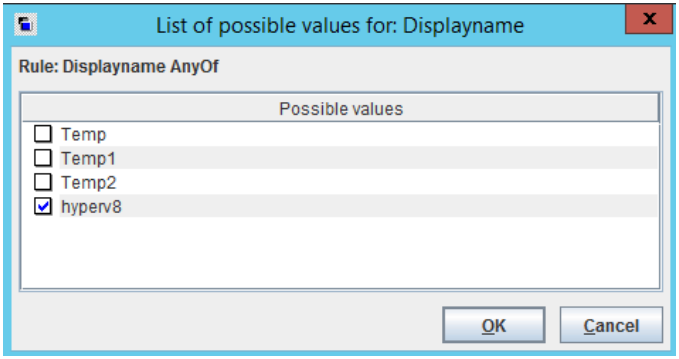
Query Builder drop-down fields	Description
Join	Selects a connector to join rules. For the first rule, choices are blank (none) or **NOT**. After you add a rule, the available connectors are **AND, AND NOT, OR, OR NOT**.
Field	Selects a parameter on which to build the rule. See Table 5-13 on page 65.
Operator	Selects an operator. See Table 5-14 on page 66.
Value(s)	Specifies value(s) for the **Field** parameter. The value(s) you enter must be enclosed in single quotes or double quotes. You can specify multiple comma-separated values. See Table 5-15 on page 68.
	Allows browsing for values, depending on the selections that are made in the other drop-down fields. Use the pop-up to select the value(s): 
	Adds the current drop-down selections to the **Query** pane as a new rule.

Table 5-12 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)

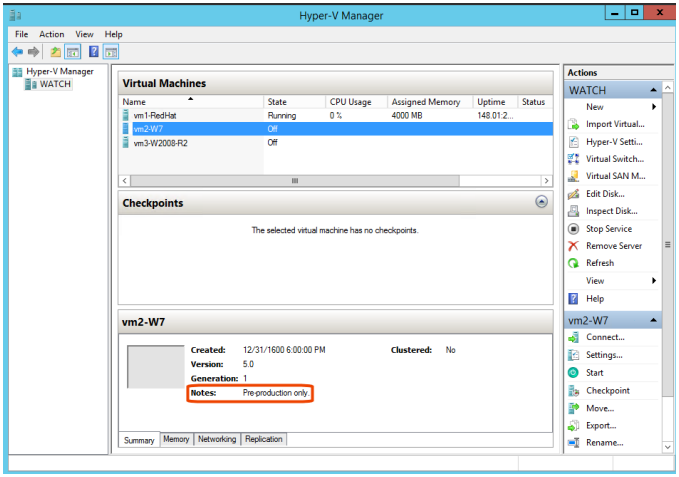
Table 5-13 describes the keywords available in the **Field** drop-down. The table also indicates whether the values for each keyword (in the **Values** field) are case-sensitive.

Note that the **Field** keyword does not determine by itself the inclusion or exclusion of virtual machines. Selection of virtual machines depends on the rule you construct: the combination of Join, Field, Operator, and Value(s).

Table 5-13 Keywords in the **Field** drop-down

Field keyword	Data type	Description
Displayname	Alphanumeric string	The virtual machine's display name. Values are case-sensitive.
HypervServer	Alphanumeric string	The name of the Hyper-V server. Values are not case-sensitive.
IsClustered	Boolean	TRUE if the virtual machine resides in a Hyper-V server that is in a cluster.

Table 5-13 Keywords in the **Field** drop-down *(continued)*

Field keyword	Data type	Description
Notes	Alphanumeric string	A note that was recorded about the virtual machine, in the virtual machine's **Summary** tab in Hyper-V Manager. Values are case-sensitive.  To make entries in a virtual machine's **Notes** field: right-click on the virtual machine, then click **Settings > Management > Name**.
Powerstate	Alphabetic	The state of the virtual machine. Values are `poweredOff`, `poweredOn`, `suspended`, `starting`, `offCritical`.

Operators

Table 5-14 describes the operators available in the **Operator** drop-down.

Table 5-14 Operators in the **Operator** drop-down

Operator	Description
AnyOf	Matches any of the specified values in the Value(s) field. For example: If the display names in the Value(s) field are "`vm01`","`vm02`","`vm03`", **AnyOf** matches any VM that has one of those names. If the names of your VMs are not identical to any of the specified values, no match occurs. A VM that is named "`vm01A`" is not a match.

Table 5-14 Operators in the **Operator** drop-down *(continued)*

Operator	Description
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 58. See "Effect of Primary VM identifier parameter on Selection column in Test Query results" on page 71. See "Test Query: Failed virtual machines" on page 70.
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.
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 "`flat_box`".

Value(s)

Table 5-15 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 5-15 Characters you can enter for Value(s)

Character types	String characters allowed
Alphanumerics	A to Z, a to z, 0 to 9 (decimal), and the following special characters: `, ~ ! @ $ % ^ & * ( ) ` - _ = + [ ] { } | \ : ; , . < > / ?` **Note:** If the policy's **Primary VM identifier** option is set to **VM display name**, only the following characters are supported in the virtual machine's display name: A to Z, a to z, 0 to 9, hyphen (-), period (.), underscore (_), plus sign (+), percent sign (%), left and right parentheses (), spaces.
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 for Hyper-V

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 events 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*.

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.

Table 5-16 Test Query screen fields

Field	Description
Test 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 70. The operator IsSet can be used to filter out such virtual machines. More information is available on IsSet. See "The IsSet operator in queries" on page 58.
Included: **Excluded:** **Failed:**	The bottom of the screen gives a tally of how many virtual machines were included, excluded, or failed in the test.

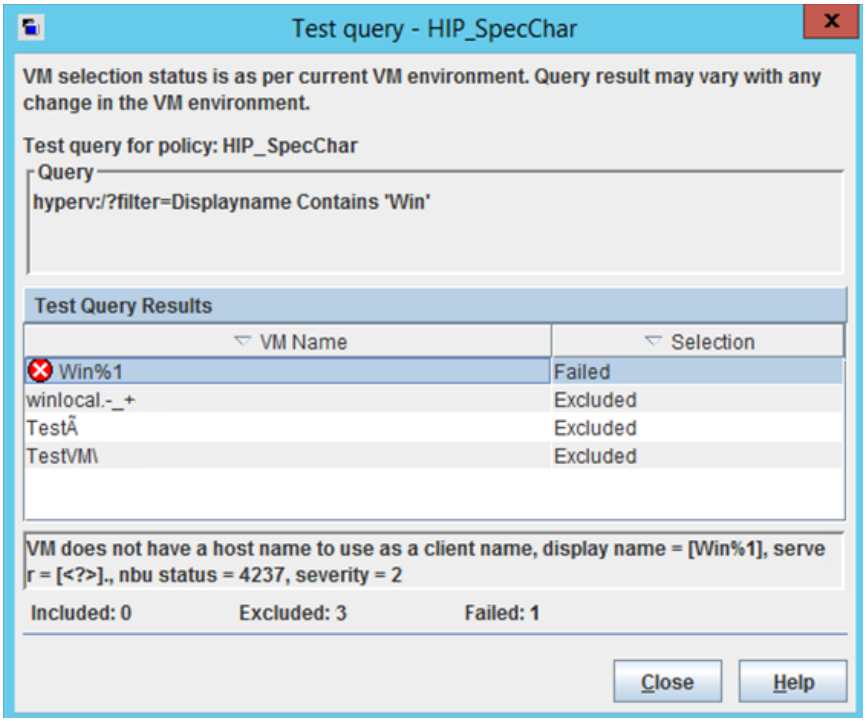
Test Query: Failed virtual machines

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 `Win%1` in the example does not have a host name. In the NetBackup policy, on the **Hyper-V** 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.

To fix this problem, use the Hyper-V Manager to configure a host name for the virtual machine.

See "The IsSet operator in queries" on page 58.

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 5-17 Effect of Primary VM identifier parameter and query rules on test query results

Primary VM identifier setting on Hyper-V policy tab	Query rule in Query Builder	Test query result
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 do not have a display name that contains "VM". FAILED: Any virtual machines that have a display name that contains "VM" but 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.

Table 5-17 Effect of Primary VM identifier parameter and query rules on test query results *(continued)*

Primary VM identifier setting on Hyper-V policy tab	Query rule in Query Builder	Test query result
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.

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.
- 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.

Restoring a VM that was backed up with a Hyper-V Intelligent Policy and that has a pass-through disk

If a Hyper-V VM with a pass-through disk was backed up with a Hyper-V intelligent policy (Query Builder), the restored VM may not start. The following message appears:

```
An error occurred while attempting to start the selected virtual
machine(s).
```

The message includes the name of the VM, its virtual machine ID, and related details.

Note: Although the VM does not start, the VM data (including the pass-through disk) is successfully restored.

To start a VM that is in a Hyper-V cluster:

1. In the Failover Cluster Manager, under **Actions** click **Configure Role…**.
2. In the **Select Role** screen, select **Virtual Machine** as the role.
3. In the **Select Virtual Machine** screen, select the VM to configure for high availability.

   Note: The VM was restored to a state of non high-availability.

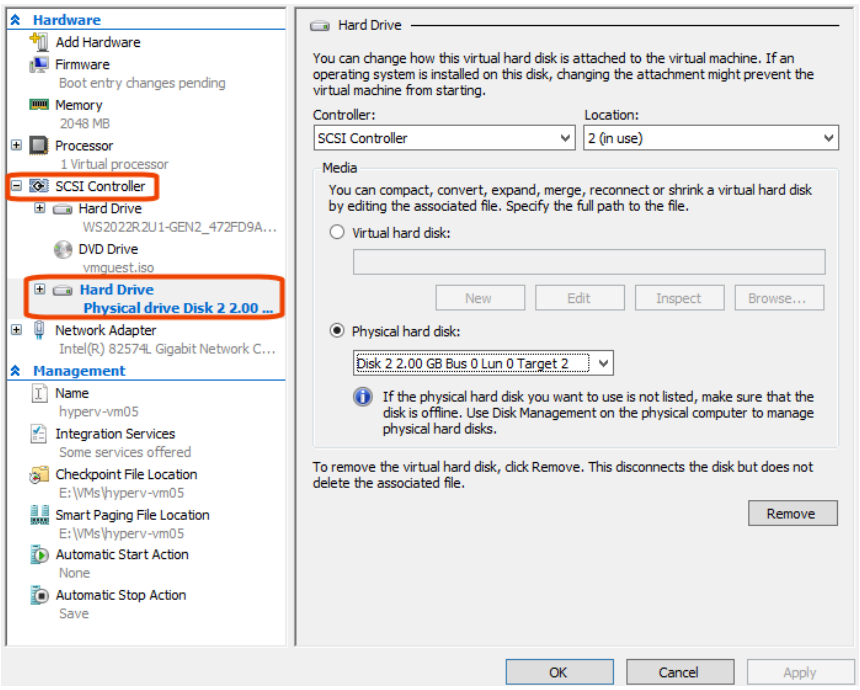
   When the restored virtual machine is set to high availability, it should start normally.
4. Right-click on the VM and click **Start**.

To start a VM that is not in a Hyper-V cluster:

1. In the Hyper-V Manager, right-click the VM and click **Settings**.
2. Select the pass-through drive's **IDE Controller** (for Generation 1 VM) or the **SCSI Controller** (for Generation 2 VM).

   The pass-through disk appears under the controller, as **Hard Drive Physical drive Disk x**.

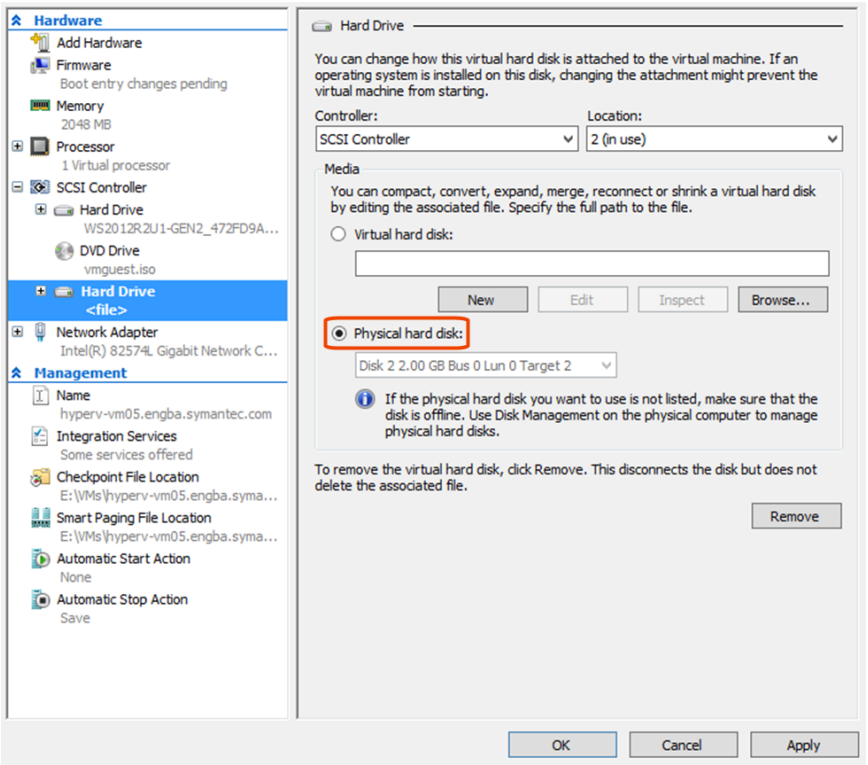
   For example:



3. In the right panel under **Physical hard disk**, click **Remove**.
4. Click **Apply** to commit the change.
5. Reselect the pass-through drive's **IDE Controller** or **SCSI Controller**.
6. Select **Hard Drive** and click **Add**.

   Beneath the IDE Controller or SCSI Controller appears **Hard Drive <file>**. The default selection in the **Media** panel on the right is **Virtual hard disk**.

7 To add the pass-through disk, click **Physical hard disk**.



8 Click **Apply** and then click **OK**.

9 Right-click on the virtual machine and click **Start**.

The virtual machine should start normally.

Chapter 6

Windows Server 2008 and 2012 failover cluster support

This chapter includes the following topics:

About virtual machines on Windows 2008 and 2012 failover clusters

NetBackup support for failover clusters includes the following:

- NetBackup can use a single policy to back up high availability (HA) and non-HA virtual machines in the cluster.
- NetBackup can back up a virtual machine even if it migrates to a different node in the cluster.
- NetBackup can restore the entire virtual machine to a cluster or to any Hyper-V host.

Note: A NetBackup client must be installed on each node of the cluster.

When restoring a clustered virtual machine to its original location, note the following:

- The restore destination depends on the following: The virtual machine's HA status at the time of its backup and at the time of restore (if it still exists).
  See "Location of the restored virtual machine in a cluster" on page 80.
- Virtual machines are always restored to a state of non-high-availability. They can be manually reset for high availability.
- If the existing virtual machine has a status of highly available at restore time, also note the following:
  - Its cluster resources are deleted during the restore.
  - Its cluster group is not deleted during restore. Removal of the cluster group must be done manually.
    See "Virtual machine maintenance after a restore" on page 81.

Notes on CSV backup and restore

The Windows Server 2008 R2 added a new feature for Hyper-V called Cluster Shared Volumes (CSV). CSV allows multiple virtual machines to share volumes (disk LUNs). CSV also allows live migration of a running virtual machine from one Hyper-V server to another without user interruption.

Multiple virtual machines can be created on a single cluster-shared volume (CSV) and owned by different nodes. (Hyper-V servers are configured as nodes in the cluster.) All nodes can access the CSV simultaneously.

NetBackup can back up the virtual machines that are configured in cluster-shared volumes.

Note the following:

- During the backup, the cluster-shared volume (CSV) enters the online state ("Backup in progress, Redirected access"). The cluster node that performs the backup becomes the owner of the CSV.
- On Windows versions before 2012, multiple nodes cannot back up a CSV simultaneously. When a node backs up a virtual machine on a CSV, the attempt by another node to back up the same virtual machine fails.

Note: On Windows server 2012, cluster nodes can back up the same CSV simultaneously.

For Windows versions before 2012: You can use the **Cluster shared volumes timeout** option in the policy to adjust how long NetBackup waits for another backup of the same CSV to complete.
See "Cluster shared volumes timeout (Hyper-V)" on page 34.

- A single node containing two virtual machines can back up both virtual machines simultaneously, even if they use the same CSV. As long as both virtual machines reside on the same node, simultaneous backups are allowed.
- For Windows Server 2008 and 2008 R2: If a VM is on a CSV, restoring the VM fails if the CSV is a reparse point that is specified as the restore destination. NetBackup may incorrectly assume that the restore destination is not large enough to contain the VM, and the restore does not start.
See "Hyper-V restore may fail if the VM was created on a CSV and the CSV is a reparse point on the destination drive" on page 82.
- For a successful backup of a virtual machine on a CSV, the virtual machine must use CSV volumes only. If a local disk on the Hyper-V server (not a CSV volume) is added to the virtual machine, the backup fails with status 156. Reconfigure the virtual machine to use CSV volumes only, and retry the backup.

Creating a policy for virtual machines in a cluster

This procedure focuses on the configuration items that are unique to the virtual machines that use a CSV. Broader details on creating a policy are available:

See "Creating a Hyper-V policy from the NetBackup Policies utility" on page 28.

