Install SAN Host Utilities

ONTAP SAN Host Utilities

NetApp
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Learn about SAN Host Utilities

Learn about the latest information on SAN Host Utility releases and access the installation procedure for your host configuration.

There are several SAN Host Utilities software packages available on the NetApp Support site. NetApp recommends using the SAN Host Utilities software if it's available for your SAN host.

The AIX, HP-UX, Linux, and Solaris Host Utilities software provide a command line toolkit. The toolkit helps you manage ONTAP LUNs and host bus adapters (HBAs). NetApp customer support can also use the SAN Host Utilities to gather information about your configuration if you have an issue that requires assistance. The toolkit is automatically installed when you install the Host Utilities software package.

The Windows Host Utilities enable you to connect a Windows host computer to NetApp storage systems. The software includes an installation program that sets the required Windows registry and HBA parameters. This enables the Windows host to correctly handle the storage system behaviors for ONTAP and E-Series platforms.

For reliable operation after installation, use the 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 Release Notes

The release notes describe new features and enhancements, issues fixed in the current release, known issues 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 Interoperability Matrix Tool.

The AIX Host Utilities releases contain the following new features and enhancements.

What's new in AIX Host Utilities 8.0

An IBM Interim Fix (ifix) is available for AIX Host Utilities 8.0 that ensures the `sanlun fcp show adapter -v` command displays the correct HBA speed information, such as supported and negotiated speeds for the adapters. You can install the ifix on the following AIX and VIOS versions:

- AIX: 7.3 TL3 SP0, 7.3 TL2 SP2, 7.3 TL1 SP4, 7.2 TL5 SP9, 7.2 TL5 SP8
- VIOS: 4.1.1.0, 4.1.0.21, 3.1.4.50, 3.1.4.41

What's new in AIX Host Utilities 7.0

AIX Host Utilities 7.0 supports SCSI UNMAP on the AIX host OS. With AIX Host Utilities 7.0, SCSI thin provisioning functions seamlessly with AIX and NetApp LUNs for FC devices.

What's new in AIX Host Utilities 6.1

AIX Host Utilities 6.1 includes 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 Microsoft Multipath I/O (MPIO) and related ODM remain unchanged.

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	Affects version	Title	Description
N/A	7.0	SCSI UNMAP support for ONTAP iSCSI LUNs	AIX Host Utilities 7.0 only supports the SCSI UNMAP feature for FC devices. SCSI UNMAP support for iSCSI devices are not included in this release.
1069147		AIX HU Sanlun reports incorrect HBA speed	Instances of sanlun displaying incorrect HBA speeds are reported while running the `sanlun fcp show adapter -v` command. The `sanlun fcp show adapter -v` 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 `fcstat fcsx` 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

What's next?

Learn about installing AIX Host Utilities

Install AIX Host Utilities

Install AIX Host Utilities 8.0 for ONTAP storage

The AIX Host Utilities help you manage ONTAP storage attached to an AIX host. NetApp strongly recommends installing the AIX Host Utilities to improve ONTAP storage

management and assist NetApp support in gathering information about your configuration.

AIX Host Utilities 8.0 supports the following transport protocols and AIX environments:

- FC, FCoE, and iSCSI
- AIX Multipath I/O (MPIO)
- PowerVM

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

About this task

- You need to install the AIX Host Utilities SAN Toolkit with AIX MPIO to manage ONTAP storage attached to an AIX host.
- When you install AIX Host Utilities, they don't change any settings on your AIX host.

Before you begin

- Use the Interoperability Matrix Tool to verify that your AIX OS, protocol, and ONTAP version support SAN booting.
- Enable dynamic tracking for all FC and FCoE initiators by running the `chdev -l <fscsi_device> -a dyntrk=ye` command on the AIX host.

Steps

1. Log in to your host:

   AIX

   On an AIX host, log in as **root**.

   PowerVM

   On a PowerVM host:

   a. Log in as **padmin**.

   b. Become a root user:

   ```
   oem_setup_env
   ```

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_8.0.tar.gz
   ```

   The `ntap_aix_host_utilities_8.0.` directory is created when you decompress the file. This

directory contains one of the following subdirectories: MPIO, NON_MPIO, or SAN_Tool_Kit.

5. Install AIX MPIO:

```
installp -aXYd /var/tmp/ntap_aix_host_utilities_8.0/MPIO
NetApp.MPIO_Host_Utilities_Kit
```

6. Install the SAN Toolkit:

```
installp -aXYd /var/tmp/ntap_aix_host_utilities_8.0/ NetApp.SAN_toolkit
```

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

```
lslpp -l |grep -i netapp
```

Show example output

```
NetApp.MPIO_Host_Utilities_Kit.config
                             8.0.0.0  COMMITTED  NetApp MPIO PCM
Host Utilities
  NetApp.MPIO_Host_Utilities_Kit.fcp
                             8.0.0.0  COMMITTED  NetApp MPIO PCM
Host Utilities
  NetApp.MPIO_Host_Utilities_Kit.iscsi
                             8.0.0.0  COMMITTED  NetApp MPIO PCM
Host Utilities
  NetApp.MPIO_Host_Utilities_Kit.pcmodm
                             8.0.0.0 COMMITTED  NetApp MPIO PCM Host
Utilities
NetApp.SAN_toolkit.sanlun  8.0.0.0 COMMITTED NetApp SAN Toolkit
sanlun
```

9. Confirm that the software version is 8.0.1f0fc74c:

```
sanlun version
```

10. Verify that the SCSI UNMAP `lbp_enabled` parameter has been added to the ODM:

```
odmget -q "uniquetype=disk/fcp/NetAppMPIO" PdAt |grep  "lbp_enabled"
```

Example ouptut

```
attribute = "lbp_enabled"
```

```
odmget -q "uniquetype=disk/fcp/NetAppMPIO and attribute=lbp_enabled"
PdAt`
```

Show example output

```
PdAt:
        uniquetype = "disk/fcp/NetAppMPIO"
        attribute = "lbp_enabled"
        deflt = "true"
        values = "true,false"
        width = ""
        type = "R"
        generic = ""
        rep = "s"
        nls_index = 18
```

What's next?

Learn about the AIX SAN Toolkit.

Install AIX Host Utilities 7.0 for ONTAP storage

The AIX Host Utilities help you manage ONTAP storage attached to an AIX host. NetApp strongly recommends installing the AIX Host Utilities to improve ONTAP storage management and assist NetApp support in gathering information about your configuration.

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   tar -xvf ntap_aix_host_utilities_7.0.tar.gz
   ```

   The following directory is created when you decompress the file: `ntap_aix_host_utilities_7.0`. This directory contains 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_7.0/MPIO
   NetApp.MPIO_Host_Utilities_Kit
   ```

6. Install the SAN Toolkit:

   ```
   installp -aXYd
   /var/tmp/ntap_aix_host_utilities_7.0/SAN_Tool_Kit/NetApp.SAN_toolkit
   ```

7. Reboot the host.

8. Verify the installation:

