



Install SAN host utilities

SAN hosts and cloud clients

NetApp
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Install SAN host utilities

Overview

Discover the latest information on SAN host utility releases and access the installation procedure for your host configuration.



For reliable operation after installation, use the [NetApp Interoperability Matrix Tool](#) to verify that your host supports the complete NVMe over Fabrics (including NVMe over TCP and NVMe over Fibre Channel), iSCSI, FC, or FCoE configuration.

AIX Host Utilities

AIX Host Utilities 6.1 Release Notes

The release notes describe new features and enhancements, issues fixed in the current release, known problems and limitations, and important cautions related to configuring and managing your specific AIX host with your ONTAP storage system.

For specific information about the operating system versions and updates that the Host Utilities support, see the [NetApp Interoperability Matrix Tool](#).

What's new

The AIX Host Utilities 6.1 release contains the following new features and enhancements:

- AIX Host Utilities 6.1 added support for the memory fault issue that occurred in earlier versions of the AIX host OS. With AIX Host Utilities 6.1, only the sanlun binary has changed. The MPIO and related ODM remain unchanged.

Fixed in this release

BugID	Title	Description
872113	sanlun lun show -p command might cause a memory fault on some versions of AIX host OS	Intermittent instances of AIX coredump are reported while running the <code>sanlun lun show -p</code> command. Sanlun's <code>lun show -p</code> option provides the multipathing information for all the LUNs discovered on a host. It arranges this information to present which SCSI device is sourced from which LUN, the path state (primary or secondary), and other details. However, on some AIX hosts running the <code>sanlun lun show -p</code> command might cause a memory fault. This issue is observed only when you run the <code>sanlun</code> command with the <code>-p</code> option.

Known problems and limitations

You should be aware of the following known problems and limitations that might impact performance on your specific host.

Bug ID	Title	Description
1069147	AIX HU Sanlun reports incorrect HBA speed	Instances of sanlun displaying incorrect HBA speeds are reported while running the <code>sanlun fcp show adapter -v</code> command. The <code>sanlun fcp show adapter -v</code> command displays the HBA cards information, such as supported and negotiated speeds for the adapters. This seems to be a reporting issue only. To identify the actual speed, use the <code>fcstat fcsx</code> command.

[NetApp Bugs Online](#) provides complete information for most known issues, including suggested workarounds where possible. Some keyword combinations and bug types that you might want to use include the following:

- FCP General: Displays FC and HBA bugs that are not associated with a specific host.
- FCP - AIX

Install AIX Host Utilities 6.1

The AIX Unified Host Utilities assists you to manage NetApp ONTAP storage attached to an AIX host.

AIX Host Utilities support the following protocols:

- FC
- FCoE
- iSCSI

AIX Host Utilities support the following environments:

- AIX MPIO (Native OS)
- PowerVM

For more information about PowerVM, see the IBM PowerVM Live Partition Mobility Red Book.

What you'll need

- For reliable operation, verify that your entire iSCSI, FC, or FCoE configuration is supported.

You can use the [NetApp Interoperability Matrix Tool](#) to verify your configuration.

- Dynamic tracking must be enabled for all FC and FCoE initiators.



The NetApp AIX Host Utilities software package is available on the [NetApp Support Site](#) in a compressed tar.gz file. You must install the AIX Host Utilities kit while using AIX MPIO with NetApp ONTAP Storage.

Steps

1. Log in to your host.
 - On an AIX host, log in as **root**.
 - On a PowerVM host, log in as **padmin**, and then enter the `oem_setup_env` command to become root.
2. Go to the [NetApp Support Site](#) and download the compressed file containing the Host Utilities to a directory on your host.
3. Go to the directory containing the download.
4. Decompress the file and extract the SAN toolkit software package.

```
tar -xvf ntap_aix_host_utilities_6.1.tar.gz
```

The following directory is created when you decompress the file: `ntap_aix_host_utilities_6.1`. This directory will have one of the following subdirectories: `MPIO`, `NON_MPIO`, or `SAN_Tool_Kit`.

5. Install the AIX MPIO:

```
installp -aXYd /var/tmp/ntap_aix_host_utilities_6.1/MPIO
NetApp.MPIO_Host_Utilitys_Kit
```

6. Install the SAN toolkit:

```
installp -aXYd /var/tmp/ntap_aix_host_utilities_6.1/SAN_Tool_Kit
NetApp.SAN_toolkit
```

7. Reboot the host.
8. Verify the installation:

```
`sanlun version`
```

SAN Toolkit

AIX Host Utilities is a NetApp host software that provides a command line toolkit on your IBM AIX host. The toolkit is installed when you install the NetApp Host Utilities package. This kit provides the `sanlun` utility, which helps you manage LUNs and host bus adapters (HBAs). The `sanlun` command returns information about the LUNs mapped to your host, multipathing, and information necessary to create initiator groups.

Example

In the following example, the `sanlun lun show` command returns the LUN information.

```
#sanlun lun show all
```

Example output

```
controller(7mode)/ device host lun

vserver(Cmode) lun-pathname filename adapter protocol size mode
-----
data_vserver    /vol/vol1/lun1 hdisk0 fcs0    FCP        60g C
data_vserver    /vol/vol2/lun2 hdisk0 fcs0    FCP        20g C
data_vserver    /vol/vol3/lun3 hdisk11 fcs0    FCP        20g C
data_vserver    /vol/vol4/lun4 hdisk14 fcs0    FCP        20g C
```



This toolkit is common across all Host Utilities configurations and protocols. As a result, some of its contents apply to one configuration, but not another. Having unused components does not affect your system performance. The SAN toolkit is supported on AIX and PowerVM/VIOS OS versions.

AIX Host Utilities 6.1 sample command reference

You can use the AIX Host Utilities 6.1 sample command reference for an end-to-end validation of the NetApp storage configuration using the host utilities tool.

List all host initiators mapped to host

You can retrieve a list of host initiators mapped to a host.

```
# sanlun fcp show adapter -v
```

Example output

```
bash-3.2# sanlun fcp show adapter -v
adapter name: fcs0
WWPN: 100000109b22e143
WWNN: 200000109b22e143
driver name: /usr/lib/drivers/pci/emfcdd
model: df1000e31410150
model description: FC Adapter
serial number: YA50HY79S117
hardware version: Not Available
driver version: 7.2.5.0
firmware version: 00012000040025700027
Number of ports: 1
port type: Fabric
port state: Operational
supported speed: 16 GBit/sec
negotiated speed: Unknown
OS device name: fcs0
adapter name: fcs1
WWPN: 100000109b22e144
WWNN: 200000109b22e144
driver name: /usr/lib/drivers/pci/emfcdd
model: df1000e31410150
model description: FC Adapter
serial number: YA50HY79S117
hardware version: Not Available
driver version: 7.2.5.0
firmware version: 00012000040025700027
Number of ports: 1
port type: Fabric
port state: Operational
supported speed: 16 GBit/sec
negotiated speed: Unknown
OS device name: fcs1
bash-3.2#
```

List all LUNs mapped to host

You can retrieve a list of all LUNs mapped to a host.

```
# sanlun lun show -p -v all
```

Example output

```

ONTAP Path: vs_aix_clus:/vol/gpfs_205p2_207p1_vol_0_8/aix_205p2_207p1_lun
LUN: 88
LUN Size: 15g
Host Device: hdisk9
Mode: C
Multipath Provider: AIX Native
Multipathing Algorithm: round_robin

```

host	vserver	AIX	AIX		
path	path	MPIO	host	vserver	path
state	type	path	adapter	LIF	priority
up	primary	path0	fcs0	fc_aix_1	1
up	primary	path1	fcs1	fc_aix_2	1
up	secondary	path2	fcs0	fc_aix_3	1
up	secondary	path3	fcs1	fc_aix_4	1

List all LUNs mapped to host from a given SVM

You can retrieve a list of all LUNs mapped to a host from a specified SVM.

```
# sanlun lun show -p -v sanboot_unix
```

Example output

```

ONTAP Path: sanboot_unix:/vol/aix_205p2_boot_0/boot_205p2_lun
LUN: 0
LUN Size: 80.0g
Host Device: hdisk85
Mode: C
Multipath Provider: AIX Native
Multipathing Algorithm: round_robin

```

host	vserver	AIX	AIX		
path	path	MPIO	host	vserver	path
state	type	path	adapter	LIF	priority
up	primary	path0	fcs0	sanboot_1	1
up	primary	path1	fcs1	sanboot_2	1
up	secondary	path2	fcs0	sanboot_3	1
up	secondary	path3	fcs1	sanboot_4	1

List all attributes of a given LUN mapped to host

You can retrieve a list of all attributes of a specified LUN mapped to a host.

```
# sanlun lun show -p -v  
vs_aix_clus:/vol/gpfs_205p2_207p1_vol_0_8/aix_205p2_207p1_lun
```

Example output

```
ONTAP Path: vs_aix_clus:/vol/gpfs_205p2_207p1_vol_0_8/aix_205p2_207p1_lun  
LUN: 88  
LUN Size: 15g  
Host Device: hdisk9  
Mode: C  
Multipath Provider: AIX Native  
Multipathing Algorithm: round_robin
```

host	vserver	AIX	AIX MPIO		
path	path	MPIO	host	vserver	path
state	type	path	adapter	LIF	priority
up	primary	path0	fcs0	fc_aix_1	1
up	primary	path1	fcs1	fc_aix_2	1
up	secondary	path2	fcs0	fc_aix_3	1
up	secondary	path3	fcs1	fc_aix_4	1

