Microsoft® Hyper-V® Data Protection Guide on Dell™ PowerVault™ MD Series Storage Arrays

A Dell Technical White Paper

Dell™ PowerVault™ MD32X0, MD32X0i, and MD36X0i Series of Arrays

June 4, 2012

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This document provides information about planning your backup and restore strategies using Microsoft® Hyper-V® technology and the Dell™ PowerVault™ MD32X0, MD32X0i, and MD36X0i Series of Storage Arrays.

Hyper-V provides the software infrastructure and management tools in the Windows Server® 2008 operating system to create and manage a virtualized server computing environment. The configuration in this document uses the Windows Server 2008 Release 2 operating system with the following enhancements to Hyper-V:

- **Live Migration** – A transparent move of virtual machines (VMs) from one cluster-node to another with no loss of VM connectivity between nodes. Live Migration uses Clustered Shared Volumes (CSVs).
- **Dynamic virtual machine storage** – Support for hot plug-in and hot removal of storage.
- **Enhanced processor support** – Up to 32 physical cores.
- **Enhanced networking support** – Support for jumbo frames on VMs.

For information about how to deploy Hyper-V, refer to *Implementing Hyper-V on the Dell PowerVault MD32X0, MD32X0i, and MD36X0i Series of Storage Arrays*. For information about backup and recovery options, refer to *Data Protection on the Dell PowerVault MD32X0, MD32X0i, and MD36X0i Series of Storage Arrays in a Hyper-V Environment*.

This document provides useful information for system administrators and IT planners or designers who are in the process of planning to use Hyper-V in their environment.

Disclaimer

The steps in this document were performed on a test configuration. Live data was not used. This document implies no warranties. These instructions are not guaranteed to work in every situation. For the latest information about Dell IP storage area network (SAN) storage arrays, refer to the Dell storage array installation guides. Go to this website:

http://www.dell.com

Supported Hardware and Software

Microsoft Hyper-V requires specific hardware. Refer to the Microsoft Windows Server catalog for Hyper-V to find out if your systems qualify. Go to this website:

 http://go.microsoft.com/fwlink/?LinkId=111228

You also can check the Dell-supported hardware for Microsoft Hyper-V contained in the *Dell Solutions Overview Guide for Microsoft Hyper-V*. Go to this website:

http://support.dell.com/support/edocs/software/HyperV/en

If you need additional information, go to this website:

http://www.dell.com/hyperv

The MD32X0, MD32X0i, and MD36X0i storage arrays are all supported with the Microsoft Windows Server 2008 Release 2 operating system running the Hyper-V role.

Planning for Hyper-V Virtualized Configurations

Planning for Hyper-V virtualized configurations includes the following items:

- Making sure that pre-installation requirements are met
- Configuring the network adapters
- Deciding how to assign physical drives to virtual machines
- Deciding when to use pass-through physical disks or virtual hard drives (VHDs)
- Planning child partitions
- Deciding how to cluster

Pre-Installation Requirements

To install and use the Hyper-V role, make sure that you have the following processing features on your system:

- An x64-based processor

  Hyper-V is not available for 32-bit systems or Intel® Itanium®-based systems

- Hardware-assisted virtualization

  Processors with Intel Virtualization Technology (Intel VT)

  AMD Virtualization Technology (AMD-V)

- Hardware-enforced data execution prevention (DEP) available and enabled

  The Intel XD bit must be enabled (execution disable bit).

  The AMD NX bit must be enabled (no execute bit).

Install the updates that you need. To receive a current list of all of the updates, go to this website:

http://technet.microsoft.com/en-us/library/dd430893.aspx

Suggested Hyper-V and PowerVault™ MD32X0, MD32X0i, and MD36X0i Configurations

Figure 1 shows how to configure a Microsoft Hyper-V environment with a PowerVault MD32X0 storage array.

Figure 1.   Dell PowerVault MD32X0 Configuration
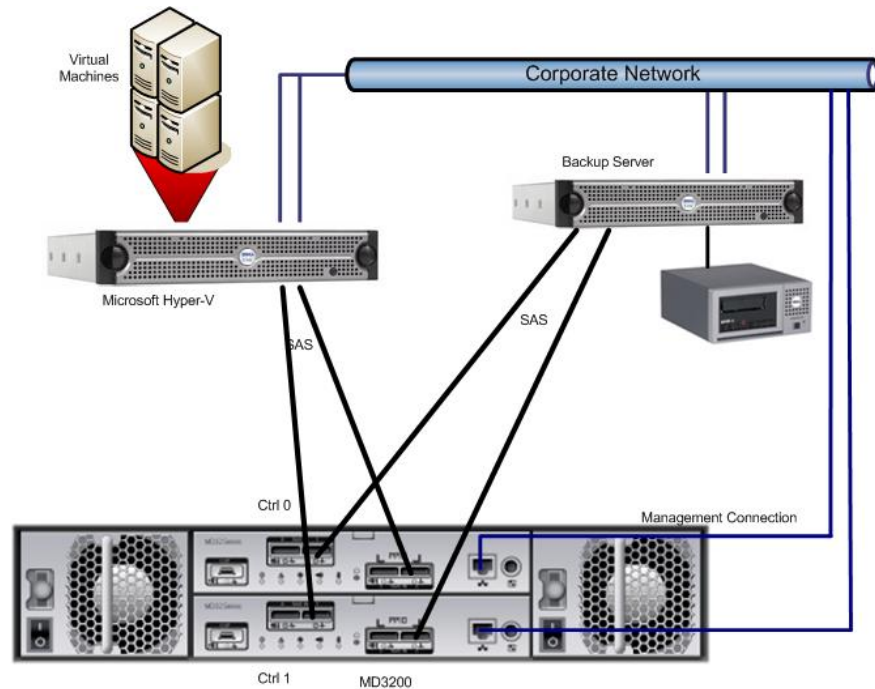
Redundancy is established by installing separate data paths between the host and the storage array, in which each path is to different RAID controller modules. Redundancy protects the host from losing access to data in the event of path failure, because both RAID controllers can access all the disks in the storage array. Figure 1 shows redundant, high-availability cabling configuration for two hosts. This is best practice for Microsoft Hyper-V installations.

