



**Hewlett Packard**  
Enterprise

# **HPE 3PAR Citrix XenServer Implementation Guide**

## **Abstract**

This guide provides instructions for establishing communication between an HPE 3PAR StoreServ Storage system and a host running Citrix XenServer 7.x, 6.x, or 5.x. It is intended for system and storage administrators who manage system configurations and resource allocation for the HPE 3PAR StoreServ Storage system.

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# Introduction

This Hewlett Packard Enterprise (HPE) implementation guide provides information for establishing communication between the HPE 3PAR StoreServ Storage system and a host running Citrix XenServer 7.x, 6.x, or 5.x. It describes the steps for allocating storage on the HPE 3PAR StoreServ Storage system.

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## NOTE:

- For predictable performance and results with the HPE 3PAR StoreServ Storage, the information in this guide must be used in conjunction with the documentation provided by Hewlett Packard Enterprise for the HPE 3PAR StoreServ Storage and the documentation provided by the vendor for its respective products.
  - In addition to the OS patches mentioned in this guide, there might be patches referenced on the **SPOCK** website.
- 

For information about supported hardware and software platforms, see the **SPOCK** website (**SPOCK Home > Explore Storage Interoperability With SPOCK > Explore HPE 3PAR StoreServ Storage interoperability**).

## More information

[www.hpe.com/storage/spock](http://www.hpe.com/storage/spock)

## Audience

This implementation guide is intended for system and storage administrators who monitor and direct system configurations and resource allocation for the HPE 3PAR StoreServ Storage. It is assumed that the administrators are familiar with the host OS and the HPE 3PAR OS.

## HPE 3PAR OS versions reference

This guide references older versions of the HPE 3PAR OS that are not supported, such as 3.1.1, 3.1.2, 3.1.3, and 3.2.1. These versions are mentioned to document when a storage feature was first introduced. This guide is not a statement of support.

For information about the latest supported hardware and software releases, refer to the *Active/Inactive Status of HPE 3PAR OS* document on the **SPOCK** website (**SPOCK Home > Software > 3PAR Array Software > HPE 3PAR Product Safe Harbor, OS Active/Inactive Status**).

## Supported configurations

The following types of host connections are supported between the HPE 3PAR StoreServ Storage and hosts with the Citrix XenServer OS:

- FC (Fibre Channel)
- Software iSCSI initiator
- FCoE (Fibre Channel over Ethernet)
  - FCoE initiator connecting to an FC target or an FCoE target

FC connections are supported between the HPE 3PAR OS and the host in both a fabric-attached and direct-connect topology.

# HPE 3PAR OS upgrade considerations

This implementation guide refers to new installations. For information about planning an online HPE 3PAR OS upgrade, see the *HPE 3PAR Operating System Upgrade Pre-Planning Guide* on the [Hewlett Packard Enterprise Information Library](#) website.

For complete details about supported host configurations and interoperability, see the [SPOCK](#) website ([SPOCK Home](#) > [Explore Storage Interoperability With SPOCK](#) > [Explore 3PAR StoreServ Storage interoperability](#)).

## More information

[www.hpe.com/info/storage/docs](http://www.hpe.com/info/storage/docs)

[www.hpe.com/storage/spock](http://www.hpe.com/storage/spock)

# HPE 3PAR coexistence

The HPE 3PAR StoreServ Storage array can coexist with other Hewlett Packard Enterprise storage array families.

For supported Hewlett Packard Enterprise storage array combinations and rules, see the *HPE SAN Design Reference Guide* on the [SPOCK](#) website ([SPOCK Home](#) > [Design Guides](#) > [SAN Design Guide](#)).

# HPE 3PAR documentation

Type of documentation:	See:
Current version of this implementation guide and other HPE 3PAR StoreServ storage documentation	<a href="#">Hewlett Packard Enterprise Information Library</a>
Supported hardware and software platforms	The Single Point of Connectivity Knowledge ( <a href="#">SPOCK</a> )
Customer Self Repair procedures (media)	<a href="#">Hewlett Packard Enterprise Customer Self Repair Services Media Library</a> <ol style="list-style-type: none"><li>1. Under <b>Product category</b>, select <b>Storage</b>.</li><li>2. Under <b>Product family</b>, select <b>3PAR StoreServ Storage</b>.</li><li>3. Under <b>Product series</b>, select your product series.</li></ol>
All Hewlett Packard Enterprise products	<a href="#">Hewlett Packard Enterprise Support Center</a>

# Configuring the HPE 3PAR StoreServ Storage and host—FC

The following topics describe how to establish an FC connection between an HPE 3PAR StoreServ Storage and a Citrix host using FC, and cover HPE 3PAR OS 3.2.x and 3.1.x. For information on setting up the physical connection for a particular HPE 3PAR StoreServ Storage, see the appropriate installation manual.