List ONTAP LUN attributes by host device filename

You can retrieve a list of ONTAP LUN attributes by specifying a host device filename.

```
#sanlun lun show -d /dev/hdisk1
```

Example output

```

controller(7mode) /
device host lun
vserver(Cmode)      lun-pathname
-----
---
vs_aix_clus          /vol/gpfs_205p2_207p1_vol_0_0/aix_205p2_207p1_lun

filename adapter protocol size mode
-----
hdisk1      fcs0      FCP      15g   C

```

List all SVM target LIF WWPNs attached to host

You can retrieve a list of all SVM target LIF WWPNs attached to a host.

```
# sanlun lun show -wwpn
```

Example output

```

controller(7mode) /
target device host lun
vserver(Cmode)      wwpan          lun-pathname
-----
-----

vs_aix_clus          203300a098ba7afe
/vol/gpfs_205p2_207p1_vol_0_0/aix_205p2_207p1_lun
vs_aix_clus          203300a098ba7afe
/vol/gpfs_205p2_207p1_vol_0_9/aix_205p2_207p1_lun
vs_aix_clus          203300a098ba7afe
/vol/gpfs_205p2_207p1_vol_en_0_0/aix_205p2_207p1_lun_en
vs_aix_clus          202f00a098ba7afe
/vol/gpfs_205p2_207p1_vol_en_0_1/aix_205p2_207p1_lun_en

filename      adapter      size  mode
-----
hdisk1        fcs0          15g   C
hdisk10       fcs0          15g   C
hdisk11       fcs0          15g   C
hdisk12       fcs0          15g   C

```

HP-UX Host Utilities

HP-UX Host Utilities 6.0 Release Notes

The release notes describe new features and enhancements, issues fixed in the current release, known problems and limitations, and important cautions related to configuring and managing your specific HP-UX host with your ONTAP storage system.

The HP-UX Host Utilities 6.0 continues to support the following versions:

- HP-UX 11iv2
- HP-UX 11iv3

There are no new features, enhancements, known limitations, or cautions for the HP-UX host utilities 6.0 release.

HP-UX Host Utilities 6.0

The HP-UX Host Utilities enable you to connect an HP-UX host to NetApp storage.

The HP-UX Host Utilities supports multiple protocols and the following environments:

- Native MPIO
- Veritas Dynamic Multipathing (DMP)



To indicate which environment is being used, this document sometimes specifies "DMP" for the Veritas DMP environment and "MPIO" for the HP-UX native environment. In some cases, the commands you use might vary depending on which drivers you are using. In those cases, both the environment and driver types are specified.

What you'll need

- For reliable operation, verify that your entire iSCSI, FC, or FCoE configuration is supported.

You can use the [NetApp Interoperability Matrix Tool](#) to verify your configuration.

About this task

The NetApp HP-UX Host Utilities software package is available on the [NetApp Support Site](#) in a compressed file. After you download the file, you must decompress it before installation.

Steps

1. Log in to your host.
2. Download the HP-UX Host Utilities file `netapp_hpux_host_utilities_6.0_ia_pa.depot.gz` from the [NetApp Support Site](#) to your HP-UX host.
3. Decompress the `netapp_hpux_host_utilities_6.0_ia_pa.depot.gz` file:

```
# gunzip netapp_hpux_host_utilities_6.0_ia_pa.depot.gz
```

The system places the extracted software in the directory where you uncompressed the depot file.

4. Install the software:

```
# swinstall -s /depot_path
```

`depot_path` provides the path and name of the depot file.

The `swinstall` command runs an installation script that verifies the status of your HP-UX setup. If your system meets the requirements, this script installs the `sanlun` utility and diagnostic scripts in the `/opt/NetApp/santools/bin` directory.

5. Verify the installation:

```
sanlun version
```

SAN Toolkit

HP-UX Host Utilities is a NetApp host software that provides a command line tool kit on your HP-UX host. The toolkit is installed when you install the NetApp Host Utilities package. This kit provides the `sanlun` utility which helps you manage the LUNs and host bus adapters. (HBAs). The `sanlun` command returns information about the LUNs mapped to your host, multipathing, and information necessary to create initiator groups.

Example

In the following example, the `sanlun lun show` command returns the LUN information.

```
# sanlun lun show all

controller(7mode)/ device host lun
vserver(Cmode)      lun-pathname      filename
adapter  protocol  size  mode
-----
sanboot_unix      /vol/hpux_boot/boot_hpux_lun      /dev/rdisk/c34t0d0
fclp1      FCP      150g  C
sanboot_unix      /vol/hpux_boot/boot_hpux_lun      /dev/rdisk/c23t0d0
fclp1      FCP      150g  C
sanboot_unix      /vol/hpux_boot/boot_hpux_lun      /dev/rdisk/c12t0d0
fclp0      FCP      150g  C
sanboot_unix      /vol/hpux_boot/boot_hpux_lun      /dev/rdisk/c81t0d0
fclp0      FCP      150g  C
```



This toolkit is common across all Host Utilities configurations and protocols. As a result, some of its contents apply to one configuration, but not another. Having unused components does not affect your system performance.

HP-UX Host Utilities 6.0 command reference

You can use the HP-UX Unified Host Utilities 6.0 sample command reference for an end-to-end validation of the NetApp storage configuration using the host utilities tool.

List all host initiators mapped to host

You can retrieve a list of all host initiators mapped to a host.

```
# sanlun fcp show adapter -v
```

Example output

```
adapter name:      fclp2
WWPN:              10000000c985ef92
WWNN:              20000000c985ef92
driver name:       fclp
model:             AJ763-63001
model description: HP 8Gb Dual Channel PCI-e 2.0 FC HBA
serial number:     MY19034N9U
hardware version:  3
driver version:    @(#) FCLP: PCIe Fibre Channel driver (FibrChanl-02),
B.11.31.1805, Feb  5 2018, FCLP_IFC (3,2)
firmware version:  2.02X2 SLI-3 (U3D2.02X2)
Number of ports:   1 of 2
port type:         Unknown
port state:        Link Down
supported speed:   8 GBit/sec
negotiated speed:  Speed not established
OS device name:    /dev/fclp2

adapter name:      fclp3
WWPN:              10000000c985ef93
WWNN:              20000000c985ef93
driver name:       fclp
model:             AJ763-63001
model description: HP 8Gb Dual Channel PCI-e 2.0 FC HBA
serial number:     MY19034N9U
hardware version:  3
driver version:    @(#) FCLP: PCIe Fibre Channel driver (FibrChanl-02),
B.11.31.1805, Feb  5 2018, FCLP_IFC (3,2)
firmware version:  2.02X2 SLI-3 (U3D2.02X2)
Number of ports:   2 of 2
port type:         Unknown
port state:        Link Down
supported speed:   8 GBit/sec
negotiated speed:  Speed not established
OS device name:    /dev/fclp3
```

List all LUNs mapped to host

You can retrieve a list of all LUNs mapped to a host.

```
# sanlun lun show -p -v all
```

Example output

```
\
                                ONTAP Path:
vs_hp_cluster:/vol/chathpux_217_vol_en_1_10/hp_en_217_lun
                                LUN: 55
                                LUN Size: 15g
                                Host Device: /dev/rdisk/disk718
                                Mode: C
                                VG: /dev/vg_data
                                Multipath Policy: A/A
                                Multipath Provider: Native
-----
host      vservers      /dev/dsk
HP A/A
path      path          filename              host      vservers
path failover
state     type           or hardware path      adapter LIF
priority
-----
up        primary         /dev/dsk/c37t6d7      fclp0     hpux_7
0
up        primary         /dev/dsk/c22t6d7      fclp1     hpux_8
0
up        secondary      /dev/dsk/c36t6d7      fclp0     hpux_5
1
up        secondary      /dev/dsk/c44t6d7      fclp1     hpux_6
1
```

List all LUNs mapped to host from a given SVM

You can retrieve a list of all LUNs mapped to host from a certain SVM.

```
# sanlun lun show -p -v vs_hp_cluster
```

Example output

```

ONTAP Path:
vs_hp_cluster:/vol/chathpux_217_vol_en_1_10/hp_en_217_lun
    LUN: 55
    LUN Size: 15g
    Host Device: /dev/rdisk/disk718
    Mode: C
    VG: /dev/vg_data
    Multipath Policy: A/A
    Multipath Provider: Native

```

```

-----
-----
host      vservers  /dev/dsk
HP A/A
path      path      filename      host      vservers
path failover
state     type      or hardware path  adapter LIF
priority
-----
-----
up        primary    /dev/dsk/c37t6d7  fclp0     hpux_7
0
up        primary    /dev/dsk/c22t6d7  fclp1     hpux_8
0
up        secondary  /dev/dsk/c36t6d7  fclp0     hpux_5
1
up        secondary  /dev/dsk/c44t6d7  fclp1     hpux_6
1

```

List all attributes of a given LUN mapped to host

You can retrieve a list of all attributes of a specified LUN mapped to a host.

```

# sanlun lun show -p -v
vs_hp_cluster:/vol/chathpux_217_vol_en_1_5/hp_en_217_lun