Note: It is best practice to install two dual-ported HBAs and use a port from each one to improve availability. With this configuration, either a cable or a SAS HBA can fail and the access to the data is still guaranteed.

For more information about the MD32X0 storage array, go to this website:

http://www.dell.com/content/products/productdetails.aspx/pvaul_MD32X0?c=us&cs=555&l=en&s=biz&dgc=IR&cid=14054&lid=407200

You can cable your MD32X0 storage array to up to four hosts. The configuration that you choose depends on the number of hosts you have, whether you are connecting to a host or a cluster-node, and the level of data redundancy that you need.

Figure 2.   **Dell PowerVault MD32X0i (IP-SAN)**
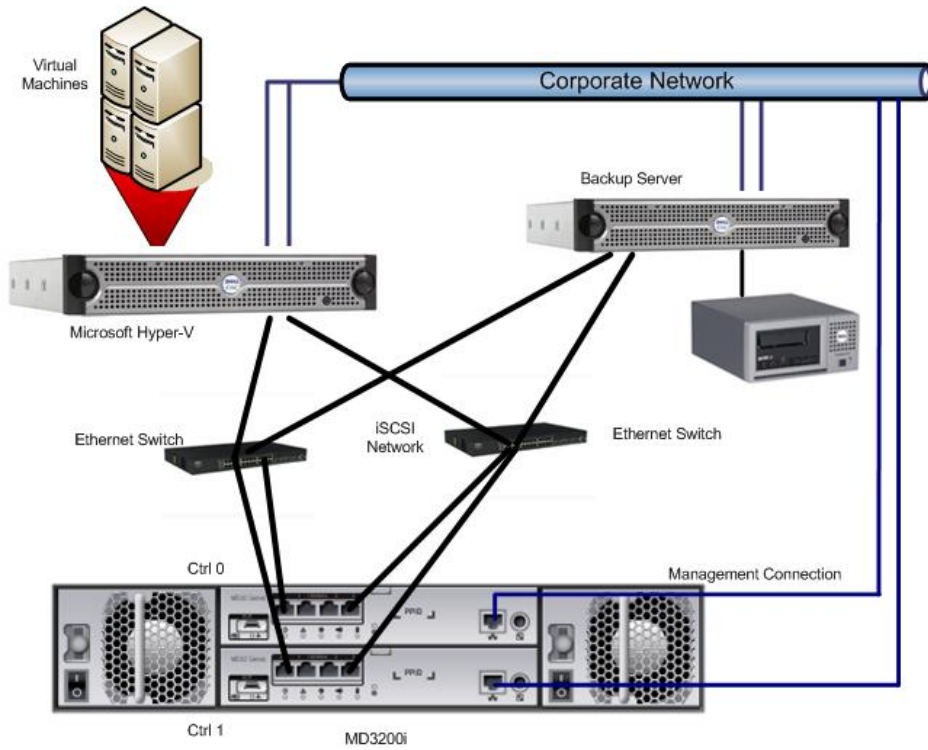
Figure 3.   **Dell PowerVault MD36X0i (IP-SAN)**
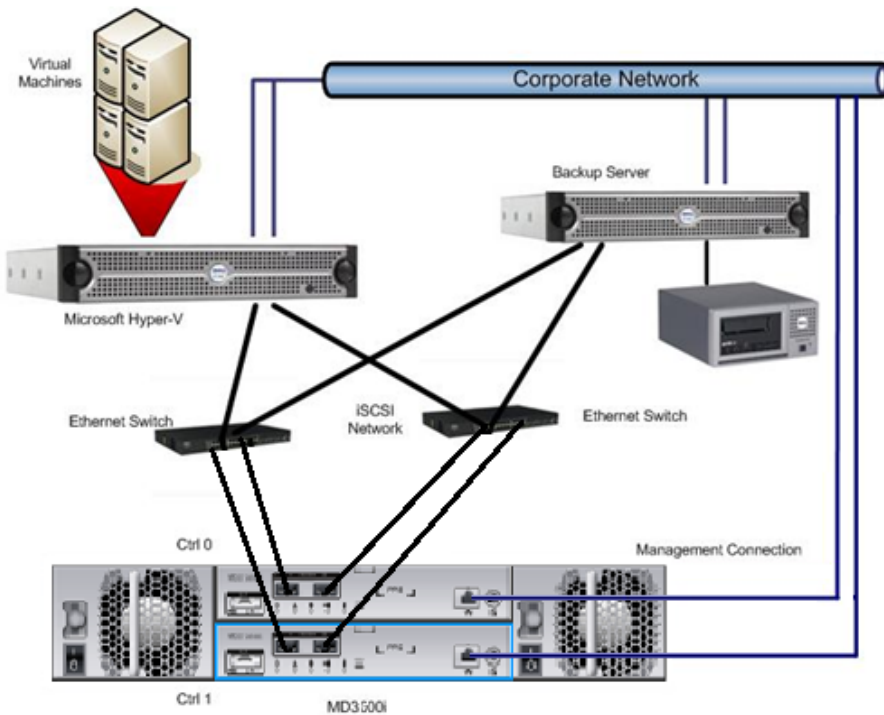
For the iSCSI-based MD32X0i or MD36X0i storage array, you must have two network interface cards (NICs) for I/O communication to occur between the storage array and each server. It is best practice to set up the management ports (out-of-band) for managing the MD32X0i or MD36X0i storage array because they will be required for the initial configuration. For best performance when planning the network connection to the MD32X0i or MD36X0i storage array, make sure that the cabling looks similar to Figure 4 or Figure 5 (these configuration uses maximum performance by using all four or two ports per controller, respectively).

