

Data ONTAP DSM 3.4 for Windows MPIO **Installation and Administration Guide**

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Part number 215-05175_A0
October 2010

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About this guide

You can use your product more effectively when you understand this document's intended audience and the conventions that this document uses to present information.

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.

The DSM (device specific module) works with the Microsoft Windows MPIO (multipath I/O) components to manage paths between a storage system and a host computer running a supported Windows operating system.

See the NetApp Interoperability Matrix for information on the specific Windows configurations supported.

Next topics

[Audience](#) on page 11

[Where to enter commands](#) on page 12

[Keyboard and formatting conventions](#) on page 12

[Special messages](#) on page 13

[How to send your comments](#) on page 13

Related information

[NetApp Interoperability Matrix - http://now.netapp.com/NOW/products/interoperability/](http://now.netapp.com/NOW/products/interoperability/)

Audience

This document is written with certain assumptions about your technical knowledge and experience.

This guide is for administrators of Windows host computers and NetApp storage systems who are configuring multipath I/O (MPIO) connections using the Data ONTAP DSM for Windows MPIO.

You should be familiar with the specifics of your configuration, including the following items.

- The iSCSI or Fibre Channel (FC) protocols.
- Windows Host Utilities software.
- FC host bus adapters (HBAs), FCoE converged network adapters (CNAs) and iSCSI initiators (software or HBA).

Where to enter commands

You can use your product more effectively when you understand how this document uses command conventions to present information.

You can perform common administrator tasks in one or more of the following ways:

- You can enter Windows, ESX, HP-UX, AIX, Linux, and Solaris commands at the applicable client console.
In examples that illustrate command execution, the command syntax and output shown might differ from what you enter or see displayed, depending on your version of the operating system.
- You can use the client graphical user interface.
Your product documentation provides details about how to use the graphical user interface.

Keyboard and formatting conventions

You can use your product more effectively when you understand how this document uses keyboard and formatting conventions to present information.

Keyboard conventions

Convention	What it means
The NOW site	Refers to the NetApp Support site at now.netapp.com .
<i>Enter, enter</i>	• Used to refer to the key that generates a carriage return; the key is named Return on some keyboards. • Used to mean pressing one or more keys on the keyboard and then pressing the Enter key, or clicking in a field in a graphical interface and then typing information into the field.
hyphen (-)	Used to separate individual keys. For example, Ctrl-D means holding down the Ctrl key while pressing the D key.
type	Used to mean pressing one or more keys on the keyboard.

Formatting conventions

Convention	What it means
<i>Italic font</i>	- Words or characters that require special attention. - Placeholders for information that you must supply. For example, if the guide says to enter the <code>arp -d <i>hostname</i></code> command, you enter the characters "arp -d" followed by the actual name of the host. - Book titles in cross-references.
Monospaced font	- Command names, option names, keywords, and daemon names. - Information displayed on the system console or other computer monitors. - Contents of files. - File, path, and directory names.
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.

Special messages

This document might contain the following types of messages to alert you to conditions that you need to be aware of.

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

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

How to send your comments

You can help us to improve the quality of our documentation by sending us your feedback.

Your feedback is important in helping us to provide the most accurate and high-quality information. If you have suggestions for improving this document, send us your comments by e-mail to doccomments@netapp.com. To help us direct your comments to the correct division, include in the subject line the name of your product and the applicable operating system. For example, *FAS6070—Data ONTAP 7.3*, or *Host Utilities—Solaris*, or *Operations Manager 3.8—Windows*.

DSM Concepts

The Data ONTAP DSM for Windows MPIO enables you to have multiple Fibre Channel (FC) and iSCSI paths between a Windows host computer and a NetApp storage system.

Next topics

- [*Device specific module overview*](#) on page 15
- [*ALUA support and requirements*](#) on page 16
- [*Microsoft iSCSI DSM*](#) on page 17
- [*L_T and L_T_L nexus overview*](#) on page 17
- [*Multiple paths require MPIO software*](#) on page 17
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- [*Failover examples*](#) on page 29
- [*Mapping identifiers between the host and storage system*](#) on page 33
- [*Support for non-English operating system versions*](#) on page 33

Device specific module overview

The Data ONTAP DSM for Windows MPIO is a device specific module (DSM) that works with 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.

For Windows Server 2003, the DSM installation program installs or upgrades the Windows MPIO components to the version required by the DSM if needed. For Windows Server 2008, the DSM uses the standard MPIO components included with the operating system.

DSM includes storage-system-specific intelligence needed to identify paths and manage path failure and recovery.

Starting with Data ONTAP DSM 3.4, ALUA (asymmetric logical unit access) is supported and must be enabled for Fibre Channel (FC) paths. ALUA is enabled on the igroup to which a LUN is mapped on the storage controller.

Data ONTAP does not currently support ALUA for iSCSI paths. Because the ALUA setting must be the same for all paths to a LUN, mixed FC and iSCSI paths to the same virtual disk (LUN) are not

supported with DSM 3.4. You can still have FC paths to some LUNs and iSCSI paths to other LUNs from the same Windows host.

Coexistence with other DSMs

The Data ONTAP DSM claims all LUNs it discovers on NetApp and IBM N series storage systems. These LUNs have the vendor identifier and product identifier (VID/PID) pair "NETAPP LUN". Other DSMs can be used on the same Windows host to claim LUNs from other storage systems with other VID/PID values.

The Microsoft iSCSI Initiator for Windows Server 2003 includes a DSM (msiscsidsm) that can manage the iSCSI paths that use the software initiator. The Data ONTAP DSM and msiscsidsm can co-exist, as long as both versions are listed on the appropriate support matrixes.

Microsoft Windows Server 2008 includes a DSM (msdsm) that can manage FC and iSCSI paths. The msdsm claims any devices not claimed by other DSMs. The Data ONTAP DSM and the msdsm can co-exist as long as the configuration is listed on the appropriate support matrixes.

The Data ONTAP DSM is not intended to be used on the same system as the Veritas DMP DSM.

ALUA support and requirements

ALUA (asymmetric logical unit access) is supported for Fibre Channel paths starting with Data ONTAP DSM 3.4. ALUA is required for FC paths.

ALUA is an industry standard protocol for identifying optimized paths between a storage system and a host. ALUA enables the initiator to query the target about path attributes, such as primary path and secondary path. It also allows the target to communicate events back to the initiator.

ALUA is supported by certain versions of Data ONTAP software. All of the versions of Data ONTAP that are qualified with DSM 3.4 support ALUA for FC. The `single_image cfmode` setting is required.

ALUA is not currently supported for iSCSI. Because all paths to a LUN must have the same ALUA setting, mixed FC and iSCSI paths to a LUN are not currently supported.

ALUA support is enabled or disabled on the `igroup` or `igroups` to which a LUN is mapped. All `igroups` mapped to a LUN must have the same ALUA setting. Windows detects a change to the ALUA setting when rebooted.

Although mixed FC and iSCSI paths to one LUN are not currently supported, you can still have FC paths to some LUNs and iSCSI paths to other LUNs.

Related tasks

[Enabling ALUA for FC paths](#) on page 39

[Troubleshooting ALUA configuration problems](#) on page 73

Microsoft iSCSI DSM

If you are using iSCSI to access another vendor's storage, 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.

The Microsoft iSCSI DSM can manage LUNs from other vendors' storage systems.

When both DSMs are installed, the Data ONTAP DSM has priority in claiming iSCSI LUNs on NetApp and IBM N series storage systems.

I_T and I_T_L nexus overview

An initiator-target (I_T) nexus represents the path from the host's initiator to the storage systems' 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 FC paths, 02 for non-optimized FC paths, and 03 for iSCSI paths.

Multiple paths require MPIO software

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.

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.

Without MPIO software, the disk manager treats each path as a separate disk, which can corrupt the data on the virtual disk.

Mixing FC and iSCSI paths

Data ONTAP DSM 3.4 for Windows MPIO does not support both FC and iSCSI paths to the same LUN.

Because ALUA is required for FC paths, and ALUA is not currently supported for iSCSI paths, DSM 3.4 does not support both FC and iSCSI paths to the same LUN. All paths must have the same ALUA setting.

You can still have FC paths to some LUNs and iSCSI paths to other LUNs.

If you are upgrading from an earlier version of the Data ONTAP DSM and have mixed FC and iSCSI paths, you must remove either the FC or the iSCSI paths to the LUN before enabling ALUA and upgrading to DSM 3.4.

Related concepts

[Load balance policies determine failover behavior](#) on page 27

Path limits

You need multiple paths to a LUN to ensure high availability. However, you should limit the number of paths to the recommended maximum number.

The *Fibre Channel and iSCSI Configuration Guide* for your version of Data ONTAP software lists the number of paths that have been tested and supported.

Related information

[Fibre Channel and iSCSI Configuration Guide - now.netapp.com/NOW/knowledge/docs/docs.cgi](http://now.netapp.com/NOW/knowledge/docs/docs.cgi)

Do not mix 10 Gb and 1 Gb iSCSI sessions to a LUN

Mixing 10 Gb and 1 Gb iSCSI sessions to the same LUN is not supported.

To avoid multipathing problems with iSCSI sessions, use either all 10 Gb sessions or all 1 Gb sessions to a given LUN.

Windows Administrator account requirement

Starting with DSM 3.4, the Windows service installed by the Data ONTAP DSM for Windows MPIO runs under the default SYSTEM account.

When you install the DSM, the default action is to run the Data ONTAP DSM Management Service under the default SYSTEM account.

You can optionally supply the user name and password of an Administrator-level account. If you later change the password of this user-specified account, you must run the **Repair** option of the DSM

installation program and enter the new password. You can also update the credentials of the Data ONTAP DSM Management Service in the Windows Services applet.

Timeout and tuning parameters overview

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 topics.

Next topics

- [*FC HBA settings*](#) on page 20
- [*ClusSvcHangTimeout setting*](#) on page 21
- [*InquiryRetryCount setting*](#) on page 21
- [*InquiryTimeout setting*](#) on page 21
- [*InstallDir setting*](#) on page 21
- [*IPSecConfigTimeout setting*](#) on page 22
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FC HBA settings

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

Note that the same HBA parameters are set by the 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 fcconfig.ini file displays this same parameter as MpioLinkDownTimeout.

Emulex HBAs

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

LinkTimeOut=1 The LinkTimeOut parameter specifies the interval after which a link that is down stops issuing a BUSY status for requests and starts issuing SELECTION_TIMEOUT error status. This LinkTimeOut includes port login and discovery time.

