

Data ONTAP® DSM 3.2 for Windows® MPIO **Installation and Administration Guide**

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Preface

About this guide	This guide describes how to install and use the Data ONTAP® DSM for Windows® MPIO. It also explains how to troubleshoot common problems and understand log messages.
Audience	This guide is for administrators of Windows host computers and NetApp storage systems who are configuring multipath I/O (MPIO) connections.
Terminology	Storage systems that run Data ONTAP are sometimes also referred to as filers, appliances, storage appliances, or systems. The name of the graphical user interface for Data ONTAP (FilerView) reflects one of these common usages.
Command conventions	You can enter storage system commands on the system console or from any client that can obtain access to the storage system using a Telnet session.
Formatting conventions	The following table lists different character formats used in this guide to set off special information.

Formatting convention	Type of information
<i>Italic type</i>	◆ Words or characters that require special attention. ◆ Placeholders for information you must supply. For example, if the guide requires you to enter the <code>fc test adaptername</code> command, you enter the characters “fc test” followed by the actual name of the adapter. ◆ Book titles in cross-references.
Monospaced font	◆ Command and daemon names. ◆ Information displayed on the system console or other computer monitors. ◆ The contents of files.

Formatting convention	Type of information
Bold monospaced font	Words or characters you type. What you type is always shown in lowercase letters, unless your program is case-sensitive and uppercase letters are necessary for it to work properly.

Keyboard conventions

This guide uses capitalization and some abbreviations to refer to the keys on the keyboard. The keys on your keyboard might not be labeled exactly as they are in this guide.

What is in this guide...	What it means...
hyphen (-)	Used to separate individual keys. For example, Ctrl-D means holding down the Ctrl key while pressing the D key.
<i>Enter</i>	Used to refer to the key that generates a carriage return; the key is named Return on some keyboards.
<i>type</i>	Used to mean pressing one or more keys on the keyboard.
<i>enter</i>	Used to mean pressing one or more keys and then pressing the Enter key.

Special messages

This guide contains special messages that are described as follows:

Note

A note contains important information that helps you install or operate the system efficiently.

Attention

An attention contains instructions that you must follow to avoid damage to the equipment, a system crash, or loss of data.

Topics in this chapter

This chapter includes the following topics:

- ◆ [“DSM and path concepts”](#) on page 2
- ◆ [“MPIO concepts”](#) on page 4
- ◆ [“Understanding timeout and tuning parameters”](#) on page 5
- ◆ [“Failover and load balance policy concepts”](#) on page 11

DSM and path concepts

About device specific modules

The Data ONTAP® DSM for Windows® MPIO is a device specific module (DSM) that works with the Microsoft Windows MPIO drivers (mpdev.sys, mpio.sys, and mpspfldr.sys) to manage multiple paths between NetApp and IBM N series storage systems and Windows host computers. The DSM includes the storage-system-specific intelligence needed to correctly identify paths and to manage path failure and recovery.

DSM 3.2 can manage both FCP and iSCSI paths, including mixed FCP and iSCSI paths to the same virtual disk (LUN).

Coexistence with other DSMs

The Microsoft iSCSI Initiator also includes a DSM that can manage the iSCSI paths that use the software initiator. The two DSMs can co-exist, as long as both versions are listed on the appropriate support matrixes.

If you install the Microsoft iSCSI Initiator on the same host as the Data ONTAP DSM:

- ◆ Install the iSCSI Windows Host Utilities 4.1 for Native OS or later; check the support matrix for the latest information.
- ◆ If you want to use the Microsoft iSCSI DSM, be sure to install the Microsoft iSCSI DSM by selecting the **Microsoft MPIO Multipathing Support for iSCSI** check box when installing the Initiator. Choose to claim only FCP LUNs when installing the Data ONTAP DSM.

I_T and I_T_L nexus

An initiator-target (I_T) nexus represents the path from the host's HBA (initiator) to the storage systems's HBA (target). An initiator-target-LUN (I_T_L) nexus represents one virtual disk (LUN) as seen by the DSM. The DSM groups all I_T_L nexuses to the same LUN together, and presents a single virtual disk to the Windows disk manager.

The I_T_L nexus is assigned an eight-character DSM identifier. The identifier is made up of four fields: port, bus, target, and LUN. For example, DSM ID 03000101 represents port 03, bus 00, target 01, and LUN 01.

Each path (I_T nexus) also has an eight-character identifier made up of four fields. The first three fields are the same as the DSM ID: port, bus, and target. The fourth field indicates the path type: 01 for optimized (non-proxy) and 02 for proxy.

MPIO concepts

Multiple paths require MPIO software

Multipath I/O (MPIO) solutions use multiple physical paths between the storage system and the Windows host. If one or more of the components that make up a path fails, the MPIO system switches I/O to other paths so that applications can still access their data.

If you have multiple paths between a storage system and a Windows host computer, you must have some type of MPIO software so that the Windows disk manager sees all of the paths as a single virtual disk. Without MPIO software, the disk manager treats each path as a separate disk, which can corrupt the data on the virtual disk.

Mixing FCP and iSCSI paths

Starting with the Data ONTAP DSM 3.2 for Windows MPIO, you can create both FCP and iSCSI paths to the same LUN. FCP paths typically perform better than iSCSI paths. By default, the DSM prefers FCP paths and uses them when available; the iSCSI paths are used only when no FCP path can be used.

You can change the relative priority of FCP and iSCSI paths using different load balance policies. See “[Failover and load balance policy concepts](#)” on page 11.

The storage system must be running single_image cfmode to support both FCP and iSCSI paths to the same LUN.

Path limits

You can have a maximum of 32 paths to a LUN. This maximum applies to any mix of FCP and iSCSI paths. This is a limitation of the Windows MPIO layer.

Attention

Additional paths can be created, but are not claimed by the DSM. Exceeding 32 paths leads to unpredictable behavior of the Windows MPIO layer and possible data loss.

Understanding timeout and tuning parameters

Registry settings

The installation program for the Data ONTAP DSM for Windows MPIO sets a number of parameters to optimize performance and ensure correct failover and giveback behavior.

You should not change these values unless directed to do so by your storage system support representative. More information about what each setting does is included in the following sections.

The installer sets only the parameters needed for the types of LUNs you choose to claim during installation: FCP only, iSCSI only, or both FCP and iSCSI.

LinkDownTime setting

The LinkDownTime parameter specifies the length of time that the iSCSI Initiator retries failed I/O requests when the Ethernet connection to the switch (or storage system, for direct-connect configurations) is lost. A lost link is indicated by the link light on the host Ethernet port being off.

LinkDownTime is set to 5 seconds. If the link is still down after 5 seconds, the I/O fails over to an alternate path to the LUN.

This parameter is set only if the DSM is configured to claim iSCSI LUNs in the following Windows registry key:

HKLM\SYSTEM\CurrentControlSet\Control\Class\{*identifier*}*instance*\Parameters

identifier is the key which has the default name value “SCSI and RAID controllers”.

instance is the controller instance which has the DriverDesc value “Microsoft iSCSI Initiator”.

MaxRequestHold Time setting

The MaxRequestHoldTime value specifies the length of time that the iSCSI Initiator retries failed I/O requests when the path to the target is lost.

MaxRequestHoldTime is set to 120 seconds. The value of 120 seconds matches the maximum expected time for a storage system controller to fail over to its partner.

This parameter is set only if the DSM is configured to claim iSCSI LUNs in the following Windows registry key:

HKLM\SYSTEM\CurrentControlSet\Control\Class\{*identifier*}*instance*\Parameters

identifier is the key which has the default name value “SCSI and RAID controllers”.

instance is the controller instance which has the DriverDesc value “Microsoft iSCSI Initiator”.

InstallDir setting

The InstallDir parameter specifies the installation directory used by the DSM.

The default value of InstallDir is
C:\Program Files\NetApp\MPIO\.

This parameter is set in the following Windows registry key:

HKLM\SOFTWARE\Network Appliance\MPIO

LogDir setting

The LogDir parameter specifies the directory used by the DSM to store log files.

The default value of LogDir is
C:\temp\netapp\.

This parameter is set in the following Windows registry key:

HKLM\SOFTWARE\Network Appliance\MPIO

ProductVersion setting

The ProductVersion parameter indicates the version of Data ONTAP DSM for Windows MPIO installed on the host.

This parameter is set in the following Windows registry key:

HKLM\SOFTWARE\Network Appliance\MPIO\ProductVersion

MPIOSupported DeviceList setting

The MPIOSupportedDeviceList parameter specifies the vendor identifier (VID) and product identifier (PID) of LUNs that are always claimed by the multipathing layer in Windows. Once LUNs are claimed at the multipathing layer, one DSM then claims all LUNs with a given VID and PID value pair.

The values of `MPIOSupportedDeviceList` are `NETAPP LUN` and some additional values that are being reserved for future use.

This parameter is set in the following Windows registry key:

`HKLM\SYSTEM\CurrentControlSet\Control\MPDEV`

TimeOutValue setting

The disk `TimeOutValue` parameter specifies how long an I/O request is held at the SCSI layer before timing out and passing a timeout error to the application above.

The `TimeOutValue` is set to 60 seconds.

This parameter is set in the following Windows registry key:

`HKLM\SYSTEM\CurrentControlSet\Services\Disk`

Attention

Installing the cluster service on Windows 2003 sets the disk `TimeOutValue` to 10 seconds. If cluster service is installed after you install the Data ONTAP DSM, use the Repair option to change the disk `TimeOutValue` back to 60 seconds. In the Windows Control Panel, launch **Add or Remove Programs**. Select **Data ONTAP DSM for Windows MPIO** and click **Change**. Then click **Repair** to revert to the original timeout setting.

PathVerifyEnabled setting

The `PathVerifyEnabled` parameter specifies whether the Windows MPIO driver periodically requests that the DSM check its paths.

The `PathVerifyEnabled` parameter is set to 0 (disabled). This value was set to 1 in the Data ONTAP DSM 3.0.

This parameter is set in the following Windows registry key:

`HKLM\SYSTEM\CurrentControlSet\Services\ontapdsm\Parameters`

PDORemovePeriod setting

The `PDORemovePeriod` parameter specifies the maximum time that the MPIO layer will wait for the device specific module (DSM) to find another path to a LUN. If a new path is not found at the end of this time, the MPIO layer removes its pseudo-LUN and reports that the disk device has been removed.

PDORemovePeriod is set to 130 seconds. This time is based on the maximum time expected for a storage system fail over, plus the time for the path to be established.

This parameter is set in the following Windows registry key:

HKLM\SYSTEM\CurrentControlSet\Services\ontapdsm\Parameters

Persistent ReservationKey setting

The PersistentReservationKey parameter stores the persistent reservation key generated by the DSM for Windows Server 2003 systems. The DSM uses a persistent reservation key to track which host in a Microsoft Windows cluster (MSCS) is currently allowed to write to a virtual disk (LUN).

PersistentReservationKey is set to a unique generated binary value.

This parameter is set only for Windows Server 2003 systems in the following Windows registry key:

HKLM\SYSTEM\CurrentControlSet\Services\ontapdsm\Parameters

Protocols setting

The Protocols parameter specifies which LUNs are claimed by the DSM. The value is determined when installing the DSM. Run the Repair option of the DSM installer to change which types of LUNs are claimed.

Protocols is set to:

- ◆ 1 if only FCP LUNs are claimed
- ◆ 2 if only iSCSI LUNs are claimed
- ◆ 3 if both FCP and iSCSI LUNs are claimed

This parameter is set in the following Windows registry key:

HKLM\SYSTEM\CurrentControlSet\Services\ontapdsm\Parameters

RetryCount setting

The RetryCount parameter specifies the number of times the current path to a LUN is retried before failing over to an alternate path.