```

Example output

```

ONTAP Path:
vs_hp_cluster:/vol/chathpux_217_vol_en_1_5/hp_en_217_lun
    LUN: 49
    LUN Size: 15g
    Host Device: /dev/rdisk/disk712
    Mode: C
    VG: /dev/vg_data
    Multipath Policy: A/A
    Multipath Provider: Native

```

```

-----
-----
host      vservers    /dev/dsk
HP A/A
path      path        filename          host      vservers
path failover
state     type         or hardware path  adapter LIF
priority
-----
-----
up        primary    /dev/dsk/c37t6d1  fclp0     hpux_7
0
up        primary    /dev/dsk/c22t6d1  fclp1     hpux_8
0
up        secondary  /dev/dsk/c36t6d1  fclp0     hpux_5
1
up        secondary  /dev/dsk/c44t6d1  fclp1     hpux_6
1

```

List ONTAP LUN attributes by host device filename

You can retrieve a list of ONTAP LUN attributes by a specified host device filename.

```
#sanlun lun show -dv /dev/rdisk/disk716
```

Example output

host	lun	device	
vserver	lun-pathname	filename	
adapter	protocol	size	mode

vs_hp_cluster	/vol/chathpux_217_vol_en_1_14/hp_en_217_lun		
/dev/rdisk/disk716 0	FCP	15g	C
LUN Serial number: 80D71?NiNP5U			
Controller Model Name: AFF-A800			
Vserver FCP nodename: 208400a098ba7afe			
Vserver FCP portname: 207e00a098ba7afe			
Vserver LIF name: hpux_5			
Vserver IP address: 10.141.54.30			
10.141.54.35			
10.141.54.37			
10.141.54.33			
10.141.54.31			
Vserver volume name: chathpux_217_vol_en_1_14			
MSID::0x000000000000000000000000080915935			
Vserver snapshot name:			

List all SVM target LIF WWPNs attached to host

You can retrieve a list of all SVM target LIF WWPNs attached to a host.

```
# sanlun lun show -wwpn
```

Example output

```

controller(7mode) /
vserver(Cmode)      target wwpn      lun-pathname
device filename
-----
vs_hp_cluster      208300a098ba7afe
/vol/chathpux_217_vol_en_1_10/hp_en_217_lun  /dev/rdisk/c22t6d7
vs_hp_cluster      208100a098ba7afe
/vol/chathpux_217_vol_en_1_10/hp_en_217_lun  /dev/rdisk/c44t6d7
vs_hp_cluster      208200a098ba7afe
/vol/chathpux_217_vol_en_1_10/hp_en_217_lun  /dev/rdisk/c37t6d7
vs_hp_cluster      207e00a098ba7afe
/vol/chathpux_217_vol_en_1_10/hp_en_217_lun  /dev/rdisk/c36t6d7
vs_hp_cluster      207d00a098ba7afe  /vol/chathpux_217_os/hp_217_os
/dev/rdisk/c18t7d4
vs_hp_cluster      207f00a098ba7afe  /vol/chathpux_217_os/hp_217_os
/dev/rdisk/c42t7d4

host adapter      lun size      mode
-----
fclp1              15g           C
fclp1              15g           C
fclp0              15g           C
fclp0              15g           C
fclp1              30g           C
fclp0              30g           C

```

Linux Unified Host Utilities

Linux Unified Host Utilities 7.1 Release Notes

The release notes describe new features and enhancements, known problems and limitations, and important cautions for configuring and managing your specific host with your ONTAP storage system.

For specific information about the operating system versions and updates that the Host Utilities support, see the [NetApp Interoperability Matrix Tool](#).

What's New

The Linux Host Utilities 7.1 release contains the following new features and enhancements:

- Linux Host Utilities is now called *Linux Unified Host Utilities* because it supports NetApp E-Series storage systems running SANtricity as well as AFF, FAS, and ASA systems running ONTAP.



Any mention of Host Utilities or Linux Host Utilities in this document refers to Linux Unified Host Utilities.

- The following operating systems are now supported:
 - SUSE Linux Enterprise Server 15 series
 - Oracle VM 3.2 series
 - Oracle Linux 6 and 7 series
 - Red Hat Enterprise Linux 6 and 7 series
 - SUSE Linux Enterprise Server 11 SP4
 - KVM and XEN, RHEV 6.4 and 6.5
 - Citrix XenServer
- On Red Hat Enterprise Linux (RHEL) 6 and RHEL 7 hosts, a tuned package for setting server profiles is now supported. You can use the `tuned-adm` command to set different profiles, depending on the environment. For example, you can also use the virtual guest profile as a guest virtual machine and you can use the enterprise storage profile for configurations where LUNs from enterprise storage arrays are used. Using these tuned packages can result in improvement in throughput and latency in ONTAP.
- Adds support for 32GB FC adapters from Broadcom Emulex and Marvell Qlogic.



NetApp continues to work with the Host Utilities to add support for features after the initial release. For latest information about the features that are supported and the new features that have been added, see the [NetApp Interoperability Matrix Tool](#).

Fixed in this release

The intermittent host OS failure issue that occurs when running the `sanlun lun show -p` command in SLES12SP1, OL7.2, RHEL7.2, and RHEL 6.8 is fixed in this release.

Known problems and limitations

The Linux Host Utilities 7.1 release has the following known problems and limitations.

NetApp Bug ID	Title	Description
1457017	sanlun installation issues warning messages related to <code>libdevmapper.so</code> and <code>libnl.so</code> libraries. These warnings do not affect the functionality of <code>sanlun</code> kit.	<p>When you execute the Linux Unified Host Utilities CLI command - "sanlun fcp show adapter -v" on a SAN host, the command fails with an error message displaying that the library dependencies required for an host bus adapter (HBA) discovery cannot be located:</p> <pre>[root@hostname ~]# sanlun fcp show adapter -v Unable to locate /usr/lib64/libHBAAPI.so library Make sure the package installing the library is installed & loaded Refer to the public report 1508554.</pre>

[NetApp Bugs Online](#) provides complete information for most known issues, including suggested workarounds where possible.

Install Linux Unified Host Utilities 7.1

The Linux Unified Host Utilities (LUHU) assists you to manage NetApp ONTAP storage attached to a Linux host. NetApp strongly recommends installing the Linux Unified Host Utilities, but it is not mandatory. The utilities do not change any settings on your Linux host. The utilities improve management and assist NetApp customer support in gathering information about your configuration.

The following Linux distributions are supported:

- Red Hat Enterprise Linux
- SUSE Linux Enterprise Server
- Oracle Linux
- Oracle VM
- Citrix XenServer

What you'll need

The NetApp Linux Unified Host Utilities software package is available on the [NetApp Support Site](#) in a 32-bit or 64-bit .rpm file.

- For reliable operation, you must verify that your entire iSCSI, FC, or FCoE configuration is supported.

You can use the [NetApp Interoperability Matrix Tool](#) to verify your configuration.

- You must install the host bus adapter (HBA) management packages available on the vendor support site.

The management software enables the SAN toolkit commands to gather information about the FC HBAs, such as their WWPNs. For the `sanlun fcp show adapter` command to work, verify that the following packages are correctly installed:

- Marvell QLogic HBA – QConvergeConsole CLI
- Broadcom Emulex HBA - OneCommand Manager core application CLI
- Marvell Brocade HBA – Brocade Command Utility CLI
- RPM Packages "libhbaapi" and "libhbalinux" available for each Linux distribution should be installed on the host OS.



Linux Unified Host Utilities software does not support NVMe over Fibre Channel (NVMe/FC) and NVMe over TCP (NVMe/TCP) host protocols.

Steps

1. If you have a version of Linux Unified Host Utilities currently installed, use the following command to remove it:

```
rpm -e netapp_linux_unified_host_utilities-7-1
```

For older versions of Linux Host Utilities, go to the directory where the host utility software is installed and enter the uninstall command to remove the installed package.

2. Download the 32-bit or 64-bit Linux Unified Host Utilities software package from the [NetApp Support Site](#) to your host.
3. Go to the directory to which you downloaded the software package and use the following command to install it:

```
rpm -ivh netapp_linux_unified_host_utilities-7-1.x86_xx.rpm
```

Example output

```
Verifying... #####
[100%]
Preparing... #####
[100%]
Updating / installing...
 1:netapp_linux_unified_host_utiliti#####
[100%]
```

4. Verify the installation:

```
sanlun version
```

Example output

```
sanlun version 7.1.386.1644
```

Recommended driver settings with Linux kernel

When you configure an FC environment that uses native inbox drivers that are bundled with the Linux kernel, you can use the default values for the drivers.

SAN Toolkit

Linux Unified Host Utilities is a NetApp host software that provides a command line tool kit on your Linux host.

The toolkit is installed automatically when you install the NetApp Host Utilities package. This kit provides the `sanlun` utility, which helps you manage LUNs and HBAs. The `sanlun` command returns information about the LUNs mapped to your host, multipathing, and information necessary to create initiator groups.