```
lslpp -l |grep -i netapp
```

```
NetApp.MPIO_Host_Utilities_Kit.config
                             7.0.0.0  COMMITTED  NetApp MPIO PCM Host
Utilities
  NetApp.MPIO_Host_Utilities_Kit.fcp
                             7.0.0.0  COMMITTED  NetApp MPIO PCM Host
Utilities
  NetApp.MPIO_Host_Utilities_Kit.iscsi
                             7.0.0.0  COMMITTED  NetApp MPIO PCM Host
Utilities
  NetApp.MPIO_Host_Utilities_Kit.pcmodm
                             7.0.0.0  COMMITTED  NetApp MPIO PCM Host
Utilities
NetApp.SAN_toolkit.sanlun  7.0.0.0  COMMITTED  NetApp SAN Toolkit sanlun
```

9. Confirm the software version:

```
sanlun version
```

```
7.0.725.3521
```

10. Verify that the SCSI UNMAP `lbp_enabled` parameter is added to the ODM:

```
odmget -q "uniquetype=disk/fcp/NetAppMPIO" PdAt |grep  "lbp_enabled"
```

```
attribute = "lbp_enabled"
```

```
odmget -q "uniquetype=disk/fcp/NetAppMPIO and attribute=lbp_enabled"
PdAt`
```

```
PdAt:
        uniquetype = "disk/fcp/NetAppMPIO"
        attribute = "lbp_enabled"
        deflt = "true"
        values = "true,false"
        width = ""
        type = "R"
        generic = ""
        rep = "s"
        nls_index = 18
```

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Steps

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AIX

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On a PowerVM host:

a. Log in as **padmin**.

b. Become a root user:

```
oem_setup_env
```

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_Utilities_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
```

What's next?

Learn about the AIX SAN Toolkit.

Learn about the AIX SAN Toolkit for ONTAP storage

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

The following example output shows the ONTAP LUN information returned for the `sanlun lun show` command:

```
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
```

The SAN Toolkit is common across all AIX host configurations and transport protocols. As a result, all of the components don't apply to every configuration. Unused components don't affect your system performance. The SAN Toolkit is supported on AIX and PowerVM/VIOS OS versions.

What's next?

Learn about using the AIX Host Utilities tool.

Use AIX Host Utilities commands to verify ONTAP storage configuration

You can use the AIX Host Utilities 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
```

8.0

Show example for AIX Host Utilities 8.0

```
adapter name:      fcs4
WWPN:              100000109bf606a8
WWNN:              200000109bf606a8
driver name:       /usr/lib/drivers/pci/emfcdd
model:             df1000e31410150
model description: FC Adapter
serial number:     Y050HY22L002
hardware version:  Not Available
driver version:    7.2.5.201
firmware version:  00014000000057400007
Number of ports:   1
port type:         Fabric
port state:        Operational
supported speed:   32 GBit/sec
negotiated speed:  32 GBit/sec
OS device name:    fcs4
adapter name:      fcs5
WWPN:              100000109bf606a9
WWNN:              200000109bf606a9
driver name:       /usr/lib/drivers/pci/emfcdd
model:             df1000e31410150
model description: FC Adapter
serial number:     Y050HY22L002
hardware version:  Not Available
driver version:    7.2.5.201
firmware version:  00014000000057400007
Number of ports:   1
port type:         Fabric
port state:        Operational
supported speed:   32 GBit/sec
negotiated speed:  32 GBit/sec
OS device name:    fcs5
bash-3.2#
```

7.0 and 6.1

Show example for AIX Host Utilities 7.0 and 6.1

```
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
```

8.0

Show example for AIX Host Utilities 8.0

```
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
```

7.0 and 6.1

Show example for AIX Host Utilities 7.0 and 6.1

```
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 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
```

8.0

Show example for AIX Host Utilities 8.0

```
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 MPIO
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
```

7.0 and 6.1

Show example for AIX Host Utilities 7.0 and 6.1

```
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 MPIO
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
```

8.0

Show example for AIX Host Utilities 8.0

```
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
```

7.0 and 6.1

Show example for AIX Host Utilities 7.0 and 6.1

```
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
```

8.0

Show example for AIX Host Utilities 8.0

```
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
```

7.0 and 6.1

Show example for AIX Host Utilities 7.0 and 6.1

```
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
```

8.0

Show example for AIX Host Utilities 8.0

```
controller(7mode)/
target device host lun
vserver(Cmode)          wwpn            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
```

7.0 and 6.1

Show example for AIX Host Utilities 7.0 and 6.1

```
controller(7mode)/
target device host lun
vserver(Cmode)          wwpn            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 Release Notes

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

What's new in HP-UX Host Utilities 6.0

There are no new features and enhancements.

HP-UX Host Utilities 6.0 supports the following HP-UX OS versions:

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

Known issues and limitations

There are no known issues or limitations.

What's next?

Learn about installing HP-UX Host Utilities

Install HP-UX Host Utilities 6.0 for ONTAP storage

The HP-UX Host Utilities help you manage ONTAP storage attached to an HP-UX host. NetApp strongly recommends installing the HP-UX Host Utilities, but it isn't mandatory. The utilities improve management and assist NetApp customer support in gathering information about your configuration.

The HP-UX Host Utilities support the following environments:

- Native Microsoft Multipath I/O (MPIO)
- Veritas Dynamic Multipathing (DMP)

Before you begin

For reliable operation, use the Interoperability Matrix Tool to verify that your iSCSI, FC, or FCoE configuration is supported.

Steps

1. Log in to your HP-UX host 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
   ```

What's next?

Learn about the SAN Toolkit.

Learn about the SAN Toolkit for ONTAP storage

HP-UX Host Utilities is a NetApp host software that provides a command line toolkit 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 ONTAP LUNs and host bus adapters. The `sanlun` command returns information about the LUNs mapped to your host, multipathing, and information necessary to create initiator groups.

In the following example, the `sanlun lun show` command returns ONTAP 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/rdsk/c34t0d0
fclp1      FCP         150g    C
sanboot_unix          /vol/hpux_boot/boot_hpux_lun      /dev/rdsk/c23t0d0
fclp1      FCP         150g    C
sanboot_unix          /vol/hpux_boot/boot_hpux_lun      /dev/rdsk/c12t0d0
fclp0      FCP         150g    C
sanboot_unix          /vol/hpux_boot/boot_hpux_lun      /dev/rdsk/c81t0d0
fclp0      FCP         150g    C
```

This SAN toolkit is common across all Host Utilities configurations and protocols. As a result, all of the components don't apply to every configuration. Unused components don't affect your system performance.

The SAN Toolkit is supported on AIX and PowerVM/VIOS OS versions.

What's next?