RetryCount is set to 6. This value enables recovery from a transient path problem. If the path is not recovered in 6 tries, it is probably a more serious network problem.

This parameter is set in the following Windows registry key:

HKLM\SYSTEM\CurrentControlSet\Services\ontapdsm\Parameters

RetryCount was set to 8 in the DSM version 3.0. It was changed in DSM 3.1 and DSM 3.2 to match the value used for the FCP Host Utilities.

RetryInterval setting

The RetryInterval parameter specifies the amount of time to wait between retries of a failed path.

RetryInterval is set to 1 second. This value gives the path a chance to recover from a transient problem before trying again.

This parameter is set in the following Windows registry key:

HKLM\SYSTEM\CurrentControlSet\Services\ontapdsm\Parameters

SupportedDeviceList setting

The SupportedDeviceList parameter specifies the vendor identifier (VID) and product identifier (PID) of LUNs that should be claimed by the DSM.

The values of SupportedDeviceList are NETAPP LUN and some additional values that are being reserved for future use.

This parameter is set in the following Windows registry key:

HKLM\SYSTEM\CurrentControlSet\Services\ontapdsm\Parameters

TestUnitReadyRetryCount setting

The DSM sends a SCSI TEST UNIT READY command to the target to verify a path is available for use. Occasionally, the target may fail to respond to the command, so the DSM sends it again.

The TestUnitReadyRetryCount parameter specifies the number of times the DSM sends a SCSI TEST UNIT READY command on a path before marking a path as failed and rebalancing paths.

TestUnitReadyRetryCount is set to 3. If the target does not respond after three SCSI TEST UNIT READY commands, the DSM assumes there is something wrong with the path and it should not be used.

This parameter is set in the following Windows registry key:

HKLM\System\CurrentControlSet\Services\ontapdsm\Parameters

ManageDisksOnSystemBuses setting

The ManageDisksOnSystemBuses parameter is used by SAN-booted systems to ensure that the startup disk, pagefile disks, and cluster disks are all on the same SAN fabric.

This parameter is set in the following registry key:

HKLM\SYSTEM\CurrentControlSet\Services\ClusSvc\Parameters

For detailed information about the ManageDisksOnSystemBuses parameter, see Microsoft Support article 886569 at <http://support.microsoft.com/kb/886569>.

HBA settings

The DSM installer sets the following Fibre Channel host bus adapter (HBA) parameters.

Note that the same HBA parameters are set by the FCP Windows Host Utilities installer. The Host Utilities installer sets different values depending on whether it detects that MPIO is selected.

The names of the parameters may vary slightly depending on the program. For example, in QLogic SANsurfer, the parameter is displayed as Link Down Timeout. The Host Utilities fcconfig.ini file displays this parameter as either LinkDownTimeout or MpioLinkDownTimeout depending on whether MPIO is detected. However, all of these names refer to the same HBA parameter.

QLogic HBAs: For QLogic® HBAs, the DSM installation program sets the following HBA parameters:

- ◆ LinkDownTimeout=5
- ◆ PortDownRetryCount=30

Emulex HBAs: For Emulex® HBAs, the DSM installation program sets the following HBA parameters:

- ◆ LinkTimeout=5
- ◆ NodeTimeout=30

Failover and load balance policy concepts

Load balance policies determine failover behavior

The DSM chooses one or more active I_T_L nexuses between the LUN on the storage system and the Windows host based on the following:

- ◆ load balance policy of the LUN
- ◆ whether the path is local or proxy
- ◆ whether the path is FCP or iSCSI
- ◆ state of all possible paths
- ◆ load on each path

By default, the DSM uses optimized (non-proxy) FCP paths whenever they are available. When no optimized paths are available, the DSM uses proxy FCP paths. When no FCP paths are available, the DSM uses iSCSI paths. You can change this default behavior by changing the load balance policy for a virtual disk.

There are six load balance policies that can be used for FCP and iSCSI paths:

Least Queue Depth: I/O to the virtual disk is automatically sent on the available path with the smallest current outstanding queue. The queue length is determined at the I_T nexus level and not the LUN path level. This policy enables you to maximize bandwidth utilization without the need for administrator intervention. The initial paths used are selected in order of optimized FCP first, then proxy FCP, and finally iSCSI.

Least Weighted Paths: The available path with the lowest weight (zero is highest priority) is used to access the virtual disk. If multiple paths with the same weight value are available, the DSM selects the path shared with the fewest other LUNs. The weight value can be set from 0 (highest priority) to 2146999999 (lowest priority).

Round Robin: The Round Robin policy is an “active/active” policy. All optimized (non-proxy) paths to the storage system are used when available.

Round Robin with Subset: The Round Robin with Subset policy also uses multiple paths. However, you can specify the paths you want used when available. You can also specify optimized standby paths.

Although you can specify non-optimized (proxy) paths as part of the active subset, this is not recommended. By default, all optimized paths are initially selected. To specify the subset, you make individual paths active or passive as desired.

FailOver Only: The FailOver Only policy enables you to manually select a single preferred I_T_L nexus. This I_T_L nexus will be used whenever it is available.

Auto Assigned: The Auto Assigned policy attempts to spread the load evenly across all available local paths. For each LUN, only one path is used at a time. Whenever a path changes state, the DSM automatically rebalances the load.

Required cfmode settings

The following table lists the FCP cfmode setting required on the storage system for each load balance policy. Data ONTAP 7.2.2 or later is required.

Note

Mixed FCP and iSCSI access to the same LUN requires the `single_image` cfmode setting. For iSCSI-only access, the cfmode setting does not matter.

Policy	Supported cfmode values
Auto Assigned	<code>single_image</code> , <code>standby</code> , <code>partner</code> , <code>dual_fabric</code>
FailOver Only	<code>single_image</code> , <code>standby</code> , <code>partner</code> , <code>dual_fabric</code>
Least Weighted Paths	<code>single_image</code> , <code>standby</code> , <code>partner</code> , <code>dual_fabric</code>
Round Robin	<code>single_image</code> , <code>standby</code>
Round Robin with Subset	<code>single_image</code> , <code>standby</code>
Least Queue Depth	<code>single_image</code> , <code>standby</code>

Note

The `single_image` setting is strongly recommended. The `standby`, `partner`, and `dual-fabric` values are supported for migration from existing configurations.

Other factors affect behavior

About optimized paths: The DSM differentiates between FCP optimized (local or non-proxy) and proxy FCP paths. Proxy paths use the cluster interconnect between storage system controllers in an active/active configuration

(storage system cluster) and are less efficient than local paths. Proxy paths are not used when optimized paths are available, unless you explicitly set proxy paths to active when using the FailOver-only or Round Robin with Subset policy, or you set proxy paths to a lower weight using the Least Weighted Paths policy.

Windows clusters: The DSM applies special rules to Windows cluster (also known as MSCS in Windows Server 2003 and Failover Cluster in Windows Server 2008) configurations. After any path changes state (a new path becomes available or an existing path becomes unavailable), the DSM waits two minutes for I/O to stabilize before moving LUNs owned by a clustered Windows host to balance the load among paths.

Disabled paths: If you manually disable an I_T_L nexus, the DSM does not normally fail over to it. However, if the active I_T_L nexus fails, and there are no enabled I_T_L nexuses available, the DSM will try to enable and fail over to a disabled I_T_L nexus. As soon as an enabled I_T_L nexus is available, the DSM will fail back to the enabled I_T_L nexus and return the I_T_L nexus to the disabled state.

Failover examples

Least Queue Depth example: A Windows host has four FCP paths and four iSCSI paths to a LUN, two paths of each protocol to each node (controller) in an active/active storage system configuration. The load balance policy is Least Queue Depth.

Initial path selection with all components working:

- ◆ ITL_1 Optimized FCP - Active
- ◆ ITL_2 Proxy FCP - Passive
- ◆ ITL_3 iSCSI - Passive
- ◆ ITL_4 iSCSI - Passive
- ◆ ITL_5 Proxy FCP - Passive
- ◆ ITL_6 Optimized FCP- Active
- ◆ ITL_7 iSCSI - Passive
- ◆ ITL_8 iSCSI - Passive

I/O between the host and storage system is sent on ITL_1 or ITL_6, depending on which currently has the shorter queue.

After ITL_1 fails:

- ◆ ITL_2 Proxy FCP - Passive
- ◆ ITL_3 iSCSI - Passive
- ◆ ITL_4 iSCSI - Passive

- ◆ ITL_5 Proxy FCP - Passive
- ◆ ITL_6 Optimized FCP- Active
- ◆ ITL_7 iSCSI - Passive
- ◆ ITL_8 iSCSI - Passive

All I/O is sent over ITL_6.

If both ITL_1 and ITL_6 fail:

- ◆ ITL_2 Proxy FCP - Active
- ◆ ITL_3 iSCSI - Passive
- ◆ ITL_4 iSCSI - Passive
- ◆ ITL_5 Proxy FCP - Active
- ◆ ITL_7 iSCSI - Passive
- ◆ ITL_8 iSCSI - Passive

I/O is sent on ITL_2 or ITL_5, depending on which currently has the shorter queue.

After all FCP paths fail:

- ◆ ITL_3 iSCSI - Active
- ◆ ITL_4 iSCSI - Active
- ◆ ITL_7 iSCSI - Active
- ◆ ITL_8 iSCSI - Active

I/O is sent on whichever iSCSI path has the shortest queue.

Round Robin example: A Windows host has four paths to a LUN, two paths to each node (controller) in an active/active storage system configuration. The load balance policy is Round Robin.

Before path fail-over:

- ◆ ITL_1 Optimized - Active
- ◆ ITL_2 Proxy - Passive
- ◆ ITL_3 Proxy - Passive
- ◆ ITL_4 Optimized - Active

After one active I_T_L nexus (path) fails, the other active I_T_L nexus continues to deliver data:

- ◆ ITL_2 Proxy - Passive
- ◆ ITL_3 Proxy - Passive
- ◆ ITL_4 Optimized - Active

If the second active I_T_L nexus fails, the two passive paths are activated:

- ◆ ITL_2 Proxy - Active
- ◆ ITL_3 Proxy - Active

Whenever either optimized (non-proxy) path becomes available again, it is made active and the proxy paths become passive.

Round Robin with Subset example: A Windows host has four FCP paths to a LUN, two paths to each node (controller) in an active/active storage system configuration. The load balance policy is Round Robin with Subset. The administrator has set ITL_4 as the preferred path and set ITL_1 to passive.

Before path fail-over:

- ◆ ITL_1 Optimized - Passive
- ◆ ITL_2 Proxy - Passive
- ◆ ITL_3 Proxy - Passive
- ◆ ITL_4 Optimized, Preferred - Active

After the active I_T_L nexus fails, the optimized passive I_T_L nexus is activated:

- ◆ ITL_1 Optimized - Active
- ◆ ITL_2 Proxy - Passive
- ◆ ITL_3 Proxy - Passive

After losing the optimized, non-preferred I_T_L nexus, the two passive paths are activated:

- ◆ ITL_2 Proxy - Active
- ◆ ITL_3 Proxy - Active

Finally, both optimized paths become available again, and the preferred path is again active and the other three paths are passive.

FailOver Only example: A Windows host has four FCP paths to a LUN, two paths to each node in an active/active storage system configuration. The load balance policy for the LUN is FailOver Only. ITL_1 has been selected as the preferred ITL nexus by manually activating it.