To create a policy for the virtual machines that are in a CSV cluster

1. Select **Hyper-V** as the policy type.
2. Note the following options on the **Hyper-V** tab.

Enable offline backup for non-VSS VMs	Determines whether or not NetBackup is allowed to perform an offline backup of a virtual machine. See "Enable offline backup for non-VSS VMs (Hyper-V)" on page 34.
Cluster shared volumes timeout	Determines how many minutes the backup job waits, in case another node backs up the same shared volume(s) that this backup requires. **Note:** This option is not used if the cluster is on Windows 2012. See "Cluster shared volumes timeout (Hyper-V)" on page 34.

3 On the **Clients** tab, enter the name of the cluster in the **Hyper-V server** field.

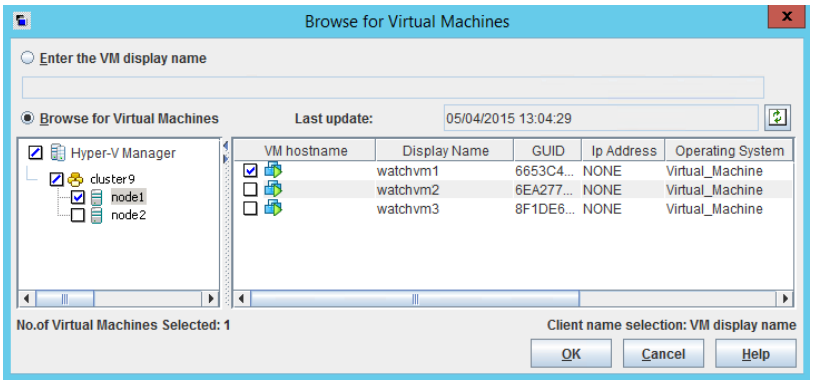
4 On the **Clients** tab, click **New**.

Note: This procedure describes how to select virtual machines manually. For automatic selection of virtual machines with a Hyper-V Intelligent policy, see the following topics:

See "Creating a Hyper-V policy for automatic virtual machine selection" on page 50.

See "Changing the NetBackup Legacy Network Service logon (vnetd.exe) to the domain user account" on page 23.

5 You can enter the host name, display name, or GUID of the virtual machine to back up, or click **Browse and select Virtual Machine**.



The cluster name and its nodes (Hyper-V servers) appear in the left pane, under **Hyper-V Manager**. The virtual machines appear in the larger pane to the right.

The **High Availability** column indicates whether the virtual machine is configured as highly available in the cluster.

Note the following:

- The host name or display name must appear in the list according to the **Primary VM identifier** option on the **Hyper-V** tab. If you selected **VM hostname** for the **Primary VM identifier** option, and a host name for the virtual machine does not appear: The virtual machine cannot be added to the **Clients** list.

  The host name of a virtual machine is available only when the virtual machine is in the running state. The display name and GUID are always available. If the host name does not appear, make sure that the virtual

machine is turned on. To update the cache file and re-display virtual machines, click the refresh icon to the right of the **Last Update** field.

- If the right pane reads "Unable to connect," the highlighted node in the left pane is down or the NetBackup client service is not running.

6 When you have selected virtual machines, click **OK**.

The selected virtual machine(s) appear on the **Clients** tab.

Location of the restored virtual machine in a cluster

When you restore a virtual machine to a cluster, you can restore to the original location or to a different location. But for a virtual machine that failed over to another node after the backup occurred, what is the original location? Is it the node (Hyper-V server) where the virtual machine resided when it was backed up, or the node where it now resides?

The following table is a decision chart for restore to original location in a cluster. It indicates where the virtual machine is restored. The location depends on the virtual machine's high availability (HA) state when it was backed up and when it was restored.

Table 6-1 Decision chart for restore to original location in a cluster

Is the virtual machine status HA at time of backup?	Is the virtual machine status HA at time of restore?	Virtual machine is restored to this node (to non-HA state):
Yes	Yes	Restored to node that owns the virtual machine at the time of restore.
Yes	No	Restored to node on which the virtual machine resided at the time of backup.
Yes	Virtual machine does not exist.	Restored to node on which the virtual machine resided at the time of backup.
No	Yes	Restored to node on which the virtual machine resided at the time of backup. At the time of restore, if virtual machine resides on a different node from where it resided when backed up, the restore fails.
No	No	Restored to node on which the virtual machine resided at the time of backup.
No	Virtual machine does not exist.	Restored to node on which the virtual machine resided at the time of backup.

Note: In all cases, the virtual machine is restored to the non-HA state.

Virtual machine maintenance after a restore

Note the following about restoring a virtual machine in a cluster:

- Virtual machines are always restored to a state of non-high availability. To return the virtual machine to high availability, use the **Microsoft Failover Cluster Manager** and the **High Availability Wizard**. For instructions, refer to the following Microsoft document:
  Hyper-V: Using Hyper-V and Failover Clustering
- If the existing virtual machine has a status of high availability and the restore overwrites the virtual machine, note the following:
  - The existing virtual machine's cluster resources are removed during the restore.
    See "Removal of cluster resources during restore" on page 81.
  - The virtual machine's cluster group is not removed during restore. When two or more virtual machines are created on the same cluster disks, the cluster software places their resources in the same virtual machine group. Since another virtual machine may share that group, NetBackup does not delete the group.
    Removal of the cluster group must be done manually. Refer to Microsoft documentation for instructions.

Removal of cluster resources during restore

When a virtual machine is configured as highly available, the Microsoft Cluster software creates a group for that virtual machine. The group contains various resources, such as VM resource, VM configuration resource, and disk resource. These resources are under the control of the group.

When a highly available (HA) virtual machine is restored to its original location, the existing virtual machine at that location must be removed. As part of the restore, the Microsoft Cluster software automatically removes the virtual machine's group resources as well, as described in the following table.

Table 6-2 Removal of cluster resources during restore: CSV-based vs. non-CSV-based

Is the HA virtual machine based on a CSV volume?	These group resources are removed along with the existing virtual machine:
Yes	VM resource, VM configuration resource, and disk resource are removed.
No	VM resource and VM configuration resource are removed. The existing disk resource is retained as part of the cluster group.

Hyper-V restore may fail if the VM was created on a CSV and the CSV is a reparse point on the destination drive

For Windows server 2008 and 2008 R2: NetBackup blocks the attempt to restore a Hyper-V VM to an alternate location in the following case:

- The VM was created on a Hyper-V Cluster Shared Volume (CSV),
- The CSV is mounted as a reparse point on a local drive on the Hyper-V server,
- The reparse point on the local drive is specified as the destination for the restore,
- And the VM is larger than the space available on the local destination drive.

For example:

- The CSV is a reparse point on local drive C (C:\ClusterStorage\Volume2). The reparse point is specified as the destination for the restore.
- The CSV has 50 GB of free space, but the C:\ drive has only 10 GB of free space.
- The VM to restore is 30 GB in size.

In this case, NetBackup identifies the 10 GB of free space on the Hyper-V C:\ drive. It does not identify the 50 GB of free space on the CSV. NetBackup fails the pre-recovery check and the restore job does not begin. In the **NetBackup Restore Marked Files** dialog, the following message appears:

```
Data may not be restored successfully - there is not enough space
available in the destination directory.
```

Note: NetBackup 7.6.1 fixes this restore issue for VMs on Windows 2012 or later Hyper-V servers. NetBackup examines the space available on the CSV; if sufficient CSV space is available, NetBackup restores the VM.

For VMs on Windows 2008 R2 and earlier Hyper-V servers, do the following: For the restore location, select a drive on the Hyper-V server that has free space at least equal to the size of the VM.

Chapter 7

Back up and restore Hyper-V

This chapter includes the following topics:

Backing up Hyper-V virtual machines

Virtual machine backups can be initiated 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.

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

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

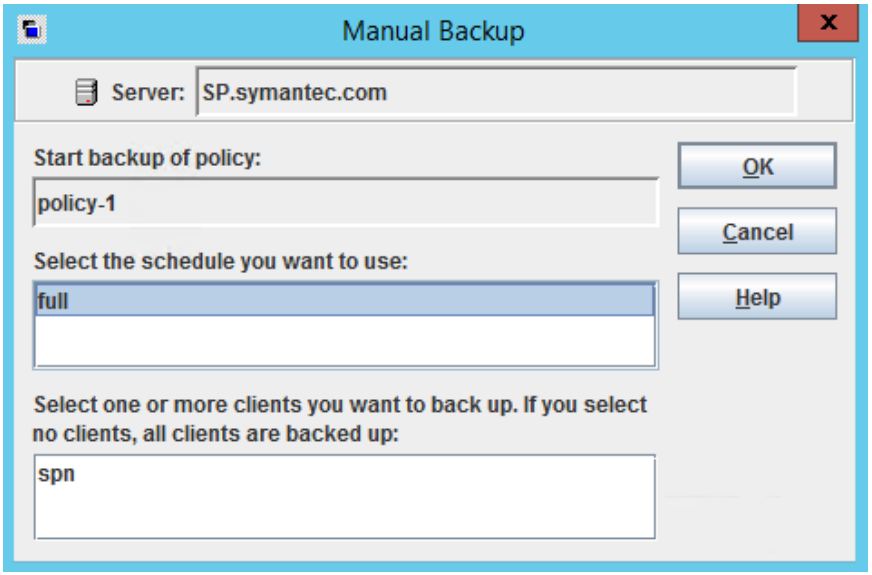
See "Creating a Hyper-V policy from the NetBackup Policies utility" on page 28.

See "Creating a Hyper-V policy from the Policy Configuration Wizard " on page 27.

To back up a virtual machine manually from an existing policy

1 In the **NetBackup Administration Console**, click on **Policies**, select the policy name, 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.

4 Click **OK** to start the backup.

5 To watch the backup progress in the **NetBackup Administration Console**, click **Activity Monitor**.

Notes on individual file restore

Note the following:

- If you are running antivirus protection on Hyper-V virtual machines, Symantec recommends Symantec Endpoint Protection 11.0 Maintenance Release 4 (build 11.0.4000) or later. Restores of virtual machine files complete faster if the virtual machine is running this version as opposed to an earlier version of Endpoint Protection.
- Cross-platform restore of individual files is not supported. You can restore Windows files to Windows guest operating systems only, not to Linux. You can restore Linux files to Linux guest operating systems only, not to Windows.
- To restore files to a shared location on the virtual machine, note: Virtual machines must be in the same domain as the NetBackup client and master and media server.
- To restore an individual file that is larger than approximately 2 GB, restore the file to a host that has a NetBackup client. NetBackup for Hyper-V does not currently support restores of large files by means of a shared location on the virtual machine. This file size restriction does not apply to restore of an entire virtual machine.
  See "Restoring individual files to a host that has a NetBackup client" on page 92.
- From a backup image that was made with the **Enable file recovery from VM backup** option: If you select individual files to restore, the selected files must have originally resided on the same virtual machine volume. If some files resided on one volume and other files resided on a different volume, the restore fails.
- To restore Windows encrypted files, the NetBackup Client Service must be logged on as Administrator on the target host for the restore. Under services on the control panel, change the logon for the NetBackup Client Services from Local System Account to Administrator.
- Files that use NTFS-file system features cannot retain those features if you attempt to restore the files to a FAT or FAT32 file system.

  Note the following:

  - Files that were compressed under NTFS are restored as uncompressed files in a FAT or FAT32 file system.
  - Files that were encrypted under NTFS cannot be restored to a FAT or FAT32 file system.
  - Files that had NTFS-based security attributes are restored without those attributes in a FAT or FAT32 file system.

  - The restore fails with NetBackup status 2817 when the files that have alternate data streams are restored to a FAT or FAT32 file system.

- Windows Hyper-V provides no mechanism for quiescing file system activity on Linux virtual machines. Therefore, at the time of backup, a snapshot of a Linux virtual machine may be in an inconsistent state (sometimes called crash-consistent). Note that the backup succeeds. For restore of inconsistent Linux files from the backup, NetBackup creates a NetBackup.lost+found directory for each Linux volume.
  See "About the NetBackup lost and found directory on Linux" on page 90.
- On a restore, NetBackup recreates the linking between a hard link and its original file only if the link file and its target file are restored in the same job. If each file is restored individually in separate restore jobs, they are restored as separate files and the link is not re-established.
- On a Linux virtual machine, a backup that was made with the **Enable file recovery from VM backup** option may have file-mapping issues if the virtual machine experiences heavy I/O. (Windows Hyper-V provides no mechanism for quiescing file system activity on Linux virtual machines.)
  See "Problems with restore of individual files" on page 128.
- For Linux virtual machines, only 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. Note: The "/" (root) partition must be formatted with ext2, ext3, or ext4 so that NetBackup can present mount points in the Backup, Archive, and Restore interface.
- 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.
- To migrate an ext2 or ext3 file system to ext4: See the instructions under Converting an ext3 file system 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, note: Run the Linux sync command on the ext4 file system before starting each backup.
- NetBackup supports backup of Linux FIFO files and socket files. Note however that 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, NetBackup cannot restore individual files from software RAID volumes. The files are restored when you restore the entire virtual machine
- 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.
- For VMs on a Windows 2012 R2 Hyper-V server, the BAR interface may list Hyper-V snapshot files when you browse to restore VM files. In some cases, the snapshot file data is not application consistent and the file should not be restored.
  To identify the snapshot file and to decide whether to restore it:
  See "The BAR interface may list Hyper-V snapshot files when you browse to restore Hyper-V VM files" on page 105.
- For Linux, additional notes apply.
  See "Notes on Linux virtual machines" on page 21.
- NetBackup for Hyper-V does not support individual file restore by means of ClientDirect Restore.

Notes on full virtual machine restore

Note the following:

- A backup of the full virtual machine can be restored only to Windows Server 2008 or later with the Hyper-V role enabled.
- By default, the NetBackup client on the Hyper-V server does not have Windows Administrator privileges. You can restore a full virtual machine from the NetBackup server. You cannot restore a full virtual machine from a NetBackup client that does not have Administrator privileges.
- For the virtual machines that are configured in a volume GUID with a differencing disk in another volume GUID, redirected restores are not supported.
  See "Restored virtual machine fails to start" on page 126.
- When you restore the virtual machine to its original location with the **Overwrite virtual machine** option, note: The same virtual machine on the Hyper-V server

is automatically turned off and deleted before the restore. The vhd or vhdx files of the virtual machine on the Hyper-V server are overwritten by the vhd or vhdx files from the backup image. If any new vhd or vhdx files were created after the backup, those files are not removed.

- When you restore the virtual machine to a different location on the original Hyper-V server or to a different server, note: The same virtual machine (if it exists) on the Hyper-V server is automatically turned off and deleted before the restore if you choose the **Overwrite virtual machine** option. The `.vhd` or `.vhdx` files of the deleted virtual machine, however, are not deleted. You must delete those files.
- When you restore the virtual machine to a Hyper-V server that has a virtual machine of the same GUID, you must select the **Overwrite virtual machine** option. Otherwise, the restore fails.
- If you restore a virtual machine without the **Overwrite virtual machine** option, note: You must remove the current virtual machine and its vhd or vhdx files from the destination server before you start the restore. If you remove the virtual machine but leave one or more of its vhd or vhdx files on the destination server, the vhd or vhdx files from the backup are not restored.
- (This item is a limitation in VSS and the Hyper-V writer, not in NetBackup.) If the virtual machine contains Hyper-V snapshot files (avhd or avhdx files), NetBackup cannot restore the virtual machine to a different location or to a different Hyper-V server.

  Note the following:

  - This issue has been fixed in Windows Server 2008 R2 (restore server).
  - This restriction does not apply in either of the following cases: When you restore the virtual machine to its original location on the original Hyper-V server, or when you restore to a staging location.

  Note that NetBackup does not create Hyper-V snapshot files (avhd or avhdx).
- (This item is a limitation in VSS, not in NetBackup.) Immediately after a full virtual machine is restored, the virtual machine volume may be larger than it was when the virtual machine was backed up. The increase is normal: After the restore, snapshot-related cache files remain on the volume. After about 20 minutes, the cache files are automatically removed and the volume returns to its original size

  Note: A new backup of the restored virtual machine could fail if the virtual machine volume contains insufficient space to create a snapshot for the backup. According to Microsoft, this situation should not occur as long as the virtual machine volume has at least 10 to 15% free space.
- In the following case a race condition may result:
  - You attempt to do a full restore of two virtual machines at the same time.

- The two virtual machines also share a virtual hard disk (vhd or vhdx file) that both restore jobs have selected to restore.

The two jobs may simultaneously attempt to access the same vhd or vhdx file, but only one job gains access to the file. The other job is denied access, and that job may fail with error code 185.
See "NetBackup status codes related to Hyper-V" on page 117.

- If you restore a virtual machine to a different Hyper-V server, the original Hyper-V server and the target server must have the same number of network adapters (NICs). You must configure the network adapter(s) for the restored virtual machine on the target server.
See "Restored virtual machine fails to start" on page 126.
- A restore of a virtual machine to an alternate location fails if any of its virtual disks has an ampersand (&) in its path. As a workaround, restore the virtual machine to its original location, or restore to a staging location and register the virtual machine manually.
- Windows Hyper-V provides no mechanism for quiescing file system activity on Linux virtual machines. Therefore, at the time of backup, a snapshot of a Linux virtual machine may be in an inconsistent state (crash-consistent). Note that the backup succeeds. For restore of inconsistent Linux files from the backup, NetBackup creates a NetBackup.lost+found directory for each Linux volume.