Learn about using the HP-UX Host Utilities tool.

Use HP-UX Host Utilities commands to verify ONTAP storage configuration

Use the HP-UX Host Utilities 6.0 sample command reference for an end-to-end validation of the ONTAP storage configuration using the Host Utilities tool.

List all host initiators mapped to host

Retrieve a list of all host initiators mapped to a host.

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

Show 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

Retrieve a list of all LUNs mapped to a host.

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

Show 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     vserver    /dev/dsk
HP A/A
path     path       filename             host    vserver
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

Retrieve a list of all LUNs mapped to a host from a specific SVM.

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

Show 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     vserver    /dev/dsk
HP A/A
path     path       filename             host    vserver
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

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
```

Show 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     vserver    /dev/dsk
HP A/A
path     path       filename             host    vserver
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

Retrieve a list of ONTAP LUN attributes by a specified host device filename.

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

Show example output

```
                                                                          device
host                  lun
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: 80D7l?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::0x00000000000000000000000080915935
         Vserver snapshot name:
```

List all SVM target LIF WWPNs attached to host

Retrieve a list of all SVM target LIF WWPNs attached to a host.

```
sanlun lun show -wwpn
```

Show 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/rdsk/c22t6d7
vs_hp_cluster         208100a098ba7afe
/vol/chathpux_217_vol_en_1_10/hp_en_217_lun   /dev/rdsk/c44t6d7
vs_hp_cluster         208200a098ba7afe
/vol/chathpux_217_vol_en_1_10/hp_en_217_lun   /dev/rdsk/c37t6d7
vs_hp_cluster         207e00a098ba7afe
/vol/chathpux_217_vol_en_1_10/hp_en_217_lun   /dev/rdsk/c36t6d7
vs_hp_cluster         207d00a098ba7afe   /vol/chathpux_217_os/hp_217_os
/dev/rdsk/c18t7d4
vs_hp_cluster         207f00a098ba7afe   /vol/chathpux_217_os/hp_217_os
/dev/rdsk/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 Host Utilities

Linux Host Utilities Release Notes

The release notes describe new features, enhancements, fixed issues, known issues, 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 Interoperability Matrix Tool.

What's New in Linux Host Utilities 8.0

The Linux Host Utilities 8.0 release contains the following new features and enhancements

Linux Host Utilities 8.0 includes support for 64-bit speed QLogic and Emulex FC host bus adapters (HBA).

The following operating systems are supported:

- Red Hat Enterprise Linux (RHEL) 9 and 8 series
- SUSE Linux Enterprise Server
- Oracle Linux 9 and 8 series
- Ubuntu

What's New in Linux Host Utilities 7.1

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.
- The following operating systems are supported:
  - Citrix XenServer
  - KVM and XEN, RHEV 6.5 and 6.4
  - Oracle VM 3.2 series
  - Oracle Linux 7 and 6 series
  - RHEL 7 and 6 series
  - SUSE Linux Enterprise Server 15 series
  - SUSE Linux Enterprise Server 11 SP4
- On RHEL 6 and 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 use the virtual guest profile as a guest virtual machine and the enterprise storage profile for configurations when LUNs from enterprise storage arrays are used. Using these tuned packages can result in improvement in throughput and latency in ONTAP.
- Linux Host Utilities 7.1 adds support for 32GB FC adapters from Broadcom Emulex and Marvell Qlogic.

NetApp continues to work with the Linux 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 Interoperability Matrix Tool.

Fixed issues

The following issues have been fixed in Linux Host Utilities.

Fixed in version	Description
7.1	The intermittent host OS failure issue that occurs when running the `sanlun lun show -p` command in SUSE Linux Enterprise Server 12 SP1, Oracle Linux 7.2, RHEL 7.2, and RHEL 6.8.

Known issues and limitations

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

NetApp Bug ID	Affects version	Title	Description

1457017	7.1	`sanlun` installation issues warning messages related to `libdevmapper.so` and `libnl.so` libraries. These warnings do not affect the functionality of `sanlun` kit.	When you execute the Linux 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:
			
			`[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 NetApp Bugs Online - 1508554.

NetApp Bugs Online provides complete information for most known issues, including suggested workarounds where possible.

What's next

Learn about installing Linux Host Utilities

Install Linux Host Utilities

Install Linux Host Utilities 8.0 for ONTAP storage

The Linux Host Utilities help you manage ONTAP storage attached to a Linux host. NetApp strongly recommends installing the Linux Host Utilities, but it isn't mandatory. The utilities improve management and assist NetApp customer support in gathering information about your configuration.

Linux Host Utilities 8.0 supports the following distribution types:

- Red Hat Enterprise Linux (RHEL)
- SUSE Linux Enterprise Server
- Oracle Linux
- Ubuntu

> The Linux Host Utilities software doesn't support NVMe over Fibre Channel (NVMe/FC) and NVMe over TCP (NVMe/TCP) host protocols.

About this task

When you install the Linux Host Utilities, it doesn't change any settings on your Linux host.

Before you begin

- For reliable operation, use the Interoperability Matrix Tool to verify that your iSCSI, FC, or FCoE configuration is supported.
- Install the host bus adapter (HBA) management packages available on the vendor support site. The management software enables the `sanlun` commands to gather information about the FC HBAs, such as their WWPNs.

  Refer to the vendor documentation to verify that the following packages are correctly installed. These packages are required to support the `sanlun fcp show adapter` command:

  - Marvell QLogic HBA – QConvergeConsole CLI
  - Broadcom Emulex HBA - OneCommand Manager core application CLI

Steps

1. If you have a version of Linux Host Utilities currently installed, remove it:

   Linux hosts

   Remove Linux Host Utilities from a RHEL, SUSE Linux Enterprise Server, or Oracle Linux host:

   ```
   rpm -e netapp_linux_unified_host_utilities-x-x
   ```

   Ubuntu

   Remove Linux Host Utilities from an Ubuntu host:

   ```
   sudo apt remove netapp_linux_unified_host_utilities-x-x
   ```

   For earlier 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. The NetApp Linux Host Utilities software package is available on the NetApp Support Site in a 64-bit .rpm file. Download the 64-bit file from the NetApp Support Site to your host.
3. Go to the directory to which you downloaded the software package and install it:

Linux hosts

Install Linux Host Utilities 8.0 on a RHEL, SUSE Linux Enterprise Server, or Oracle Linux host:

```
rpm -ivh netapp_linux_unified_host_utilities-8-0.x86_xx.rpm
```

You should see an output similar to the following example:

```
rpm -ivh netapp_linux_unified_host_utilities-8-0.x86_64.rpm
Verifying...
 ################################# [100%]
Preparing...
 ################################# [100%]
Updating / installing...

