HP StoreVirtual Storage Multipathing Deployment Guide

HP Part Number: AX696-10022
Published: August 2015
Edition: 7

Acknowledgements

Microsoft® and Windows® are trademarks of the Microsoft group of companies.

Revision History

Revision 1	September 2011
First edition of the *HP P4000 DSM for MPIO Deployment Guide* as standalone document. Previously published as part of the Windows Solution Pack documentation. Added the Best Practices section.	
Revision 2	November 2012
Release version 10.0 of the *HP LeftHand Storage DSM for MPIO Deployment Guide*. Updated versions supported and branding.	
Revision 3	March 2013
Release version 10.5 of the *HP StoreVirtual DSM for Microsoft MPIO Deployment Guide*. Updated versions supported and branding.	
Revision 4	September 2013
Release version 11.0 of the *HP StoreVirtual DSM for Microsoft MPIO Deployment Guide*. Updated troubleshooting information.	
Revision 5	December 2013
Updated the supported versions of Microsoft Windows Server (including the removal of Windows 2003).	
Revision 6	January 2015
Release version 12.0 of the *HP StoreVirtual Storage Multipathing Deployment Guide* (formerly *HP StoreVirtual DSM for Microsoft MPIO Deployment Guide*). Added StoreVirtual MEM MPIO information.	
Revision 7	August 2015
Release version 12.5 of the *HP StoreVirtual Storage Multipathing Deployment Guide*. Added additional MEM MPIO information and troubleshooting information.	

Contents

1 StoreVirtual Multipathing for Windows and VMware

HP StoreVirtual Multipathing for Windows and VMware provides enhanced MPIO functionality as follows:

- Automatic creation of an I/O path to each storage system in the cluster on which the volume resides, plus a path for the administrative connection.
- Provides improved performance architecture over native Device Specific Module (DSM) solutions:
  - Read I/Os are always serviced by a storage system that holds the authoritative copy of the data being requested.
  - Write I/Os are always serviced by a storage system that receives a copy of the data. Remaining copies (replicas) of the data are forwarded to the appropriate storage system based on the data protection level of the volume.
- Ability to build a robust, fault-tolerant solution because an I/O path can be automatically built to every storage system in the cluster. For example, in a cluster with five storage systems, DSM-connected volumes have six iSCSI DSM connections to the SAN, one for each storage system and one for the administrative connection. Five of the six connections could go offline, and I/O would still be serviced.
- VMware hosts can use different MPIO solutions to access the same volumes. Mixing ESXi hosts with different multipathing solutions accessing the same StoreVirtual volumes is allowed.
- Access to volumes from hosts running Microsoft MPIO and hosts running the StoreVirtual DSM is supported.
- Multi-site configurations are supported (use StoreVirtual Multipathing for improved throughput).
- Support for multiple NIC connections in the application server to the SAN. Configuring with multiple NICs improves fault-tolerant physical network connections in the server. The same approach is viable with VMware when using the hardware iSCSI adapter or using multiple vmkernel adapters with Software iSCSI.

2 Using StoreVirtual Multipathing for Windows

The StoreVirtual DSM for Microsoft Windows MPIO is commonly referred to as the StoreVirtual DSM. This DSM provides advanced multipathing capability for StoreVirtual cluster deployments in Windows Server environments.

Best practices

- If the StoreVirtual DSM is not required, then do not install the StoreVirtual DSM or enable the Microsoft DSM service.
- If you are currently using the StoreVirtual DSM, then upgrade to the latest version.
- To avoid issues with active/passive StoreVirtual DSM configurations and disk timeout errors when the iSCSI initiator detects a failure and reconnects, change the `EnableNOPOut` registry setting to 1 as described in the Microsoft iSCSI Initiator Driver Timers section of the *Microsoft iSCSI Software Initiator Version 2.X Users Guide*.
- The StoreVirtual DSM is recommended for the following:
  - Providing the maximum possible performance for specified configurations.
  - With Multi-Site SAN storage clusters, the StoreVirtual DSM with site preference is recommended, particularly if the intersite link is significantly slower than local access. This configuration will ensure that reads are performed with a local replica when one is available. This is particularly useful for Microsoft clusters where a Microsoft cluster node is on each side of the intersite link.
- The Microsoft DSM is recommended for the following configurations:
  - For any volumes that are accessed by ESX and Windows initiators (as might be done for VMware Consolidated backup), do not use the StoreVirtual DSM.
  - Configurations requiring connections through storage routers.
  - Large Hyper-V clusters (either large storage clusters or many server NICs).
  - Large storage clusters with simultaneous access to many volumes using the StoreVirtual DSM may encounter the Microsoft limit of 255 iSCSI sessions. In this case, use Microsoft MPIO, which uses fewer sessions. To determine whether the Microsoft MPIO iSCSI session limit might apply, multiply the expected number of volumes by the number of storage systems plus the number of server NICs. If you are using Round Robin load balancing, add an additional session per server NIC per storage system per volume. Active/passive or vendor-specific load balancing settings use an additional session per storage system per volume.
  - Running the DSM on a Windows virtual machine that has VMware ESX Server or VMware Hyper-V Server installed.

NOTE: If the storage configuration is not recommended for the StoreVirtual DSM, then uninstall the StoreVirtual DSM during the upgrade to Version 9.x or later, and use the Microsoft DSM.

Using Microsoft DSM

Beginning with LeftHand OS software Version 9.0, you can use the Microsoft DSM on your application servers. For additional information about the Microsoft DSM, see the DSM white paper available from the Microsoft website:

http://www.microsoft.com/download/en/details.aspx?id=9787

When configuring the DSM load balancing policy, use only the Fail Over Only or Round Robin options. For more information, see "Setting the StoreVirtual DSM load balancing policy" (page 8).