This is a new value for DSM 3.4; the LinkTimeOut parameter was set to 5 by DSM 3.3.1.

NodeTimeOut=10 The NodeTimeOut parameter specifies the interval after which a formerly logged-in node issues SELECTION_TIMEOUT error status to an I/O request. This causes the system to wait for a node that might reenter the configuration soon before reporting a failure. The timer starts after port discovery is completed and the node is no longer present.

This is a new value for DSM 3.4; the NodeTimeOut parameter was set to 30 by DSM 3.3.1.

QLogic HBAs

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

LinkDownTimeOut=1 The LinkDownTimeOut parameter controls the timeout when a link that is down stops issuing a BUSY status for requests and starts issuing SELECTION_TIMEOUT error status. This LinkDownTimeOut includes port login and discovery time.

This is a new value for DSM 3.4; the LinkDownTime parameter was set to 5 by DSM 3.3.1.

PortDownRetryCount=10 The PortDownRetryCount parameter specifies the number of times the I/O request is re-sent to a port that is not responding in one second intervals.

This is a new value for DSM 3.4; the PortDownRetryCount parameter was set to 30 by DSM 3.3.1.

ClusSvcHangTimeout setting

The DSM installer sets ClusSvcHangTimeout to 240 seconds for Windows Server 2008 R2 hosts in a cluster configuration. This ensures the correct path discovery sequence after all paths to a LUN are lost and paths begin to return.

The ClusSvcHangTimeout setting specifies the time period for which a PR_IN is retried after loss of all paths. This setting must be greater than the PDORemovePeriod for Windows Server 2008 R2.

This parameter is set in the following Windows registry key: \HKLM\Cluster\

Note: If you configure a Windows cluster after installing Windows Host Utilities, run the Repair option of the Host Utilities installation program to set ClusSvcHangTimeout. If Data ONTAP DSM for Windows MPIO is installed, run the Repair option of the DSM installation program instead.

InquiryRetryCount setting

The InquiryRetryCount parameter specifies how many times the DSM retries SCSI inquiry requests to the storage system.

The DSM sends SCSI inquiry requests to the storage system controller to get information about a LUN or about storage system configuration. If a response is not received within the InquiryTimeout time, the request is retried the number of times specified by InquiryRetryCount before failing the request.

InquiryRetryCount is set to 6.

This parameter is set in the following Windows registry key: HKLM\System\CurrentControlSet\Services\ontapdsm\Parameters

InquiryTimeout setting

The InquiryTimeout parameter specifies how long the DSM waits before retrying SCSI inquiry requests of the storage system.

The DSM sends SCSI inquiry requests to the storage system controller to get information about a LUN or about storage system configuration. If a response is not received within the InquiryTimeout time, the request is retried the number of times specified by InquiryRetryCount before failing the request.

InquiryTimeout is set to 2 seconds.

This parameter is set in the following Windows registry key: HKLM\System\CurrentControlSet\Services\ontapdsm\Parameters

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\NetApp\MPIO

IPSecConfigTimeout setting

The IPSecConfigTimeout parameter specifies how long the driver waits for the discovery service to configure or release ipsec for an iSCSI connection.

IPSecConfigTimeout is set to 60 to enable the initiator service to start correctly on slow-booting systems that use CHAP.

This parameter is set in the following Windows registry key: HKLM\SYSTEM\CurrentControlSet\Control\Class\{iSCSI_driver_GUID}\instance_ID\Parameters\IPSecConfigTimeout

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

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

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. The link light on the host Ethernet port goes off to indicate a lost link.

Starting with DSM 3.4, LinkDownTime is set to 15 seconds. If the link is still down after 15 seconds, the I/O fails over to an alternate path to the LUN.

LinkDownTime was set to 5 seconds by DSM 3.3.1.

This parameter is set in the following Windows registry key: HKLM\SYSTEM\CurrentControlSet\Control\Class\{4D36E97B-E325-11CE-BFC1-08002BE10318}\instance\Parameters

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

LogDir setting

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

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

This parameter is set in the following Windows registry key: HKLM\SOFTWARE\NetApp\MPIO

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 to 1 in the following registry key: HKLM\SYSTEM\CurrentControlSet\Services\ClusDisk\Parameters

For detailed information about the ManageDisksOnSystemBuses parameter, see Microsoft Support article 886569.

Related information

Microsoft Support article 886569 - <http://support.microsoft.com/kb/886569>

MaxRequestHoldTime 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 in the following Windows registry key: HKLM\SYSTEM\CurrentControlSet\Control\Class\{4D36E97B-E325-11CE-BFC1-08002BE10318}\instance\Parameters

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

MPIOSupportedDeviceList 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.

After LUNs are claimed at the multipathing layer, one DSM claims all LUNs with a given VID and PID value pair.

The value appended to MPIOSupportedDeviceList by the DSM installation program is "NETAPP LUN ". Note that there are two spaces after "NETAPP" to fill out the 8-byte VID and 13 spaces after "LUN" to fill out the 16-byte PID.

This parameter is set in the following Windows registry key: HKLM\SYSTEM\CurrentControlSet\Control\MPDEV

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 parameter is set in the following Windows registry key: HKLM\SYSTEM\CurrentControlSet\Services\ontapdsm\Parameters

PersistentReservationKey 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

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 failover, 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

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\NetApp\MPIO\ProductVersion

Protocols setting

The Protocols parameter specifies which LUNs are claimed by the DSM. Starting with DSM 3.3, both FC and iSCSI LUNs are always claimed.

The parameter was used by previous versions of the DSM to specify which types of LUNs are claimed.

Protocols is set to 3 to indicate both FC and iSCSI LUNs are claimed.

This parameter is set in the following Windows registry key: HKLM\SYSTEM\CurrentControlSet\Services\ontapdsm\Parameters

RebalanceGuardTime setting

The RebalanceGuardTime parameter specifies the amount of time after any path changes state (a new path becomes available or an existing path becomes unavailable) that the DSM waits for I/O to stabilize before rebalancing the load among available paths.

This applies only to LUNs owned by a clustered Windows host.

RebalanceGuardTime is set to 120 seconds.

This parameter is set in the following Windows registry key: HKLM\System\CurrentControlSet\Services\ontapdsm\Parameters

ReservationRetryInterval setting

The ReservationRetryInterval parameter is used by the DSM to control persistent reservation handling in a Windows cluster configuration.

ReservationRetryInterval is set to 1 second.

This parameter is set in the following Windows registry key: HKLM\System\CurrentControlSet\Services\ontapdsm\Parameters

ReservationTimeout setting

The ReservationTimeout parameter is used by the DSM to control persistent reservation handling in a Windows cluster configuration.

ReservationTimeout is set to 10 seconds.

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 later to match the value used for Windows Host Utilities.

RetryInterval setting

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

RetryInterval is set to 2 seconds. 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 value appended to SupportedDeviceList by the DSM installation program is "NETAPP LUN ". Note that there are two spaces after "NETAPP" to fill out the 8-byte VID and 13 spaces after "LUN" to fill out the 16-byte PID.

This parameter is set in the following Windows registry key: HKLM\SYSTEM\CurrentControlSet\Services\ontapdsm\Parameters

TestUnitReadyRetryCount setting

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.

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.

TestUnitReadyRetryCount is set to 6. If the target does not respond after six 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

TestUnitReadyTimeout setting

The TestUnitReadyTimeout parameter specifies the number of seconds the DSM waits between sending SCSI TEST UNIT READY commands.

The DSM sends a SCSI TEST UNIT READY command to the target to verify a path is available for use.

TestUnitReadyTimeout is set to 2 seconds.

This parameter is set in the following Windows registry key: HKLM\System\CurrentControlSet\Services\ontapdsm\Parameters

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 20 seconds.

This parameter is set in the following Windows registry key: HKLM\SYSTEM\CurrentControlSet\Services\Disk

Attention: Installing the cluster service on Windows Server 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 20 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.

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 several factors.

The factors include:

- Load balance policy of the LUN
- Whether the path is optimized or non-optimized
- State of all possible paths
- Load on each path

By default, the DSM uses optimized (non-proxy) FC paths whenever they are available. When no optimized paths are available, the DSM uses non-optimized (proxy) FC paths. For iSCSI paths, all paths are treated as optimized 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 FC 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. For FC, the initial paths used are selected in order of optimized paths first, then non-optimized paths.
Least Weighted Paths	The available path with the lowest weight value 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 to 2146999999. Set the weight of a path to 0 to always use it when it is available.
Round Robin	The Round Robin policy is an “active/active” policy. All paths to the storage system are used when available, including non-optimized paths. The Round Robin policy is <i>not</i> recommended for FC paths.
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. By default, all optimized paths are initially selected. To specify the subset, you make individual paths active or passive as desired. Although you can specify non-optimized (proxy) paths as part of the active subset, this is not recommended.
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.

Path types and Windows clusters affect failover behavior

In addition to the load balance policy, failover behavior is affected by optimized paths, disabled paths, and Windows clusters.

Next topics

[*DSM prefers optimized paths*](#) on page 28

[*DSM uses special rules for Windows clusters*](#) on page 28

[*DSM can use disabled paths*](#) on page 28

DSM prefers optimized paths

The DSM differentiates between FC optimized (local or non-proxy) and non-optimized (proxy) FC paths.

Non-optimized (proxy) paths use the cluster interconnect between storage system controllers in an active/active configuration (HA pair or storage system cluster) and are less efficient than optimized paths.

Non-optimized paths are not used when optimized paths are available, unless you explicitly set non-optimized paths to active when using the FailOver-only or Round Robin with Subset policy, or you set non-optimized paths to a lower weight using the Least Weighted Paths policy.

Note: Do not make non-optimized paths active, except for brief maintenance work on the optimized paths. For fabric-attached MetroCluster configurations, never make non-optimized paths active manually.

DSM uses special rules for Windows clusters

The DSM applies special load balance 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) for LUNs owned by a clustered Windows host, the DSM waits two minutes for I/O to stabilize before rebalancing the load among available paths.

DSM can use 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.

Required cfmode setting

The `single_image` FC cfmode setting is required starting with DSM 3.3.

The `single_image` cfmode setting is now required for all storage systems with Fibre Channel (FC) connections to the Windows host.

The cfmode setting applies only to FC connections. It does not apply to iSCSI-only access.

Failover examples

Examples of the failover behavior for different load balance policies demonstrate how the DSM selects active paths.