Example

In the following example, the `sanlun lun show` command returns LUN information.

```
# sanlun lun show all
```

Example output:

```
controller(7mode/E-Series)/      device      host      lun
vserver(cDOT/FlashRay)    lun-pathname filename  adapter  protocol  size
Product
-----
data_vserver              /vol/vol1/lun1  /dev/sdb   host16    FCP
120.0g  cDOT
data_vserver              /vol/vol1/lun1  /dev/sdc   host15    FCP
120.0g  cDOT
data_vserver              /vol/vol2/lun2  /dev/sdd   host16    FCP
120.0g  cDOT
data_vserver              /vol/vol2/lun2  /dev/sde   host15    FCP
120.0g  cDOT
```



- This toolkit is common across all configurations and protocols of the Host Utilities. As a result, some of its contents apply to one configuration, but not another. Having unused components does not affect your system performance.
- The SAN toolkit is not supported on Citrix XenServer, Oracle VM, and Red Hat Enterprise Virtualization Hypervisor.

Linux Unified Host Utilities 7.1 command reference

You can use the Linux Unified Host Utilities 7.1 sample command reference for an end-to-end validation of the NetApp storage configuration using the host utilities tool.

List all host initiators mapped to host

You can retrieve a list of all host initiators mapped to a host.

```
# sanlun fcp show adapter -v
```

Example output

```

adapter name:      host15
WWPN:              10000090fa022736
WWNN:              20000090fa022736
driver name:       lpfc
model:             LPe16002B-M6
model description: Emulex LPe16002B-M6 PCIe 2-port 16Gb Fibre Channel
Adapter
serial number:     FC24637890
hardware version:  0000000b 00000010 00000000
driver version:    12.8.0.5; HBAAPI(I) v2.3.d, 07-12-10
firmware version:  12.8.340.8
Number of ports:   1
port type:         Fabric
port state:        Operational
supported speed:   4 GBit/sec, 8 GBit/sec, 16 GBit/sec
negotiated speed:  16 GBit/sec
OS device name:    /sys/class/scsi_host/host15

adapter name:      host16
WWPN:              10000090fa022737
WWNN:              20000090fa022737
driver name:       lpfc
model:             LPe16002B-M6
model description: Emulex LPe16002B-M6 PCIe 2-port 16Gb Fibre Channel
Adapter
serial number:     FC24637890
hardware version:  0000000b 00000010 00000000
driver version:    12.8.0.5; HBAAPI(I) v2.3.d, 07-12-10
firmware version:  12.8.340.8
Number of ports:   1
port type:         Fabric
port state:        Operational
supported speed:   4 GBit/sec, 8 GBit/sec, 16 GBit/sec
negotiated speed:  16 GBit/sec
OS device name:    /sys/class/scsi_host/host16

```

List all LUNs mapped to host

You can retrieve a list of all LUNs mapped to a host.

```
# sanlun lun show -p -v all
```

Example output

```

ONTAP Path: vs_sanboot:/vol/sanboot_169/lun
LUN: 0
LUN Size: 150g
Product: cDOT
Host Device: 3600a0980383143393124515873683561
Multipath Policy: service-time 0
DM-MP Features: 3 queue_if_no_path pg_init_retries 50
Hardware Handler: 1 alua
Multipath Provider: Native

```

```

-----
-----
dm-mp      host      vservers      host:
state      path      path      /dev/      chan:      vservers      major:
state      state      type      node      id:lun      LIF      minor
-----
-----
active      up      primary      sdq      15:0:5:0      lif_18      65:0
active      up      primary      sds      16:0:5:0      lif_17      65:32
active      up      primary      sdac      16:0:7:0      lif_25      65:192
active      up      primary      sdad      15:0:7:0      lif_26      65:208
active      up      secondary    sdt      15:0:4:0      lif_20      65:48
active      up      secondary    sdr      15:0:6:0      lif_19      65:16
active      up      secondary    sdad      16:0:4:0      lif_27      66:96
active      up      secondary    sdan      16:0:6:0      lif_28      66:112

```

List all LUNs mapped to host from a given SVM

You can retrieve a list of all LUNs mapped to a host from a specific storage VM (SVM).

```
# sanlun lun show -p -v vs_sanboot
```

Example output


```

ONTAP Path: vs_sanboot:/vol/sanboot_169/lun
LUN: 0
LUN Size: 160g
Product: cDOT
Host Device: 3600a0980383143393124515873683561
Multipath Policy: service-time 0
DM-MP Features: 3 queue_if_no_path pg_init_retries 50
Hardware Handler: 1 alua
Multipath Provider: Native

```

dm-mp major: state minor	host path	vserver path	/dev/	host: chan:	vserver
	state	type	node	id:lun	LIF
active 69:32	up	primary	sdce	15:0:5:0	lif_16g_5
active 130:96	up	primary	sdfk	16:0:5:0	lif_16g_7
active 130:128	up	primary	sdfm	16:0:7:0	lif_16g_8
active 69:64	up	primary	sdcg	15:0:7:0	lif_16g_6
active 69:16	up	secondary	sdcd	15:0:4:0	lif_16g_1
active 69:48	up	secondary	sdcf	15:0:6:0	lif_16g_2
active 130:80	up	secondary	sdfj	16:0:4:0	lif_16g_3
active 130:112	up	secondary	sdf1	16:0:6:0	lif_16g_4

List all attributes of a given LUN mapped to host

You can retrieve a list of all attributes of a specified LUN mapped to a host.

```
# sanlun lun show -p -v vs_sanboot:/vol/sanboot_169/lun
```

Example output

```

ONTAP Path: vs_sanboot:/vol/sanboot_169/lun
LUN: 0
LUN Size: 160g
Product: cDOT
Host Device: 3600a0980383143393124515873683561
Multipath Policy: service-time 0
DM-MP Features: 3 queue_if_no_path pg_init_retries 50
Hardware Handler: 1 alua
Multipath Provider: Native

```

dm-mp major: state minor	host path	vserver path	/dev/	host: chan:	vserver
	state	type	node	id:lun	LIF
active 69:32	up	primary	sdce	15:0:5:0	lif_16g_5
active 130:96	up	primary	sdfk	16:0:5:0	lif_16g_7
active 130:128	up	primary	sdfm	16:0:7:0	lif_16g_8
active 69:64	up	primary	sdcg	15:0:7:0	lif_16g_6
active 69:16	up	secondary	sdcd	15:0:4:0	lif_16g_1
active 69:48	up	secondary	sdcf	15:0:6:0	lif_16g_2
active 130:80	up	secondary	sdfj	16:0:4:0	lif_16g_3
active 130:112	up	secondary	sdf1	16:0:6:0	lif_16g_4

List the ONTAP SVM identity from which a given LUN is mapped to host

You can retrieve a list of ONTAP SVM identity from which a specific LUN is mapped to a host.

```
# sanlun lun show -m -v vs_sanboot:/vol/sanboot_169/lun
```

Example output

```

                                device
host                               lun
vserver                          lun-pathname      filename
adapter    protocol    size    product
-----
vs_sanboot                               /vol/sanboot_169/lun      /dev/sdfm
host16      FCP          160g    cDOT
          LUN Serial number: 81C91$QXsh5a
          Controller Model Name: AFF-A400
          Vserver FCP nodename: 2008d039ea1308e5
          Vserver FCP portname: 2010d039ea1308e5
          Vserver LIF name: lif_16g_8
          Vserver IP address: 10.141.12.165
                                10.141.12.161
                                10.141.12.163
          Vserver volume name: sanboot_169
MSID::0x0000000000000000000000000809E7CC3
          Vserver snapshot name:

```

List ONTAP LUN attributes by host device filename

You can retrieve a list of ONTAP LUN attributes by a host device filename.

```
# sanlun lun show -d /dev/sdce
```

Example output

```

controller(7mode/E-Series)/                                device      host
lun
vserver(cDOT/FlashRay)    lun-pathname      filename      adapter
protocol    size    product
-----
vs_sanboot                               /vol/sanboot_169/lun      /dev/sdce      host15
FCP          160g    cDOT
[root@sr630-13-169 ~]#

```

List all SVM target LIF WWPNS attached to host

You can retrieve a list of all SVM target LIF WWPNS attached to a host.

```
# sanlun lun show -wwpn
```

Example output

```
controller(7mode/E-Series)/  target
device          host        lun
vservers(cDOT/FlashRay)      wwpn          lun-pathname
filename        adapter     size    product
-----
vs_169_16gEmu          202cd039ea1308e5  /vol/VOL_8g_169_2_8/lun
/dev/sdlo             host18           10g      cDOT
vs_169_16gEmu          202cd039ea1308e5  /vol/VOL_8g_169_2_9/lun
/dev/sdlp             host18           10g      cDOT
vs_169_16gEmu          202cd039ea1308e5  /vol/VOL_8g_169_2_7/lun
/dev/sdln             host18           10g      cDOT
vs_169_16gEmu          202cd039ea1308e5  /vol/VOL_8g_169_2_5/lun
/dev/sdll             host18           10g      cDOT
```

List ONTAP LUNs seen on host by a given SVM target LIF WWPN

You can retrieve a list of ONTAP LUNs noticed on a host by a specified SVM target LIF WWPN.

```
# sanlun lun show -wwpn 2010d039ea1308e5
```

Example output

```
controller(7mode/E-Series)/  target
device          host        lun
vservers(cDOT/FlashRay)      wwpn          lun-pathname
filename        adapter     size    product
-----
vs_sanboot          2010d039ea1308e5  /vol/sanboot_169/lun
/dev/sdfm           host16           160g      cDOT
```

Solaris Host Utilities

Solaris Host Utilities 6.2 Release Notes

The release notes describe new features and enhancements, issues fixed in the current release, known problems and limitations, and important cautions related to configuring

and managing your specific Solaris host with your ONTAP storage system..