**NOTE:** Hewlett Packard Enterprise recommends using the default values to configure the host unless instructed otherwise in the procedures.

### Prerequisites

If you are setting up a fabric with your installation of the HPE 3PAR StoreServ Storage, consult **Setting up and zoning the fabric—FC** on page 13 before configuring or connecting the HPE 3PAR StoreServ Storage.

## Workflow for configuring the HPE 3PAR StoreServ Storage and host—FC

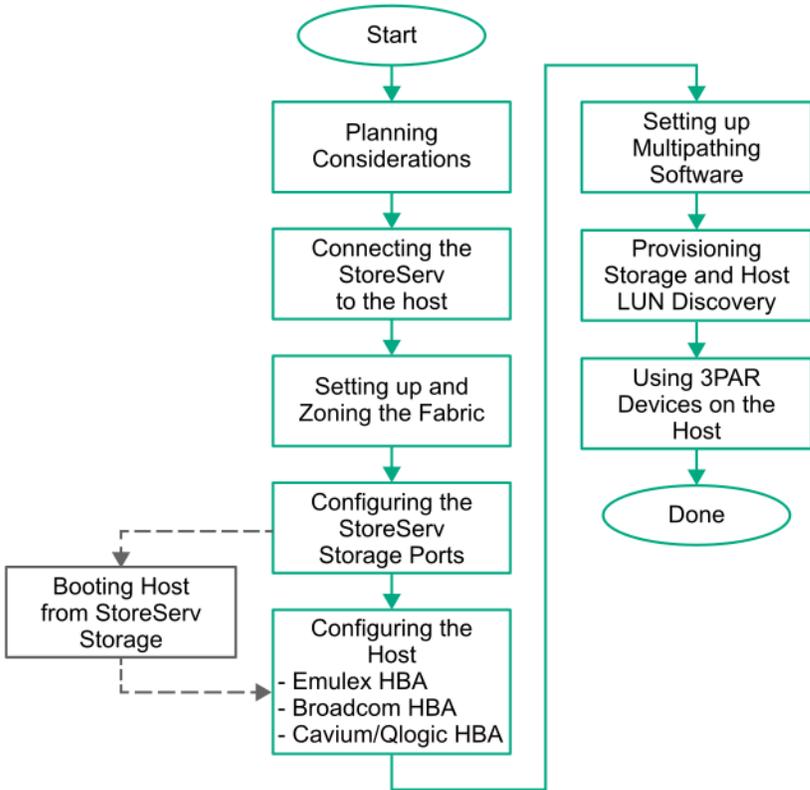


Figure 1: Configuring the HPE 3PAR StoreServ Storage and host—FC

## Considerations for planning the configuration—FC

When planning your configuration, review the following:

- [Target port limits and specifications—FC](#) on page 9
- [HPE 3PAR Persistent Ports—FC](#) on page 10
- [HPE 3PAR Persistent Ports—FCoE](#) on page 20
- [HPE 3PAR Smart SAN—FC](#) on page 11
- [HPE 3PAR Priority Optimization—FC](#) on page 12
- [HPE 3PAR Express Writes—FC](#) on page 12

## Target port limits and specifications—FC

To avoid overwhelming a target port and to ensure continuous I/O operations, observe the following limitations on a target port:

- Follow the instructions for setting the maximum number of initiator connections supported per array port, per array node pair, and per array as shown in the *HPE 3PAR Support Matrix* documentation on the [SPOCK](#) website ([SPOCK Home](#) > [Other Hardware](#) > [3PAR](#)).
- Maximum I/O queue depth per port on each HPE 3PAR StoreServ Storage HBA model, as follows:

HBA	Protocol	Array	Bus	Speed	Ports	Max. Queue Depth
Emulex LP11002	FC	HPE F200, F400, T400, T800	PCI-X	4 Gbps	2	959
3PAR FC044X	FC	HPE F200, F400, T400, T800	PCI-X	4 Gbps	4	1638
Emulex LPe12002	FC	HPE 3PAR StoreServ 7000	PCIe	8 Gbps	2	3276
Emulex LPe12004	FC	HPE 3PAR StoreServ 7000, 10000	PCIe	8 Gbps	4	3276
Emulex LPe16002	FC	HPE 3PAR StoreServ 7000, 8000, 10000	PCIe	16 Gbps	2	3072
Emulex LPe16004	FC	HPE 3PAR StoreServ 8000, 9000, 20000	PCIe	16 Gbps	4	3072

- The I/O queues are shared among the connected host HBA ports on a first-come, first-served basis.
- When all queues are in use and a host HBA port tries to initiate I/O, it receives a target queue full response from the HPE 3PAR StoreServ Storage port. This condition can result in erratic I/O performance on each host. If this condition occurs, each host should be throttled so that it cannot overrun the HPE 3PAR StoreServ Storage port's queues when all hosts are delivering their maximum number of I/O requests.

