



Windows® Unified Host Utilities 7.0

Using Windows Hosts with ONTAP Storage

March 2017 | 215-09444_BO
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Preparing to use Windows hosts with ONTAP storage

You must prepare the Windows host to access ONTAP storage by creating LUNs and ensuring that the LUNs are available. You can do this by creating LUNs that are of the appropriate type, configuring initiator groups (igroups), setting up iSCSI and FC targets, and partitioning the LUNs.

Setting up LUNs

LUNs are the basic unit of storage in a SAN configuration. The Windows host sees LUNs on your storage system as virtual disks.

LUN overview

You can use a LUN the same way you use local disks on the host.

After you create the LUN, you must make it visible to the host. The LUN then appears on the Windows host as a disk. You can:

- Format the disk. To do this, you must initialize the disk and create a new partition. Only basic disks are supported with the native OS stack.
- Use the disk as a raw device. To do this, you must leave the disk offline. Do not initialize or format the disk.
- Configure automatic start services or applications that access the LUNs. You must configure these start services so that they depend on the Microsoft iSCSI initiator service.

LUN types to use for hosts and guest operating systems

The LUN type determines the on-disk layout of the LUN. The LUN type that you specify depends on the Windows version, the disk type, and the ONTAP version.

It is important to specify the correct LUN type to achieve good performance.

Note: Not all LUN types are available when you create LUNs by using the FilerView interface for some versions of ONTAP software. To use the `hyper_v`, `windows_2008`, `windows_gpt`, and `windows_lhs` LUN types, you might have to create the LUN by using the ONTAP command-line interface (CLI).

You can use the following table to select the correct LUN type:

LUN type	ONTAP versions	Windows disk type and version
windows	All	Master boot record (MBR) on Windows Server 2003
hyper_v	7.3.1 and later	Windows Server 2008 and Windows Server 2008 R2 Hyper-V LUNs containing virtual hard disks (VHDs). Note: For raw LUNs, you must use the child operating system type as the LUN type.
windows_2008	7.2.5, 7.3.0 RC2, and later	All disks on Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, and Windows Server 2016
windows_gpt	7.2.1 and later	GUID Partition Type (GPT) disks on Windows Server 2003
windows_lhs	7.3.0 RC1	All disks on Windows Server 2008
linux	7.2.4 and earlier	All disks on Windows Server 2008

Overview of creating LUNs

You can create LUNs manually or by using SnapDrive for Windows or the System Manager software.

You can access a LUN by using either the FC protocol or the iSCSI protocol. The procedure for creating LUNs is the same regardless of which protocol you use. You must create an initiator group (igroup), create a LUN, and then map the LUN to the igroup.

Note: If you are using the optional SnapDrive software, you must use SnapDrive for Windows to create LUNs and igroups. See the documentation for your version of SnapDrive software for specific steps. If you are using the optional System Manager software, see the online help for specific steps.

The igroup must be the correct type for the protocol that you are using to access the LUN. You cannot use an iSCSI igroup when you are using the FC protocol to access the LUN. If you want to access a LUN with both FC and iSCSI protocols, you must create two igroups (one FC igroup and one iSCSI igroup). For ONTAP, you can create an igroup with mixed protocol type.

To create igroups and LUNs on the storage system, you can use the `lun setup` command for Data ONTAP operating in 7-Mode and the `vserver setup` command for ONTAP. You can also create igroups and LUNs by executing a series of individual commands, such as, `igroup create`, `lun create`, and `lun map`. Detailed steps for creating LUNs are included in the *SAN Administration Guide* (formerly the *Block Access Management Guide for iSCSI and FC*) for your version of ONTAP.

Initiator group overview

Initiator groups (igroups) specify which hosts can access specified LUNs on the storage system. You can create igroups manually, or you can use the optional SnapDrive for Windows software, which automatically creates igroups.

Initiator groups are protocol-specific.

- For FC connections, you should create an FC igroup by using all of the WWPNs for the host.
- For iSCSI connections, you should create an iSCSI igroup by using the iSCSI node name of the host.
- For systems using both FC and iSCSI connections to the same LUN, you should create two igroups: one for FC and one for iSCSI; you should then map the LUN to both igroups. ONTAP supports mixed protocol igroups when used with Data ONTAP DSM 3.5 and later.

Note: You cannot create a combined FC/iSCSI igroup when ONTAP is used with Microsoft DSM (msdsm) or Microsoft iSCSI DSM.

Note: See the "Windows configurations that support ALUA" section for configurations in which ALUA must be enabled.

