Veritas NetBackup™ for Hyper-V Administrator's Guide

Release 8.0
Veritas NetBackup™ for Hyper-V Administrator's Guide

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Introduction

This chapter includes the following topics:

- About Hyper-V
- Updates to this guide for NetBackup 8.0
- NetBackup for Hyper-V environment
- Hyper-V terminology related to backup
- Basic phases in a NetBackup backup of a Hyper-V virtual machine
- NetBackup administrator tasks for Hyper-V
- Quick reference for troubleshooting

About Hyper-V

NetBackup for Hyper-V provides snapshot-based backup of the virtual machines that run on Hyper-V servers. For a list of supported Hyper-V servers, see the NetBackup Software Compatibility List available from the following location:

NetBackup Master Compatibility List

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) and Windows Management Instrumentation (WMI).

- NetBackup for Hyper-V performs full backups and file-level incremental backups of the virtual machine. With the WMI backup method, it also performs block-level incremental backups and Accelerator backups.

- Can restore the full virtual machine from the following:
■ Full backups of the VM.
■ Block-level incremental backups of the VM.
■ Accelerator backups of the VM.

■ Can restore individual files of the virtual machine from the following:
  ■ Full backups of the VM.
  ■ File-level incremental backups of the VM.
  ■ Block-level incremental backups of the VM.
  ■ Accelerator backups of the VM.

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

Updates to this guide for NetBackup 8.0

This revision adds information on features for faster backup and recovery of Hyper-V virtual machines on Windows Server 2016.

Table 1-1 NetBackup 8.0 features for Hyper-V virtual machines on Windows Server 2016

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WMI backup method</td>
<td>These NetBackup 8.0 features for Hyper-V use the WMI backup method. (These features do not use VSS.) For support notes and requirements for these new Hyper-V features, see Support for NetBackup in virtual environments at the following location: <a href="http://www.veritas.com/docs/000006177">http://www.veritas.com/docs/000006177</a>. See “Creating a Hyper-V policy from the NetBackup Policies utility” on page 35.</td>
</tr>
<tr>
<td>Block-level incremental backup (BLIB)</td>
<td>BLIB uses Microsoft's resilient change tracking (RCT) to perform faster backup of the virtual machines. BLIB backups support recovery of the full virtual machine and of individual files. BLIB also reduces the size of the virtual machine backup image. See &quot;Optimization options (Hyper-V)&quot; on page 42.</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Accelerator                   | Accelerator uses Microsoft's resilient change tracking (RCT) to perform faster backup of virtual machines (full backups and incremental backups). Accelerator backups support recovery of the full virtual machine and of individual files.  
**Note:** Accelerator requires the use of block-level incremental backup (BLIB).  
See “About the NetBackup Accelerator for virtual machines” on page 132.  
See “Accelerator notes and requirements for virtual machines” on page 134. |
| Control of resources          | New resource limit settings for Hyper-V Server 2016 and the WMI backup method.  
See "Setting global limits on the use of Hyper-V resources" on page 27. |
| Support for new storage types | ■ Windows Server Message Block (SMB) 3.0 file shares  
For backup and restore of the virtual machines that are hosted on SMB 3.0 file shares. Hyper-V can use SMB 3.0 files shares as shared storage for virtual machine files.  
■ Windows Storage Spaces and Storage Spaces Direct  
For backup and restore of the virtual machines that are hosted on Windows Storage Spaces. Storage Spaces and Storage Spaces Direct are Windows virtual disks that are configured from the available capacity in disk storage pools. |
| Policy Query Builder option to filter VMs based on VM configuration version | Two new Hyper-V Intelligent Policy filters are available, for automatic selection of virtual machines based on their VM configuration version.  
See “Query Builder field reference” on page 80. |
| Restore features              | The following are enhancements for restoring a VM that was backed up with the WMI method:  
■ A new VM GUID is generated by default when you restore a VM to an alternate location. As an option, you can choose to keep the original GUID.  
■ A new VM display name can be specified when you restore a VM.  
See "Restore Marked Files dialog for restore of the Hyper-V virtual machine” on page 123.  
**Note:** The GUID and display name enhancements cannot be used when you restore the VM to a staging location. |

---

**NetBackup for Hyper-V environment**

The following table describes the components that are required for NetBackup to back up and restore a Hyper-V virtual machine.
<table>
<thead>
<tr>
<th>Component</th>
<th>Description and requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>NetBackup master server</td>
<td>Runs the backup policies and starts backups and restores.</td>
</tr>
<tr>
<td>NetBackup media server</td>
<td>Reads and writes backup data and manages NetBackup storage media. 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 Hyper-V host.</td>
</tr>
<tr>
<td>NetBackup client (and optional alternate client)</td>
<td>Processes backup and restore requests. The NetBackup client must be installed on the Hyper-V host(s). If the Server Type on the policy Clients tab is System Center Virtual Machine Manager, a NetBackup client must also be installed on the SCVMM server.</td>
</tr>
<tr>
<td>Hyper-V server</td>
<td>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.</td>
</tr>
<tr>
<td>Hyper-V integration services (integration components)</td>
<td>Provides the integration between the Hyper-V server and the virtual machines. Note: The Hyper-V backup integration service must be enabled.</td>
</tr>
</tbody>
</table>

The following figure shows the NetBackup for Hyper-V environment.
Hyper-V terminology related to backup

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

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>avhd, avhdx file</td>
<td>A snapshot file that Windows Hyper-V creates, for point-in-time recovery of the virtual machine. See “Basic phases in a NetBackup backup of a Hyper-V virtual machine” on page 15.</td>
</tr>
<tr>
<td>Common vhd, vhdx files</td>
<td>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 128.</td>
</tr>
<tr>
<td>CSV</td>
<td>A cluster-shared volume in a failover cluster. Refer to your Microsoft documentation for more details regarding CSV.</td>
</tr>
<tr>
<td>Differencing disk</td>
<td>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.</td>
</tr>
<tr>
<td>HA (high availability)</td>
<td>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.</td>
</tr>
</tbody>
</table>
Table 1-3  Hyper-V terminology related to backup (continued)

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass-through disk</td>
<td>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.</td>
</tr>
<tr>
<td>vhd, vhdx file</td>
<td>A file in a Windows Hyper-V installation that contains the virtualized contents of a hard disk. The 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.</td>
</tr>
<tr>
<td>Virtual machine</td>
<td></td>
</tr>
<tr>
<td>configuration files:</td>
<td></td>
</tr>
<tr>
<td>xml, bin, vsv, vmcx,</td>
<td>NetBackup backs up these files as part of a full virtual machine backup.</td>
</tr>
<tr>
<td>vmrs</td>
<td>The bin and the vsv files are visible only when the virtual machine is running.</td>
</tr>
<tr>
<td>Virtual machine GUID</td>
<td>A globally unique identifier of the virtual machine.</td>
</tr>
<tr>
<td></td>
<td>In an SCVMM environment, the VM GUID is referred to as the <strong>VM ID</strong>.</td>
</tr>
</tbody>
</table>

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

The following tables describe the phases of the NetBackup backup process for the two Hyper-V backup methods: VSS and WMI.

Table 1-4  VSS backup method: Phases of NetBackup for Hyper-V backup

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>The NetBackup master server initiates the backup.</td>
</tr>
<tr>
<td>Phase 2</td>
<td>The NetBackup client on the Hyper-V host initiates a snapshot.</td>
</tr>
</tbody>
</table>
| Phase 3 | On Windows 2012 hosts and earlier: The VSS Hyper-V writer quiesces the Windows virtual machine (places the data in a consistent state) 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. 
On Windows 2012 R2 hosts and later: The Hyper-V writer quiesces the Windows virtual machine and creates a .avhd or .avhdx snapshot on the host volume. The following Microsoft article contains more details on Hyper-V backup on 2012 R2 hosts: **How Hyper-V Backup Got Better in 2012 R2** |
Table 1-4  VSS backup method: Phases of NetBackup for Hyper-V backup
(continued)

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 4</td>
<td>On Windows 2012 hosts and earlier: If the virtual machine was placed in the Saved state, Hyper-V returns the virtual machine to its original state.</td>
</tr>
<tr>
<td>Phase 5</td>
<td>The NetBackup client on the Hyper-V host 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.</td>
</tr>
<tr>
<td>Phase 6</td>
<td>The NetBackup client on the Hyper-V host deletes the host volume snapshot.</td>
</tr>
</tbody>
</table>

Table 1-5  WMI backup method: Phases of NetBackup for Hyper-V backup

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>The NetBackup master server initiates the backup.</td>
</tr>
<tr>
<td>Phase 2</td>
<td>The NetBackup client on the Hyper-V host initiates a virtual machine snapshot (checkpoint).</td>
</tr>
<tr>
<td>Phase 3</td>
<td>On Windows 2016 hosts or later, the NetBackup client on the Hyper-V host creates a virtual machine snapshot (checkpoint).</td>
</tr>
<tr>
<td>■ If the Hyper-V policy Consistency level option is set to Application Consistent or Application Consistent Then Crash Consistent: The VSS integration services component inside the guest OS attempts to quiesce the virtual machine.</td>
<td></td>
</tr>
<tr>
<td>■ If the Hyper-V policy Consistency level option is set to Crash Consistent: The virtual machine is not quiesced.</td>
<td></td>
</tr>
<tr>
<td>If the backup uses block-level incremental backup (BLIB), the snapshot is converted to a reference point. Resilient change tracking (RCT) is used to perform faster backup of the virtual machines by moving only the blocks that have changed between backups.</td>
<td></td>
</tr>
<tr>
<td>As a result of the virtual machine snapshot (checkpoint), the .avhd or .avhdx files are created for the virtual machine. All subsequent writes from the virtual machine go to these files.</td>
<td></td>
</tr>
<tr>
<td>Note: The Consistency level option is set on the policy's Hyper-V tab, under Advanced....</td>
<td></td>
</tr>
<tr>
<td>Phase 4</td>
<td>The NetBackup client reads the data directly from the virtual machine files on the Hyper-V host and transfers the data to the media server. The media server writes the data to the storage unit.</td>
</tr>
<tr>
<td>Phase 5</td>
<td>The NetBackup client on the Hyper-V host deletes the virtual machine snapshot (checkpoint). As a result, the .avhd or .avhdx files that were created during the backup are merged back into the original virtual machine disks.</td>
</tr>
</tbody>
</table>

NetBackup administrator tasks for Hyper-V

The following are the tasks for the NetBackup administrator:
- Install the NetBackup master server and media server.
  For information on licensing, contact your Veritas sales or partner representative.
  See the NetBackup Installation Guide.

- Install a NetBackup client on each 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.
  See “About restoring individual files” on page 114.

- To back up VMs under the Microsoft System Center Virtual Machine Manager (SCVMM), install a NetBackup client on the SCVMM server.
  See “About backup of virtual machines in an SCVMM environment” on page 95.

- 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 112.
  See “Notes on individual file restore” on page 110.

- Read the best practices.
  See “Best practices” on page 146.

- Create a NetBackup policy for Hyper-V.
  See “Creating a Hyper-V policy from the NetBackup Policies utility” on page 35.
  See “Creating a Hyper-V policy for automatic virtual machine selection” on page 65.

- Run a Hyper-V backup.
  See “Backing up Hyper-V virtual machines” on page 108.

- Perform a restore.
  See “About restoring individual files” on page 114.
  See “Restoring the full Hyper-V virtual machine” on page 122.

- 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 155.
- See “NetBackup logs and how to create them” on page 149.
Notes and prerequisites

This chapter includes the following topics:

■ NetBackup for Hyper-V prerequisites
■ NetBackup for Hyper-V notes and restrictions
■ NetBackup character restrictions for virtual machine display names
■ NetBackup character restrictions for vhd or vhdx names and the VM path when the Enable file recovery from VM backup option is used
■ Notes on Linux virtual machines

NetBackup for Hyper-V prerequisites

The following prerequisites apply to NetBackup for Hyper-V:

■ For a list of supported Hyper-V servers, see the appropriate version of the NetBackup Software Compatibility List available from the following location: NetBackup Master Compatibility List
■ For Hyper-V servers on Windows 2008, apply the following hotfixes:
  ■ http://support.microsoft.com/kb/959962
    This hotfix 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 hotfix 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 hotfixes 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 hotfix 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 hotfix has not been applied, the backup is performed offline.
  
  Windows 2008 R2 contains all required hotfixes.
  
  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:

- 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. Consult the release notes of the array vendor or VSS provider.

- NetBackup for Hyper-V does not support the NetBackup Instant Recovery feature.

- The following is due to a Microsoft limitation: NetBackup for Hyper-V does not support VSS or WMI backup or restore of the vhdx files that are shared among multiple VMs.

- 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.

**Note:** The SAN Client feature for Hyper-V is only supported for the VSS backup method (not for WMI).
The following is due to a Microsoft limitation: If the VM's virtual disk files reside in a volume or folder that is compressed, NetBackup cannot use the WMI backup method to create a snapshot of the VM. The snapshot job fails with status 156, “snapshot error encountered.” As a workaround, remove compression from the volume or folder where the virtual disk resides and rerun the backup.

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.

If a policy is changed from manual selection to Intelligent policy (or vice versa), note: The next backup of the VM is a regular full backup, even if a backup already exists for that VM.

For example:

- In a new Hyper-V policy, the Select manually option on the Clients tab is used to select a VM. The first backup from the policy runs.

- In the policy, an Intelligent Policy query is used to select the same VM, and the VM is backed up a second time. Because of the switch from manual selection to query-based selection, this second backup is a regular full backup. Note that for a policy that uses Enable block-level incremental backup (BLIB) or BLIB plus Accelerator, the backup processing is not limited to changed blocks only.

For the second backup, the Detailed status log includes a message similar to the following:

```
Sep 29, 2016 11:16:53 AM - Info bpbrm (pid=13680) There is no complete backup image match with track journal, a regular full backup will be performed.
```

The same backup behavior occurs if the policy’s VM selection is switched from query-based to manual selection: The second backup is a regular full backup.

- For the WMI backup method with the Enable block-level incremental backup option (with or without Accelerator): If the VM has multiple virtual disks that have
the same disk UUID, NetBackup performs a full backup of those disks. It does not perform an incremental backup of them. The disks that have unique IDs undergo an incremental backup, as expected. In the Activity Monitor, the job details include messages such as the following:

The virtual machine (Name: testVM, GUID: 98321741-A936-4128-8AB0-07099B23E25C) uses multiple disks with the same disk Id.

Disk Id: 7198C033-AB5D-4585-905D-0DA68D26F9C5 Disk path: E:\VMs\testVM\testVM1.vhdx

Disk Id: 7198C033-AB5D-4585-905D-0DA68D26F9C5 Disk path: E:\VMs\testVM\testVM2.vhdx

You may lose optimization during the backups for the above listed disks.

To perform incremental backup of these virtual disks, assign a unique ID to each disk. For example, you can use the `Set-VHD` PowerShell cmdlet to reset the disk ID for testVM1 as follows:

```powershell
Set-VHD -Path E:\VMs\testVM\testVM1.vhdx -ResetDiskIdentifier
```

In the case of the differencing disks, you must run additional commands to re-create the disk chain. For more details on the `Set-VHD` cmdlet, see the following Microsoft TechNet article:


- Additional notes are available on Accelerator: See “Accelerator notes and requirements for virtual machines” on page 134.
- 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; this note applies to the VSS backup method only. 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 for VSS” on page 171.
- The WMI backup method (for Hyper-V Server 2016 and later) does not employ online vs offline backups. See “WMI backup method: State of the virtual machine before and after restore” on page 110.
- For the VSS backup method: If a virtual machine is in the Paused state when the backup starts, the virtual machine is placed in the Saved state after the backup completes.
- The WMI backup method supports a new Hyper-V policy option: **Consistency level** (on the policy’s Hyper-V tab under Advanced). The available settings are Application Consistent Then Crash Consistent, Application Consistent, and Crash Consistent.

For the WMI backup method, note the following:
If a virtual machine is in the Paused state during backup and **Consistency level** is set to **Application Consistent**, the backup fails during snapshot creation. If **Consistency level** is set to **Application Consistent Then Crash Consistent** or **Crash Consistent**, the backup succeeds. The virtual machine is in the Off state after the restore.

If a virtual machine is in the Saved state during backup and **Consistency level** is set to **Application Consistent**, the backup fails during snapshot creation. If **Consistency level** is set to **Application Consistent Then Crash Consistent** or **Crash Consistent**, the backup succeeds. The virtual machine is in the Saved state after the restore.

See “**Consistency level parameter (WMI)**” on page 48.

NetBackup for Hyper-V has certain character restrictions for virtual machine display names.

See “**NetBackup character restrictions for virtual machine display names**” on page 22.

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 110.

See “**Notes on full virtual machine restore**” on page 112.

More information about NetBackup for Hyper-V support is available in the following documents:

- **The NetBackup Software Compatibility List:**
  NetBackup Master Compatibility List
- **Support for NetBackup in virtual environments:**
  http://www.veritas.com/docs/000006177

### 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
NetBackup character restrictions for vhd or vhdx names and the VM path when the Enable file recovery from VM backup option is used

- Period (.)
  Note however that a display name cannot end with a period.
- Hyphen (-)
- Underscore (_)
- Plus 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 43.

NetBackup character restrictions for vhd or vhdx names and the VM path when the Enable file recovery from VM backup option is used

For Hyper-V policies that include the **Enable file recovery from VM backup** option, non-ASCII characters are not supported in the vhd name or vhdx name or anywhere in the VM’s path. Examples of non-ASCII characters are Japanese or Chinese characters (multi-byte). If the virtual disk name or VM path contains non-ASCII characters, the backup job completes but the VM’s files cannot be individually restored from the backup.

As an alternative, you can restore the entire VM.

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.

- 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.

- The NetBackup policy’s **Enable file recovery from VM backup** option is not supported for the disks inside a Linux guest OS that are configured as follows:
  - The disks are divided into logical volumes by means of the Linux Logical Volume Manager (LVM), and
  - The LVM volumes were created with thin-provisioning.

- More information is available on the restore of Hyper-V virtual machines.
  See “Notes on individual file restore” on page 110.
  See “Notes on full virtual machine restore” on page 112.
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
- Setting global limits on the use of Hyper-V resources

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.

   For **This account**, enter the user name in the form `domain\username`.