 1:netapp_linux_unified_host_utiliti################################
# [100%]
```

Ubuntu

a. Install Linux Host Utilities 8.0 on an Ubuntu host:

```
sudo apt install
/<path_to_file>/netapp_linux_unified_host_utilities-8-
0.x86_xx.deb
```

b. Manually link the Ubuntu OS to the HBA library:

```
cp
/opt/QLogic_Corporation/QConvergeConsoleCLI/lib64/libHBAAPI.so.2.
0.2 /usr/lib64/libHBAAPI.so
```

4. Verify the installation:

```
sanlun version
```

You should see an output similar to the following example:

```
sanlun version 8.0.386.1644
```

What's next?

- 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.

- Learn about the "sanlun" utility.

Install Linux Host Utilities 7.1 for ONTAP storage

The Linux Host Utilities help you manage ONTAP storage attached to a Linux host. NetApp strongly recommends installing the Linux Host Utilities, but it isn't mandatory. The utilities improve management and assist NetApp customer support in gathering information about your configuration.

Linux Host Utilities 7.1 supports the following distribution types:

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

> The Linux Host Utilities software doesn't support NVMe over Fibre Channel (NVMe/FC) and NVMe over TCP (NVMe/TCP) host protocols.

About this task

When you install the Linux Host Utilities, it doesn't change any settings on your Linux host.

Before you begin

- For reliable operation, use the Interoperability Matrix Tool to verify that your iSCSI, FC, or FCoE configuration is supported.
- Install the host bus adapter (HBA) management packages available on the vendor support site. The management software enables the `sanlun` commands to gather information about the FC HBAs, such as their WWPNs.

  Refer to the vendor documentation to verify that the following packages are correctly installed. These packages are required to support the `sanlun fcp show adapter` command:

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

Steps

1. If you have a version of Linux Host Utilities currently installed, remove it:

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

For earlier 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 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 install it:

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

You should see an output similar to the following example:

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

4. Verify the installation:

```
sanlun version
```

You should see an output similar to the following example:

```
sanlun version 7.1.386.1644
```

What's next?

- 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.

- Learn about the "sanlun" utility.

Learn about the "sanlun" utility for ONTAP storage

Linux Host Utilities is a NetApp host software that provides `sanlun` commands on your Linux host. The `sanlun` utility is installed automatically when you install the NetApp Host Utilities package. This utility provides the `sanlun` commands that you can use to manage

ONTAP LUNs and host bus adapters (HBAs). The `sanlun` commands return information about the ONTAP LUNs mapped to your host, multipathing, and information necessary to create initiator groups.

In the following example, the `sanlun lun show all` command returns ONTAP LUN information:

```
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
```

- For Linux Host Utilities 7.1, the "sanlun" utility 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 doesn't affect your system performance.
- The "sanlun" utility isn't supported for the following hypervisor types:

8.0

For Linux Host Utilities 8.0, the "sanlun" utility isn't supported for Citrix XenServer, Oracle VM, and Red Hat Enterprise Virtualization.

7.1

For Linux Host Utilities 7.1, the "sanlun" utility isn't supported for Citrix Xenserver, Red hat Enterprise Virtualization, and Proxmox.

What's next?

Learn about using the Linux Host Utilities tool.

Use Linux Host Utilities commands to verify ONTAP storage configuration

You can use the Linux Host Utilities 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
```

Show example

```
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
```

Show example

```
                    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
----------- --------- ---------- ------- ------------ ----------
----------
            host      vserver            host:
dm-mp       path      path       /dev/   chan:        vserver    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
```

Show example

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

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
```

Show example

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

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 hist.

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

Show example

```
                                                                    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::0x00000000000000000000000809E7CC3
         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
```

Show example

```
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
```

Show example

```
controller(7mode/E-Series)/   target
device          host       lun
vserver(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
```

Show example

```
controller(7mode/E-Series)/   target
device         host       lun
vserver(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 Release Notes

The Solaris Host Utilities release notes describe new features, enhancements, known issues, 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 Interoperability Matrix Tool.

What's new in Solaris Host Utilities 8.0

- Solaris Host Utilities 8.0 introduces the `disksort:false` and `cache-nonvolatile:true` parameter settings. These parameters suppress constant sync calls from the host. The sync calls impact performance and aren't required because ONTAP doesn't have volatile cache. For more information, see Cache Flush Behavior for Flash and NVRAM Storage Devices.
- Solaris Host Utilities 8.0 supports automated updates for FC drivers. The FC drivers that bind the parameters for Solaris 11.4 use SCSI disks. For more information, see the Oracle Support Doc ID 2595926.1.

Known issues and limitations

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

Bug ID	Affects version	Title	Description
	Solaris Host Utilities 8.0		The Solaris Host Utilities 8.0 release only supports Solaris 11.4 with SPARC and x86 platforms. For Solaris 11.3 and earlier versions, you need to use the Solaris Host Utilities 6.2.
1385189	Solaris 11.4	Solaris 11.4 FC driver binding changes required in HUK 6.2	Solaris 11.4 and HUK recommendations: FC driver binding is changed from `ssd(4D)` to `sd(4D)`. Move configuration that you have in `ssd.conf` to `sd.conf` 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

What's next

Learn about installing Solaris Host Utilities

Install Solaris Host Utilities

Install Solaris Host Utilities 8.0 for ONTAP storage

The Solaris Host Utilities help you manage ONTAP storage attached to a Solaris host and assist technical support with gathering configuration data.

The Solaris Host Utilities support the following Solaris environments and transport protocols. These are the primary supported environments:

- The native OS with Oracle Solaris I/O Multipathing (MPxIO) and either the FC or iSCSI protocol on a system using either a SPARC or x86/64 processor.
- Veritas Dynamic Multipathing (DMP) with the FC or iSCSI protocol on a system using a SPARC processor.

Solaris Host Utilities 8.0 support the Solaris 11.4 series.

Before you begin

Verify that your iSCSI, FC, or FCoE configuration is supported. You can use the Interoperability Matrix Tool to verify your configuration.