For specific information about the operating system versions and updates that the Host Utilities support, see the [NetApp Interoperability Matrix Tool](#).

Known problems and limitations

You should be aware of the following known problems and limitations that might impact performance on your specific host.

Bug ID	Title	Description
1385189	Solaris 11.4 FC driver binding changes required in HUK 6.2	Solaris 11.4 and HUK recommendations: FC driver binding is changed from <code>ssd(4D)</code> to <code>sd(4D)</code> . Move configuration that you have in <code>ssd.conf</code> to <code>sd.conf</code> as mentioned in Oracle (Doc ID 2595926.1). The behavior varies across newly installed Solaris 11.4 systems and systems upgraded from 11.3 or lower versions.

[NetApp Bugs Online](#) provides complete information for most known issues, including suggested workarounds where possible. Some keyword combinations and bug types that you might want to use include the following:

- FCP General: Displays FC and host bus adapter (HBA) bugs that are not associated with a specific host.
- FCP - Solaris

Install Solaris Host Utilities 6.2

The Solaris Unified Host Utilities assists you in managing NetApp ONTAP storage attached to a Solaris host.

The Solaris Host Utilities 6.2 supports several Solaris environments and multiple protocols. The primary host utilities environments are:

- Native OS with MPxIO with either the Fibre Channel (FC) or iSCSI protocol on a system using either a SPARC processor or an x86/64 processor.
- Veritas Dynamic Multipathing (DMP) with either the FC or iSCSI protocol on a system using a SPARC processor, or the iSCSI protocol on a system using an x86/64 processor.

The Solaris Unified Host Utilities 6.2 continues to support the following versions of Solaris:

- Solaris 11.x series
- Solaris 10.x series

What you'll need

- For reliable operation, verify that your entire iSCSI,FC or FCoE configuration is supported.

You can use the [NetApp Interoperability Matrix Tool](#) to verify your configuration.



The NetApp Solaris Host Utilities software package is available on the [NetApp Support Site](#) in a compressed file format for your processor. You can download the Host Utilities software package for your environment from the Support site.

Steps

1. Login to your host as root.
2. Download a copy of the compressed file containing the Host Utilities from the [NetApp Support Site](#) to a directory on your host.

At the time this documentation was prepared, the compressed files were called:

- SPARC CPU: `netapp_solaris_host_utilities_6_2_sparc.tar.gz`
- x86/x64 CPU: `netapp_solaris_host_utilities_6_2_amd.tar.gz`

3. Go to the directory containing the download.
4. Unzip the file using the `gunzip` command:

```
# gunzip netapp_solaris_host_utilities_6_2_sparc.tar.gz
```

5. Unzip the file. You can use the `tar xvf` command to do this.

```
# tar xvf netapp_solaris_host_utilities_6_2_sparc.tar
```

6. Add the packages that you extracted from tar file to your host. You can use the `pkgadd` command to do this.

The packages are added to the `/opt/NTAP/SANToolkit/bin` directory. The following example uses the `pkgadd` command to install the Solaris installation package:

```
# pkgadd -d ./NTAPSANTool.pkg
```

7. Confirm that the toolkit was successfully installed by using the `pkginfo` command or the `ls -al` command.

```
# ls -alR /opt/NTAP/SANToolkit
/opt/NTAP/SANToolkit:
total 1038
drwxr-xr-x  3 root    sys          4 Jul 22  2019 .
drwxr-xr-x  3 root    sys          3 Jul 22  2019 ..
drwxr-xr-x  2 root    sys          6 Jul 22  2019 bin
-r-xr-xr-x  1 root    sys      432666 Sep 13  2017 NOTICES.PDF

/opt/NTAP/SANToolkit/bin:
total 7962
drwxr-xr-x  2 root    sys          6 Jul 22  2019 .
drwxr-xr-x  3 root    sys          4 Jul 22  2019 ..
-r-xr-xr-x  1 root    sys    2308252 Sep 13  2017 host_config
-r-xr-xr-x  1 root    sys       995 Sep 13  2017 san_version
-r-xr-xr-x  1 root    sys   1669204 Sep 13  2017 sanlun
-r-xr-xr-x  1 root    sys       677 Sep 13  2017 vidpid.dat

# (cd /usr/share/man/man1; ls -al host_config.1 sanlun.1)
-r-xr-xr-x  1 root    sys      12266 Sep 13  2017 host_config.1
-r-xr-xr-x  1 root    sys      9044 Sep 13  2017 sanlun.1
```

8. After you finish, configure the host parameters for your environment using the `/opt/NTAP/SANToolkit/bin/host_config` command:

- MPxIO
- Veritas DMP

9. Verify the installation:

```
sanlun version
```

SAN Toolkit

Solaris Host Utilities is a NetApp host software that provides a command line toolkit on your Oracle Solaris host. The toolkit is installed when you install the NetApp Host Utilities package. This kit provides the `sanlun` utility which helps you manage LUNs and host bus adapters (HBAs). The `sanlun` command returns information about the LUNs mapped to your host, multipathing, and information necessary to create initiator groups.

Example

In the following example, the `sanlun lun show` command returns the LUN information.

```
#sanlun lun show all
controller(7mode)/ device host lun
vserver(Cmode)                lun-pathname          filename
adapter protocol size mode
-----
data_vserver                    /vol/vol1/lun1
/dev/rdisk/c0t600A098038304437522B4E694E49792Dd0s2 qlc3    FCP      10g
cDOT
data_vserver                    /vol/vol0/lun2
/dev/rdisk/c0t600A098038304437522B4E694E497938d0s2 qlc3    FCP      10g
cDOT
data_vserver                    /vol/vol2/lun3
/dev/rdisk/c0t600A098038304437522B4E694E497939d0s2 qlc3    FCP      10g
cDOT
data_vserver                    /vol/vol3/lun4
/dev/rdisk/c0t600A098038304437522B4E694E497941d0s2 qlc3    FCP      10g
cDOT
```



This toolkit is common across all Host Utilities configurations and protocols. As a result, some toolkit content might apply to one configuration, but not another. Having unused components does not affect your system performance.

Solaris Host Utilities 6.2 command reference

You can use the Solaris Host Utilities 6.2 sample command reference for an end-to-end validation of the NetApp storage configuration using the host utilities tool.

List all host initiators mapped to host

You can retrieve a list of all host initiators mapped to a host.

```
# sanlun fcp show adapter -v
```

Example output


```
adapter name:      qlc3
WWPN:              21000024ff17a301
WWNN:              20000024ff17a301
driver name:       qlc
model:              7335902
model description: 7115462, Oracle Storage Dual-Port 32 Gb Fibre Channel
PCIe HBA
serial number:     463916R+1720333838
hardware version:  Not Available
driver version:    210226-5.10
firmware version:  8.08.04
Number of ports:   1 of 2
port type:         Fabric
port state:        Operational
supported speed:   8 GBit/sec, 16 GBit/sec, 32 GBit/sec
negotiated speed:  32 GBit/sec
OS device name:    /dev/cfg/c7
```

```
adapter name:      qlc2
WWPN:              21000024ff17a300
WWNN:              20000024ff17a300
driver name:       qlc
model:              7335902
model description: 7115462, Oracle Storage Dual-Port 32 Gb Fibre Channel
PCIe HBA
serial number:     463916R+1720333838
hardware version:  Not Available
driver version:    210226-5.10
firmware version:  8.08.04
Number of ports:   2 of 2
port type:         Fabric
port state:        Operational
supported speed:   8 GBit/sec, 16 GBit/sec, 32 GBit/sec
negotiated speed:  16 GBit/sec
OS device name:    /dev/cfg/c6
```

List all LUNs mapped to host

You can retrieve a list of all LUNs mapped to a host.

```
# sanlun lun show -p -v all
```

Example output

```

        ONTAP Path: data_vserver:/vol1/lun1
            LUN: 1
            LUN Size: 10g
        Host Device:
/dev/rdisk/c0t600A0980383044485A3F4E694E4F775Ad0s2
            Mode: C
        Multipath Provider: Sun Microsystems
        Multipath Policy: Native

```

List all LUNs mapped to host from a given SVM/ List all attributes of a given LUN mapped to host

You can retrieve a list of all LUNs mapped to a host from a certain SVM.

```
# sanlun lun show -p -v sanboot_unix`
```

Example output

```

ONTAP Path: sanboot_unix:/vol/sol_boot/sanboot_lun
            LUN: 0
            LUN Size: 180.0g

```

List ONTAP LUN attributes by host device filename

You can retrieve a list of all ONTAP LUN attributes by specifying a host device filename.

```
# sanlun lun show all
```

Example output

```

controller(7mode/E-Series)/                               device
vserver(cDOT/FlashRay)      lun-pathname
filename
-----
sanboot_unix                 /vol/sol_193_boot/chatsol_193_sanboot
/dev/rdisk/c0t600A098038304437522B4E694E4A3043d0s2

host adapter    protocol lun size    product
-----
qlc3            FCP      180.0g    cDOT

```

Windows Unified Host Utilities

Install Windows Unified Host Utilities 7.2

The Windows Unified Host Utilities (WUHU) enable you to connect a Windows host computer to NetApp storage systems.