Figure 4. MD32X0i Network Configuration
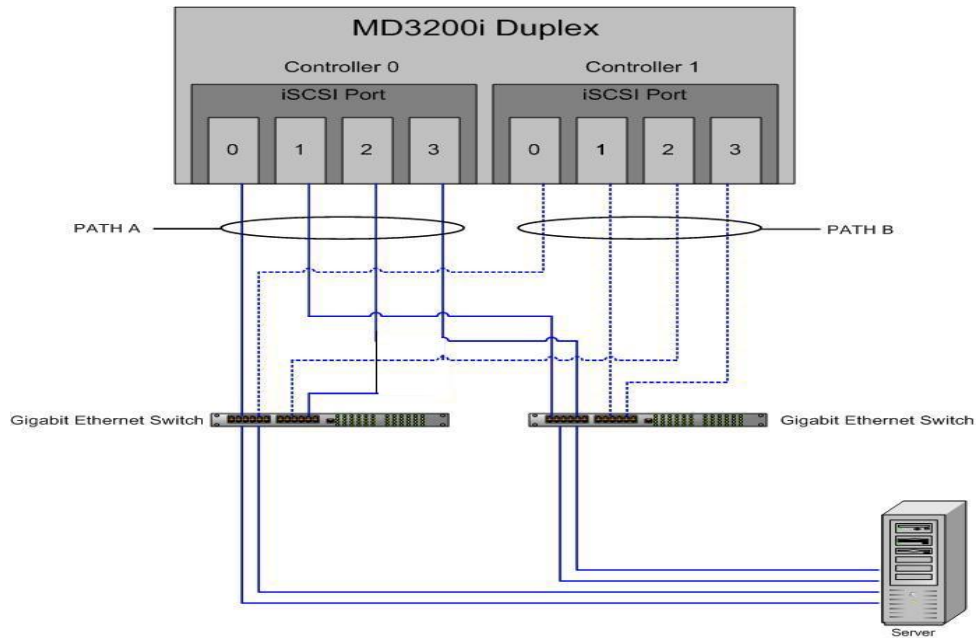
Figure 5. MD36X0i Network Configuration
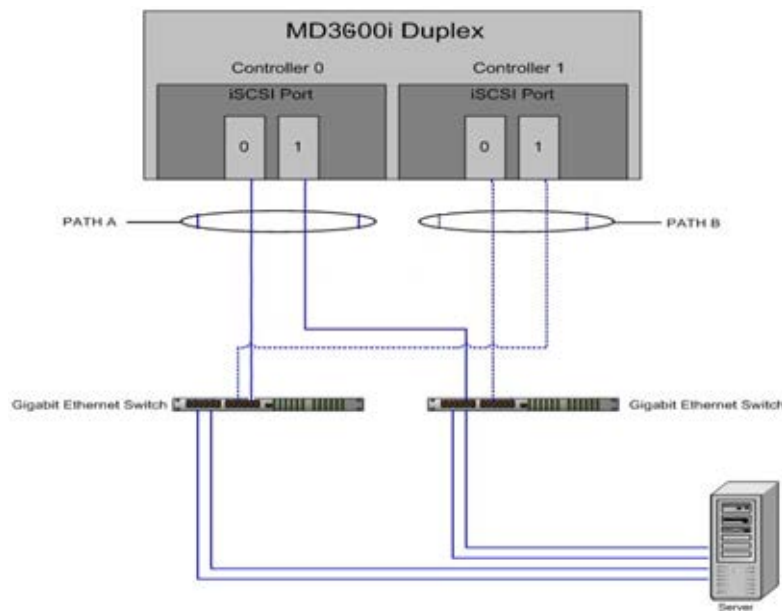
For more information about how to plan for an IP SAN network, refer to the *IP SAN Best-Practices*, which is available at this website:

http://www.dell.com/downloads/global/products/pvaul/en/ip-san-best-practices-en.pdf

Implementing Data Protection on the PowerVault MD32X0, MD32X0i, or MD36X0i Storage Array in a Hyper-V Environment

You can implement a backup and restore strategy several ways in the Microsoft Hyper-V environment using the PowerVault MD32X0, MD32X0i, or MD36X0i storage array. This section describes different options using some standard backup software products and storage array-based features, such as Snapshot and Virtual Disk Copy.

Backup and Restore through the Hyper-V Host or Parent

You must consider several items before implementing the backup strategy for your Hyper-V environment when you plan to provide backup through the parent. For example, you can only back up VHDs while using Microsoft Volume Shadow Copy Services (VSS) through the parent. You can back up pass-through through the child (virtual machine or VM) or by using the Snapshot premium feature. However, if you want to use the Snapshot premium feature, you must pause the VM to make sure that the snapshot is consistent for the snapshot creation. Figure 6 shows several ways you can back up your system.