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 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 41.
### Table 3-1: Hyper-V resource types and limits

<table>
<thead>
<tr>
<th>Resource type</th>
<th>Backup method</th>
<th>Resource limit</th>
</tr>
</thead>
</table>
| **Active Snapshots Per Server** | VSS           | Controls the maximum number of active backup jobs per Hyper-V server. Applies to a standalone Hyper-V server as well as to every Hyper-V server in a cluster. The typical setting for this resource type is 2. See the following examples.  
  **Example 1:**  
  - A Hyper-V Intelligent Policy discovers 32 VMs on one Hyper-V server.  
  - **Active Snapshots Per Server:** 12.  
  The NetBackup Activity Monitor shows 32 snapshot jobs. 12 snapshot jobs and their backup jobs are active. 20 snapshot jobs are queued. As active backup jobs are completed, queued snapshot jobs become active.  
  **Example 2:**  
  - A cluster has two nodes (Node1 and Node2), each node with 32 VMs.  
  - A Hyper-V Intelligent Policy discovers 64 VMs in the cluster.  
  - **Active Snapshots Per Server:** 12.  
  The NetBackup Activity Monitor shows 64 snapshot jobs. 12 snapshot jobs for VMs on Node1 are active and another 12 snapshot jobs for VMs on Node2 are active. 40 snapshot jobs are queued. As active backup jobs are completed, queued snapshot jobs become active. |
Table 3-1  Hyper-V resource types and limits (continued)

<table>
<thead>
<tr>
<th>Resource type</th>
<th>Backup method</th>
<th>Resource limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Snapshots Per Cluster</td>
<td>VSS</td>
<td>Controls the maximum number of active backup jobs per Hyper-V cluster.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The typical setting for this resource type is 4.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Example 1:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ A cluster has two nodes (Node1 and Node2), each node with 32 VMs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ A Hyper-V Intelligent Policy discovers 60 VMs in the cluster.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Active Snapshots Per Cluster: 20.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Active Snapshots Per Server: No Limit.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The NetBackup Activity Monitor shows 60 snapshot jobs. For the VMs in the cluster,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20 snapshot jobs are active. 40 snapshot jobs are queued. As active backup jobs are</td>
</tr>
<tr>
<td></td>
<td></td>
<td>completed, queued jobs become active.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Example 2:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ A cluster has two nodes (Node1 and Node2), each node with 32 VMs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ A Hyper-V Intelligent Policy discovers 60 VMs in the cluster.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Active Snapshots Per Cluster: 20.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Active Snapshots Per Server: 5.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The NetBackup Activity Monitor shows 60 snapshot jobs. 10 snapshot jobs for the VMs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>in Node1 and Node2 are active. 50 snapshot jobs are queued. Even though the <strong>Active Snapshots Per Cluster</strong> setting is higher, the <strong>Active Snapshots Per Server</strong> setting controls the number of active jobs.</td>
</tr>
</tbody>
</table>
### Table 3-1 Hyper-V resource types and limits (continued)

<table>
<thead>
<tr>
<th>Resource type</th>
<th>Backup method</th>
<th>Resource limit</th>
</tr>
</thead>
</table>
| **Snapshot Operations Per Server**  | VSS           | Controls the maximum number of simultaneous VSS operations such as create snapshot and delete snapshot on a Hyper-V server or a Hyper-V server in a cluster. Applies only during the snapshot creation and snapshot deletion phase of a backup. Does not control the number of simultaneous backup jobs. The typical setting for this resource type is 1. Each VM backup consists of a snapshot job and a subsequent backup job. Note: **Snapshot Operations Per Server** controls VSS snapshot creation and deletion, which are part of the snapshot job. When snapshot creation is completed, the backup job starts. When the backup job is active, the snapshot job is still shown as active even though the snapshot creation is completed. Therefore, this resource does not control the number of active backup jobs. See the following examples. **Example 1:**  
  ■ A Hyper-V Intelligent Policy discovers 32 VMs on one Hyper-V server.  
  ■ **Snapshot Operations Per Server**: 2.  
  ■ **Active Snapshots Per Server**: No Limit.  
  The NetBackup Activity Monitor shows 32 snapshot jobs. 2 snapshot jobs are active and 30 snapshot jobs are queued. When the first snapshot job completes the snapshot creation, its backup job starts and the third snapshot job becomes active. When the second snapshot job completes snapshot creation, its backup job starts and the fourth snapshot job becomes active. When all the snapshots are created, there are 32 active backup jobs.  
  **Example 2:**  
  ■ A Hyper-V Intelligent Policy discovers 32 VMs on one Hyper-V server.  
  ■ **Snapshot Operations Per Server**: 2.  
  ■ **Active Snapshots Per Server**: 10.  
  The NetBackup Activity Monitor shows 32 snapshot jobs. 2 snapshot jobs are active and 30 snapshot jobs are queued. When the first snapshot job completes snapshot creation, its backup job starts and the third snapshot job becomes active. When the second snapshot job completes snapshot creation, its backup job starts and the fourth snapshot job becomes active. This process continues until there are 10 active snapshot jobs and their backup jobs. When the first backup job completes, the eleventh snapshot job becomes active, and so forth. |
### Table 3-1  Hyper-V resource types and limits (continued)

<table>
<thead>
<tr>
<th>Resource type</th>
<th>Backup method</th>
<th>Resource limit</th>
</tr>
</thead>
</table>
| **Snapshot Operations Per Cluster** | VSS           | Controls the maximum number of simultaneous VSS operations such as create snapshot and delete snapshot within a cluster. Applies only during the snapshot creation and snapshot deletion phase of a backup. Does not control the number of simultaneous backup jobs. For example:  
  - A cluster has two nodes (Node1 and Node2), each node with 32 VMs.  
  - A Hyper-V Intelligent Policy discovers 60 VMs in the cluster.  
  - **Snapshot Operations Per Cluster**: 5.  
  - **Active Snapshots Per Cluster**: 12.  
  The NetBackup Activity Monitor shows 60 snapshot jobs. 5 snapshot jobs are active and 55 snapshot jobs are queued. When the first snapshot job completes snapshot creation, the corresponding backup job starts and the sixth snapshot job becomes active. When the second snapshot job completes snapshot creation, its backup job starts and the seventh snapshot job becomes active, and so forth. When 12 backup jobs are active, the thirteenth and following backup jobs are queued because **Active Snapshots Per Cluster** is set to 12. |
| **Active Backups Per Hyper-V Server** | WMI           | Controls the maximum number of active backup jobs per Hyper-V server. Applies to a standalone Hyper-V server as well as to every Hyper-V server in a cluster. The typical setting for this resource type is 2. Example 1:  
  - A Hyper-V Intelligent Policy discovers 32 VMs on one Hyper-V server.  
  - **Active Backups Per Hyper-V Server**: 12.  
  The NetBackup Activity Monitor shows 32 snapshot jobs. 12 snapshot jobs and their backup jobs are active. 20 snapshot jobs are queued. As active backup jobs are completed, queued snapshot jobs become active. Example 2:  
  - A cluster has two nodes (Node1 and Node2), each node with 32 VMs.  
  - A Hyper-V Intelligent Policy discovers 40 VMs in the cluster (10 on Node1 and 30 on Node2).  
  - **Active Backups Per Hyper-V Server**: 12.  
  The NetBackup Activity Monitor shows 40 snapshot jobs. 10 snapshot jobs for VMs on Node1 are active and 12 snapshot jobs for VMs on Node2 are active. 18 snapshot jobs are queued for the VMs on Node2. |
Table 3-1 Hyper-V resource types and limits (continued)

<table>
<thead>
<tr>
<th>Resource type</th>
<th>Backup method</th>
<th>Resource limit</th>
</tr>
</thead>
</table>
| Active Backups Per Hyper-V Cluster     | WMI            | Controls the maximum number of active backup jobs per Hyper-V cluster. The typical setting for this resource type is 6. Example 1:  
  - A cluster has two nodes (Node1 and Node2), each node with 32 VMs.  
  - A Hyper-V Intelligent Policy discovers 60 VMs in the cluster.  
  - Active Backups Per Hyper-V Cluster: 20.  
  - Active Backups Per Hyper-V Server: No Limit. The NetBackup Activity Monitor shows 60 snapshot jobs. 20 snapshot jobs for VMs on the cluster are active. 40 snapshot jobs are queued. As active backup jobs are completed, queued snapshot jobs become active. Example 2:  
  - A cluster has two nodes (Node1 and Node2), each node with 32 VMs.  
  - A Hyper-V Intelligent Policy discovers 60 VMs in the cluster.  
  - Active Backups Per Hyper-V Cluster: 20.  
  - Active Backups Per Hyper-V Server: 5. The NetBackup Activity Monitor shows 60 snapshot jobs. 10 snapshot jobs for VMs on Node1 and Node2 are active. 50 snapshot jobs are queued. Even though the Active Backups Per Hyper-V Cluster setting is higher, the Active Backups Per Hyper-V Server setting controls the number of active jobs. |

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.
3 Click **Hyper-V**.

4 Click in the **Resource Limit** column to change the limit for a resource. The settings apply to all policies for the master server.

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

*Table 3-1* describes the limits.
Configure NetBackup policies for Hyper-V

This chapter includes the following topics:

- Creating a Hyper-V policy from the Policy Configuration Wizard
- Creating a Hyper-V policy from the NetBackup Policies utility
- Limit jobs per policy on the Attributes tab (for Hyper-V)
- Virtual machine host names and display names should be unique if VMs are selected manually in the policy
- Backup options on the Hyper-V tab
- Hyper-V - Advanced Attributes
- Browse for Hyper-V virtual machines
- Prerequisites for alternate client backup of a virtual machine (VSS)
- Configuring alternate client backup of virtual machines
- Requirements for a NetBackup client inside the virtual machine

Creating a Hyper-V policy from the Policy Configuration Wizard

The following procedure describes how to create a Hyper-V backup policy with the Policy Configuration Wizard.
Note: The Policy Configuration Wizard does not support the WMI backup method. To create a policy with WMI, use the NetBackup Policies utility.

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 65.

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.
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**.

For the VSS backup method on the **Hyper-V** tab, incremental backups require selection of the **Enable file recovery from VM backup** option.

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

The following backup methods are available:

- **Hyper-V Host 2008 SP2 or later (VSS)**
  For Hyper-V hosts running Windows Server 2008 SP2 or later (including Windows Server 2016). Select this method for older Hyper-V hosts. This method does not support block-level incremental backups or Accelerator.

- **Hyper-V Host 2016 or later (WMI)**
  A new backup method in NetBackup 8.0 that enables the faster Hyper-V backup features. This method is for Hyper-V hosts running Windows Server 2016 Technical Preview 5 or later. The virtual machines must be at a VM configuration version later than 5.

  **Note:** This WMI method is recommended for Windows Server 2016 or later and is required for block-level incremental backups and Accelerator.

For the options on this dialog, further information is available:

See “**Backup options on the Hyper-V tab**” on page 42.

See “**Hyper-V - Advanced Attributes**” on page 46.

The available options depend on the backup method that is selected, as follows.

**Hyper-V Host 2008 SP2 or later (VSS):**
Hyper-V Host 2016 or later (WMI):
7 Click the Clients tab.

- To manually select the virtual machines to back up, click Select manually then click New.... For Server Name, enter the name of the Hyper-V server or cluster. This host must contain a NetBackup client to perform backups of the virtual machines.

- To set up the rules that select virtual machines automatically, click the Select automatically through Hyper-V Intelligent Policy query option. That option is also required for VMs that an SCVMM server manages. Automatic selection of virtual machines is explained in different topics: See “About Hyper-V Intelligent Policy (automatic selection of virtual machines for backup)” on page 57. See “Options for selecting Hyper-V virtual machines” on page 63. See “Creating a Hyper-V policy for automatic virtual machine selection” on page 65.
8 For manual selection of virtual machines: 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 51.

- 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 examines 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 27.

Virtual machine host names and display names should be unique if VMs are selected manually in the policy

Hyper-V servers do not require unique names for virtual machines. In a given Hyper-V server, two or more virtual machines can have the same host name or display name.

Identically named virtual machines can present a problem for any policies that are configured as follows:

- The master server’s policies use the **Select manually** option on the **Clients** tab to select the VMs for backup.
The Primary VM identifier option on the Hyper-V tab identifies VMs by their host names or display names.

These policies may back up a different but identically named VM, instead of the VM that you selected. In that case, the VM that you selected is not backed up. For these policies to work, the virtual machines' display names or host names must be unique.

Consider the following options:

- For manual policies that identify VMs by display name or host name, change the VM names so that each VM has a unique host name or display name.

- As an alternative, configure the policies’ Primary VM identifier option to identify the VMs by their VM GUIDs instead of by host name or display name. See “Primary VM identifier option (Hyper-V)” on page 43.

- Instead of policies with manual-selection, use a Hyper-V Intelligent policy to select the VMs through a query. Even if the Primary VM identifier option is set to host name or display name, NetBackup identifies each VM by its GUID.

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 topics describe the Hyper-V backup options.

Optimization options (Hyper-V)

### Table 4-1 Optimizations for Hyper-V

<table>
<thead>
<tr>
<th>Option</th>
<th>Backup method</th>
<th>Description</th>
</tr>
</thead>
</table>
| Enable file recovery from VM backup         | VSS, WMI      | This option allows the restore of individual guest OS files from the backup, such as text files and other documents.  
**Note:** With or without this option, you can restore the entire virtual machine. |
| Enable block-level incremental backup       | WMI           | For block-level backups of the virtual machine. Uses Microsoft's resilient change tracking (RCT) to perform faster backup of virtual machines.  
This option also reduces the size of the backup image.  
**Note:** When you select this option, **Perform block level incremental backups** (on the *Attributes* tab) is automatically selected by default and grayed out. |
Table 4-1  Optimizations for Hyper-V (continued)

<table>
<thead>
<tr>
<th>Option</th>
<th>Backup method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use Accelerator</td>
<td>WMI</td>
<td>NetBackup Accelerator uses Microsoft's resilient change tracking (RCT) to perform faster backups (full and incremental backups).</td>
</tr>
<tr>
<td>Exclude deleted blocks</td>
<td>WMI</td>
<td>Reduces the size of the backup image by excluding any unused or deleted blocks within the file system on the virtual machine. This option uses proprietary mapping technology to identify vacant sectors (allocated but empty) within the file system. This option supports the following file systems: Windows NTFS, and Linux ext2, ext3, and ext4. It also supports the Windows Logical Disk Manager (LDM) and the Linux Logical Volume Manager (LVM2).</td>
</tr>
</tbody>
</table>
| Exclude swap and paging files | WMI | Reduces the size of the backup image by excluding the data in the guest OS system paging file (Windows) or the swap file (Linux).

Note: This option does not exclude the swapping and paging files from the backup: it only excludes the data in those files. If the files are restored, they are restored as empty files.

Note: For a Linux virtual machine, this option disables the swap file when you restore the virtual machine. You must reconfigure the swap file after the virtual machine is restored. To allow the virtual machine to be restored with its swap file enabled, do not select Exclude swap and paging files.

See “NetBackup character restrictions for vhd or vhdx names and the VM path when the Enable file recovery from VM backup option is used” on page 23.

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 4-2  Primary VM identifier options

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VM hostname</td>
<td>Specifies the network host name for the virtual machine.</td>
</tr>
</tbody>
</table>

Note: For VMs in a Hyper-V server or cluster, 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.

Note: On the policy Clients tab, if the Server Type is System Center Virtual Machine Manager, NetBackup can back up VMs by their host name even if they are powered off.
Table 4-2 Primary VM identifier options (continued)

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
</table>
| 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.  
See "NetBackup character restrictions for virtual machine display names" on page 22. |
| VM GUID | Specifies the unique ID assigned to the virtual machine when the virtual machine was created. In an SCVMM environment, the VM GUID is referred to as the VM ID.  
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, consider using 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 of non-VSS VMs (Hyper-V with VSS)

For the VSS backup method, 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 “Snapshot error encountered (status code 156)” on page 157.
See “About Hyper-V online and offline backups for VSS” on page 171.

Cluster shared volumes timeout (Hyper-V with VSS)

For the VSS backup method, for clusters on Windows server 2008 R2: This option applies to backups of the virtual machines that are configured in a Windows Server Failover 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 or later, 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.

Hyper-V - Advanced Attributes

The Hyper-V - Advanced Attributes 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 parameters for Hyper-V backup. In most situations, the best settings are the defaults.

The available settings depend on which backup method you have chosen: VSS or WMI.

Table 4-3 Hyper-V Advanced Attributes

<table>
<thead>
<tr>
<th>Configuration parameter</th>
<th>Backup method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provider Type</td>
<td>VSS</td>
<td>See “Provider Type configuration parameter (VSS)” on page 46.</td>
</tr>
<tr>
<td>Snapshot Attribute</td>
<td>VSS</td>
<td>See “Snapshot Attribute configuration parameter (VSS)” on page 47.</td>
</tr>
<tr>
<td>Virtual disk selection</td>
<td>WMI</td>
<td>See “Virtual disk selection parameter (WMI)” on page 47.</td>
</tr>
<tr>
<td>Existing snapshot handling</td>
<td>WMI</td>
<td>See “Existing snapshot handling parameter (WMI)” on page 48.</td>
</tr>
<tr>
<td>Consistency level</td>
<td>WMI</td>
<td>See “Consistency level parameter (WMI)” on page 48.</td>
</tr>
</tbody>
</table>

Provider Type configuration parameter (VSS)

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.
Not certified in this release.

Software

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 (VSS)**

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**.

**Virtual disk selection parameter (WMI)**

Determines the kind of disks on the virtual machine that are included in the backup. This parameter can reduce the size of the backup, but should be used with care. The following options are intended only for the virtual machines that have multiple virtual disks.

- **Include all disks**
  This option is the default. Backs up all virtual disks that are configured for the virtual machine.

- **Exclude boot disk**
  The virtual machine's boot disk (for example the C drive) is not included in the backup. Any other disks (such as D) are backed up. Consider this option if you have another means of recreating the boot disk, such as a virtual machine template for boot drives.

  See “About the Exclude disk options for Virtual disk selection” on page 49.
**Note:** A virtual machine that is restored from this backup cannot start. Data files are available in the restored data disks.

- **Exclude data disks**
  The virtual machine's data disks (for example the D drive) are not included in the backup. Only the boot disk is backed up. Consider this option only if you have a different policy that backs up the data disks.
  See “About the Exclude disk options for Virtual disk selection” on page 49.

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

---

**Existing snapshot handling parameter (WMI)**

This option specifies the action that NetBackup takes when a NetBackup snapshot is discovered before NetBackup creates a new snapshot for the virtual machine backup. After it creates a snapshot, NetBackup usually deletes the snapshot when the backup completes.

**Abort if NetBackup snapshot(s) exist**

If a virtual machine snapshot (checkpoint) exists that a NetBackup backup previously created for a WMI backup, NetBackup aborts the job for that virtual machine only.

You can use the NetBackup `nbhypervtool.exe` tool to remove NetBackup snapshots of the virtual machine. This tool is in the following location on the Hyper-V server:

```bash
install_path\NetBackup\bin\nbhypervtool.exe
```

For example, to remove a snapshot by specifying the name of the VM:

```bash
nbhypervtool.exe deleteNbuCheckpoints -vmname VM_name
```

Where `VM_name` is the name of the VM.

To remove a snapshot by specifying the GUID of the VM:

```bash
nbhypervtool.exe deleteNbuCheckpoints -vmsguid VM_guid
```

Where `VM_guid` is the GUID of the VM.