About the NetBackup lost and found directory on Linux

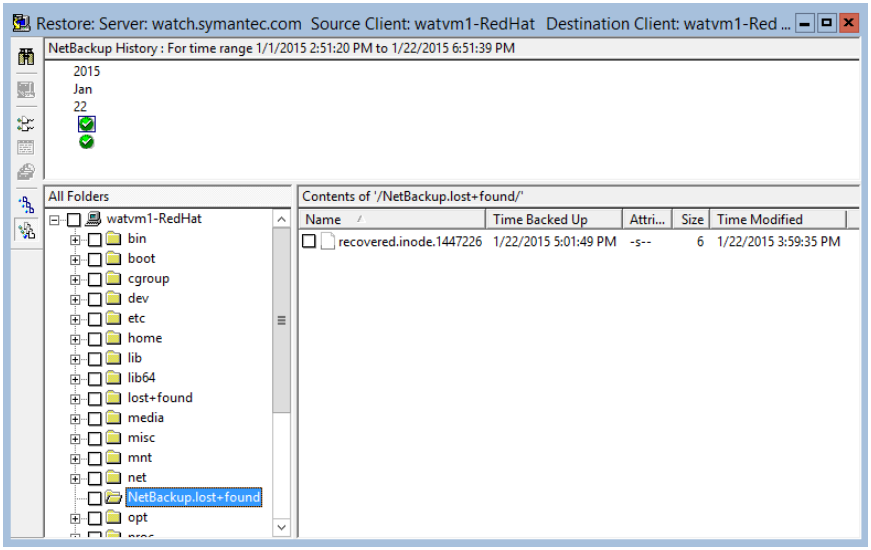
Windows Hyper-V provides no mechanism for quiescing file system activity on Linux virtual machines. As a result, a snapshot of a Linux virtual machine may be in an inconsistent state (crash-consistent). In that case, the snapshot data is equivalent to the state of a file system after an abrupt, uncontrolled shutdown. If the system is restarted, a file system consistency check (`fsck`) reports the 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 an example of an inconsistent file 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 files 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.

About restoring individual files

If the **Enable file recovery from VM backup** option was enabled, you can restore the files and folders that existed on that virtual machine at the time of the backup.

If the **Enable file recovery from VM backup** option was not enabled, you can restore the full virtual machine only.

See "Restoring the full Hyper-V virtual machine" on page 99.

More information is available on the Hyper-V backup options.

See "Creating a Hyper-V policy from the NetBackup Policies utility" on page 28.

You can set up a configuration to restore individual files in any of the following ways:

- Install a NetBackup client on another computer. Create a share on the virtual machine to allow that computer to access the virtual machine. (The virtual machine does not require a NetBackup client.) Specify the UNC path as the destination for the restore. More information is available on this option:
  See "Restoring individual files to a shared location on the virtual machine" on page 97.
  See "Setting up NetBackup Client Service for restore to a shared location on the virtual machine" on page 98.
- Install a NetBackup client on the virtual machine where you want to restore the files. Restore the files to the virtual machine in the same manner as restoring to any NetBackup client.
  See "Restoring individual files to a host that has a NetBackup client" on page 92.
- Install a NetBackup client on another computer. Restore the files to that computer and then copy the files to the virtual machine.
  To restore encrypted files, you must install a NetBackup client on the virtual machine and restore the files directly to the virtual machine.
  See "Restoring individual files to a host that has a NetBackup client" on page 92.

You can use the NetBackup Backup, Archive, and Restore interface to restore files and folders from NetBackup for Hyper-V backups.

Important notes on Hyper-V restore are also available.

See "Notes on full virtual machine restore" on page 88.

See "Notes on individual file restore" on page 86.

Restoring individual files to a host that has a NetBackup client

Use the following procedure to restore individual files to a host that has a NetBackup client.

To restore individual files to a host that has NetBackup client

1. Start the **NetBackup Backup, Archive, and Restore** interface on a NetBackup client.
2. Click **Files > Specify NetBackup Machines and Policy Type**.

   Select the following.

Server to use for backups and restores	Enter the NetBackup master server that performed the Hyper-V backup.
Source client for restores (or virtual client for backups)	Enter the Hyper-V virtual machine that was backed up.
Destination client for restores	Enter a physical host or a virtual machine. The host or virtual machine must contain a NetBackup client. You must use a different procedure to restore the files to a virtual machine that does not have a NetBackup client. See "Restoring individual files to a shared location on the virtual machine" on page 97.
Policy type for restores	Enter **Hyper-V**.
Date / time range	The time period within which to search for backups.

3. Click **OK**.
4. Click **Select for Restore > Restore from Normal Backup**.
5. Under **All folders** and **Contents**, select the files to restore.
6. Click **Actions > Restore**.
7. Make your selections in the **Restore Marked Files** dialog box.

   Note the following:

   - **Restore everything to its original location**
     Select this option to restore the files to their original paths or folders on the destination client. If the original volume at the time of backup (such as E:\) does not exist on the destination client for this restore, the restore fails.
   - **Restore everything to a different location (maintaining existing structure)**
     Select this option to restore the files to a different path or folder on the destination client. Specify the folder in the **Destination** field.
     If the original volume at the time of backup (such as E:\) does not exist on the destination client for this restore, the restore fails.

Use a different procedure to restore the files to a virtual machine that does not have a NetBackup client:

See "Restore Marked Files dialog for restore of individual files" on page 94.
See "Restoring individual files to a shared location on the virtual machine" on page 97.

- **Restore individual folders and files to different locations**
  Select this option to restore files to particular locations. Each item you selected to restore appears in the **Source** column. Double-click on an item to enter or browse for a restore destination.

8 Click **Start Restore**.

Restore Marked Files dialog for restore of individual files

Select from the following options on the **Restore Marked Files** dialog.

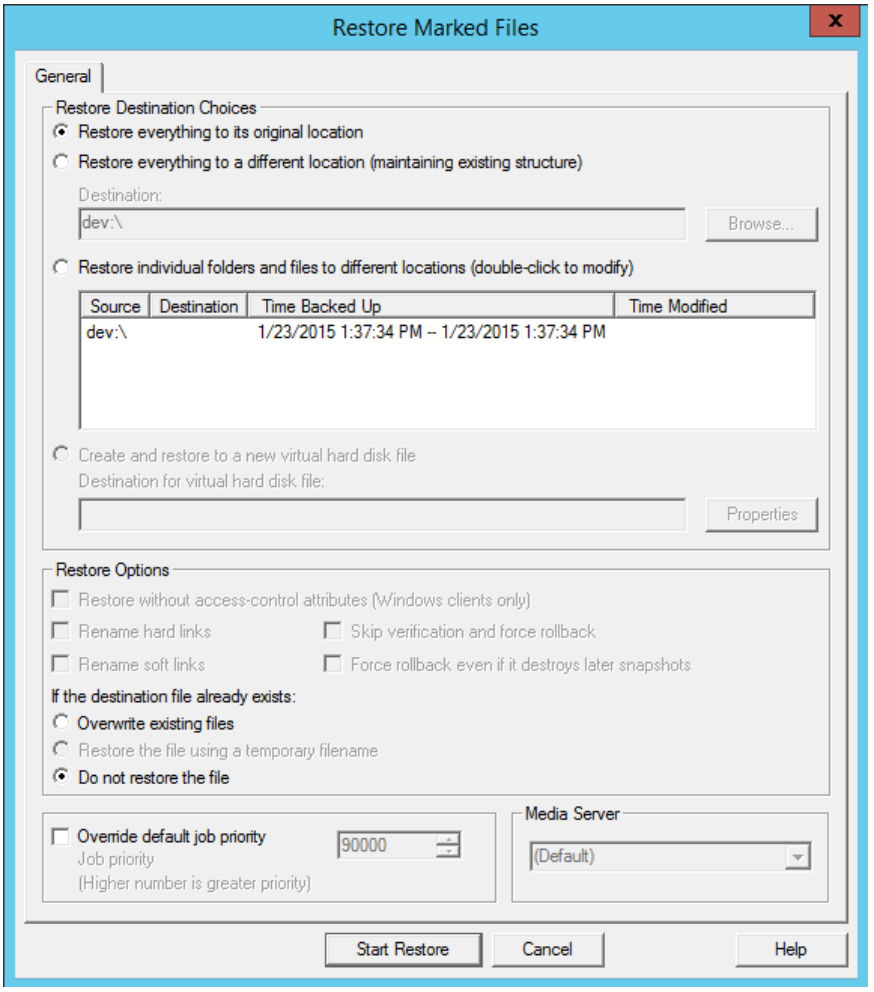


Table 7-1 Options for individual file restore on the **Restore Marked Files** dialog box

Option	Description
Restore Destination Choices	Select from the following options.
Restore everything to its original location	Restores the folders and files to the location where they resided when the backup occurred.

Table 7-1 Options for individual file restore on the **Restore Marked Files** dialog box *(continued)*

Option	Description
Restore everything to a different location (maintaining existing structure)	Restores the folders and files with their original hierarchy, but to a different location. Use the **Destination** field to enter the restore location. Click **Browse** to browse to the restore location. If the original volume at the time of backup (such as E:\) does not exist on the destination client for this restore, the restore fails.
Restore individual folders and files to different locations (double-click to modify)	Restores the folders and files to individually designated locations. To designate a restore destination for each source folder, double click on its row.
Create and restore to a new virtual hard disk file	This option is not implemented.
Restore options	Most of these options do not apply to the restore of a Hyper-V virtual machine.
Overwrite existing files	If any of the files to restore already exist at the restore destination, the restore overwrites the existing files.
Do not restore the file	If any of the files to restore already exist at the restore destination, the restore does not overwrite those files. Restores only the files that do not already exist at the destination.
Override default job priority	Determines the restore job's priority for restore resources. A higher priority means that NetBackup assigns the first available drive to the first restore job with the highest priority. Enter a number (maximum 99999). The default for all restore jobs is 0, the lowest priority possible. Any restore job with a priority greater than zero has priority over the default setting.
Media Server	You can use this option to select a media server that has access to the storage unit that contains the backup image. An example of such an environment is a Media Server Deduplication Pool (MSDP) with multiple media servers. **Note:** If the storage unit that contains the backup image is not shared with multiple media servers, this option is grayed out.

Restoring individual files to a shared location on the virtual machine

You can restore virtual machine files to a Hyper-V virtual machine that does not have a NetBackup client installed on it.

To restore individual files to a virtual machine that is not a NetBackup client

1. Install a NetBackup client on a physical host.

   The host must be in the same domain as the virtual machine that you want to restore the files to. This host can be a Hyper-V server or another computer.

2. Create a share to allow the host that contains the NetBackup client to access the virtual machine. The share must allow write access.

   For example: `\\virtual_machine1\share_folder`

   In this example, virtual_machine1 is the ultimate destination for the restored files. The host with the NetBackup client acts as a conduit for the restore.

3. Start the NetBackup Backup, Archive, and Restore interface on the NetBackup client.

4. Click **Files > Specify NetBackup Machines and Policy Type**.

   Select the following.

Server to use for backups and restores	Specify the NetBackup master server that performed the Hyper-V backup.
Source client for restores (or virtual client for backups)	Specify the Hyper-V virtual machine that was backed up.
Destination client for restores	Select the host that has the NetBackup client. The virtual machine to which you want to restore must have a share for this host. Do not specify the virtual machine in this field.
Policy type for restores	Specify Hyper-V.
Date / time range	The time period within which to search for backups.

5. Click **OK**.

6. Click **Select for Restore > Restore from Normal Backup**.

7. Under **All folders** and **Contents**, select the files to restore.

8 Click **Actions > Restore**.

9 In the **Restore Marked Files** dialog box, click **Restore everything to a different location (maintaining existing structure)**.

In the **Destination:** field, enter the UNC path name that refers to the shared drive or folder on the destination virtual machine.

For example, to restore files to E:\folder1 on virtual_machine1, enter the following:

```
\\virtual_machine1\share_folder\
```

NetBackup restores the files to the shared location on the virtual machine.

10 You may have to change the logon for the NetBackup Client Service.

See "Setting up NetBackup Client Service for restore to a shared location on the virtual machine" on page 98.

Setting up NetBackup Client Service for restore to a shared location on the virtual machine

To restore individual files to a Windows virtual machine that has a shared drive, note: the NetBackup Client Service must be logged on as the domain administrator account. It must not be logged on as the Local System account. The Administrator account allows NetBackup to 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 host that has a share to the virtual machine, double-click the NetBackup Client Service.

2 Check the **Log On** tab: if the service is not logged on as Administrator, stop the service.

3 Change the logon to the Administrator account, in the domain in which both the virtual machine and the host that has a share reside.

4 Restart the service.

5 Retry the restore.

Restoring the full Hyper-V virtual machine

You can restore the entire virtual machine to the original Hyper-V server or to a different Hyper-V server.

For important notes on restoring the full virtual machine, see the following:

See "Notes on full virtual machine restore" on page 88.

To restore the entire Hyper-V virtual machine

1. Start the **NetBackup Backup, Archive, and Restore** interface.
2. Click **File > Specify NetBackup Machines and Policy Type**.

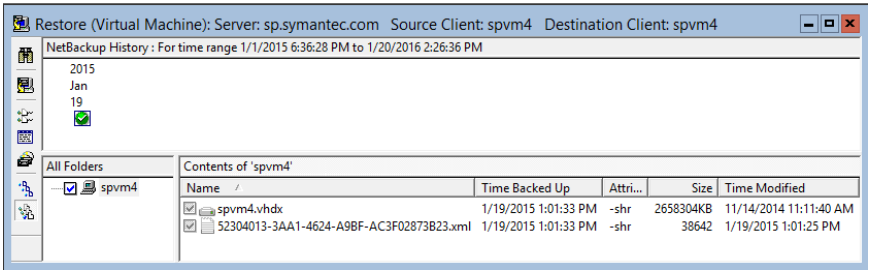
   Select the following.

Server to use for backups and restores	Enter the NetBackup master server that performed the Hyper-V backup.
Source client for restores (or virtual client for backups)	Enter the Hyper-V virtual machine that was backed up.
Destination client for restores	This field is ignored when you restore an entire virtual machine. A later step in this procedure explains how to restore to a different Hyper-V server.
Policy type for restores	Select Hyper-V.
Date / time range	The time period within which to search for backups.

3. Click **OK**.
4. Click **File > Select Files and Folders to Restore > From Virtual Machine Backup**.

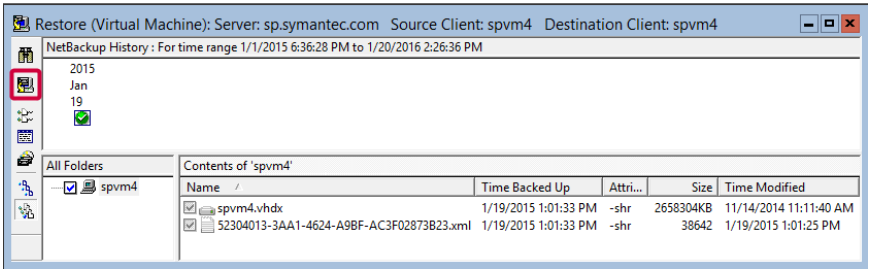
   A restore window displays the backups available for restore.

5 Select the backup of the virtual machine that you want to restore.



In the **NetBackup History** pane, click on the Hyper-V backup, then click the check box under **All Folders**. You must select the entire virtual machine.

6 Click the **Start Restore of Marked Files** icon.



7 Select restore options and the restore destination on the **Restore Marked Files** dialog.

See "Restore Marked Files dialog for restore of the Hyper-V virtual machine" on page 100.

8 Click **Start Restore**.

When the restore is complete, the restored virtual machine is placed in the Saved or Off state. The state after restore depends on its state at the time of the backup and the type of Hyper-V backup that occurred.

See "About Hyper-V online and offline backups" on page 133.

Restore Marked Files dialog for restore of the Hyper-V virtual machine

Select from the following options on the **Restore Marked Files** dialog box.