Before path fail-over:

- ◆ ITL_1 Optimized - Active
- ◆ ITL_2 Proxy - Passive
- ◆ ITL_3 Proxy - Passive
- ◆ ITL_4 Optimized - Passive

After the active I_T_L nexus fails, the DSM selects the passive optimized I_T_L nexus:

- ◆ ITL_2 Proxy - Passive
- ◆ ITL_3 Proxy - Passive
- ◆ ITL_4 Optimized - Active

After losing both optimized I_T_L nexuses, the DSM selects the proxy I_T_L nexus with the lowest load:

- ◆ ITL_2 Proxy - Active
- ◆ ITL_3 Proxy - Passive

Whenever the preferred optimized I_T_L nexus becomes available again, the DSM activates that I_T_L nexus for I/O to the LUN.

Auto Assigned example: In this example, the Windows host again has four paths, but the load balance policy is Auto Assigned. The DSM activates the optimized I_T_L nexus that uses the path with the fewest active I_T_L nexuses. In this example, ITL_4 is selected. The administrator is not allowed to manually activate a path.

- ◆ ITL_1 Optimized - Passive
- ◆ ITL_2 Proxy - Passive
- ◆ ITL_3 Proxy - Passive
- ◆ ITL_4 Optimized - Active

The failover behavior is the same as for the FailOver Only example. The DSM will first select an optimized passive I_T_L nexus. If there are no optimized I_T_L nexuses, the DSM will select a proxy I_T_L nexus. Again, the particular I_T_L nexus selected depends on which available path has the lowest current load.

The AutoAssigned failback behavior is somewhat different from FailOver Only. If a proxy I_T_L nexus is in use, the DSM will activate the first available optimized I_T_L nexus.

If ITL_1 was the first optimized I_T_L nexus available, it would be activated:

- ◆ ITL_1 Optimized - Active
- ◆ ITL_2 Proxy - Passive
- ◆ ITL_3 Proxy - Passive

As additional optimized paths become available, the DSM rebalances paths so that active I_T_L nexuses are distributed evenly across paths. In this example, ITL_4 becomes available and uses a path with no active I_T_L nexus. ITL_1 uses a path that currently has two active I_T_L nexuses. The DSM activates ITL_4 so that each path has one active I_T_L nexus:

- ◆ ITL_1 Optimized - Passive
- ◆ ITL_2 Proxy - Passive
- ◆ ITL_3 Proxy - Passive
- ◆ ITL_4 Optimized - Active

If the paths are used by a clustered Windows host, the DSM waits two minutes after the path becomes available before balancing the load. This enables the I/O to stabilize and prevents the Windows cluster from failing over unnecessarily. Of course if a Windows cluster loses an active I_T_L nexus, a passive I_T_L nexus is activated immediately.

Topics in this chapter

Be sure to complete procedures in this chapter in the order shown. This chapter includes the following topics:

- ◆ [“Before you begin”](#) on page 20
- ◆ [“Upgrading from Data ONTAP DSM 3.x for Windows MPIO”](#) on page 22
- ◆ [“Step 2: Install Windows hotfixes”](#) on page 25
- ◆ [“Step 3: Remove or Upgrade SnapDrive for Windows”](#) on page 26
- ◆ [“Step 4: Install the FCP Host Utilities and HBA drivers”](#) on page 27
- ◆ [“Step 5: Obtain an MPIO license key”](#) on page 28
- ◆ [“Step 6: Run the installer program”](#) on page 29
- ◆ [“Step 7: Install the iSCSI software initiator and Host Utilities”](#) on page 31
- ◆ [“Uninstalling the Data ONTAP DSM”](#) on page 32
- ◆ [“Using the Data ONTAP DSM repair option”](#) on page 34

Before you begin

About Windows Server 2008 upgrades

If you are running a earlier version of the Data ONTAP DSM for Windows MPIO with Windows Server 2003, you must upgrade to DSM 3.2 *before* upgrading your host from Windows Server 2003 to Windows Server 2008.

Verify support

Be sure that you have a supported combination of the following:

- ◆ Data ONTAP® software version on your storage system (Data ONTAP 7.2.2 and later are currently supported)
- ◆ Windows® operating system version on your host computer
- ◆ SnapDrive® for Windows software version on your host computer
- ◆ FCP Host Utilities software versions on your host computer
- ◆ Fibre Channel host bus adapter model, driver, and firmware versions on your host computer
- ◆ Fibre Channel switch model and firmware version
- ◆ Optional iSCSI software initiator and iSCSI Host Utilities

See the FCP Host Compatibility Matrix and SnapDrive & SnapManager Compatibility Matrix at

http://now.netapp.com/NOW/knowledge/docs/san/fcp_iscsi_config/index.shtml.

Installation overview

To install the Data ONTAP DSM for Windows MPIO on a Windows host computer, you complete the following steps in the order shown. The rest of this chapter contains detailed procedures for each step.

1. Stop applications using LUNs on the storage system. Stop any I/O to the host, including any I/O using the iSCSI protocol. For clustered hosts, stop the cluster service.
2. Install required Windows hotfixes. This requires one or more reboots.
3. Remove SnapDrive 4.2.1 for Windows or earlier if installed or upgrade to SnapDrive 5.0 for Windows or later.
4. Install the FCP Windows Host Utilities and required Fibre Channel HBA drivers.

5. Obtain a new MPIO license key (MPIO-WIN key) if you do not already have one. If you have a license key for the MPIO component of SnapDrive 4.1 for Windows or earlier (SDR-MPIO key), you can use that key.
6. Run the installer program for the Data ONTAP DSM for Windows MPIO. You will need to provide a license key and specify which types of LUNs are claimed by the DSM (FCP, iSCSI, or both). You will also need to provide the User name and password of an account in the Administrators group on the Windows host under which the DSM management service will be logged on. A reboot is required.
7. Install the Microsoft iSCSI Initiator and iSCSI Windows Host Utilities.

Upgrading from Data ONTAP DSM 3.x for Windows MPIO

Upgrade overview If you are running the Data ONTAP DSM 3.0 or 3.1, you can upgrade to version 3.2 by following the steps in this section. The overview process includes the following steps:

- 1. Install required Windows hotfixes. This requires one or more reboots.
- 2. Stop applications using LUNs on the storage system. Stop any I/O to the host, including any I/O using the iSCSI protocol. Stop the MSCS cluster service. Run the installer program for the new version.

Note When upgrading from DSM 3.0, to be recognized as an upgrade, you must run the DSM 3.2 installer from the same Windows account used to install DSM 3.0. If you run the DSM 3.2 installer from a different account, the DSM 3.2 installer cannot locate the DSM 3.0 information. The installation will proceed as a new install, and you have to enter the MPIO license key.

Install hotfixes In addition to the hotfixes you installed for version 3.0, you must install the following hotfixes for version 3.2:

Windows 2003 SP1, SP2, and R2:
Q932755

Run the installer Complete the following steps to upgrade the Data ONTAP DSM for Windows MPIO:

Step	Action
1	Download or copy the appropriate installation file for your Windows host's processor architecture.
2	Launch the installer program and follow the instructions on the screen.

Step	Action
3	Verify the MPIO license key when prompted. The installer automatically gets the current key value.
4	Enter the User name and password of the account on the Windows host under which the DSM management service will be logged on. This account must be in the Windows Administrators group.
5	Select the type of LUNs to claim: FCP only, iSCSI only, or both.
6	When prompted, click Yes to reboot the Windows host and complete the installation.

After installing

The installer will convert existing failover policies for existing LUNs to active/active if it can. Verify that your new failover policies are configured the way you want.

If you want to install an iSCSI initiator, see “[Step 7: Install the iSCSI software initiator and Host Utilities](#)” on page 31.

Step 1: Stop host applications, I/O, and cluster service

Stop applications

The installation of hotfixes, host utilities, and the DSM itself requires rebooting the Windows host one or more times. Stop all host applications that use the storage system.

Stop I/O

Stop all I/O between the host and storage system before installing.

Stop Windows cluster service

For hosts running MSCS, stop the cluster service before installing.

Step 2: Install Windows hotfixes

Matrix lists hotfixes For the current list of hotfixes required for your version of Windows, see the FCP Host Compatibility Matrix at http://now.netapp.com/NOW/knowledge/docs/san/fcp_iscsi_config/index.shtml.

As of the time of publication, the following hotfixes are required.

Windows Server 2003 SP1 and R2:

Q891957	Q898790
Q902837	Q908249
Q911030	Q912848
Q922772	Q932755

Windows Server 2003 SP2:

Q932755

Windows Server 2008:

None currently required.

Downloading fixes Some of the required hotfixes can be directly downloaded from the Microsoft download site:
<http://www.microsoft.com/downloads/search.aspx?displaylang=en>

Enter the hotfix number in search box and select Go.

Note that some hotfixes must be requested from Microsoft support. They are not available for direct download.

Installing fixes Follow the instructions provided by Microsoft to install the hotfixes. Some of the hotfixes require a reboot of your Windows host.

When you run the installer for the Data ONTAP DSM, it will list any missing hotfixes. You must add the required hotfixes before the installer will complete the installation process.

Step 3: Remove or Upgrade SnapDrive for Windows

SnapDrive 5.0 or later supported

The Data ONTAP DSM for Windows MPIO works with SnapDrive 5.0 for Windows and later. If you have an earlier version of SnapDrive on your Windows host, remove it or upgrade before the DSM is installed.

For the currently supported SnapDrive for Windows versions, see the SnapDrive & SnapManager Compatibility Matrix at http://now.netapp.com/NOW/knowledge/docs/san/fcp_iscsi_config/index.shtml.

Before removing SnapDrive 4.1

Be sure you have a record of the SnapDrive for Windows license keys before removing SnapDrive 4.1 or earlier from your host. There are two license keys: one for the LUN management component and one for the MPIO component.

To view the license keys, complete the following steps:

Step	Action
1	Open Windows Computer Management: Right click My Computer and select Manage or Select Start>Run>compmgmt.msc
2	Expand the Storage option in the left pane of the Computer Management window.
3	Select SnapDrive , then right-click SnapDrive and select SnapDrive Licenses .
4	Record the license values.

Removing or upgrading SnapDrive

To upgrade to SnapDrive 5.0 for Windows or later, following the instructions in the *Installation and Administration Guide* for the new version of SnapDrive.

To uninstall SnapDrive for Windows, use the Windows Add or Remove Programs utility as explained in the *SnapDrive 5.0 for Windows Installation and Administration Guide*.

If you have the MPIO component installed, you must reboot your Windows host to complete the removal.

Step 4: Install the FCP Host Utilities and HBA drivers

FCP Host Utilities 4.0 or later required

If you are using the DSM to claim FCP LUNs, install the FCP Windows Host Utilities including the supported driver version for your FCP host bus adapters.

For the current Host Utilities version, see the FCP Host Compatibility Matrix at http://now.netapp.com/NOW/knowledge/docs/san/fcp_iscsi_config/index.shtml.

If you have a version of the FCP Windows Host Attach Kit prior to 3.0, be sure to remove it before installing the Host Utilities. If you have the Host Attach Kit 3.0, the FCP Host Utilities installer can upgrade the Host Attach Kit software.

Step 5: Obtain an MPIO license key

Use key from previous DSM version

If you have an MPIO license key for you host from the Data ONTAP DSM 3.0 or 3.1, you can use that key for the DSM 3.2 when upgrading.

Use key from SnapDrive MPIO

If you had a previous version of SnapDrive 4.1 for Windows or earlier with an MPIO license, you can use that license key (SDR-MPIO key) with the Data ONTAP DSM for Windows MPIO. You should have recorded the license key in “[Step 3: Remove or Upgrade SnapDrive for Windows](#)” on page 26 before removing SnapDrive.