---

**Consistency level parameter (WMI)**

This option determines whether or not the I/O on the virtual machine is quiesced before NetBackup creates the snapshot.
Application Consistent Then Crash Consistent
NetBackup makes two attempts to quiesce I/O on the virtual machine for an application-consistent snapshot. If both attempts fail to create an application-consistent snapshot, NetBackup creates a crash-consistent snapshot and proceeds with the backup. (See the other two options for a description of application consistent and crash consistent.)

Application Consistent
This setting is the default. I/O on the virtual machine is quiesced before NetBackup creates the snapshot. Without quiescing file activity, data consistency in the snapshot cannot be guaranteed. If not consistent, the backed-up data may be of little or no value.
In the great majority of cases, you should accept the default.

Note: If the virtual machine is in the saved state or the paused state, it cannot be quiesced and the backup job fails. You must use one of the other Consistency level options.

Note these prerequisites for the Application consistent option:
- The latest version of Hyper-V integration services must be installed and running inside the VM.
- The Hyper-V integration services must be enabled in the VM settings.

Crash Consistent
The snapshot is created without quiescing I/O on the virtual machine. In this case, you must perform your own analysis for data consistency in the backed-up data.

Caution: In most cases, Veritas does not recommend Crash Consistent. With this setting, NetBackup cannot guarantee that all required data has been flushed to disk when the snapshot occurs. The data that is captured in the snapshot may be incomplete.

About the Exclude disk options for Virtual disk selection
The Hyper-V - Advanced Attributes dialog has an option called Virtual disk selection. The default setting is Include all disks. You should use this setting in most cases.
The other options are **Exclude boot disk** and **Exclude data disks**. These options are intended for the virtual machines that have multiple virtual disks. You should use these options with care.

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

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

The boot disk must include the following:

- The boot partition.
- The system directory (Windows system directory or Linux boot directory).

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

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

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

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

  - If the virtual machine has a boot disk but has no other disks, the boot disk is backed up. It is not excluded.
  - Adding a virtual disk and changing this option before the next backup can have unexpected results.
    See “Virtual disk selection options: an example to avoid” on page 51.

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

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

  - If the virtual machine has only one disk (such as C:), that drive is backed up. It is not excluded.
  - If the virtual machine's boot disk is an independent disk, and the virtual machine has a separate data disk, the boot disk is backed up. The restored boot disk however contains no data, because NetBackup cannot back up the data in an independent disk.
**Note:** When the virtual machine is restored from the backup, the virtual machine data for the data disk may be missing or incomplete.

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

The following topics contain important guidance on the exclude disk options:

See “Virtual disk selection options: an example to avoid” on page 51.

See “Restoring data from the backups that excluded the boot disk or data disks” on page 51.

### Virtual disk selection options: an example to avoid

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

### Restoring data from the backups that excluded the boot disk or data disks

If the policy's Virtual disk selection option excluded the boot disk or data disks, you can restore the backed-up data as follows:

- If Enable file recovery from VM backup was enabled on the backup policy: You can restore individual files from those portions of the virtual machine that the Virtual disk selection option did not exclude.

- If the Virtual disk selection option was set to Exclude boot disk: You can restore the virtual machine and move the restored data disk(s) to another virtual machine.

### 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>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
</table>
| **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 52. |
| **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 35.
Prerequisites for alternate client backup of a virtual machine (VSS)

With the VSS backup method, 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:

- Requires the VSS backup method.
- 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.
- 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 35.

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. Click the Hyper-V tab and select Hyper-V Host 2008 SP2 or later (VSS).
3. Click Perform off-host backup and select Alternate client from the Use pull-down. Enter the name of the alternate client in the Machine field.

4. On the Hyper-V tab, review the other options.

   See “Backup options on the Hyper-V tab” on page 42.

   Note the following:

   Enable file recovery from VM backup

   This option supports full and incremental schedules.

5. Create a schedule for the backup.
6 On the Clients tab, click New to select the virtual machine(s) to back up. See “Browse for Hyper-V virtual machines” on page 51.

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

7 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 162.

### 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 175.
- To back up databases or applications using NetBackup agents.
Configure Hyper-V Intelligent Policies

This chapter includes the following topics:

- About Hyper-V Intelligent Policy (automatic selection of virtual machines for backup)
- The basics of a NetBackup query rule
- Important notes on Hyper-V Intelligent Policy
- NetBackup requirements for Hyper-V Intelligent Policy
- Setting up Hyper-V Intelligent Policy: Task overview
- Options for selecting Hyper-V virtual machines
- Creating a Hyper-V policy for automatic virtual machine selection
- Editing a query in Basic Mode
- Using the Query Builder in Advanced Mode
- AND vs. OR in queries
- Examples for the NetBackup Query Builder
- The IsSet operator in queries
- About selecting virtual machines by means of multiple policies
- Order of operations in queries (precedence rules)
- Parentheses in compound queries
- Query rules for virtual machine Notes that contain a newline character
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 requirements for Hyper-V Intelligent Policy, see the appropriate version of the NetBackup 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

<table>
<thead>
<tr>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add new virtual machines</td>
<td>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.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Rule</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displayname Contains &quot;vm&quot;</td>
<td>NetBackup selects the virtual machines that have the characters vm anywhere in their display names.</td>
</tr>
<tr>
<td>Displayname EndsWith &quot;vm&quot;</td>
<td>NetBackup selects the virtual machines that have the characters vm at the end of their display names.</td>
</tr>
</tbody>
</table>
### Table 5-2  Examples of rules (continued)

<table>
<thead>
<tr>
<th>Rule</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HypervServer AnyOf &quot;hv1&quot;,&quot;hv2&quot;</td>
<td>NetBackup selects the virtual machines that reside on Hyper-V servers hv1 or hv2.</td>
</tr>
<tr>
<td>Powerstate Equal poweredOn</td>
<td>NetBackup selects only the virtual machines that are currently turned on.</td>
</tr>
</tbody>
</table>

### 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!

<table>
<thead>
<tr>
<th>Note!</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create rules carefully....</td>
<td>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 &quot;prod&quot;, NetBackup does that. Any virtual machine that is added to the environment with a host name containing &quot;prod&quot; is automatically selected and backed up when the policy runs. Virtual machines with the names that do not contain &quot;prod&quot; are not backed up. To have other virtual machines automatically backed up, you must change the query rules (or create additional policies).</td>
</tr>
<tr>
<td>Changes to the virtual environment can affect backup times.</td>
<td>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.</td>
</tr>
</tbody>
</table>
### Table 5-3  Important notes on automatic virtual machine selection!
*(continued)*

<table>
<thead>
<tr>
<th>Note!</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| 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 90.  
See “Effect of Primary VM identifier parameter on VM Name column in Test query results” on page 91. |
| A query test does not create the backup list. NetBackup creates the backup list when the backup runs. | 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. |

A query test does not create the backup list. NetBackup creates the backup list when the backup runs.
Table 5-3  Important notes on automatic virtual machine selection!
(continued)

<table>
<thead>
<tr>
<th>Note!</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The policy does not display a list of the virtual machines that are to be backed up. Use the Activity Monitor or OpsCenter.</td>
<td>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.</td>
</tr>
<tr>
<td>When you save the policy, the query rules are not validated.</td>
<td>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.</td>
</tr>
</tbody>
</table>

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 161.

- 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 (+), 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.

- Refer to the following Veritas document for support information and additional requirements for Hyper-V Intelligent Policy:
  Support for NetBackup 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>
<thead>
<tr>
<th>Steps to configure automatic selection</th>
<th>Description and notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configure a Hyper-V policy</td>
<td>Use the policy Attributes tab. See “Creating a Hyper-V policy from the NetBackup Policies utility” on page 35.</td>
</tr>
<tr>
<td>Set rules for virtual machine selection in the policy Query Builder</td>
<td>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 65. See “Options for selecting Hyper-V virtual machines” on page 63.</td>
</tr>
<tr>
<td>Test the rules</td>
<td>Click Test Query in the Query Builder on the Clients tab. Virtual machines are labeled as included or excluded, based on the rules. <strong>Note:</strong> The list of virtual machines is not saved in the Clients tab. <strong>Note:</strong> 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.</td>
</tr>
<tr>
<td>Execute a backup</td>
<td>When the policy executes, NetBackup consults the rules in the Query Builder, creates a list of virtual machines, and backs them up.</td>
</tr>
</tbody>
</table>
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 65.

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

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server Type</td>
<td>Select the type of environment in which NetBackup searches for the VMs to back up.</td>
</tr>
<tr>
<td>Server Name</td>
<td>Enter the name of the Hyper-V server or SCVMM server.</td>
</tr>
<tr>
<td></td>
<td>For a clustered environment, note:</td>
</tr>
<tr>
<td></td>
<td>■ Enter the name of the cluster (or one of the Hyper-V cluster nodes).</td>
</tr>
<tr>
<td></td>
<td>■ Set the NetBackup Legacy Network Service logon to the cluster user.</td>
</tr>
<tr>
<td></td>
<td>See “Changing the NetBackup Legacy Network Service logon (vnetd.exe) to the domain user account” on page 25.</td>
</tr>
<tr>
<td></td>
<td>■ The NetBackup master server should not be installed on any Hyper-V nodes in the cluster.</td>
</tr>
<tr>
<td></td>
<td>If the master server resides on one of the nodes, you cannot log on to the NetBackup Administration Console.</td>
</tr>
<tr>
<td>Select manually</td>
<td>Click this option and click New to manually enter virtual machines names, or to browse and select them from a list.</td>
</tr>
<tr>
<td></td>
<td>See “Browse for Hyper-V virtual machines” on page 51.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> The rest of the fields and options are for automatic selection of virtual machines.</td>
</tr>
</tbody>
</table>
Table 5-5  Virtual machine selection options (not available on the Backup Policy Configuration Wizard panel) (continued)

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select automatically through Hyper-V Intelligent Policy query</td>
<td>Click this option to allow NetBackup to automatically select virtual machines for backup based on the rules that you enter in the Query Builder.</td>
</tr>
</tbody>
</table>

Table 5-6  Query Builder

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
</table>
| 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 80.  
  See “Examples for the NetBackup Query Builder” on page 72. |
| Advanced | Places the Query Builder in Advanced Mode for manual entry of rules.  
  See “Using the Query Builder in Advanced Mode” on page 70.  
  See “Query Builder field reference” on page 80.  
  See “Examples for the NetBackup Query Builder” on page 72. |
| Basic | Returns the Query Builder from Advanced Mode to Basic Mode.  
  See “Query Builder field reference” on page 80. |
| 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). |
<p>| Remove | Deletes a query rule when in Basic Mode. Click on the rule and then click Remove. |</p>
<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Query</td>
<td>Click this option to test which virtual machines NetBackup selects based on the rules in the Query Builder.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> 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.</td>
</tr>
<tr>
<td></td>
<td>See “Test Query screen for Hyper-V” on page 88.</td>
</tr>
<tr>
<td></td>
<td>As an alternative, you can use the <code>nbdiscover</code> command to test a query. Refer to the <code>NetBackup Commands Reference Guide</code>.</td>
</tr>
</tbody>
</table>

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.
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 had used the Select manually option to select virtual machines, those virtual machines are removed from the policy.
4  Select the **Server Type**.

   ![Server Type select screen]

This option designates the type of environment in which NetBackup searches for the VMs to back up.

**Hyper-V Standalone/Cluster**  A standalone Hyper-V server or cluster.

**System Center Virtual Machine Manager**  An SCVMM server that manages Hyper-V servers or clusters.

5  For **Server Name**, enter the name of the Hyper-V server, cluster, or SCVMM server.

Another topic describes the requirements for SCVMM:

See “About backup of virtual machines in an SCVMM environment” on page 95.

For a clustered environment, note the following:

- Enter the name of the cluster (or one of the Hyper-V cluster nodes) in the **Server Name** 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 25.
- 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.

6  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 80.

The arrow icon resets the **Join**, **Field**, **Operator**, and **Value(s)** fields to blank.
7 Click the plus sign to add the rule to the **Query** pane.

8 Create more rules as needed.
   - See “**Query Builder field reference**” on page 80.
   - See “**Examples for the NetBackup Query Builder**” on page 72.

9 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 88.

10 To create queries manually (Advanced Mode) instead of using the pull-down menus, click **Advanced**.
   
   See “**Using the Query Builder in Advanced Mode**” on page 70.
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 65.

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 drop-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 71.
   See “Order of operations in queries (precedence rules)” on page 76.
   See “Parentheses in compound queries” on page 78.

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.

Since the available Query Builder keywords depend on the **Server Type** that is selected on the policy **Clients** tab, the following examples are in two groups:

- **Table 5-7** provides examples for server type **Hyper-V Standalone/Cluster**.
- **Table 5-8** provides examples for server type **System Center Virtual Machine Manager**.

<table>
<thead>
<tr>
<th>Table 5-7</th>
<th>Query Builder examples for server type <strong>Hyper-V Standalone/Cluster</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example query</strong></td>
<td><strong>Query result when backup job runs</strong></td>
</tr>
<tr>
<td>No query rules specified (Query pane is empty)</td>
<td>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 90.</td>
</tr>
<tr>
<td>Displayname Contains &quot;prod&quot;</td>
<td>All virtual machines with the display names that contain the string &quot;prod&quot; are added to the backup list. See “Effect of Primary VM identifier parameter on Selection column in Test Query results” on page 90.</td>
</tr>
</tbody>
</table>
### Table 5-7  Query Builder examples for server type **Hyper-V** Standalone/Cluster (continued)

<table>
<thead>
<tr>
<th>Example query</th>
<th>Query result when backup job runs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displayname AnyOf &quot;grayfox7&quot;, &quot;grayfox9&quot;</td>
<td>The virtual machines named &quot;grayfox7&quot; and &quot;grayfox9&quot; are added to the backup list. Note that each value must be enclosed in its own quotes, with a comma in between.</td>
</tr>
<tr>
<td>powerstate Equal &quot;poweredOn&quot;</td>
<td>Any virtual machine that is turned on is added to the backup list.</td>
</tr>
<tr>
<td>powerstate Equal &quot;poweredOn&quot; AND HypervServer Equal &quot;HV_serv1&quot;</td>
<td>Any virtual machine that is turned on and resides on Hyper-V server HV_serv1 is added to the backup list.</td>
</tr>
<tr>
<td>IsClustered Equal TRUE</td>
<td>Any virtual machine that is in a clustered Hyper-V server is added to the backup list.</td>
</tr>
<tr>
<td>Displayname Contains &quot;pre-prod&quot; AND IsClusteredEqual FALSE</td>
<td>Any virtual machine with a display name containing &quot;pre-prod&quot; and that is not in a clustered Hyper-V server is added to the backup list.</td>
</tr>
<tr>
<td>IsClustered Equal TRUE AND Notes Contains &quot;pre-prod&quot;</td>
<td>Adds to the backup list any virtual machine in a clustered Hyper-V server if the virtual machine has &quot;pre-prod&quot; in its Notes field.</td>
</tr>
<tr>
<td>Displayname StartsWith &quot;prod&quot; OR Notes Contains &quot;prod&quot;</td>
<td>Adds to the backup list any virtual machine with a display name starting with &quot;prod&quot; or with Notes that contain &quot;prod.&quot;</td>
</tr>
<tr>
<td>ConfigurationVersion Greater &quot;5&quot;</td>
<td>Adds to the backup list any virtual machine that has a VM configuration version greater than 5.</td>
</tr>
</tbody>
</table>

### Table 5-8  Query Builder examples for server type **System Center Virtual Machine Manager**

<table>
<thead>
<tr>
<th>Example query</th>
<th>Query result when backup job runs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name StartsWith &quot;prod&quot;</td>
<td>Adds to the backup list any VMs that have a display name that starts with &quot;prod&quot;. <strong>Note:</strong> For VMs that reside under SCVMM, a Hyper-V Intelligent policy can back up VMs by their host name even if they are powered off. In this example: even if the policy's <strong>Primary VM identifier</strong> is set to <strong>VM hostname</strong>, VMs are added to the backup list whether they are powered on or powered off.</td>
</tr>
<tr>
<td>ComputerName Contains &quot;VM&quot;</td>
<td>Adds to the backup list any VMs that have a network host name that contains &quot;VM&quot;. See the note in this table for the example <strong>Name StartsWith &quot;prod&quot;</strong>.</td>
</tr>
</tbody>
</table>
Table 5-8  Query Builder examples for server type **System Center Virtual Machine Manager** *(continued)*

<table>
<thead>
<tr>
<th>Example query</th>
<th>Query result when backup job runs</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMHost AnyOf &quot;hv1&quot;,&quot;hv2&quot; AND Description Contains &quot;pre-prod&quot;</td>
<td>Adds to the backup list any VMs that reside on Hyper-V servers &quot;hv1&quot; or &quot;hv2&quot; if the VM has &quot;pre-prod&quot; in its <strong>Description</strong> field. The SCVMM <strong>Description</strong> field is similar to the VM's <strong>Notes</strong> field in Hyper-V.</td>
</tr>
<tr>
<td>Generation Equal &quot;2&quot;</td>
<td>Adds to the backup list any VMs of Generation 2.</td>
</tr>
<tr>
<td>IsUndergoingLiveMigration Equal FALSE</td>
<td>Adds to the backup list any VM that is not in live migration.</td>
</tr>
<tr>
<td>VirtualMachineState Equal &quot;Running&quot;</td>
<td>Adds to the backup list any VM that is running.</td>
</tr>
<tr>
<td>Cloud Contains &quot;cloud9&quot; AND HasSharedStorage Equal TRUE</td>
<td>Adds to the backup list any VM that meets the following: the VM is part of an SCVMM cloud that contains cloud9 in its name, if the VM is in a cluster that has shared storage.</td>
</tr>
<tr>
<td>IsHighlyAvailable Equal TRUE AND IsFaultTolerant Equal FALSE</td>
<td>Adds to the backup list any VM that resides in a CSV cluster if the VM is not marked for fault tolerance.</td>
</tr>
<tr>
<td>VMConfigurationVersion Greater &quot;5&quot;</td>
<td>Adds to the backup list any virtual machine that has a VM configuration version greater than 5.</td>
</tr>
</tbody>
</table>

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 5-9**  Examples of queries with the IsSet operator

<table>
<thead>
<tr>
<th>Query rules with IsSet operator</th>
<th>Effect of the query on virtual machine selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displayname Contains &quot;prod&quot; AND Notes IsSet</td>
<td>INCLUDED: Any virtual machine with a display name that contains the string &quot;prod&quot; 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.</td>
</tr>
</tbody>
</table>
Table 5-9  Examples of queries with the IsSet operator (continued)

<table>
<thead>
<tr>
<th>Query rules with IsSet operator</th>
<th>Effect of the query on virtual machine selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster Contains &quot;dev&quot;</td>
<td>INCLUDED: Any virtual machine in a cluster that has a name that contains the string &quot;dev&quot; if the virtual machine also has Notes.</td>
</tr>
<tr>
<td>AND Notes IsSet</td>
<td>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 &quot;dev&quot;.</td>
</tr>
<tr>
<td></td>
<td>Without Notes in this query, virtual machines without Notes cannot be excluded.</td>
</tr>
</tbody>
</table>

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 90.