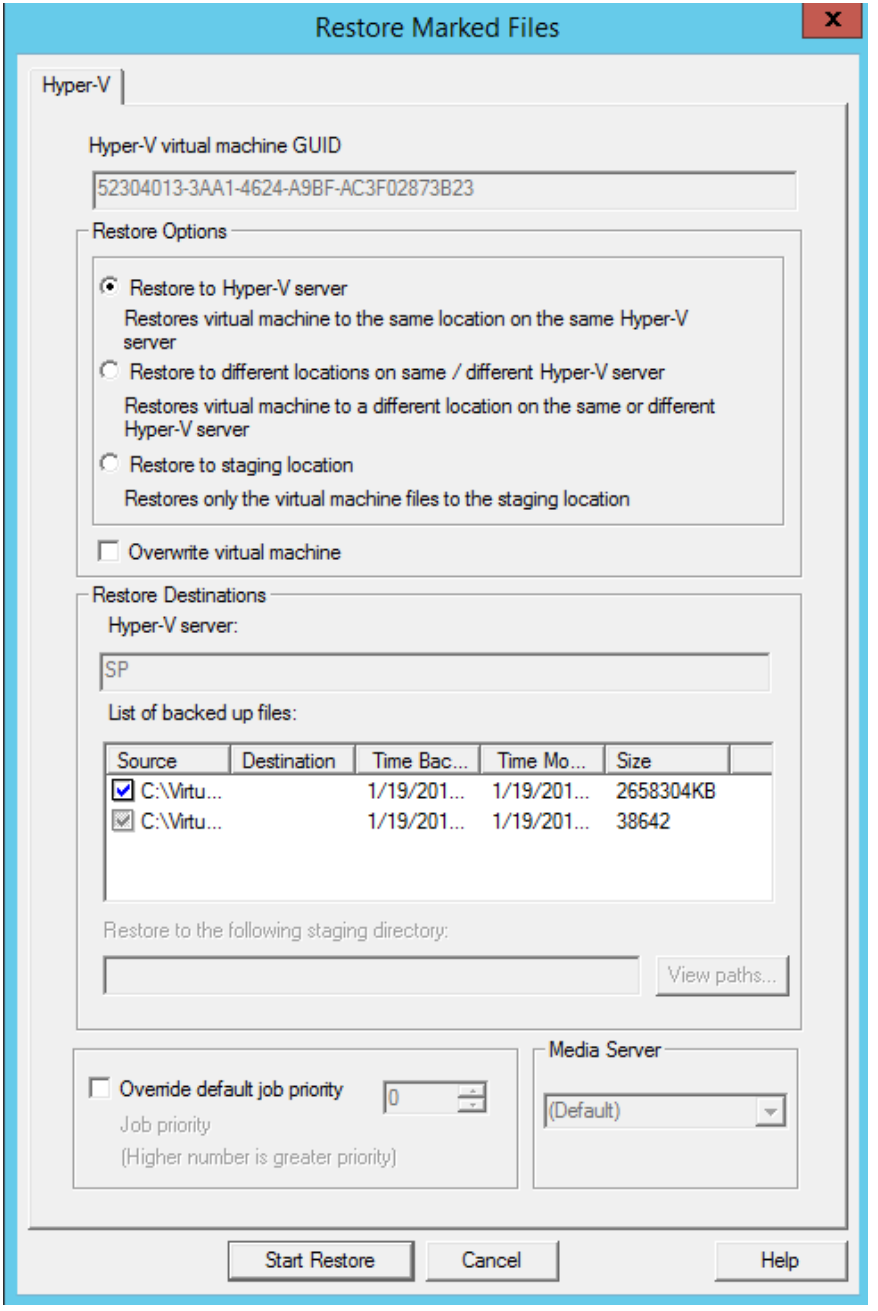

Restore Marked Files
Hyper-V
Hyper-V virtual machine GUID
52304013-3AA1-4624-A9BF-AC3F02873B23
Restore Options
Restore to Hyper-V server
Restores virtual machine to the same location on the same Hyper-V server
Restore to different locations on same / different Hyper-V server
Restores virtual machine to a different location on the same or different Hyper-V server
Restore to staging location
Restores only the virtual machine files to the staging location
Overwrite virtual machine
Restore Destinations
Hyper-V server:
SP
List of backed up files:
Source
Destination
Time Bac...
Time Mo...
Size
C:\Virtu...
1/19/201...
1/19/201...
2658304KB
C:\Virtu...
1/19/201...
1/19/201...
38642
Restore to the following staging directory:
View paths...
Override default job priority
0
Job priority
(Higher number is greater priority)
Media Server
(Default)
Start Restore
Cancel
Help

Table 7-2 Options on the **Restore Marked Files** dialog box

Option	Description
Hyper-V virtual machine GUID	Shows the Hyper-V GUID (globally unique identifier) of the virtual machine that was backed up. Use this value to verify that this backup represents the virtual machine that you want to restore. The GUID is a unique string for a virtual machine in addition to the host name.
Restore Options	See the following fields.
Restore to Hyper-V server	Restores the virtual machine to its original location on the original Hyper-V server.
Restore to different locations on same / different Hyper-V server	Restores the virtual machine to a different location on the original Hyper-V server, or restores it to a different Hyper-V server.
Restore to staging location	Restores the virtual machine files to the staging location on the server that you specify under **Hyper-V server** and **Restore everything to different directory**. Use this option if: ■ You do not want to restore an entire virtual machine ■ You do not want NetBackup to start the virtual machine after the restore For instance, you can use this option to add restored files as a vhd or vhdx volume to a virtual machine other than the one from which they were backed up.
Overwrite virtual machine (If you selected **Restore to staging location**, this option is **Overwrite existing files**)	If you selected **Restore to Hyper-V server** or **Restore to different locations on same / different Hyper-V server**, note the following: ■ If a virtual machine with the same GUID exists at the destination server, that virtual machine is removed with its configuration files and snapshot files. Any existing vhd or vhdx files for the virtual machine on the destination server are overwritten. The virtual machine that you selected to restore is restored from the backup. ■ If the **Overwrite virtual machine** option is not selected and a virtual machine with the same GUID exists on the destination server, the restore fails. ■ If the **Overwrite virtual machine** option is not selected and vhd or vhdx file(s) for the virtual machine still exist on the destination: The vhd or vhdx file(s) from the backup are not restored. See "Problems with restore of the full virtual machine" on page 129. If you selected **Restore to staging location**, note the following: ■ If the vhd or vhdx file already exists on the destination server in the specified restore location, that file on the destination server is overwritten. ■ If the **Overwrite existing files** option is not selected and any file you want to restore already exists in the restore location, the file is not overwritten. Any other files that are selected for restore are restored. The restore is reported as a partial success.
Restore Destinations	See the following fields.

Table 7-2 Options on the **Restore Marked Files** dialog box *(continued)*

Option	Description
Hyper-V server	If you selected **Restore to Hyper-V server** (to restore to the original location), note: the restore destination is the name of the Hyper-V server from which the virtual machine was backed up. In this case, the destination cannot be changed. For the other restore options (restore to a different location, or restore to a staging location), enter the destination Hyper-V server for the restore.
List of backed up files (Source)	Lists the Hyper-V virtual machine files as they existed when the virtual machine was backed up. By default, all listed files are selected for restore. If you do not want the restore to replace certain files on the current virtual machine on the destination server, uncheck those files. Leave a check mark next to the files that you want to restore. The files that are not checked are not restored. Note that the following virtual machine configuration files are not de-selectable in restores other than staging restores: xml, vsv, and bin files, and avhd or avhdx files. **Caution:** Replacing common files with earlier versions can be problematic for the virtual machines that rely on the common files. If you do not want to overwrite the common files on the Hyper-V server, uncheck the common files that you do not want to restore. See "About restoring common files" on page 104. Note the following about the listed files: ■ If you do not select any vhd or vhdx files, NetBackup tries to find them in their original location. If they are absent from the original location, the restore fails. If a parent vhd or vhdx file was in E:\myVhds\ on the original virtual machine and is not selected during restore, NetBackup looks for the parent file in E:\myVhds\ on the target virtual machine. If the file does not exist, the restore fails. ■ For **Restore to Hyper-V server** or **Restore to different locations on same / different Hyper-V server**, you can uncheck any vhd or vhdx files in this list. All other files are pre-checked and cannot be unchecked. ■ For **Restore to staging location**, you can uncheck any files in the list. ■ Configuration files (such as xml, bin, vsv, and snapshot files) are always restored when you restore the full virtual machine.
Restore everything to different directory	This field is disabled if you selected **Restore to Hyper-V server**. For restore to a different location or to a staging location: Enter the path on the server or other computer that you specified under **Hyper-V server** or **Staging machine name**. NetBackup creates the appropriate subdirectories.
View Paths	Displays the directories on the destination server in which the Hyper-V files are to be restored. You must specify a destination path in the **Restore everything to different directory** field.

Table 7-2 Options on the **Restore Marked Files** dialog box *(continued)*

Option	Description
Override default job priority	Determines the restore job's priority for restore resources. A higher priority means that NetBackup assigns the first available drive to the first restore job with the highest priority. Enter a number (maximum 99999). The default for all restore jobs is 0, the lowest priority possible. Any restore job with a priority greater than zero has priority over the default setting.
Media Server	You can use this option to select a media server that has access to the storage unit that contains the backup image. An example of such an environment is a Media Server Deduplication Pool (MSDP) with multiple media servers. **Note:** If the storage unit that contains the backup image is not shared with multiple media servers, this option is grayed out.

About restoring common files

You can save disk space by creating a Hyper-V virtual hard disk that contains the files that a number of virtual machines require. Instead of copies of the same vhd or vhdx file existing in several places, multiple virtual machines can share a single file. Two or more virtual machines (each called a child) can access that virtual disk. The parent vhd or vhdx file is called a common file, because more than one virtual machine uses it.

The files unique to each virtual machine are maintained on differencing virtual disks. These virtual disks are in a child relationship to the parent disk. The parent and child virtual disks may be on the same physical drive or on different physical drives.

For example, the base version of Windows XP can be installed as a read-only image on a virtual hard disk (parent). Two or more virtual machines can run the same XP system files from the base image on the parent virtual hard disk. Applications that are unique to a virtual machine are not included in the common files. Instead they are on the vhd or the vhdx files that are specific to the virtual machine.

Caution: Use care when restoring common files. If you restore an earlier version of the common files (overwriting the current version), the virtual machines that rely on those files may experience problems.

When restoring common files, note the following:

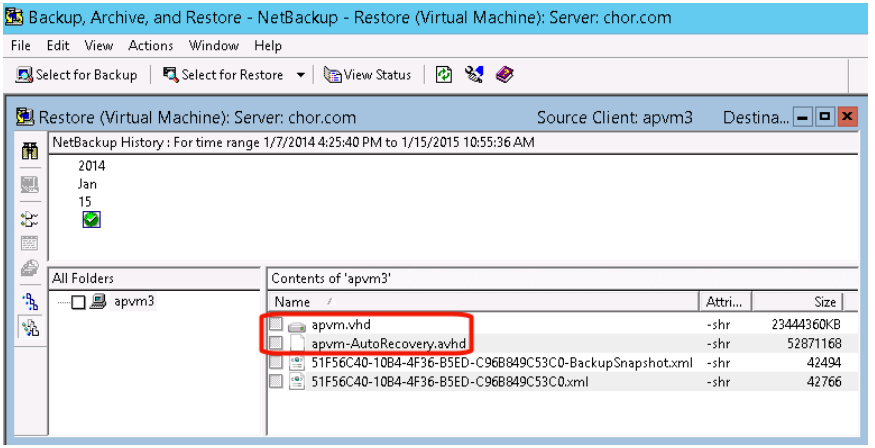
- Before you restore common files, make sure the virtual machines that use the common files are in the Off or Saved state. Otherwise, a virtual machine may have a lock on the common files and the restore fails.

- To keep the common files that are currently on the server, uncheck the common vhd files or vhdx files on the **Restore Marked Files** dialog box under **List of backed up files**. The restore does not replace the files on the destination Hyper-V server that are not selected in the **Restore Marked Files** dialog box.
- To overwrite the existing common files, check all the vhd files or vhdx files from the **List of backed up files**. However, if the common files are in use on the destination server, the restore fails. For the restore to succeed, the virtual machines that use the common files must be in the Off or Saved state.
- To restore common files without overwriting any common files that exist on the destination server: Specify a different location on the **Restore Marked Files** dialog box under **Restore everything to different directory**.

The BAR interface may list Hyper-V snapshot files when you browse to restore Hyper-V VM files

On Windows 2012 R2 Hyper-V servers, the NetBackup Backup, Archive, and Restore interface may list Hyper-V snapshot files when you browse to restore VM files.

For example:

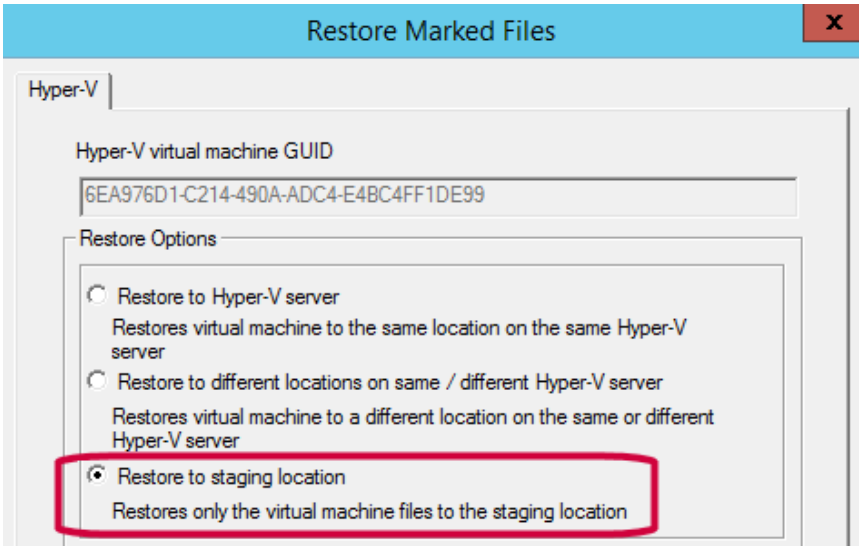


In this example, `apvm-AutoRecovery.avhd` is a Hyper-V snapshot file (`apvm.vhd` is the parent vhd file).

NetBackup automatically uses or ignores the snapshot data as appropriate when you restore the VM to its original location or to a different location.

However, in the following case you must decide whether to restore the Hyper-V snapshot file or to exclude it from the restore:

- In the BAR interface you select Restore from Virtual Machine Backup.
- And on the **Restore Marked Files** dialog, you select **Restore to staging location**.



In this case, use the following criteria (based on Hyper-V server version) to identify the snapshot file and to decide whether to restore it:

On a Windows 2012 R2 Hyper-V server

For VMs with a Windows 2003/2008 or Linux guest OS: The Hyper-V snapshot file is `ChildVhd.avhd` or `ChildVhd.avhdx`. The data in this snapshot is not application consistent. In most instances it is best not to restore this file.

Note: If you select **Restore to Hyper-V server** or **Restore to different locations on same / different Hyper-V server**, NetBackup automatically excludes the snapshot file.

Note: In the snapshot's parent file (apvm.vhd in the example) and in the other VM files, the data is complete. To restore the VM data, you should restore those files.

On a Windows 2012 R2 Hyper-V server with the 2012 R2 update of April 2014

For VMs with a Windows 2003/2008 or Linux guest OS: The Hyper-V snapshot file is named *vmname_guid*.avhd or *vmname_guid*.avhdx. The data in this snapshot is not application consistent. In most instances it is best not to restore this file.

Note: If you select **Restore to Hyper-V server** or **Restore to different locations on same / different Hyper-V server**, NetBackup automatically excludes the snapshot file.

Note: In the snapshot's parent file (apvm.vhd in the example) and in the other VM files, the data is complete. To restore the VM data, you should restore those files.

On a Windows 2012 R2 Hyper-V server with or without the 2012 R2 update of April 2014

For VMs with a Windows 2008 R2/2012/2012 R2 guest OS: The Hyper-V snapshot file is AutoRecovery.avhd or AutoRecovery.avhdx. The data in this snapshot is application consistent. To restore the VM data, you should restore this file along with the parent vhd(x) file.

Note: If you select **Restore to Hyper-V server** or **Restore to different locations on same / different Hyper-V server**, NetBackup automatically incorporates the snapshot data in the restore.

Chapter 8

Best practices and more information

This chapter includes the following topics:

Best practices

Symantec recommends the following for NetBackup for Hyper-V:

- For a more efficient backup, the NetBackup media server should be installed on the same host as the Hyper-V server. In an off-host configuration, install the NetBackup media server on the same host as the alternate client. In this configuration, the backup data can be sent to storage without traveling over the network.
- When creating virtual machines, use the same name for both host name and display name. If the NetBackup policy's **Primary VM identifier** option is changed, the existing entries on the policy **Clients** tab still work.
  See "Primary VM identifier option (Hyper-V)" on page 33.

More information is available on NetBackup and Hyper-V.

- For a list of supported Hyper-V servers, see the *Symantec NetBackup Enterprise Server and Server 7.7 - 7.7.x OS Software Compatibility List* available from the following location:
  NetBackup Master Compatibility List
- A wide variety of information is available at Microsoft TechNet.
  For example, refer to the Hyper-V Getting Started Guide:
  http://technet.microsoft.com/en-us/library/cc732470.aspx

Chapter 9

Troubleshooting

This chapter includes the following topics:

NetBackup logs and how to create them

For log messages about NetBackup for Hyper-V backup or restore, see the following NetBackup log folders.

Table 9-1 NetBackup logs that pertain to Hyper-V backup and restore

Log folder	Contains the messages on	Resides on
install_path\NetBackup\logs\bpbrm	Backup and restore	NetBackup master or media server
install_path\NetBackup\logs\bptm	Backup and restore	NetBackup media server
install_path\NetBackup\logs\bpcd	Snapshot creation, backup, and restore	NetBackup client on the Hyper-V server
install_path\NetBackup\logs\bpfis	Snapshot creation and backup	NetBackup client on the Hyper-V server
install_path\NetBackup\logs\bpbkar	Backup	NetBackup client on the Hyper-V server
install_path\NetBackup\logs\bprd	Restore	NetBackup master server
install_path\NetBackup\logs\tar	Restore	NetBackup client on the Hyper-V server
install_path\NetBackup\logs\bpVMreq	Restore	NetBackup master or media server, and NetBackup client on the Hyper-V server
install_path\NetBackup\logs\bpVMutil	Policy configuration and on restore	NetBackup client on the Hyper-V server
install_path\NetBackup\logs\nbproxy	Policy configuration	NetBackup master or media server
install_path\NetBackup\logs\vxms	File mapping during backup and VxMS APIs. This folder also contains the vhd log, which describes the format of the virtual machine's vhd files. NetBackup support can use the vhd log to reproduce a customer's virtual machine environment for troubleshooting purposes.	NetBackup client on the Hyper-V server

Table 9-1 NetBackup logs that pertain to Hyper-V backup and restore *(continued)*

Log folder	Contains the messages on	Resides on
\Program Files\Common Files\Symantec Shared\VxFI\4\logs\	Snapshot creation and VSS APIs.	NetBackup client on the Hyper-V server See "Enabling VxFI logging" on page 111.