The Windows Unified Host Utilities supports the following versions of Windows:

- Windows 2022
- Windows 2019
- Windows 2016
- Windows 2012R2
- Windows 2012

Windows Unified Host Utilities includes an installation program that sets the required Windows registry and Host Bus Adapter (HBA) parameters so that a Windows host can correctly handle the storage system behaviors for NetApp ONTAP and E-Series platforms.

When you install the Host Utilities software, the installer sets the required Windows registry and HBA parameters.

The following programs and files are installed on the Windows host computer. The default directory is C:\Program Files\NetApp\Windows Host Utilities.

Program	Purpose
emulexhba.reg	Troubleshooting program; run this program only if instructed to do so by technical support personnel.
\NetAppQCLI\fcconfig.exe	Used by the installation program to set the HBA parameters.
\NetAppQCLI\fcconfig.ini	Used by the installation program to set the HBA parameters.
\NetAppQCLI*.*	Used by the installation program to set the QLogic FC HBA parameters.
san_version.exe	Displays the version of the Host Utilities and FC HBAs.

The host utilities support different Windows host configurations, protocols, and multipathing options. For more information, see the [NetApp Interoperability Matrix Tool](#).

Verify your host and storage system configuration

Before you install the host utilities, you must verify that the host utilities version supports your host and storage system configuration so that the software installs correctly.

Steps

1. Check the supported configuration in the [NetApp Interoperability Matrix Tool](#).

2. Check the hotfixes required for the respective host in the [SAN host Windows documentation](#).



The [Using Windows server 2022 with ONTAP](#) document provides instructions on [installing Windows hotfixes](#) for Windows server 2022. Refer to the Windows documents in the host configurations category to find the relevant hotfix information for earlier versions of Windows server.

3. Add the iSCSI, FCP, or NVMe-oF license and start the target service.



The FC and iSCSI protocols do not require licenses on E-Series storage systems using the SANtricity Storage Manager.

4. Verify your cabling.

See the [SAN configuration reference](#) documentation for your version of ONTAP or [E-Series hardware cabling](#) for detailed cabling and configuration information.

Configure FC HBAs and switches

Install and configure one or more supported FC host bus adapters (HBAs) for FC connections to the storage system.

The Windows Host Utilities installer sets the required FC HBA settings.



Do not change the HBA settings manually.

Steps

1. Install one or more supported FC HBAs according to the instructions provided by the HBA vendor.
2. Obtain the supported HBA drivers and management utilities and install them according to the instructions provided by the HBA vendor.
3. Connect the HBAs to your FC switches or directly to the storage system.
4. Create zones on the FC switch according to your FC switch documentation.
5. For ONTAP, zone the switch by the WWPN. Be sure to use the WWPN of the logical interfaces (LIFs) and not the WWPN of the physical ports on the storage controllers. See the [SAN configuration reference](#) documentation for more information.

Install the Host Utilities

The installation program installs the host utilities package and sets the Windows registry and HBA settings.

You must specify whether to include multipathing support when you install the Windows Unified Host Utilities software package. The installer prompts you for the following options. You can also run a quiet (unattended) installation from a Windows command prompt.

Multipathing support

- Choose `MPIO` if you have more than one path from the Windows host or virtual machine to the storage system.
- Choose `no MPIO` only if you are using a single path to the storage system.

The MPIO selection is not available for Windows XP and Windows Vista systems; multipath I/O is not

supported on these guest operating systems.

For Hyper-V guests, raw (pass-through) disks do not appear in the guest OS if you choose multipathing support. You can either use raw disks, or you can use MPIO, but you cannot use both in the guest OS.

You can install the host utilities interactively or using the command line. The new Host Utilities installation package must be in a path that is accessible by the Windows host. Follow the instructions for installing the Host Utilities interactively or from the Windows command line.

Install interactively

To install the Host Utilities software package interactively, you must run the host utilities installation program and follow the prompts.

Steps

1. Download the executable file from the [NetApp Support Site](#).
2. Change to the directory where you downloaded the executable file.
3. Run the `netapp_windows_host_utilities_7.2_x64` file and follow the instructions on the screen.
4. Reboot the Windows host when prompted.

Install from a command line

You can perform a quiet (unattended) installation of the host utilities by entering the appropriate commands at the Windows command prompt. The system automatically reboots when the installation is complete.

Steps

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

```
msiexec /i installer.msi /quiet MULTIPATHING= {0 | 1}  
[INSTALLDIR=inst_path]
```

- `installer` is the name of the `.msi` file for your CPU architecture.
- `MULTIPATHING` specifies whether MPIO support is installed. The allowed values are "0" for no and "1" for yes.
- `inst_path` is the path where the host utilities files are installed. The default path is `C:\Program Files\NetApp\Windows Host Utilities\`.



To see the standard Microsoft Installer (MSI) options for logging and other functions, enter `msiexec /help` at the Windows command prompt. For example, the `msiexec /i install.msi /quiet /l*v <install.log> LOGVERBOSE=1` command displays logging information.

Install Windows Unified Host Utilities 7.1

The Windows Unified Host Utilities (WUHU) enable you to connect a Windows host computer to NetApp storage systems.

The Windows Unified Host Utilities supports the following versions of Windows:

- Windows 2022
- Windows 2019
- Windows 2016
- Windows 2012R2
- Windows 2012

Windows Unified Host Utilities includes an installation program that sets the required Windows registry and Host Bus Adapter (HBA) parameters so that a Windows host can correctly handle the storage system behaviors for NetApp ONTAP and E-Series platforms.

When you install the Host Utilities software, the installer sets the required Windows registry and Host Bus Adapter (HBA) parameters.

The following programs and files are installed on the Windows host computer. The default directory is C:\Program Files\NetApp\Windows Host Utilities.

Program	Purpose
emulexhba.reg	Troubleshooting program; run this program only if instructed to do so by technical support personnel.
\NetAppQCLI\fcconfig.exe	Used by the installation program to set HBA parameters.
\NetAppQCLI\fcconfig.ini	Used by the installation program to set HBA parameters.
\NetAppQCLI*. *	Used by the installation program to set QLogic FC HBA parameters.
san_version.exe	Displays the version of the Host Utilities and FC HBAs.

The Host Utilities support different Windows host configurations, protocols, and multipathing options. See the [NetApp Interoperability Matrix Tool](#) for the most current list of supported configurations.

Verify your host and storage system configurations

Before you install the Host Utilities, you must verify that the Host Utilities version supports your host and storage system configuration so that the software installs correctly.

Steps

1. Check the supported configuration in the [NetApp Interoperability Matrix Tool](#).
2. Check the hotfixes required for the respective host on the [SAN host Windows documentation](#).



The [Using Windows server 2022 with ONTAP](#) document provides instructions on [installing Windows hotfixes](#) for Windows server 2022. Refer to the Windows documents in the host configurations category to find the relevant hotfix information for earlier versions of Windows server.

3. Add the iSCSI or FCP license and start the target service.



The FC and iSCSI protocols do not require licenses on E-Series storage systems using the SANtricity Storage Manager.

4. Verify your cabling

See the [SAN configuration reference](#) documentation for your version of ONTAP or [E-Series hardware cabling](#) for detailed cabling and configuration information.

Configure FC HBAs and switches

Install and configure one or more supported FC host bus adapters (HBAs) for FC connections to a storage system.

The Windows Host Utilities installer sets the required FC HBA settings.



Do not change the HBA settings manually.

Steps

1. Install one or more supported FC HBAs according to the instructions provided by the HBA vendor.
2. Obtain the supported HBA drivers and management utilities and install them according to the instructions provided by the HBA vendor.
3. Connect the HBAs to your FC switches or directly to the storage system.
4. Create zones on the FC switch according to your FC switch documentation.
5. For ONTAP, zone the switch by worldwide port name (WWPN). Be sure to use the WWPN of the LIFs and not of the physical ports on the storage controllers. See the [SAN configuration reference](#) documentation for more information.

Install the Host Utilities

The installation program installs the Host Utilities package and sets the Windows registry and HBA settings.

You must specify whether to include multipathing support when you install the Windows Unified Host Utilities software package. The installer prompts you for the following choice. You can also run a quiet (unattended) installation from a Windows command prompt.

Multipathing support

- Choose `MPIO` if you have more than one path from the Windows host or virtual machine to the storage system.
- Choose `no MPIO` only if you are using a single path to the storage system.

The MPIO selection is not available for Windows XP and Windows Vista systems; multipath I/O is not supported on these guest operating systems.

For Hyper-V guests, raw (pass-through) disks do not appear in the guest OS if you choose multipathing support. You can either use raw disks, or you can use MPIO, but you cannot use both in the guest OS.

You can install the host utilities interactively or using the command line. The new Host Utilities installation package must be in a path that is accessible by the Windows host. Follow the instructions for installing the Host Utilities interactively or from the Windows command line.

Install interactively

Steps

To install the Host Utilities software package interactively, you must run the Host Utilities installation program and follow the prompts.