### 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 5-10  Three policies that back up the virtual machines in phases**

<table>
<thead>
<tr>
<th>Policy</th>
<th>Query Builder rules</th>
<th>Backup result</th>
</tr>
</thead>
<tbody>
<tr>
<td>First policy</td>
<td>Notes IsSet</td>
<td>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.</td>
</tr>
<tr>
<td>Primary VM identifier parameter: VM hostname</td>
<td>Notes IsSet</td>
<td>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.</td>
</tr>
</tbody>
</table>
Table 5-10

Three policies that back up the virtual machines in phases (continued)

<table>
<thead>
<tr>
<th>Policy</th>
<th>Query Builder rules</th>
<th>Backup result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second policy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary VM identifier parameter: VM display name</td>
<td>NOT Notes IsSet AND IsClustered Equal 'TRUE'</td>
<td>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.</td>
</tr>
<tr>
<td>Third policy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary VM identifier parameter: VM GUID</td>
<td>NOT Notes IsSet AND IsClustered NotEqual 'TRUE'</td>
<td>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.</td>
</tr>
</tbody>
</table>

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 90.

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 5-11

Order of operations

<table>
<thead>
<tr>
<th>Operation</th>
<th>Description</th>
<th>Precedence</th>
</tr>
</thead>
<tbody>
<tr>
<td>!x</td>
<td>Produces the value 0 if x is true (nonzero) and the value 1 if x is false (0).</td>
<td>7</td>
</tr>
<tr>
<td>x Contains y</td>
<td>Does y exist somewhere in x</td>
<td>6</td>
</tr>
<tr>
<td>x.StartsWith y</td>
<td>Does x start with y</td>
<td>6</td>
</tr>
<tr>
<td>x.EndsWith y</td>
<td>Does x end with y</td>
<td>6</td>
</tr>
<tr>
<td>x AnyOf list</td>
<td>Does x appear in list</td>
<td>6</td>
</tr>
<tr>
<td>x Greater y</td>
<td>Is x greater than y</td>
<td>5</td>
</tr>
</tbody>
</table>
### Table 5-11  Order of operations (continued)

<table>
<thead>
<tr>
<th>Operation</th>
<th>Description</th>
<th>Precedence</th>
</tr>
</thead>
<tbody>
<tr>
<td>x GreaterEqual y</td>
<td>Is x greater than or equal to y</td>
<td>5</td>
</tr>
<tr>
<td>x Less y</td>
<td>Is x less than y</td>
<td>5</td>
</tr>
<tr>
<td>x LessEqual y</td>
<td>Is x less than or equal to y</td>
<td>5</td>
</tr>
<tr>
<td>x Equal y</td>
<td>Is x equal to y</td>
<td>4</td>
</tr>
<tr>
<td>x NotEqual y</td>
<td>Is x not equal to y</td>
<td>4</td>
</tr>
<tr>
<td>Not x</td>
<td>operator produces the value 0 if x is true (nonzero) and the value 1 if x is false (0).</td>
<td>3</td>
</tr>
<tr>
<td>x And y</td>
<td>True if both x and y are true</td>
<td>2</td>
</tr>
<tr>
<td>x OR y</td>
<td>True if either x or y are true</td>
<td>1</td>
</tr>
</tbody>
</table>

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 78.

- 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 NotEqual.

  See “Using the Query Builder in Advanced Mode” on page 70.
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.

**Table 5-12  Examples of compound queries with and without parentheses**

<table>
<thead>
<tr>
<th>Example query</th>
<th>The following virtual machines are selected</th>
</tr>
</thead>
</table>
| `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 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 5-13 describes the drop-down fields and options for creating rules in the Query Builder.

<table>
<thead>
<tr>
<th>Query Builder drop-down fields</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Join</td>
<td>Selects a connector to join rules. For the first rule, choices are blank (none) or <strong>NOT</strong>. After you add a rule, the available connectors are <strong>AND, AND NOT, OR, OR NOT</strong>.</td>
</tr>
<tr>
<td>Field</td>
<td>Selects a parameter on which to build the rule. See Table 5-14 on page 81.</td>
</tr>
<tr>
<td>Operator</td>
<td>Selects an operator. See Table 5-16 on page 86.</td>
</tr>
<tr>
<td>Value(s)</td>
<td>Specifies value(s) for the <strong>Field</strong> parameter. The value(s) you enter must be enclosed in single quotes or double quotes. You can specify multiple comma-separated values. See Table 5-17 on page 87.</td>
</tr>
</tbody>
</table>

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):

![List of possible values for: Displayname](image)

Adds the current drop-down selections to the **Query** pane as a new rule.
Table 5-13  Query Builder drop-down options: Join, Field, Operator, Value(s) (continued)

<table>
<thead>
<tr>
<th>Query Builder drop-down fields</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Blanks out the drop-down fields.</td>
</tr>
</tbody>
</table>

Field (keywords)

The following tables describe the keywords available in the Field drop-down. The tables also indicate 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).

The available keywords depend on the Server Type that is selected:

- For a description of the Hyper-V Standalone/Cluster keywords, see Table 5-14.
- For a description of the System Center Virtual Machine Manager keywords, see Table 5-15.

Table 5-14  For server type Hyper-V Standalone/Cluster: Keywords in the Field drop-down

<table>
<thead>
<tr>
<th>Field keyword</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ConfigurationVersion</td>
<td>Numeric</td>
<td>The configuration version of the virtual machine. This option requires that the NetBackup master server and the NetBackup client are at 8.0 or later.</td>
</tr>
<tr>
<td>Displayname</td>
<td>Alphanumeric string</td>
<td>The virtual machine's display name. Values are case-sensitive.</td>
</tr>
<tr>
<td>HypervServer</td>
<td>Alphanumeric string</td>
<td>The name of the Hyper-V server. Values are not case-sensitive.</td>
</tr>
<tr>
<td>IsClustered</td>
<td>Boolean</td>
<td>TRUE if the virtual machine resides in a Hyper-V server that is in a cluster.</td>
</tr>
</tbody>
</table>
### Table 5-14
For server type **Hyper-V Standalone/Cluster**: Keywords in the Field drop-down (continued)

<table>
<thead>
<tr>
<th>Field keyword</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notes</td>
<td>Alphanumeric</td>
<td>A note that was recorded about the virtual machine, in the virtual machine’s Summary tab in Hyper-V Manager. Values are case-sensitive.</td>
</tr>
<tr>
<td>Powerstate</td>
<td>Alphabetic</td>
<td>The state of the virtual machine. Values are poweredOff, poweredOn, suspended, starting, offCritical.</td>
</tr>
</tbody>
</table>

To make entries in a virtual machine’s Notes field: right-click on the virtual machine, then click **Settings > Management > Name**.

### Table 5-15
For server type **System Center Virtual Machine Manager**: Keywords in the Field drop-down

<table>
<thead>
<tr>
<th>Field keyword</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BackupEnabled</td>
<td>Boolean</td>
<td>TRUE if the BackupEnabled property is enabled in Integration Services.</td>
</tr>
<tr>
<td>Cloud</td>
<td>Alphanumeric</td>
<td>The name of the SCVMM cloud that the VM is a part of. Values are not case-sensitive.</td>
</tr>
<tr>
<td>CloudVMRoleName</td>
<td>Alphanumeric</td>
<td>The name of the VM role for the SCVMM cloud. Values are not case-sensitive.</td>
</tr>
<tr>
<td>Field keyword</td>
<td>Data type</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------------</td>
<td>-------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>ComputerName</td>
<td>Alphanumeric string</td>
<td>The network host name of the VM. Values are not case-sensitive.</td>
</tr>
<tr>
<td>CostCenter</td>
<td>Alphanumeric string</td>
<td>The name of the VM's cost center. Values are not case-sensitive.</td>
</tr>
<tr>
<td>Description</td>
<td>Alphanumeric string</td>
<td>The VM's description in SCVMM. This field is similar to the VM's Notes field in Hyper-V. Values are case-sensitive. Note: If the VM's description field contains a newline character, the Query Builder's folder icon for browsing may not return the correct values. See “Query rules for virtual machine Notes that contain a newline character” on page 78.</td>
</tr>
<tr>
<td>DRState</td>
<td>Alphanumeric string</td>
<td>The disaster recovery state of the VM. Values are Disabled, Enabled.</td>
</tr>
<tr>
<td>Generation</td>
<td>Numeric string</td>
<td>The numeric Generation (or type) of the VM that the SCVMM server manages.</td>
</tr>
<tr>
<td>HasPassThroughDisk</td>
<td>Boolean</td>
<td>TRUE if the VM has a pass-through disk configured.</td>
</tr>
<tr>
<td>HasSharedStorage</td>
<td>Boolean</td>
<td>TRUE if the VM is in a cluster that has shared storage configured.</td>
</tr>
<tr>
<td>HasVirtualFibreChannelAdapters</td>
<td>Boolean</td>
<td>TRUE if the VM has virtual Fibre Channel adapters. These adapters enable Hyper-V VMs to have direct access to Fibre Channel SAN array resources.</td>
</tr>
<tr>
<td>HostGroupPath</td>
<td>Alphanumeric string</td>
<td>The complete host group path to the VM. Values are not case-sensitive.</td>
</tr>
<tr>
<td>IsDREnabled</td>
<td>Boolean</td>
<td>TRUE if Microsoft Azure Site Recovery Provider (formerly Hyper-V Recovery Manager) manages the VM's disaster recovery.</td>
</tr>
<tr>
<td>IsFaultTolerant</td>
<td>Boolean</td>
<td>TRUE if the VM is marked for fault tolerance (if it can run without interruption in the case of a host failure).</td>
</tr>
<tr>
<td>Field keyword</td>
<td>Data type</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------</td>
<td>--------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>IsHighlyAvailable</td>
<td>Boolean</td>
<td>TRUE if the virtual machine resides in a Hyper-V server that is in a CSV cluster.</td>
</tr>
<tr>
<td>IsPrimaryVM</td>
<td>Boolean</td>
<td>TRUE if the VM is a primary VM that is configured to be replicated to a secondary VMM site.</td>
</tr>
<tr>
<td>IsRecoveryVM</td>
<td>Boolean</td>
<td>TRUE if the VM is a replicated copy (of the primary VM) at a secondary Virtual Machine Manager (VMM) site.</td>
</tr>
<tr>
<td>IsTestReplicaVM</td>
<td>Boolean</td>
<td>TRUE if the VM is a replicated copy that is designated in the Microsoft Azure Site Recovery Provider (formerly Hyper-V Recovery Manager) for failover test. Test failover is initiated on a replica VM to test the virtualized workload without interrupting the production site or ongoing replication. You can exclude such VMs from the backup by creating queries such as: <code>IsTestReplicaVM Equal 'FALSE'</code></td>
</tr>
<tr>
<td>IsUndergoingLiveMigration</td>
<td>Boolean</td>
<td>TRUE if the VM is in migration from one Hyper-V server to another by means of the Hyper-V live migration feature.</td>
</tr>
<tr>
<td>Name</td>
<td>Alphanumeric string</td>
<td>The VM's display name in SCVMM. Values are case-sensitive.</td>
</tr>
<tr>
<td>OperatingSystem</td>
<td>Alphanumeric string</td>
<td>The VM's guest operating system. Values are not case-sensitive.</td>
</tr>
<tr>
<td>Owner</td>
<td>Alphanumeric string</td>
<td>The VM owner’s name. Values are not case-sensitive.</td>
</tr>
<tr>
<td>RecoveryPointObjective</td>
<td>Numeric</td>
<td>The recovery point objective (RPO) value for this VM. RPO is the maximum acceptable data loss as measured in time. In backup storage, RPO is the maximum age of the data that is required to resume normal operations if a failure occurs. For example, if the RPO is set to 30 minutes, then a backup of the system is required every 30 minutes.</td>
</tr>
<tr>
<td>Tag</td>
<td>Alphanumeric string</td>
<td>The name of the tag. A tag is a string for logical grouping of VMs in the NetBackup Administration Console. Values are not case-sensitive.</td>
</tr>
<tr>
<td>TotalSize</td>
<td>Numeric</td>
<td>The total size on disk (in bytes) of all the VM's VHDs.</td>
</tr>
<tr>
<td>Field keyword</td>
<td>Data type</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>UserRole</td>
<td>Alphanumeric</td>
<td>The user role the VM is a part of, such as Administrator, Fabric Administrator, or Tenant Administrator. Values are not case-sensitive.</td>
</tr>
<tr>
<td>VirtualMachineState</td>
<td>Alphanumeric</td>
<td>The power state of the virtual machine. Values are not case-sensitive. Hyper-V has many possible values for the VM state, such as PowerOff and Running. You can use the browse icon to list the current power states of the VMs in the SCVMM environment:</td>
</tr>
</tbody>
</table>
| VMConfigurationVersion| Numeric      | The configuration version of the virtual machine. Note the following:  
- This option requires that the NetBackup master server and the NetBackup client are at 8.0 or later.  
- This option works only with SCVMM 2016 and later. In SCVMM 2012, the VM's configuration version is not available, so NetBackup is unable to retrieve the configuration version.  
If the NetBackup master server protects SCVMM 2016 as well as SCVMM 2012, you can use VMConfigurationVersion with the IsSet operator. For example:  
\[ \text{Name Contains "Production" AND} \]
\[ \text{VMConfigurationVersion IsSet AND} \]
\[ \text{VMConfigurationVersion Greater "5.0"} \]
In this example, no VMs in SCVMM 2012 are selected, because the VMConfigurationVersion IsSet rule returns "false." On SCVMM 2016, VMConfigurationVersion IsSet returns "true": The query can select any VM that contains "Production" in its name and is at a configuration version later than 5.0. |
### Table 5-15: Keywords in the Field drop-down (continued)

<table>
<thead>
<tr>
<th>Field keyword</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMHost</td>
<td>Alphanumeric string</td>
<td>The name of the Hyper-V host for this VM. Values are not case-sensitive.</td>
</tr>
<tr>
<td>VMResource</td>
<td>Alphanumeric string</td>
<td>The resource for a highly available VM. Values are not case-sensitive.</td>
</tr>
<tr>
<td>VMResourceGroup</td>
<td>Alphanumeric string</td>
<td>The resource group for a highly available VM. Values are not case-sensitive.</td>
</tr>
</tbody>
</table>

### Operators

Table 5-16 describes the operators available in the Operator drop-down.

### Table 5-16: Operators in the Operator drop-down

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AnyOf</td>
<td>Matches any of the specified values in the Value(s) field.</td>
</tr>
<tr>
<td></td>
<td>For example: If the display names in the Value(s) field are &quot;vm01&quot;,&quot;vm02&quot;,&quot;vm03&quot;, 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 &quot;vm01A&quot; is not a match.</td>
</tr>
<tr>
<td>Contains</td>
<td>Matches the value in the Value(s) field wherever that value occurs in the string.</td>
</tr>
<tr>
<td></td>
<td>For example: If the Value(s) entry is &quot;dev&quot;, Contains matches strings such as &quot;01dev&quot;, &quot;01dev99&quot;, &quot;devOP&quot;, and &quot;Development_machine&quot;.</td>
</tr>
<tr>
<td>EndsWith</td>
<td>Matches the value in the Value(s) field when it occurs at the end of a string.</td>
</tr>
<tr>
<td></td>
<td>For example: If the Value(s) entry is &quot;dev&quot;, EndsWith matches the string &quot;01dev&quot; but not &quot;01dev99&quot;, &quot;devOP&quot;, or &quot;Development_machine&quot;.</td>
</tr>
<tr>
<td>Equal</td>
<td>Matches only the value that is specified in the Value(s) field.</td>
</tr>
<tr>
<td></td>
<td>For example: If the display name to search for is &quot;VMtest27&quot;, Equal matches virtual machine names such as &quot;VMTest27&quot; or &quot;vmtest27&quot; or &quot;vmTEST27&quot;, and so forth. The name &quot;VMtest28&quot; is not matched.</td>
</tr>
<tr>
<td>Greater</td>
<td>Matches any value that is greater than the specified Value(s), according to the ASCII collating sequence.</td>
</tr>
<tr>
<td>GreaterEqual</td>
<td>Matches any value that is greater than or equal to the specified Value(s), according to the ASCII collating sequence.</td>
</tr>
</tbody>
</table>
### Table 5-16 Operators in the Operator drop-down (continued)

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IsSet</td>
<td>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 74. See &quot;Effect of Primary VM identifier parameter on Selection column in Test Query results&quot; on page 90. See “Test Query: Failed virtual machines” on page 89.</td>
</tr>
<tr>
<td>Less</td>
<td>Matches any value that is less than the specified Value(s), according to the ASCII collating sequence.</td>
</tr>
<tr>
<td>LessEqual</td>
<td>Matches any value that is less than or equal to the specified Value(s), according to the ASCII collating sequence.</td>
</tr>
<tr>
<td>NotEqual</td>
<td>Matches any value that is not equal to the value in the Value(s) field.</td>
</tr>
<tr>
<td>StartsWith</td>
<td>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 &quot;box&quot;, StartsWith matches the string &quot;box_caz&quot; but not &quot;flat_box&quot;.</td>
</tr>
</tbody>
</table>

### Value(s)

Table 5-17 describes the characters that can be entered in the Value(s) field. The Field keyword determines case sensitivity.

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

### Table 5-17 Characters you can enter for Value(s)

<table>
<thead>
<tr>
<th>Character types</th>
<th>String characters allowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alphanumerics</td>
<td>A to Z, a to z, 0 to 9 (decimal), and the following special characters: $, % &amp; * ( ) ^ _ = + [ ] { }</td>
</tr>
</tbody>
</table>
Table 5-17  Characters you can enter for Value(s) (continued)

<table>
<thead>
<tr>
<th>Character types</th>
<th>String characters allowed</th>
</tr>
</thead>
</table>
| 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 5-18 Test Query screen fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test query for policy</td>
<td>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.</td>
</tr>
<tr>
<td>Test Query Results</td>
<td>VM Name: Shows the display name of all discovered virtual machines. Selection: Lists the virtual machines that were discovered, as follows:</td>
</tr>
<tr>
<td></td>
<td>■ INCLUDED: The virtual machine matches the rules in the query.</td>
</tr>
<tr>
<td></td>
<td>■ EXCLUDED: The virtual machine does not match the rules in the query.</td>
</tr>
<tr>
<td></td>
<td>■ 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 =</td>
</tr>
<tr>
<td></td>
<td>See “Test Query: Failed virtual machines” on page 89.</td>
</tr>
<tr>
<td></td>
<td>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 74.</td>
</tr>
<tr>
<td>Included:</td>
<td>The bottom of the screen gives a tally of how many virtual machines were included, excluded, or failed in the test.</td>
</tr>
<tr>
<td>Excluded:</td>
<td></td>
</tr>
<tr>
<td>Failed:</td>
<td></td>
</tr>
</tbody>
</table>

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 74.