Steps

1. Log in 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.

   SPARC CPU

   ```
   netapp_solaris_host_utilities_8_0_sparc.tar.gz
   ```

   x86/x64 CPU

   ```
   netapp_solaris_host_utilities_8_0_amd.tar.gz
   ```

3. Go to the directory on your host containing the download.
4. Unzip the file using the `gunzip` command, and then extract the file using `tar -xvf`:

   ```
   gunzip netapp_solaris_host_utilities_8_0_sparc.tar.gz
   ```

   ```
   tar -xvf netapp_solaris_host_utilities_8_0_sparc.tar
   ```

5. Add the packages that you extracted from the tar file to your host:

   ```
   pkgadd
   ```

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
```

6. Confirm that the toolkit was successfully installed by using the following command to the installed path:

```
pkgchk
```

Show example output

```
# pkgchk -l -p /opt/NTAP/SANToolkit

Pathname: /opt/NTAP/SANToolkit
Type: directory
Expected mode: 0755
Expected owner: root
Expected group: sys
Referenced by the following packages: NTAPSANTool
Current status: installed

# ls -alR /opt/NTAP/SANToolkit
/opt/NTAP/SANToolkit:
total 1038
drwxr-xr-x   3 root     sys            4 Mar  7 13:11 .
drwxr-xr-x   3 root     sys            3 Mar  7 13:11 ..
drwxr-xr-x   2 root     sys            6 Mar 17 18:32 bin
-r-xr-xr-x   1 root     sys       432666 Dec 31 13:23 NOTICES.PDF

/opt/NTAP/SANToolkit/bin:
total 3350
drwxr-xr-x   2 root     sys            6 Mar 17 18:32 .
drwxr-xr-x   3 root     sys            4 Mar  7 13:11 ..
-r-xr-xr-x   1 root     sys      1297000 Feb  7 22:22 host_config
-r-xr-xr-x   1 root     root         996 Mar 17 18:32 san_version
-r-xr-xr-x   1 root     sys       309700 Feb  7 22:22 sanlun
-r-xr-xr-x   1 root     sys          677 Feb  7 22:22 vidpid.dat

# cd /usr/share/man/man1; ls -al host_config.1 sanlun.1
-r-xr-xr-x   1 root     sys        12266 Feb  7 22:22 host_config.1
-r-xr-xr-x   1 root     sys         9044 Feb  7 22:22 sanlun.1
```

7. Configure the host parameters for your "MPxIO" or "Veritas DMP" environment by using the `/opt/NTAP/SANToolkit/bin/host_config` command with the multipath stack from the command reference:

   ```
   /opt/NTAP/SANToolkit/bin/host_config -setup -protocol fcp|iscsi|mixed
   -multipath mpxio|dmp|non [-noalua] [-mcc 60|90|120]
   ```

For example, if your setup is…	Use the command…
FCP with multipath as MPxIO	`#/opt/NTAP/SANToolkit/bin/host_config -setup -protocol fcp -multipath mpxio` For information on the configuration changes for SnapMirror active sync, see the Knowledge Base article Solaris Host support recommended settings in SnapMirror active sync (formerly SM-BC) configuration.
FCP with multipath as DMP	`#/opt/NTAP/SANToolkit/bin/host_config -setup -protocol fcp -multipath dmp`
FCP on MetroCluster with multipath as MPxIO, and the All Paths Down value is set to 120s. (This is the recommended setting for MetroCluster configurations).	`#/opt/NTAP/SANToolkit/bin/host_config -setup -protocol fcp -multipath mpxio -mcc 120` For more information, see the Knowledge Base article Solaris host support considerations in a MetroCluster configuration.

8. Reboot the host.

   The Host Utilities load the following NetApp recommended timeout parameter settings for ONTAP LUNs.

Show example

```
#prtconf -v |grep NETAPP
   value='NETAPP  LUN' +
   physical-block-size:4096,
   retries-busy:30,
   retries-reset:30,
   retries-notready:300,
   retries-timeout:10,
   throttle-max:64,
   throttle-min:8,
   disksort:false,
   cache-nonvolatile:true'
```

9. Verify the Host Utilities installation:

```
sanlun version
```

What's next?

Learn about the SAN Toolkit.

Install Solaris Host Utilities 6.2 for ONTAP storage

The Solaris Host Utilities help you manage ONTAP storage attached to a Solaris host and assist technical support with gathering configuration data.

The Solaris Host Utilities support several Solaris environments and multiple transport protocols. These are the primary Solaris Host Utilities environments:

- The native OS with MPxIO and 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 Host Utilities 6.2 support the following Solaris series:

- Solaris 11.x
- Solaris 10.x

Before you begin

Verify that your iSCSI, FC, or FCoE configuration is supported. You can use the Interoperability Matrix Tool to verify your configuration.

Steps

1. Log in 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 Solaris host:

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 on your Solaris host containing the download.
4. Unzip the file using the `gunzip` command:

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

5. Extract the file using the `tar xvf` command:

```
tar xvf netapp_solaris_host_utilities_6_2_sparc.tar
```

6. Add the packages that you extracted from tar file to your host

```
pkgadd
```

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 one of the following commands:

```
pkginfo
```

```
ls - al
```

Show example outputs

```
# 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. Configure the host parameters for your MPxIO or Veritas DMP environment:

```
/opt/NTAP/SANToolkit/bin/host_config
```

9. Verify the installation:

```
sanlun version
```

What's next?

Learn about the SAN Toolkit.

Learn about the SAN Toolkit for ONTAP storage

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.

The following example output shows the ONTAP LUN information returned for the `sanlun lun show` command:

Show example output

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

This toolkit is common across all Host Utilities configurations and protocols. As a result, all of the components don't apply to every configuration. Unused components don't affect your system performance.

What's next?

Learn about using the Solaris Host Utilities tool.

Use Solaris Host Utilities commands to verify ONTAP storage configuration

You can use the Solaris Host Utilities 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
```

8.0

Show example for Solaris Host Utilities 8.0

```
adapter name:      qlc0
WWPN:              2100f4e9d40fe3e0
WWNN:              2000f4e9d40fe3e0
driver name:       qlc
model:             7023303
model description: 7101674, Sun Storage 16Gb FC PCIe Universal HBA,
QLogic
serial number:     463916R+1912389772
hardware version:  Not Available
driver version:    230206-5.12
firmware version:  8.08.04
Number of ports:   1 of 2
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:    /dev/cfg/c4

adapter name:      qlc1
WWPN:              2100f4e9d40fe3e1
WWNN:              2000f4e9d40fe3e1
driver name:       qlc
model:             7023303
model description: 7101674, Sun Storage 16Gb FC PCIe Universal HBA,
QLogic
serial number:     463916R+1912389772
hardware version:  Not Available
driver version:    230206-5.12
firmware version:  8.08.04
Number of ports:   2 of 2
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:    /dev/cfg/c5
```

6.2

Show example for Solaris Host Utilities 6.2

```
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
```

8.0

Show example for Solaris Host Utilities 8.0

```
ONTAP Path: sanboot_unix:/vol/test1/lun1
       LUN: 0
       LUN Size: 21g
       Host Device:
/dev/rdsk/c0t600A098038314B314E5D574632365A51d0s2
       Mode: C
       Multipath Provider: Sun Microsystems
       Multipath Policy: Native
```

6.2

Show example for Solaris Host Utilities 6.2

```
                    ONTAP Path: data_vserver:/vol1/lun1
                           LUN: 1
                      LUN Size: 10g
                   Host Device:
/dev/rdsk/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 specific SVM.

```
sanlun lun show -p -v <svm_name>
```

8.0

Show example for Solaris Host Utilities 8.0

```
ONTAP Path: sanboot_unix:/vol/test1/lun1
       LUN: 0
       LUN Size: 20g
       Host Device:
/dev/rdsk/c0t600A098038314B314E5D574632365A51d0s2
       Mode: C
       Multipath Provider: Sun Microsystems
       Multipath Policy: Native
```

6.2

Show example for Solaris Host Utilities 6.2

```
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
```

8.0

Show example for Solaris Host Utilities 8.0

```
controller(7mode/E-Series)/
device
vserver(cDOT/FlashRay)       lun-pathname
filename
------------------------------------------------------------------------
-----------------------------------------
sanboot_unix                /vol/test1/lun1
/dev/rdsk/
c0t600A098038314B314E5D574632365A51d0s2

host adapter    protocol lun size   product
-----------------------------------------
qlc1            FCP      20g        cDOT
```

6.2

Show example for Solaris Host Utilities 6.2

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

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

Windows Host Utilities

Windows Host Utilities Release Notes

The release notes describe new features, enhancements, known issues, limitations, and important cautions related to configuring and managing your specific Windows host with your ONTAP storage system.