Get new key

To obtain a license key for a new copy of the Data ONTAP DSM for Windows MPIO (MPIO-WIN key), go to the NOW Protocol License page at <https://now.netapp.com/eservice/agree.do>. You must purchase a separate license for each Windows host.

In the Show me all field, select DSM-MPIO-WIN, enter your company name, and then click Go.

Record the appropriate license key.

Step 6: Run the installer program

Choose interactive or silent install

You can choose either an interactive installation or a silent (unattended) installation. This section describes the interactive installation. If you prefer the silent installation, see [Appendix B](#) on page 75.

Before you begin

Stop applications using LUNs on the storage system. Stop any I/O to the host, including any I/O using the iSCSI protocol. For hosts running MSCS, stop the cluster service.

Verify that you have a license key and that you have completed the previous steps in this chapter.

You should back up any critical data on your Windows host before installing.

A reboot of the Windows host is required to complete the installation.

Running the installer

Complete the following steps to install the Data ONTAP DSM for Windows MPIO:

Step	Action
1	Download or copy the appropriate installation file for your Windows host's processor architecture.
2	Stop any I/O to the host, including any I/O using the iSCSI protocol.
3	For hosts running MSCS, stop the cluster service.
4	Launch the installer program and follow the instructions on the screen.
5	Enter the MPIO license key when prompted.
6	Enter the User name and password of the account on the Windows host under which the DSM management service will be logged on. This account must be in the Windows Administrators group.
7	Select the type of LUNs to claim: FCP only, iSCSI only, or both.

Step	Action
8	When prompted, click Yes to reboot the Windows host and complete the installation.

Note

If the installer reports a problem, such as a required hotfix not found, correct the problem and run the installer again.

Step 7: Install the iSCSI software initiator and Host Utilities

Claiming iSCSI LUNs

You can use the iSCSI protocol to connect to LUNs on the same or different storage systems. You can also use the iSCSI protocol to connect to the same LUNs you access with the FCP protocol. You specify whether the Data ONTAP DSM claims iSCSI LUNs when you install the DSM.

You can change whether the Data ONTAP DSM claims iSCSI LUNs. See [“Changing the LUN types claimed by the DSM”](#) on page 35.

For Windows Server 2003, you install a separate iSCSI Initiator, available from the Microsoft Web site. For Windows Server 2008, the iSCSI Initiator is built in and does not require a separate product installation.

Install Microsoft MPIO Multipathing Support for iSCSI

If you do not configure the Data ONTAP DSM to claim iSCSI LUNs, you must install the Microsoft iSCSI DSM by selecting the **Microsoft MPIO Multipathing Support for iSCSI** check box when installing the iSCSI initiator for Windows Server 2003.

If the Data ONTAP DSM does not claim iSCSI LUNs, and the Microsoft iSCSI DSM is not installed, any iSCSI LUNs do not appear in Windows Disk Management. The LUNs still appear in the iSCSI applet. Existing LUNs disappear when the Data ONTAP DSM is installed and new LUNs do not appear when they are added.

It is recommended that you install the Microsoft iSCSI DSM even if you claim iSCSI LUNs with the Data ONTAP DSM. When both DSMs are installed, the Data ONTAP DSM has priority in claiming iSCSI LUNs on NetApp and IBM N series storage systems.

Verify supported version

Be sure to check the Support Matrix to verify which versions of the Microsoft iSCSI software Initiator and the iSCSI Windows Host Utilities are supported with this version of the DSM.

See the iSCSI Host Compatibility Matrix at http://now.netapp.com/NOW/knowledge/docs/san/fcp_iscsi_config/index.shtml.

Follow the instructions included with your version of iSCSI Windows Host Utilities to install iSCSI support.

Uninstalling the Data ONTAP DSM

Typical uninstall

In most cases you can use the Add or Remove Programs applet. Select the Data ONTAP DSM for Windows MPIO and click Remove. You will have to reboot your Windows host computer after removing the DSM.

Repairing the Host Utilities

Data ONTAP DSM sets some of the same registry entries as FCP Windows Host Utilities and iSCSI Windows Host Utilities. If you remove the DSM and still want to use the Host Utilities, you must restore the registry entries needed by the remaining Host Utilities.

After removing Data ONTAP DSM:

- ◆ Run the Repair option for FCP Windows Host Utilities from Add or Remove Programs.
- ◆ Run the Repair option for iSCSI Windows Host Utilities from Add or Remove Programs.

Reverting to DSM 3.0

If you want to revert from Data ONTAP DSM 3.2 to DSM 3.0, be sure to uninstall 3.2 before running the 3.0 installer. Use Windows Add or Remove Programs to uninstall DSM 3.2.

Attention

If DSM 3.2 is still installed, the 3.0 installer will attempt to “upgrade” 3.2 to 3.0, but the installation will fail and the system will crash on reboot. Contact technical support for assistance.

Force removal of MPIO for Windows Server 2003

To prevent accidentally removing the Windows Server 2003 MPIO components needed by another multipathing solution when removing the Data ONTAP DSM (the installer cannot reliably detect a DSM that is not currently active), the installer does not remove all Windows MPIO components. The Data ONTAP DSM 3.2 for Windows MPIO uses MPIO version 1.20 for Windows Server 2003. If you plan to install a program that needs an earlier version of the Windows MPIO code, such as SnapDrive for Windows 4.1 or earlier, you need to force the removal of the MPIO components when removing the Data ONTAP DSM.

Note

This procedure does not apply to Windows Server 2008 systems.

Caution

If you have other vendors' multipathing solutions installed, this procedure will prevent multipathing from working until the multipath software is reinstalled.

Never use multiple paths to storage unless you have multipathing software installed and running.

To remove the Data ONTAP DSM and force the removal of all Windows MPIO components, complete the following steps.

Step	Action
1	Quiesce host I/O and stop any applications accessing LUNs on the storage system.
2	Open a Windows command line and change to the directory or CD where the Data ONTAP DSM setup program is located.
3	Enter the following command: msiexec /uninstall <i>installer.msi</i> FORCE_REMOVE_MPIO=1 <i>installer.msi</i> is the DSM installation program for your Windows host's processor architecture.
4	Reboot the Windows computer when prompted.
5	Reinstall any other multipathing software solutions.
6	Resume I/O to SAN storage.

Using the Data ONTAP DSM repair option

About the repair option

The installer for the Data ONTAP DSM for Windows MPIO includes a repair option. The repair option is available from the Windows Add or Remove Programs applet.

The repair option updates the Windows registry settings and puts new copies of the DSM and MPIO driver files into the Windows driver folder.

You can use the repair option to change the types of LUNs claimed by the DSM.

Running the repair option

To run the DSM repair option, complete the following steps. A reboot is required.

Step	Action
1	Open the Windows Add or Remove Programs applet.
2	Select the Data ONTAP DSM for Windows MPIO , and click Change .
3	Select the Repair option.
4	Enter the User name and password of the account on the Windows host under which the DSM management service will be logged on. This account must be in the Windows Administrators group.
5	Verify the selection for type of LUNs claimed is correct.
6	Following the instructions on the screen and reboot the Windows host when prompted.

Changing the LUN types claimed by the DSM

Initially set during installation

When you install the Data ONTAP DSM for Windows MPIO, you specify the LUN types claimed by the DSM: iSCSI only, FCP only, or both.

Changing after installation

You can change the types of LUNs claimed after installation. Changing the setting requires a reboot of the Windows host.

Use the Repair option of the DSM installer to change the setting. See [“Using the Data ONTAP DSM repair option”](#) on page 34.

You can also change whether iSCSI LUNs are claimed using the `dsmcli` command. This does not affect the FCP LUNs. See [“Using dsmcli protocol”](#) on page 55.

Topics in this chapter

This chapter includes the following topics:

- ◆ “[Viewing LUNs and paths](#)” on page 39
- ◆ “[Changing load balance policies](#)” on page 41
- ◆ “[Changing the Active paths](#)” on page 42
- ◆ “[Enabling and disabling paths](#)” on page 44
- ◆ “[Managing the DSM license key](#)” on page 45
- ◆ “[Displaying the DSM persistent reservation key](#)” on page 46

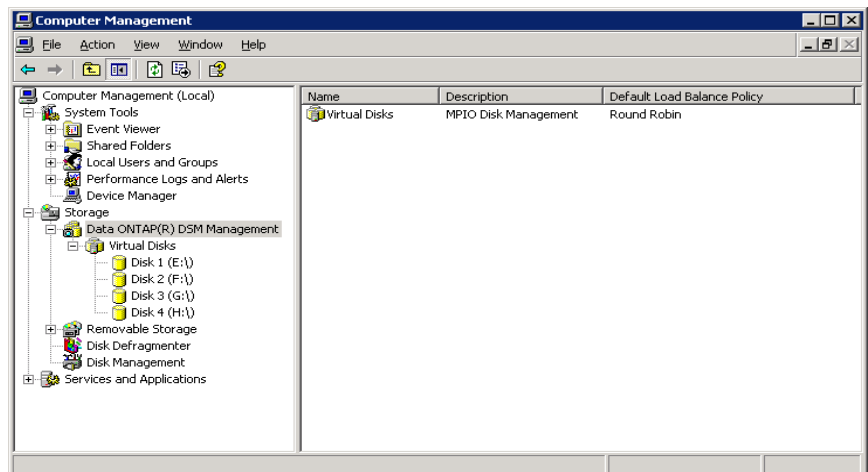
Management options

You can manage the Data ONTAP DSM for Windows MPIO using either a graphical user interface (GUI) or a command line interface (CLI). This chapter describes how to complete typical management tasks using the GUI. If you prefer to use a CLI, see [Chapter 4](#) on page 47.

Launching the GUI

The GUI is an MMC Snapin Extension under the Storage node in both the Server Manager console and the Computer Management console. Open the Windows Computer Management utility (Microsoft Management Console). Select **Start>Administrative Tools>Computer Management**.

Expand the **Storage** option in the left pane of the Computer Management application, and then select **Data Ontap DSM Management**. The DSM GUI is displayed.



By default, the GUI manages the local Windows host. To manage the DSM on another Windows host on your network, select **Action>Connect to another computer**.

Discovering new virtual disks (LUNs)

When you add new LUNs to your storage system, the new virtual disks are not automatically discovered by the Windows host. You must manually rescan disks.

To discover new virtual disks:

1. Click **Start>Administrative Tools>Computer Management**.
2. Select **Storage>Disk Management** in the left pane.
3. The **Initialize and Convert Disk** wizard starts. Follow the prompts to initialize the disks, but do not convert them to dynamic disks. Partition and format the disks if desired. If the wizard does not start, select **Action>Rescan Disks**.

The new virtual disks appear in the DSM GUI (you may have to refresh the display).

Load balance policy descriptions

For a description of each load balance policy, see “[Failover and load balance policy concepts](#)” on page 11 or the GUI online Help.

Viewing LUNs and paths

Viewing LUNs (virtual disks)

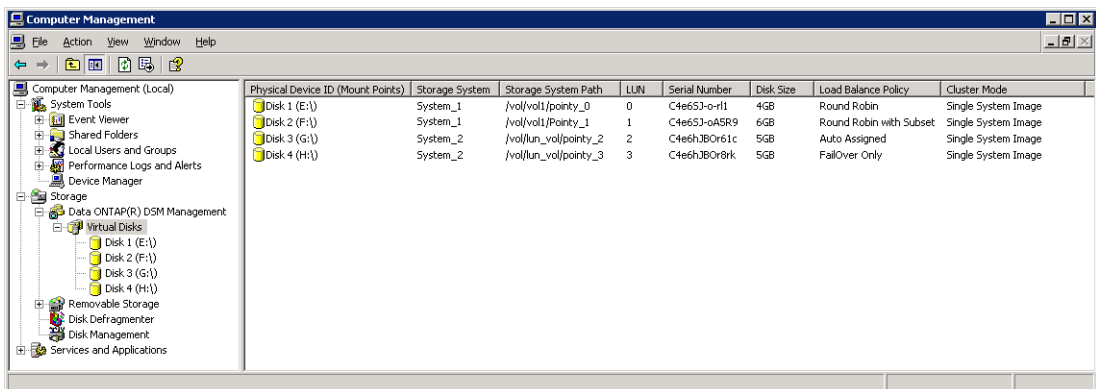
In the DSM GUI, expand Data ONTAP DSM Management, and then select Virtual Disks in the left pane.