Figure 6. **Backup Strategies through the Parent**

1. Backup of a passthrough device through the child partition
2. Backup of a VHD File through the parent Server
3. Backup of a Array-Based Snapshot through the parent Server
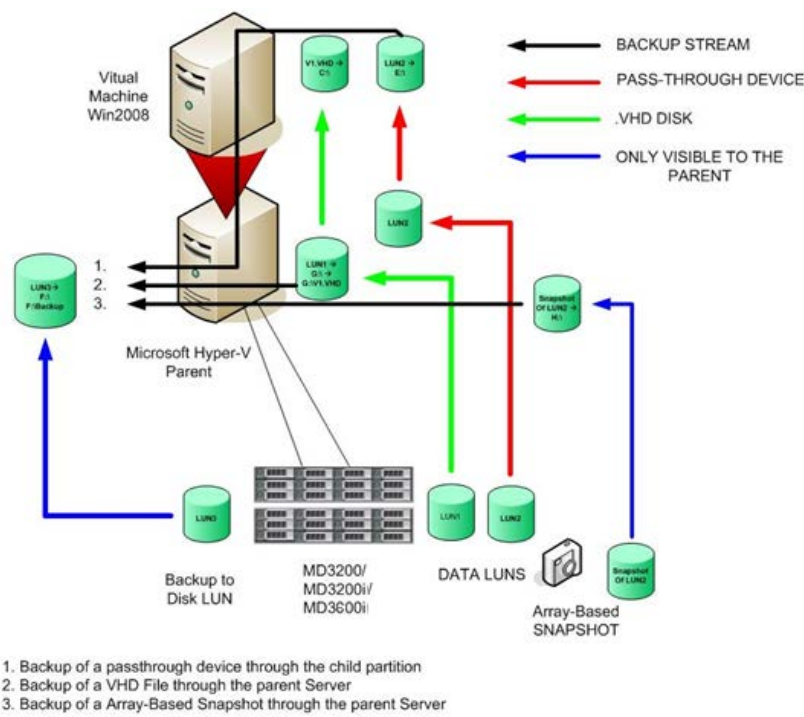
Backing Up your Virtual Machine with Windows Server Backup

If the VM uses only VHDs, you can easily back up the VHDs with Windows Server backup. Windows Server backup lets you make consistent backups using the internal Microsoft feature. To perform the backup, make sure that the Windows Server backup feature is installed. You can install this feature by using the **Feature** option in the Server Manager.

Click **Add Feature** to run a wizard that will install the selected features.

Note	In this section, an example is referenced that was developed during testing. Whenever the words "In the example" appear, the text following those words refers to the test example.

You can now configure Windows Server® backup to back up your VM. For fastest restore performance, you can create a backup virtual disk on the MD32X0, MD32X0i, or MD36X0i storage array. For best price-per-capacity, you can use near-line SAS hard drives. Because of the increase in command queuing, the near-line SAS hard drives have a higher write performance than SATA drives which are offered in the earlier MD3000 or MD3000i storage array and are ideal for backing up to disk devices. In this example, a backup virtual disk was created on the MD32X0, MD32X0i, or MD36X0i storage array and connected to the parent as drive `F:\`.

The next steps show you how to back up a VM using only VHDs. You should also back up the VM configuration. In the example, the VM configuration and the VHD file reside on the same disk, so the complete disk must be backed up.

1. Start the Windows Server Backup.

2. Select the Backup policy that you want to run. You can either run it once or schedule it.

The **Backup Wizard** guides you through the process for a backup.

Table 1.   **Backup Wizard**

Page	Action
Backup Options	1. Select the type of backup that you want to perform. You can select either **Scheduled backup options** or **Different options**. In the example, **Different options** was selected. 2. Click **Next**.
Select Backup Configuration	3. Select the type of configuration you want. You can select either **Full server** or **Custom**. Select **Custom** if you only want to back up the virtual machine. 4. Click **Next**.
Specify Items for Backup	5. Click **Add Items**. 6. Select the drive on which the VM is stored. If you assigned more than one VHD to your VM, make sure that those VHDs are also selected. This action makes sure that the VHD file is backed up along with the VM

	configuration information.
	7. Click **OK**.
	8. Click **Next**.
Specify Destination Type	9. Select the type of storage for backup. You can select either **Local drives** or **Remote shared server**.
	10. Click **Next**.
Select Backup Destination	11. Select the volume on which you want the backup stored.
	12. Click **Next**.
Confirmation	The Confirmation page shows you an overview of the last steps.
	13. Click **Backup**.
	After you click **Backup**, Windows shows the progress. The application first creates the snapshot and then backs up the files.

Note	The Snapshot backup uses the internal VSS provider, which means that the snapshot is created using a file system snapshot. You need approximately 20 percent free space on your disk device for the snapshot.

The backup is now in progress. To receive continuous protection, perform a scheduled backup.

Backing Up the VM with Snapshot

You can use the built-in hardware-based Snapshot and Virtual Disk Copy premium features to back up virtual machines (VMs). Using these features lets you back up VHDs and pass-through devices of the VM. The advantages of using Snapshot and Virtual Disk Copy are that the backup operation is independent from the server and you can mount those snapshots on a backup server to perform an off-host backup. However, you need approximately 20 percent free capacity on your MD32X0, MD32X0i, or MD36X0i storage array to perform a snapshot backup. To make sure that your data is valid, you must pause your VM during snapshot creation. Later sections describe how to use the Microsoft VSS to back up VMs with the Snapshot premium feature. The VSS feature lets you make consistent online snapshots without pausing your VM. This capability requires a third-party product, such as Symantec® BackupExec 12.5 or Commvault Galaxy, to achieve this function. If you do not want to use those products and if you are familiar with scripting, you also can script this feature by using the Microsoft VSS Software Development Kit (SDK) to create a comprehensive command line VSS feature set. You can download the SDK from this website:
http://www.microsoft.com/downloads/details.aspx?FamilyID=0B4F56E4-0CCC-4626-826A-ED2C4C95C871&displaylang=en

To start the backup, determine on which virtual disks the VM resides. In the example, the `G:\` drive contains the boot image (as a VHD) and the VM configuration. A pass-through device also is mapped to this VM.