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**NOTE:**

- When host ports can access multiple targets on fabric zones, the target number assigned by the host driver for each discovered target can change when the host is booted and some targets are not present in the zone. This situation might change the device node access point for devices during a host restart. This issue can occur with any fabric-connected storage, and is not specific to the HPE 3PAR StoreServ Storage.
  - The maximum number of I/O paths supported is 16.
- 

**More information**

[www.hpe.com/storage/spock](http://www.hpe.com/storage/spock)

## HPE 3PAR Persistent Ports—FC

The HPE 3PAR Persistent Ports (or virtual ports) feature minimizes I/O disruption during an HPE 3PAR StoreServ Storage online upgrade or node-down event. Port shutdown or reset events do not trigger this feature.

Each FC target storage array port has a partner array port automatically assigned by the system. Partner ports are assigned across array node pairs.

HPE 3PAR Persistent Ports allows an HPE 3PAR StoreServ Storage FC port to assume the identity of a failed port (WWN port) while retaining its own identity. Where a given physical port assumes the identity of its partner port, the assumed port is designated as a persistent port. Array port failover and failback with HPE 3PAR Persistent Ports is transparent to most host-based multipathing software, which can keep all of its I/O paths active.

---

**NOTE:** Use of HPE 3PAR Persistent Ports technology does not negate the need for properly installed, configured, and maintained host multipathing software.

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For a complete description of the HPE 3PAR Persistent Ports feature, its operation, and a complete list of required setup and connectivity guidelines, see the following documents:

- Technical white paper *HPE 3PAR StoreServ Persistent Ports* (Hewlett Packard Enterprise document #F4AA4-4545ENW) on the [Hewlett Packard Enterprise Support Center](http://www.hpe.com/support/center) website.
- *HPE 3PAR Command Line Interface Administrator's Manual* in the "Using Persistent Ports for Nondisruptive Online Software Upgrades" topic on the [Hewlett Packard Enterprise Information Library](http://www.hpe.com/info/library) website.

**More information**

[www.hpe.com/support/hpesc](http://www.hpe.com/support/hpesc)  
[www.hpe.com/info/storage/docs](http://www.hpe.com/info/storage/docs)

## HPE 3PAR Persistent Ports setup and connectivity guidelines—FC

**Starting with HPE 3PAR OS 3.1.2**, the HPE 3PAR Persistent Ports feature is supported for FC target ports.

**Starting with HPE 3PAR OS 3.1.3**, the HPE 3PAR Persistent Ports feature has additional functionality to minimize I/O disruption during an array port `loss_sync` event triggered by a loss of array port connectivity to the fabric.

Follow the specific cabling setup and connectivity guidelines so that HPE 3PAR Persistent Ports function properly:

- HPE 3PAR StoreServ Storage FC partner ports must be connected to the same FC fabric, and preferably to different FC switches on the fabric.
- The FC fabric must support NPIV, and NPIV must be enabled.
- Configure the host-facing HBAs for point-to-point fabric connection. (There is no support for direct-connect "loops.")
- Hewlett Packard Enterprise recommends that Dynamic FCID assignment on the fabric or switch where the HPE 3PAR target ports are connected to is turned OFF/disabled. This will help the Host to resume I/O faster when Persistent Ports failover/failback occurs. Refer to the switch manufacturer documentation for guidance how to turn OFF/disable "Dynamic FCID assignment."
- WWN zoning is required for Persistent Ports to work.

For information about the HPE 3PAR Persistent Ports feature for an FCoE initiator to FC target configuration (FCoE to FC switched), see **Connecting the HPE 3PAR StoreServ Storage to the host—FC**.

## HPE 3PAR Smart SAN—FC

HPE 3PAR Smart SAN feature on 16 Gb FC targets began with HPE 3PAR OS 3.2.2. The following HPE 3PAR StoreServ Storage systems support this feature:

- HPE 3PAR StoreServ 20000 Storage
- HPE 3PAR StoreServ 10000 Storage
- HPE 3PAR StoreServ 9000 Storage
- HPE 3PAR StoreServ 8000 Storage
- HPE 3PAR StoreServ 7000 Storage

HPE 3PAR Smart SAN for 3PAR through its TDPZ (target-driven peer zoning) feature enables customers to automate peer zoning, which results in the creation of fewer zones and enables configuration of zones in minutes. Through automation, it reduces the probability of errors and potential downtime. Without HPE 3PAR Smart SAN, an administrator needs to preconfigure zones on the FC switch, before configuring hosts and VLUNs on the HPE 3PAR StoreServ Storage. With HPE 3PAR Smart SAN, the administrator can configure and control zoning directly from the HPE 3PAR CLI.