Note: These log folders must already exist in order for logging to occur. If these folders do not exist, you must create them.

To create most of these log folders, run the following command on the NetBackup servers and on the Hyper-V server:

Windows:

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

UNIX (on master or media servers):

```
/opt/openv/netbackup/logs/mklogdir
```

For more detail on snapshot-related logs, logging levels, and the required folders, see the *NetBackup Snapshot Client Administrator's Guide*.

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

Enabling VxFI logging

By default, VxFI logging occurs at the error level. You can increase the logging verbosity by changing the log configuration file for the appropriate provider.

To increase the VxFI logging level

1. On the Windows desktop of the Hyper-V server where the NetBackup client is installed, go to the following location:

   \Program Files\Common Files\Symantec Shared\VxFI\4\ConfigFiles\

   This folder contains a configuration file for each provider, such as `vss.conf` and `emcclariionfi.conf`. These files are generated after a successful load of VxFI providers, usually during NetBackup policy validation.

2. Edit the `.conf` file for the appropriate provider, as follows:

   Change the TRACELEVEL entry to the following:

   ```
   "TRACELEVEL"=dword:00000006
   ```

   The default TRACELEVEL value is 00000001.

   Note that VSS and WMI provider logs are relevant to Hyper-V.

Configuring VxMS and vhd logging

The following procedure describes how to configure VxMS logging.

Except as noted in this topic, you can also use the Logging Assistant (in the NetBackup Administration Console) to configure VxMS logging. For details on the Logging Assistant, see the NetBackup Administrator's Guide, Volume I.

The following topic describes the format of VxMS log file names:

See "Format of the VxMS core.log and provider.log file names" on page 115.

Note: VxMS logging may require significant resources on the Hyper-V server.

To configure VxMS and vhd logging on the Hyper-V server

1 Create the VxMS log directory:

install_path\NetBackup\logs\vxms

Note: For logging to occur, the VxMS folder must exist.

Note: If you have run the NetBackup `mklogdir.bat` command, the VxMS log directory already exists.

See "NetBackup logs and how to create them" on page 110.

2 In the Windows registry, create the DWORD registry entry `VXMS_VERBOSE` in the following location:

HKEY_LOCAL_MACHINE > SOFTWARE > Veritas > NetBackup > CurrentVersion > Config

3 To configure the logging level, set the numeric value of `VXMS_VERBOSE` to 0 or greater. Larger numbers result in more verbose logs.

0	No logging.
1	Error logging.
2	Level 1 + warning messages.
3	Level 2 + informative messages.
4	Same as level 3.
5	Highly verbose (includes level 1) + auxiliary evidence files (`.mmf, .dump, VDDK logs, .xml, .rvpmem`). You can set the logging level for the VDDK messages.
6	VIX (VMware virtual machine metadata) dumps only.
7	VHD (Hyper-V virtual machine metadata) dumps only.
>7	Full verbose + level 5 + level 6 + level 7.

Note: Log levels higher than 5 cannot be set in the Logging Assistant.

Note: Log levels higher than 5 should be used in very unusual cases only. At that level, the log files and metadata dumps may place significant demands on disk space and host performance.

4 To change the log location:

- Open regedit and go to the following location:
  HKEY_LOCAL_MACHINE > SOFTWARE > Veritas > NetBackup > CurrentVersion
- Create the registry entry `vxmslogdir` with a string value `(REG_SZ)`. For the string value, specify the full path to an existing folder.

Note: You can use NTFS compression on VxMS log folders to compress the log size. The new logs are written in compressed form only.

Note: If the VxMS log location is changed, the Logging Assistant does not collect the logs.

Format of the VxMS core.log and provider.log file names

For the log files `core.log` and `provider.log` created by default during VxMS logging, the NetBackup administrator's user name is inserted into the log file name.

Table 9-2 describes the format of the log file names.

Table 9-2 Format of VxMS core.log and provider.log file names

Platform	VxMS log-file-name format

Windows	`VxMS-`*`thread_id-user_name`*`.`*`mmddyy_tag`*`.log`
	For example:
	`VxMS-7456-ALL_ADMINS.070214_core.log`
	`VxMS-7456-ALL_ADMINS.070214_provider.log`

UNIX, Linux	`VxMS-`*`thread_id-user_name`*`.log.`*`mmddyy_tag`*
	For example:
	`VxMS-27658-root.log.081314_core`
	`VxMS-27658-root.log.081314_provider`

See "Configuring VxMS and vhd logging" on page 112.

Errors during policy creation

The following errors may occur when you attempt to create a policy:

- `cannot connect on socket (25)`
- `Error Validating Hyper-V machine name`
  `Connect to Hyper-v server <name> failed (25)`

  In either case, the NetBackup client service is not running on the current owner (node) of the cluster. Start the NetBackup client service on the cluster node and create the policy again.

NetBackup policy validation failed

NetBackup policy validation may fail in the following cases:

- No host name entry for the virtual machine exists in the DNS server or in the Windows hosts file on the Hyper-V server:
  Windows\System32\drivers\etc\hosts

Create a virtual machine name entry in either the DNS server or in the hosts file of the Hyper-V server.

- A firewall is enabled and no port entry exists for the master server.
  Add a port entry for the NetBackup master server.
  See the *NetBackup Administrator's Guide*.

Increasing the client connect timeout value

You can use the **Browse for Virtual Machines** dialog box in the policy to search for virtual machines and add them to the policy. If the virtual machines are in a cluster and a cluster node is not accessible, note: A default timeout may prevent listing the virtual machines in the dialog box. Use the following procedure to resolve this problem by increasing the client connect timeout value.

To increase the client connect timeout value

1. Open the appropriate configuration file on the NetBackup master server, as follows:

   UNIX

   `/usr/openv/netbackup/bp.conf`

   Windows

   In regedit, go to the following:

   My computer > HKEY_LOCAL_MACHINE > SOFTWARE > Veritas > NetBackup > Current Version > Config

2. Set the `CLIENT_CONNECT_TIMEOUT` value to 30 seconds.

   Add the following:

   `CLIENT_CONNECT_TIMEOUT=30`

   where 30 designates 30 seconds.

   When this string is added to the configuration file, the clustered virtual machines should appear in the **Browse for Virtual Machines** dialog box, as follows:

   - Browsing continues for 30 seconds.
   - The Hyper-V cluster nodes are listed beneath the Hyper-V cluster name.
   - Downed cluster nodes are displayed as `unable to connect to client`.
   - All virtual machines are listed beneath the owner node, including migrated virtual machines.

NetBackup status codes related to Hyper-V

The following table describes the NetBackup status codes that are related to Hyper-V.

Table 9-3 NetBackup status codes related to Hyper-V

NetBackup status code	Explanation and recommended action
1, the requested operation was partially successful	The problem may be one of the following: ■ The problem may involve a virtual disk that is configured for Logical Disk Manager (LDM) volumes. See "LDM volumes and status code 1" on page 122. ■ A snapshot of the virtual machine (`*.avhd` or `*.avhdx` file) was created while the backup was in progress. See "Hyper-V snapshots (avhd or avhdx files) and status code 1" on page 123. ■ The virtual machine is configured with pass-through disks. NetBackup for Hyper-V does not back up pass-through disks. If all of the virtual machine's disks are pass-through, note: Only the configuration files (such as XML, bin, vsv) that represent the virtual machine are backed up. To back up pass-through disks, see the following: See "About Hyper-V pass-through disks with NetBackup" on page 136.
42, network read failed	The Windows shadow storage for the volume may have insufficient space to hold all required snapshots. A larger shadow storage area may be required. See " Viewing or resizing Windows NTFS shadow storage " on page 121.
48, client hostname could not be found	The problem may be one of the following: ■ The NetBackup master server cannot communicate with the virtual machine. ■ The host name of the virtual machine is not available. The NetBackup job details log contains the following message: `Error bpbrm(pid=8072) Nameuse [0], VM [<vm name>] not found on any node. Is either powered off or does not exist.` The virtual machine is either not running, or it is starting up. Make sure that the virtual machine is running and then rerun the backup.
156, snapshot error encountered	See "Snapshot error encountered (status code 156)" on page 118.

Table 9-3 NetBackup status codes related to Hyper-V *(continued)*

NetBackup status code	Explanation and recommended action
185, tar did not find all the files to be restored	If you attempt to do a full restore of two VMs at the same time, note: If the two VMs share a virtual hard disk that contains a file that both restore jobs must restore, a race condition may result. The two jobs may simultaneously attempt to access the same file, but only one job gains access to the file. The other job is denied access, and that job may fail with status code 185. After the first restore job successfully completes, retry the second job.
2817 Hyper-V policy restore error	The problem may be one of the following: ■ In a full virtual machine restore, the **Overwrite virtual machine** option was not selected: A virtual machine with the same GUID exists on the destination server. If a virtual machine with the same GUID exists on the destination server, you must select **Overwrite virtual machine**. ■ For individual file restore through a shared location on the destination virtual machine, one or more of the files is larger than 2 GB. Restore such files to a virtual machine that has a NetBackup client. (This issue does not apply to recovery of the full virtual machine.) ■ In a restore of common files, the virtual machines that use the common files were in the Running or Paused state. The virtual machines that use the common files must be in the Off or Saved state. Otherwise, a virtual machine may have a lock on the common files. ■ The virtual machine is highly available (HA). But the node that owns the virtual machine is not the restore server (the node that performs the restore). See "Problems with restore of the full virtual machine" on page 129. ■ The virtual machine restore job fails but the virtual machine is nonetheless registered in the Hyper-V server. See "Problems with restore of the full virtual machine" on page 129. ■ A redirected restore failed because the virtual machine had `*.avhd` or `*.avhdx` file(s) when it was backed up. The restore system is earlier than Windows Server 2008 R2. The tar log contains the following: `Redirected restore of VM having [.avhd] files is not supported on this platform. It is supported on [Windows server 2008 R2] onwards.` ■ A redirected restore failed because the virtual machine is configured in a volume GUID and its differencing disk is configured in another volume GUID. See "Restored virtual machine fails to start" on page 126.

Snapshot error encountered (status code 156)

The following table describes the Hyper-V issues that relate to NetBackup status code 156.

Table 9-4 Possible causes of status code 156

Causes of status code 156	Description and recommended action
The virtual machine name is incorrectly specified in the NetBackup policy.	A mismatch may exist between the virtual machine names that are specified on the policy **Clients** tab and the actual names on the Hyper-V server. Check the actual names as listed in the Hyper-V Manager on the Hyper-V server. The following are the recommended actions: ■ In the NetBackup policy, the virtual machines must be specified as fully qualified names. ■ In the NetBackup policy, the virtual machine name may have been entered incorrectly. If you browsed for the virtual machines on the **Clients** tab and selected names from the list, the list may be out of date. (The list is derived from a cache file.) Refresh the list by clicking on the icon next to the **Last Update** field.
Volumes on the virtual machine are almost full.	Volumes on the virtual machine do not have enough free space for the snapshot. Microsoft recommends that at least 10% of the virtual machine volume is available for the snapshot. Recommended action: create more space on the volume.
The Hyper-V integration component is absent.	The Hyper-V integration component is not properly installed in the virtual machine. Recommended action: See "The Hyper-V integration component is not installed" on page 122.

Table 9-4 Possible causes of status code 156 *(continued)*

Causes of status code 156	Description and recommended action
The VSS framework in the virtual machine does not work properly	The following application error event may be written to the virtual machine during backup: `Event Type: Error` `Event Source: VSS` `Event Category: None` `Event ID: 12302` `Date: 1/8/2009` `Time: 1:36:21 AM` `User: N/A` `Computer: ARTICTALEVM8` `Description:` `Volume Shadow Copy Service error: An internal inconsistency was detected in trying to contact shadow copy service writers. Please check to see that the Event Service and Volume Shadow Copy Service are operating properly. For more information, see Help and Support Center at http://go.microsoft.com/fwlink/events.asp.`  Recommended action: Run the `vssadmin list writer` command. If no writer is listed in the output and a similar error is logged, refer to the following to resolve this issue: http://support.microsoft.com/kb/940184
A CSV timeout occurred	The bpfis log contains the following: `VssNode::prepareCsvsForBackup: CSV TimeOut expired, Not all required CSV available in required state.` One or more or the required cluster shared volumes (CSV) cannot be prepared in the specified timeout period. A current backup that started from another node needs one or more of the same CSVs. Increase the **Cluster shared volumes timeout** period and rerun backup, or try the backup at another time. See "Cluster shared volumes timeout (Hyper-V)" on page 34.

Table 9-4 Possible causes of status code 156 *(continued)*

Causes of status code 156	Description and recommended action
A local disk has been added to a VM that is on CSV	For a successful backup of a virtual machine on a CSV, the virtual machine must use CSV volumes only. If a local disk on the Hyper-V server (not a CSV volume) is added to the virtual machine, the backup fails. Reconfigure the virtual machine to use CSV volumes only, and rerun the backup.
The **Enable offline backup for non-VSS VMs** option is disabled	The bpfis log contains the following: `VssNode::prepare Backup type of VM [<VM GUID>] will be OFFLINE and configuration parameter allowOfflineBackup] is not set. To backup this VM, set [allowOfflineBackup] configuration parameter.` NetBackup is not allowed to perform an offline backup of the virtual machine, because the **Enable offline backup for non-VSS VMs** option is disabled. Enable the **Enable offline backup for non-VSS VMs** option. See "Enable offline backup for non-VSS VMs (Hyper-V)" on page 34.

Backup job hangs for multiple virtual machines

If the policy specifies multiple virtual machines, and the storage unit "Maximum concurrent jobs" option is set to 2 or more, the backup may hang. If you have Symantec Endpoint Protection on your Hyper-V server, make sure that it is at version 11.0 Maintenance Release 4 (build 11.0.4000) or later. Backups of multiple virtual machines with multiple concurrent jobs may experience this backup problem with earlier versions of Symantec Endpoint Protection.

Viewing or resizing Windows NTFS shadow storage

For the backups that are made with the **System** Provider Type (for a block-level copy-on-write snapshot), note: Windows shadow storage for a volume on a Hyper-V host must have enough space to hold all required snapshots. If too little space is available, the backup fails with status code 42, "network read failed." In that case, a larger shadow storage area is required. Refer to Microsoft documentation for recommendations on shadow storage size. For example, refer to the following:

http://technet.microsoft.com/en-us/library/cc728305.aspx

If additional space is not available for shadow storage, reschedule backups so they do not occur at the same time.

To view or resize Windows NTFS shadow storage

1. To list the current shadow storage settings, run the following on the virtual machine:

   ```
   vssadmin list shadowstorage
   ```

2. To resize shadow storage, run the following:

   ```
   vssadmin resize shadowstorage
   ```

   Refer to your Microsoft Windows documentation for more details.

The Hyper-V integration component is not installed

Make sure the proper version of the Hyper-V virtual machine integration component is installed on the virtual machine. Otherwise, the backup fails with status code 156.

For details on the proper versions, see "Hyper-V online backups require proper version of Hyper-V integration services in the VM" in the following Symantec document:

http://www.symantec.com/docs/TECH127089

LDM volumes and status code 1

If a virtual disk has been configured for Logical Disk Manager (LDM) volumes, and the NetBackup policy specifies the **Enable file recovery from VM backup** option, note: in certain cases a backup of the virtual machine may not complete. The NetBackup job may issue status 1, "the requested operation was partially successful." This error can occur if the controller type of the .vhd disk was SCSI when the disk was formatted but the controller type was later changed to IDE (or vice versa).

In this case, the NetBackup progress log may contain the following message:

```
ERR - Unable to retrieve volumes from virtual machine, error = 1
```

You must restore the controller type of the .vhd disk to the controller type originally assigned before the LDM volume was created. Then retry the backup.

Hyper-V snapshots (avhd or avhdx files) and status code 1

If a snapshot of the virtual machine (avhd or avhdx file) is created while a NetBackup backup of the virtual machine is in progress, the backup may be only partially successful. A message similar to the following appears in the bpbkar log:

```
5:02:54Hyper-V snapshot.570 PM: [10948.8980] <2> tar_base::V_vTarMsgW: INF - VxMS
Error message 1 = translate_to_virtual_extent: ERROR Unable to locate MAP file = \\?\
GLOBALROOT\Device\HarddiskVolumeShadowCopy89\VM1\testvm2.veritas.com\TestVM1_diffVM1k
_8275A265-BD90-4E61-94C8-C347B7228E95.avhd
```

Retry the backup.

Note that NetBackup does not create Hyper-V avhd or avhdx files. NetBackup creates its own snapshots when it backs up virtual machines.