**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 5-19  Effect of Primary VM identifier parameter and query rules on test query results

<table>
<thead>
<tr>
<th>Primary VM identifier setting on Hyper-V policy tab</th>
<th>Query rule in Query Builder</th>
<th>Test query result</th>
</tr>
</thead>
<tbody>
<tr>
<td>VM hostname</td>
<td>Displayname Contains &quot;VM&quot;</td>
<td>INCLUDED: Any virtual machines that have a host name and that have a display name that contains &quot;VM&quot;. EXCLUDED: Any virtual machines that do not have a display name that contains &quot;VM&quot;. FAILED: Any virtual machines that have a display name that contains &quot;VM&quot; 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.</td>
</tr>
<tr>
<td>VM display name</td>
<td>Displayname Contains &quot;VM&quot;</td>
<td>INCLUDED: Any virtual machines with the display names that contain &quot;VM&quot;. 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.</td>
</tr>
</tbody>
</table>

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.
NetBackup Hyper-V for SCVMM

This chapter includes the following topics:

- About backup of virtual machines in an SCVMM environment
- Notes on NetBackup for Hyper-V with SCVMM
- Creating a query to back up VMs in a localized SCVMM environment

About backup of virtual machines in an SCVMM environment

A NetBackup Hyper-V Intelligent policy can protect VMs that are managed by Microsoft's System Center Virtual Machine Manager (SCVMM). By means of queries in the policy's Query Builder, a policy can discover and back up the VMs on all the Hyper-V servers that SCVMM manages.

**Note:** To restore the VMs, you can use the NetBackup Backup, Archive, and Restore interface, or the NetBackup Add-in for SCVMM.

*Figure 6-1* shows NetBackup in an SCVMM environment. SCVMM manages multiple Hyper-V servers. A NetBackup policy can discover and back up the VMs on all the Hyper-V servers.
Figure 6-1 NetBackup for Hyper-V under SCVMM

Note: This SCVMM feature requires NetBackup's Hyper-V Intelligent Policy (automatic selection of VMs through a predefined query).

Note: This SCVMM feature adds a new capability: For VMs that reside under SCVMM, NetBackup can identify and back up VMs by their host name even if they are powered off.

The following topics contain further information on NetBackup for Hyper-V with SCVMM:

See “Creating a Hyper-V policy for automatic virtual machine selection” on page 65.

See “Examples for the NetBackup Query Builder” on page 72.

See “Query Builder field reference” on page 80.

See “Notes on NetBackup for Hyper-V with SCVMM” on page 96.

Notes on NetBackup for Hyper-V with SCVMM

Note the following about NetBackup for Hyper-V with SCVMM:

- Requires SCVMM 2012 R2 or later.

For a list of supported versions of SCVMM, see the appropriate version of the NetBackup Software Compatibility List available from the following location:
NetBackup Master Compatibility List

- NetBackup client software must be installed on the SCVMM server and on each Hyper-V server.
- Certain kinds of VMs are excluded from the backup list when the NetBackup Hyper-V policy runs:
  - Hyper-V VMs that are marked for deletion.
  - Hyper-V VM templates.
  - Hyper-V VMs that are stored on an SCVMM library server.
  - Any VMs that do not reside on a Hyper-V server, such as VMware VMs.

---

**Note:** SCVMM can manage non-Hyper-V VMs. NetBackup for Hyper-V does not back up these VMs. To back up VMware VMs for example, use NetBackup for VMware.

The **Test Query** dialog lists these types of VMs as **Excluded**, with a message that explains the reason for the exclusion. (The **Test Query** option is available on the policy **Clients** tab.)

- Changes that are made through Hyper-V Manager on individual Hyper-V hosts or clusters can take up to 24 hours to be reflected in SCVMM. This delay is due to the Microsoft SCVMM refresh cycle. In an SCVMM environment, Microsoft recommends making VM configuration changes through SCVMM (not through the Hyper-V Manager on individual hosts or clusters). Changes that are made through the SCVMM Console are reflected immediately in SCVMM.
- In an SCVMM environment, the VM GUID is referred to as the **VM ID**.

---

**Caution:** If the SCVMM environment includes multiple VMs that have the same VM ID, each SCVMM refresh cycle reports only one of the VMs. Any other VM with the same VM ID is not visible. The NetBackup policy can back up only the VM that is currently reported or visible. Any other VM that has the same VM ID is not visible and is not backed up.

To make sure that NetBackup can discover and back up all VMs, avoid duplicate VM IDs in the SCVMM environment.

---

- To back up VMs in an SCVMM environment, the NetBackup policy must use queries to select the VMs automatically (Hyper-V Intelligent Policy). If the query includes localized (non-English) values, the policy may not be able to select and back up the VMs.
Creating a query to back up VMs in a localized SCVMM environment

This topic describes how to create a query in a Hyper-V Intelligent Policy to back up VMs in a localized (non-English) SCVMM environment.

To create a Hyper-V Intelligent Policy for a non-localized (English) SCVMM environment, see the following topic:

See “Creating a Hyper-V policy for automatic virtual machine selection” on page 65.

To create a query to back up VMs in a localized SCVMM environment

1. In the policy’s Query Builder, select from the Join, Field, and Operator pull-downs to begin building the query.

2. Use the browse icon to retrieve the possible values for the Field keyword.

   The browse icon returns the English values. For example:

   ![Query Builder screenshot](image)

   In this example, the browse icon returned the possible values for the VirtualMachineState keyword.
3 Click the value to use in the query.

4 Click the plus sign to add a query with that value.
Windows Server failover cluster support

This chapter includes the following topics:

- Notes on CSV backup and restore
- Creating a policy for virtual machines in a cluster
- Location of the restored virtual machine in a cluster
- Virtual machine maintenance after a restore
- Hyper-V restore may fail if the VM was created on a CSV and the CSV is a reparse point on the destination drive


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 104.

- 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 105.

**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 with VSS)” on page 45.

- 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 107.

- 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 35.

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

1. Select **Hyper-V** as the policy type.
2. Click the **Hyper-V** tab and select the backup method (VSS or WMI).
3 For the VSS backup method only: 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 of non-VSS VMs (Hyper-V with VSS)" on page 44.

- **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 with VSS)" on page 45.

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

5 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 65.
  - See "Changing the NetBackup Legacy Network Service logon (vnetd.exe) to the domain user account" on page 25.

6 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.

7 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 7-1: Decision chart for restore to original location in a cluster

<table>
<thead>
<tr>
<th>Is the virtual machine status HA at time of backup?</th>
<th>Is the virtual machine status HA at time of restore?</th>
<th>Virtual machine is restored to this node (to non-HA state):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>The restore behavior depends on the backup method that was used to make the backup (WMI or VSS):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ WMI: Restored to node on which the virtual machine resided at the time of backup.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ At the time of restore, if virtual machine resides on a different node than where it resided when backed up, the restore fails.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ VSS: Restored to node that owns the virtual machine at the time of restore.</td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>For both WMI and VSS:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Restored to node on which the virtual machine resided at the time of backup.</td>
</tr>
<tr>
<td>Yes</td>
<td>Virtual machine does not exist.</td>
<td>For both WMI and VSS:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Restored to node on which the virtual machine resided at the time of backup.</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
<td>For both WMI and VSS:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Restored to node on which the virtual machine resided at the time of backup.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>At the time of restore, if virtual machine resides on a different node than where it resided when backed up, the restore fails.</td>
</tr>
<tr>
<td>No</td>
<td>No</td>
<td>For both WMI and VSS:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Restored to node on which the virtual machine resided at the time of backup.</td>
</tr>
<tr>
<td>No</td>
<td>Virtual machine does not exist.</td>
<td>For both WMI and VSS:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Restored to node on which the virtual machine resided at the time of backup.</td>
</tr>
</tbody>
</table>

**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 106.
- 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 Windows Server Failover Cluster (WSFC) 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 WSFC software automatically removes the virtual machine’s group resources as well, as described in the following table.

<table>
<thead>
<tr>
<th>Is the HA virtual machine based on a CSV volume?</th>
<th>These group resources are removed along with the existing virtual machine:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>VM resource, VM configuration resource, and disk resource are removed.</td>
</tr>
<tr>
<td>No</td>
<td>VM resource and VM configuration resource are removed. The existing disk resource is retained as part of the cluster group.</td>
</tr>
</tbody>
</table>
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.
Back up and restore Hyper-V

This chapter includes the following topics:

- Backing up Hyper-V virtual machines
- WMI backup method: State of the virtual machine before and after restore
- Notes on individual file restore
- Notes on full virtual machine restore
- About restoring individual files
- Restoring individual files to a host that has a NetBackup client
- Restore Marked Files dialog for restore of individual files
- Restoring individual files to a shared location on the virtual machine
- Restoring the full Hyper-V virtual machine
- Restore Marked Files dialog for restore of the Hyper-V virtual machine
- About restoring common files
- The BAR interface may list Hyper-V snapshot files when you browse to restore Hyper-V VM files

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 35.

See “Creating a Hyper-V policy from the Policy Configuration Wizard” on page 34.

**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.

   ![Manual Backup Dialog](image)

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**.
WMI backup method: State of the virtual machine before and after restore

Unlike the VSS backup method, the WMI method (for Hyper-V Server 2016 and later) does not employ online vs offline backups.

Table 8-1  WMI backup method: State of the virtual machine before and after restore

<table>
<thead>
<tr>
<th>State at the time of backup</th>
<th>State after restore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running</td>
<td>Off</td>
</tr>
<tr>
<td>Saved</td>
<td>Saved</td>
</tr>
<tr>
<td>Paused</td>
<td>Off</td>
</tr>
<tr>
<td>Off</td>
<td>Off</td>
</tr>
</tbody>
</table>

Notes on individual file restore

Note the following:

- If you are running antivirus protection on Hyper-V virtual machines, Veritas 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 115.

- 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.

- 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 165.

- 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:
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 129.

- For Linux, additional notes apply.
  See “Notes on Linux virtual machines” on page 23.

- 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 162.

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 virtual disk files on the destination server, the virtual disk 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.

(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 155.

- 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 162.

- 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.

### 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 122.

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

See “Creating a Hyper-V policy from the NetBackup Policies utility” on page 35.

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 120.
See “Setting up NetBackup Client Service for restore to a shared location on
the virtual machine” on page 121.

- 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 115.

- 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 115.

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 112.
See “Notes on individual file restore” on page 110.

**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. In the NetBackup Administration Console, click **Backup, Archive, and Restore**.
2. Click **Actions > 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**: 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 120.
   - **Policy type for restores**: Enter **Hyper-V**.
3. Click **OK**.
4. Under **Restore type**, click **Normal Backups**.
5. Enter a date and time range within which to search for backups.
6. Under **Directory Structure** and **Contents of selected directory**, select the files to restore.
7. Click **Actions > Restore**.
8. 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 117. See “Restoring individual files to a shared location on the virtual machine” on page 120.

- **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.

9. Click **Start Restore**.

**Restore Marked Files dialog for restore of individual files**

Select from the following options on the **Restore Marked Files** dialog.
Table 8-2 Options for individual file restore on the Restore Marked Files dialog box

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restore Destination Choices</td>
<td>Select from the following options.</td>
</tr>
<tr>
<td>Restore everything to its original location</td>
<td>Restores the folders and files to the location where they resided when the backup occurred.</td>
</tr>
</tbody>
</table>
## Table 8-2
Options for individual file restore on the Restore Marked Files dialog box (continued)

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Restore everything to a different location (maintaining existing structure)</strong></td>
<td>Restores the folders and files with their original hierarchy, but to a different location. Use the <strong>Destination</strong> field to enter the restore location. Click <strong>Browse</strong> 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.</td>
</tr>
<tr>
<td><strong>Restore individual folders and files to different locations (double-click to modify)</strong></td>
<td>Restores the folders and files to individually designated locations. To designate a restore destination for each source folder, double click on its row.</td>
</tr>
<tr>
<td><strong>Create and restore to a new virtual hard disk file</strong></td>
<td>This option is not implemented.</td>
</tr>
<tr>
<td><strong>Restore options</strong></td>
<td>Most of these options do not apply to the restore of a Hyper-V virtual machine.</td>
</tr>
<tr>
<td><strong>Overwrite existing files</strong></td>
<td>If any of the files to restore already exist at the restore destination, the restore overwrites the existing files.</td>
</tr>
<tr>
<td><strong>Do not restore the file</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Override default job priority</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Media Server</strong></td>
<td>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. <strong>Note:</strong> If the storage unit that contains the backup image is not shared with multiple media servers, this option is grayed out.</td>
</tr>
</tbody>
</table>
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.


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 121.

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 112.

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.

![Image of NetBackup History pane]

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.

![Image of NetBackup History pane]

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 123.

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 for VSS” on page 171.

---

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

Select from the following options on the Restore Marked Files dialog box.
**Note:** The available options depend on the backup method that was used to make the backup: WMI or VSS.
<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyper-V virtual machine GUID</td>
<td>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. In an SCVMM environment, the VM GUID is referred to as the VM ID.</td>
</tr>
<tr>
<td>Restore Options</td>
<td>See the following fields.</td>
</tr>
<tr>
<td>Restore to original Hyper-V server</td>
<td>Restores the virtual machine to its original location on the original Hyper-V server.</td>
</tr>
<tr>
<td>Restore to different location on the original or different Hyper-V server</td>
<td>Restores the virtual machine to a different location on the original Hyper-V server, or restores it to a different Hyper-V server.</td>
</tr>
<tr>
<td>Restore to staging location</td>
<td>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:</td>
</tr>
</tbody>
</table>
|                                           |   - 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 volume or vhdx volume to a virtual machine. The virtual machine must not be the one from which they were backed up.                                                                                      |
| Overwrite virtual machine                  | If you selected Restore to Hyper-V server or Restore to different locations on same / different Hyper-V server, note the following:                                                                                                                                   |
| (If you selected Restore to staging location, this option is Overwrite existing files) |   - 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 file(s) or vhdx file(s) from the backup are not restored.                                                                 |
|                                           |   See “Problems with restore of the full virtual machine” on page 166.                                                                                                                                     |
|                                           | If you selected Restore to staging location, note the following:                                                                                                                                              |
|                                           |   - If the vhd file or vhdx file already exists on the destination server in the 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. |
### Table 8-3 Options on the *Restore Marked Files* dialog box (continued)

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Retain original GUID</strong></td>
<td>Keeps the original GUID for the restored virtual machine. To generate a new GUID for the restored virtual machine, clear this option.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> This option applies only to the virtual machines on Hyper-V Server 2016 (and later) that were backed up with the WMI method.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> For restore to the original location (<em>Restore to original Hyper-V server</em>), the <em>Retain Original GUID</em> option is selected and cannot be deselected.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> NetBackup does not generate a new GUID if you select <em>Restore to staging location</em>.</td>
</tr>
<tr>
<td><strong>Hyper-V virtual machine original GUID</strong></td>
<td>Shows the virtual machine's original GUID.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> This option applies only to virtual machines on Hyper-V Server 2016 and later.</td>
</tr>
<tr>
<td><strong>Hyper-V virtual machine display name</strong></td>
<td>You can enter a new display name for the restored virtual machine.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> This option applies only to virtual machines on Hyper-V Server 2016 and later.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> This option is not available if you select <em>Restore to staging location</em>.</td>
</tr>
<tr>
<td><strong>Restore Destinations</strong></td>
<td>See the following fields.</td>
</tr>
<tr>
<td><strong>Hyper-V server</strong></td>
<td>If you selected <em>Restore to Hyper-V server</em> (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.</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
</tbody>
</table>
## Table 8-3 Options on the Restore Marked Files dialog box (continued)

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>List of backed up files (Source)</td>
<td>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, deselect those files. Leave a check mark next to the files that you want to restore. The files that are not selected are not restored. Note that the following virtual machine configuration files are not de-selectable in restores other than staging restores: The xml, vsv, and bin files, and avhd or avhdx files. <strong>Caution:</strong> 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, deselect the common files that you do not want to restore. See “About restoring common files” on page 128. Note the following about the listed files: ■ If you do not select any vhd files 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 <strong>Restore to Hyper-V server</strong> or <strong>Restore to different locations on same / different Hyper-V server</strong>, you can deselect any vhd files or vhdx files in this list. All other files are pre-selected and cannot be deselected. ■ For <strong>Restore to staging location</strong>, you can deselect 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.</td>
</tr>
<tr>
<td>Restore everything to different directory</td>
<td>This field is disabled if you selected <strong>Restore to Hyper-V server</strong>. For restore to a different location or to a staging location: Enter the path on the server or other computer that you specified under <strong>Hyper-V server</strong> or <strong>Staging machine name</strong>. NetBackup creates the appropriate subdirectories.</td>
</tr>
<tr>
<td>View Paths</td>
<td>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 <strong>Restore everything to different directory</strong> field.</td>
</tr>
<tr>
<td>Override default job priority</td>
<td>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.</td>
</tr>
</tbody>
</table>
### 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, deselect 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.

### Table 8-3 Options on the **Restore Marked Files** dialog box *(continued)*

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
</table>
| 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. |
To overwrite the existing common files, select 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.
Use Accelerator to back up Hyper-V

This chapter includes the following topics:

- About the NetBackup Accelerator for virtual machines
- Accelerator: full vs. incremental schedules
- How the NetBackup Accelerator works with virtual machines
- Accelerator notes and requirements for virtual machines
- Accelerator forced rescan for virtual machines (schedule attribute)
- Accelerator requires the OptimizedImage attribute
- Accelerator backups and the NetBackup catalog
- Accelerator messages in the backup job details log
- NetBackup logs for Accelerator with virtual machines
- About reporting the amount of Accelerator backup data that was transferred over the network
- Replacing the Accelerator image size with the network-transferred data in NetBackup command output

About the NetBackup Accelerator for virtual machines

NetBackup Accelerator reduces the backup time for Hyper-V backups. NetBackup uses Hyper-V resilient change tracking (RCT) to identify the changes that were
made within a virtual machine. Only the changed data blocks are sent to the NetBackup media server, to significantly reduce the I/O and backup time. The media server combines the new data with previous backup data and produces a traditional full NetBackup image that includes the complete virtual machine files.

**Note:** Accelerator is most appropriate for virtual machine data that does not experience a high rate of change.

Accelerator has the following benefits:

- Performs the full backups faster than traditional backup. Creates a compact backup stream that uses less network bandwidth between the backup host and the server.
  Accelerator sends only changed data blocks for the backup. NetBackup then creates a full traditional NetBackup image that includes the changed block data.

- Accelerator backups (full and incremental) support instant recovery of virtual machines.

- If the **Enable file recovery from VM backup** option on the policy **Hyper-V** tab is enabled, you can restore individual files from the backup (full or incremental).

- Reduces the I/O on the backup host.

- Reduces the CPU load on the backup host.