Next topics

[Least queue depth example](#) on page 29

[Round robin example](#) on page 30

[Round robin with subset example](#) on page 30

[Failover-only example](#) on page 31

[Auto-assigned example](#) on page 32

Least queue depth example

This example demonstrates failover behavior with FC paths to a LUN.

A Windows host has four FC paths to a LUN, two optimized paths to one node (controller) in an active/active storage system configuration and two non-optimized paths to the partner node. The load balance policy is Least Queue Depth.

Although the status of the non-optimized paths is called Active/Unoptimized, these paths are not actively used for I/O as long as an optimized path is available.

Initial path selection with all components working:

- ITL_1 Optimized FC - Active
- ITL_2 Optimized FC- Active
- ITL_3 Non-optimized FC - not used
- ITL_4 Non-optimized FC - not used

I/O between the host and storage system is sent on ITL_1 or ITL_2, depending on which currently has the shorter queue.

After ITL_1 fails, all I/O is sent over ITL_2:

- ITL_2 Optimized FC- Active
- ITL_3 Non-optimized FC - not used

- ITL_4 Non-optimized FC - not used

If both ITL_1 and ITL_2 fail, I/O is sent on ITL_3 or ITL_4, depending on which currently has the shorter queue:

- ITL_3 Non-optimized FC - Active
- ITL_4 Non-optimized FC - Active

Round robin example

This example demonstrates failover behavior of iSCSI paths using the round robin load balance policy.

A Windows host has four iSCSI paths to a LUN on a controller in an active/active (HA-pair) storage system configuration. The load balance policy is round robin.

For iSCSI, all paths connect to ports on the controller that owns the LUN. If that controller becomes unavailable, all paths fail over to partner ports on the partner controller.

All available iSCSI paths are treated as optimized paths.

Before path failover:

- ITL_1 Optimized iSCSI - Active
- ITL_2 Optimized iSCSI - Active
- ITL_3 Optimized iSCSI - Active
- ITL_4 Optimized iSCSI - Active

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

- ITL_2 Optimized iSCSI - Active
- ITL_3 Optimized iSCSI - Active
- ITL_4 Optimized iSCSI - Active

If the second active I_T_L nexus fails, the two remaining paths continue to serve data:

- ITL_2 Optimized iSCSI - Active
- ITL_3 Optimized iSCSI - Active

Note: The round robin policy distributes traffic across all available paths regardless of whether they are optimized or non-optimized. This works fine for iSCSI, but is *not* recommended for Fibre Channel.

Round robin with subset example

This example demonstrates failover behavior of FC paths when you select a preferred path using the round robin load balance policy.

A Windows host has four FC paths to a LUN, two paths to each node (controller) in an active/active (HA-pair) 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 FC - Passive
- ITL_2 Non-optimized FC - Passive
- ITL_3 Non-optimized FC - Passive
- ITL_4 Optimized FC, Preferred - Active

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

- ITL_1 Optimized FC - Active
- ITL_2 Non-optimized FC - Passive
- ITL_3 Non-optimized FC - Passive

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

- ITL_2 Non-optimized FC - Active
- ITL_3 Non-optimized FC - 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

This example demonstrates failover behavior of FC paths when you select an active path using the failover only load balance policy. Because this is an active/passive policy, only one path is active at a time.

A Windows host has four FC paths to a LUN, two paths to each node in an active/active (HA-pair) 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 FC - Active
- ITL_2 Non-optimized FC - Passive
- ITL_3 Non-optimized FC - Passive
- ITL_4 Optimized FC - Passive

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

- ITL_2 Non-optimized FC - Passive
- ITL_3 Non-optimized FC - Passive
- ITL_4 Optimized FC - Active

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

- ITL_2 Non-optimized FC - Active
- ITL_3 Non-optimized FC - 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

This example demonstrates failover behavior of FC paths using the auto assigned load balance policy. Because this is an active/passive policy, only one path is active at a time.

In this example, the Windows host has four FC paths and 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.

Before path failover:

- ITL_1 Optimized FC - Passive
- ITL_2 Non-optimized FC - Passive
- ITL_3 Non-optimized FC - Passive
- ITL_4 Optimized FC - Active

The failover behavior is the same as for the failover only load balance policy. 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. The particular I_T_L nexus selected depends on which available path has the lowest current load. After the active I_T_L nexus fails, the DSM selects the passive optimized I_T_L nexus:

- ITL_2 Non-optimized FC - Passive
- ITL_3 Non-optimized FC - Passive
- ITL_4 Optimized FC - Active

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

- ITL_2 Non-optimized FC - Active
- ITL_3 Non-optimized FC - Passive

The auto-assigned failback behavior is somewhat different from failover only. If a non-optimized 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 FC - Active
- ITL_2 Non-optimized FC - Passive
- ITL_3 Non-optimized FC - 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 FC - Passive

- ITL_2 Non-optimized FC - Passive
- ITL_3 Non-optimized FC - Passive
- ITL_4 Optimized FC - 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.

Mapping identifiers between the host and storage system

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 `dsmcli lun list` 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 `lun show -v` 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 DSM virtual disks GUI 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 (DSM ID) 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 `dsmcli path list` 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, 02 for non-optimized (proxy), and 03 for iSCSI.

The DSM ID is displayed on the DSM GUI details page for each virtual disk.

Support for non-English operating system versions

Data ONTAP DSM for Windows MPIO is supported on all Language Editions of Windows Server 2003, Server 2008, and Server 2008 R2. All product interfaces and messages are displayed in English. However, all variables accept Unicode characters as input.

Installing the DSM

Complete the following tasks in the order shown to install the DSM and related software components.

1. [*Before you install*](#) on page 35
2. [*Upgrading from an earlier DSM*](#) on page 36
3. [*Stop host I/O and cluster service*](#) on page 37
4. [*Installing Windows hotfixes*](#) on page 38
5. [*Removing or upgrading SnapDrive for Windows*](#) on page 38
6. [*Installing Windows Host Utilities and storage adapter drivers*](#) on page 39
7. [*Enabling ALUA for FC paths*](#) on page 39
8. [*Obtaining an MPIO license key*](#) on page 40
9. [*Enabling the Multipath I/O feature for Windows Server 2008 and 2008R2*](#) on page 40
10. [*Running the DSM installation program interactively*](#) on page 41
11. [*Running the DSM installation program from a command line*](#) on page 42
12. [*Installing the iSCSI software initiator*](#) on page 44

Before you install

Verify your configuration before installing the DSM.

Before you begin

Windows Server 2003 or Server 2008 systems must be running Data ONTAP DSM 3.2R1 or later to upgrade directly to DSM 3.4. For earlier DSM versions, you must first upgrade to DSM 3.2R1 and reboot before you can upgrade to DSM 3.4.

Windows Server 2008 R2 systems must be running Data ONTAP DSM 3.3.1 to upgrade directly to DSM 3.4. You must uninstall earlier versions of the Data ONTAP DSM before installing DSM 3.4. You must also remove the Windows MPIO feature after uninstalling the DSM and before installing DSM 3.4.

Step

1. Use the Interoperability Matrix to verify you have a supported combination of the following components.
 - Data ONTAP software version on your storage system (Data ONTAP 7.3.2 and later are currently supported)
 - Windows operating system
 - SnapDrive for Windows software

- Windows Host Utilities software
- Fibre Channel host bus adapter model, driver, and firmware
- Fibre Channel switch model and firmware version
- iSCSI software or hardware initiator

Related information

NetApp Interoperability Matrix - <http://now.netapp.com/NOW/products/interoperability/>

Upgrading from an earlier DSM

If you have an earlier version of Data ONTAP DSM for Windows MPIO, you can upgrade to this version.

Before you begin

Windows Server 2003 or Server 2008 systems must be running Data ONTAP DSM 3.2R1 or later to upgrade directly to DSM 3.4. For earlier DSM versions, you must first upgrade to DSM 3.2R1 and reboot before you can upgrade to DSM 3.4.

Windows Server 2008 R2 systems must be running Data ONTAP DSM 3.3.1 to upgrade directly to DSM 3.4. You must uninstall earlier versions of the Data ONTAP DSM before installing DSM 3.4. You must also remove the Windows MPIO feature after uninstalling the DSM and before installing DSM 3.4.

Steps

1. Download or copy the appropriate installation file for the processor architecture of your Windows host.
2. Install required Windows hotfixes. This requires one or more reboots.
Required hotfixes are listed in the Interoperability Matrix. The installer will also notify you of any required hotfixes that are missing.
3. Stop applications using LUNs on the storage system.
4. If any LUNs use both iSCSI paths and FC paths, remove either the iSCSI paths or the FC paths.
Mixed FC and iSCSI paths are not supported in DSM 3.4.
5. For all LUNs with FC paths, enable ALUA on the igroups to which the LUNs are mapped.
The Windows host does not recognize the ALUA change until it is rebooted.
6. Stop any I/O to the host, including any I/O using the iSCSI protocol.
7. Optionally stop the Windows Server 2003 MSCS cluster service.
The installation might run very slowly if the cluster service is running.

8. Run the DSM installation program for the new version.
 - a. Launch the installer program and follow the instructions on the screen.
 - b. Verify the MPIO license key when prompted. The installer automatically gets the current key value.
 - c. Select the **Use the default system account** check box. Or optionally 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.
 - d. When prompted, click **Yes** to reboot the Windows host and complete the installation.

Result

The installer maintains the existing failover policies for existing LUNs if it can. Verify that your new failover policies are configured the way you want.

After you finish

For Windows Server 2008 and 2008 R2, use Windows Disk Management to verify that all existing disks are online. If any disks are offline, set them online.

If the installation program displays a message instructing you to install a Windows hotfix after installing the DSM, download the hotfix from the Microsoft support site and install it.

Stop host I/O and cluster service

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

Steps

1. Stop all host applications that use storage on the storage system.
2. Stop any remaining I/O between the host and the storage system.
3. For Windows Server 2003 running MSCS, optionally stop the cluster service.

The installation might run very slowly if the cluster service is running.

See bug 373412 at Bugs Online for the latest information about this issue.

Related information

[Bugs Online - now.netapp.com/NOW/cgi-bin/bol/](http://now.netapp.com/NOW/cgi-bin/bol/)

Installing Windows hotfixes

Obtain and install the required Windows hotfixes for your version of Windows. Required hotfixes are listed in the Interoperability Matrix.

Before you begin

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.

The DSM installation program might also display a message instructing you to install additional Windows hotfixes after installing the DSM.

Note: Some hotfixes for Windows Server 2008 are not recognized unless the affected feature is enabled. For example, an MPIO hotfix might not be recognized as installed until the MPIO feature is enabled. If you are prompted to install a hotfix that is already installed, try enabling the affected Windows feature and then restart the DSM installation program.