Unable to log in to the NetBackup Administration Console

For a policy that automatically selects VMs in a Hyper-V cluster, the NetBackup master server should not reside on any Hyper-V nodes in the cluster. If the master server resides on one of the nodes, you cannot log in to the NetBackup Administration Console.

Use a master server that is not installed on a Hyper-V cluster node.

When backing up the virtual machines that reside on the same CSV, Windows warning 1584 can be ignored

In a simultaneous backup of virtual machines that reside on the same Cluster Shared Volume (CSV), the following Windows warning event (1584) may be issued:

```
A backup application initiated a VSS snapshot on Cluster Shared
Volume Volume1 (Cluster Disk 8) without properly preparing the volume for
snapshot. This snapshot may be invalid and the backup may not be usable for
restore operations. Please contact your backup application vendor to verify
compatibility with Cluster Shared Volumes.
```

For this case, Microsoft has acknowledged that message 1584 is a false alarm. For NetBackup backups of the virtual machines that reside on the same CSV, this warning can be safely ignored.

Problems with alternate client backup

Note the following potential problems:

- If the snapshot job fails, check the detailed error messages in the bpfis logs on the primary client and alternate client.
- If the bpfis log shows VSS errors, check the VxFI VSS provider logs for details: \Program Files\Common Files\Symantec Shared\VxFI\4\logs\

  Note the following strings in the VxFI VSS provider logs:

  - VSS_E_PROVIDER_VETO
  - VSS_E_NO_SNAPSHOTS_IMPORTED
    This string indicates that the snapshot resources are not available. Check the Windows event logs and the VSS hardware provider logs.
    The snapshot device that the VSS hardware provider creates is not visible to the primary client or alternate client. Check the Windows event logs and the VSS hardware provider logs. Use the `vshadow` command to rule out any configuration issues.
    See "Verifying support for transportable snapshots by using the `vshadow` command" on page 124.

Verifying support for transportable snapshots by using the `vshadow` command

The `vshadow` command is a VSS test tool supplied with the Windows VSS SDK. The following procedure describes how to verify support for transportable snapshots.

Note: To use the following procedure, only vshadow.exe needs to be copied to the host. You do not have to install the VSS SDK.

To verify support for transportable snapshots

1. On the primary host, create a snapshot with the transportable option.

   Snapshot information is maintained as part of a Backup Components Document (.xml file).

   For example: If the virtual machine to be backed up resides on volumes M:\ and N:\, do the following:

   Use the `vshadow` command to create a hardware snapshot (plex) for M:\ and for N:\ with the Hyper-V writer:

   ```
   vshadow -p -ap -t=c:\bcd1.xml M:\ N:\
   ```

   This command creates a bcd.xml file in the location that the -t option specifies.

   The following is example output:

```
...

Select explicitly included components ...
 * Writer 'Microsoft Hyper-V VSS Writer':
   - Add component \276E8343-33A9-4122-88EA-51646ACB7F50
Creating shadow set {c63b0a96-5952-4f48-a6d7-33162f1def74} ...
- Adding volume \\?\Volume{1c5150b9-0249-11de-b47c-001aa03ba298}\ [M:\] to the
shadow set...
- Adding volume \\?\Volume{1c5150b3-0249-11de-b47c-001aa03ba298}\ [N:\] to the
shadow set...
...

Shadow copy set successfully created.
```

   The important lines in the output are shown in italics, for emphasis:

   The `* Writer` line should include `Microsoft Hyper-V VSS Writer`.

   The `Add component` line should show the virtual machine GUID.

   More information is available about the `vshadow` command:

   http://msdn.microsoft.com/en-us/library/bb530725%28VS.85%29.aspx

2. Copy the generated bcd.xml file from the primary to the alternate client.

3 Import the snapshot to the alternate client.

For example:

```
vshadow -I=c:\bcd1.xml
```

where `c:\bcd1.xml` specifies the location of the bcd.xml file on the alternate client.

If these `vshadow` commands run successfully on the primary client and alternate client, the VSS snapshot provider supports transportable snapshots with the Hyper-V writer.

Restored virtual machine fails to start

The following issues may prevent a restored virtual machine from starting:

- If you restore a virtual machine to a different Hyper-V server, and the original Hyper-V server and the target server do not have the same number of network adapters (NICs), note: You must configure the network adapter(s) for the restored virtual machine on the target server. Otherwise, the attempt to start the restored virtual machine fails and a message similar to the following appears:

  ```
  Microsoft Synthetic Ethernet Port (Instance ID {C549AG45-5925-49C0-
  ADD2-218E70A4A1EA}): Failed to power on with Error 'The system
  cannot find the path specified.' (0x80070003). (Virtual machine
  5412BD43-DC85-31CB-A688-1B29CE2C57C8)
  ```

- The restored virtual machine may fail to start if all of the following are true:
  - The virtual machine resided on a Hyper-V Server 2008 when the virtual machine was backed up.
  - At the time of backup, the virtual machine was not in the Off state.
  - The virtual machine is restored to a Hyper-V Server 2008 R2.

  A Hyper-V message states

  ```
  An error occurred while attempting to start the selected virtual
  machine(s). <virtual machine name> could not initialize.
  Saved state file version is incompatible.
  ```

  In this case, you must delete the virtual machine's saved state file after the restore and then start the virtual machine. In the Hyper-V Manager interface, right-click on the restored virtual machine and select “Delete Saved State.”
- After a redirected restore of the virtual machine on Windows 2008 SP2 and Windows 2008 R2, the virtual machine unexpectedly enters the Saved state. It

also fails to start. If the virtual machine was backed up in the Online state, the expected state after restore is Off. But due to a Hyper-V error, the virtual machine incorrectly enters the Saved state.

During the restore, the Hyper-V-VMMS writes the event ID 12340. The following is a sample message:

```
'Saved State' cannot read key '/configuration/_ba8735ef-e3a9-
4f1b-badd-dbf3a5909915_/VideoMonitor/State' from the repository.
Error: %%2147778581'(7864368). (Virtual machine ID
0AD7DFCC-BDC0-4218-B6DF-7A3BC0A734BF)
```

In the Hyper-V Manager, you must delete the virtual machine's saved state after the restore and then start the virtual machine.

- For the virtual machines that are configured in a volume GUID with a differencing disk in another volume GUID, redirected restores are not supported. Note that redirected restores are supported if the virtual machine's vhd or vhdx file is configured in a drive-letter volume rather than a volume GUID.

  A virtual machine restore to an alternate location may fail in the following case:

  - The virtual machine's vhd or vhdx file is in a GUID-based volume, and
  - A differencing disk for the same vhd or vhdx is in another GUID-based volume.

  In this case, the attempt to restore the virtual machine to an alternate location fails. The cause of the failure is in the Microsoft Hyper-V Writer. The vhd or vhdx files and other configuration files are restored to the correct location, but registration of the virtual machine fails. As a result, Hyper-V is unable to start the restored virtual machine. A Hyper-V writer event log similar to the following may appear:

  ```
  Failed to update the path of the parent disk for virtual
  hard disk 'E:\restore123\Volume{D2CC1448-BCFD-11CE-96DD-
  001EC9EEF3B2}\test1\diff.vhd' for virtual machine 'test':
  The system cannot find the path specified. (0x80070003).
  The disk may not work properly. If you cannot start your virtual
  machine, remove the disk and try again.(Virtual machine ID <id>)
  ```

  After the restore, you must configure a new virtual machine and attach the restored vhd or vhdx files to the new virtual machine. The restored .xml file contains information on the original configuration of the virtual machine.

- When a virtual machine is restored to a different Hyper-V server: The location of a virtual CD or DVD drive may prevent the virtual machine from restarting.

  The problem occurs in the following case:

- The original virtual machine had a CD ISO image that is attached to a virtual CD or DVD drive.
- On the Hyper-V server where the virtual machine was restored: The ISO image is not on the same path as on the original Hyper-V host during backup. For example: The virtual machine originally had E:\cd1.iso attached to its virtual DVD drive. But E:\cd1.iso does not exist on the target Hyper-V host, or it exists at a different location, such as F:\cd1.iso. In either case, the restored virtual machine does not turn on.

To solve the attached CD/DVD problem

1. In the Hyper-V Manager, click on the restored virtual machine.
2. Click **Settings**.
3. Under the appropriate IDE Controller, click **DVD drive**.
4. In the **Media** pane, specify the correct location of the CD, or select None.

Problem with a restart of a restored virtual machine: Why did the computer shut down unexpectedly?

An unexpected shutdown message is displayed when a restored Windows virtual machine is started.

When you start a restored virtual machine, the system may display the message "Why did the computer shut down unexpectedly?" It may prompt you to enter a problem ID. This message and prompt occur if the virtual machine was in the Running state when the backup was initiated.

When a Windows system starts up, a bit is set indicating that the system did not shut down gracefully. If the system is shut down gracefully, the bit is cleared. However, when an online backup of a running virtual machine is performed, the unexpected shutdown bit remains set in the backed-up image. When the restored virtual machine is started, the bit is detected and the unexpected shutdown message is displayed.

Problems with restore of individual files

When you restore individual files (not the entire virtual machine), the restore may fail in certain cases. The following table describes the problems and recommended actions for the restore of individual files.

Table 9-5 Problems with restore of individual files

Cause of the problem	Description and recommended action

Files are selected from multiple drives (volumes) on the virtual machine.	For example: The original virtual machine had two drives (C:\ and D:\), and files from each drive are selected in the same restore operation. Messages similar to the following appear in the job progress log:
	
	`13:26:05 (86.001) (86.001) INF - Skipping to next file header...`
	`13:26:05 (86.001) (86.001) INF - TAR EXITING WITH STATUS = 0`
	`13:26:05 (86.001) (86.001) INF - TAR RESTORED 11368 OF 11463 FILES SUCCESSFULLY`
	`13:26:05 (86.001) (86.001) INF - TAR KEPT 0 EXISTING FILES`
	`13:26:05 (86.001) (86.001) INF - TAR PARTIALLY RESTORED 0 FILES`
	
	`13:26:15 (86.001) Status of restore from image created 7/21/2008 2:55:05 PM = the requested operation was partially successful`
	
	Select files from a single drive at a time. Selecting files from multiple drives is not supported.

You have attempted to restore the files into a mapped drive on the virtual machine. The restore fails with NetBackup status code 185.	Restore the files by means of a shared location on the virtual machine (with a UNC path) rather than by means of a mapped drive. See "Restoring individual files to a shared location on the virtual machine" on page 97.
The snapshot contains invalid inodes.	Windows Hyper-V provides no mechanism for quiescing file system activity on Linux virtual machines. As a result, invalid inodes may be present in the snapshot. A backup that was made with the **Enable file recovery from VM backup** option may have file-mapping failures if the virtual machine experiences heavy I/O. The failures are reported in the **NetBackup Administration Console** in this form: `ERR - Unable to read metadata for index: 379023, VFM error = 6.` Note that the backup succeeds, but any files with metadata errors cannot be restored individually. For the backups that enable individual restore of all files, schedule the backup when the I/O activity is lower. If metadata errors persist, shut down the virtual machine during the backup.

Problems with restore of the full virtual machine

Restores of a full virtual machine may fail in the following cases:

- The **Overwrite virtual machine** option was not selected and vhd or vhdx file(s) for the virtual machine still exist on the destination. In that case, the vhd or vhdx file(s) from the backup are not restored. You must select **Overwrite virtual machine** for the restore, or remove the current virtual machine and vhd or vhdx files from the destination server before you start the restore. If you remove the virtual machine but leave one or more vhd or vhdx files at the destination, the vhd or vhdx files from the backup are not restored.
- The virtual machine restore job fails but the virtual machine is nonetheless registered in the Hyper-V server. The Hyper-V-VMMS writes the following warnings in the events log:
  Event ID: 10127, sample event log message:

```
Unable to repair the network configuration for virtual machine'Virtual Machine
Display Name'. The virtual machine may not have the same network connectivity as
it did when the backup was taken. Inspect the network settings and modify them
as necessary. (Virtual machine ID 0AD8DFCC-BDC0-4818-B6DF-7A1BA0A735BF)
```

  Event ID: 10104, sample event log message:

```
One or more errors occurred while restoring the virtual machine from backup.
The virtual machine might not have registered or it might not start. (Virtual
machine ID "0AD8DFCC-BDC0-4718-B6DF-7A3BA2A735BF ")
```

  The Hyper-V writer encountered a Network configuration error. The restored virtual machine can be started after you change the Network Adaptor configuration in the virtual machine settings.
- The virtual machine is highly available (HA), but the node that owns the virtual machine is not the restore server. (It is not the node that performs the restore.) The tar log contains a message similar to the following:

```
VssNode::doRestore: Current owner of VM .[<VM name> {<VM guid>}] is
[<current owner>] not this [<restore server>], To perform this restore either move
VM to this host [<restore server>] or Delete VM from Cluster, or perform redirected
restore at current owner.
```

  Note the following explanations:

  - For a restore to the original location: When the backup took place, the virtual machine was not HA, but now the virtual machine is HA. However, the node that owns the virtual machine is not the node from which the virtual machine was backed up.
  - For a redirected restore: The virtual machine is HA but the node that owns the virtual machine is not the restore server (the node that performs the restore).

See the recommended actions in the tar log message.

- A redirected restore of a volume-GUID-based virtual machine fails if the virtual machine was backed up from a previous redirected restore.
  Note: In a redirected restore, the virtual machine is restored to a different location on the original Hyper-V server or to a different Hyper-V server. It is not restored to its original location on the original server.
  A virtual machine may be configured on a Windows volume GUID. The following is an example of a Windows volume GUID:

  ```
  \\?\Volume{1a2b74b1-1b2a-11df-8c23-0023acfc9192}\
  ```

  If you perform a redirected restore of a volume-GUID-based virtual machine and you back up the restored virtual machine, note: An attempt to do a redirected restore from the backup may fail. For example, consider a virtual machine that is configured on the following volume GUID:

  ```
  \\?\Volume{1a2b74b1-1b2a-11df-8c23-0023acfc9192}\
  ```

  The virtual machine is then restored to a different volume GUID, such as:

  ```
  \\?\Volume{2a3b70a1-3b1a-11df-8c23-0023acfc9192}\
  ```

  If the restored virtual machine is backed up and you do a redirected restore from the backup, the restore may fail.
  To avoid this problem in a redirected restore, restore the virtual machine to a subdirectory of the volume GUID, such as to the following:

  ```
  \\?\Volume{1a3b70a1-3b1a-11df-8c23-0023acfc9192}\REDIR_subdirectory\
  ```

- NetBackup cannot perform a redirected restore of a virtual machine to a Hyper-V 2008 R2 server if the virtual machine contains a compressed vhd or vhdx file.
  The NetBackup job Detailed Status tab contains a message similar to the following:

```
12/11/2009 17:35:58 - started process bpdm (pid=2912)
...
the restore failed to recover the requested files  (5)
12/11/2009 17:47:06 - Error bpbrm (pid=1348) client restore EXIT STATUS 185: tar
did not find all the files to be restored
```

A message similar to the following appears in the eventvwr.msc file:

```
Failed to update the configuration with the new location of virtual hard disk
'F:\REDIR_VM\f\ADD_VHD\IDE_1_DISK.vhd' for virtual machine
```

```
'<virtual_machine_name>': The requested operation could not be
completed due to a virtual disk system limitation.  Virtual disks are only
supported on NTFS volumes and must be both uncompressed and unencrypted.
(0xC03A001A). Remove the disk from the virtual machine and then attach the disk
from the new location. (Virtual machine ID <virtual_machine_ID.)
```

This issue is due to a Microsoft limitation. See the following Microsoft link for more information:
http://technet.microsoft.com/en-us/library/dd440865.aspx

Linux VMs and persistent device naming

For Linux VMs without persistent device naming, multiple disk controllers (such as IDE, SCSI, and SATA) may complicate the recovery of individual files. This issue occurs because non-persistent device naming, such as `/dev/sda` and `/dev/sdb`, may cause unexpected mount point changes after a restart. If the VM has a SCSI disk and SATA disk, the Backup, Archive, and Restore interface may show incorrect mount points for the VM's files. For example, the files originally under `/vol_a` might appear under `/vol_b` when you browse to restore them. The restore is successful, but the restored files may not be in their original directories.

As a workaround, search for the files on the restored VM and move them to the proper locations.

To prevent this issue on Linux VMs with multiple disk controllers, Symantec recommends a persistent device-naming method for mounting the file systems. When persistent naming is in place, device mounting is consistent and this issue does not occur when you restore files from future backups.

For persistent device naming, you can mount devices by UUIDs. The following is an example of the `/etc/fstab` file that contains the devices that are mounted by UUIDs:

```
UUID=93a21fe4-4c55-4e5a-8124-1e2e1460fece /boot  ext4  defaults  1 2
UUID=55a24fe3-4c55-4e6a-8124-1e2e1460fadf /vola  ext3  defaults  0 0
```

To find the device UUIDs, you can use either of the following commands:

```
blkid
```

```
ls -l /dev/disk/by-uuid/
```

Note: NetBackup also supports the by-LABEL method for persistent device naming.

Appendix A

Hyper-V online and offline backups

This appendix includes the following topics:

About Hyper-V online and offline backups

A Hyper-V virtual machine can be in any of the following states: Running, Saved, Paused, or Off.