Installing the StoreVirtual DSM

Prerequisites

- For supported versions of Windows Server, see the HP *StoreVirtual Compatibility Matrix*, which is available at:

  http://www.hp.com/go/StoreVirtualcompatibility

- Microsoft iSCSI Initiator (integrated in Windows Server)
- Windows feature "Multipath I/O" is enabled

Installing the StoreVirtual DSM into an existing Microsoft cluster

1. Move all cluster resources and related file shares to one system that will stay active.
2. Pause the system that does not have any cluster resources and install the StoreVirtual DSM.

Performing the installation

IMPORTANT: Installing the StoreVirtual DSM requires a server reboot to complete the installation.

1. Double-click the HP StoreVirtual DSM for Microsoft Windows MPIO executable that you downloaded to start the installation.
2. Accept the terms of the license agreement and click **Next**.

   The installation wizard takes you through the installation process for the StoreVirtual DSM.
3. Reboot the server to complete the installation.

NOTE: If you are updating the StoreVirtual DSM, the preferred update order is to update the StoreVirtual DSM first, and the LeftHand OS software second. See the *HP StoreVirtual Storage Upgrade Guide* for more information.

Performing a silent install for Windows Server 2008 Server Core option

1. Open a command prompt and use the `cd` command to navigate to `setup.exe` in the installation media.
2. Type the following command:

   ```
   setup /s /f1".\setup.iss"
   ```

   The setup begins. You will see nothing until after a minute or two, when the server reboots.
3. When the server is back up, check `\Windows\dsminstall.log` for errors.

Connecting volumes with the StoreVirtual DSM

Once the StoreVirtual DSM is installed on the server, all iSCSI volume connections made to an iSCSI SAN will attempt to connect with the StoreVirtual DSM. You do not need to configure the multiple I/O paths manually.

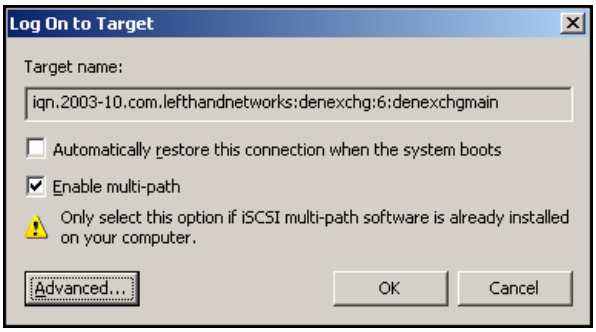
If you are also using the Multi-Site SAN features, you can assign servers to specific sites to avoid high-latency connections between sites. For more information, see the *HP StoreVirtual Storage Multi-Site Configuration Guide*.

Connecting application servers with single or multiple NICs to volumes

To connect to the volumes using the iSCSI Initiator:

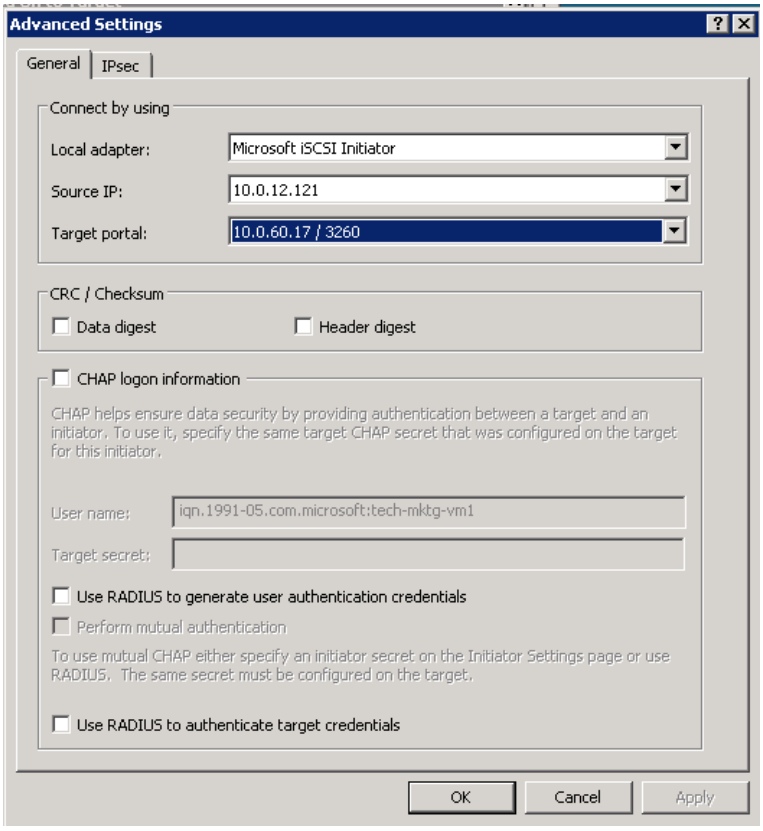
1. Open the iSCSI Initiator.
2. On the Discovery tab, enter the VIP address of the cluster.
3. On the Targets tab, select the volume to log on to.
4. Click **Log On**.
5. Select the **Enable multi-path** check box.

Figure 1 Enabling multi-path for StoreVirtual DSM



6. [Optional] If you want this volume to be available after rebooting, select the **Automatically restore...** check box.
7. Click **Advanced** to open the Advanced Settings window.
8. Configure the Advanced Settings as follows:
   - For Local adapter, select **Microsoft iSCSI initiator**.
   - For Source IP, select the IP address of the storage NIC to connect to the volume.
   - For Target portal, select the VIP of the cluster containing the volume.