Steps

1. Use the Interoperability Matrix to determine which hotfixes are required for your version of Windows.
2. Download hotfixes from the Microsoft download site. Enter the hotfix number in search box and select **Go**.

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

3. Follow the instructions provided by Microsoft to install the hotfixes.

Related information

*Microsoft download site - <http://www.microsoft.com/downloads/search.aspx?displaylang=en>
NetApp Interoperability Matrix - <http://now.netapp.com/NOW/products/interoperability/>*

Removing or upgrading SnapDrive for Windows

The Data ONTAP DSM for Windows MPIO works with supported versions of SnapDrive for Windows. 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 Interoperability Matrix.

Steps

1. To upgrade SnapDrive for Windows, follow the instructions in the *Installation and Administration Guide* for the new version of SnapDrive.
2. To uninstall SnapDrive for Windows, use the Windows Add or Remove Programs utility as explained in the SnapDrive for Windows *Installation and Administration Guide*.

Related information

NetApp Interoperability Matrix - <http://now.netapp.com/NOW/products/interoperability/>

Installing Windows Host Utilities and storage adapter drivers

Install a supported version of Windows Host Utilities. If you are using host bus adapters (HBAs) or converged network adapters (CNAs), be sure you have a supported driver version. DSM 3.4 currently requires Windows Host Utilities 5.3.

Steps

1. Follow the instructions in the Windows Host Utilities *Installation and Setup Guide* for your version of the host utilities.
2. If you have one or more HBAs, verify that the driver version is supported. Install new drivers if needed. The Windows Host Utilities *Installation and Setup Guide* contains the detailed steps.

Enabling ALUA for FC paths

ALUA is required for Fibre Channel paths starting with DSM 3.4. Enable ALUA on the igroups for any LUNs with FC paths.

About this task

All igroups mapped to a LUN must have the same ALUA setting. Because ALUA is not currently supported for iSCSI, mixed FC and iSCSI paths to the same LUN are not currently supported.

Step

1. Enter the following command on the storage controller to enable ALUA on each igroup with FC paths mapped to LUNs used by the Windows host:
igroup set *igroup_name* alua yes

The Windows host does not detect the ALUA setting until it is rebooted.

After you finish

Remove any iSCSI paths to LUNs that also use FC paths.

Related concepts

[ALUA support and requirements](#) on page 16

Related tasks

[Troubleshooting ALUA configuration problems](#) on page 73

Obtaining an MPIO license key

The Data ONTAP DSM for MPIO requires a license key. You must purchase a separate license for each Windows host.

Before you begin

If you have an MPIO license key for your host from an earlier version of the DSM, you can use that key when upgrading.

Steps

1. To obtain a license key for a new copy of the Data ONTAP DSM for Windows MPIO (MPIO-WIN key), go to the NetApp Support Protocol License page.
2. In the **Show Me All** field, select **DSM-MPIO-WIN**, and then click **Go**.
3. Record the appropriate license key.

Related information

[NetApp Support Protocol License page - now.netapp.com/eservice/agree.do](http://now.netapp.com/eservice/agree.do)

Enabling the Multipath I/O feature for Windows Server 2008 and 2008R2

The Windows MPIO components are built into Windows Server 2008 and 2008R2, but are not enabled by default. Enable the Multipath I/O feature before installing the DSM.

Steps

1. Start Windows Server Manager and select **Features** in the navigation tree.

2. Click **Add Features**.
3. Select the **Multipath I/O** check box and then click **Next**.
4. Follow the instructions on your screen to complete the installation. Reboot the Windows host if prompted.

Running the DSM installation program interactively

Run the installation program to install the DSM code and to set required parameters for HBAs and in the Windows registry. You can also use the silent (command line) installation option.

Before you begin

This process is for new DSM installations. For upgrades, follow the upgrading process instead.

You must have already completed the following tasks:

- Stopped applications, I/O, and for hosts running MSCS, stopped the cluster service.
- Obtained an MPIO license key.
- Backed up any critical data on your Windows host.
- For Windows Server 2008 and 2008R2, enabled the Windows Multipath I/O feature.

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

The installation program displays the current and new versions of DSM and Windows MPIO components. However, the installation program never installs new Windows MPIO components for Windows Server 2008.

Steps

1. Change to the directory to which you downloaded the executable file.
2. Launch the installation program and follow the instructions on the screen.
3. Enter the MPIO license key when prompted.
4. Select the **Use the default system account** check box. Or optionally 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.

The DSM service requires an Administrator-level account to allow it to manage disks and paths on the Windows host.

5. When prompted, click **Yes** to reboot the Windows host and complete the installation.

After you finish

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

The installation program might also display a message instructing you to install Windows hotfixes *after* installing the DSM. If so, download the specified hotfixes from the Microsoft support site and install them.

For Windows Server 2008 and 2008 R2, use Windows Disk Management to verify that all existing disks are online. If any disks are offline, set them online.

Related concepts

[*Windows Administrator account requirement*](#) on page 18

Related tasks

[*Stop host I/O and cluster service*](#) on page 37

[*Obtaining an MPIO license key*](#) on page 40

[*Running the DSM installation program from a command line*](#) on page 42

[*Upgrading from an earlier DSM*](#) on page 36

Running the DSM installation program from a command line

Run the installation program from a command prompt to install the DSM code and to set required parameters for HBAs and in the Windows registry without operator intervention. You can also run the installation program interactively.

Before you begin

This process is written for new DSM installations. If you are upgrading, be sure to read the upgrading process as well.

You must have already completed the following tasks:

- Stopped applications, I/O, and for hosts running MSCS, stopped the cluster service.
- Obtained an MPIO license key.
- Backed up any critical data on your Windows host.
- For Windows Server 2008 and 2008R2, enabled the Windows Multipath I/O feature.

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 `rsync`, programs are executed under the SYSTEM account by default. You must change the `rsync` options to use an administrative account.

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

Steps

1. Download or copy the appropriate installation file for the processor architecture of your Windows host.
2. Enter the following commands on your Windows host:

```
msiexec /package installer.msi /quiet /l*v log_file_name LICENSECODE=key
USESYSTEMACCOUNT={0|1} [SVCUSERNAME=domain\user SVCUSERPASSWORD=password
SVCONFIRMUSERPASSWORD=password] [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 *l*v* option is a lower case L.

key is the MPIO license code for the DSM.

USESYSTEMACCOUNT=1 specifies that the DSM management service runs under the default SYSTEM account. You do not specify account credentials.

USESYSTEMACCOUNT=0 specifies that the DSM management service run under a different account. You must provide the account credentials.

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. The DSM service requires an Administrator-level account to allow it to manage disks and paths on the Windows host.

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\.

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

```
msiexec /?
```

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.

After you finish

Search the installation log file for the term "hotfix" to locate messages about missing Windows hotfixes you need to install.

For Windows Server 2008 and 2008 R2, use Windows Disk Management to verify that all existing disks are online. If any disks are offline, set them online.

Related concepts

Windows Administrator account requirement on page 18

Related tasks

Stop host I/O and cluster service on page 37

Obtaining an MPIO license key on page 40

Running the DSM installation program interactively on page 41

Upgrading from an earlier DSM on page 36

Installing the iSCSI software initiator

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.

Before you begin

Be sure to check the Interoperability Matrix to verify which versions of the Microsoft iSCSI software Initiator are supported with this version of the DSM.

Step

1. Download a supported version of the Microsoft iSCSI initiator from the Microsoft Web site and install it following the instructions in the Windows Host Utilities *Setup Guide*.

Related concepts

Microsoft iSCSI DSM on page 17

Related information

NetApp Interoperability Matrix - <http://now.netapp.com/NOW/products/interoperability/>

Removing or repairing the DSM

You can remove the Data ONTAP DSM for Windows MPIO from your Windows host. The Repair option updates HBA and registry settings and replaces any damaged or missing components.

Next topics

[Uninstalling the Data ONTAP DSM interactively](#) on page 45

[Uninstalling the DSM silently \(unattended\)](#) on page 46

[Repairing the Data ONTAP DSM installation](#) on page 47

Uninstalling the Data ONTAP DSM interactively

In most cases you can use the Windows Add or Remove Programs applet to uninstall the Data ONTAP DSM for Windows MPIO interactively.

Before you begin

You will have to reboot your Windows host computer after removing the DSM.

Data ONTAP DSM sets some of the same registry entries as 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.

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 3.4 for Windows MPIO uses MPIO version 1.23 for Windows Server 2003. If you plan to install a program that needs an earlier version of the Windows MPIO code, contact technical support for assistance.

Note: You should not uninstall the DSM for a SAN-booted Windows Server 2003 host. Because the boot LUN uses the DSM and MPIO software, you might lose access to the boot LUN. If you must remove the DSM software, contact technical support for assistance. You can safely upgrade SAN-booted Server 2003 hosts to a later DSM without uninstalling.

Steps

1. Open the Windows **Add or Remove Programs** applet.
2. Select **Data ONTAP DSM for Windows MPIO**.
3. Click **Remove**.
4. Reboot the Windows host when prompted.

After you finish

Run the **Repair** option for Windows Host Utilities from **Add or Remove Programs**.

Related tasks

Forcing removal of MPIO for Windows Server 2003 on page 0

Uninstalling the DSM silently (unattended)

You can uninstall the Data ONTAP DSM without operator intervention. A reboot of your Windows host is required to complete the procedure.

Before you begin

Data ONTAP DSM sets some of the same registry entries as 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.

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 3.4 for Windows MPIO uses MPIO version 1.23 for Windows Server 2003. If you plan to install a program that needs an earlier version of the Windows MPIO code, contact technical support for assistance.

Note: You should not uninstall the DSM for a SAN-booted Windows Server 2003 host. Because the boot LUN uses the DSM and MPIO software, you might lose access to the boot LUN. If you must remove the DSM software, contact technical support for assistance. You can safely upgrade SAN-booted Server 2003 hosts to a later DSM without uninstalling.

Steps

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 installer.msi /quiet /l*v log_file_name
```

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

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 *l*v* option is a lower case L.

After you finish

Run the **repair** option for Windows Host Utilities from **Add or Remove Programs**.

Related tasks

[Forcing removal of MPIO for Windows Server 2003](#) on page 0

Repairing the Data ONTAP DSM installation

The installer for the Data ONTAP DSM for Windows MPIO includes a repair option that updates the HBA and Windows registry settings and puts new copies of the DSM and MPIO driver files into the Windows driver folder.