Steps

1. Download the executable file from the [NetApp Support Site](#).
2. Change to the directory from which you downloaded the executable file.
3. Run the `netapp_windows_host_utilities_7.1_x64` file and follow the instructions on the screen.
4. Reboot the Windows host when prompted.

Install from a command line

You can perform a quiet (unattended) installation of the Host Utilities by entering the appropriate commands at a Windows command prompt. The system automatically reboots when the installation is complete.

Steps

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

```
msiexec /i installer.msi /quiet MULTIPATHING= {0 | 1}  
[INSTALLDIR=inst_path]
```

- `installer` is the name of the `.msi` file for your CPU architecture
- `MULTIPATHING` specifies whether MPIO support is installed. Allowed values are "0" for no, "1" for yes
- `inst_path` is the path where the Host Utilities files are installed. The default path is `C:\Program Files\NetApp\Windows Host Utilities\`.



To see the standard Microsoft Installer (MSI) options for logging and other functions, enter `msiexec /help` at a Windows command prompt. For example, the `msiexec /i install.msi /quiet /!v <install.log> LOGVERBOSE=1`` command displays logging information.

Upgrade the Windows Unified Host Utilities

The new Host Utilities installation package must be in a path that is accessible by the Windows host. Follow the instructions for installing the Host Utilities interactively or from the Windows command line in order to upgrade the installation package.

Upgrade interactively

To upgrade the Host Utilities software package interactively, you must run the Host Utilities installation program and follow the prompts.

Steps

1. Change to the directory where you downloaded the executable file.
2. Run the executable file and follow the instructions on the screen.
3. Reboot the Windows host when prompted.
4. After the reboot completes, check the host utility version:
 - a. Open **Control Panel**.
 - b. Go to **Program and features** and check the host utility version.

Upgrade from a command line

You can perform a quiet (unattended) upgrade of the new Host Utilities by entering the appropriate commands at the Windows command prompt.

Steps

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

```
msiexec /i installer.msi /quiet MULTIPATHING= {0 | 1}  
[INSTALLDIR=inst_path]
```

- `installer` is the name of the `.msi` file for your CPU architecture.
- `MULTIPATHING` specifies whether MPIO support is installed. The allowed values are "0" for no and "1" for yes.
- `inst_path` is the path where the Host Utilities files are installed. The default path is `C:\Program Files\NetApp\Windows Host Utilities\`.



To see the standard Microsoft Installer (MSI) options for logging and other functions, enter `msiexec /help` at the Windows command prompt. For example, the `msiexec /i install.msi /quiet /l*v <install.log> LOGVERBOSE=1` command displays logging information.

The system automatically reboots when the installation is complete.

Repair and remove the Windows Unified Host Utilities

You can use the **Repair** option of the Host Utilities installation program to update the Host bus adapter (HBA) and Windows registry settings. You can also remove the Host Utilities entirely, either interactively or from the Windows command line.

Repair or remove interactively

The **Repair** option updates the Windows registry and FC HBAs with the required settings. You can also remove the Host Utilities entirely.

Steps

1. Open Windows **Programs and Features** (Windows Server 2012 R2, Windows Server 2016, Windows Server 2019, and Windows 2022).
2. Select **NetApp Windows Unified Host Utilities**.
3. Select **Change**.
4. Select **Repair** or **Remove**, as needed.
5. Follow the instructions on the screen.

Repair or remove from command line

The **Repair** option updates the Windows registry and FC HBAs with the required settings. You can also remove the Host Utilities entirely from a Windows command line.

Steps

1. Enter the following command on the Windows command line to repair Windows Host Utilities:

```
msiexec /f installer.msi [/quiet]
```

- `/f` repairs the installation.
- `installer.msi` is the name of the Windows Host Utilities installation program on your system.
- `/quiet` suppresses all feedback and reboots the system automatically without prompting when the command completes.

Configure registry settings

The Host Utilities require certain registry and parameter settings to verify that the Windows host correctly handles the storage system behavior.

Windows Host Utilities set the parameters that affect how the Windows host responds to a delay or loss of data. The particular values have been selected to verify that the Windows host correctly handles events such as the failover of one controller in the storage system to its partner controller.

Not all values apply to the device-specific module (DSM) for SANtricity Storage Manager; however, any overlap of values set by the Host Utilities and those set by the DSM for SANtricity Storage Manager do not result in conflicts.

FC, NVMe/FC, and iSCSI HBAs also have parameters that you must set to ensure best performance and to successfully handle storage system events.

The installation program supplied with Windows Unified Host Utilities sets the Windows, FC, and NVMe/FC HBA parameters to the supported values.

You must manually set the iSCSI HBA parameters.

The installer sets different values depending on whether you specify multipath I/O (MPIO) support when

running the installation program.



You should not change these values unless NetApp technical support directs you to do so.

Registry values set by Windows Unified Host Utilities 7.2

The Windows Unified Host Utilities installer automatically sets registry values that are based on the choices that you make during the installation. You should be aware of these registry values and the operating system version.

The following values are set by the Windows Unified Host Utilities installer. All values are in decimal unless otherwise stated.



HKLM is the abbreviation for HKEY_LOCAL_MACHINE.

Registry key	Value	When set
HKLM\SYSTEM\CurrentControlSet\Services\msdsm\Parameters\DsmMaximumRetryTimeDuringStateTransition	120	When MPIO support is specified and your server is Windows Server 2012 R2, Windows Server 2016 and Windows 2019, or Windows Server 2022
HKLM\SYSTEM\CurrentControlSet\Services\msdsm\Parameters\DsmMaximumStateTransitionTime	120	When MPIO support is specified and your server is Windows Server 2012 R2, or Windows Server 2016, Windows 2019 or Windows Server 2022
HKLM\SYSTEM\CurrentControlSet\Services\msdsm\Parameters\DsmSupportedDeviceList	"NETAPP LUN", "NETAPP LUN C-Mode" "NVMe NetApp ONTAP Con"	When MPIO support is specified
HKLM\SYSTEM\CurrentControlSet\Control\Class\{iSCSI_driver_GUID}\instance_ID\Parameters\IPSecConfigTimeout	60	Always
HKLM\SYSTEM\CurrentControlSet\Control\Class\{iSCSI_driver_GUID}\instance_ID\Parameters\LinkDownTime	10	Always
HKLM\SYSTEM\CurrentControlSet\Services\ClusDisk\Parameters\ManageDisksOnSystemBuses	1	Always

Registry key	Value	When set
HKLM\SYSTEM\CurrentControlSet\Control\Class\ {iSCSI_driver_GUID}\instance_ID\Parameters\MaxRequestHoldTime	120	When no MPIO support is selected
HKLM\SYSTEM\CurrentControlSet\Control\Class\ {iSCSI_driver_GUID}\instance_ID\Parameters\MaxRequestHoldTime	30	Always
HKLM\SYSTEM\CurrentControlSet\Control\MPDEV\MPIOSupportedDeviceList	"NETAPP LUN", "NETAPP LUN C-Mode", "NVMe NetApp ONTAP Con"	When MPIO support is specified
HKLM\SYSTEM\CurrentControlSet\Services\mpio\Parameters\PathRecoveryInterval	30	When your server is Windows Server 2012 R2, Windows Server 2016, Windows Server 2019, or Windows Server 2022
HKLM\SYSTEM\CurrentControlSet\Services\mpio\Parameters\PathVerifyEnabled	1	When MPIO support is specified
HKLM\SYSTEM\CurrentControlSet\Services\msdsm\Parameters\PathVerifyEnabled	1	When MPIO support is specified and your server is Windows Server 2012 R2, Windows Server 2016, Windows Server 2019, or Windows Server 2022
HKLM\SYSTEM\CurrentControlSet\Services\vnetapp\Parameters\PathVerifyEnabled	0	When MPIO support is specified
HKLM\SYSTEM\CurrentControlSet\Services\mpio\Parameters\PDORemovePeriod	130	When MPIO support is specified
HKLM\SYSTEM\CurrentControlSet\Services\msdsm\Parameters\PDORemovePeriod	130	When MPIO support is specified and your server is Windows Server 2012 R2, Windows Server 2016 , Windows Server 2019, or Windows Server 2022
HKLM\SYSTEM\CurrentControlSet\Services\vnetapp\Parameters\PDORemovePeriod	130	When MPIO support is specified, except if Data ONTAP DSM is detected

Registry key	Value	When set
HKLM\SYSTEM\CurrentControlSet\Services\mpio\Parameters\RetryCount	6	When MPIO support is specified
HKLM\SYSTEM\CurrentControlSet\Services\msdsm\Parameters\RetryCount	6	When MPIO support is specified and your server is Windows Server 2012 R2, Windows Server 2016, Windows Server 2019, or Windows Server 2022
HKLM\SYSTEM\CurrentControlSet\Services\mpio\Parameters\RetryInterval	1	When MPIO support is specified
HKLM\SYSTEM\CurrentControlSet\Services\msdsm\Parameters\RetryInterval	1	When MPIO support is specified and your server is Windows Server 2012 R2, Windows Server 2016, Windows Server 2019, or Windows Server 2022
HKLM\SYSTEM\CurrentControlSet\Services\vnetapp\Parameters\RetryInterval	1	When MPIO support is specified
HKLM\SYSTEM\CurrentControlSet\Services\disk\TimeOutValue	120	When no MPIO support is selected
HKLM\SYSTEM\CurrentControlSet\Services\mpio\Parameters\UseCustomPathRecoveryInterval	1	When MPIO support is specified and your server is Windows Server 2012 R2, Windows Server 2016, Windows Server 2019, or Windows Server 2022

NVMe parameters

The following NVMe Emulex driver parameters are updated when installing Windows Unified Host Utilities 7.2:

- EnableNVMe = 1
- NVMEMode = 0
- LimTransferSize=1

Registry values set by Windows Unified Host Utilities 7.1

The Windows Unified Host Utilities installer automatically sets registry values that are based on the choices that you make during installation. You should be aware of these registry values, the operating system version.