Figure 2 Configuring advanced settings for multiple NICs



9. Click **OK** to close the Advanced Settings dialog.

10. Click **OK** again to finish logging on.
11. If you want to set the StoreVirtual DSM load balancing policy, see "Setting the StoreVirtual DSM load balancing policy" (page 8).
12. If you have multiple NICs, repeat steps 3 through 11 for the additional storage NICs.

Connecting volumes in a Multi-Site SAN (StoreVirtual DSM)

Connecting to volumes in a Multi-Site SAN is similar to connecting to volumes in a single-site configuration, with a couple of important differences.

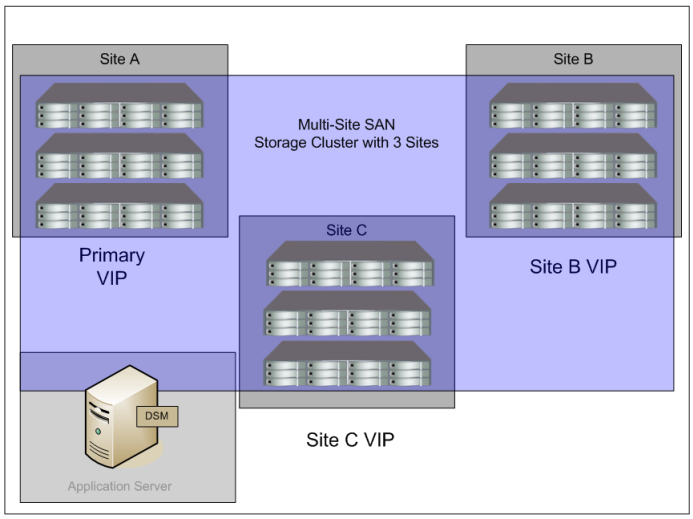
- For proper failover/failback configuration of a Multi-Site SAN you must configure all cluster VIPs for discovery. List the VIPs in the preferred order of connection. For example, if Site A is the first preference for connection, put the VIP associated to Site A first in the discovery list.
- You must also log on to the volumes with the default Target Portal setting.

Using multiple cluster VIPs when connecting to a Multi-Site SAN

Use the Virtual IP address of the HP StoreVirtual Storage cluster when connecting to volumes using the StoreVirtual DSM. In a Multi-Site SAN, you must enter the VIPs of all the multi-site clusters on all the application servers to take advantage of the StoreVirtual DSM's multipath I/O capabilities. In addition, all the application servers must have the VIPs listed in the same order.

A sample Multi-Site SAN configuration is shown in Figure 3 (page 8). In this configuration, the cluster has three sites: Site A, Site B, and Site C. Site A is primary.

Figure 3 Multi-Site SAN VIPs with the StoreVirtual DSM



Setting the StoreVirtual DSM load balancing policy

When you connect application servers to volumes, you can also set the StoreVirtual DSM load balancing policy in the iSCSI Initiator.

Supported load balancing options

Only two load balancing options are supported, Fail Over and Round Robin.

- **Fail Over Only** – Also called active/passive DSM. Two (or more) I/O paths are built between the server and the storage. One path is actively used for I/O to the storage. The other paths are available for failover only in the event the primary path goes down.
- **Round Robin** – Also called active/active DSM. Two (or more) I/O paths are built between the server and the storage. All paths are actively used for I/O to the storage.

In the StoreVirtual DSM, Vendor Specific is selected by default. This option is the same as selecting Fail Over Only and will not be available after you select another option. In the Microsoft DSM,

Fail Over Only is the default selection for all Windows versions, except for Windows 2008 R2, for which Round Robin is the default.

The StoreVirtual DSM load balancing policy affects the number of iSCSI connections created to the volume. The number of connections also differs based on whether you are using the StoreVirtual DSM. Figure 4 (page 9) through Figure 7 (page 10) show the connections created with applications servers that have two NICs.

NOTE: These figures are a representation on a volume per volume basis. The administrative path for another volume may be on a different storage system in the cluster depicted.

Figure 4 the StoreVirtual DSM with two NICs in the server and Fail Over load balancing

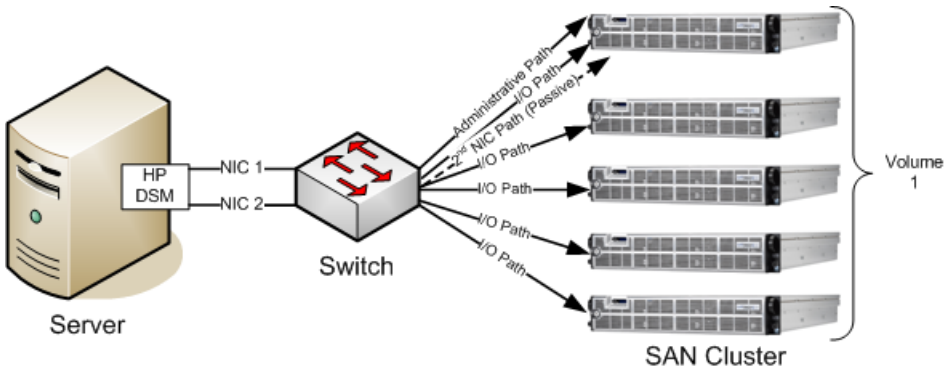


Figure 5 the StoreVirtual DSM with two NICs in the server and Round Robin load balancing