ALUA for igroups must be disabled when using the Data ONTAP DSM 3.3.1 for Windows MPIO or earlier.

There are many ways to create and manage igroups and LUNs on your storage system. These processes vary, depending on your configuration. These topics are covered in detail in the *SAN Administration Guide* (formerly the *Block Access Management Guide for iSCSI and FC*) for your version of ONTAP.

If you use the optional SnapDrive for Windows software, the software creates igroups as required. Starting with SnapDrive 6.4 for Windows, the SnapDrive software enables ALUA when it detects the

Data ONTAP DSM for Windows MPIO. Starting with SnapDrive 6.2 for Windows, the SnapDrive software enables ALUA when it detects the msdsm. For earlier versions of SnapDrive for Windows, you must manually enable ALUA.

Mapping LUNs to igroups

When you map a LUN to an igroup, you assign the LUN identifier.

You must assign the LUN ID of 0 to any LUN that will be used as a boot device. LUNs with IDs other than 0 are not supported as boot devices.

If you map a LUN to both an FC igroup and an iSCSI igroup, the LUN has two different LUN identifiers.

Note: The Windows operating system only recognizes LUNs with identifiers 0 through 254, regardless of the number of LUNs mapped. Be sure to map your LUNs to numbers in this range.

About mapping LUNs for Windows clusters

When you use clustered Windows systems, all members of the cluster must be able to access LUNs for shared disks.

Map shared LUNs to an igroup for each node in the cluster.

Attention: If more than one host is mapped to a LUN, you must run clustering software on the hosts to prevent data corruption.

About FC targets

The host automatically discovers FC targets that are accessible to its HBAs. However, you do need to verify that the host selects only primary (optimized) paths to FC targets.

About non-optimized paths in FC configurations

Non-optimized paths are intended for use when certain storage system resources are not available.

A configuration has both optimized and non-optimized FC paths. Non-optimized paths have higher overhead and possibly lower performance. To prevent performance problems, make sure the FC paths are configured so that non-optimized paths are only used when there is a failure.

If your FC paths are not configured correctly, routine traffic can flow over a non-optimized path. The storage system measures FC traffic over optimized and non-optimized paths. If it detects significant traffic on a non-optimized path, the storage system issues a log message and triggers an AutoSupport message.

Verifying FC paths to LUNs

When you configure your host for FC, you should verify that the active paths are optimized paths.

About this task

You can verify the paths by mapping a LUN to the host on each storage system node, generating I/O to the LUN, and then checking the FC statistics on each node.

For ONTAP, you must run the `sysstat` command through the nodeshell. You can access the nodeshell by using the `system node run` command. For information about how to use the `system node run` command, see the man page.

Steps

1. Map a LUN to the host on each node.

2. On the consoles of each node, display the statistics:

```
sysstat -b
```

3. Generate I/O to the LUNs.
4. Check the FC statistics on each storage system node to verify that the non-optimized paths have zero traffic. The `sysstat` command periodically writes a line of statistics to the console. Check the Partner columns; the values should remain close to zero, while the FCP columns should show data.

Note: Some initiators send occasional traffic over passive paths, so you typically see some traffic on non-optimized paths even when the system is correctly configured.

5. Press **Ctrl-C** to exit the `sysstat` command on each console.

If the partner values remain close to zero, the traffic is flowing over the correct paths. If the Partner values are high, as in the following example, the paths are not configured correctly.

Example of high partner values

In this example, all FC traffic is flowing over non-optimized paths. Some columns from the output of the `sysstat` command are removed from the example to make it easier to read.

CPU	FCP	Partner	Total	FCP in	kB/s out	Partner in	kB/s out
26%	1785	0	1785	67096	43	0	0
17%	1679	0	1679	62265	40	0	0
15%	1709	0	1709	64985	41	0	0
14%	1764	0	1764	66816	42	0	0
15%	1777	0	1777	67430	43	0	0
14%	1737	0	1737	65934	42	0	0
15%	1771	0	1771	66583	42	0	0
9%	1573	0	1573	43245	53662	0	0
4%	1149	0	1149	202	152276	0	0
13%	1143	0	1143	27	148661	0	0
4%	1083	0	1083	26	144865	0	0
4%	1081	0	0	1081	26	0	0

Verifying FC path configurations by using the Data ONTAP DSM

When running the Data ONTAP DSM for Windows MPIO, you should verify any FC path configurations that are using Active/Non-optimized paths to the LUNs during routine operations.

About this task

Data ONTAP DSM supports ALUA and the appropriate path will be selected based on the ALUA state for the default load balance policy (Dynamic Least Queue Depth) and other Active/Active load balance policies. The default load balance policy should be used.