For information about supported FC switches and their firmware revisions with HPE 3PAR Smart SAN, see the **SPOCK** website.

For more information about HPE 3PAR Smart SAN for HPE 3PAR, including configuration, see the *HPE 3PAR Smart SAN 1.0 User Guide* on the **Hewlett Packard Enterprise Information Library** website.

### More information

[www.hpe.com/storage/spock](http://www.hpe.com/storage/spock)

[www.hpe.com/info/storage/docs](http://www.hpe.com/info/storage/docs)

## HPE 3PAR Priority Optimization—FC

**Beginning with HPE 3PAR OS 3.1.2 MU2**, the HPE 3PAR Priority Optimization feature was introduced. This feature is a more efficient and dynamic solution for managing server workloads and can be utilized as an alternative to setting host I/O throttles. When using this feature, a storage administrator is able to share storage resources more effectively by enforcing quality of service limits on the array.

---

**NOTE:** It has been noticed that a Windows VM may offline the device/LUN if the bandwidth QoS rule on the VVset that the device/LUN belongs to is too aggressive. If this is the case, you need to decrease the bandwidth QoS rule.

---

No special settings are needed on the host side to obtain the benefit of HPE 3PAR Priority Optimization, although certain per-target or per-adapter throttle settings might need to be adjusted in rare cases.

For complete details of how to use HPE 3PAR Priority Optimization (Quality of Service) on HPE 3PAR StoreServ Storage systems, see the *HPE 3PAR Priority Optimization* technical white paper.

### More information

[www.hpe.com/info/3PAR-Priority-Optimization](http://www.hpe.com/info/3PAR-Priority-Optimization)

## HPE 3PAR Express Writes—FC

**With HPE 3PAR OS 3.2.x and later**, the HPE 3PAR Express Writes feature is enabled by default with 8 Gb FC target ports in Host HBA mode with bit Express Write.

The HPE 3PAR Express Writes feature optimizes the performance for small block random writes.

HPE 3PAR StoreServ Storage handles Express Write based on the I/O size and does not require any changes in the host driver or kernel parameters.

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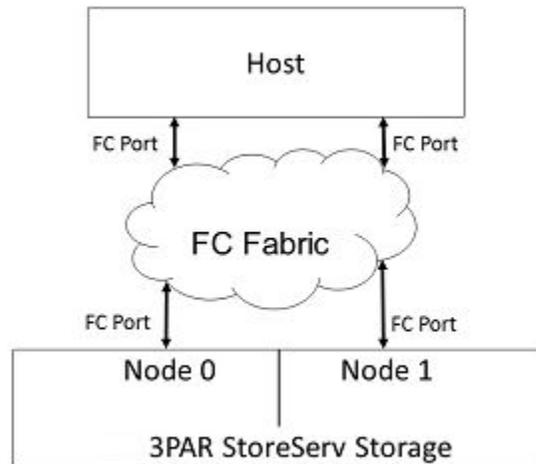
**NOTE:** For HPE 3PAR StoreServ Storage systems with 16 Gb FC target ports, the HPE 3PAR Express Writes feature is **not** supported.

---

## Connecting the HPE 3PAR StoreServ Storage to the host—FC

During this stage, connect the HPE 3PAR StoreServ Storage to the host directly or to the fabric. These procedures include the task to physically cable the HPE 3PAR StoreServ Storage to the host or fabric.

## FC-to-FC connectivity diagram



**Figure 2: FC-to-FC connectivity basic diagram**

Connect the Citrix host (FC initiator) ports to the FC switch, and then connect the HPE 3PAR StoreServ Storage (FC target) ports to the FC switch.

## Setting up and zoning the fabric—FC

Fabric zoning controls which FC end-devices have access to each other on the fabric. Zoning also isolates the host and HPE 3PAR StoreServ Storage ports from Registered State Change Notifications (RSCNs) that are irrelevant to these ports.

Set up fabric zoning by associating the device World Wide Names (WWNs) or the switch ports with specified zones in the fabric. Using the WWN method or HPE Smart SAN zoning is recommended with the HPE 3PAR StoreServ Storage. These zoning methods allow the zone to survive changing of switch ports when cables are moved around on a fabric and are also compatible with Persistent Port feature. PORT zoning or Hard zoning is not recommended as it is not compatible with Persistent Port Feature.