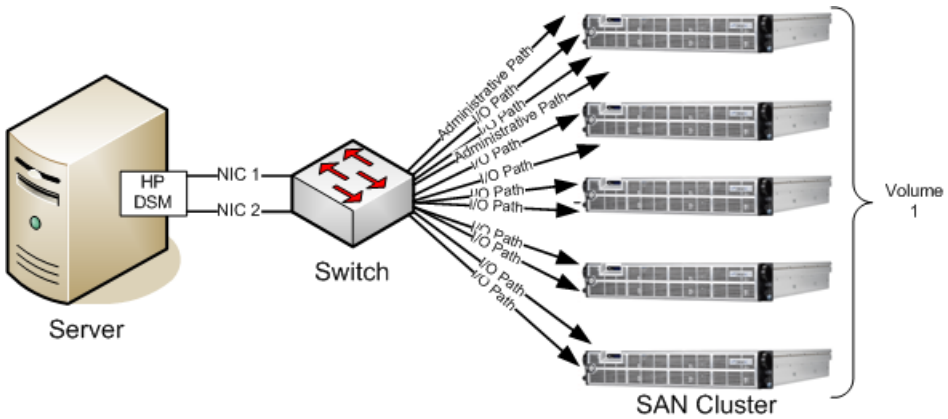


Figure 6 Microsoft DSM with two NICs in the server and Fail Over load balancing

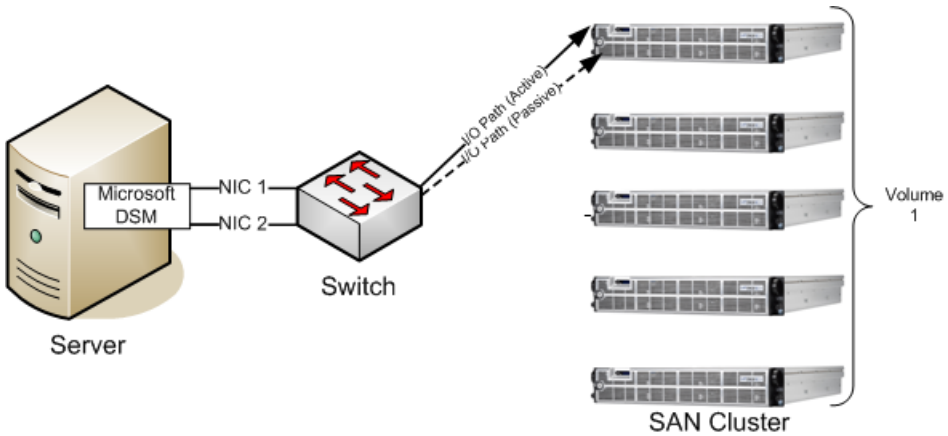
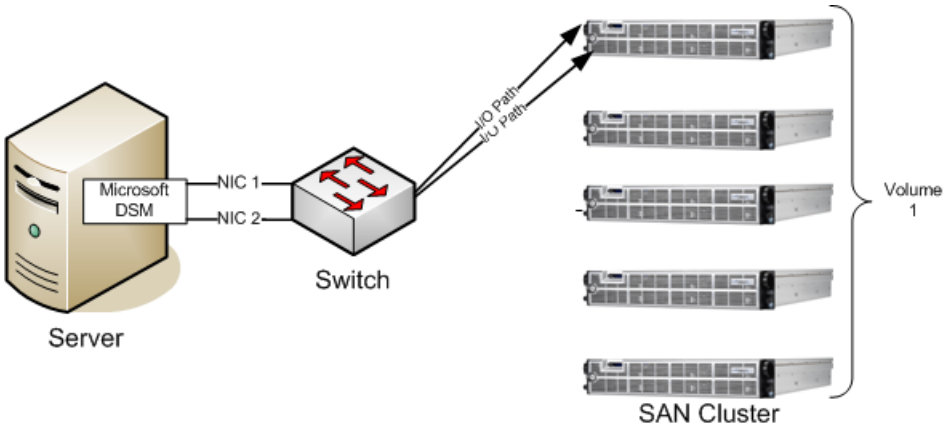


Figure 7 Microsoft DSM with two NICs in the server and Round Robin load balancing



Be sure to perform the following steps to set the StoreVirtual DSM load balancing policy. Similar options are available for Multiple Connected Session (Windows 2008). These session load balancing policies will have no effect.

To set the StoreVirtual DSM load balancing policy:

1. Select the target you just logged on to and click **Details**.
2. Select the **Devices** tab.
3. Click **Advanced**.

   NOTE: This step is not needed for Windows 2008 Server R2.

4. Click the **MPIO** button or tab.

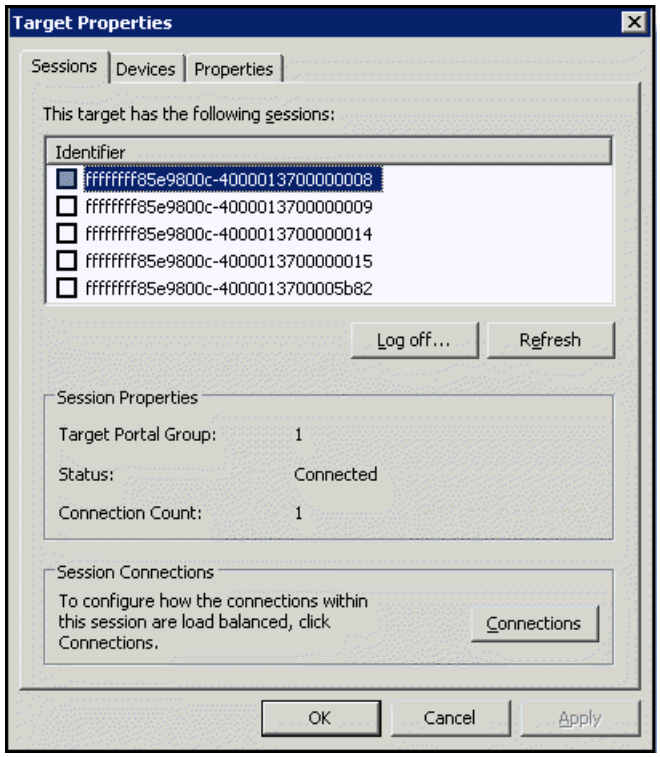
   If the **MPIO** button or tab is not available, the StoreVirtual DSM is not installed and enabled.
5. From the load balancing policy drop-down list, select either **Fail Over Only** or **Round Robin**.
6. Click **OK**.
7. Click **OK**.