In addition, Microsoft provides the following two types of Hyper-V virtual machine backups:

Online	Specifies that a virtual machine that is in the Running state is briefly quiesced for the backup. User access during the backup continues without interruption.
Offline	Specifies that a virtual machine that is in the Running or Paused state is rendered temporarily inactive. It is returned to its original state before the backup completes. User access during the backup is interrupted.

Note: Type of backup (online or offline) is a Microsoft designation and is not configured in NetBackup.

The following table shows the possible combinations of virtual machine state and the type of backup.

Table A-1 State of virtual machine before and after restore

State at the time of backup	Type of backup	State after restore
Running	Online	Off
Running	Offline	Saved
Saved	Offline	Saved
Paused	Offline	Saved
Off	Offline	Off

Conditions that determine online vs. offline backup

A Hyper-V online backup can be performed with no downtime on a running virtual machine when all of the following conditions are met:

- The Hyper-V integration services are installed and the VSS integration service is enabled.
- All virtual machine disks are configured within the guest operating system as NTFS-formatted basic disks. If the virtual machine uses dynamic disks or the FAT or FAT32 file system, an online backup cannot be performed.
  Note that "dynamic" disks are not a type of virtual hard disk (vhd or vhdx format). Dynamic disks and basic disks are disk types defined by Microsoft for certain Windows operating systems.
- Each virtual machine volume must specify itself as the storage location for its shadow copies. For example, the shadow copy storage for C:\ must be configured on the C:\ volume. The shadow copy storage for D:\ must be on D:\, and so forth.

If these conditions are not met, the backup is performed offline. An offline backup results in some downtime on the virtual machine. If the virtual machine is in the Running or Paused state, it is put in a Saved state as part of the offline backup. After the backup is completed, the virtual machine is returned to its original state.

Additional notes on offline backups

When an offline backup is performed on a virtual machine that is currently in the Running state, note: the virtual machine briefly enters the Saved state during the backup and then returns to its original state.

For a virtual machine in the Running state at the start of the backup, the type of backup is offline in the following circumstances:

- The VSS integration component of Hyper-V is not running in the virtual machine.
  The VSS integration component is part of the Hyper-V integration services that are installed in the virtual machine.
- The virtual machine is running an operating system that does not support Windows Volume Shadow Copy Service (VSS).
- The storage configuration of the virtual machine is not compliant.
  Any of the following can result in a non-compliant storage configuration:
  - The virtual machine has one or more disks that are configured as dynamic disks in the operating system. Note that dynamic disks are not a type of virtual hard disk. Dynamic disks and basic disks are disk types defined by Microsoft for certain Windows operating systems.
  - The virtual machine has the volumes that do not support Volume Shadow Copy Service (VSS).
    If the virtual machine has a non-NTFS formatted volume (such as FAT or FAT32), the virtual machine enters the Saved state during the backup.

Appendix B

Hyper-V pass-through disks

This appendix includes the following topics:

About Hyper-V pass-through disks with NetBackup

This topic describes how to use NetBackup to back up Hyper-V pass-through disks. Hyper-V pass-through configuration allows a virtual machine to directly access physical disks. With pass-through access, a virtual machine can use large storage devices such as disk arrays. Access to a pass-through disk is faster than to a fully virtualized disk (vhd or vhdx file). A pass-through disk can be locally attached to the Hyper-V server or configured on a Fibre Channel SAN.

For assistance in setting up pass-through devices, refer to your Microsoft documentation.

The devices that NetBackup supports for pass-through are the same as for a physical (non-hypervisor) environment: the device vendor however must support the device in a virtual environment.

Note: The NetBackup for Hyper-V feature and Hyper-V snapshot method (as described in other chapters of this guide) do not back up pass-through disks.

Configurations for backing up pass-through disks

You can use either of the following NetBackup configurations to back up Hyper-V pass-through disks:

- Without Snapshot Client.
  Install a NetBackup client on the virtual machine. You can configure NetBackup to back up virtual machine data as if the client was installed on a physical host. Note that without Snapshot Client software on the virtual machine, the features of Snapshot Client are not available.
- With Snapshot Client (explained in this appendix).
  Install a NetBackup client on the virtual machine, as well as a license for Snapshot Client. Configure either a local snapshot backup or an alternate client backup.
  To use a VSS hardware provider for the disk array, the off-host alternate client method is required.

Requirements for backing up Hyper-V pass-through disks

Note the following requirements:

- Consult your Microsoft documentation for pass-through configuration requirements.
- Consult your VSS provider documentation for snapshot preconfiguration requirements. For example, the disk array clones or mirrors must be synchronized with the disk array source device before the backup is started.
- 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*.
- For backups using a VSS provider type of Hardware, pass-through disks should be added as SCSI disks.
- NetBackup client software must be installed on the virtual machine.
- To use Snapshot Client for local snapshot or alternate client backup, Snapshot Client must be licensed on the virtual machine.

- For alternate client backup, 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*.

Note: The requirements for the NetBackup for Hyper-V feature do not apply to backups of the disk arrays that are configured as pass-through disks. The NetBackup for Hyper-V feature (using the Hyper-V snapshot method as described in other parts of this guide) does not back up pass-through disks.

Restrictions for Hyper-V pass-through disks

Note the following:

- For pass-through disks, Instant Recovery point-in-time rollback is not supported for the backups that were made with a VSS hardware provider.
  Note that point-in-time rollback is supported with a VSS provider type of System. You can use VSS Provider Type of System for a local snapshot backup, but not for alternate client backup. Note also that copy back restore from an Instant Recovery backup is supported with both provider types of System and Hardware.
- A pass-through disk must not be assigned by means of an IDE controller. If an IDE controller is used to assign a pass-through disk, NetBackup cannot create a snapshot of the disk using a hardware provider type.

Configuring a local snapshot backup of Hyper-V pass-through disks

To create a policy for local snapshot backup of a pass-through disk

1. Start the **NetBackup Administration Console**.
2. Click on **Policies** and create a new policy.
3. On the policy **Attributes** tab, select the **MS-Windows** policy type or **FlashBackup-Windows** policy type.
4. Click **Perform snapshot backups**.
5. Optional: click **Retain snapshots for instant Recovery**.
6. Click **Options**.

7 Select the **VSS** snapshot method.

The **Hyper-V** method does not apply.

The array may require additional OS and NetBackup configuration as described in the disk arrays topic of the *NetBackup Snapshot Client Administrator's Guide*.

8 Specify snapshot options for VSS.

Select the following:

- **Provider Type**: You can select **1-system** or **2-software**. **3-hardware** is not supported for local backup.
  See "Provider Type configuration parameter" on page 35.
  See "Restrictions for Hyper-V pass-through disks" on page 138.
- **Snapshot Attribute**: The selection depends on your VSS hardware provider. Supported snapshot methods and hardware types are described in the following document:
  NetBackup 7 Snapshot Client Compatibility
- **Maximum snapshots (Instant Recovery only)**: This option sets the maximum number of Instant Recovery snapshots to be retained at one time.
  For more information on this option, refer to the topic on the Maximum Snapshots parameter in the *NetBackup Snapshot Client Administrator's* guide.

9 In the policy **Clients** tab, select the virtual machine that has a pass-through disk configured.

10 In the policy's **Backup Selections** tab, specify the pass-through disk that you want to back up. Or specify the files or volumes that reside on the pass-through disk.

About alternate client backup of pass-through disks

Alternate client backup of pass-through disks consists of the following:

- The 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. That 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.

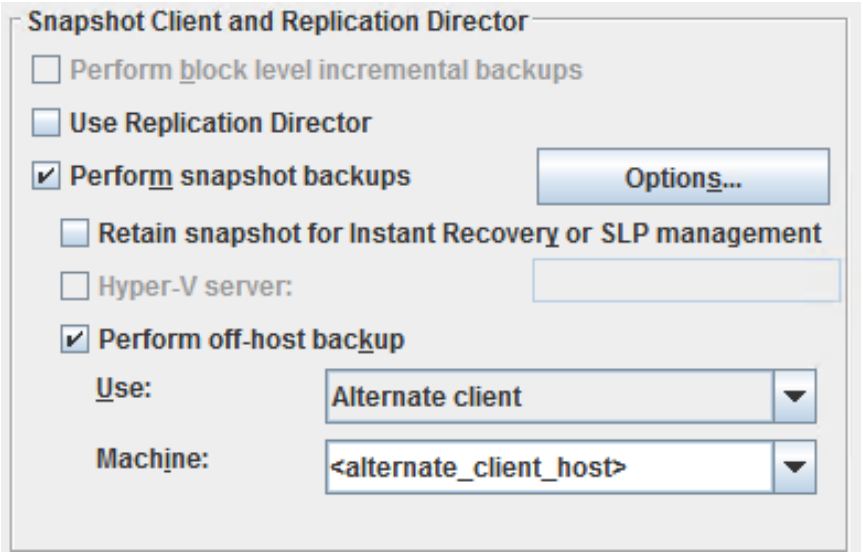
- The alternate client handles the backup I/O processing; the backup has little or no effect on the virtual machine. The media server reads the snapshot data from the alternate client and writes the data to storage.

Configuring an alternate client backup of Hyper-V pass-through disks

To create a policy for alternate client backup of a pass-through disk

1. Start the **NetBackup Administration Console**.
2. Click on **Policies** and create a new policy.
3. On the policy **Attributes** tab, select the **MS-Windows** policy type or the **FlashBackup-Windows** policy type.
4. Click **Perform snapshot backups**.
5. Optional: click **Retain snapshot for Instant Recovery or SLP management**.
6. Click **Perform off-host backup**.
7. In the **Use** field pull-down list, select **Alternate Client**.
8. For **Machine**, enter the name of the host that is configured as an off-host backup computer (the alternate client).

   The following shows the **Snapshot Client** panel of the policy **Attributes** tab.



9 Click **Options**.

The **Snapshot Options** dialog box appears.

10 Select the **VSS** snapshot method.

The **Hyper-V** method does not apply to alternate client backup and is not available in the list.

The array may require additional OS and NetBackup configuration as described in the disk arrays chapter of the *NetBackup Snapshot Client Administrator's Guide*.

11 Specify snapshot options for VSS.

Select the following:

- **Provider Type**: For disk arrays, select **3-hardware** as the provider type.
  Depending on your array and on the snapshot attribute you select, certain preconfiguration of the array may be required. In the *NetBackup Snapshot Client* guide, see the chapter on snapshot methods for disk arrays, for the appropriate topic for your disk array and the VSS method.
  For pass-through disks, note: Instant Recovery point-in-time rollback is not supported for the backups that were made with a hardware provider (VSS provider type of **3-hardware**). Copy back restore is supported.
  See "Provider Type configuration parameter" on page 35.
  See "Restrictions for Hyper-V pass-through disks" on page 138.
  See "Important note on VSS and disk arrays" on page 142.
- **Snapshot Attribute**: Select **1-differential** (for a copy-on-write type of snapshot) or **2-plex** (for a clone type or mirror type of snapshot). The choice depends on the hardware provider that is used with the disk array.
- **Maximum snapshots (Instant Recovery only)**: This option sets the maximum number of Instant Recovery snapshots to be retained at one time.
  For more information on this option, refer to the topic on the Maximum Snapshots parameter in the *NetBackup Snapshot Client Administrator's* guide.

12 On the **Clients** tab, specify the virtual machine that has a pass-through disk configured.

13 On the **Backup Selections** tab, specify the pass-through disk that you want to back up, or the files or volumes that reside on the pass-through disk.

Important note on VSS and disk arrays

To back up a Windows client with the VSS method, please note the following about snapshot parameter values:

- For Provider Type of 3-hardware and Snapshot Attribute of 2-plex, you must configure an appropriate number of clones or mirrors in the disk array.
- You must also synchronize the clones or mirrors with the disk array source device before starting the backup. If the clones or mirrors are not synchronized before the backup begins, VSS cannot select a clone or mirror on which to create the snapshot. As a result, the backup fails.

Appendix C

NetBackup commands to back up and restore Hyper-V virtual machines

This appendix includes the following topics:

Using NetBackup commands to create a Hyper-V policy

This topic describes how to use NetBackup commands to create a policy that backs up virtual machines through manual selection. For a policy that automatically selects virtual machines through a query rule, see the following:

See "Using NetBackup commands to create a Hyper-V Intelligent Policy" on page 145.

For examples of the nbrestorevm command to restore Hyper-V virtual machines, see the nbrestorevm man page or the *NetBackup Commands Reference Guide*.

The NetBackup commands for policy creation are in the following directory:

Windows:

```
install_path\Veritas\NetBackup\bin\admincmd
```

UNIX or Linux:

```
usr/openv/netbackup/bin/admincmd
```

Run these commands on the NetBackup master server.

Note: To run virtual machine backups, a NetBackup client must be installed on the Hyper-V server.

To use NetBackup commands to create a Hyper-V policy

1 Create a policy.

```
bppolicynew policyName
```

For example:

```
bppolicynew HVpolicy1
```

2 Set the policy attributes.

To accept the default attributes, enter the following:

```
bpplinfo policyName -set -pt Hyper-V -use_virtual_machine 2
-hyperv_server "hyper-v_server" -fi 1 -snapshot_method Hyper-V_v2
```

To specify additional options, enter the following:

```
bpplinfo policyName -set -pt Hyper-V -use_virtual_machine 2
-hyperv_server "Hyper-V_server" -fi 1 -snapshot_method Hyper-V_v2
-offhost_backup value -use_alt_client value -alt_client_name
"client_name" -discovery_lifetime value in seconds
-snapshot_method_args keyword=value,keyword=value,...
```

If you include the `-snapshot_method_args` option, it must be specified with all parameters. Otherwise, the snapshot job fails. `-snapshot_method_args` is a comma-delimited list of keywords that define the Hyper-V snapshot and policy. The keywords and values for snapshot_method_args are described in a separate topic:

See "bpplinfo options for Hyper-V policies" on page 149.

3 Create a policy schedule.

```
bpplsched policyName -add sched_label -st sched_type
```

For the -st option, the available schedule types are `FULL` (full), `INCR` (differential incremental), or `CINC` (cumulative incremental).

For example:

```
bpplsched policy1 -add Full -st FULL
```

4 Select the virtual machines to back up.

```
bpplclients policyName -add VM_to_back_up
```

On this command, specify one virtual machine at a time. Specify the virtual machine's display name, host name, or GUID. You can use the Hyper-V management console to obtain the display name or GUID.

For example:

```
bpplclients policy1 -add prodvm1.acme.com
```

In this example, `prodvm1.acme.com` is the virtual machine to back up, including all of its local drives. Note: The backup selection is automatically set to ALL_LOCAL_DRIVES. ALL_LOCAL_DRIVES is the only option that is available for the Hyper-V policy type.

5 Validate the policy.

```
bpclient -policy policyName -validate -fi
```

If the policy successfully validates, no output appears. Otherwise, the following error occurs:

```
Error code 48 : client hostname could not be found
```

6 Use the `bpbackup` command to start the backup.

For details on `bpbackup`, see the *NetBackup Commands Reference Guide*.

Using NetBackup commands to create a Hyper-V Intelligent Policy

This topic describes how to use NetBackup commands to create a policy to back up virtual machines automatically through a query rule.

For examples of the nbrestorevm command to restore Hyper-V virtual machines, see the nbrestorevm man page or the *NetBackup Commands Reference Guide*.

The NetBackup commands for policy creation are in the following directory:

Windows:

```
install_path\Veritas\NetBackup\bin\admincmd
```

UNIX or Linux:

```
usr/openv/netbackup/bin/admincmd
```

Run these commands on the NetBackup master server.

Note: To run virtual machine backups, a NetBackup client must be installed on the Hyper-V server.

To use NetBackup commands to create a Hyper-V policy for auto selection of VMs

1. Create a policy.

   ```
   bppolicynew policy_name
   ```

   For example:

   ```
   bppolicynew p1_auto_select_VMs
   ```

2. Set the policy attributes.

   ```
   bpplinfo policy_name -set -pt Hyper-V -use_virtual_machine 2
   -hyperv_server "Hyper-V_server" -fi 1 -application_discovery 1
   -snapshot_method Hyper-V_v2 -snapshot_method_args
   Virtual_machine_backup=value,nameuse=value,allow_offline_backup=
   value,csv_timeout=0,prov_type=0,snap_attr=0
   ```

   Note that `-snapshot_method_args` is a comma-delimited list of keywords that define the Hyper-V snapshot and policy. The keywords are described in a separate topic:

   See "bpplinfo options for Hyper-V policies" on page 149.

   For example:

   ```
   bpplinfo  p1_auto_select_VMs -set -pt Hyper-V -use_virtual_machine 2
   -hyperv_server hyperv_server_3 -fi 1 -application_discovery 1
   -snapshot_method Hyper-V_v2 -snapshot_method_args
   Virtual_machine_backup=1,nameuse=1,allow_offline_backup=1,
   csv_timeout=0,prov_type=0,snap_attr=0
   ```

   This example allows offline backup of the virtual machines if an online backup cannot be performed. The following are some of the options used in the example:

- `Virtual_machine_backup=1`

  The full virtual machine can be recovered from the backup, but not individual files.

  Note that `Virtual_machine_backup=2` enables individual file recovery.

- `nameuse=1`

  When browsing to restore from the backup, you must use the VM's display name to identify the backup image. Other options are available: `nameuse=0` uses the VM host name to identify the backup image. `nameuse=2` uses the VM GUID to identify the backup image.