Before you begin

The repair option is available from the Windows **Add or Remove Programs** applet.

You must reboot your Windows host to complete the repair procedure.

Steps

1. Open the Windows Add or Remove Programs applet.
2. Select **Data ONTAP DSM for Windows MPIO**, and click **Change**.
3. Select the **Repair** option.
4. Select the **Use the default system account** check box. Or optionally 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. Following the instructions on the screen and reboot the Windows host when prompted.

Managing the DSM using the GUI

You can manage the Data ONTAP DSM for Windows MPIO using either a graphical user interface (GUI) or a command line interface (CLI). The following topics describe how to complete typical management tasks using the GUI.

Next topics

[Starting the DSM GUI](#) on page 49
[DSM GUI icon descriptions](#) on page 50
[Discovering new virtual disks \(LUNs\)](#) on page 51
[Viewing LUNs \(virtual disks\)](#) on page 51
[Viewing paths](#) on page 52
[Changing the default load balance policy](#) on page 54
[Changing the load balance policy for existing LUNs](#) on page 54
[Method for making a path active varies by load balance policy](#) on page 55
[Making a path Passive](#) on page 56
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[Setting path weight](#) on page 56
[Enabling a path](#) on page 57
[Disabling a path](#) on page 57
[Managing the DSM license key](#) on page 57
[Displaying the persistent reservation key](#) on page 58

Related tasks

[Managing the DSM using the CLI](#) on page 59

Starting the DSM GUI

To start the Data ONTAP DSM for Windows MPIO graphical user interface (GUI), open Windows Computer Management. The DSM GUI is a Microsoft management console (MMC) Snapin Extension under the Storage node in both the Server Manager console and the Computer Management console.

Steps

1. Open the Windows Computer Management utility. Select **Start > Administrative Tools > Computer Management**.
2. Expand the **Storage** option in the tree view of Computer Management.

3. Select **Data Ontap DSM Management**.

Result

The DSM GUI is displayed.

After you finish

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

DSM GUI icon descriptions

The Data ONTAP DSM for Windows MPIO graphical user interface (GUI) uses icons to identify objects displayed in the interface.

Icon	Description
	LUN (virtual disk)
	SAN boot LUN - note that some systems display the LUN icon above for both data LUNs and SAN boot LUNs
	Active path
	Passive path
	Disabled path
	Failed path
	Pending transition path

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 them for the host.

Steps

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

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

Viewing LUNs (virtual disks)

You can view a list of virtual disks (LUNs) mapped to the Windows host using the Data ONTAP DSM for Windows MPIO graphical user interface (GUI).

Steps

1. In the DSM GUI navigation pane, expand **Data ONTAP DSM Management**.
2. Select **Virtual Disks** in the navigation pane.

Each LUN is displayed as a virtual disk in the task pane.

After you finish

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** and then refresh the Virtual Disks view.

Virtual Disks view

The Virtual Disks view in Data ONTAP DSM Management displays information about each virtual disk (LUN) mapped to the Windows host from a NetApp storage system.

The Virtual Disks view is displayed when you select **Virtual Disks** in the navigation tree of Data ONTAP DSM Management.

Field Descriptions

The Virtual Disks view displays the following fields.

Physical Device ID (Mount Points)	Virtual disk name and drive letter or mount point.
Storage System	Name of the storage system.
Storage System Path	Volume path to the LUN on the storage system.
LUN	LUN identifier on the storage system.
Serial Number	LUN serial number on the storage system.
Disk Size	Virtual disk unformatted size (usable capacity will be less).
Load balance policy	Policy in effect for the virtual disk.
Cluster mode	Storage system cfmode setting.

Viewing paths

You can view a list of paths between the storage system and Windows host using the Data ONTAP DSM for Windows MPIO graphical user interface (GUI).

Steps

1. In the DSM GUI navigation pane, expand **Data ONTAP DSM Management**.
2. Select **Virtual Disks** in the navigation pane.
Each LUN is displayed as a virtual disk in the task pane.
3. Double click the desired virtual disk.
Each path to the virtual disk is displayed in the task pane.

Paths view

The Paths view in Data ONTAP DSM Management displays information about each path to a virtual disk (LUN).

The Paths view is displayed when you select a virtual disk in the navigation tree of Data ONTAP DSM Management.

Field Descriptions

The Paths view displays the following fields.

State	The current state of the path. An asterisk (*) next to the state indicates that the path is a primary path and will always be used if available. Available values are as follows:
--------------	---

Active	This path is currently used to access the virtual disk. Used for iSCSI paths only.
Active/Optimized	This path is currently used to access the virtual disk. Optimized paths do not use the storage system interconnect between partner controllers. Used for FC paths only.
Active/Unoptimized	This path is available to take over if no Active/Optimized paths are available. Unoptimized (also called <i>proxy</i>) paths use the storage system interconnect between partner controllers and typically have lower performance than Optimized paths. Used for FC paths only.
Disabled	This path is not available to take over for the active path because an administrator set it to disabled.
Failed	The system detected an error on this path. It is not used to access the virtual disk. The system periodically attempts to retry the path.
Passive	This path is available to take over for the active path if the active path fails.
Pending Active	This path is transitioning to an active state.
Pending Passive	This path is transitioning to passive.
Unavailable	The path normally uses the storage system interconnect between partner controllers, but the interconnect is not currently connected.
DSM ID	A unique eight-character identifier on the host for the path. The identifier is made up of four two-digit fields: port, bus, target, and LUN.
Nexus ID	An eight-character identifier made up of four two-digit 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.
Initiator HBA Name	Name of the FC HBA or iSCSI initiator used for the path.
Initiator HBA Address	World wide port name (WWPN) of the HBA or IP address of the iSCSI initiator used for the path.
Target Adapter/Portal IP	WWPN and port number of the FC adapter on the storage system for FC paths, or IP address of the storage system iSCSI port used for the path.
Preferred Path	Paths that are selected by the administrator to be used when available. Applies only to the Round Robin with Subset and FailOver Only load balance policies.

Path Weight The priority value assigned to the path by the administrator. The lowest value is the highest priority. Applies only to the Least Weighted Paths load balance policy.

Changing the default load balance policy

The default load balance policy applies to newly-created virtual disks. You can change the default policy using the Data ONTAP DSM for Windows MPIO GUI. The default policy does not affect existing virtual disks.

Steps

1. In the DSM GUI navigation pane, select **Data ONTAP DSM Management**.
2. Click **Action > Set default Load Balance Policy**.
3. Select the desired policy.

Related concepts

[Load balance policies determine failover behavior](#) on page 27

Related tasks

[Changing the load balance policy for existing LUNs](#) on page 54

Changing the load balance policy for existing LUNs

You can change the load balance policy for an existing LUN (virtual disk) using the Data ONTAP DSM for Windows MPIO graphical user interface (GUI).

About this task

If a virtual disk is not eligible for a given policy, that policy is not available to be selected.

Steps

1. In the DSM GUI navigation pane, expand **Data ONTAP DSM Management**.
2. Select **Virtual Disks** in the navigation pane and then select the desired disk.
3. Select **Action > Set Load Balance Policy**, and then select the desired policy.

After you finish

Select the preferred path or path weights if appropriate.

Related concepts

[Load balance policies determine failover behavior](#) on page 27

Related tasks

[Changing the default load balance policy](#) on page 54

Method for making a path active varies by load balance policy

The method you use to manually make a path active varies, depending on the load balance policy used for the LUN.

When the load balance policy is FailOver Only or Round Robin with Subset, you can make the path active directly with the **Action > Set Active** command.

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.

Related tasks

[Disabling a path](#) on page 57

[Setting path weight](#) on page 56

Making a path Active

You can make a Passive path Active directly using the Data ONTAP DSM for Windows MPIO graphical user interface (GUI). This action applies only when the load balance policy is FailOver Only or Round Robin with Subset.

Steps

1. In the DSM GUI, expand **Data ONTAP DSM Management** in the navigation pane.
2. Expand **Virtual Disks** in the navigation pane, and then select the desired disk.
3. In the task pane, select a Passive path and then click **Action > Set Active**.

Making a path Passive

You can make an Active path Passive using the Data ONTAP DSM for Windows MPIO graphical user interface (GUI). This action applies only when the load balance policy is Round Robin with Subset.

Steps

1. In the DSM GUI, expand **Data ONTAP DSM Management** in the navigation pane.
2. Expand **Virtual Disks** in the navigation pane, and then select the desired disk.
3. In the task pane, select an Active path and then click **Action > Set Passive**.

Specifying Preferred paths

You can specify the Preferred path that is used whenever it is available using the Data ONTAP DSM for Windows MPIO graphical user interface (GUI). This action applies only when the load balance policy is FailOver Only or Round Robin with Subset.

Steps

1. In the DSM GUI, expand **Data ONTAP DSM Management** in the navigation pane.
2. Expand **Virtual Disks** in the navigation pane, and then select the desired disk.
3. In the task pane, select the desired path and then click **Action > Set Active**.

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

Setting path weight

You can set the weight of a path using the Data ONTAP DSM for Windows MPIO graphical user interface (GUI). This action applies only when the load balance policy is Least Weighted Paths. The available path with the lowest weight is used to access the virtual disk.

Before you begin

If multiple paths with the same weight value are available, the DSM selects the path shared with the fewest other LUNs.

Steps

1. In the DSM GUI, expand **Data ONTAP DSM Management** in the navigation pane.

2. Expand **Virtual Disks** in the navigation pane, and then select the desired disk.
3. In the task pane, select the desired path and then click **Action > Set Path Weight**.
4. Enter a value between 0 (highest priority) and 2146999999 (lowest priority).

Enabling a path

You can enable a disabled path using the Data ONTAP DSM for Windows MPIO graphical user interface (GUI).

Steps

1. In the DSM GUI, expand **Data ONTAP DSM Management** in the navigation pane.
2. Expand **Virtual Disks** in the navigation pane, and then select the desired disk.
3. In the task pane, select the Disabled path and then click **Action > Enable**.

Disabling a path

You can disable a Passive path using the Data ONTAP DSM for Windows MPIO graphical user interface (GUI). You cannot disable an Active path, except for paths using the Least Queue Depth policy. You must first make another path Active so that the path you want to disable becomes a Passive path.

Steps

1. In the DSM GUI, expand **Data ONTAP DSM Management** in the navigation pane.
2. Expand **Virtual Disks** in the navigation pane, and then select the desired disk.
3. In the task pane, select a Passive path, or an active path using the Least Queue Depth policy, and then click **Action > 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**.