Troubleshooting the StoreVirtual DSM

Verifying the StoreVirtual DSM operations

After logging on to a volume via iSCSI, the StoreVirtual DSM automatically builds a data path to each storage system in the cluster and one administrative path. You can verify the StoreVirtual DSM operations by looking at the Details window of the iSCSI connection for the volume after logging on to that volume.

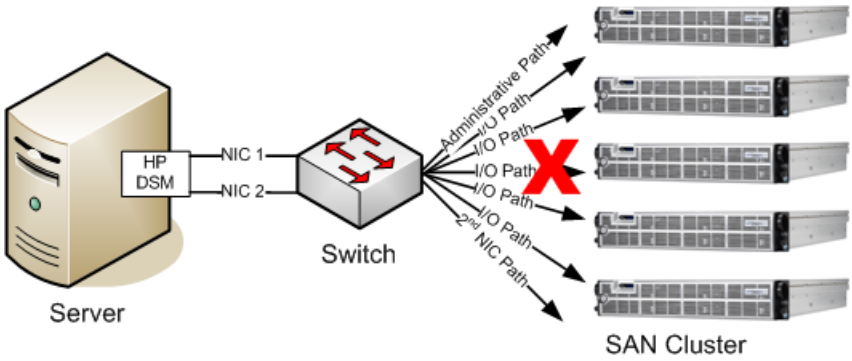
Figure 8 Verifying the StoreVirtual DSM connections



Managing a path failure with the StoreVirtual DSM

If one I/O path fails, volume I/O continues because additional active I/O paths to the iSCSI SAN remain, as illustrated in Figure 9 (page 12).

Figure 9 Multiple paths ensure continued I/O in event of path failure



When the problem with the I/O path is repaired, the StoreVirtual DSM reconnects an I/O path to the storage system, thus restoring optimized performance and fault tolerance.

Verifying Microsoft DSM operations

If you see two devices that are exactly the same listed in the Disk Manager or My Computer, you may not have the DSM installed or you may not have logged using the DSM. For more information, see "Using Microsoft DSM" (page 5) and "Connecting volumes with the StoreVirtual DSM" (page 6).

Bringing disks online

If you cannot access volumes or do not see the disks (in Disk Manager or My Computer), you may need to bring the disks online. You may also see that the device in the iSCSI Initiator is listed with a device number —1 or with no device name. Use the following Windows utilities to solve the problem:

- The `automount` setting in the Windows 2008 and Windows 2008 R2 DiskPart Command-Line affects whether disks will mount after changes in DSM status, such as uninstalling a generic DSM.

  To run DiskPart, open a Windows command line and run `diskpart.exe`.

  For detailed information about the DiskPart Command-Line, see http://technet.microsoft.com/en-us/library/cc766465(WS.10).aspx.

- Log off all iSCSI sessions and use the command `automount scrub` to clean up volume mount point directories and registry settings for volumes that are no longer in the system. This can clean up conflicting disk information that prevents disks from coming online. Information about automount is available by typing the command `help automount` from the diskpart command line.
- Check the SAN policy setting. The SAN policy should be set to Online All for LeftHand OS volumes to remount after uninstalling the StoreVirtual DSM. Information about the SAN policy is available by typing the command `help SAN` from the diskpart command line.

Table 1 Additional troubleshooting for the StoreVirtual DSM

Issue	Description
StoreVirtual DSM for Microsoft Windows MPIO driver information is not displayed under Storage controllers in the Windows Device Manager.	Beginning with release 10.0, the StoreVirtual DSM driver is listed under the System devices section of the Device Manager. In previous versions, the StoreVirtual DSM was listed under the Storage controllers section of the Device Manager.
Disks are reported as offline in the Windows Disk Manager after uninstalling the StoreVirtual DSM.	In very rare circumstances, after removing the StoreVirtual DSM and rebooting the server, some volumes may display as offline. To resolve this issue, open the Windows Disk Manager, right-click the offline disk and select **Online**. Repeat for each offline disk.
Microsoft Windows Server 2012 NIC teaming is not supported for use with iSCSI.	To use multiple interfaces for iSCSI, remove iSCSI-designated interfaces from NIC teams and use supported the StoreVirtual DSM configurations instead.
StoreVirtual DSM for Microsoft Windows MPIO Version 11.5 does not support hardware iSCSI initiators. If hardware iSCSI initiators are installed on the system hosting the StoreVirtual DSM, an exception may occur.	To avoid the exception and to configure iSCSI mode, do the following: 1. Make the system unavailable to users until the configuration is complete. 2. Log in to the Windows host system where the StoreVirtual DSM Version 11.5 is installed. 3. Stop the `HP LeftHand DSM for MPIO` service, if it is already started. To stop, navigate to **Start→Control Panel→Administrative Tools→Services**. 4. Open OneConnectManager from **Start→All Programs→Emulex→OCManager**. 5. Select **Host** view. 6. Select the network adapter under respective Windows host system. 7. Select **NIC-only** in the Adapter information window. 8. Click **Apply**. 9. Repeat steps 5 through 8 for all the NICs that are operating in iSCSI mode. 10. Start the `HP LeftHand DSM for MPIO` service. To start, navigate to **Start→Control Panel→Administrative Tools→Services**.