Figure 7.   Example Virtual Machine Settings
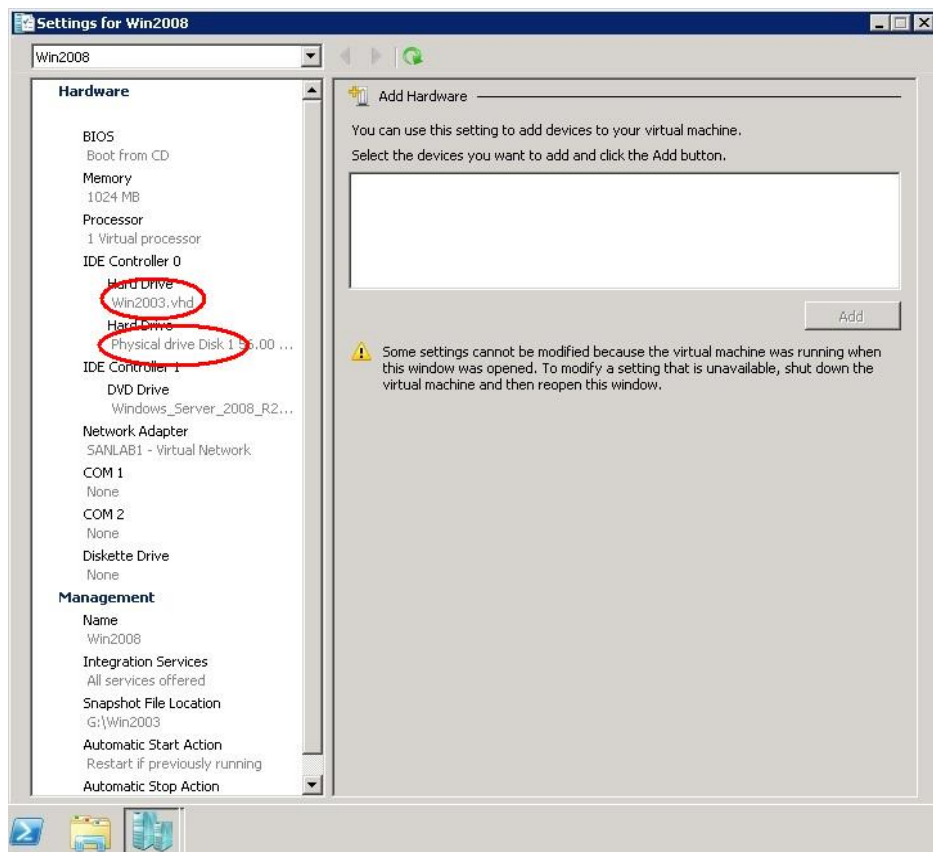
When you click the settings of the VM in the Hyper-V Manager, you can see the devices attached to this VM. In the example, the pass-through device is `Physicaldrive 1`.

A utility called `SMdevices` is installed with the Dell Modular Disk Storage Manager of the MD32X0, MD32X0i, or MD36X0i storage array. `SMdevices` is located in the following directory:

```
C:\Program Files (x86)\Dell\MD Storage Manager\Utils
```

When you run `SMdevices`, you receive output similar to the following:

```
C:\Program Files (x86)\Dell\MD Storage Manager\util>SMdevices.bat
Dell Modular Disk Storage Manager Devices, Version 10.70.36.03
Built Mon Apr 21 12:38:50 CDT 2010
Copyright (C) 2006 - 2010  Dell Inc. All rights reserved.

    \\.\PHYSICALDRIVE1 [Storage Array MD32X0i, Virtual Disk
    WIN2008_DATA, LUN 0, Virtual Disk ID
    <600a0b800036e4c70000168e4a3afe41>, Alternate Path (Controller-0):
    In Use]
    \\.\PHYSICALDRIVE4 [Storage Array MD32X0i, Virtual Disk
    LIVEMIGRATE, LUN 3, Virtual Disk ID
    <600a0b800036e4c70000e2a64a0cd55c>, Preferred Path (Controller-0):
    In Use]
```

```
\\.\PHYSICALDRIVE6 [Storage Array MD32X0i, Virtual Disk WIN2008,
LUN 5, Virtual Disk ID <600a0b800036e4c70000e2ba4a0ce7ac>,
Preferred Path (Controller-0): In Use]  \\.\PHYSICALDRIVE9
[Storage Array MD32X0i, Virtual Disk QUORUM, LUN 8, Virtual Disk
ID <600a0b800036e4cc0000444a4a0cecad>, Preferred Path (Controller-
0): In Use]  \\.\PHYSICALDRIVE11 [Storage Array MD32X0i, Virtual
Disk Backup, LUN 11, Virtual Disk ID
<600a0b800036e4cc000064394a233920>, Preferred Path (Controller-0):
In Use]  \\.\PHYSICALDRIVE12 [Storage Array MD32X0i, Virtual Disk
WIN2008-1, LUN 10, Virtual Disk ID
<600a0b800036e4cc000077584a3afada>, Preferred Path (Controller-0):
In Use]
\\.\SYMsmUTMLun0 [Storage Array MD32X0i, Virtual Disk Access, LUN
31, Virtual Disk ID <600a0b800036e4c70000158449d02c7a>]


C:\Program Files (x86)\Dell\MD Storage Manager\util>
```

The devices shown in bold text are the example VMs on the MD32X0, MD32X0i, or MD36X0i storage arrays. For this example, snapshots of the Virtual Disk WIN2008_DATA and WIN2008 are needed.

1. Open the Hyper-V Manager, and click **Pause**.

2. Open the Dell Modular Disk Storage Manager (MDSM).

3. Select the **Configure** tab.

4. Click **Create Snapshot Virtual Disks**. You must create one snapshot virtual disk at a time.

5. Select the disk, and click **Next**.

6. Select a path. You can select either **Simple** (recommended) or **Advanced**. For this example, **Simple** was selected.