### Required:

Employ fabric zoning, by using the methods provided by the switch vendor, to create relationships between host HBA/CNA ports and HPE 3PAR StoreServ Storage ports before connecting the host HBA/CNA ports or HPE 3PAR StoreServ Storage ports to the fabrics.

FC switch vendors support the zoning of the fabric end-devices in different zoning configurations. There are advantages and disadvantages with each zoning configuration, so determine what is needed before choosing a zoning configuration.

The HPE 3PAR StoreServ Storage arrays support the following zoning configurations:

- One initiator to one target per zone.
- One initiator to multiple targets per zone (zoning by HBA). This zoning configuration is recommended for the HPE 3PAR StoreServ Storage.

---

**NOTE:**

- For high availability and clustered environments that require multiple initiators to access the same set of target ports, Hewlett Packard Enterprise recommends creating separate zones for each initiator with the same set of target ports.
  - The storage targets in the zone need to be from the same HPE 3PAR StoreServ Storage or multiple HPE 3PAR StoreServ Storage systems.
- 

When using an unsupported zoning configuration and an issue occurs, Hewlett Packard Enterprise might require implementing one of the supported zoning configurations as part of the corrective action.

Verify the switch and zone configurations by using the 3PAR CLI `showhost` command to verify that each initiator is zoned with the correct targets after completing the following tasks:

- Complete configuration of the storage port to the host and connect to the switch.
- Create a zone configuration on the switch following the *HPE SAN Design Reference Guide* and enable the zone set configuration.
- Use the `showhost` command to verify that the host is seen on the storage node.

**More information**

[www.hpe.com/support/hpesc](http://www.hpe.com/support/hpesc)

[www.hpe.com/storage/spock](http://www.hpe.com/storage/spock)

**Verifying the switch and zone configurations—HPE 3PAR CLI****Prerequisites**

- Complete configuration of the storage port to the host and connect to the switch.
- Create a zone configuration on the switch as described in the *HPE SAN Design Reference Guide*, and enable the zone set configuration.
- Use the `showhost` command to verify that the host is seen on the storage node.

**Procedure**

Run the `showhost` command and verify that each initiator is zoned with the correct targets.

**Configuration guidelines for switch vendors—FC**

Use the following FC switch vendor guidelines before configuring ports on fabrics to which the HPE 3PAR StoreServ Storage connects.

- Brocade switch ports that connect to a host HBA port or to an HPE 3PAR StoreServ Storage port should be set to their default mode. On Brocade 3xxx switches running Brocade firmware 3.0.2 or later, verify that each switch port is in the correct mode by using the Brocade Telnet interface and the `portcfgshow` command as follows:

```

brocade2_1:admin> portcfgshow

Ports          0  1  2  3    4  5  6  7
-----+-----+-----+-----+-----+-----+-----+-----+
Speed          AN AN AN AN    AN AN AN AN
Trunk Port     ON ON ON ON    ON ON ON ON
Locked L_Port  .. .. .. ..    .. .. .. ..
Locked G_Port  .. .. .. ..    .. .. .. ..
Disabled E_Port .. .. .. ..    .. .. .. ..
where AN:AutoNegotiate, ..:OFF, ?:INVALID.

```

The following fill-word modes are supported on a Brocade 8 Gb switch running FOS firmware 6.3.1a and later:

```

admin>portcfgfillword

Usage: portCfgFillWord PortNumber Mode [Passive]
Mode: 0/-idle-idle   - IDLE in Link Init, IDLE as fill word (default)
      1/-arbff-arbff - ARBFF in Link Init, ARBFF as fill word
      2/-idle-arbff  - IDLE  in Link Init, ARBFF as fill word
(SW)
      3/-aa-then-ia  - If ARBFF/ARBFF failed, then do IDLE/ARBFF

```

Hewlett Packard Enterprise recommends setting the fill word to mode 3 (aa-then-ia ), which is the preferred mode, by using the `portcfgfillword` command. If the fill word is not correctly set, `er_bad_os` counters (invalid ordered set) will increase when using the `portstatsshow` command while connected to 8 Gb HBA ports, as they need the ARBFF-ARBFF fill word. Mode 3 will also work correctly for lower-speed HBAs, such as 4 Gb/2 Gb HBAs. For more information, see the *Fabric OS Command Reference Manual* and the FOS release notes available at the Brocade website.

**NOTE:** In addition, some Hewlett Packard Enterprise switches, such as the HPE SN8000B 8-slot SAN backbone director switch, the HPE SN8000B 4-slot SAN director switch, the HPE SN6000B 16 Gb FC switch, or the HPE SN3000B 16 Gb FC switch automatically select the proper fill-word mode 3 as the default setting.