The following values are set by the Windows Unified Host Utilities installer. All values are in decimal unless otherwise noted.



HKLM is the abbreviation for HKEY_LOCAL_MACHINE.

Registry key	Value	When set
HKLM\SYSTEM\CurrentControlSet\Services\msdsm\Parameters\DsmMaximumRetryTimeDuringStateTransition	120	When MPIO support is specified and your server is Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, or Windows Server 2016, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services\msdsm\Parameters\DsmMaximumStateTransitionTime	120	When MPIO support is specified and your server is Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, or Windows Server 2016, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services\msdsm\Parameters\DsmSupportedDeviceList	"NETAPP LUN"	When MPIO support is specified
	"NETAPP LUN", "NETAPP LUN C-Mode"	When MPIO support is specified, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Control\Classes\{iSCSI_driver_GUID}\instance_ID\Parameters\IPSecConfigTimeout	60	Always, except when Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Control\Class\{iSCSI_driver_GUID}\instance_ID\Parameters\LinkDownTime	10	Always
HKLM\SYSTEM\CurrentControlSet\Services\ClusDisk\Parameters\ManageDisksOnSystemBuses	1	Always, except when Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Control\Class\{iSCSI_driver_GUID}\instance_ID\Parameters\MaxRequestHoldTime	120	When no MPIO support is selected
	30	Always, except when Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Control\MPDEV\MPIOSupportedDeviceList	"NETAPP LUN"	When MPIO support is specified
	"NETAPP LUN", "NETAPP LUN C-Mode"	When MPIO is support-specified, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services\mpio\Parameters\PathRecoveryInterval	40	When your server is Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, or Windows Server 2016 only
HKLM\SYSTEM\CurrentControlSet\Services\mpio\Parameters\PathVerifyEnabled	0	When MPIO support is specified, except if Data ONTAP DSM is detected

Registry key	Value	When set
HKLM\SYSTEM\CurrentControlSet\Services\msdsm \Parameters\PathVerifyEnabled	0	When MPIO support is specified, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services\msdsm \Parameters\PathVerifyEnabled	0	When MPIO support is specified and your server is Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, or Windows Server 2016, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services\msiscdsm \Parameters\PathVerifyEnabled	0	When MPIO support is specified and your server is Windows Server 2003, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services\vnetapp \Parameters\PathVerifyEnabled	0	When MPIO support is specified, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services\mpio \Parameters\PDORemovePeriod	130	When MPIO support is specified, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services\msdsm \Parameters\PDORemovePeriod	130	When MPIO support is specified and your server is Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, or Windows Server 2016, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services\msiscdsm \Parameters\PDORemovePeriod	130	When MPIO support is specified and your server is Windows Server 2003, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services\vnetapp \Parameters\PDORemovePeriod	130	When MPIO support is specified, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services\mpio \Parameters\RetryCount	6	When MPIO support is specified, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services\msdsm \Parameters\RetryCount	6	When MPIO support is specified and your server is Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, or Windows Server 2016, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services\msiscdsm \Parameters\RetryCount	6	When MPIO support is specified and your server is Windows Server 2003, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services\vnetapp \Parameters\RetryCount	6	When MPIO support is specified, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services\mpio \Parameters\RetryInterval	1	When MPIO support is specified, except if Data ONTAP DSM is detected

Registry key	Value	When set
HKLM\SYSTEM\CurrentControlSet\Services\msdsm\Parameters\RetryInterval	1	When MPIO support is specified and your server is Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, or Windows Server 2016, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services\vnetaap\Parameters\RetryInterval	1	When MPIO support is specified, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services\disk\TimeOutValue	120	When no MPIO support is selected, except if Data ONTAP DSM is detected
	60	When MPIO support is specified, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services\mpio\Parameters\UseCustomPathRecoveryInterval	1	When your server is Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, or Windows Server 2016 only

See the [Microsoft documents](#) for the registry parameter details.

FC HBA values set by Windows Host Utilities

On systems using FC, the Host Utilities installer sets the required timeout values for Emulex and QLogic FC HBAs.

For Emulex FC HBAs, the installer sets the following parameters:

When MPIO is selected	
Property type	Property value
LinkTimeOut	1
NodeTimeOut	10
When MPIO is not selected	
Property type	Property value
LinkTimeOut	30
NodeTimeOut	120

For QLogic Fibre Channel HBAs, the installer sets the following parameters:

When MPIO is selected

Property type	Property value
LinkDownTimeOut	1
PortDownRetryCount	10

When MPIO is not selected

Property type	Property value
LinkDownTimeOut	30
PortDownRetryCount	120



The names of the parameters might vary slightly depending on the program.

For example, in the QLogic QConvergeConsole program, the parameter is displayed as `Link Down Timeout`.

The Host Utilities `fcconfig.ini` file displays this parameter as either `LinkDownTimeOut` or `MpioLinkDownTimeOut`, depending on whether MPIO is specified. However, all of these names refer to the same HBA parameter. See [Emulex](#) or [QLogic](#) to learn more about the timeout parameters.

Understand the Host Utilities changes to FC HBA driver settings

During the installation of the required Emulex or QLogic HBA drivers on an FC system, several parameters are checked and, in some cases, modified.

The Host Utilities set values for the following parameters if MS DSM for Windows MPIO is detected:

- `LinkTimeOut` – defines the length of time in seconds that the host port waits before resuming I/O after a physical link is down.
- `NodeTimeOut` – defines the length of time in seconds before the host port recognizes that a connection to the target device is down.

When troubleshooting HBA issues, check to make sure these settings have the correct values. The correct values depend on two factors:

- The HBA vendor
- Whether you are using multipathing software (MPIO)

You can correct the HBA settings by running the Repair option of the Windows Host Utilities installer.

Emulex HBA drivers

If you have an FC system, you must verify the Emulex HBA driver settings. These settings must exist for each port on the HBA.

Steps

1. Open OnCommand Manager.
2. Select the appropriate HBA from the list and click the **Driver Parameters** tab.

The driver parameters appear.

- a. If you are using MPIO software, ensure that you have the following driver settings:
 - LinkTimeOut - 1
 - NodeTimeOut - 10
- b. If you are not using MPIO software, ensure that you have the following driver settings:
 - LinkTimeOut - 30
 - NodeTimeOut - 120

QLogic HBA drivers

On FC systems, you must verify the QLogic HBA driver settings. These settings must exist for each port on the HBA.

Steps

1. Open QConvergeConsole, and then click **Connect** on the toolbar.

The **Connect to Host** dialog box appears.

2. Select the appropriate host from the list, and then select **Connect**.

A list of HBAs appears in the FC HBA pane.

3. Select the appropriate HBA port from the list, and then select the **Settings** tab.
4. Select **Advanced HBA Port Settings** from the **Select Settings** section.
5. If you are using MPIO software, verify that you have the following driver settings:
 - Link Down Timeout (linkdwnto) - 1
 - Port Down Retry Count (portdwncr) - 10
6. If you are not using MPIO software, verify that you have the following driver settings:
 - Link Down Timeout (linkdwnto) - 30
 - Port Down Retry Count (portdwncr) - 120

Troubleshoot

You can use the general troubleshooting techniques for Windows Host Utilities. Be sure to check the latest Release Notes for known issues and solutions.

The following is a list of the different areas you can investigate for potential interoperability issues:

- To identify potential interoperability issues, confirm that the Host Utilities support your combination of host operating system software, host hardware, ONTAP software, and storage system hardware. See the [NetApp Interoperability Matrix Tool](#) for more information.
- Verify that you have the correct iSCSI configuration.
- If iSCSI LUNs are not available after a reboot, verify that the target is listed as persistent on the **Persistent Targets** tab of the Microsoft iSCSI initiator GUI.
- If applications using the LUNs display errors on startup, verify that the applications are configured to depend on the iSCSI service.
- For FC paths to storage controllers running ONTAP, verify that the FC switches are zoned using the WWPNs of the target LIFs, not the WWPNs of the physical ports on the node.
- Review the [Release Notes](#) for Windows Host Utilities to check for known issues. The Release Notes include a list of known issues and limitations.
- Review the troubleshooting information in the SAN Administration Guide for your version of ONTAP.
- Search [NetApp Bugs Online](#) for recently discovered issues.
 - In the Bug Type field under Advanced Search, select **iSCSI - Windows** and then select **Go**. You should repeat the search for Bug Type **FCP -Windows**.
- Collect information about your system.
- Record any error messages that are displayed on the host or storage system console.
- Collect the host and storage system log files.
- Record the symptoms of the problem and any changes made to the host or storage system just before the problem appeared.
- If you are unable to resolve the problem, contact NetApp technical support for assistance.

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