For specific information about the operating system versions and updates that the Host Utilities support, see the Interoperability Matrix Tool.

What's new in Windows Host Utilities 8.0

Windows Host Utilities 8.0 include additional parameter settings for NVMe/FC drivers. These parameters are automatically loaded when you install the Windows Host Utilities 8.0.

What's new in Windows Host Utilities 7.2

Windows Host Utilities 7.2 includes support for NVMe/FC driver parameter settings and bug fixes for new vendor cards.

What's new in Windows Host Utilities 7.1

Windows Host Utilities 7.1 includes support for E-Series storage systems, ONTAP 9 software, and enhanced iSCSI timeouts for faster failover.

Known issues and limitations

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

Title	Affects version	Description	Workaround
Running the `linux_gos_timeout-install.sh` script is no longer required on Hyper-V guests running Red Hat Enterprise Linux or SUSE Linux Enterprise Server	7.1	You are no longer required to run the `linux_gos_timeout-install.sh` script to change disk timeouts on Red Hat Enterprise Linux 5, Red Hat Enterprise Linux 6, or SUSE Linux Enterprise Server 11 Hyper-V guests because the default timeout settings are being used. The `linux_gos_timeout-install.sh` script that was included in previous versions of the Host Utilities is no longer included in the Windows Host Utilities 7.1 version. Windows Host Utilities 7.1 uses the default disk timeout settings.	Not Applicable

NetApp Bugs Online provides complete information for most known issues, including suggested workarounds where possible.

What's next

Learn about installing Windows Host Utilities

Install Windows Host Utilities

Install Windows Host Utilities 8.0 for ONTAP storage

The Windows Host Utilities enable you to connect a Windows host computer to NetApp storage systems.

The Windows Host Utilities support the following versions of Windows:

- Windows 2025
- Windows 2022
- Windows 2019
- Windows 2016

Windows 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 ONTAP 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
`\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.
`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 Interoperability Matrix Tool.

Step 1: Verify your host and storage system configuration

Verify that your host and storage system configuration are supported before you install Windows Host Utilities for the supported Windows version.

Steps

1. Check the supported configuration in the Interoperability Matrix Tool.
2. Check the hotfixes required for your Windows Server host version in the SAN host Windows documentation.

   For example, the Configure Windows Server 2025 for ONTAP storage documentation provides the instructions for installing Windows hotfixes for Windows Server 2025.

3. Add the iSCSI or FCP license.

4. Start the target service.
5. Verify your cabling.

   Refer to the SAN configuration reference for detailed cabling and configuration information.

Step 2: 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.

> You should only allow the Windows Host Utilities installer to set the HBA parameters. This ensures that the Windows host can correctly handle the storage system behaviors for ONTAP platforms.

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. Refer to the SAN configuration reference for more information.

Step 3: Install the Windows Host Utilities

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

About this task

Optionally, you can include multipathing support when you install the Windows Host Utilities software package. The installer prompts you for the following options:

- 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're using a single path to the storage system.

You can also choose multipathing support using a Windows command line prompt.

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

> If you don't install the MPIO software, the Windows OS might see each path as a separate disk. This can lead to data corruption.

> Windows XP or Windows Vista running in a Hyper-V virtual machine doesn't support MPIO.

Steps

You can install the Host Utilities interactively or by using the Windows command line. The new Host Utilities installation package must be in a path that is accessible to the Windows host.

Install interactively

Install the Windows Host Utilities software package interactively by running the installation program and following the prompts.

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_8.0.0_x64` file and follow the instructions on the screen.
4. Reboot the Windows host when prompted.

Install noninteractively

Perform a noninteractive installation of the Host Utilities by using the Windows command line. The system automatically reboots when the installation is complete.

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.

What's next?

Learn about the Windows Host Utilities configuration for ONTAP storage

Install Windows Host Utilities 7.2 for ONTAP storage

The Windows Host Utilities enable you to connect a Windows host computer to NetApp storage systems.

The Windows Host Utilities support the following versions of Windows:

- Windows 2025
- Windows 2022

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

Windows 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 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 Interoperability Matrix Tool.

Step 1: Verify your host and storage system configuration

Verify that your host and storage system configuration are supported before you install Windows Host Utilities for the supported Windows version.

Steps

1. Check the supported configuration in the Interoperability Matrix Tool.
2. Check the hotfixes required for your Windows Server host version in the SAN host Windows documentation.

   For example, the Configure Windows Server 2022 for ONTAP storage documentation provides the instructions for installing Windows hotfixes for Windows server 2022.

3. Add the iSCSI or FCP license.

   The FC and iSCSI protocols don't require licenses on E-Series storage systems using the SANtricity Storage Manager.

4. Start the target service.

5. Verify your cabling.

   Refer to the SAN configuration reference for detailed cabling and configuration information.

Step 2: 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.

> You should only allow the Windows Host Utilities installer to set the HBA parameters. This ensures that the Windows host can correctly handle the storage system behaviors for ONTAP platforms.

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. Refer to the SAN configuration reference for more information.

Step 3: Install the Windows Host Utilities

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

About this task

Optionally, you can include multipathing support when you install the Windows Host Utilities software package. The installer prompts you for the following options:

- 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're using a single path to the storage system.

You can also choose multipathing support using a Windows command line prompt.

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

> If you don't install the MPIO software, the Windows OS might see each path as a separate disk. This can lead to data corruption.

> Windows XP or Windows Vista running in a Hyper-V virtual machine doesn't support MPIO.

Steps

You can install the Host Utilities interactively or by using the Windows command line. The new Host Utilities

installation package must be in a path that is accessible to the Windows host.

Install interactively

Install the Host Utilities software package interactively by running the Host Utilities installation program and following the prompts.

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 noninteractively

Perform a noninteractive installation of the Host Utilities by using the Windows command line. The system automatically reboots when the installation is complete.

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.

What's next?