    If you want to configure the space on which the snapshot will reside, you can select the **Advanced** option. This option lets you determine how much space you can reserve for the Snapshot operation.

7. Click **Next**.

8. Enter the name for the snapshot virtual disk and the name of the repository virtual disk.

9. Click **Next**.

10. Select if you want to map the snapshot virtual disk to the host now or later.

    You can either mount it on the same server or move the snapshot to a dedicated backup server.

11. Click **Finish**.

    A confirmation appears telling you that the snapshot was created.

    The application asks you if you want to create another snapshot. In the example, another snapshot was created for virtual disk WIN2008_DATA.

12. Resume your VM by clicking **Resume** in the Hyper-V Manager.

    The snapshot is now visible to the server.

> **Note** If you use a non-Windows OS for a virtual machine, make sure that the server to which you map the snapshots is capable of reading the file system.

13. Use the SMdevices utility to see which physical drives contain the snapshots.

```
C:\Program Files (x86)\Dell\MD Storage Manager\util>SMdevices.bat
Dell Modular Disk Storage Manager Devices, Version 10.70.36.03
Built Mon Apr 21 12:38:50 CDT 2010
Copyright (C) 2006 - 2010  Dell Inc. All rights reserved.

  \\.\PHYSICALDRIVE1 [Storage Array MD32X0i, Virtual Disk WIN2008_DATA,
LUN 0, Virtual Disk ID <600a0b800036e4c70000168e4a3afe41>, Preferred
Path (Controller-0): In Use]
\\.\PHYSICALDRIVE2 [Storage Array MD32X0i, Virtual Disk WIN2008-1, LUN
1, Virtual Disk ID <600a0b800036e4cc0000775d4a3f03d4>, Preferred Path
(Controller-0): In Use]  \\.\PHYSICALDRIVE3 [Storage Array MD32X0i,
Virtual Disk WIN2008_DATA-1, LUN 2, Virtual Disk ID
<600a0b800036e4cc000077624a3f03f5>, Preferred Path (Controller-0): In
Use]
\\.\PHYSICALDRIVE4 [Storage Array MD32X0i, Virtual Disk LIVEMIGRATE, LUN
3, Virtual Disk ID <600a0b800036e4c70000e2a64a0cd55c>, Preferred Path
(Controller-0): In Use]
\\.\PHYSICALDRIVE6 [Storage Array MD32X0i, Virtual Disk WIN2008, LUN 5,
Virtual Disk ID <600a0b800036e4c70000e2ba4a0ce7ac>, Preferred Path
(Controller-0): InUse]  \\.\PHYSICALDRIVE9 [Storage Array MD32X0i,
Virtual Disk QUORUM, LUN 8, Virtual Disk ID
<600a0b800036e4cc0000444a4a0cecad>, Preferred Path (Controller-0): In
Use]  \\.\PHYSICALDRIVE11 [Storage Array MD32X0i, Virtual Disk Backup,
LUN 11, Virtual Disk ID <600a0b800036e4cc000064394a233920>, Preferred
Path (Controller-0): In Use]  \\.\SYMsmUTMLun0 [Storage Array MD32X0i,
Virtual Disk Access, LUN 31, Virtual Disk ID
<600a0b800036e4c70000158449d02c7a>]

C:\Program Files (x86)\Dell\MD Storage Manager\util>
```

In this example, the snapshots are marked in bold text.

Placing the Snapshot Online through Windows Disk Management

1. Open the Windows **Computer Management**, and select **Disk Management**.

2. Right-click the disks shown in SMdevices. In the example, they are Disk2 and Disk3.

3. Select **Online**.

In the example, the VM is a Windows server, so you can see the name and content of the pass-through device. The snapshot virtual disks are now drive letters E:\ and H:\.

Use Windows Server Backup to back up the disks or copy the data manually to a given destination.

> **Note** Snapshots are virtual which means that the snapshot repository that was created during the snapshot creation process contains only changes that occurred since the last time you created a snapshot. If you need a full physical copy, do not map the snapshots to the server. Instead, create a virtual disk copy of the snapshot with the MDSM and map the virtual disk copy to the server. For information about how to create virtual disk copies, refer to the *MDSM User Guide*.

If you want to do recurring backups using this method, write a script. For information about how to script the MDSM Snapshot premium feature, refer to the *MDSM Command Line Interface Guide*. The following example shows how to create a snapshot using the `Smcli` program, which is usually located in `C:\Program Files (x86)\DELL\MD Storage Manager\client`.

```
C:\Program Files (x86)\Dell\MD Storage Manager\client>smcli –n MD32X0i –
c "create SnapshotVirtualDisk sourceVirtualDisk = WIN2008;"

Performing syntax check...
Syntax check complete.
Executing script...
Script execution complete.

SMcli completed successfully.
C:\Program Files (x86)\Dell\MD Storage Manager\client>
```

You can perform Windows Hyper-V scripting with the WMI Interface from Microsoft. For more information, refer to the *Windows Server 2008 Hyper-V Scripting* document at this website:

http://edge.technet.com/Media/Feature-of-the-Week-Windows-Server-2008-Hyper-V-Scripting/

## Backing Up Your Virtual Machine through the Hardware VSS Provider

Multiple methods exist to back up and recover VMs with Symantec's Backup Exec. You can choose the traditional network-based backup by installing the necessary server agents for various operating systems. You can back up using the Open File Agent or the applicable Application Agents over the network. However, this method requires sufficient network bandwidth and might impact the applications running on the virtual machines.