Uninstalling the StoreVirtual DSM

IMPORTANT: Uninstalling the StoreVirtual DSM requires a reboot of the system.

1. Log off all iSCSI sessions.
2. Navigate to Control Panel and select **Add or Remove Programs** or **Programs and Features**, depending on which version of Windows you are running.
3. Remove the StoreVirtual DSM.
4. Reboot the system.

Performing a silent uninstall for the Windows 2008 Server Core option

IMPORTANT: Uninstalling the StoreVirtual DSM requires a reboot of the system.

1. Open a command prompt and use the `cd` command to navigate to `setup.exe` in the installation media.
2. Type the following command:

```
setup /removeonly /s /f1".\uninst.iss"
```

The uninstall begins. You will see nothing until after a minute or two, when the server reboots.

3. When the server is back up, check `\Windows\dsminstall.log` for errors.

3 Using StoreVirtual Multipathing for VMware

The HP StoreVirtual Multipathing Solution for VMware is commonly referred to as the StoreVirtual Multipathing Extension Module (MEM). This module provides advanced multipathing capability for your StoreVirtual cluster deployments in a VMware environment.

Obtaining the StoreVirtual MEM for VMware

The StoreVirtual MEM for VMware is available as both a vSphere Installation Bundle (VIB) and an Offline Bundle (ZIP) via HP vibsdepot (HP Online Depot) at:

http://vibsdepot.hp.com

NOTE: Currently, the VIB is not included in HP StoreVirtual auto deployment tools.

Prerequisites

- Supported servers
- Supported software and firmware
  - VMware ESXi 5.x and 6.0 and associated updates
  - HP LeftHand OS 12.0 or later
- Only the custom LH Path Specific Plug-in (PSP) provided by HP can be used with HP's custom LH Storage Array Type Plug-in (SATP). HP does not support the use of any other PSP with its custom SATP.

Installing the StoreVirtual MEM

Using the VMware ESXi CLI

You can install both the StoreVirtual MEM VIB and offline bundle using the CLI as follows:

1. Shut down all VMs in preparation for putting the ESXi server in maintenance mode.
2. Put the ESXi server in maintenance mode.
3. Enable SSH on the vSphere hosts.
4. Copy the VIB to the ESXi server. You can use scp or WinSCP to copy the binary. A typical place to copy the VIB is the `/tmp` directory.
5. Using SSH, log in to the vSphere hosts.
6. Change the host acceptance level to `VMwareAccepted` by entering the following command:

   ```
   ~ # esxcli software acceptance set --level=VMwareAccepted
   ```

7. Install the VIB or offline bundle. You must specify the full path to the VIB location.
   - To install the VIB, enter the following command (where *X* is the version of ESXi you are using and *12.0.0.YYY* is the version of the StoreVirtual MEM):

     ```
     ~ # esxcli software vib install -v
     /tmp/hp-lh-mem.5.X.0-12.0.0.YYY.vib
     ```

   - To install the offline bundle, enter the following command (where *X* is the version of ESXi you are using and *12.0.0.YYY* is the version of the StoreVirtual MEM):

     ```
     esxcli software vib install –d
     /tmp/hp-lh-mem-5.X.0-12.0.0.YYY-offline_bundle.zip
     ```

8. View the installation result:

```
Message: Operation finished successfully.
Reboot Required: true
VIBs Installed: Hewlett-Packard_bootbank_hp-lh-mem_5.X.0-12.0.0.YYY
VIBs Removed:
VIBs Skipped:
```

9. Verify that the application loaded by entering the following command:

   ```
   ~ # esxcli software vib list | grep hp-lh-mem
   hp-lh-mem   5.X.0-12.0.0.YYY   Hewlett-Packard VMwareAccepted   2014-03-09
   ```

10. Validate the SATP rule and plug-in registration was successful:
    - Verify the SATP rule by entering the following command:

      ```
      esxcli storage nmp satp rule list | grep -i LH
      ```

      Look for the HP_SATP_LH entry. If you do not see it, un-install and re-install the plug-in.
    - Verify the plug-in registration by entering the following command:

      ```
      esxcli storage core plugin registration list
      ```

      Look for the HP_SATP_LH entry. If you do not see it, un-install and re-install the plug-in.
11. Reboot the ESXi server.

    Be aware that, after a system reboot, all files in the `/tmp` directory are automatically deleted by VMware ESXi.
12. Log off.
13. (Optional) Disable SSH.
14. After the ESXi server is rebooted, remove the ESXi server from maintenance mode.
15. Restart the VMs.

Using VMware Update Manager

Installing the StoreVirtual MEM using the vSphere Client Update Manager consists of the following steps:

- Importing the offline bundle
- Creating a baseline group and adding the StoreVirtual MEM
- Attaching the baseline group
- Installing the StoreVirtual MEM

Importing the offline bundle

1. Shut down all VMs in preparation for putting the ESXi server in maintenance mode.
2. Put the ESXi server in maintenance mode.
3. Download the Offline Bundle from the HP vibsdepot.
4. In the vSphere Client, navigate to **Home→Solutions and Applications→Update Manager**.
5. Select the **Admin View**.
6. From the Update Manager Admin view, select the **Patch Repository** tab and click **Import Patches** to start the Import Patches wizard.
7. In the Select Patches File window, browse to select `metadata-hp-lh-mem_<versionnumber>-offline_bundle.zip` and click **Next**.
8. In the Confirm Import window, review the information and click **Finish** to confirm the import.