Steps

1. Use the DSM management interface to verify the paths to the LUNs.

The detailed display for each LUN shows whether the LUN is using an Active/Non-optimized path.

For more information about using the Data ONTAP DSM interfaces to verify the LUN and path information from a Windows Server, see the *Installation and Administration Guide* for your version of the Data ONTAP DSM.

2. Based on the type of policy used, reconfigure the paths to the LUN or verify the fabric connectivity and initiator group assignments for the LUN.

If the policy used is...	Then do this...
Active/Passive load balance policy	Reconfigure the paths to the LUN so that the LUN do not use an Active/Non-optimized path under normal conditions.
Active/Active load balance policy	Verify the proper fabric connectivity and initiator group assignments for the LUN.

Verifying FC path configurations by using the Microsoft msdsm

When running a supported Microsoft operating system, you must verify any FC path configurations that are using Active/Non-optimized to the LUNs during routine operations.

About this task

The Microsoft msdsm selects FC paths using ALUA.

Steps

1. Verify that you are running a supported version of ONTAP software.
2. Verify that ALUA is enabled on the igroup.
3. Verify the state of the path from the Windows host.

Accessing LUNs

To access LUNs when you are using the iSCSI protocol, you must add an entry for the storage system using the iSCSI Initiator Properties dialog box on the host.

About this task

For Data ONTAP 7.3 and Data ONTAP operating in 7-Mode, you only need one entry for each storage system in the configuration, regardless of the number of interfaces that are enabled for the iSCSI traffic. An active/active or HA pair storage system configuration must have two entries, one for each storage system node in the configuration.

For ONTAP, you must create an entry for each iSCSI logical interface on each node that can access the LUN. MPIO software on the host is required to select the correct path or paths.

You can also add entries for the targets using the `iscsicli` interface. You can enter `iscsicli help` on the Windows command line for more information about the `iscsicli` interface.

If you are using SnapDrive for Windows software, you must use the SnapDrive interface to add iSCSI targets.

Steps

1. Open the **iSCSI Initiator Properties** dialog box.

For...	Do this...
Windows Server 2012, Windows Server 2012 R2, or Windows Server 2016	Click Server Manager > Dashboard > Tools > iSCSI Initiator .
Windows Server 2008 or Windows Server 2008 R2	Click Start > Administrative Tools > iSCSI Initiator .

2. Discover the iSCSI target port on the storage system.

For...	Do this...
Windows Server 2012, Windows Server 2012 R2, or Windows Server 2016	Click Discover Portal on the Discovery tab, and then enter the IP address of the iSCSI target port.
Windows Server 2008 or Windows Server 2008 R2	Click Add Portal on the Discovery tab, and then enter the IP address of the iSCSI target port.

3. Connect to the storage system.

For...	Do this...
Windows Server 2012, Windows Server 2012 R2, or Windows Server 2016	Click Targets , select an iSCSI target, and then click Connect . Note: You must verify that the initiator and target portal IP addresses are specified in Advanced Settings , and you should not select <code>default</code> for the initiator.
Windows Server 2008 or Windows Server 2008 R2	Click Targets , select an iSCSI target, and then click Log on . Note: You must verify that the initiator and target portal IP addresses are specified in Advanced Settings , and you should not select <code>default</code> for the initiator.

4. If you want the LUNs to be persistent across host reboots, update the **Connect To Target** dialog box.

For...	Do this...
Windows Server 2012, Windows Server 2012 R2, or Windows Server 2016	Click Properties > Add session and then select Add this connection to the list of Favorite Targets .
Windows Server 2008 or Windows Server 2008 R2	Click Properties > Add session and then select Automatically restore this connection when the computer starts .

5. If you are using MPIO or multiple connections per session, click **Enable multi-path** in the **Connect To Target** dialog box, and create additional connections to the target as required.

Enabling the optional MPIO support or multiple-connections-per-session support does not automatically create multiple connections between the host and storage system. You must explicitly create the additional connections.

For Windows Server 2008, 2008 R2, 2012, 2012 R2, or 2016, see the corresponding iSCSI topics in Help.

About dependent services on the Native Stack and iSCSI

When you use disks based on iSCSI LUNs on a Host Utilities Native stack, you must reconfigure any dependent service or application to start after the iSCSI service.

The Windows disks that are based on iSCSI LUNs become available later in the startup sequence than the local disks do. This can create a problem if you have not reconfigured the dependent services or applications.