Managing the DSM license key

You can view or change the license key for the Data ONTAP DSM for Windows MPIO using the graphical user interface (GUI).

Before you begin

You must purchase a license for each Windows host computer.

Steps

1. In the DSM GUI, select **Data ONTAP DSM Management** in the navigation pane.
2. Click **Action > Modify License Information**.

The current license key value is displayed.

3. If desired, enter a new key value and then click **OK**.

Displaying the persistent reservation key

You can display the persistent reservation key using the Data ONTAP DSM for Windows MPIO graphical user interface (GUI). This key is used for clustered Windows systems to identify the current owner of a virtual disk (LUN).

About this task

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.

Steps

1. In the DSM GUI, expand **Data ONTAP DSM Management** in the navigation pane.
2. Expand **Virtual Disks** in the navigation pane, and then select the desired disk.
3. Click **Action > Display Persistent Reservation Key**.

Managing the DSM using the CLI

You can manage the Data ONTAP DSM for Windows MPIO using either a command line interface (CLI) or a graphical user interface (GUI). The following topics describe how to complete typical management tasks using the CLI.

Next topics

[CLI overview](#) on page 59

[Getting DSM information](#) on page 60

[Setting the default load balance policy](#) on page 60

[Getting LUN information](#) on page 61

[Changing the load balance policy for a LUN](#) on page 62

[Getting the load balance policy for a LUN](#) on page 63

[Listing available load balance policies for a LUN](#) on page 63

[Viewing the persistent reservation key](#) on page 64

[Displaying path information](#) on page 65

[Changing path status](#) on page 66

[Changing the path weight](#) on page 67

Related tasks

[Managing the DSM using the GUI](#) on page 49

CLI overview

The DSM command line interface (CLI) uses the `dsmcli` command. It has four main options.

You can enter `dsmcli` commands from any Windows command prompt. The main `dsmcli` command options are:

- dsmcli dsm** Displays information about installed device specific modules and displays or sets the default load balance policy.
- 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.

To prevent text from wrapping, it is recommend that you set the command window width to 160 characters when using the CLI.

Getting DSM information

The `dsmcli dsm list` and `dsmcli dsm version` commands list information about the DSM.

Steps

1. Enter the following command at a Windows command prompt:

```
dsmcli dsm list
```

The DSMs on the system are displayed.

2. Enter

```
dsmcli dsm version
```

The Data ONTAP DSM and Windows MPIO components versions are displayed.

```
C:\>dsmcli dsm list
Number of DSM registered with MPIO is 1
List of DSMs registered with MPIO:
    "Data ONTAP DSM"

C:\>dsmcli dsm version
DSM MGMT Dll version 3.4.35385.2230 built on 09/21/2010 22:36:44
ONTAPDSM Driver  version 3.4.35385.2230 built on 09/21/2010 22:34:38
MSFT MPIO Driver version 6.0.6002.22355 built on 03/05/2010 12:31:03
MSDSM Driver version 6.0.6002.18005 built on 04/11/2009 00:15:30
```

Setting the default load balance policy

The `dsmcli dsm setdefaultlbp` command sets the default load balance policy for new virtual disks. The `dsmcli dsm getdefaultlbp` displays the current default policy.

About this task

The default load balance policy applies only to newly created virtual disks. To change the policy for an existing virtual disk, use the `dsmcli lun setlbp` command.

Steps

1. Enter the following command at a Windows command prompt to display the current policy:

```
dsmcli dsm getdefaultlbp
```

2. Enter the following command to set a new policy:

dsmcli dsm setdefaultlbp -lpolicy

policy values are: AA (Auto Assigned), FO (FailOver Only), LQD (Least Queue Depth), RR (Round Robin), RS (Round Robin with Subset), or WP (Least Weighted Paths).

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

C:\>dsmcli dsm setdefaultlbp -l WP
dsmcli: The default load balance policy for the dsm is set to
WEIGHTED PATH.
```

Related concepts

[Load balance policies determine failover behavior](#) on page 27

Getting LUN information

The `dsmcli lun list` and `dsmcli lun attributes` commands display information about the LUNs (virtual disks) mapped to the Windows host.

About this task

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.

Steps

1. Enter the following command at a Windows command prompt to display a list of LUNs:

```
dsmcli lun list
```

2. Enter the following command to display details about the LUNs:

```
dsmcli lun attributes
```

```
C:\>dsmcli lun list
Luns managed by Data ONTAP(R) DSM
C4e6SJ-o-rl1
C4e6SJ-oA5R9
C4e6hJB0r61c
C4e6hJB0r8rk

C:\>dsmcli lun attributes
Luns managed by Data ONTAP(R) DSM
SerialNumber  Storage System  Storage System Path  MountPath
*****
C4e6SJ-o-rl1  SS1                  /vol/vol1/winserv_0  E:\
```

C4e6SJ-oA5R9	SS1	/vol/vol1/winserv_1	F:\
C4e6hJB0r61c	SS2	/vol/vol1/winserv_2	G:\
C4e6hJB0r8rk	SS2	/vol/vol1/winserv_3	H:\

Changing the load balance policy for a LUN

The `dsmcli lun set lbp` command sets the load balance policy for a single LUN (virtual disk).

Before you begin

You can specify the LUN by serial number or by Windows disk letter. You can get the serial number of a LUN using the `dsmcli lun attribute` command.

The available load balance policies for a LUN depend on your configuration. The `dsmcli lun get lbp` command displays the valid policies for a specified LUN.

The `dsmcli path list -v` command displays the current load balance policy for each LUN.

Step

1. Enter the following command at a Windows command prompt:

```
dsmcli lun setlbp -l policy { -s serial_number | - d drive_letter }
```

policy values are: AA (Auto Assigned), FO (FailOver Only), LQD (Least Queue Depth), RR (Round Robin), RS (Round Robin with Subset), or WP (Least Weighted Paths).

```
C:\>dsmcli lun setlbp -l RR -s C4e6hJB0r8rk
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
```

Related concepts

[Load balance policies determine failover behavior](#) on page 27

Related tasks

[Getting LUN information](#) on page 61

[Getting the load balance policy for a LUN](#) on page 63

[Listing available load balance policies for a LUN](#) on page 63

Getting the load balance policy for a LUN

The `dsmcli path list -v` command displays the current load balance policy for each LUN.

Before you begin

The available load balance policies for a LUN depend on your configuration. The `dsmcli lun getlbp` command displays the valid policies for a specified LUN.

Step

1. Enter the following command at a Windows command prompt:

```
dsmcli path list -v
```

```
C:\>dsmcli path list -v  
  
Path Info for C4e6hJI0egMp:  
Load Balance Policy:  LEAST QUEUE DEPTH  
Number of Paths:  6  
...
```

Listing available load balance policies for a LUN

The `dsmcli lun getlbp` 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.

Before you begin

You can specify the LUN by serial number or by Windows disk letter. You can get the serial number of a LUN using the `dsmcli lun attribute` command.

Step

1. Enter the following command at a Windows command prompt: `dsmcli lun getlbp { -s serial_number | -d drive_letter }`

```
C:\>dsmcli lun getlbp -d E  
dsmcli: The supported Load Balance policies for this LUN are  
FAILOVER  
WEIGHTED PATHS  
AUTO ASSIGNED  
ROUND ROBIN  
ROUND ROBIN WITH SUBSET
```

```
LEAST QUEUE DEPTH
C:\>dsmcli lun getlbp -s C4e6hJI0eUJM
dsmcli: The supported Load Balance policies for this LUN are
FAILOVER
WEIGHTED PATHS
AUTO ASSIGNED
ROUND ROBIN
ROUND ROBIN WITH SUBSET
LEAST QUEUE DEPTH
```

Related concepts

[Load balance policies determine failover behavior](#) on page 27

Related tasks

[Getting the load balance policy for a LUN](#) on page 63

[Getting LUN information](#) on page 61

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). The `dsmcli lun getprkey` command displays the key for each virtual disk.

Before you begin

You can specify the LUN by serial number or by Windows disk letter. You can get the serial number of a LUN using the `dsmcli lun attribute` command.

In Windows Server 2003, all virtual disks on the host have the same value. In Windows Server 2008, each virtual disk has a unique value.

For LUNs that do not belong to a cluster on Windows Server 2008, the key is set to zeros (0 0 0 0 0 0 0 0).

Step

1. Enter the following command at a Windows command prompt:

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

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

```
The Persistent Reservation Key for lun C4e6hJHJGdSi is: 99 54 48 99
54 2 2 5
```

Related tasks

[Getting LUN information](#) on page 61

Displaying path information

The `dsmcli path list` command displays all of the paths for one or all virtual disks (LUNs) mapped to the Windows host.

Before you begin

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.

Step

1. Enter the following command at a Windows command prompt:

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

Set your display to 160 columns or more to best display the verbose output.

```
C:\>dsmcli path list -v

Path Info for C4e6hJ0zqAJ8:
Load Balance Policy:  LEAST QUEUE DEPTH
Number of Paths:  4
State
=====
Active/Optimized    04000001 04000001 com.emulex-42C2071-1 10:00...
Active/Optimized    03000001 03000001 com.emulex-42C2071-0 10:00...
```

```
Active/Unoptimized 03000101 03000102 com.emulex-42C2071-0 10:00...
Active/Unoptimized 04000101 04000102 com.emulex-42C2071-1 10:00...
```

Changing path status

The `dsmcli path enable`, `dsmcli path disable`, `dsmcli path active`, and `dsmcli path passive` 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.

Before you begin

You specify the path you want to change using the DSM ID. You can get the DSM ID using the `dsmcli path list` command.

Note:

- You cannot make a path Active or Passive directly for the Least Weighted Paths policy. Instead, change the weight of the paths to determine which is active using the `dsmcli path weight` command.
- You cannot disable a path if no other path is available to take over; there must always be an active path.
- Although you can make a non-optimized (proxy) path active, you should avoid doing so if any optimized paths are available.

Step

- Enter the following command at a Windows command prompt:

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

```
C:\>dsmcli path disable -p 03000001
dsmcli:Path 0x03000001 is DISABLED

C:\>dsmcli path enable -p 03000001
dsmcli:Path 0x03000001 is ENABLED

C:\>dsmcli path active -p 03000102
dsmcli:Path 0x03000102 is set to ACTIVE state

C:\>dsmcli path passive -p 03000102
dsmcli:Path 0x03000102 is set to PASSIVE state
```

Related tasks

[Displaying path information](#) on page 65

[Changing the path weight](#) on page 67

Supported path changes for load balance policies

The allowed path changes using the `dsmcli path { enable | disable | active | passive }` commands depend on the load balance policy for the path.

The following table lists which commands are allowed for each load balance policy. Note that a command might not be allowed because it tries to remove the only active path.

Table 1: Path changes allowed for each load balance policy

Load balance policy	enable	disable	active	passive
Auto Assigned	Yes	Yes	No	No
FailOver Only	Yes	Yes	Yes	No
Least Queue Depth	Yes	Yes	No	No
Least Weighted Paths	Yes	Yes	No	No
Round Robin	Yes	Yes	No	No
Round Robin with Subset	Yes	Yes	Yes	Yes

Note: You cannot disable an active path. First make another path active, then disable the passive path.

Changing the path weight

The `dsmcli path weight` 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.

Before you begin

If multiple paths with the same weight value are available, the DSM selects the path shared with the fewest other LUNs. Initially, all paths are set to 255. The active path is then set to 5.

Step

1. Enter the following command at a Windows command prompt:

```
dsmcli path weight -p DSM_ID -w weight
```

DSM_ID is available from the `dsmcli path list` command

weight can be set from 0 (highest priority) to 2146999999 (lowest priority).