A more convenient way to back up VMs with Backup Exec 12.5 is to use the Microsoft VSS Service with the MD32X0, MD32X0i, or MD36X0i storage array VSS hardware provider that is included on the storage array's Resource CD. This method lets you create hardware-based snapshots on the MD32X0, MD32X0i, or MD36X0i storage array and map them automatically to your dedicated backup server without performing any scripting. This method does not use any network bandwidth and does not create much load on the VM. In addition, this method does not affect the performance of the VM.

This section describes how to use the VSS-based backup with Symantec's Backup Exec 12.5. This software, however, does not support VSS hardware-based backup of pass-through devices. You must back up pass-through devices through the VM's file system VSS service from Microsoft over the network. If you have installed the Microsoft software iSCSI initiator in your VM and you are using an MD32X0i pr MD36X0i storage array, you can use the hardware-based VSS provider to backup data disks on virtual machines. The procedure is the same as described in this section, except that you select the server name of the VM for the backup (not the host). You must install the Advanced Open File Option (AOFO) agent on the Virtual Machine.

Figure 8 shows the data flow while using Backup Exec 12.5 with the Hardware VSS Provider.

Figure 8. **Data Flow with Backup Exec 12.5 and the Hardware VSS Provider Using Symantec Backup Exec 12.5**
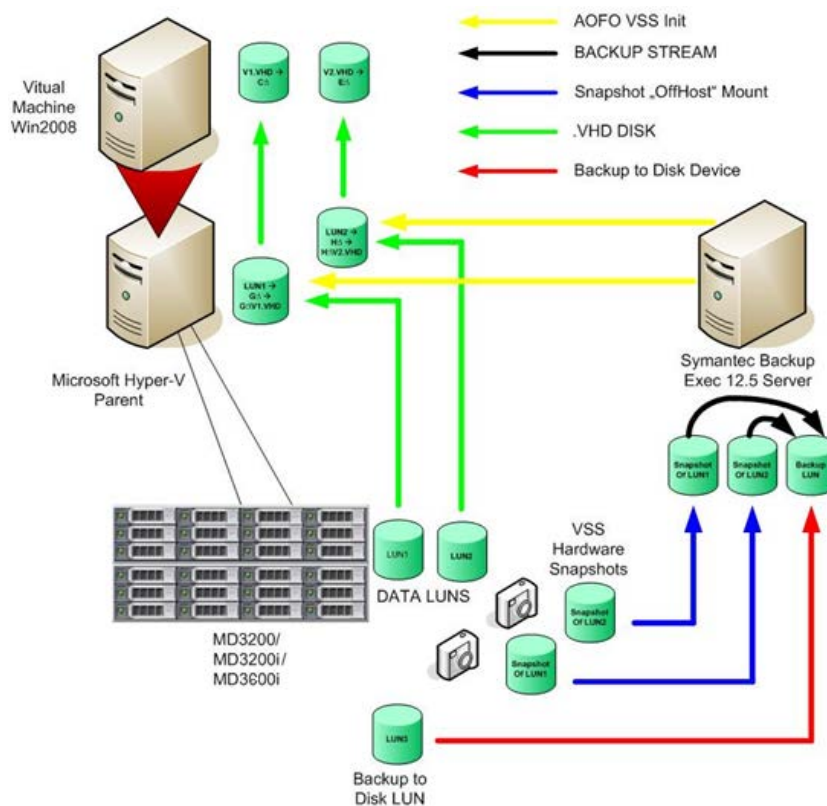
Install Symantec's Backup Exec 12.5 suite on your backup server. Make sure that all of the latest service packs and hot fixes from Microsoft and Symantec are applied. Use Symantec's live update as well as Microsoft Update to get all of the necessary updates.

Install the Dell MDSM VSS Provider from the MD32X0, MD32X0i, or MD36X0i series of storage arrays series of storage arrays Resource CD. Then configure the snapshot options for the MD32X0, MD32X0i, or MD36X0i storage array. To configure the snapshot options, go to the following directory using the command line interface:

```
C:\Program Files (x86)\Dell\SMprovider\provider>
```

To configure the snapshot options, run `SmRegTool.exe`. The VDS/VSS Configuration Tool application starts.

1. Enter the name of the MD32X0, MD32X0i, or MD36X0i storage array.

   This name must match the name of the storage array shown in the MDSM.

2. Click **Retrieve**.

3. The system asks you if you want to configure for this storage array. Click **Yes**.

4. If you entered a password in the MDSM, you must enter the password in the Password field.

5. Select **Enable monitoring for this storage array**.

6. Select **Allow unregistered initiators when masking volumes**.

   This option makes sure that the server receives the necessary mapped virtual disks even if you have not created the server in the MDSM.

7. Select the RAID level.

8. Enter the percentage of base volume. The recommended size for the snapshot is 20 percent.

9. For best performance, select **Prefer unconfigured capacity**. However, you can also choose **Prefer unconfigured capacity (create new volume group)** or **Prefer free capacity in the same volume group** if not enough unassigned drives are available.

10. Click **Save**.

Before you schedule your backup, make sure that the BackupExec is installed on all of the Hyper-V parent servers. You can use Backup Exec's Remote Agent to install this option.

1. In the **Source Selections** window, open the appropriate server that you want to back up.

2. Expand the Microsoft Hyper-V section, and select the VMs that you want to back up.

3. If your Hyper-V server is different than the backup server, open the Windows Systems in the Favorite Resources section, and select the appropriate VMs.

4. Select **Advanced Open File**.

5. Select **Use Advanced Open File**.

6. Select the Microsoft Volume Shadow Copy Service.

   You can leave the option on **Automatic**.

   Microsoft Windows selects the Provider in the following order:

   - Hardware

   - Software

   - Internal

7. For best performance while backing up, select **Advanced Disk-based Backup**.

8. Select **Use offhost backup to move backup processing from remote computer to media server**.

   By using this option, you can make sure that the created snapshots on the MD32X0, MD32X0i, or MD36X0i storage array are mapped to the backup server instead of being mapped to the Hyper-V server.