- `allow_offline_backup=1`

  Allows the offline backup of any non-VSS virtual machine.

3 Create a policy schedule.

```
bpplsched policy_name -add sched_label -st sched_type
```

For the `-st` option, the available schedule types are `FULL` (full), `INCR` (differential incremental), or `CINC` (cumulative incremental). For example:

```
bpplsched p1_auto_select_VMs -add Full -st FULL
```

4 Specify the host that is to perform virtual machine discovery.

- To specify a Hyper-V server:

  ```
  bpplclients policy_name -add Hyper-V_server
  Hyper-V_server_hardware_type Hyper-V_server_OS
  ```

- To specify a Hyper-V cluster:

  ```
  bpplclients policy_name -add Hyper-V_cluster
  ```

Note: To allow the policy to search all nodes of the cluster, you must set the `NetBackup Legacy Network Service` logon to the domain user account.

See "Changing the NetBackup Legacy Network Service logon (vnetd.exe) to the domain user account" on page 23.

For example, to specify a Hyper-V server:

```
bpplclients p1_auto_select_VMs -add hvserver3 Windows-x64 Windows
```

To find the hardware type and operating system for your server, run the following on the NetBackup master server:

```
bpplclients
```

For further information, see "Examples" under `bpplclients` in the *NetBackup Commands Reference Guide*.

5 Create a query rule to select virtual machines automatically.

```
bpplinclude policy_name -add "hyperv:/?filter=query_rule"
```

For example:

```
bpplinclude p1_auto_select_VMs -add "hyperv:/?filter=Displayname
Contains 'Production'"
```

In this example, the query rule `"hyperv:/?filter=Displayname Contains 'Production'"` selects the virtual machines with the display names that contain the word Production. `Contains` means that other characters can also appear in the display names.

For the filter options that you can use in a Hyper-V query rule, refer to the **Field** keywords in the following:

See "Query Builder field reference" on page 64.

Note: The bpplinclude command has options for modifying the query rules in an existing policy.

See "bpplinclude options for modifying query rules in Hyper-V policies" on page 151.

6 Validate the policy.

```
bpclient -policy policy_name -validate -fi
```

If the policy successfully validates, no output appears. Otherwise, the following error occurs:

```
Error code 48 : client hostname could not be found
```

7 Use the `bpbackup` command to start the backup.

For details on `bpbackup`, see the *NetBackup Commands Reference Guide*.

For a policy that lets you select virtual machines manually:

See "Using NetBackup commands to create a Hyper-V policy" on page 143.

To test the bpplinclude query rule (`hyperv:/?filter`) before you run the backup

- Run the following:

  Windows:

  ```
  install_path\NetBackup\bin nbdiscover -noxmloutput -policy
  policy_name -noreason
  ```

  UNIX, Linux:

  ```
  /usr/openv/netbackup/bin nbdiscover -noxmloutput -policy
  policy_name -noreason
  ```

  A + sign appears before the virtual machines that the query rule selects for the backup: these virtual machines are included in the backup when the policy runs.

  The virtual machines to be excluded from the backup appear with a - sign.

  The `-noreason` option omits explanations as to why the query excluded a virtual machine or why the query failed. For explanations, do not include -noreason.

  For more details on most of the command options, see the man page or the *NetBackup Commands Reference Guide*.

bpplinfo options for Hyper-V policies

Table C-1 describes the options that are available on the bpplinfo command.

Table C-1 bpplinfo options for Hyper-V

Option	Values	Required?	Navigation in policy editor of Administration Console
`-use_virtual_machine`	2	Y	
`-hyperv_server`	name of Hyper-V server	Y	**Clients** tab > **Hyper-V server**
`-application_discovery`	0 disabled, 1 enabled	N (only for automatic selection of VMs through a query rule)	**Clients** tab > **Select automatically through Hyper-V Intelligent Policy query**
`-snapshot_method`	Hyper-V_v2	Y	

Table C-1 bpplinfo options for Hyper-V *(continued)*

Option	Values	Required?	Navigation in policy editor of Administration Console
-offhost_backup	0 No off-host backup (default) 1 Use off-host backup method (for alternate client)	N	**Attributes** tab > **Perform off-host backup**
-use_alt_client	0 No alternate client 1 Use an alternate client	Y (with offhost_backup option)	**Attributes** tab > **Perform off-host backup > Use**
alt_client_name	name of alternate client	Y (with use_alt_client)	**Attributes** tab > **Perform off-host backup > Machine**
snapshot_method_args	*keyword=value,keyword=value,...* Table C-2	N	

Table C-2 describes the keywords for -snapshot_method_args.

Table C-2 Keywords and values for snapshot_method_args

Keyword	Values	Navigation in policy editor of Administration Console
Virtual_machine_backup=	1 disable file-level recovery 2 enable file-level recovery	**Hyper-V** tab > **Enable file recovery from VM backup**
nameuse=	0 Use VM host name to identify backup image 1 Use VM display name to identify backup image 2 Use VM GUID to identify backup image	**Hyper-V** tab > **Primary VM identifier**
allow_offline_backup=	0 Do not allow offline backup of non-VSS virtual machines 1 Allow offline backup of non-VSS virtual machines	**Hyper-V** tab > **Enable offline backup of non-VSS VMs**

Table C-2 Keywords and values for snapshot_method_args *(continued)*

Keyword	Values	Navigation in policy editor of Administration Console
`csv_timeout=`	Determines how many minutes the backup job waits, in case another node in the cluster backs up the same shared volume at the same time. The default is 180 (wait for 3 hours). A wait of 3 hours is recommended if you have multiple virtual machines on one CSV. The Windows 2008 R2 cluster node owns the CSV for the entire duration of the backup. If you do not want NetBackup to wait for another backup to release the shared volume, set the value to 0. If at the same time another node in the cluster backs up a shared volume that this backup requires, the backup fails with status 156. **Note:** On Windows server 2012, cluster nodes can back up the same CSV simultaneously. As a result, NetBackup does not use this option if the cluster is on Windows 2012.	**Hyper-V** tab > **Cluster shared volumes timeout**
`prov_type=`	0 Automatic selection of provider. Allows VSS to use the best possible provider for the snapshot. 1 Use system provider 2 Use software provider 3 Use hardware array provider	**Hyper-V** tab > **Advanced > Provider Type**
`snap_attr=`	0 (default) 1 Differential. Use copy-on-write snapshot method. 2 Plex. Use clone or mirror snapshot method.	**Hyper-V** tab > **Advanced > Snapshot Attribute**

bpplinclude options for modifying query rules in Hyper-V policies

The bpplinclude command has options for modifying the query rules in an existing policy.

Table C-3 bpplinclude options for modifying query rules

Option	Description

-addtoquery *query_string* ...	Adds the specified query string to the end of the policy query rules, or creates a query if none exists.
	Quotes (") must be escaped (\).
	Examples:
	To add `vm17` to the list of values in the query rules of policy1:
	`bpplinclude policy1 -addtoquery ,\"vm17\"`
	To create a query in a policy that does not have a query:
	`bpplinclude policy1 -addtoquery hyperv:/?filter=Displayname AnyOf \"grayfox7\",\"grayfox9\"`
	Note: Each quote (") is escaped with a backslash (\).

-addtoquery -f *file_name*	Adds the entries to the query rules from the specified file, or creates a query if none exists.
	In the file, quotes (") do not need to be escaped.
	Example:
	To create a query in a policy that does not have a query:
	`bpplinclude policy1 -addtoquery -f qfile1`
	where the contents of `qfile1` are:
	`hyperv:/?filter=Displayname Contains "VM" AND HypervServer Contains "ROS"`
	Note: The values "VM" and "ROS" are not escaped.
	Note: You can place entries on multiple lines in the file. All entries are added to the end of the query (if a query already exists).

Table C-3 bpplinclude options for modifying query rules *(continued)*

Option	Description

-deletefromquery *query_string* ...	Deletes the specified query string from the policy query rules.
	Examples:
	To delete `vm27` from the list of values in the query rule of policy1:
	`bpplinclude policy1 -deletefromquery \"vm27\"`
	This example also deletes the comma preceding vm27 if such a comma exists in the query rules.
	Note: The -deletefromquery option deletes a comma if: the phrase in the query_string does not begin or end with a comma and the character preceding the deleted string is a comma.
	To delete an entire query from the policy:
	`bpplinclude policy1 -deletefromquery hyperv:/?filter=Displayname AnyOf "grayfox7","grayfox9"`

-deletefromquery -f *file_name*	Deletes the file entries from the query rules.
	Example:
	To delete a query from a policy:
	`bpplinclude policy1 -deletefromquery -f qfile1`
	where the contents of `qfile1` are:
	`hyperv:/?filter=Displayname Contains "VM" AND HypervServer Contains "ROS"`
	Note: The values "VM" and "ROS" are not escaped.

Note: paths that contain wildcards must be enclosed in quotes.

Examples of nbrestorevm for restoring VMs to Hyper-V

To restore VMs, you can use the nbrestorevm command on the master server or on the recovery host. The command is located in the following directory:

Windows

install_path\NetBackup\bin\nbrestorevm.exe

UNIX and Linux:

/usr/openv/netbackup/bin/nbrestorevm

The following nbrestorevm options are used in the examples in this topic:

- `-vmhv`
  Indicates a restore to the original location.
- `-vmhvnew`
  Indicates a restore to a different location (instead of `-vmhv`).
- `-vmhvstage`
  Indicates a restore to a staging or temporary location.
- `-vmncf`
  For a VM that uses files in common with other VMs, this option restores the VM but does not restore the common files.
- `-C` *`virtual_machine_to_restore`*
  Identifies the VM to restore. The VM name must match the type of name that was selected in the **Primary VM identifier** option of the backup policy. For example, if the VM was backed up by its VM display name, use the VM's display name on the `-C` option.

  Note: Spaces in the VM name must be represented as %20 on the `-C` option. If the VM's name is `acme vm1`, enter `acme%20vm1`.

- `-R` *`absolute_path_to_rename_file`*
  For a restore to a different location, describes the path to a text file (the rename file) that contains directives for restoring the VM's files. The rename file specifies the original paths and the new paths for the restored VM files (xml, bin, vsv, vhd). The rename file must specify paths for all four VM file types.
  See example E in this topic.
  Further notes are available on the rename file:
  See "The nbrestorevm `-R` rename file for Hyper-V" on page 156.
- `-vmserver` *`Hyper-V_server`*
  Specifies a different server as the target for the restore. The default is the Hyper-V server that backed up the VM. To restore to the Hyper-V server that backed up the VM, omit this option.
- `-S` *`master_server`*
  Specifies the master server that made the backup (if different from the current master).
- `-O`
  Overwrites the VM and the associated resources if they already exist. This option is required if the VM exists in the target location.

- `-w [hh:mm:ss]`

  The nbrestorevm command waits for completion of the restore before it returns to the system prompt.

  Without the -w option, nbrestorevm initiates the restore and exits. You can check the job completion status in the Activity Monitor of the NetBackup Administration Console.

- `-L progress_log_file [-en]`

  Specifies an existing file to contain debug information about the restore. If the server where you run nbrestorevm is configured for a non-English locale, the `-en` option creates an additional log file in English.

Following are examples for nbrestorevm.

A. Restore to the original location and overwrite the VM

```
nbrestorevm -vmhv -C VM_to_restore -O
```

The `-O` option overwrites the existing VM. This option is required if the VM already exists.

B. Restore to the original location, overwrite the VM, and create a progress log

```
nbrestorevm -vmhv -C VM_to_restore -O -L progress_log_file
```

C. Restore to the original location, overwrite the VM, but do not restore the common files

```
nbrestorevm -vmncf -C VM_to_restore -O
```

D. Restore to the original location from a VM backup that a different master server made, and overwrite the VM

```
nbrestorevm -vmhv -C VM_to_restore -S master_server -O
```

The `-S` option identifies the server that made the backup.

E. Restore to a different location on the same Hyper-V server

```
nbrestorevm -vmhvnew -C VM_to_restore -R absolute_path_to_rename_file
```

On the `-R` option, enter the full path to a text file that contains the following kinds of entries:

```
change /original_VM_GUID.xml_path to /new_VM_GUID.xml_path
change /original_VM_GUID.bin_path to /new_VM_GUID.bin_path
change /original_VM_GUID.vsv_path to /new_VM_GUID.vsv_path
change /original_VM.vhd_path to /new_VM.vhd_path
```

Make sure to include all four change entries to specify locations for the VM's files (xml, bin, vsv, vhd). If any of the VM file paths are omitted, the restore may not succeed.

Note: Each `change` line must end with a carriage return.

Note: If the `-R` option is omitted, the VM is restored to its original location.

See "The nbrestorevm -R rename file for Hyper-V" on page 156.

F. Restore to a different Hyper-V server, and wait for completion status from the server before returning to the system prompt

```
nbrestorevm -vmhvnew -C VM_to_restore -R absolute_path_to_rename_file
-vm_server Hyper-V_server -w
```

The `-vm_server` option specifies the target server for the restore.

See example E for a description of the rename file.

G. Restore the VM to a staging location

```
nbrestorevm -vmhvstage -C VM_to_restore -R
absolute_path_to_rename_file -vm_server staging_server
```

The `-vm_server` option specifies the host for the staging location.

See example E for a description of the rename file.

The nbrestorevm -R rename file for Hyper-V

The `-R` rename file is a text file that uses `change` directives to specify file paths for restore to a different location. The `change` directives specify the original paths of the VM's files (xml, bin, vsv, vhd) and the paths to the files when they are restored.

Note: The `-R` option and rename file are not required when you restore the VM to its original location with all its original settings.

Note the following about restoring the VM to a different location:

- You must use the `-vmhvnew` option on nbrestorevm (instead of the `-vmhv` option).
- The `-R` option must specify the absolute path to the rename file.

- Each `change` directive in the `-R` rename file must end with a carriage return.
- The `change` directives can be in any order in the rename file.
- The `change` directives take the following form:

  `change /original_VM_file_path to /target_VM_file_path`

  Use forward slashes (/) in the paths. See Table C-4.
- Unlike the Backup, Archive, and Restore interface, nbrestorevm does not validate its command options and rename file directives before the restore job begins. Make sure to include all required options and rename file change directives.

Table C-4 Change directives for the `-R` rename file

`-R` rename file directives	Description and notes
`change /original_VM_GUID.xml_path to /new_VM_GUID.xml_path`	The path to the VM's original .xml file and to the restored .xml file.
`change /original_VM_GUID.bin_path to /new_VM_GUID.bin_path`	The path to the VM's original .bin file and to the restored .bin file.
`change /original_VM_GUID.vsv_path to /new_VM_GUID.vsv_path`	The path to the VM's original .vsv file and to the restored .vsv file.
`change /original_VM.vhd_path to /new_VM.vhd_path`	The path to the VM's original vhd file and to the restored vhd file.

Notes on troubleshooting the nbrestorevm command for Hyper-V

This topic describes NetBackup status codes relating to the nbrestorevm command for Hyper-V.

Table C-5 NetBackup status codes on nbrestorevm and Hyper-V

NetBackup status code	Explanation and recommended action
`2821, Hyper-V policy restore error`	The VM already exists at the restore location. On nbrestorevm, include the `-O` option to overwrite the existing VM.

Table C-5 NetBackup status codes on nbrestorevm and Hyper-V *(continued)*

NetBackup status code	Explanation and recommended action
`23, socket read failed`	The time span that is specified on the `-w` option is earlier than the time of the restore. You can use `-w` without time values. The nbrestorevm job waits for the restore to complete and then exits.
`135, client is not validated to perform the requested operation`	The media server or recovery host where you are running nbrestorevm is not allowed to access the NetBackup master server. Add the media server or recovery host to the master server's **Additional Servers** list. In the NetBackup Administration Console, click **Host Properties > Master Servers >** double-click the master server **> Servers**.
`144, invalid command usage`	One or more required options were omitted on nbrestorevm. For example, nbrestorevm requires either `-vmhv` (restore to original location) or `-vmhvnew` (restore to different location). See the nbrestorevm man page or the *NetBackup Commands Reference Guide* for more details.
`190, found no images or media matching the selection criteria`	A name or value that is supplied with nbrestorevm does not match the VM's actual name or value. The VM name as specified on nbrestorevm must match the type of name that was selected in the **Primary VM identifier** option of the backup policy. For example, if the VM was backed up by its VM display name, use the VM's display name on the `-C` option. **Note:** Spaces in the VM name must be represented as `%20` on the nbrestorevm `-C` option. For example, if the VM's name is `acme vm1`, enter `acme%20vm1` on the `-C` option.

Logs for troubleshooting the nbrestorevm command

The following logs may contain helpful messages on nbrestorevm.

Table C-6 Logs with messages on nbrestorevm

Log directory	Contains the messages on	Resides on
Windows *install_path*\NetBackup\logs\bprd Linux, UNIX /usr/openv/netbackup/logs/bprd	The restore operation, such as for status code 2821.	Master server
install_path\NetBackup\logs\tar	The restore operation, such as for status code 2821.	Recovery host (Hyper-V server)
Windows *install_path*\NetBackup\logs\nbrestorevm Linux, UNIX /usr/openv/netbackup/logs/nbrestorevm	Incorrect usage of the nbrestorevm command, such as omission of a required option.	Host where nbrestorevm is run

Index

M

N

O

P

Q

R

S

T

V

W