If you add a new LUN on a storage system and it does not appear in the list, run **Action>Rescan Disks** in Windows Disk Management.

Each LUN is displayed as a virtual disk. Fields include:

- ◆ Virtual disk name and drive letter or mount point.
- ◆ Name of the storage system
- ◆ Volume path to the LUN on the storage system
- ◆ LUN identifier
- ◆ LUN serial number
- ◆ Virtual disk unformatted size (usable capacity will be less)
- ◆ Load balance policy
- ◆ Storage system cfmode

The following example shows four LUNs.



Viewing paths

In the DSM GUI, expand Data ONTAP DSM Management, expand Virtual Disks, and then click a virtual disk in the list.

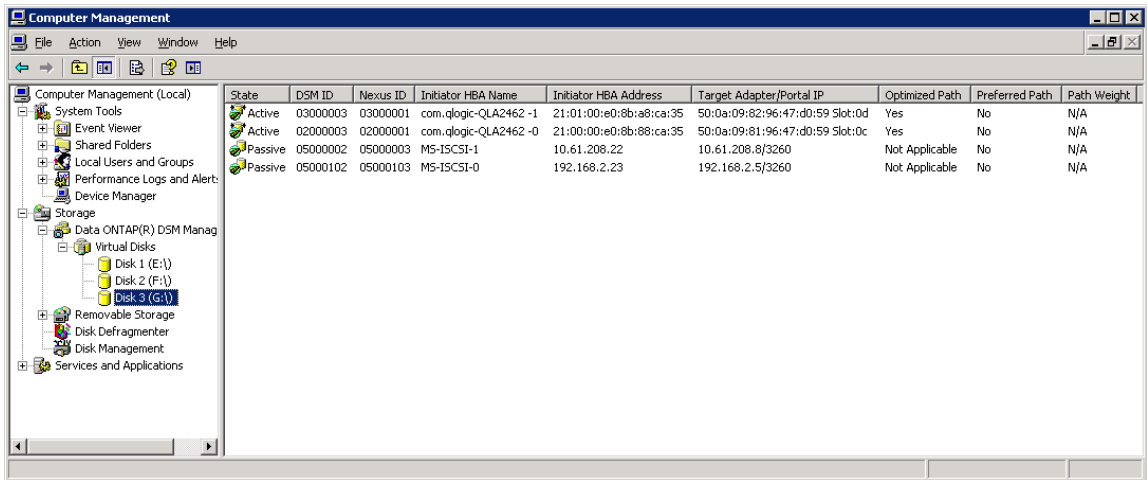
All paths to the LUN are displayed. Fields include:

- ◆ State of the virtual disk, including Active, Pending Active, Passive, Pending Passive, Disabled, or Failed

An asterisk (*) next to the state indicates that the path is a primary path and will always be used if available.

- ◆ DSM identifier of the path
- ◆ Nexus identifier
- ◆ Initiator (host) HBA name
- ◆ Initiator HBA address
- ◆ Target (storage system) adapter port
- ◆ Whether the path is an optimized (non-proxy) path
- ◆ Whether you explicitly selected the path (preferred path)

The following example shows a virtual disk with two FCP paths and two iSCSI paths. Note that the iSCSI paths are passive. The DSM prefers FCP paths when available. You can override this default using another load balance policy, such as the Round Robin with Subset policy.



State	DSM ID	Nexus ID	Initiator HBA Name	Initiator HBA Address	Target Adapter/Portal IP	Optimized Path	Preferred Path	Path Weight
* Active	03000003	03000001	com.qlogic-QLA2462 -1	21:01:00:e0:8b:a8:ca:35	50:0a:09:82:96:47:d0:59 Slot:0d	Yes	No	N/A
* Active	02000003	02000001	com.qlogic-QLA2462 -0	21:00:00:e0:8b:88:ca:35	50:0a:09:81:96:47:d0:59 Slot:0c	Yes	No	N/A
Passive	05000002	05000003	MS-ISCSI-1	10.61.208.22	10.61.208.8/3260	Not Applicable	No	N/A
Passive	05000102	05000103	MS-ISCSI-0	192.168.2.23	192.168.2.5/3260	Not Applicable	No	N/A

Changing load balance policies

Changing the default

In the DSM GUI, select Data ONTAP DSM Management. From the Action menu, select “Set default Load Balance Policy” and then select the desired policy.

The default load balance policy applies only to new virtual disks. To change the policy for an existing virtual disk, see the next section.

If you select Least Queue Depth, Round Robin, or Round Robin with Subset as the default policy, it will be used only for eligible virtual disks. These policies work only for virtual disks on storage systems using the `single_image` or `standby` `cfmode` setting. If both conditions are not met, the virtual disk defaults to Auto Assigned.

Changing the policy for a single virtual disk

In the DSM GUI, expand **Data ONTAP DSM Management**, and then select **Virtual Disks** in the left pane. Select a disk, select **Action > Set Load Balance Policy**, and then select the desired policy. If a virtual disk is not eligible for a given policy, that policy is not available to be selected.

Changing the Active paths

Making a path Active

In the DSM GUI, expand **Data ONTAP DSM Management**, expand **Virtual Disks** in the left pane, and then select a disk.

In the right pane, select a Passive path and then from the **Action** menu select **Set Active**.

Note

You can make a Passive path Active only when the load balance policy is FailOver Only, Round Robin with Subset, or Least Queue Depth. With policy Auto Assigned, you can disable the Active path, forcing a Passive path to become Active. With policy Round Robin, you can disable all Active paths, forcing all Passive paths to become Active. With policy Least Weighted Paths, you can adjust the path weight to specify which path is active.

Making a path Passive

In the DSM GUI, expand **Data ONTAP DSM Management**, expand **Virtual Disks** in the left pane, and then select a disk.

In the right pane, select an Active path and then from the **Action** menu select **Set Passive**.

This works only for the Least Queue Depth and Round Robin with Subset policies.

Specifying Preferred paths

In the DSM GUI, expand **Data ONTAP DSM Management**, expand **Virtual Disks** in the left pane, and then select a disk.

In the right pane, select a path and then from the **Action** menu select **Set Active**.

This works only for the Round Robin with Subset and FailOver Only policies.

Note

You should avoid making non-optimized (proxy) paths Preferred.

Setting path weight

In the DSM GUI, expand **Data ONTAP DSM Management**, expand **Virtual Disks** in the left pane, and then select a disk.

In the right pane, select a path and then from the **Action** menu select **Set Path Weight**. Enter a value between 0 (highest priority) and 2146999999 (lowest priority).

This works only for the Least Weighted Paths load balance policy.

Enabling and disabling paths

Enabling a path

In the DSM GUI, expand **Data ONTAP DSM Management**, expand **Virtual Disks** in the left pane, and then select a disk.

In the right pane, select a Disabled path and then from the **Action** menu select **Enable**.

Disabling a path

In the DSM GUI, expand **Data ONTAP DSM Management**, expand **Virtual Disks** in the left pane, and then select a disk.

In the right pane, select a Passive path and then from the **Action** menu select **Disable**.

If there are multiple passive paths that use the same initiator or HBA port, you can disable all of them at once by selecting Disable all paths for this initiator.

Note

For the Auto Assigned and FailOver Only policies, you cannot disable the active path. You must first activate another path so that the path you want to disable becomes a passive path.

Managing the DSM license key

Displaying the license key

In the DSM GUI, select **Data ONTAP DSM Management**. From the **Action** menu, select **Modify License Information**. The current key is displayed in the dialog box.

Entering a new license key

In the DSM GUI, select Data **ONTAP DSM Management**. From the **Action** menu, select **Modify License Information**. Enter the new key and click **OK**.

Displaying the DSM persistent reservation key

Displaying the key

In the DSM GUI, expand **Data ONTAP DSM Management**, expand **Virtual Disks** in the left pane, and then select a disk.

From the **Action** menu, select **Display Persistent Reservation Key**. The key value for the LUN is displayed in the dialog box.

Note

For Windows Server 2003, all LUNs are assigned the same key value on the host. For Windows Server 2008, each LUN has a unique key value.

Managing the DSM using the CLI

Topics in this chapter

This chapter includes the following topics:

- ◆ “[Using dsmcli dsm](#)” on page 49
- ◆ “[Using dsmcli lun](#)” on page 50
- ◆ “[Using dsmcli path](#)” on page 52
- ◆ “[Using dsmcli protocol](#)” on page 55

Management options

You can manage the Data ONTAP DSM for Windows MPIO using either a command line interface (CLI) or a graphical user interface (GUI). This chapter describes how to complete typical management tasks using the CLI. If you prefer to use a GUI, see [Chapter 3](#) on page 37.

Discovering new virtual disks (LUNs)

When you add new LUNs to your storage system, the new virtual disks are not automatically discovered by the Windows host. You must manually rescan disks.

To discover new virtual disks:

1. **Start>Administrative Tools>Computer Management**
2. Select **Storage>Disk Management** in the left pane.
3. The **Initialize and Convert Disk** wizard starts. Follow the prompts to initialize the disks, but do not convert them to dynamic disks. Partition and format the disks if desired. If the wizard does not start, select **Action>Rescan Disks**.

The new virtual disks are displayed in the output of CLI commands such as `dsmcli lun list`.

LUN path limitation

The DSM limits the LUN path on the storage system to 128 characters. The DSM fails to claim disks with longer path names. The LUN path, for example `/vol/vol2/server3_luns/lun4`, is specified when you create the LUN on the storage system. If you are using SnapDrive for Windows, the 128 character limit applies to the sum of the LUN path and name fields in the Create Disk wizard.

Main commands

The CLI uses the `dsmcli` command. It has four main options:

- ◆ `dsmcli dsm` - displays information about installed device specific modules and displays or sets the default load balance policy and persistent reservation key.
- ◆ `dsmcli lun` - displays information about LUNs managed by the DSM and sets the load balance policy for individual LUNs.
- ◆ `dsmcli path` - lists the failover status of each LUN, enables and disables paths, and sets a passive path to active.
- ◆ `dsmcli protocol` - controls whether the DSM claims iSCSI LUNs or not

The following sections describe each of the `dsmcli` options.

Using dsmcli dsm

Getting DSM information

These commands list information about the DSM.

Syntax:

```
dsmcli dsm { list | version }
```

Examples:

```
C:\>dsmcli dsm list
Number of DSM registered with MPIO is 1
List of DSMs registered with MPIO:
    "Data ONTAP Multi-Path Device Specific Module"

C:\>dsmcli dsm version
DSM MGMT Dll version 3.2.14575.300 built on 01/11/2008 03:07:20
ONTAPDSM Driver version 3.2.14575.300 built on 01/11/2008 03:07:16
MSFT MPIO Driver version 1.20.3790.2099 built on 11/22/2007
22:24:04
MSISCDSM Driver version 5.2.3790.3497 built on 11/22/2007 22:23:26
```

Setting the default load balance policy

The default load balance policy applies only to newly created virtual disks. Values are FailOver Only (FO), Auto Assigned (AA), Round Robin (RR), Round Robin with Subset (RS), Least Weighted Paths (WP), or Least Queue Depth (LQD). To change the policy for an existing virtual disk, use the `dsmcli lun setlbp` command. For a description of each load balance policy, see [“Failover and load balance policy concepts”](#) on page 11.