Creating a baseline group and adding the StoreVirtual MEM

1. From the Update Manager Admin view, select the **Baselines and Groups** tab.
2. In the Baseline Groups section, click **Create** to start the New Baseline Group Wizard.

3. On the Name and Type window, select **Host Baseline Group** as the Baseline Group Type, enter a name for the group, and click **Next**.
4. On the Patches window, select **Create a new Extension Host Patch Baseline** and click **Next**.
5. In the New Baseline wizard, Select **Fixed** and click **Next**.
6. On the Patch Options window, enter **MEM** for the name, select **Host Patch**, and click **Next**.
7. On the Baseline Name and Type window, select the **HP LH Path Selection Plugin** in the **Fixed Patches to Add** list and click **Next**.
8. On the Patches window, review the information and click **Finish** to complete the New Baseline wizard. The wizard returns to the Patches window of the New Baseline Group Wizard.
9. Select the MEM patch baseline you just created and click **Next**.
10. Review the settings for the new baseline group with the MEM patch baseline and click **Finish**. The Baselines and Groups tab opens with the MEM baseline and the HP LH baseline group added.

Attaching the baseline group

1. In the vSphere Client, navigate to the server hosting the StoreVirtual VSAs.
2. Select the **Update Manager** tab and select **Attach** to view the baseline group and MEM you previously created.
3. On the Update Manager tab, verify the attached baseline groups and baselines, and click **Stage** to begin the Stage Wizard.
4. On the Baseline Selection window, select the attached baseline to stage, and click **Next**.
5. On the Ready to Complete window, review the summary and click **Finish** to complete the staging.

Installing the MEM

1. In the vSphere Client, select the **Update Manager** tab and click **Remediate** to start the Remediation wizard.
2. On the Remediation Selection window, ensure that the correct Baseline Group and Baselines are selected and click **Next**.
3. On the Schedule window, specify the timing for the remediation, either **Immediately** or **At time** and set the time, and click **Next**.
4. On the Host Remediation Options window:
   - For the Power State, select **Do Not Change VM Power State**
   - Select **Retry entering maintenance mode in case of failure** and enter the delay and number of retries
5. Clear the other choices on the Host Remediation Options window, and click **Next**.
6. On the Cluster Remediation Options window, select **Disable Distributed Power Management (DPM) . . .** and click **Next**.
7. On the Ready to Complete window, review the Remediation settings and click **Finish**.
8. Reboot the ESXi server.
9. Remove the ESXi server from maintenance mode.

   Be aware that, after a system reboot, all files in the `/tmp` directory are automatically deleted by VMware ESXi.
10. Restart the VMs.

Using VMware ESX Server native MPIO

With VMware ESX, use the native ESX MPIO. For more information, see the article entitled *HP LeftHand Storage with VMware vSphere: Design considerations and best practices*, which is available at:

http://h20195.www2.hp.com/v2/GetPDF.aspx/4AA3-6918ENW.pdf

Best practices

For the maximum possible performance:

- Ensure iSCSI networking is configured based on the StoreVirtual VSA iSCSI best practice configuration.
  - Separate iSCSI traffic from management traffic and vMotion/HA traffic if possible.
  - Use the highest bandwidth network adapter for the iSCSI traffic.
  - A single vSwitch or multiple vSwitches for iSCSI traffic are both adequate for StoreVirtual MEM configuration.
- The maximum number of data paths supported per device with the StoreVirtual MEM is dependent on the number of storage systems in your StoreVirtual cluster and cannot exceed a total of 34 paths (administrative and data paths), as shown in Figure 10 (page 18). VMware's path limit for iSCSi devices is 8. However the 34 iSCSI paths provided are supported.

NOTE: Administrative paths are not included in Figure 10 (page 18).

Figure 10 Maximum number of data paths

# Nodes/#vm nic	2	3	4	5	6	7	8
2 (+VM /FOM)	4	6	8	10	12	14	16
3	6	9	12	15	18	21	32
4	8	12	16	20	24		
5	10	15	20	25			
6	12	18	24				
7	14	21	28				
8	16	24					
9	18	27					
10	20	30					
11	22						
12	24						
13	26						
14	28						
15	30						
16	32						

- The StoreVirtual MEM does not make any restrictions on the number of devices but is constrained by VMware limitations of 256 devices per host.
- HP recommends that you use the VMware VIB for single server deployment of the StoreVirtual MEM as it is a simpler process. For multi-server installation, using the StoreVirtual MEM offline bundle and VMware Update Manager is the recommended deployment method.
- The StoreVirtual MEM requires that the ESXi server acceptance level be set to `VMwareAccepted`. The StoreVirtual MEM will not install on any server with an acceptance level higher than `VMwareAccepted`. It will however install on systems with lower acceptance levels such as `PartnerSupport` and `CommunitySupported`.
- With ESXi hardware iSCSI configurations, it is required to manually or programmatically add the HP StoreVirtual Storage VIP to the dynamic discovery object of every hardware iSCSI adapter used for StoreVirtual iSCSI traffic.

Connecting volumes with the StoreVirtual MEM MPIO

Once the StoreVirtual MEM is installed on the ESX server, all supported StoreVirtual iSCSI volume connections made to an iSCSI SAN will be claimed by the StoreVirtual MEM. You do not need to configure the connections manually.