Learn about the Windows Host Utilities configuration for ONTAP storage

Install Windows Host Utilities 7.1 for ONTAP storage

The Windows Host Utilities enable you to connect a Windows host computer to NetApp storage systems.

Windows Host Utilities supports the following versions of Windows:

- Windows 2022
- Windows 2019
- Windows 2016

- Windows 2012R2
- Windows 2012

Windows 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 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 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 Interoperability Matrix Tool for the current list of supported configurations.

Step 1: Verify your host and storage system configurations

Verify that your host and storage system configuration are supported before you install Windows Host Utilities for the supported Windows version.

Steps

1. Check the supported configuration in the Interoperability Matrix Tool.
2. Check the hotfixes required for your Windows Server host version in the SAN host Windows documentation.

   For example, the Configure Windows Server 2022 for ONTAP storage documentation provides the instructions for installing Windows hotfixes for Windows server 2022.

3. Add the iSCSI or FCP license.

   The FC and iSCSI protocols don't require licenses on E-Series storage systems using the SANtricity Storage Manager.

4. Start the target service.
5. Verify your cabling.

Refer to the SAN configuration reference for detailed cabling and configuration information.

Step 2: 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.

> You should only allow the Windows Host Utilities installer to set the HBA parameters. This ensures that the Windows host can correctly handle the storage system behaviors for ONTAP platforms.

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. Refer to the SAN configuration reference for more information.

Step 3: Install the Windows Host Utilities

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

About this task

Optionally, you can include multipathing support when you install the Windows Host Utilities software package. The installer prompts you for the following options:

- 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're using a single path to the storage system.

You can also choose multipathing support using a Windows command line prompt.

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

> If you don't install the MPIO software, the Windows OS might see each path as a separate disk. This can lead to data corruption.

> Windows XP or Windows Vista running in a Hyper-V virtual machine doesn't support MPIO.

Steps

You can install the Host Utilities interactively or by using the Windows command line. The new Host Utilities installation package must be in a path that is accessible to the Windows host.

Install interactively

Install the Host Utilities software package interactively by running the Host Utilities installation program and following the prompts.

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 noninteractively

Perform a noninteractive installation of the Host Utilities by using the Windows command line. The system automatically reboots when the installation is complete.

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 /l*v <install.log> LOGVERBOSE=1` command displays logging information.

What's next?

Learn about the Windows Host Utilities configuration for ONTAP storage

Review the Windows Host Utilities configuration for ONTAP storage

The Windows Host Utilities require certain registry and parameter settings so that a Windows host correctly handles the ONTAP storage system behavior.

These registry and parameter values affect how a Windows host responds to a delay or loss of data, for example, correctly handling events such as a storage failover.

Some of the registry and parameter values don't apply to the device-specific module (DSM) for SANtricity Storage Manager. Overlap between values set by the Windows Host Utilities and the DSM for SANtricity Storage Manager don't cause conflicts.

A Windows host also requires certain FC, NVMe/FC, and iSCSI HBA parameters to successfully handle storage system events:

- Beginning with Windows Host Utilities 7.2, the installer sets the Windows, iSCSI, FC, and NVMe/FC parameters to the supported values.
- Beginning with Windows Host Utilities 7.1, the installer sets the Windows, FC, and NVMe/FC HBA parameters to the supported values. You need to manually set the iSCSI HBA parameters.

The installer sets different values when you specify Microsoft Multipath I/O (MPIO) support during the installation.

> You need to change the LimTransferSize parameter value after installing Windows Host Utilities 7.2. See NVME parameters.
>
> For all other parameters and registry keys for Windows Host Utilities 8.0, 7.2, or 7.1, you don't need to change the values unless technical support advises you to do so.

Review the configuration settings for Windows Host Utilities 8.0

The Windows Host Utilities installer automatically sets the Windows registry values and the iSCSI and NVMe HBA parameters based on the choices that you make during the installation. Review these values and the operating system version.

Windows registry values

All Windows registry values are in decimal unless otherwise stated.

HKLM is the abbreviation for `HKEY_LOCAL_MACHINE`.

Registry key	Value	Set registry key…
HKLM\SYSTEM\CurrentControlSet\Services\msdsm\Parameters\DsmMaximumRetryTimeDuringStateTransition	120	When MPIO support is specified and your server is Windows Server 2025, 2022, 2019, or 2016
HKLM\SYSTEM\CurrentControlSet\Services\msdsm\Parameters\DsmMaximumStateTransitionTime	120	When MPIO support is specified and your server is Windows Server 2025, 2022, 2019, or 2016
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\Services\ClusDisk\Parameters\ManageDisksOnSystemBuses	1	Always
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 2025, 2022, 2019, or 2016
HKLM\SYSTEM\CurrentControlSet\Services\mpio\Parameters\PathVerifyEnabled	1	When MPIO support is specified

Registry key	Value	Set registry key…
HKLM\SYSTEM\CurrentControlSet\Services\msdsm\Parameters\PathVerifyEnabled	1	When MPIO support is specified and your server is Windows Server 2025, 2022, 2019, or 2016
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 2025, 2022, 2019, or 2016
HKLM\SYSTEM\CurrentControlSet\Services\vnetapp\Parameters\PDORemovePeriod	130	When MPIO support is specified
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 2025, 2022, 2019, or 2016
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 2025, 2022, 2019, or 2016
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
	60	When MPIO support is specified
HKLM\SYSTEM\CurrentControlSet\Services\mpio\Parameters\UseCustomPathRecoveryInterval	1	When MPIO support is specified and your server is Windows Server 2025, 2022, 2019, or 2016

iSCSI HBA values

All iSCSI HBA values are in decimal unless otherwise stated.

HKLM is the abbreviation for `HKEY_LOCAL_MACHINE`.

Registry key	Value	Set registry key…
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\Control\Class\{iSCSI_driver_GUID}\instance_ID\Parameters\MaxRequestHoldTime	120	When no MPIO support is selected

NVMe parameters

Windows Host Utilities 8.0 updates the following NVMe Emulex driver parameters during installation:

- EnableNVMe = 1
- NVMEMode = 0

Review the configuration settings for Windows Host Utilities 7.2

The Windows Host Utilities installer automatically sets the Windows registry values and the iSCSI and NVMe HBA parameters based on the choices that you make during the installation. Review these values and the operating system version.

Windows registry values

All Windows registry values are in decimal unless otherwise stated.

HKLM is the abbreviation for `HKEY_LOCAL_MACHINE`.