- McDATA switch or director ports should be in their default modes as **G** or **GX-port** (depending on the switch model), with their speed setting permitting them to autonegotiate.
- Cisco switch ports that connect to HPE 3PAR StoreServ Storage ports or host HBA ports should be set to **AdminMode = FX** and **AdminSpeed = auto port** , with the speed set to **auto negotiate**.

#### More information

[www.brocade.com/en.html](http://www.brocade.com/en.html)

## Configuring the HPE 3PAR StoreServ Storage ports—FC

Before connecting the HPE 3PAR StoreServ Storage port to the host, configure the ports using the procedures in the following topics.

**When using Brocade FC HBAs**, download Brocade HBA drivers, firmware, and the BCU utility from the QLogic website. Specific Brocade drivers are named with a BR prefix, such as BR-xxx HBA model.

See the *HPE SAN Design Reference Guide* on the [SPOCK](#) website ([SPOCK Home](#) > [Design Guides](#) > [SAN Design Guide](#)).

**More information**

- [www.hpe.com/support/hpesc](http://www.hpe.com/support/hpesc)
- [cavium.com/fc-adapters-products.html](http://cavium.com/fc-adapters-products.html)
- [www.hpe.com/storage/spock](http://www.hpe.com/storage/spock)

## Configuring ports on the HPE 3PAR StoreServ Storage—direct connection—FC

A different FC array target port connection type is required depending on the HPE 3PAR OS version on the array on the array, the array target port type, and the speed of host FC adapter that will directly connect to the array.

**NOTE:** Support for direct connection to hosts using the 16 Gbps FC HPE 3PAR StoreServ Storage target begins at HPE 3PAR OS version 3.3.1 GA.

To identify the type of array target port adapter, use the `showport -par` command and identify the `MaxRate` listed for the port planned for direct connect. For example, array target port 0:1:1 is listed as 8Gbps and 2:1:1 as 16Gbps.

```
cli % showport -par
N:S:P Connmode ConnType CfgRate MaxRate Class2 UniqNodeWwn VCN IntCoal TMWO Smart_SAN
0:1:1 host loop auto 8Gbps disabled disabled disabled disabled enabled n/a
1:1:1 host loop auto 8Gbps disabled disabled disabled disabled enabled n/a
2:1:1 host point auto 16Gbps disabled disabled disabled disabled disabled
unsupported
3:1:1 host point auto 16Gbps disabled disabled disabled disabled disabled
unsupported
```

Support for direct connection to FC HPE 3PAR StoreServ Storage target interfaces is limited to specific host adapters. For more information, see the [SPOCK](#) website ([SPOCK Home](#) > [Explore Storage interoperability With SPOCK](#) > [interoperability](#) > [Explore 3PAR StoreServ Storage](#)). Once you have determined your host has a supported adapter, use the *Direct Connection Support* table to determine the required connection type to set on the HPE 3PAR array:

**Table 1: Direct Connection Support**

3PAR OS version	3PAR Array FC Target Port	Supported Host Adapter Port	Connection Type	Link Speed
3.2.2 and earlier	8 Gbps	4 Gbps	Loop	4 Gbps
		8 Gbps	Loop	8 Gbps
		16 Gbps	Loop	8 Gbps
	16 Gbps	Not supported	Not supported	Not supported
3.3.1 GA and later	8 Gbps	4 Gbps	Loop	4 Gbps
		8 Gbps	Loop	8 Gbps

*Table Continued*

3PAR OS version	3PAR Array FC Target Port	Supported Host Adapter Port	Connection Type	Link Speed
		16 Gbps	Loop	8 Gbps
	16 Gbps	4 Gbps	Loop	4 Gbps
		8 Gbps	Loop	8 Gbps
		16 Gbps	Point	16 Gbps
		32 Gbps	Point	16 Gbps

### Configuring the FC HPE 3PAR StoreServ Storage Target Interface for Direct Connection

Run the following HPE 3PAR CLI commands with the appropriate parameters for each direct connect port:

1. Take the port off line using the `controlport offline <node:slot:port>` command.

```
cli % controlport offline 0:1:1
```

2. Run the `controlport config host -ct <connection type> <node:slot:port>` command, where `<connection type>` specifies the required value `loop` or `point` for the connection.

```
cli % controlport config host -ct loop 0:1:1
```

3. Reset the port by using the `controlport rst <node:slot:port>` command on the HPE 3PAR StoreServ Storage.

```
cli % controlport rst 0:1:1
```