Connecting application servers with single or multiple NICs to volumes

To determine the best use of iSCSI hardware and software on your ESX server, see the article entitled *HP LeftHand Storage with VMware vSphere: Design considerations and best practices*, which is available at:

http://h20195.www2.hp.com/v2/GetPDF.aspx/4AA3-6918ENW.pdf

To connect StoreVirtual volumes to an iSCSI VM HBA:

1. Use the vSphere Client vSphere Web Client to select an ESXi host.
2. Select the **Configuration** tab.
3. Select either the VM HBA under iSCSI Software Adapter if using software iSCSI or a VM HBA suitable for hardware iSCSI.
4. Right-click and select **Properties**.
5. Select the **Dynamic Discovery** tab of the Properties dialog box.
6. Click **Add**.
7. Enter the VIP in the iSCSI Server field.
8. If CHAP authentication is not going to be enabled, click **OK**.
9. Click **Yes** when prompted.
10. Click **Close** on the Properties dialog box.
11. Click **OK** when prompted to rescan the device.

Connecting volumes in a Multi-Site SAN (MEM)

Connecting to volumes in a Multi-Site SAN is similar to connecting to volumes in a single-site configuration, with the following differences:

- For proper failover/failback configuration of a Multi-Site SAN, you must configure all cluster VIPs for discovery.
- VIPs must be added to the Dynamic Discovery tab on the iSCSI Initiator Properties page for the VM HBA through which the StoreVirtual volumes are presented.

StoreVirtual MEM load balancing policy

When the StoreVirtual MEM is installed, all load balancing is automatically managed by the HP_PSP_LH path selection plug-in. You do not need to select a load balancing policy since the load balancing algorithm is part of the HP_PSP_LH.

IMPORTANT: Do **not** select a load balancing policy if the StoreVirtual MEM is installed.

Only the HP_PSP_LH path selection plug-in is able to optimize load balancing access to volumes managed by the StoreVirtual MEM. Using any of the VMware built-in path selection plug-ins will cause the volume to lose the performance optimization provided by the StoreVirtual MEM. For this reason, HP recommends that you do not set a different path selection plug-in on volumes managed by the StoreVirtual MEM.

Uninstalling the StoreVirtual MEM

Using the CLI

IMPORTANT: The StoreVirtual MEM uninstaller requires a reboot of the system to clean up all files.

You can uninstall the StoreVirtual MEM VIB using the CLI as follows:

1. Put the ESXi server in maintenance mode.
2. Enable SSH on the vSphere hosts.
3. Using SSH, log in to the vSphere hosts.
4. Uninstall the VIB using the following command:

   ```
   ~ # esxcli software vib remove -n hp-lh-mem
   ```

   The following should display:

   ```
   Message: The update completed successfully, but the system needs to be rebooted for the changes to be
   effective.
   Reboot Required: true
   VIBs Installed:
   VIBs Removed: Hewlett-Packard_bootbank_hp-lh-mem_5.5.0-12.0.0.52
   VIBs Skipped:
   ~ #
   ```

5. Reboot the ESXi server.
6. Log off.
7. (Optional) Disable SSH.

Upgrading the StoreVirtual MEM

To upgrade to a later version of the StoreVirtual MEM, complete the following steps:

1. Uninstall the existing version. See "Uninstalling the StoreVirtual MEM" (page 20).
2. Install the new version. See "Installing the StoreVirtual MEM" (page 15).

Troubleshooting Multipathing for VMware

Table 2 Troubleshooting Multipathing for VMware issues

Issue	Solution
The StoreVirtual MEM fails to establish the correct number of paths for CN1000Q attached volumes.	The StoreVirtual MEM is not recommended for use with the CN1000Q (CNA card). Use native MEM instead.
Using ESXi 6.0, if 2-way CHAP is configured on the CMC and 1-way CHAP is configured on the ESXI host, volumes are discovered successfully without an authentication error.	Ideally, the CHAP configuration should be the same on the CMC and on the ESXi host. To ensure proper configuration, ensure that you configure CHAP on the target and the initiator on both the CMC and the ESXi host.

4 Support and other resources

Contacting HP

For worldwide technical support information, see the HP support website:

http://www.hp.com/support

Before contacting HP, collect the following information:

- Product model names and numbers
- Technical support registration number (if applicable)
- Product serial numbers
- Error messages
- Operating system type and revision level
- Detailed questions

Subscription service

HP recommends that you register your product for HP Support Alerts at:

http://www.hp.com/go/e-updates

After registering, you will receive e-mail notification of product enhancements, new driver versions, firmware updates, and other product resources.

HP Insight Remote Support

HP strongly recommends that you register your device for remote support to enable enhanced delivery of your HP Warranty, HP Care Pack Service, or HP contractual support agreement. HP Insight Remote Support supplements your monitoring continuously to ensure maximum system availability by providing intelligent event diagnosis, and automatic, secure submission of hardware event notifications to HP, which will initiate a fast and accurate resolution, based on your product's service level. Notifications can be sent to your authorized HP Channel Partner for onsite service, if configured and available in your country.

HP Insight Remote Support is available as part of your HP Warranty, HP Care Pack Service, or HP contractual support agreement. For more information, see the product documentation on the HP website (http://www.hp.com/go/insightremotesupport/docs).

Related information

You can find related documents on the product manuals page:

http://www.hp.com/support/StoreVirtualManuals

You can also find related documents on the Storage Information Library:

http://www.hp.com/go/storage/docs

HP websites

For additional information, see the following HP websites:

- http://www.hp.com
- http://www.hp.com/go/storage
- http://www.hp.com/service_locator
- http://www.hp.com/go/StoreVirtualDownloads
- http://www.hp.com/go/storevirtualcompatibility
- http://www.hp.com/storage/whitepapers

5 Documentation feedback

HP is committed to providing documentation that meets your needs. To help us improve the documentation, send any errors, suggestions, or comments to Documentation Feedback (docsfeedback@hp.com). Include the document title and part number, version number, or the URL when submitting your feedback.