Accessing LUNs on hosts that use the native OS stack

To access a LUN when you are using the native OS stack, you must make the LUN visible to the Windows host.

About this task

These steps apply only to the native OS stack.

Steps

1. Open the **Computer Management** window.

If you are using...	Then do this...
Windows Server 2012	Click Server Manager > Dashboard > Tools > Computer Management .
Windows Server 2003, Windows Server 2008, Windows Server 2008 R2, and Windows Vista	Click My Computer on your desktop, and then right-click and select Manage .

2. Expand **Storage**, and double-click the **Disk Management** folder.
3. From the **Action** menu, select **Rescan Disks**.
4. From the **Action** menu, select **Refresh**.
5. In the **Computer Management** window with **Storage** expanded and the **Disk Management** folder open, check the lower right pane to verify that the newly created LUN is visible as a disk on the host.

Overview of initializing and partitioning the disk

You can create one or more basic partitions on the LUN.

After you rescan the disks, the LUN appears in the Disk Management folder as an unallocated disk.

If you format the disk as NTFS, be sure to select the **Perform a quick format** option.

The procedures for initializing disks vary depending on which version of Windows you are running on the host. For more information, see the Windows Disk Management online Help.

Setting up a SAN boot LUN for Windows Server

You can boot up a host from a storage system LUN instead of an internal hard disk. SAN booting can help to improve system availability, enable centralized administration, and eliminate the costs associated with maintaining and servicing hard drives.

Before you begin

- Your system must support SAN boot LUNs.
See the Interoperability Matrix for the latest SAN booting requirements for your operating system version.
- For Fibre Channel HBAs, specific queue depths provide best results.
It is a best practice to tune the queue depths on the server-side HBA for Windows hosts to 254 for Emulex HBAs or 256 for QLogic HBAs.

Note: To avoid host queuing, the host queue depths should not exceed the target queue depths on a per-target basis. For more information about target queue depths, see the *SAN Configuration Guide* for your version of ONTAP software.

- Fibre Channel SAN booting does not require support for special SCSI operations; it is not different from any other SCSI disk operation.
The HBA uses code in the BIOS that enables the host to boot from a LUN on the storage system. iSCSI SAN booting also uses code in the BIOS that enables the host to boot from a LUN on the storage system. However, you must have set specific parameters in the BIOS to enable iSCSI SAN booting.

Steps

1. Enable BootBIOS on the HBA.

BootBIOS firmware is installed on your HBA, but it is disabled by default. For information about how to enable BootBIOS on the HBA, see your HBA vendor-specific documentation.

2. Add the initiator to an igroup.

You can use this igroup to specify the host that can access the boot LUN. To add the initiator to the igroup, you can enter the WWPN for Fibre Channel HBAs or the iSCSI node name. For information about creating and managing igroups, see the *SAN Administration Guide* for your version of ONTAP software.

3. Restrict the HBA to a single path to the boot LUN.

You can add additional paths after Windows is installed and you have a multipathing solution in place.

To limit a single path to the boot LUN, you can use an ONTAP feature called port sets. You create a port set, add the port (or LIF) to the port set, and then bind the port set to an igroup. Port sets are supported for Fibre Channel (Data ONTAP operating in 7-Mode and ONTAP) and for iSCSI (ONTAP only). For more information about port sets, see the *SAN Administration Guide* for your version of ONTAP software.

4. Create the LUN that you want to use as a boot device, and map it to the igroup as LUN ID 0.

For information about creating LUNs, see the *SAN Administration Guide* for your version of ONTAP software.

For iSCSI boot solutions, see your vendor-specific documentation.

5. Use your HBA vendor's BootBIOS utility to configure the LUN as a boot device.
See your HBA vendor-specific documentation for instructions.
6. Reboot the host, and access the host BIOS utility.
7. Configure the host BIOS to set the boot LUN as the first disk device in the boot order.
See your host documentation for instructions.
8. Obtain the HBA device drivers for your version of Windows.
9. Install the Windows Server operating system and the HBA device driver on the boot LUN.
See your HBA vendor-specific documentation for instructions.
10. Install the Windows Host Utilities.
Note: For the latest information about SAN booting, including restrictions and configuration recommendations, see the *Windows Unified Host Utilities Release Notes*.

Related information

[*Microsoft Support Article 305547: Support for booting from a Storage Area Network \(SAN\)*](#)

[*NetApp Interoperability Matrix Tool*](#)

[*NetApp Documentation*](#)

[*Emulex Downloads and Documentation*](#)

[*Qlogic: Driver Downloads and Documentation*](#)

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