Registry key	Value	Set registry key…
HKLM\SYSTEM\CurrentControlSet\Services\msdsm\Parameters\DsmMaximumRetryTimeDuringStateTransition	120	When MPIO support is specified and your server is Windows Server 2025, 2022, 2019, 2016, or 2012 R2
HKLM\SYSTEM\CurrentControlSet\Services\msdsm\Parameters\DsmMaximumStateTransitionTime	120	When MPIO support is specified and your server is Windows Server 2025, 2022, 2019, 2016, or 2012 R2
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\Services\ClusDisk\Parameters\ManageDisksOnSystemBuses	1	Always
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 2025, 2022, 2019, 2016, or 2012 R2
HKLM\SYSTEM\CurrentControlSet\Services\mpio\Parameters\PathVerifyEnabled	1	When MPIO support is specified

Registry key	Value	Set registry key…
HKLM\SYSTEM\CurrentControlSet\Services\msdsm\Parameters\PathVerifyEnabled	1	When MPIO support is specified and your server is Windows Server 2025, 2022, 2019, 2016, or 2012 R2
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 2025, 2022, 2019, 2016, or 2012 R2
HKLM\SYSTEM\CurrentControlSet\Services\vnetapp\Parameters\PDORemovePeriod	130	When MPIO support is specified
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 2025, 2022, 2019, 2016, or 2012 R2
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 2025, 2022, 2019, 2016, or 2012 R2
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
	60	When MPIO support is specified
HKLM\SYSTEM\CurrentControlSet\Services\mpio\Parameters\UseCustomPathRecoveryInterval	1	When MPIO support is specified and your server is Windows Server 2025, 2022, 2019, 2016, or 2012 R2

iSCSI HBA values

All iSCSI HBA values are in decimal unless otherwise stated.

HKLM is the abbreviation for `HKEY_LOCAL_MACHINE`.

Registry key	Value	Set registry key…
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\Control\Class\{iSCSI_driver_GUID}\instance_ID\Parameters\MaxRequestHoldTime	120	When no MPIO support is selected

NVMe parameters

Windows Host Utilities 7.2 updates the following NVMe Emulex driver parameters during installation:

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

  The LimTransferSize parameter is automatically set to "1" when you install Windows Host Utilities 7.2. After installation, you change the LimTransferSize value to "0" and reboot the server.

Review the configuration settings for Windows Host Utilities 7.1

The Windows Host Utilities installer automatically sets registry values based on the choices that you make during installation. Review these registry values and the operating system version. All values are in decimal unless otherwise noted.

`HKLM` is the abbreviation for `HKEY_LOCAL_MACHINE`.

Registry key	Value	Set registry key…
HKLM\SYSTEM\CurrentControlSet\Services\msdsm\Parameters\DsmMaximumRetryTimeDuringStateTransition	120	When MPIO support is specified and your server is Windows Server 2016, 2012 R2, 2012, 2008 R2, or 2008, except if Data ONTAP DSM is detected

Registry key	Value	Set registry key…
HKLM\SYSTEM\CurrentControlSet\Services \msdsm\Parameters \DsmMaximumStateTransitionTime	120	When MPIO support is specified and your server is Windows Server 2016, 2012 R2, 2012, 2008 R2, or 2008, 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\Class {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
HKLM\SYSTEM\CurrentControlSet\Services\msdsm \Parameters\PathVerifyEnabled	0	When MPIO support is specified, except if Data ONTAP DSM is detected

Registry key	Value	Set registry key…
HKLM\SYSTEM\CurrentControlSet\Services \msdsm\Parameters\PathVerifyEnabled	0	When MPIO support is specified and your server is Windows Server 2016, 2012 R2, 2012, 2008 R2, or 2008, 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 2016, 2012 R2, 2012, 2008 R2, or 2008, 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 2016, 2012 R2, 2012, 2008 R2, or 2008, 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
HKLM\SYSTEM\CurrentControlSet\Services \msdsm\Parameters\RetryInterval	1	When MPIO support is specified and your server is Windows Server 2016, 2012 R2, 2012, 2008 R2, or 2008, except if Data ONTAP DSM is detected
HKLM\SYSTEM\CurrentControlSet\Services \vnetapp\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
	60	When MPIO support is specified

Registry key	Value	Set registry key…
HKLM\SYSTEM\CurrentControlSet\Services\mpio\Parameters\UseCustomPathRecoveryInterval	1	When your server is Windows Server 2016, 2012 R2, 2012, 2008 R2, or 2008

See the Microsoft documents for the registry parameter details.

Learn about the FC HBA values set by Windows Host Utilities

The Windows Host Utilities installer sets the required timeout values for Emulex and QLogic FC HBAs on systems using FC.

The installer sets the following parameters for Emulex FC HBAs:

When you select MPIO

Property type	Property value
LinkTimeOut	1
NodeTimeOut	10

When you don't select MPIO

Property type	Property value
LinkTimeOut	30
NodeTimeOut	120

The installer sets the following parameters for QLogic FC HBAs:

When you select MPIO

Property type	Property value
LinkDownTimeOut	1
PortDownRetryCount	10

When you don't select MPIO

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.

Learn about the Host Utilities changes to FC HBA driver settings

During installation of the required Emulex or QLogic HBA drivers on an FC system, Windows Host Utilities checks several parameters and, in some cases, modifies them.

The Windows Host Utilities sets 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 that these settings have the correct values. The correct values depend on two factors:

- The HBA vendor
- Whether you are using MPIO software.

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

Emulex HBA drivers

Verify the Emulex HBA driver settings on FC systems. These settings must exist for each port on the HBA.

Steps

1. Open OnCommand Manager.
2. Select the appropriate HBA from the list and select 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 aren't using MPIO software, ensure that you have the following driver settings:
      - LinkTimeOut - 30
      - NodeTimeOut - 120

QLogic HBA drivers

Verify the QLogic HBA driver settings on FC systems. These settings must exist for each port on the HBA.

Steps

1. Open QConvergeConsole, and then select **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 (portdwnrc) - 10
6. If you aren't using MPIO software, verify that you have the following driver settings:
   - Link Down Timeout (linkdwnto) - 30
   - Port Down Retry Count (portdwnrc) - 120

Upgrade Windows Host Utilities for ONTAP storage

You can upgrade Windows Host Utilities software in your ONTAP storage configuration by following the installation instructions interactively or by using the Windows command line. You need to install the new Windows Host Utilities installation software on a path that is accessible to the Windows host.

Upgrade interactively

Upgrade the Windows Host Utilities software interactively by running the Host Utilities installation program and following 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 noninteractively

Perform a noninteractive Windows Host Utilities software upgrade by using the Windows command line.

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 Microsoft Multipath I/O (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 Host Utilities for ONTAP storage

Use the **Repair** option in 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 Host Utilities**.
3. Select **Change**.
4. Select **Repair** or **Remove**, as needed.
5. Follow the instructions on the screen.

Repair or remove noninteractively

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. 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.

Troubleshoot issues for Windows Host Utilities with ONTAP storage configuration

Use the general troubleshooting techniques to investigate issues that might occur for a Windows Host Utilities with ONTAP storage configuration. You should also check the Windows Host Utilities 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 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 ONTAP SAN administration documentation.
- 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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