```
C:\>dsmcli path weight -p 04000100 -w 0  
dsmcli:Path 0x04000100 weight is set to 0
```

Related tasks

[Displaying path information](#) on page 65

Troubleshooting

Use the information in the following topics to help you resolve typical problems with installation and operation of the Data ONTAP DSM for Windows MPIO.

Next topics

[Troubleshooting installation problems](#) on page 69

[Troubleshooting GUI and CLI problems](#) on page 72

[Troubleshooting failover problems](#) on page 73

[Troubleshooting ALUA configuration problems](#) on page 73

[Windows event log entries](#) on page 74

Troubleshooting installation problems

Most installation problems are easily resolved. The following are typical problems when installing the Data ONTAP DSM for Windows MPIO.

Next topics

[Installing missing Windows hotfixes](#) on page 69

[Resolving the SnapDrive 4.1 installation error](#) on page 70

[Internal Error: Access is Denied during installation](#) on page 70

Installing missing Windows hotfixes

The DSM installation program checks for required Windows hotfixes and displays an error listing any missing hotfixes. The installation will not continue until all required hotfixes are installed.

Steps

1. Record the list of missing Windows hotfixes reported by the DSM installer.
2. Obtain the Windows hotfixes from Microsoft and install them according to the instructions provided by Microsoft.
3. Run the DSM installation program again.

Related tasks

[Installing Windows hotfixes](#) on page 38

Resolving the SnapDrive 4.1 installation error

The DSM installation program checks for SnapDrive 4.1 for Windows or earlier and reports an error if found.

About this task

Your Windows system must run a version of SnapDrive for Windows that is supported with the DSM version.

Steps

1. Remove the old SnapDrive version .
2. Run the DSM installation program again.

Related tasks

[*Removing or upgrading SnapDrive for Windows*](#) on page 38

Internal Error: Access is Denied during installation

On Windows Server 2008, you might receive an Internal Error: Access is Denied message if User Access Control is enabled and installation is attempted from a user account other than Administrator.

There are two workarounds for this problem: installing from an elevated command prompt or disabling User Access Control.

For the latest information, see bug 312358 at Bugs Online.

For more information about User Access Control, see the Microsoft Technet article *User Account Control Step-by-Step Guide*.

Next topics

[*Installing from an elevated command prompt*](#) on page 71

[*Disabling User Access Control*](#) on page 71

Related information

[*Bugs Online - now.netapp.com/NOW/cgi-bin/bol/*](http://now.netapp.com/NOW/cgi-bin/bol/)

[*Microsoft Technet User Account Control Step-by-Step Guide - technet.microsoft.com/en-us/library/cc709691.aspx*](http://technet.microsoft.com/en-us/library/cc709691.aspx)

Installing from an elevated command prompt

Run the installation from an elevated command prompt to avoid the Internal Error: Access is Denied error.

An elevated command prompt is required to install the DSM when User Access Control (UAC) is enabled. The elevated command prompt overrides the UAC restrictions.

Steps

1. Click **Start**.
2. Right-click **Command Prompt** and then click **Run as Administrator**.
3. Run the installation program by navigating to the directory containing the installation package and entering the package name at the command prompt.

Related information

[Microsoft Technet User Account Control Step-by-Step Guide - technet.microsoft.com/en-us/library/cc709691.aspx](http://technet.microsoft.com/en-us/library/cc709691.aspx)

Disabling User Access Control

Disable User Access Control to avoid the Internal Error: Access is Denied error.

Steps

1. Log in as an administrator.
2. Select **Control Panel > User Accounts > Turn User Account Control on or off**.
3. Clear the **Use User Access Control (UAC) to help protect your computer** check box and then click **OK**.
4. Run the installation program again.

Related information

[Microsoft Technet User Account Control Step-by-Step Guide - technet.microsoft.com/en-us/library/cc709691.aspx](http://technet.microsoft.com/en-us/library/cc709691.aspx)

Troubleshooting GUI and CLI problems

You can resolve typical graphical user interface (GUI) and command line interface (CLI) problems using the following topics.

Next topics

[Unable to disable path](#) on page 72

[Unable to change paths](#) on page 72

[Changes not displayed in GUI](#) on page 72

[Windows event log lists errors](#) on page 72

Unable to disable path

The DSM graphical user interface (GUI) does not allow you to disable the active DSM ID (I_T_L nexus), except for paths using the Least Queue Depth policy.

You must first activate another DSM ID (path) 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.

Unable to 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.

Changes not displayed in GUI

The DSM graphical user interface (GUI) does not automatically refresh for all events.

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

Windows event log lists errors

The DSM writes events to the Windows event log. Check the system log for messages from Source "ontapdsm" or the application log for messages from source "Data ONTAP(R) DSM Management Service".

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.

Related concepts

[Mapping identifiers between the host and storage system](#) on page 33

Troubleshooting failover problems

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

Steps

1. Verify that the Windows host has a path to the LUN on each storage system node.
2. For FC, 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.
3. For iSCSI, verify that each iSCSI port on one storage node has a partner port configured on the partner node.
4. Verify the storage system is running a supported version of Data ONTAP and a supported cfmode.

Troubleshooting ALUA configuration problems

ALUA must be enabled for FC paths starting with DSM 3.4. An event message is logged when a path is detected with ALUA disabled.

Steps

1. Using Windows Event Viewer, check the Windows logs for event 61212.
2. Record the disk serial number from the event.
3. Locate the serial number in the DSM Virtual Disks display to identify which LUN and storage controller it belongs to.
4. On the storage controller that owns the LUN, enable ALUA on the igroup mapped to the LUN.

After you finish

Reboot the Windows host to detect the ALUA configuration change.

Related concepts

[ALUA support and requirements](#) on page 16

Related tasks

[Enabling ALUA for FC paths](#) on page 39

Windows event log entries

The Data ONTAP DSM for Windows MPIO 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.

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.

Next topics

[Changing what gets logged by the DSM](#) on page 74

[Event data section encoding](#) on page 75

[Event message reference](#) on page 75

Changing what gets logged by the DSM

You can change the number of messages that get written to the Windows event log by the Data ONTAP DSM. A registry value specifies which messages get logged.

Before you begin

Changing this registry value affects only messages written by the DSM itself. It does not affect messages written by the other Windows MPIO components.

Steps

1. Back up the current Windows registry settings.
2. Open the Windows registry editor by entering `regedit` at the Windows run prompt.
3. Navigate to the following registry key: `HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ontapdsm\Parameters`
4. Create a new DWORD value named **EventLogLevel** and set its value to 0, 1, 2, or 3.

The default value is 1. The allowed values are:

- 0 No logging.
- 1 Normal logging of events.

- 2 Log additional events for path transitions and reservation changes.
- 3 Log all events. Recommended only for debugging.

The event message reference table lists all messages logged by the DSM. For each message, the table includes the log level settings at which that message is logged.

Related references

[Event message reference](#) on page 75

Event data section encoding

Some event log entries include raw data in their data sections. This enables these events to include more information than would be possible using text data.

The following table lists the data fields for raw event data and their offsets within the data.

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

Event message reference

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.

The Level column lists the log level settings at which this message gets logged. The default level is 1.

ID	Sev	Level	Explanation
61002	I	1, 2, 3	The DSM successfully initialized. Issued once each time the driver starts.
61003	E	1, 2, 3	Reported when MPIO components cannot be located. Reinstall the DSM.
61004	W	1, 2, 3	The query did not return a serial number for a LUN. The DSM cannot manage the LUN.
61005	E	1, 2, 3	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	1, 2, 3	The specified LUN uses an unsupported protocol. The DSM cannot manage the LUN.
61007	I	1, 2, 3	Issued once each time the DSM is unloaded.
61018	I	1, 2, 3	The specified DSM ID (I_T_L nexus) is now active.
61019	I	1, 2, 3	The administrative request to make specified DSM ID (I_T_L nexus) active failed.
61023	I	1, 2, 3	The default load balance policy for new virtual disks changed to the specified value.
61026	E	1, 2, 3	The storage system is running a version of Data ONTAP software that is not compatible with the DSM version.
61034	W	1, 2, 3	The specified LUN on the specified storage system disconnected. All paths to the LUN have been removed.
61035	I	2, 3	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	1, 2, 3	An earlier revision of the Windows MPIO drivers than is required by the DSM was found on the Windows system. Reinstall the DSM.
61041	I	2, 3	The specified logical unit on the specified storage system connected using FC on the specified DSM ID (I_T_L nexus). The target WWPN is contained in the data section of this message at byte offset 0x28.

ID	Sev	Level	Explanation
61042	I	2, 3	The specified logical unit on the specified storage system connected using FC on the specified DSM ID (I_T_L nexus). The target IP address and the Nexus ID is contained in the data section of this message.
61045	I	1, 2, 3	This information is used for diagnosing problems with host bus adapters.
61048	I	2, 3	The specified DSM ID (I_T_L nexus) has been associated with the specified initiator-target nexus (path).
61049	W	1, 2, 3	There are no paths available to the specified LUN. The DSM requests path verification from the MPIO driver.
61051	W	3	The path with the specified DSM ID is in a degraded state. A SCSI command has failed.
61052	I	1, 2, 3	The specified DSM ID (I_T_L nexus) to the target is now working.
61053	E	1, 2, 3	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	1, 2, 3	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	2, 3	The specified DSM ID (I_T_L nexus) was enabled. It must still be activated before it is used for I/O.
61056	I	2, 3	The specified DSM ID (I_T_L nexus) has been disabled and will not be selected for I/O.
61057	E	1, 2, 3	The administrative request to enabled the specified DSM ID (I_T_L nexus) failed.
61058	E	1, 2, 3	The administrative request to disable the specified DSM ID (I_T_L nexus) failed. The last available I_T_L nexus cannot be disabled.
61059	I	1, 2, 3	The DSM requested that the MPIO 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.

ID	Sev	Level	Explanation
61060	I	1, 2, 3	The MPIO driver did not allow throttling of I/O on the specified DSM ID (I_T_L nexus).