### Accelerator: full vs. incremental schedules

NetBackup Accelerator supports full and incremental backups.

Note: After an initial full backup, Accelerator backups with a full schedule have about the same effect on I/O and performance as traditional incremental backups. The NetBackup catalog however includes all catalog references that would be made if the backup was a traditional (non-Accelerator) full.

### How the NetBackup Accelerator works with virtual machines

To enable acceleration of virtual machine backups from Hyper-V policies, click the policy's **Hyper-V** tab and select **Hyper-V Host 2016 or later (WMI)**. Then select **Enable block-level incremental backup** and **Use Accelerator**.

See "Creating a Hyper-V policy from the NetBackup Policies utility" on page 35.
The NetBackup Accelerator creates the backup stream and backup image for each virtual machine as follows:

- If the virtual machine has no previous backup, NetBackup performs a full backup. Hyper-V resilient change tracking (RCT) is enabled to track the data in use for each virtual disk.
- At the next backup, NetBackup identifies data that has changed since the previous backup. Only changed blocks and the header information are included in the backup, to create a full virtual disk backup.
- The backup host sends to the media server a tar backup stream that consists of the following: The virtual machine's changed blocks, and the previous backup ID and data extents (block offset and size) of the unchanged blocks.
- The media server reads the virtual machine's changed blocks, the backup ID, and information about the data extents of the unchanged blocks. From the backup ID and data extents, the media server locates the rest of the virtual machine's data in existing backups.
- The media server directs the storage server to create a new full image that consists of the following: The newly changed blocks, and the existing unchanged blocks that reside on the storage server. The storage server may not write the existing blocks but rather link them to the image.

**Accelerator notes and requirements for virtual machines**

Note the following about Accelerator for virtual machines:

- Accelerator for Hyper-V is available for virtual machines on Hyper-V Server 2016 and later. In a Hyper-V policy, click the policy's Hyper-V tab and select Hyper-V Host 2016 or later (WMI). Then select Enable block-level incremental backup and Use Accelerator.
- Accelerator for virtual machines uses Hyper-V resilient change tracking (RCT) to identify the changes that were made within a virtual machine.
- After the first Accelerator backup: If you create a checkpoint on the VM (or delete a checkpoint), the next backup from that policy is a full backup. That is, the backup processing for the second backup is not limited to changed blocks: Under Accelerator Optimization in the NetBackup Activity Monitor, the optimization rate is 0%.
- If you create another checkpoint and run a third Accelerator backup: The optimization rate may increase, depending on the amount of data that is captured
in the checkpoint (the size of the checkpoint file). The smaller the checkpoint file, the higher the rate of optimization in the third backup. Similarly, if a checkpoint is deleted after the second backup, the optimization rate in the next backup depends on the size of the virtual disk that was affected by the checkpoint deletion.

- Supports the disk storage units that have the following storage destinations:
  - Cloud storage. Storage that a supported cloud storage vendor provides.
  - Qualified third-party OpenStorage devices.

To verify that your storage unit supports Accelerator, refer to the NetBackup hardware compatibility list for the currently supported OST vendors: NetBackup Master Compatibility List

- Veritas recommends that you not enable Expire after copy retention for any storage units that are used with storage lifecycle policies (SLP) in combination with Accelerator. The Expire after copy retention can cause images to expire while the backup runs. To synthesize a new full backup, the SLP backup needs the previous backup image. If the previous image expires during the backup, the backup fails.

- Update the NetBackup device mapping files if needed. The NetBackup device mapping files contain all storage device types that NetBackup can use. To add support for the new devices or upgraded devices that support Accelerator, download the current device mapping files from the Veritas support site. See the NetBackup Administrator’s Guide Volume I for information on the device mapping files and how to download them.

- Storage unit groups are supported only if the storage unit selection in the group is Failover.

- Supports the full backups and incremental backups. Every Accelerator backup (from a full schedule or incremental schedule) results in a complete image of the virtual machine.

- You can use incremental backups (cumulative or differential) as follows: To reduce the file-mapping overhead and to reduce the number of files that are recorded in the NetBackup catalog. Cumulative backups may involve more file-mapping because they do not use the random indexing method to determine which files have changed. In some cases, differential backups may be faster than cumulative backups.
■ If a backup of the virtual machine does not exist, NetBackup performs a full backup. This initial backup occurs at the speed of a normal (non-accelerated) full backup. Subsequent Accelerator backups of the virtual machine use resilient change tracking (RCT) to accelerate the backup.

■ If the storage unit that is associated with the policy cannot be validated when you create the policy, note: The storage unit is validated later when the backup job begins. If Accelerator does not support the storage unit, the backup fails. In the `bpbrm` log, a message appears that is similar to one of the following:

  Storage server %s, type %s, doesn't support image include.

  Storage server type %s, doesn't support accelerator backup.

■ Accelerator requires the storage to have the `OptimizedImage` attribute enabled. See “Accelerator requires the `OptimizedImage` attribute” on page 137.

### Accelerator forced rescan for virtual machines (schedule attribute)

Accelerator for virtual machines uses Hyper-V resilient change tracking (RCT) to identify changed blocks. NetBackup requires the changed blocks when it creates a full virtual machine (synthesized) image. NetBackup is therefore dependent on RCT for correctly identifying changed blocks. To protect against any potential omissions by underlying Hyper-V resilient change tracking (RCT) using timestamps, the Accelerator forced rescan option conducts the backup by reading all allocated blocks from the virtual hard disk.

This option provides a safety net by establishing a new baseline for the next Accelerator backup.

When Accelerator forced rescan is used, all the data on the virtual machine is backed up. This backup is similar to the first Accelerator backup for a policy. For the forced rescan job, the optimization percentage for Accelerator is 0. The duration of the backup is similar to a non-Accelerator full backup.

As an example: You can set up a weekly full-backup schedule with the Use Accelerator option. You can supplement that policy with a second schedule that enables the Accelerator forced rescan option, to run every 6 months.

---

**Note:** Accelerator forced rescan is unavailable if the Use Accelerator option on the Hyper-V tab is not selected.
Accelerator requires the **OptimizedImage** attribute

Accelerator requires that the storage has the `OptimizedImage` attribute enabled.

To ensure that your storage is configured properly, see the documentation for your storage option:

- **NetBackup Media Server Deduplication Pool.**
  The `OptimizedImage` attribute is enabled by default beginning with the NetBackup 7.1 release. If you created the storage servers and pools in an earlier release, you must configure them for `OptimizedImage`.
  See the *NetBackup Deduplication Guide*.

- **Backups to a third-party disk appliance.**
  The storage device must support the `OptimizedImage` attribute.
  See the *NetBackup OpenStorage Solutions Guide for Disk*.

- **Cloud storage that NetBackup supports.**
  See the *NetBackup Cloud Administrator's Guide*.

### Accelerator backups and the NetBackup catalog

Use of Accelerator does not affect the size of the NetBackup catalog. A full backup with Accelerator generates the same catalog size as a full backup of the same data without Accelerator. The same is true of incremental backups: use of Accelerator does not require more catalog space than the same backup without Accelerator.

A potential catalog effect does exist, depending on how often you use Accelerator with full backups. A full backup with Accelerator completes faster than a normal full. It may therefore be tempting to replace your incremental backups with Accelerator full backups. Note: Since a full backup requires more catalog space than an incremental, replacing incrementals with fulls increases the catalog size. When changing your incrementals to fulls, you must weigh the advantage of Accelerator fulls against the greater catalog space that fulls require compared to incrementals.

### Accelerator messages in the backup job details log

When a virtual machine is first backed up, Accelerator is not used for that backup. The following messages appear in the job details log:
7/25/2012 4:45:35 PM - Info bpbrm(pid=6192) There is no complete backup image match with track journal, a regular full backup will be performed

... 

7/25/2012 4:53:22 PM - Info bpbkar32(pid=5624) accelerator sent 5844728320 bytes out of 5844726784 bytes to server, optimization 0.0%

When subsequent backups of the virtual machine use Accelerator, the following messages appear in the job details log:

7/27/2012 4:40:01 AM - Info bpbrm(pid=412) accelerator enabled

...

7/27/2012 4:43:07 AM - Info bpbkar32(pid=4636) accelerator sent 74764288 bytes out of 5953504256 bytes to server, optimization 98.7%

This message is a key trace for Accelerator. In this example Accelerator was successful at reducing the backup data by 98.7%.

NetBackup logs for Accelerator with virtual machines

Accelerator does not require its own log directory. For log messages about Accelerator, see the following standard NetBackup log directories.

**Table 9-1** NetBackup logs that may contain Accelerator information

<table>
<thead>
<tr>
<th>Log directory</th>
<th>Resides on</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNIX: /usr/openv/netbackup/logs/bpbrm</td>
<td>NetBackup master or media server</td>
</tr>
<tr>
<td>Windows: install_path\NetBackup\logs\bpbrm</td>
<td></td>
</tr>
<tr>
<td>UNIX: /usr/openv/netbackup/logs/bptm</td>
<td>NetBackup media server</td>
</tr>
<tr>
<td>Windows: install_path\NetBackup\logs\bptm</td>
<td></td>
</tr>
<tr>
<td>/usr/openv/netbackup/logs/bpbkar</td>
<td>Backup host</td>
</tr>
<tr>
<td>Windows: install_path\NetBackup\logs\bpbkar</td>
<td></td>
</tr>
<tr>
<td>/usr/openv/netbackup/logs/bpfis</td>
<td>Backup host</td>
</tr>
<tr>
<td>Windows: install_path\NetBackup\logs\bpfis</td>
<td></td>
</tr>
</tbody>
</table>
Table 9-1  NetBackup logs that may contain Accelerator information (continued)

<table>
<thead>
<tr>
<th>Log directory</th>
<th>Resides on</th>
</tr>
</thead>
<tbody>
<tr>
<td>VxMS logs</td>
<td>See “NetBackup logs and how to create them” on page 149.</td>
</tr>
</tbody>
</table>

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

On Windows:

`install_path\NetBackup\logs\mklogdir.bat`

On UNIX/Linux:

`/usr/openv/netbackup/logs/mklogdir`

About reporting the amount of Accelerator backup data that was transferred over the network

For Accelerator backup reporting, several NetBackup commands can report the amount of data that is transferred over the network for each Accelerator backup. The amount of transferred data is often much less than the size of the Accelerator backup image.

For each Accelerator backup, NetBackup combines the client’s (or VM’s) changed blocks with the unchanged data from previous backups to synthesize a backup image. However, NetBackup sends only the changed data over the network when the backup occurs. The resulting backup image may be much larger than the amount of backup data that travels the network. For backup reporting, it may be important to distinguish between the backup image size and the amount of data that was transferred over the network.

For Accelerator backups, the network-transferred data can appear in the output of the following NetBackup commands: `bpdbjobs`, `bpimagelist`, and `bpclimagelist`. Table 9-2 lists the default location of these commands.
Table 9-2 Default location of `bpdbjobs`, `bpimagelist`, and `bpclimagelist`

<table>
<thead>
<tr>
<th>Command</th>
<th>Default location</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>bpdbjobs</code>, <code>bpimagelist</code></td>
<td>Windows: install_path\NetBackup\bin\admincmd\</td>
</tr>
<tr>
<td></td>
<td>UNIX, Linux /usr/openv/netbackup/bin/admincmd/</td>
</tr>
<tr>
<td><code>bpclimagelist</code></td>
<td>Windows: install_path\NetBackup\bin\</td>
</tr>
<tr>
<td></td>
<td>UNIX, Linux /usr/openv/netbackup/bin/</td>
</tr>
</tbody>
</table>

The following example uses the `bpimagelist` command to show the results of a backup of `acmevm2`:

```
bpimagelist -backupid acmevm2
```

Example output:

```
IMAGE acmevm2 0 0 12 acmevm2 accl_vmware 40 *NULL* root f 0 9 14344
79628 558 2147483647 0 0 7799632 20196 1 2 0 accl_vmware_1434479628_FULL.f NULL
* NULL* 0 1 0 0 * NULL* 0 0 1 0 0 1434479628 1434479628 * NULL* 0 0 0 * NULL* 9
0 0 3398732 0 0 * NULL* * NULL* 0 1434479628 0 0 * NULL* * NULL* 0 0 0 0 225792
HISTO 0 0 0 0 0 0 0 0 0 0 0
FRAG 1 -1 3319 76 0 0 @aaaab acmevm6.acme.com 262144 0 0 -1 102
4 1; PureDisk; acmevm6.acme.com; mspdp_dp; PureDiskVolume; 0 2147483647
0 65545 0 0 0 6 0 1434480186 1 1 * NULL* * NULL* 0 0
FRAG 1 1 7796313 0 0 0 @aaaab acmevm6.acme.com 262144 0 0 -1 102
28 1; PureDisk; acmevm6.acme.com; mspdp_dp; PureDiskVolume; 0 2147483647
7 0 65545 0 0 0 6 0 1434480186 1 1 * NULL* * NULL* 0 0
```

**Note:** This example output is for a VMware backup, but the output formatting is the same for Hyper-V.

In this example, the backup image size in kilobytes is 7799632, and the amount of data that was transferred over the network is 225792.

You can use the following commands to show the amount of data that was transferred over the network for an Accelerator backup.
**bpimagelist**

bpimagelist -backupid backup_id [-l | -L | -json | -json_compact]

Brackets [ ] indicate optional elements, and the vertical bars | indicate that you can choose only one of the options within the brackets.

Table 9-3 describes how the network-transferred data field appears in the bpimagelist output.

<table>
<thead>
<tr>
<th>bpimagelist option</th>
<th>How the network-transferred data field appears</th>
</tr>
</thead>
<tbody>
<tr>
<td>No option</td>
<td>The field is unlabeled. For example: 225792.</td>
</tr>
<tr>
<td></td>
<td>See the bpimagelist example output earlier in this topic.</td>
</tr>
<tr>
<td>-l</td>
<td>The field is unlabeled (same as no option). For example: 225792</td>
</tr>
<tr>
<td>-L</td>
<td>The field is labeled. For example:</td>
</tr>
<tr>
<td></td>
<td>Kilobytes Data Transferred: 225792</td>
</tr>
<tr>
<td>-json</td>
<td>The field is labeled. For example:</td>
</tr>
<tr>
<td></td>
<td>&quot;kilobytes_data_transferred&quot;: 225792,</td>
</tr>
<tr>
<td>-json_compact</td>
<td>The field is labeled. For example:</td>
</tr>
<tr>
<td></td>
<td>&quot;kilobytes_data_transferred&quot;:225792,</td>
</tr>
</tbody>
</table>

**bpdbjobs**

bpdbjobs -jobid job_id -report -most_columns

or

bpdbjobs -jobid job_id -report -all_columns

The network-transferred data field appears at the end of the output.

**bpclimagelist**

bpclimagelist -client client_name

This command can only show the network-transferred data in the field that normally shows the Accelerator backup image size. To show the network-transferred data with this command, you must configure a NetBackup setting:

See “Replacing the Accelerator image size with the network-transferred data in NetBackup command output” on page 142.
Additional details on these commands are available in the *NetBackup Commands Reference Guide* or in the NetBackup man pages.

**Replacing the Accelerator image size with the network-transferred data in NetBackup command output**

You can configure the output of `bpimagelist`, `bpdbjobs`, and `bpclimagelist` to show the amount of Accelerator backup data that was transferred over the network instead of the backup image size.

The following is the default `bpimagelist` output that shows the Accelerator image size (see the circled value 7799632). The amount of network-transferred data appears farther down in the output (225792):

```
IMAGE acmevm2 0 0 12 acmevm2_accl_vmware 40 *NULL* root f 0 9 14344
79628 558 2147483647 0 0 7799632 28196 1 2 0 accl_vmware_1434479628_PULL.f *NULL*
* *NULL* 0 1 0 0 *NULL* 0 0 1 0 0 1434479628 1434479628 *NULL* 0 0 0 *NULL* 9
0 0 3398732 0 0 *NULL* *NULL* 0 1434479620 0 0 *NULL* *NULL* 0 0 0 225792
HISTO 0 0 0 0 0 0 0 0
FRAG 1 -1 3319 76 0 0 0 @aaaab acmevm6.acme.com 262144 0 0 -1 102
4 1;PureDisk; acmevm6.acme.com;msdp_dp;PureDiskVolume;0 2147483647
0 65535 0 0 0 0 0 0 1434480186 1 1 *NULL* *NULL* 0 0
FRAG 1 1 7796313 0 0 0 @aaaab acmevm6.acme.com 262144 0 0 -1 10
28 1;PureDisk; acmevm6.acme.com;msdp_dp;PureDiskVolume;0 2147483647
7 0 65535 0 0 0 0 0 0 1434480186 1 1 *NULL* *NULL* 0 0
```

**Note:** This example output is for a VMware backup, but the output formatting is the same for Hyper-V.

You can configure NetBackup command output to show the network-transferred data in the image size field. In the output, the image size value is replaced with the network-transferred data value (see the following example). A script that reads the image size from the command output now reads the amount of network-transferred data.

In the following `bpimagelist` output, the image size field shows the network-transferred data (225792):

```
IMAGE acmevm2 0 0 12 acmevm2_accl_vmware 40 *NULL* root f 0 9 14344
79628 558 2147483647 0 0 *NULL* 225792 28196 1 2 0 accl_vmware_1434479628_PULL.f *NULL*
* *NULL* 0 1 0 0 *NULL* 0 0 1 0 0 1434479628 1434479628 *NULL* 0 0 0 *NULL* 9
0 0 3398732 0 0 *NULL* *NULL* 0 1434479620 0 0 *NULL* *NULL* 0 0 0 225792
HISTO 0 0 0 0 0 0 0 0
FRAG 1 -1 3319 76 0 0 0 @aaaab acmevm6.acme.com 262144 0 0 -1 102
4 1;PureDisk; acmevm6.acme.com;msdp_dp;PureDiskVolume;0 2147483647
0 65535 0 0 0 0 0 0 1434480186 1 1 *NULL* *NULL* 0 0
FRAG 1 1 7796313 0 0 0 @aaaab acmevm6.acme.com 262144 0 0 -1 10
28 1;PureDisk; acmevm6.acme.com;msdp_dp;PureDiskVolume;0 2147483647
7 0 65535 0 0 0 0 0 0 1434480186 1 1 *NULL* *NULL* 0 0
```
Note: The same change occurs in the labeled output of the commands (such as with the \(-L\) option of `bpimagelist`). For example, the `Kilobytes` field shows the transferred data value (225792 in the example) rather than the Accelerator backup image size.

To enable the reporting of network-transferred data in the Accelerator image size field of `bpimagelist`, `bpdbjobs`, and `bpclimagelist`:

- Use the `bpsetconfig` command to enable the output change.

To enable this change for the `bpclimagelist` command, enter the `bpsetconfig` command on the master server. To enable this change for `bpimagelist` or `bpdbjobs`, enter the `bpsetconfig` command on the server where you intend to run `bpimagelist` or `bpdbjobs`.