After all the ports are configured, verify that they are configured for a host in a direct connection by using the `showport -par` command on the HPE 3PAR StoreServ Storage.

```
cli % showport -par
N:S:P Connmode ConnType CfgRate MaxRate Class2 UniqNodeWwn VCN IntCoal TMWO
Smart_SAN
0:1:1 host loop auto 8Gbps disabled disabled disabled disabled enabled n/a
```

or

```
cli % showport -par
N:S:P Connmode ConnType CfgRate MaxRate Class2 UniqNodeWwn VCN IntCoal TMWO
Smart_SAN
0:1:1 host point auto 8Gbps disabled disabled disabled disabled enabled n/a
```

## More information

[www.hpe.com/storage/spock](http://www.hpe.com/storage/spock)

## Configuring ports on the HPE 3PAR StoreServ Storage—fabric connection—FC

To configure HPE 3PAR StoreServ Storage ports for fabric connections on the HPE 3PAR CLI, use the following procedure. Complete this procedure for **each** port.

### Procedure

1. Check if a port is configured for a host port in fabric mode by using the HPE 3PAR CLI `showport -par` command on the HPE 3PAR StoreServ Storage.

If the connection type `ConnType` value is `point`, the port is already configured for a fabric connection. If the `ConnType` value is `loop`, the port is a direct connection and has not been configured for a fabric connection.

```
cli % showport -par
N:S:P Connmode ConnType CfgRate MaxRate Class2 UniqNodeWwn VCN
IntCoal
0:4:1 host point auto 8Gbps disabled disabled disabled
enabled
```

2. If the port has **not** been configured, take the port offline before configuring it for connection to a host.

**⚠ CAUTION:** Before taking a port offline in preparation for a fabric connection, verify that it was not previously defined and that it is not connected to a host, because this would interrupt the existing host connection. If a HPE 3PAR StoreServ Storage port is already configured for a fabric connection, ignore this step 2.

To take the port offline, run the `controlport offline <node:slot:port>` command on the HPE 3PAR StoreServ Storage. For example:

```
cli % controlport offline 1:5:1
```

3. To configure the port to the host, run the `controlport config host -ct point <node:slot:port>` command on the HPE 3PAR StoreServ Storage, where `-ct point` indicates that the connection type is a fabric connection. For example:

---

```
cli % controlport config host -ct point 1:5:1
```

---

4. Reset the port by using the `controlport rst <node:slot:port>` command on the HPE 3PAR StoreServ Storage. For example:

---

```
cli % controlport rst 1:5:1
```

---

## Creating a host definition—FC

### Create a host definition for FC overview

Before connecting the host to the HPE 3PAR StoreServ Storage, create a host definition that specifies a valid host persona on the HPE 3PAR StoreServ Storage that is to be connected to a host HBA port through a fabric or a direct connection.

---

**NOTE: Beginning with HPE 3PAR OS 3.2.2**, the `createhost` command has been enhanced with the `-port` option, which automatically creates zones on the switch or fabric if the target port is a 16 Gb FC target and the switch supports enhanced zoning. See **HPE 3PAR Smart SAN—FC** on page 11 . For complete details about using the `controlport`, `createhost`, and `showhost` commands, see the *HPE 3PAR Command Line Interface Reference* or the *HPE 3PAR StoreServ Management Console User's Guide* available at the [Hewlett Packard Enterprise Information Library](#) website.

---

### Creating a host definition for FC

#### Procedure

1. Create host definitions by using the `createhost [options] <hostname> [<WWN>...]` command.

In the following example, the `Generic` indicates that the default host persona is used.

---

```
cli % createhost -persona 2 Citrixhost 1122334455667788 1122334455667799
```

---

2. Verify that the host has been created by using the `showhost` command.

---

```
cli % showhost
```

Id	Name	Persona	-WWN/iSCSI_Name-	Port
6	Citrixhost	Generic-ALUA	1122334455667788	---
			1122334455667799	---

---

---

**NOTE:**

---

Operating system	HPE 3PAR OS 3.1.2 and earlier host persona	HPE 3PAR OS 3.1.3 MU1 and later and 3.2.1 host persona	HPE 3PAR OS 3.2.2 host persona	HPE 3PAR OS 3.3.1 host persona
Citrix XenServer 5.6	Generic Persona 1	Generic Persona 1	Generic Persona 1	Generic Persona 1
Citrix XenServer 6.x and 7.x	Generic Persona 1	Generic Persona 1 Generic-ALUA Persona 2	Generic Persona 1 Generic-ALUA Persona 2	Generic-ALUA Persona 2

---

For information about migrating the Citrix XenServer host from host Generic Persona 1 to host Generic-ALUA Persona 2, see [Host Persona migration](#) on page 68.

---

**More information**

[www.hpe.com/info/storage/docs](http://www.hpe.com/info/storage/docs)

---

## Configuring the host—FC/FCoE

---

**NOTE:** Hewlett Packard Enterprise recommends using default values to configure your host unless otherwise specified in the following procedures.