Syntax:

```
dsmcli dsm getdefaultlbp

dsmcli dsm setdefaultlbp -l { FO | AA | RR | RS | WP | LQD }
```

Examples:

```
C:\>dsmcli dsm getdefaultlbp
dsmcli:The default load balance policy for the dsm is LEAST QUEUE
DEPTH

C:\>dsmcli dsm setdefaultlbp -l RS
dsmcli:The default load balance policy for the dsm is set to ROUND
ROBIN WITH SUBSET.
```

Using dsmcli lun

Getting LUN information

These commands display information about the LUNs (virtual disks) mapped to the Windows host.

If you add a LUN on a storage system and it is not listed, rescan disks using the Windows disk manager and then run the `dsmcli` command again.

Syntax:

```
dsmcli lun { list | attributes }
```

Examples:

```
C:\>dsmcli lun list
Disks managed by  ONTAPDSM
C4e6SJ-o-r11      Data ONTAP Multi-Path Device Specific Module
C4e6SJ-oA5R9      Data ONTAP Multi-Path Device Specific Module
C4e6hJBOr61c      Data ONTAP Multi-Path Device Specific Module
C4e6hJBOr8rk      Data ONTAP Multi-Path Device Specific Module

C:\>dsmcli lun attributes
Disks managed by  ONTAPDSM
SerialNumber  Storage System  Storage System Path  MountPath
*****
C4e6SJ-o-r11  SS1              /vol/vol1/pointy_0    E:\
C4e6SJ-oA5R9  SS1              /vol/vol1/pointy_1    F:\
C4e6hJBOr61c  SS2              /vol/lun_vol/pointy_2  G:\
C4e6hJBOr8rk  SS2              /vol/lun_vol/pointy_3  H:\
```

Changing the load balance policy

This command displays the load balance policy for a single LUN (virtual disk). Values are FailOver Only (FO), Auto Assigned (AA), Round Robin (RR), Round Robin with Subset (RS), Least Weighted Paths (WP), or Least Queue Depth (LQD). The serial number can be displayed using the commands above. For a description of each load balance policy, see [“Failover and load balance policy concepts”](#) on page 11

Syntax:

```
dsmcli lun setlbp -l { FO | AA | RR | RS | WP | LQD }
{ -s serial_number | - d drive_letter }
```

Examples:

```
C:\>dsmcli lun setlbp -l RR -s C4e6hJBOr8rk
dsmcli:The load balance policy for the lun is set to  ROUND ROBIN
```

```
C:\>dsmcli lun setlbp -l AA -d H
dsmcli:The load balance policy for the lun is set to  AUTO ASSIGNED
```

Listing available load balance policies

This command displays the load balance policies that can be used with the specified virtual disk (LUN). Different policies might be available, depending on your configuration. For a description of each load balance policy, see [“Failover and load balance policy concepts”](#) on page 11.

Syntax:

```
dsmcli lun getlbp { -s serial_number | -d drive_letter }
```

Examples:

```
C:\>dsmcli lun getlbp -s C4e6SJFmQYJ1
dsmcli: The supported Load Balance policies for this LUN are
      FAILOVER
      WEIGHTED PATHS
      AUTO ASSIGNED
      ROUND ROBIN
      ROUND ROBIN WITH SUBSET
      LEAST QUEUE DEPTH
```

Viewing the persistent reservation key

The Data ONTAP DSM for Windows MPIO uses a persistent reservation key to track which host in a Microsoft Windows 2003 cluster (MSCS) or Windows 2008 Failover Cluster is currently allowed to write to a virtual disk (LUN). You can view the key for each virtual disk. In Windows Server 2003, all virtual disks have the same value on the host. In Windows Server 2008, each virtual disk has a unique value.

Syntax:

```
dsmcli lun getprkey { -s serial_number | -d drive_letter }
```

Examples:

```
C:\>dsmcli lun getprkey -d E
```

```
The Persistent Reservation Key for lun C4e6SJFmQYJ1 is:
10 5 45 41 2 52 10 11
```

Using dsmcli path

Displaying path information

This command displays all of the paths for one or all virtual disks (LUNs) mapped to the Windows host.

To display the paths for a single virtual disk, specify the serial number or drive letter.

Use the verbose (-v) option to get additional details on each path.

Syntax:

```
dsmcli path list [ -v ] [ -s serial_number | -d drive_letter ]
```

Examples:

```
C:\>dsmcli path list -v -d F:\
Serial Number: C4e6SJFmTmGm
MPIO Paths: 2
Load Balance Policy:  WEIGHTED PATHS
```

```
Dsm Id:          0x50000000
SCSI Address:
  Scsiport : 5
  HostPathId : 0
  Targetid : 0
  lun : 0
Path State:      PASSIVE
Path Weight: 255
Protocol : iSCSI
Initiator Name : MS-iSCSI-1
Initiator Portal : 10.61.208.22/1427
Target Portal IP : 10.61.208.8
```

```
Dsm Id:          0x50001000
SCSI Address:
  Scsiport : 5
  HostPathId : 0
  Targetid : 1
  lun : 0
Path State:      ACTIVE
Path Weight: 100
Protocol : iSCSI
Initiator Name : MS-iSCSI-0
Initiator Portal : 192.168.2.23/1428
Target Portal IP : 192.168.2.5
```

Changing path status

These commands change the status of the specified path. The actions you can take depend on the load balance policy of the virtual disk and the status of the other paths.

You specify the path you want to change using the Dsm Id. You can get the Dsm Id using the `dsmcli path list` command. The “0x” prefix for the Dsm ID is optional.

Note

You can make a Passive path Active for any load balance policy except Auto Assigned. With policy Auto Assigned, you can disable the Active path, forcing a Passive path to become Active. You cannot disable a path if no other path is available to take over; there must always be an active path.

The passive option applies only to the Round Robin with Subset and Least Queue Depth load balance policies.

Although you can make a non-optimized (proxy) path active, you should avoid doing so if any optimized paths are available.

Syntax:

```
dsmcli path { enable | disable | active | passive } -p Dsm_Id
```

Examples:

```
C:\>dsmcli path active -p 0x3000002
dsmcli:Path 0x03000002 is set to ACTIVE state
```

```
C:\>dsmcli path disable -p 0x3000002
dsmcli:Path 0x03000002 is DISABLED
```

```
C:\>dsmcli path enable -p 0x3000002
dsmcli:Path 0x03000002 is ENABLED
```

```
C:\>dsmcli path passive -p 3000101
dsmcli:Path 0x03000101 is set to PASSIVE state
```

Changing the path weight

This command sets the weight assigned to each path for virtual disks with the Least Weighted Path load balance policy.

The available path with the lowest weight is used to access the virtual disk. If multiple paths with the same weight value are available, the DSM selects the path shared with the fewest other LUNs. The *weight* value can be set from 0 (highest priority) to 2146999999 (lowest priority).

Initially, all paths are set to 255.

Syntax:

```
dsmcli dsmcli path weight -p Dsm_Id -w weight
```

Example:

```
C:\>dsmcli path weight -p 5000100 -w 100  
dsmcli:Path 0x05000100 weight is set to 100
```

Using dsmcli protocol

Displaying the status of iSCSI LUNs

This command displays whether the Data ONTAP DSM claims iSCSI LUNs. During installation, you specify whether to claim FCP LUNs, iSCSI LUNs, or both.

Syntax:

```
dsmcli protocol iscsi -l
```

Example:

```
C:\>dsmcli protocol iscsi -l  
dsmcli:Ontap dsm manages only the FCP luns.
```

Changing whether the DSM claims iSCSI LUNs

This command changes whether the Data ONTAP DSM claims iSCSI LUNs (use -c option) or not (use -d option).

You can also change the types of LUNs claimed by running the Repair option of the DSM installer.

You must reboot the Windows host for this change to take effect.

Syntax:

```
dsmcli protocol iscsi { -c | -d }
```

Example:

```
C:\>dsmcli protocol iscsi -c  
dsmcli:Ontapdsm will manage the iscsi luns also. Please reboot the  
system for the changes be effective.
```


Contents of appendix

This appendix contains troubleshooting information to help you resolve typical problems with installation and operation of the Data ONTAP DSM for Windows MPIO. This appendix includes the following topics:

- ◆ “[Windows event log entries](#)” on page 58
- ◆ “[Troubleshooting installation problems](#)” on page 71
- ◆ “[Troubleshooting GUI and CLI problems](#)” on page 72
- ◆ “[Troubleshooting failover problems](#)” on page 73

Windows event log entries

About event log entries

The DSM writes event log entries to the standard Windows event logs. Because of the limitations on the data that can be written to the event log, the details of some events are written in a raw format. The following section explains how to interpret the data in these events.

Most event messages are in text format and do not require special interpretation.

Event messages that apply to a particular virtual disk (LUN) or I_T_L nexus (path) include the DSM identifier. This identifier is included on the DSM GUI page for each virtual disk, and is returned by the `dsmcli path list` command.

Event data section encoding

Some events include raw data in their data sections. This enables these events to include more information than would be possible using text data. These events have the following data fields at the offsets shown:

Byte Offset (Hex)	Data
0x28 - 0x2B	DsmID
0x2C - 0x2F	PathID
0x30 – 0x33	NT Status Code
0x34 – 0x37	SrbFlags
0x38 – 0x39	Function
0x3A	SRB Status
0x3B	SCSI Status
0x3C	SenseKey
0x3D	ASC
0x3E	Reserved
0x40-0x4F	CDB

ONTAPDSM log messages

The following messages can be written to the Windows system event log. The source of these messages is ontapdsm. The severity (Sev) values are listed as **I** for informational, **W** for warning, or **E** for error.

ID	Sev	Explanation
61002	I	The DSM successfully initialized. Issued once each time the driver starts.
61003	E	Reported when MPIO components cannot be located. Reinstall the DSM.
61004	W	The query did not return a serial number for a LUN. The DSM cannot manage the LUN.
61005	E	The DSM could not obtain required information about the specified LUN, such as the storage system name and LUN path. The DSM cannot manage the LUN.
61006	I	The specified LUN uses an unsupported protocol. The DSM cannot manage the LUN.
61007	I	Issued once each time the DSM is unloaded.
61018	I	The specified DSM ID (I_T_L nexus) is now active.
61019	I	The administrative request to make specified DSM ID (I_T_L nexus) active failed.
61023	I	The default load balance policy for new virtual disks changed to the specified value.
61026	E	The storage system is running a version of Data ONTAP software that is not compatible with the DSM version.
61034	W	The specified LUN on the specified storage system disconnected. All paths to the LUN have been removed.
61035	I	The DSM discovered the first path to a new LUN. The LUN, storage system, and DSM ID (I_T_L nexus) are listed. Because the storage system meets the requirements, all load balance policies are supported.
61040	E	An earlier revision of the Windows MPIO drivers than is required by the DSM was found on the Windows system. Reinstall the DSM.