Refer to Table 9-4 for the `bpsetconfig` command to use based on the type of Accelerator backup that you want to report on.
To enable the reporting of network-transferred data in the Accelerator image size field of `bpimagelist`, `bpclimagelist`, or `bpdbjobs` output:

<table>
<thead>
<tr>
<th>Type of backup to report on</th>
<th>Enter this command</th>
</tr>
</thead>
</table>
| Incremental Hyper-V Accelerator backups | Windows  
  `echo REPLACE_IMAGE_SIZE_WITH_DATA_TRANSFERRED = REPLACE_IMAGE_SIZE_FOR_ACCL_INC_HYPERV | install_path\NetBackup\bin\admincmd\bpsetconfig`  
  UNIX, Linux  
  `echo "REPLACE_IMAGE_SIZE_WITH_DATA_TRANSFERRED = REPLACE_IMAGE_SIZE_FOR_ACCL_INC_HYPERV" | /usr/openv/netbackup/bin/admincmd/bpsetconfig` |
| All Hyper-V Accelerator backups (full and incremental) | Windows  
  `echo REPLACE_IMAGE_SIZE_WITH_DATA_TRANSFERRED = REPLACE_IMAGE_SIZE_FOR_ACCL_ALL_HYPERV | install_path\NetBackup\bin\admincmd\bpsetconfig`  
  UNIX, Linux  
  `echo "REPLACE_IMAGE_SIZE_WITH_DATA_TRANSFERRED = REPLACE_IMAGE_SIZE_FOR_ACCL_ALL_HYPERV" | /usr/openv/netbackup/bin/admincmd/bpsetconfig` |
| All incremental Accelerator backups (physical clients and virtual machines) | Windows  
  `echo REPLACE_IMAGE_SIZE_WITH_DATA_TRANSFERRED = REPLACE_IMAGE_SIZE_FOR_ACCL_INC_ALL | install_path\NetBackup\bin\admincmd\bpsetconfig`  
  UNIX, Linux  
  `echo "REPLACE_IMAGE_SIZE_WITH_DATA_TRANSFERRED = REPLACE_IMAGE_SIZE_FOR_ACCL_INC_ALL" | /usr/openv/netbackup/bin/admincmd/bpsetconfig` |
| All Accelerator backups (full and incremental, physical clients and virtual machines) | Windows  
  `echo REPLACE_IMAGE_SIZE_WITH_DATA_TRANSFERRED = REPLACE_IMAGE_SIZE_FOR_ACCL_ALL_ALL | install_path\NetBackup\bin\admincmd\bpsetconfig`  
  UNIX, Linux  
  `echo "REPLACE_IMAGE_SIZE_WITH_DATA_TRANSFERRED = REPLACE_IMAGE_SIZE_FOR_ACCL_ALL_ALL" | /usr/openv/netbackup/bin/admincmd/bpsetconfig` |
To reset the command output to the default setting

◆ To disable the reporting of network-transferred data in the Accelerator image size field (return to default), enter the following:

Windows

```bash
echo REPLACE_IMAGE_SIZE_WITH_DATA_TRANSFERRED = REPLACE_IMAGE_SIZE_DISABLED | install_path\NetBackup\bin\admincmd\bpsetconfig
```

UNIX, Linux

```bash
echo "REPLACE_IMAGE_SIZE_WITH_DATA_TRANSFERRED = REPLACE_IMAGE_SIZE_DISABLED" | /usr/openv/netbackup/bin/admincmd/bpsetconfig
```
Best practices and more information

This chapter includes the following topics:

- Best practices

Best practices

Veritas recommends the following for NetBackup for Hyper-V:

- When creating virtual machines, use the same name for the VM's host name and display name. If the NetBackup policy's Primary VM identifier option is changed, the existing entries on the NetBackup policy Clients tab still work. See “Primary VM identifier option (Hyper-V)” on page 43.

- In a virtual desktop infrastructure where VMs share a common parent disk, do the following when restoring a VM to its original location: Restore the VM's differencing disk but not its parent disk. Make sure that the parent disk already exists on the same restore path.

  On the Restore Marked Files dialog, under List of backed up files, clear the check mark from the parent disk. In the following example, the parent disk vm1.vhdx is unselected:
**Note:** If you restore the parent disk to the original location, the other linked VMs that share the parent disk cannot be used. Their connection to the parent disk is lost. Instead, restore the differencing disk without the parent disk and make sure that the parent disk already exists on the same restore path. Otherwise, the restore fails because the parent disk does not exist.

**Note:** This issue does not apply when you restore the VM to an alternate location. As long as no other VMs at the restore location share the parent disk, you can restore the parent disk along with the differencing disk.

**Caution:** For restore to the original location: If you restore the parent disk and edit the linked VMs by reconnecting their differencing disks to the restored parent disk, VM data may be lost.

More information is available on NetBackup and Hyper-V.

- For a list of supported Hyper-V servers, see the appropriate version of the NetBackup Software Compatibility List available from the following location: [NetBackup Master Compatibility List](#).

- For additional details on NetBackup support for Hyper-V, see the following: [Support for NetBackup in virtual environments](#).

Troubleshooting

This chapter includes the following topics:

- NetBackup logs and how to create them
- Errors during policy creation
- NetBackup status codes related to Hyper-V
- Backup job hangs for multiple virtual machines
- Viewing or resizing Windows NTFS shadow storage
- The Hyper-V integration component is not installed
- LDM volumes and status code 1
- Hyper-V snapshots (avhd or avhdx files) and status code 1
- Unable to log in to the NetBackup Administration Console
- When backing up the virtual machines that reside on the same CSV, Windows warning 1584 can be ignored
- Problems with alternate client backup
- Restored virtual machine fails to start
- Problem with a restart of a restored virtual machine: Why did the computer shut down unexpectedly?
- Problems with restore of individual files
- Problems with restore of the full virtual machine
- Increasing the WMI create disk time-out value
- Linux VMs and persistent device naming
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>
<thead>
<tr>
<th>Log folder</th>
<th>Contains the messages on</th>
<th>Resides on</th>
</tr>
</thead>
<tbody>
<tr>
<td>install_path\NetBackup\logs\bpbrm</td>
<td>Backup and restore</td>
<td>NetBackup master or media server</td>
</tr>
<tr>
<td>install_path\NetBackup\logs\bptm</td>
<td>Backup and restore</td>
<td>NetBackup media server</td>
</tr>
<tr>
<td>install_path\NetBackup\logs\bpcd</td>
<td>Snapshot creation, backup, and restore</td>
<td>NetBackup client on the Hyper-V server</td>
</tr>
<tr>
<td>install_path\NetBackup\logs\bpfis</td>
<td>Snapshot creation and backup</td>
<td>NetBackup client on the Hyper-V server</td>
</tr>
<tr>
<td>install_path\NetBackup\logs\bpbkar</td>
<td>Backup</td>
<td>NetBackup client on the Hyper-V server</td>
</tr>
<tr>
<td>install_path\NetBackup\logs\bpprd</td>
<td>Restore</td>
<td>NetBackup master server</td>
</tr>
<tr>
<td>install_path\NetBackup\logs\tar</td>
<td>Restore</td>
<td>NetBackup client on the Hyper-V server</td>
</tr>
<tr>
<td>install_path\NetBackup\logs\bpVMreq</td>
<td>Restore</td>
<td>NetBackup master or media server, and NetBackup client on the Hyper-V server</td>
</tr>
<tr>
<td>install_path\NetBackup\logs\bpVMutil</td>
<td>Policy configuration and on restore</td>
<td>NetBackup client on the Hyper-V server</td>
</tr>
<tr>
<td>install_path\NetBackup\logs\nbproxy</td>
<td>Policy configuration</td>
<td>NetBackup master or media server</td>
</tr>
<tr>
<td>install_path\NetBackup\logs\vxms</td>
<td>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.</td>
<td>NetBackup client on the Hyper-V server</td>
</tr>
</tbody>
</table>
Table 11-1  NetBackup logs that pertain to Hyper-V backup and restore
(continued)

<table>
<thead>
<tr>
<th>Log folder</th>
<th>Contains the messages on</th>
<th>Resides on</th>
</tr>
</thead>
<tbody>
<tr>
<td>\Program Files\Common Files\Symantec Shared\VxFl4\logs\</td>
<td>Snapshot creation and VSS APIs.</td>
<td>NetBackup client on the Hyper-V server</td>
</tr>
<tr>
<td></td>
<td></td>
<td>See “Enabling VxFI logging” on page 150.</td>
</tr>
</tbody>
</table>

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\n
This folder contains a configuration file for each provider, such as vss.conf and emcclrioni.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 for NetBackup.

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

VxMS and vhd logging 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 149.

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.

See Table 11-2 for the available logging levels.

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.
VxMS logging levels

Table 11-2 lists the VxMS logging levels.

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

**Note:** Logging 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.

Table 11-2  
VxMS logging levels

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

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 11-3 describes the format of the log file names.
### Table 11-3 Format of VxMS core.log and provider.log file names

<table>
<thead>
<tr>
<th>Platform</th>
<th>VxMS log-file-name format</th>
<th>For example:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows</td>
<td>VxMS-thread_id-user_name.mmdyy_tag.log</td>
<td>VxMS-7456-ALL_ADMINS.070214_core.log</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VxMS-7456-ALL_ADMINS.070214_provider.log</td>
</tr>
<tr>
<td>UNIX, Linux</td>
<td>VxMS-thread_id-user_name.log.mmdyy_tag</td>
<td>VxMS-27658-root.log.081314_core</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VxMS-27658-root.log.081314_provider</td>
</tr>
</tbody>
</table>

See “Configuring VxMS and vhd logging” on page 151.

### 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*. 
# NetBackup status codes related to Hyper-V

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

**Table 11-4  NetBackup status codes related to Hyper-V**

<table>
<thead>
<tr>
<th>NetBackup status code</th>
<th>Explanation and recommended action</th>
</tr>
</thead>
</table>
| 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 160.  
- 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 161.  
- 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 175. |
| 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 159. |
| 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 157. |
### Table 11-4 NetBackup status codes related to Hyper-V (continued)

<table>
<thead>
<tr>
<th>NetBackup status code</th>
<th>Explanation and recommended action</th>
</tr>
</thead>
<tbody>
<tr>
<td>185, tar did not find all the files to be restored</td>
<td>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.</td>
</tr>
<tr>
<td>2821 Hyper-V policy restore error</td>
<td>The problem may be one of the following:</td>
</tr>
</tbody>
</table>
|                                                            | ■ 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**.  
  **Note:** In an SCVMM environment, the VM GUID is referred to as the **VM ID**.  
  ■ 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 166.  
  ■ 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 166.  
  ■ 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 162.  
  ■ From a backup that was made with the WMI method, the restore failed because it took too long to write the virtual disk. This error may occur if the VM has a large fixed virtual disk. See “Increasing the WMI create disk time-out value” on page 168. |

Snapshot error encountered (status code 156)

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

**Table 11-5** Possible causes of status code 156

<table>
<thead>
<tr>
<th>Causes of status code 156</th>
<th>Description and recommended action</th>
</tr>
</thead>
</table>
| 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:                                                   |
| 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 160.                                                                                           |
Table 11-5 Possible causes of status code 156 (continued)

<table>
<thead>
<tr>
<th>Causes of status code 156</th>
<th>Description and recommended action</th>
</tr>
</thead>
</table>
| 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 writers 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 the backup, or try the backup at another time.  
See “Cluster shared volumes timeout (Hyper-V with VSS)” on page 45. |
### Table 11-5  Possible causes of status code 156 (continued)

<table>
<thead>
<tr>
<th>Causes of status code 156</th>
<th>Description and recommended action</th>
</tr>
</thead>
<tbody>
<tr>
<td>A local disk has been added to a VM that is on CSV</td>
<td>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.</td>
</tr>
<tr>
<td>The Enable offline backup for non-VSS VMs option is disabled</td>
<td>The bpfis log contains the following: VssNode::prepare Backup type of VM [&lt;VM GUID&gt;] 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 of non-VSS VMs (Hyper-V with VSS)” on page 44.</td>
</tr>
</tbody>
</table>

### 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

**Note:** This topic applies to the VSS backup method only (not to WMI).

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.

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 Veritas document:

http://www.veritas.com/docs/000006177

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.

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.
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 `diskshadow` command to rule out any configuration issues. Refer to Microsoft documentation for assistance.

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
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 11-6  Problems with restore of individual files

<table>
<thead>
<tr>
<th>Cause of the problem</th>
<th>Description and recommended action</th>
</tr>
</thead>
</table>
| 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 120. |
Table 11-6  Problems with restore of individual files (continued)

<table>
<thead>
<tr>
<th>Cause of the problem</th>
<th>Description and recommended action</th>
</tr>
</thead>
</table>
| 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\n
- 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:

Increasing the WMI create disk time-out value

It can take a long time to create a large virtual disk of type fixed (as opposed to a dynamic virtual disk). If a Hyper-V VM with a large fixed disk was backed up with the WMI method and is then restored, note: The restore job may time out before the restored virtual disk is fully written. The restore job fails with status 2821 and the VM's data is not restored.

Note: The default time-out period for Hyper-V disk creation is 24 hours.

Do the following to allow the restore job to complete.
To increase the WMI create disk time-out value

1. Use the NetBackup nbsetconfig command as follows:

```
nbsetconfig -h host
```

Where `host` is the name of the NetBackup master server where the configuration is to be updated.

2. At the nbsetconfig prompt, enter the following to allow more time for creation of the virtual disk.

This example sets the period to 48 hours:

```
HYPERV_WMI_CREATE_DISK_TIMEOUT = 48
```

The range for `HYPERV_WMI_CREATE_DISK_TIMEOUT` is 0 hours to 240 hours.

---

**Note:** A value of 0 means the restore job never times out during virtual disk creation.

3. To escape the command, enter the following:

   - On UNIX: `ctl-D`
   - On Windows: `ctl-Z`

More information on the nbsetconfig command is available in the NetBackup Commands Reference Guide.

http://www.veritas.com/docs/000003214

---

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, Veritas 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.
VSS backup method: Hyper-V online and offline backups

This appendix includes the following topics:

- About Hyper-V online and offline backups for VSS
- Conditions that determine online vs. offline backup for VSS
- Additional notes on offline backups with VSS
- Hyper-V 2012 R2 virtual machines may be in the Off state when restored

About Hyper-V online and offline backups for VSS

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 for the VSS backup method:

<table>
<thead>
<tr>
<th>Online</th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offline</td>
<td>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.</td>
</tr>
</tbody>
</table>
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 (online or offline) when you use the VSS backup method.

**Table A-1  VSS backup: State of virtual machine before and after restore**

<table>
<thead>
<tr>
<th>State at the time of backup</th>
<th>Type of backup</th>
<th>State after restore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running</td>
<td>Online</td>
<td>Off</td>
</tr>
<tr>
<td>Running</td>
<td>Offline</td>
<td>Saved</td>
</tr>
<tr>
<td>Saved</td>
<td>Offline</td>
<td>Saved</td>
</tr>
<tr>
<td>Paused</td>
<td>Offline</td>
<td>Saved</td>
</tr>
<tr>
<td>Off</td>
<td>Offline</td>
<td>Off</td>
</tr>
</tbody>
</table>

Note: The WMI backup method (for Hyper-V Server 2016 and later) does not employ online vs offline backups.

See “WMI backup method: State of the virtual machine before and after restore” on page 110.

**Conditions that determine online vs. offline backup for VSS**

This topic applies to the NetBackup Hyper-V VSS backup method only (not to WMI). With the VSS backup method, 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 with VSS**

This topic applies to the NetBackup Hyper-V VSS backup method only (not to WMI).

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.

**Hyper-V 2012 R2 virtual machines may be in the Off state when restored**

This topic applies to the NetBackup Hyper-V VSS backup method only (not to WMI).

For Hyper-V server 2012 R2 and later, the virtual machine is restored in the Off state (not the Saved state) in either of the following cases:
- The virtual machine's operating system does not support Windows Volume Shadow Copy Service (VSS).
- The virtual machine does not have Hyper-V integration services enabled.

During the backup, the virtual machine is not placed in the Saved state (the bin file and vsv file are not generated or backed up). The Hyper-V VSS writer instead creates a checkpoint of the virtual machine. As a result, the virtual machine remains in the Off state when it is restored.

The following MSDN article contains more information:

Hyper-V Backup doesn’t interrupt running virtual machines (anymore)
Hyper-V pass-through disks

This appendix includes the following topics:

- About Hyper-V pass-through disks with NetBackup
- Configurations for backing up pass-through disks
- Requirements for backing up Hyper-V pass-through disks
- Restrictions for Hyper-V pass-through disks
- Configuring a local snapshot backup of Hyper-V pass-through disks
- About alternate client backup of pass-through disks
- Configuring an alternate client backup of Hyper-V pass-through disks
- Important note on VSS and disk arrays

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 snapshot for Instant Recovery or SLP management.

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 (VSS)” on page 46.

  See “Restrictions for Hyper-V pass-through disks” on page 177.

- **Snapshot Attribute**: The selection depends on your VSS hardware provider.

  For the supported snapshot methods and hardware types, see the NetBackup Software Compatibility List available from the following location: NetBackup Master Compatibility List

- **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 (VSS)” on page 46.

See “Restrictions for Hyper-V pass-through disks” on page 177.

See “Important note on VSS and disk arrays” on page 181.

- **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.
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
- Using NetBackup commands to create a Hyper-V Intelligent Policy
- The bpplinfo options for Hyper-V policies
- bpplinclude options for modifying query rules in Hyper-V policies
- Examples of nbrestorevm for restoring VMs to Hyper-V
- The nbrestorevm -R rename file for Hyper-V
- Notes on troubleshooting the nbrestorevm command for Hyper-V
- Logs for troubleshooting the nbrestorevm command

Using NetBackup commands to create a Hyper-V policy

This topic describes how to use NetBackup commands to create a backup policy that includes the new features for Hyper-V on Windows Server 2016: Block-level incremental backup and Accelerator. Note that this topic explains how to create a policy that selects virtual machines manually.

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 185. 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 "HV" -blkincr 1 -use_accelerator 1`

   To specify additional options, enter the following with `-snapshot_method_args`:

   `bpplinfo policyName -set -pt Hyper-V -use_virtual_machine 2 -hyperv_server "Hyper-V_server" -fi 1 -snapshot_method "HV" -blkincr 1 -use_accelerator 1 -snapshot_method_args "nameuse=1, Virtual_machine_backup=2, file_system_optimization=1, exclude_swap=1, drive_selection=0, snapact=3, hv_snapshot_consistency_level=0"

**Notes:**

- The `-hyperv_server` option specifies the Hyper-V host, Hyper-V cluster, or SCVMM server that contains the VMs to back up.
- The option `-snapshot_method "HV"` specifies the WMI snapshot method for VMs on Hyper-V Server 2016. (`-snapshot_method "Hyper-V_v2"` specifies the VSS method, which does not support block-level incremental backup or Accelerator.)
- The option `-blkincr: 1` enables block-level incremental backup (BLIB).
- The option `-use_accelerator: 1` enables Accelerator. (This option also enables BLIB.)