9. Change the schedule in the **Schedule** option according to your needs.

   The backup is now configured and ready to run. The backup automatically creates hardware-based snapshots and backs them up to the selected backup devices. However, if you are using the off-host backup method, you must specify a backup-to-disk folder. If you

want to back up to tape, you must create another backup job that will back up the backup-to-disk folder onto the specified tape devices.

10. Click **Run Now**.

You can monitor the progress in the Job Monitor tab.

Another advantage of using a backup-to-disk folder is that the restore of a VM is quick, because this method removes the media mount time. This method also is fast on reading the inventory. For information about how to create this folder, refer to the *Symantec Backup Exec 12.5 User Guide*.

The following Table provides a high level overview of supported backup scenarios.

Table 2.   **Comparing the Different Backup Scenarios**

	MS Hyper-V and Windows Server Backup	Dell Premium Features	Symantec Backup Exec	Commvault Galaxy
Description	This option provides integrated backup.	This option provides simple local snapshots.	This option is more complex but provides better online protection.	This option is more complex but provides better online protection.
Usage Scenario	Use this option to back up one or more parent servers. This option cannot use hardware-assisted snapshots.	Use this option to back up VMs that are non-critical. You must pause the VM if using this option standalone, or when using Backup Exec, or when using Commvault Galaxy with hardware-based snapshots.	This application provides more options than the standard Windows Backup or premium feature options. Use this option with the Hardware VSS Provider. You have the ability to back up applications with selective modules.	This application provides more options than the standard Windows Backup or premium feature options. Use this option with the Hardware VSS Provider. You can back up applications with selective modules.

	MS Hyper-V and Windows Server Backup	Dell Premium Features	Symantec Backup Exec	Commvault Galaxy
Backup Process	This option uses the parent server CPU cycles, network bandwidth, or both.	This option does not use network bandwidth. This option provides fast backups. If used without backup software, you must pause VMs during snapshot creation.	This option does not use network bandwidth if it is used with a hardware-based snapshot. This option provides fast backup. The VMs stay online during the snapshot creation.	This option does not use network bandwidth if it is used with a hardware-based snapshot. This option provides fast backup. The VMs stay online during the snapshot creation.
Restore	This option restores single files or complete VMs through a wizard.	This option mounts the snapshot and copies the files manually back if it is used as a standalone.	This option allows you to recover quickly. This option is wizard based and provides single file restoration. This option uses single mailbox restore with agents.	This option allows you to recover quickly. This option is wizard based and provides single file restoration. This option uses single mailbox restore with agents.
Licensing	The license is included with the Windows Server 2008 operating system.	A license is required for each storage array.	A license is required for each server or agent.	A license is required for each server or agent.

Contact Information

Go to this website:

http://www.dell.com/

or call 1-800-WWW-DELL.

Appendix

Appendix A: Tips on Configuring Applications

For information about how to configure Microsoft Exchange 2007 in a Microsoft Hyper-V Environment, go to this website:

http://technet.microsoft.com/en-us/library/cc794548.aspx

For information about how to configure MS-SQL in a Microsoft Hyper-V Environment, go to this website:

http://download.microsoft.com/download/d/9/4/d948f981-926e-40fa-a026-5bfcf076d9b9/SQL2008inHyperV2008.docx

Appendix B: System Troubleshooting

For information about how to troubleshoot MD32X0, MD32X0i, or MD36X0i storage arrays, refer to the "Troubleshooting Problems" chapter of the *Dell™ PowerVault™ Modular Disk Storage Manager User's Guide*. Go to this website:

http://support.dell.com/support/edocs/systems/MD32X0/en/index.htm

Appendix C: References

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Appendix D: Terminology

Bandwidth – The amount of data that the storage array can process over time. Bandwidth is measured in megabytes per second (MB/s).

Initiator – The system component that originates an input/output (I/O) command over an I/O bus or network. I/O adapters, network interface cards, and intelligent RAID controller module device I/O bus control application specific integrated circuits (ASICs) are typical initiators. A peripheral device is a target. (*The Dictionary of Storage Networking Terminology*)

Latency – The interval of time between submitting a request and receiving a response.

MPIO (Multi Path I/O) – In computer storage, an arrangement whereby more than one logical path exists between the central processing unit (CPU) in a computer system and its storage devices. This path is routed through the buses and bridge devices that connect the CPU and its storage devices. If one RAID controller module, port, or switch fails, the operating system can route I/O through the remaining RAID controller module so that work can continue.

Network interface card (NIC) – An adapter that connects an intelligent device to a network. The common terminology is a network interface card or an Ethernet NIC network.

Node – An addressable entity connected to an input/output (I/O) bus or network and used primarily to refer to computers, storage devices, and storage arrays. The component of a node that connects to the bus or network is a port. (*The Dictionary of Storage Networking Terminology*).

Pass-through physical disk – An unformatted physical disk directly assigned to the virtual machine.

Portal – A service that links initiators and targets when their IP addresses are not known.

Response time – The interval of time between submitting a request and receiving a response.

Session – A group of iSCSI connections. As each connection is established, the session can negotiate its own unique parameters.

Target – The storage destination. In this document, the target is the MD32X0i storage array.

Throughput – The number of individual I/Os the storage array can process over time. Throughput is measured in I/Os per second (IOPs).

Transmission Control Protocol/ Internet Protocol (TCP/IP) – A suite of protocols that includes Transmission Control Protocol (TCP), Internet Protocol (IP), User Datagram Protocol (UDP), and Internet Control Message Protocol (ICMP). These protocols form the basic set of communication protocols used on the Internet. (*The Dictionary of Storage Networking Terminology*)