61061	I	1, 2, 3	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	1, 2, 3	Unable to remove the throttle on the specified DSM ID (I_T_L nexus).
61063	I	1, 2, 3	The specified protocol was enabled for the DSM.
61064	I	1, 2, 3	The specified protocol was disabled for the DSM.
61068	E	1, 2, 3	The attempt to change the load balance policy for the specified LUNs failed.
61070	I	2, 3	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	2, 3	The specified DSM ID (I_T_L nexus) has been activated and will be used for I/O.
61072	I	2, 3	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	1, 2, 3	The specified DSM ID (I_T_L nexus) failed to transition to the active state as requested by the administrator.
61074	I	1, 2, 3	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	1, 2, 3	The specified active DSM ID (I_T_L nexus) was replaced by the new active DSM ID.
61076	E	1, 2, 3	The specified DSM ID (I_T_L nexus) reported an I/O error. The I/O will be retried. This message contains raw data that must be decoded.
61077	W	1, 2, 3	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	1, 2, 3	The specified LUN has failed over to the new DSM ID (I_T_L nexus) specified.

ID	Sev	Level	Explanation
61079	W	1, 2, 3	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	1, 2, 3	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. This message contains raw data that must be decoded.
61081	E	1, 2, 3	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. This message contains raw data that must be decoded.
61082	E	1, 2, 3	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. This message contains raw data that must be decoded.
61083	E	1, 2, 3	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. This message contains raw data that must be decoded. Contact customer support to report this error.
61084	E	1, 2, 3	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. This message contains raw data that must be decoded.
61085	E	1, 2, 3	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.
61086	E	1, 2, 3	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. This message contains raw data that must be decoded.
61087	E	1, 2, 3	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.

ID	Sev	Level	Explanation
61088	E	1, 2, 3	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. This message contains raw data that must be decoded.
61089	E	1, 2, 3	The storage system reported an invalid task attribute error for an I/O operation on the specified DSM ID (I_T_L nexus). This message contains raw data that must be decoded.
61090	E	1, 2, 3	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. This message contains raw data that must be decoded.
61091	W	1, 2, 3	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. This message contains raw data that must be decoded.
61092	W	1, 2, 3	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	1, 2, 3	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. This message contains raw data that must be decoded.
61094	E	1, 2, 3	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	1, 2, 3	The LUN on the specified DSM ID (I_T_L nexus) is not ready, but is becoming ready. The I/O will be retried. This message contains raw data that must be decoded.
61096	E	1, 2, 3	The storage system reported that the LUN on the specified DSM ID (I_T_L nexus) is offline. The I/O will be retried. This message contains raw data that must be decoded. Check the LUN status on the storage system and bring online.

ID	Sev	Level	Explanation
61097	I	3	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. This message contains raw data that must be decoded.
61098	I	2, 3	The DSM lost its SCSI reservation to the LUN on the specified DSM ID (I_T_L nexus). This message contains raw data that must be decoded.
61099	I	2, 3	The storage system reported that the SCSI reservations to the LUN on the specified DSM ID (I_T_L nexus) were released. This message contains raw data that must be decoded.
61100	I	2, 3	The storage system reported that the registration of the specified DSM ID (I_T_L nexus) was cleared. This message contains raw data that must be decoded.
61101	I	2,3	The storage system reported the asymmetric access to the LUN in the specified DSM ID (I_T_L nexus) changed. This message contains raw data that must be decoded.
61102	I	2, 3	The storage system reported that a volume was created on the LUN in the specified DSM ID (I_T_L nexus). This message contains raw data that must be decoded.
61103	I	2, 3	The storage system reported a change in the availability of the LUN in the specified DSM ID (I_T_L nexus). This message contains raw data that must be decoded.
61104	E	1, 2, 3	The storage system reported an attempt to write to the read-only LUN in the specified DSM ID (I_T_L nexus). This message contains raw data that must be decoded.
61105	E	1, 2, 3	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. This message contains raw data that must be decoded. Check the storage system log for disk errors.
61106	E	1, 2, 3	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. This message contains raw data that must be decoded. Check the storage system log for disk errors.

ID	Sev	Level	Explanation
61107	E	1, 2, 3	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. This message contains raw data that must be decoded. Check the storage system log for disk errors.
61108	E	1, 2, 3	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. This message contains raw data that must be decoded. Check the storage system log for disk errors.
61109	W	1, 2, 3	The storage system aborted a SCSI command on the specified DSM ID (I_T_L nexus). The I/O will be retried. This message contains raw data that must be decoded. This is a common event during storage system giveback.
61110	E	1, 2, 3	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	1, 2, 3	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	1, 2, 3	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	3	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	3	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	3	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	1, 2, 3	The port servicing the specified DSM ID (I_T_L nexus) did not finish processing an I/O request.
61117	I	1, 2, 3	The port servicing the specified DSM ID (I_T_L nexus) cancelled an I/O operation successfully.

ID	Sev	Level	Explanation
61118	W	1, 2, 3	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	1, 2, 3	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	2, 3	The port servicing the specified DSM ID (I_T_L nexus) reported that an I/O operation request was not supported.
61121	E	1, 2, 3	The port servicing the specified DSM ID (I_T_L nexus) reported that the bus is no longer valid.
61122	E	1, 2, 3	The port servicing the specified DSM ID (I_T_L nexus) reported that the LUN is no longer present.
61123	E	1, 2, 3	The port servicing the specified DSM ID (I_T_L nexus) reported that an I/O operation timed out. This event is usually triggered when the target is extremely busy and does not respond within the timeout period allowed. The DSM retries these operations automatically. If LUN statistics from AutoSupport or Perfstat show the LUN is not very busy at the time of the event, the event might be caused by a degraded SFP or other hardware component in the path.
61124	E	1, 2, 3	The port servicing the specified DSM ID (I_T_L nexus) reported that the LUN did not respond to selection.
61125	E	1, 2, 3	The port servicing the specified DSM ID (I_T_L nexus) reported that an I/O command timed out.
61126	E	1, 2, 3	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	2, 3	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	1, 2, 3	The port servicing the specified DSM ID (I_T_L nexus) reported a parity error. The request will be retried.

ID	Sev	Level	Explanation
61129	E	1, 2, 3	The port servicing the specified DSM ID (I_T_L nexus) failed a request-sense command. The request will be retried.
61130	E	1, 2, 3	The port servicing the specified DSM ID (I_T_L nexus) did not respond to an I/O request.
61131	E	1, 2, 3	The port servicing the specified DSM ID (I_T_L nexus) disconnected unexpectedly.
61132	E	1, 2, 3	The port servicing the specified DSM ID (I_T_L nexus) reported an illegal phase sequence failure.
61133	E	1, 2, 3	The port servicing the specified DSM ID (I_T_L nexus) reported an improper SRB request.
61134	I	1, 2, 3	The port servicing the specified DSM ID (I_T_L nexus) reported that a request for status was stopped.
61135	W	1, 2, 3	The port servicing the specified DSM ID (I_T_L nexus) reported that the LUN is invalid.
61136	E	1, 2, 3	The port servicing the specified DSM ID (I_T_L nexus) reported that the storage system is no longer available.
61137	W	1, 2, 3	The port servicing the specified DSM ID (I_T_L nexus) reported a bad function request in an I/O request.
61138	W	1, 2, 3	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	1, 2, 3	The port servicing the specified DSM ID (I_T_L nexus) reported that the storage system is not powered.
61140	W	1, 2, 3	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	1, 2, 3	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	1, 2, 3	The specified nexus (path) failed.
61143	I	1, 2, 3	The specified nexus (path) is working normally.
61144	W	1, 2, 3	The specified DSM ID (I_T_L nexus) was used for an I/O operation, because there we no paths without I/O errors.

ID	Sev	Level	Explanation
61145	W	1, 2, 3	The specified nexus (path) is degraded. One or more DSM IDs (I_T_L nexuses) have lost connectivity with the storage system.
61146	I	2, 3	The specified DSM ID (I_T_L nexus) is reserved by host clustering software.
61147	I	2, 3	The reservation for the specified DSM ID (I_T_L nexus) was released.
61148	W	2, 3	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	1, 2, 3	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.
61150	W	1, 2, 3	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 it's 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	1, 2, 3	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	1, 2, 3	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	1, 2, 3	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.

ID	Sev	Level	Explanation
61154	I	1, 2, 3	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	1, 2, 3	The specified DSM ID (I_T_L nexus) failed to release a LUN.
61156	W	1, 2, 3	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	1, 2, 3	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	1, 2, 3	The reservation for the specified LUN was lost.
61201	I	1, 2, 3	The specified DSM ID (I_T_L nexus) has transitioned to the active state.
61202	I	1, 2, 3	The specified DSM ID (I_T_L nexus) has transitioned to the passive state.
61203	E	1, 2, 3	The specified DSM ID (I_T_L nexus) has transitioned to the failed state.
61204	W	1, 2, 3	The specified DSM ID (I_T_L nexus) is in the process of being removed.
61205	W	1, 2, 3	The specified DSM ID (I_T_L nexus) was removed.
61206	W	1, 2, 3	The specified DSM ID (I_T_L nexus) has transitioned to the disabled state.
61207	I	1, 2, 3	The specified DSM ID (I_T_L nexus) has transitioned to the pending active state.
61208	I	1, 2, 3	The specified DSM ID (I_T_L nexus) has transitioned to the pending passive state.
61209	W	1, 2, 3	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 cfmodesetting is not single_image or standby.

ID	Sev	Level	Explanation
61212	E	1, 2, 3	The DSM ID for the virtual disk with the specified serial number does not have ALUA enabled. This event is logged whenever the specified path changes state or the LUN is first discovered. ALUA is required for FC paths starting with DSM 3.4. Enable ALUA and reboot the Windows host.

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