- The `-snapshot_method_args` option is a comma-delimited list of keywords that define the Hyper-V snapshot and policy. The available keywords and values for `-snapshot_method_args` are described in a separate topic: See “The `bpplinfo` options for Hyper-V policies” on page 188.

3 Create a policy schedule.

```bash
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.

```bash
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`, which is the only option that is available for the Hyper-V policy type.

5 Validate the policy.

```bash
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`. The following topic contains examples of the `nbrestorevm` command to restore Hyper-V virtual machines:

See “Examples of `nbrestorevm` for restoring VMs to Hyper-V” on page 193.
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. It includes features for Hyper-V on Windows Server 2016: Block-level incremental backup and Accelerator.

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, and on the SCVMM server (if any).

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 pl_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 "HV" -blkincr 1 -use_accelerator 1
   -snapshot_method_args "nameuse=1,Virtual_machine_backup=2,
   file_system_optimization=1,exclude_swap=1,drive_selection=0,
   snapact=3,hv_snapshot_consistency_level=0"
   ```

Notes:

- The `hyperv_server` option specifies the Hyper-V host, Hyper-V cluster, or SCVMM server that contains the VMs to back up.
- The option `snapshot_method "HV"` specifies the WMI snapshot method for Hyper-V Server 2016. (`snapshot_method "Hyper-V_v2"` specifies the VSS method, which does not support block-level incremental backup or Accelerator.)
The option `-blkincri: 1` enables block-level incremental backup.

The option `-use_accelerator: 1` enables Accelerator. (This option also enables BLIB.)

`-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 “The bpplinfo options for Hyper-V policies” on page 188.

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 pl_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`
     For example:

     `bpplclients Accel_policy_auto_select1 -add scvmmserver3 Windows-x64 Windows`

     In this example, the host to perform virtual machine discovery is `scvmmserver3`.

   - 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 25.

   - To specify a System Center Virtual Machine Manager (SCVMM) that manages Hyper-V servers or clusters:
     `bpplclients policy_name -add SCVMM_server SCVMM_server_hardware_type SCVMM_server_OS`

     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 the examples under bpplclients in the NetBackup Commands Reference Guide.

5 Create a query rule to select virtual machines automatically.

bpplinclude policy_name -add "hyperv://;server_type=value?filter=query_rule"

The possible values for server_type=value are the following (these values are not case-sensitive):

- **Hyperv**
  NetBackup discovers the VMs by communicating with the Hyper-V server or cluster. The Hyper-V server or Hyper-V cluster must contain the NetBackup client software.

- **Scvmm**
  NetBackup discovers the VMs by communicating with the SCVMM server. The SCVMM server (as well as each of the Hyper-V hosts) must contain the NetBackup client software.

For example:

bpplinclude Accel_policy_auto_select1 -add "hyperv://;server_type=Scvmm?filter=Displayname Contains 'Production'"

This query rule selects from the virtual machines that an SCVMM server manages. This example selects only 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 80.
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 182.

To test the bpplinclude query rule before you run the backup

◆ Run the following on the Hyper-V server or SCVMM server that is designated in the policy:

install_path\NetBackup\bin nbdiscover -noxmloutput “query filter=query_rule” -noreason

Where “query filter=query_rule” is the actual query to test. For example:

"hyperv:/;server_type=Hyperv?filter=Displayname Contains 'Production'"

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

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

The -noreason option omits explanations as to why the query excluded a virtual machine or why the query failed. For explanations, omit -noreason.

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

The bpplinfo options for Hyper-V policies

Table C-1 describes the options that are available on the NetBackup bpplinfo command.
### Table C-1  The bpplinfo options for Hyper-V

<table>
<thead>
<tr>
<th>Option</th>
<th>Backup method</th>
<th>Values</th>
<th>Required?</th>
<th>Navigation in policy editor of NetBackup Administration Console</th>
</tr>
</thead>
<tbody>
<tr>
<td>-use_virtual_machine</td>
<td>WMI, VSS</td>
<td>2</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>-hyperv_server</td>
<td>WMI, VSS</td>
<td>The name of the Hyper-V server</td>
<td>Y</td>
<td>Clients tab &gt; Hyper-V server</td>
</tr>
<tr>
<td>-application_discovery</td>
<td>WMI, VSS</td>
<td>0 disabled, 1 enabled</td>
<td>N (only for automatic selection of VMs through a query rule)</td>
<td>Clients tab &gt; Select automatically through Hyper-V Intelligent Policy query</td>
</tr>
<tr>
<td>-blkincr</td>
<td>WMI</td>
<td>For block-level incremental backup 0 disabled, 1 enabled</td>
<td>N (required for Accelerator)</td>
<td>Hyper-V tab</td>
</tr>
<tr>
<td>-use_accelerator</td>
<td>WMI</td>
<td>0 disabled, 1 enabled</td>
<td>N</td>
<td>Hyper-V tab</td>
</tr>
<tr>
<td>-snapshot_method</td>
<td>WMI, VSS</td>
<td>HV (for WMI) Hyper-V_v2 (for VSS)</td>
<td>Y</td>
<td>Hyper-V tab</td>
</tr>
<tr>
<td>-offhost_backup</td>
<td>VSS</td>
<td>0 No off-host backup (default) 1 Use off-host backup method (for alternate client)</td>
<td>N</td>
<td>Attributes tab &gt; Perform off-host backup</td>
</tr>
<tr>
<td>-use_alt_client</td>
<td>VSS</td>
<td>0 No alternate client 1 Use an alternate client</td>
<td>Y (with -offhost_backup option)</td>
<td>Attributes tab &gt; Perform off-host backup &gt; Use</td>
</tr>
<tr>
<td>alt_client_name</td>
<td>VSS</td>
<td>The name of the alternate client</td>
<td>Y (with use_alt_client)</td>
<td>Attributes tab &gt; Perform off-host backup &gt; Machine</td>
</tr>
<tr>
<td>snapshot_method_args</td>
<td>WMI, VSS</td>
<td>keyword=value, keyword=value,...</td>
<td>N</td>
<td></td>
</tr>
</tbody>
</table>

Table C-2 describes the keywords for -snapshot_method_args.
<table>
<thead>
<tr>
<th>Keyword</th>
<th>Backup method</th>
<th>Values</th>
<th>Navigation in policy editor of NetBackup Administration Console</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtual_machine_backup=</td>
<td>WMI, VSS</td>
<td>1 Disable file-level recovery</td>
<td>Hyper-V tab &gt; Enable file recovery from VM backup</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 Enable file-level recovery</td>
<td></td>
</tr>
<tr>
<td>nameuse=</td>
<td>WMI, VSS</td>
<td>0 Use VM host name to identify backup image</td>
<td>Hyper-V tab &gt; Primary VM identifier</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Use VM display name to identify backup image</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 Use VM GUID to identify backup image</td>
<td></td>
</tr>
<tr>
<td>allow_offline_backup=</td>
<td>VSS</td>
<td>0 Do not allow offline backup of non-VSS virtual machines</td>
<td>Hyper-V tab &gt; Enable offline backup of non-VSS VMs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Allow offline backup of non-VSS virtual machines</td>
<td></td>
</tr>
<tr>
<td>csv_timeout=</td>
<td>VSS</td>
<td>Determines how many minutes the backup job waits,</td>
<td>Hyper-V tab &gt; Cluster shared volumes timeout</td>
</tr>
<tr>
<td></td>
<td></td>
<td>in case another node in the cluster backs up the same shared volume</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>at the same time. The default is 180 (wait for 3 hours). A wait of 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>hours is recommended if you have multiple virtual machines on one CSV</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The Windows 2008 R2 cluster node owns the CSV for the entire duration</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>of the backup. If you do not want NetBackup to wait for another</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>backup to release the shared volume, set the value to 0. If at the</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>same time another node in the cluster backs up a shared volume that</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>this backup requires, the backup fails with status 156.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Note:</strong> On Windows server 2012, cluster nodes can back up the same</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CSV simultaneously. As a result, NetBackup does not use this option if</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>the cluster is on Windows 2012.</td>
<td></td>
</tr>
<tr>
<td>prov_type=</td>
<td>VSS</td>
<td>0 Automatic selection of provider. Allows VSS to use the best possible</td>
<td>Hyper-V tab &gt; Advanced &gt; Provider Type</td>
</tr>
<tr>
<td></td>
<td></td>
<td>provider for the snapshot.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Use system provider</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 Use software provider</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 Use hardware array provider</td>
<td></td>
</tr>
</tbody>
</table>
## Table C-2

Keywords and values for `snapshot_method_args` (continued)

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Backup method</th>
<th>Values</th>
<th>Navigation in policy editor of NetBackup Administration Console</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>snap_attr=</code></td>
<td>VSS</td>
<td>0 (default)</td>
<td>Hyper-V tab &gt; Advanced &gt; Snapshot Attribute</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Differential. Use copy-on-write snapshot method.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 Plex. Use clone or mirror snapshot method.</td>
<td></td>
</tr>
<tr>
<td><code>file_system_optimization=</code></td>
<td>WMI</td>
<td>0 Disable file system optimization</td>
<td>File system optimization is enabled if either or both of the following are selected:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Enable file system optimization</td>
<td>Hyper-V tab &gt; Exclude deleted blocks</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hyper-V tab &gt; Exclude swap and paging files</td>
</tr>
<tr>
<td><code>exclude_swap=</code></td>
<td>WMI</td>
<td>Reduces the size of the backup image by excluding the data in the guest OS system paging file (Windows) or the swap file (Linux).</td>
<td>Hyper-V tab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 Disable</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Enable</td>
<td></td>
</tr>
<tr>
<td><code>snapact=</code></td>
<td>WMI</td>
<td>3 Abort if NetBackup snapshots exist</td>
<td>Hyper-V tab &gt; Advanced &gt; Existing snapshot handling</td>
</tr>
<tr>
<td><code>drive_selection=</code></td>
<td>WMI</td>
<td>0 Include all disks</td>
<td>Hyper-V tab &gt; Advanced &gt; Virtual disk selection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Exclude boot disk</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 Exclude data disks</td>
<td></td>
</tr>
<tr>
<td><code>hv_snapshot_consistency_level=</code></td>
<td>WMI</td>
<td>Determines whether the VM's file system data is consistent (quiesced) before the backup starts.</td>
<td>Hyper-V tab &gt; Advanced &gt; Consistency level</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 Application Consistent Then Crash Consistent</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Application Consistent</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 Crash Consistent</td>
<td></td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
</table>
| `-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)

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-deletefromquery query_string</td>
<td>Deletes the specified query string from the policy query rules.</td>
</tr>
<tr>
<td></td>
<td>Examples:</td>
</tr>
<tr>
<td></td>
<td>To delete vm27 from the list of values in the query rule of policy1:</td>
</tr>
<tr>
<td></td>
<td>bpplinclude policy1 -deletefromquery &quot;vm27&quot;</td>
</tr>
<tr>
<td></td>
<td>This example also deletes the comma preceding vm27 if such a comma exists in the query rules.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> 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.</td>
</tr>
<tr>
<td></td>
<td>To delete an entire query from the policy:</td>
</tr>
<tr>
<td></td>
<td>bpplinclude policy1 -deletefromquery hyperv://?filter=Displayname AnyOf &quot;grayfox7&quot;,&quot;grayfox9&quot;</td>
</tr>
<tr>
<td>-deletefromquery -f file_name</td>
<td>Deletes the file entries from the query rules.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td>To delete a query from a policy:</td>
</tr>
<tr>
<td></td>
<td>bpplinclude policy1 -deletefromquery -f qfile1</td>
</tr>
<tr>
<td></td>
<td>where the contents of qfile1 are:</td>
</tr>
<tr>
<td></td>
<td>hyperv://?filter=Displayname Contains &quot;VM&quot; AND HypervServer Contains &quot;ROS&quot;</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> The values &quot;VM&quot; and &quot;ROS&quot; are not escaped.</td>
</tr>
</tbody>
</table>

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:**
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.

- **–vmid**
  For restore to an alternate location, retains the original GUID for the restored VM (prevents the creation of a new GUID).

- **–R absolute_path_to_rename_file**
  For restore to an alternate 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 “Hyper-V examples of restore to alternate locations” on page 196.
  Further notes are available on the rename file:
  See “The nbrestorevm –R rename file for Hyper-V” on page 198.

- **–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 verify 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.

**Hyper-V examples of restore to original location**

For restore to the original location, NetBackup 8.0 adds a new feature for VMs that were backed up with the WMI method: You can specify a new display name for the restored a VM.

**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. From a backup that was made with the WMI method, restore to the original location and change the virtual machine's display name**

```
nbrestorevm.exe -vmhv -C vml.acme.com -O -R C:\vmadmin\renamefile2
```

The file renamefile2 specifies the new display name. The following example rename file changes the display name to vm6:

```
change /F/VMs/vml/2D7C007E-90FB-44EC-ABB2-6733D42A51F5.VMRS to /F/VMs/vml/2D7C007E-90FB-44EC-ABB2-6733D42A51F5.VMRS
change /F/VMs/vml/2D7C007E-90FB-44EC-ABB2-6733D42A51F5.vmcx to /F/VMs/vml/2D7C007E-90FB-44EC-ABB2-6733D42A51F5.vmcx
change /F/VMs/vml/Virtual Hard Disks/vm1.vhdx
```
to /F/VMs/vm1/Virtual Hard Disks/vm1.vhdx

change vmname to vm6

Note: The paths in the rename file should be identical for both change and to. Only the last directive (change vmname to vm6) specifies the new display name, where vmname is a required literal entry, and to specifies the new name.

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

nbrestorevm -vmhv -C VM_to_restore -O -L progress_log_file

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

nbrestorevm -vmncf -C VM_to_restore -O

E. 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.

Hyper-V examples of restore to alternate locations

For restore to an alternate location, NetBackup 8.0 adds new restore features for VMs that were backed up with the WMI method:

- A new VM GUID is generated by default when you restore a VM to an alternate location.
  As an option, you can choose to keep the original GUID.
- You can specify a new display name when you restore the VM.

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

nbrestorevm -vmhnew -C VM_to_restore -R absolute_path_to_rename_file

In the -R option rename file, 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:** From the backups that were made with the WMI method, nbrestorevm generates a new VM GUID by default when you restore to an alternate location. To retain the original GUID, add the -vmid option.

**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 198.

**B. From a backup that a different master server made with the WMI method, restore to an alternate location and retain the VM's original GUID**

```
nbrestorevm.exe -vmhvnew -C vm1.acme.com -S master44.acme.com
-vmserver HVserver6.acme.com -vmid -R \C:\vmadmin\renamefile1
```

- The -vmserver option specifies the restore destination (HVserver6.acme.com).
- The -S option specifies the master server that made the WMI backup (different from the current master).
- The -vmid option retains the original GUID for the restored VM. To generate a new GUID, omit the -vmid option.
- The -R option identifies a text file that uses change directives to specify file paths for restore to the alternate location.

**Note:** The -R option must specify the absolute path to the rename file. In this example, renamefile1 contains the following directives to change the VM's file paths at the alternate restore location:

```
change /F/VMs/vm1/2D7C007E-90FB-44EC-ABB2-6733D42A51F5.VMRS to /D/VMs/vm1/2D7C007E-90FB-44EC-ABB2-6733D42A51F5.VMRS
change /F/VMs/vm1/2D7C007E-90FB-44EC-ABB2-6733D42A51F5.vmcx to /D/VMs/vm1/2D7C007E-90FB-44EC-ABB2-6733D42A51F5.vmcx
change /F/VMs/vm1/Virtual Hard Disks/vm1.vhdx to /D/VMs/vm1/Virtual Hard Disks/vm2.vhdx
```
C. 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 A or B for rename file examples.

D. Restore the virtual machine files to a staging location

```
nbrestorevm.exe -vmhvstage -S master44.acme.com -C vm6.acme.com -O
-vmserver HVserver6.acme.com -R "C:\Program Files\Veritas\NetBackup\Logs\44\Admin\logs\rfile4.tmp.chg" -L "C:\Program Files\Veritas\NetBackup\Logs\44\Admin\logs\rfile4.tmp.log"
```

- The `-vmhvstage` option restores the virtual machine files to a staging location.
- The `-vmserver` option specifies the host for the staging location.
- The `-L` option specifies the name of an existing file in which to write progress information.
- For restore to a staging location, NetBackup does not generate a new GUID.
- The file `rfile4.tmp.chg` specifies the new paths for the virtual machine files at the staging location:

```
change /F/VMs/vm6/2D7C007E-90FB-44EC-ABB2-6733D42A51F5.VMRS to /E/VMs/vm6/2D7C007E-90FB-44EC-ABB2-6733D42A51F5.VMRS
change /F/VMs/vm6/2D7C007E-90FB-44EC-ABB2-6733D42A51F5.vmcx to /E/VMs/vm6/2D7C007E-90FB-44EC-ABB2-6733D42A51F5.vmcx
change /F/VMs/vm6/Virtual Hard Disks/vm1.vhdx to /E/VMs/vm6/Virtual Hard Disks/vm2.vhdx
```

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

<table>
<thead>
<tr>
<th><code>-R</code> rename file directives</th>
<th>Description and notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>change /original_VM_GUID.xml_path to /new_VM_GUID.xml_path</code></td>
<td>The path to the VM's original .xml file and to the restored .xml file.</td>
</tr>
<tr>
<td><code>change /original_VM_GUID.bin_path to /new_VM_GUID.bin_path</code></td>
<td>The path to the VM's original .bin file and to the restored .bin file.</td>
</tr>
<tr>
<td><code>change /original_VM_GUID.vsv_path to /new_VM_GUID.vsv_path</code></td>
<td>The path to the VM's original .vsv file and to the restored .vsv file.</td>
</tr>
<tr>
<td><code>change /original_VM.vhd_path to /new_VM.vhd_path</code></td>
<td>The path to the VM's original vhd file and to the restored vhd file.</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>NetBackup status code</th>
<th>Explanation and recommended action</th>
</tr>
</thead>
<tbody>
<tr>
<td>2821, Hyper-V policy restore error</td>
<td>The VM already exists at the restore location. On nbrestorevm, include the -o option to overwrite the existing VM.</td>
</tr>
<tr>
<td>23, socket read failed</td>
<td>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.</td>
</tr>
<tr>
<td>135, client is not validated to perform the requested operation</td>
<td>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 &gt; Master Servers &gt; double-click the master server &gt; Servers.</td>
</tr>
<tr>
<td>144, invalid command usage</td>
<td>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.</td>
</tr>
<tr>
<td>190, found no images or media matching the selection criteria</td>
<td>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. <strong>Note:</strong> 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.</td>
</tr>
</tbody>
</table>

### Logs for troubleshooting the nbrestorevm command

The following logs may contain helpful messages on nbrestorevm.
### Table C-6 Logs with messages on nbrestorevm

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