ID	Sev	Explanation
61041	I	The DSM discovered a new initiator-target-LUN (I_T_L) nexus and assigned it the specified DSM identifier. The WWPN of the target port is at byte offset 0x28 in the event text data.
61045	I	This information is used for diagnosing problems with host bus adapters.
61048	I	The specified DSM ID (I_T_L nexus) has been associated with the specified initiator-target nexus (path).
61049	W	There are no paths available to the specified LUN. The DSM requests path verification from the MPIO driver.
61051	W	The target cannot be reached on the specified DSM ID (I_T_L nexus).
61052	I	The specified DSM ID (I_T_L nexus) to the target is now working.
61053	E	The specified nexus failed. This was the last remaining path to a target. The DSM requests path verification from the MPIO driver. This event is reported during failover processing.
61054	W	All DSM IDs (I_T_L nexuses) in the specified nexus are marked as failed because the target is not responding. None of the member DSM IDs will be considered for I/O until at least one DSM ID passes path verification. Verification is started for all DSM IDs in the nexus.
61055	I	The specified DSM ID (I_T_L nexus) was enabled. It must still be activated before it is used for I/O.
61056	I	The specified DSM ID (I_T_L nexus) has been disabled and will not be selected for I/O.
61057	E	The administrative request to enable the specified DSM ID (I_T_L nexus) failed.
61058	E	The administrative request to disable the specified DSM ID (I_T_L nexus) failed. The last available I_T_L nexus cannot be disabled.

ID	Sev	Explanation
61059	I	The DSM requested that the MPIIO driver stop using this DSM ID (I_T_L nexus) and drain its queue. This is similar to disabling the DSM ID, but not persistent across host reboot.
61060	I	The MPIIO driver did not allow throttling of I/O on the specified DSM ID (I_T_L nexus).
61061	I	The throttling of I/O on the specified DSM ID (I_T_L nexus) was removed. I/O resumes on the DSM ID.
61062	I	Unable to remove the throttle on the specified DSM ID (I_T_L nexus).
61063	I	The specified protocol was enabled for the DSM.
61064	I	The specified protocol was disabled for the DSM.
61068	E	The attempt to change the load balance policy for the specified LUNs failed.
61070	I	The path to a target has been removed for the specified I_T nexus. There are no other DSM IDs (I_T_L nexuses) to the target port of the nexus, so the nexus is removed.
61071	I	The specified DSM ID (I_T_L nexus) has been activated and will be used for I/O.
61072	I	The specified DSM ID (I_T_L nexus) is no longer active. It remains a passive I_T_L nexus that can be used if the active I_T_L nexus fails.
61073	I	The specified DSM ID (I_T_L nexus) failed to transition to the active state as requested by the administrator.
61074	I	The specified DSM ID (I_T_L nexus) failed to transition to the passive state. To make the active DSM ID passive, activate a passive DSM ID.
61075	W	The specified active DSM ID (I_T_L nexus) was replaced by the new active DSM ID.
61076	E	The specified DSM ID (I_T_L nexus) reported an I/O error. The I/O will be retried. For information on decoding the data section of the event, see “ Event data section encoding ” on page 58.

ID	Sev	Explanation
61077	W	The specified DSM ID (I_T_L nexus) failed. The DSM requests path verification from the MPIO driver. The DSM activates a new I_T_L nexus.
61078	I	The specified LUN has failed over to the new DSM ID (I_T_L nexus) specified.
61079	W	The specified I_T nexus was reported as failed, but it recovered before failover processing could complete. The original nexus will continue to be used.
61080	W	The storage system reported a queue full error for the specified DSM ID (I_T_L nexus). The target port has reached its limit for outstanding requests. The I/O will be retried. For information on decoding the data section of the event, see “Event data section encoding” on page 58.
61081	E	The storage system reported a write error for I/O on the specified DSM ID (I_T_L nexus). The I/O will be retried. For information on decoding the data section of the event, see “Event data section encoding” on page 58.
61082	E	The storage system reported an invalid command for an I/O operation on the specified DSM ID (I_T_L nexus). The I/O is not retried. For information on decoding the data section of the event, see “Event data section encoding” on page 58.
61083	E	The storage system reported the logical block address for an I/O operation on the specified DSM ID (I_T_L nexus) is out of range. For information on decoding the data section of the event, see “Event data section encoding” on page 58. Contact NetApp customer support to report this error.
61084	E	The storage system reported an invalid field error for an I/O operation on the specified DSM ID (I_T_L nexus). The I/O is not retried. For information on decoding the data section of the event, see “Event data section encoding” on page 58.
61085	E	The storage system reported that the requested LUN does not exist. The LUN may have been deleted on the storage system by the administrator. This error can also occur during storage system giveback. Check the event data section for additional information.

ID	Sev	Explanation
61086	E	The storage system reported an invalid parameter list error for an I/O operation on the specified DSM ID (I_T_L nexus). The I/O is not retried. For information on decoding the data section of the event, see “ Event data section encoding ” on page 58.
61087	E	The DSM attempted to release a persistent reservation on the specified DSM ID (I_T_L nexus) for a LUN that it does not own. The I/O is not retried.
61088	E	The storage system reported an invalid parameter list length error for an I/O operation on the specified DSM ID (I_T_L nexus). The I/O is not retried. For information on decoding the data section of the event, see “ Event data section encoding ” on page 58.
61089	E	The storage system reported an invalid task attribute error for an I/O operation on the specified DSM ID (I_T_L nexus). For information on decoding the data section of the event, see “ Event data section encoding ” on page 58.
61090	E	The storage system reported a configuration problem with the LUN on the specified DSM ID (I_T_L nexus). The I/O is not retried. For information on decoding the data section of the event, see “ Event data section encoding ” on page 58.
61091	W	The LUN on the specified DSM ID (I_T_L nexus) could not be reached because of problems with the storage system interconnect. The I/O is retried on another DSM ID. For information on decoding the data section of the event, see “ Event data section encoding ” on page 58.
61092	W	The storage system reported that the LUN on the specified DSM ID (I_T_L nexus) was not ready. The I/O will be retried. Check the event data section for additional information.
61093	W	The LUN on the specified DSM ID (I_T_L nexus) is not currently available because it is being formatted. The I/O will be retried. For information on decoding the data section of the event, see “ Event data section encoding ” on page 58.

ID	Sev	Explanation
61094	E	The storage system reported that the LUN on the specified DSM ID (I_T_L nexus) is not available. The I/O will be retried on another DSM ID. Check the event data section for additional information.
61095	W	The LUN on the specified DSM ID (I_T_L nexus) is not ready, but is becoming ready. The I/O will be retried. For information on decoding the data section of the event, see “Event data section encoding” on page 58.
61096	E	The storage system reported that the LUN on the specified DSM ID (I_T_L nexus) is offline. The I/O will be retried. For information on decoding the data section of the event, see “Event data section encoding” on page 58. Check the LUN status on the storage system and bring online.
61097	I	The storage system reported that the LUN on the specified DSM ID (I_T_L nexus) was reset. The I/O will be retried immediately. For information on decoding the data section of the event, see “Event data section encoding” on page 58.
61098	I	The DSM lost its SCSI reservation to the LUN on the specified DSM ID (I_T_L nexus). For information on decoding the data section of the event, see “Event data section encoding” on page 58.
61099	I	The storage system reported that the SCSI reservations to the LUN on the specified DSM ID (I_T_L nexus) were released. For information on decoding the data section of the event, see “Event data section encoding” on page 58.
61100	I	The storage system reported that the registration of the specified DSM ID (I_T_L nexus) was cleared. For information on decoding the data section of the event, see “Event data section encoding” on page 58.
61102	I	The storage system reported that a volume was created on the LUN in the specified DSM ID (I_T_L nexus). For information on decoding the data section of the event, see “Event data section encoding” on page 58.

ID	Sev	Explanation
61103	I	The storage system reported a change in the availability of the LUN in the specified DSM ID (I_T_L nexus). For information on decoding the data section of the event, see “Event data section encoding” on page 58.
61104	E	The storage system reported an attempt to write to the read-only LUN in the specified DSM ID (I_T_L nexus). For information on decoding the data section of the event, see “Event data section encoding” on page 58.
61105	E	The storage system reported a write error on the LUN in the specified DSM ID (I_T_L nexus). The I/O will be retried. For information on decoding the data section of the event, see “Event data section encoding” on page 58. Check the storage system log for disk errors.
61106	E	The storage system reported a write error on the LUN in the specified DSM ID (I_T_L nexus) and was unable to reallocate the bad blocks. The I/O will be retried. For information on decoding the data section of the event, see “Event data section encoding” on page 58. Check the storage system log for disk errors.
61107	E	The storage system reported that one of the disks used for the LUN in the specified DSM ID (I_T_L nexus) was not supported. The I/O is not retried. For information on decoding the data section of the event, see “Event data section encoding” on page 58. Check the storage system log for disk errors.
61108	E	The storage system reported a high error rate for the LUN in the specified DSM ID (I_T_L nexus). The I/O will be retried. For information on decoding the data section of the event, see “Event data section encoding” on page 58. Check the storage system log for disk errors.
61109	W	The storage system aborted a SCSI command on the specified DSM ID (I_T_L nexus). The I/O will be retried. For information on decoding the data section of the event, see “Event data section encoding” on page 58. This is a common event during storage system giveback.

ID	Sev	Explanation
61110	E	The DSM was unable to communicate with the LUN on the specified DSM ID (I_T_L nexus). The DSM will try another path to the LUN. The data section of the event contains the NTSTATUS code.
61111	I	The DSM detected a buffer error for the LUN on the specified DSM ID (I_T_L nexus). The I/O is not retried. The data section of the event contains the NTSTATUS code.
61112	W	The DSM detected that the specified DSM ID (I_T_L nexus) is pending deletion while processing an I/O operation. The DSM will try another path to the LUN.
61113	W	The DSM detected an invalid device request on the specified DSM ID (I_T_L nexus). The I/O is not retried. Check the event data section for additional information.
61114	I	The DSM found the queue for the specified DSM ID (I_T_L nexus) frozen. The queue is now unfrozen and the I/O will be retried.
61115	E	The DSM found the queue for the specified DSM ID (I_T_L nexus) frozen. The DSM is unable to unfreeze the queue. The I/O will be retried.
61116	E	The port servicing the specified DSM ID (I_T_L nexus) did not finish processing an I/O request.
61117	I	The port servicing the specified DSM ID (I_T_L nexus) cancelled an I/O operation successfully.
61118	W	The port servicing the specified DSM ID (I_T_L nexus) was unable to cancel an I/O operation because the I/O operation could not be located.
61119	W	The port servicing the specified DSM ID (I_T_L nexus) reported that it was too busy to accept an I/O request. The I/O request will be retried.
61120	W	The port servicing the specified DSM ID (I_T_L nexus) reported that an I/O operation request was not supported.
61121	E	The port servicing the specified DSM ID (I_T_L nexus) reported that the bus is no longer valid.

ID	Sev	Explanation
61122	E	The port servicing the specified DSM ID (I_T_L nexus) reported that the LUN is no longer present.
61123	E	The port servicing the specified DSM ID (I_T_L nexus) reported that an I/O operation timed out.
61124	E	The port servicing the specified DSM ID (I_T_L nexus) reported that the LUN did not respond to selection.
61125	E	The port servicing the specified DSM ID (I_T_L nexus) reported that an I/O command timed out.
61126	E	The port servicing the specified DSM ID (I_T_L nexus) reported that the storage system rejected a message. This response is normally returned only for SRB_FUNCTION_TERMINATE_IO requests.
61127	W	The port servicing the specified DSM ID (I_T_L nexus) reported a bus reset while processing an I/O request. The request will be retried.
61128	E	The port servicing the specified DSM ID (I_T_L nexus) reported a parity error. The request will be retried.
61129	E	The port servicing the specified DSM ID (I_T_L nexus) failed a request-sense command. The request will be retried.
61130	E	The port servicing the specified DSM ID (I_T_L nexus) did not respond to an I/O request.
61131	E	The port servicing the specified DSM ID (I_T_L nexus) disconnected unexpectedly.
61132	E	The port servicing the specified DSM ID (I_T_L nexus) reported an illegal phase sequence failure.
61133	E	The port servicing the specified DSM ID (I_T_L nexus) reported an improper SRB request.
61134	I	The port servicing the specified DSM ID (I_T_L nexus) reported that a request for status was stopped.
61135	W	The port servicing the specified DSM ID (I_T_L nexus) reported that the LUN is invalid.

ID	Sev	Explanation
61136	E	The port servicing the specified DSM ID (I_T_L nexus) reported that the storage system is no longer available.
61137	W	The port servicing the specified DSM ID (I_T_L nexus) reported a bad function request in an I/O request.
61138	W	The port servicing the specified DSM ID (I_T_L nexus) reported that an I/O request completed with an error and that the SCSI INITIATE RECOVERY message was received.
61139	E	The port servicing the specified DSM ID (I_T_L nexus) reported that the storage system is not powered.
61140	W	The storage system reported that the LUN on the specified DSM ID (I_T_L nexus) is busy. The request will be retried.
61141	W	The storage system reported that the queue for the LUN on the specified DSM ID (I_T_L nexus) is full. The request will be retried.
61142	E	The specified nexus (path) failed.
61143	I	The specified nexus (path) is working normally.
61144	W	The specified DSM ID (I_T_L nexus) was used for an I/O operation, because there we no paths without I/O errors.
61145	W	The specified nexus (path) is degraded. One or more DSM IDs (I_T_L nexuses) have lost connectivity with the storage system.
61146	I	The specified DSM ID (I_T_L nexus) is reserved by host clustering software.
61147	I	The reservation for the specified DSM ID (I_T_L nexus) was released.
61148	W	The DSM has chosen the specified DSM ID (I_T_L nexus) even though it is on a degraded I_T nexus. All other I_T nexuses are degraded or processing I/O failures.
61149	W	The DSM has chosen the specified DSM ID (I_T_L nexus) even though it is disabled. The DSM will switch from the disabled path as soon as an enabled DSM ID is available.

ID	Sev	Explanation
61150	W	The DSM has determined that no alternate paths exist for the specified LUN on the specified storage system. The LUN is in a severely degraded state and I/O may fail. This event indicates that a LUN has lost all of its paths and if this state remains, then I/O may fail. If this event occurs, use the DSM GUI or CLI to verify that all paths are in a normal state and operational. You can safely ignore this message if it occurs at reboot time and all paths are normal after the reboot completes.
61151	W	The DSM is retrying I/O on the specified DSM ID (I_T_L nexus). The retry was requested to move a reservation so that outstanding I/O would not error.
61152	I	The specified DSM ID (I_T_L nexus) is recovering from an I/O error. This event is reported during the first phase of error recovery, when path verification is requested after a failover.
61153	I	The specified DSM ID (I_T_L nexus) has completed error recovery from an I/O error. This event is reported as part of the second phase of error recovery after an I/O error. This event indicates that the I_T_L nexus is now operational.
61154	I	The specified DSM ID (I_T_L nexus) has reestablished communication for its I_T nexus (path). The specified path is now normal. An I_T_L on a nexus which previously had experienced a path verification failure has detected that the nexus is now working. All of the I_T_Ls on this nexus are now available for path selection.
61155	W	The specified DSM ID (I_T_L nexus) failed to release a LUN.
61156	W	The specified DSM ID (I_T_L nexus) failed to reserve a LUN. See the data section of the event for more information.
61157	W	The DSM is using the specified DSM ID (I_T_L nexus) to force the release of any reservations on the specified LUN.
61158	E	The reservation for the specified LUN was lost.

ID	Sev	Explanation
61201	I	The specified DSM ID (I_T_L nexus) has transitioned to the active state.
61202	I	The specified DSM ID (I_T_L nexus) has transitioned to the passive state.
61203	E	The specified DSM ID (I_T_L nexus) has transitioned to the failed state.
61204	W	The specified DSM ID (I_T_L nexus) is in the process of being removed.
61205	W	The specified DSM ID (I_T_L nexus) was removed.
61206	W	The specified DSM ID (I_T_L nexus) has transitioned to the disabled state.
61207	I	The specified DSM ID (I_T_L nexus) has transitioned to the pending active state.
61208	I	The specified DSM ID (I_T_L nexus) has transitioned to the pending passive state.
61209	W	The specified virtual disk does not support the active/active load balance policies (Round Robin, Round Robin with Subset, or Least Queue Depth). The reported version of Data ONTAP software is earlier than 7.2.2 or the reported cfmode setting is not single_image or standby.

Troubleshooting installation problems

Missing Windows hotfixes

The DSM installer checks for required Windows hotfixes. The specific hotfixes vary by Windows version and processor architecture.

If the installer cannot find a required hotfix, it displays an error message. Record the missing hotfix numbers from the message, install them, and restart the DSM installer.

SnapDrive 4.1 found

The installer checks for SnapDrive 4.1 for Windows or earlier. If it finds SnapDrive 4.1 or earlier it displays an error message. Remove the old SnapDrive version and then restart the DSM installer. Note that the installer does not detect all unsupported versions of SnapDrive; see “[Step 3: Remove or Upgrade SnapDrive for Windows](#)” on page 26.

Microsoft iSCSI software initiator

The Microsoft iSCSI initiator version 2.02 can overwrite the Windows MPIO components used by the DSM with an earlier, incompatible version. Do not install the Microsoft iSCSI initiator version 2.02 on a system running the Data ONTAP DSM 3.2 for Windows MPIO.

Troubleshooting GUI and CLI problems

Cannot disable entry

The DSM graphical user interface (GUI) does not allow you to disable the active DSM ID (I_T_L nexus). You must first activate another DSM ID and then disable the passive DSM ID.

In general, the GUI does not allow you to disrupt the host's access to a virtual disk.

Cannot change paths

If your DSM license has expired, the DSM will not allow you to make any changes, such as changing paths. A license that you purchase does not expire, but free demo licenses do expire. If your demo license expires, contact your sales representative to purchase a DSM license.

Check the event log

The DSM writes events to the Windows event log. Check the system log for messages from ontapdsm. Many events contain a DSM ID value. This value can be used to identify the virtual disk displayed in the GUI.

The DSM identifier is made up of four fields: port, bus, target, and LUN. For example, DSM ID 03000101 represents port 03, bus 00, target 01, and LUN 01. In the GUI, this value is displayed in the **DSM ID** column when you select a virtual disk.

Note that the VirtualDisk ID displayed in the GUI changes, depending on which underlying I_T_L nexus is active.

Refresh the display

The GUI does not automatically refresh for all events. To manually refresh the display, first select Disks or Data ONTAP DSM Management in the left pane. Then select Refresh from the Action menu. If refresh does not work, try closing the GUI and opening it again.

Troubleshooting failover problems

Storage system failover

If a LUN is lost when an active/active storage system configuration fails over, check the following items:

- ◆ Verify that the Windows host has a path to the LUN on each storage system node.
- ◆ Verify that the igroup for the LUN includes the world wide port name (WWPN) of each initiator (HBA on Windows host) that you want to access the LUN with.
- ◆ Verify the storage system is running a supported version of Data ONTAP and a supported cfmode.

Mapping identifiers between the host and storage system

About identifiers	The Data ONTAP DSM for Windows MPIO includes a number of identifiers to help you map the virtual disks (LUNs) and paths (I_T_L nexuses) between the Windows host and the storage system.
Disk serial number	The Virtual Disks page in the DSM GUI, and the output of the <code>dsmcli lun list</code> command include a serial number for each virtual disk. This serial number is assigned by Data ONTAP to a LUN on the storage system. The Data ONTAP <code>lun show -v</code> command displays the serial number. You can also view the serial number in the FilerView® interface by selecting LUN>Manage and clicking the path name in the LUN column. The virtual disks page also shows the host name of the storage system controller, the LUN path, and the LUN identifier on the storage system for each virtual disk.
DSM Identifier	Each path (I_T_L nexus) is assigned an eight-character DSM identifier. The identifier is made up of four fields: port, bus, target, and LUN. For example, DSM ID 03000101 represents port 03, bus 00, target 01, and LUN 01. The DSM ID is displayed on the DSM GUI details page for each virtual disk and is returned by the <code>dsmcli path list</code> command. The DSM ID is included in most event log messages written by the Data ONTAP DSM.
Nexus Identifier	Each nexus (I_T nexus) also has an eight-character identifier made up of four fields. The first three fields are the same as the DSM ID: port, bus, and target. The fourth field indicates the path type: 01 for optimized (non-proxy) and 02 for proxy. The DSM ID is displayed on the DSM GUI details page for each virtual disk.

Quiet (Unattended) Installation

About silent installation

The quiet (unattended) installation option of the Windows installer enables you to install the Data ONTAP DSM for Windows MPIO on one or more computers without operator interaction. You can also perform a quiet uninstall.

Because installing the DSM requires a reboot, the Windows host will automatically be rebooted at the end of the quiet installation. There is no warning or prompt before reboot.

Note

Some of the command options are case sensitive. Be sure to enter the commands exactly as shown.

Note

The account doing the actual installation must be in the Administrators group. For example, when using rsh, programs are executed under the SYSTEM account by default. You must change the rsh options to use an administrative account.

Quiet installation commands

Command line: To run a quiet installation from a command line, enter the following commands on your Windows host. Replace *installer* with the name of the installation program for your Windows host's processor architecture.

```
msiexec /package installer.msi /quiet /! *v log_file_name  
LICENSECODE=key SVCUSERNAME=domain\user SVCUSERPASSWORD=password  
SVCCONFIRMUSERPASSWORD=password PROTOCOLS={ 1 | 2 | 3 }  
[INSTALLDIR=inst_path] [TEMP_FOLDER=temp_path]
```

installer.msi is the DSM installation program for your Windows host's processor architecture.

log_file_name is the file path and name for the MSI installer log. Note the first character of the *! *v* option is a lower case L.

key is the MPIO license code for the DSM. See [“Step 5: Obtain an MPIO license key”](#) on page 28.

domain\user is the Windows domain and user name of an account in the Administrators group on the Windows host under which the DSM management service will be logged on.

password is the password for the account above.

inst_path is the path where the DSM files are installed. The default path is C:\Program Files\NetApp\MPIO\.

temp_path is the path where log files are written (except the MSI installer log). The default path is C:\temp\netapp\.

PROTOCOLS={ 1 | 2 | 3 } specifies which LUN types are claimed by the DSM. Allowed values are 1 for FCP only, 2 for iSCSI only, and 3 for both.

Scripting: To include the silent install command in a script, use `start /b /wait` before the `installer.exe` command:

```
start /b /wait msiexec /package installer.msi ...
```

The wait option is needed to get the correct installation return value. If you just run *installer.msi*, it returns success if the Windows installer is successfully launched. However, the installation itself may still fail. By using the wait option as shown above, the return code describes the success or failure of the actual installation.

Command help

To view help for the Windows installer, run the following command:

```
msiexec /?
```

Uninstalling

To silently uninstall the DSM, run the following command:

```
msiexec /uninstall installer.msi /quiet /! *v log_file_name  
[FORCE_REMOVE_MPIO=1]
```

installer.msi is the DSM installation program for your Windows host's processor architecture.

log_file_name is the file path and name for the MSI installer log. Note the first character of the `! *v` option is a lower case L.

The `FORCE_REMOVE_MPIO=1` option removes the Windows MPIO components to enable reverting to an earlier version. Before using this option, see [“Uninstalling the Data ONTAP DSM”](#) on page 32.

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