---

### HPE 3PAR Persistent Ports—FCoE

The HPE 3PAR Persistent Ports (or virtual ports) feature minimizes I/O disruption during a HPE 3PAR StoreServ Storage online upgrade, node-down or cable pull event. Port shutdown or reset events do not trigger this feature.

Each FCoE target storage array port has a partner array port automatically assigned by the system. Partner ports are assigned across array node pairs.

HPE 3PAR Persistent Ports allow a HPE 3PAR StoreServ Storage FCoE port to assume the identity of a failed port (WWN port) while retaining its own identity. Where a given physical port assumes the identity of its partner port, the assumed port is designated as a persistent port. Array port failover and failback with HPE 3PAR Persistent Ports is transparent to most host-based multipathing software, which can keep all of its I/O paths active.

---

**NOTE:** Use of HPE 3PAR Persistent Ports technology does not negate the need for properly installed, configured, and maintained host multipathing software.

---

For a more complete description of the HPE 3PAR Persistent Ports feature, its operation, and a complete list of required setup and connectivity guidelines, see the following documents:

- Technical white paper *HPE 3PAR StoreServ Persistent Ports* (Hewlett Packard Enterprise document #F4AA4-4545ENW) on the [Hewlett Packard Enterprise Support Center](#) website
- *HPE 3PAR Command Line Interface Administrator's Manual* in the "Using Persistent Ports for Nondisruptive Online Software Upgrades" topic on the [Hewlett Packard Enterprise Information Library](#) website

## More information

[www.hpe.com/support/hpesc](http://www.hpe.com/support/hpesc)  
[www.hpe.com/info/storage/docs](http://www.hpe.com/info/storage/docs)

## HPE 3PAR Persistent Ports setup and connectivity guidelines—FCoE

### Beginning with HPE 3PAR OS 3.1.3:

- The HPE 3PAR Persistent Ports feature is supported for FCoE target ports (FCoE end-to-end configurations).
- The HPE 3PAR Persistent Ports feature is enabled by default for 3PAR StoreServ Storage FCoE ports during node-down events.

**Follow the specific cabling setup and connectivity guidelines for HPE 3PAR Persistent Ports to function properly. Key elements for the HPE 3PAR Persistent Ports feature setup and connectivity are:**

- HPE 3PAR StoreServ Storage FCoE partner ports must be connected to the same FCoE network.
- The same CNA port on host-facing HBAs in the nodes of a node pair must be connected to the same FCoE network, and preferably to different FCoE switches on the network.
- The FCoE network must support NPIV, and NPIV must be enabled.

## Installing the Emulex HBA/CNA—FC/FCoE

### Procedure

Install the Emulex HBAs or CNAs in the host according to the documentation provided with the HBAs/CNAs and host.

## Installing the Emulex HBA/CNA using Emulex OneCommand CLI—FC/FCoE

### Procedure

1. Determine an Emulex driver that was already installed by the Citrix XenServer installation:

```
# cat /sys/module/lpfc/version
```

If no Emulex driver was installed, see the [SPOCK](#) website for supported drivers (**SPOCK Home > Explore Storage Interoperability With SPOCK > Explore 3PAR StoreServ Storage interoperability > Explore HPE 3PAR Block Persona interoperability**).

Download and install the driver from one of the following websites:

<http://www.citrix.com>

<https://www.broadcom.com/support/download-search>

2. The Emulex FC/FCoE utility `hbacmd` is installed during the Citrix XenServer installation.

## More information

[www.hpe.com/storage/spock](http://www.hpe.com/storage/spock)

## Modifying the `nodev-tmo` parameter to a value of 1—FC/FCoE

---

**NOTE:** With XenServer 6.x or 5.6, it is not required to change the Emulex driver parameter `nodev-tmo` to a value of 1.

---

This section describes how to modify the `nodev-tmo` parameter by using the `hbacmd` command.

See Emulex documentation for using the `hbacmd` command, which is available at the Emulex website.

The tool is at `/usr/sbin/ocmanager/hbacmd` with default installation.

Use the following procedure to obtain the available command usage and syntax as well as set `nodev-tmo` parameter:

### Procedure

1. Display the usage by using the `./hbacmd` command.
2. List installed HBAs Port WWN:

---

```
./hbacmd ListHBAs
```

---

3. Invoke the syntax for the `SetDriverParam` command:

---

```
# ./hbacmd Help DriverParams
```

---

4. Set the `nodev-tmo` parameter:

---

```
# ./hbacmd SetDriverParam <Port WWN> G P nodev-tmo 1
```

---

5. Verify that the parameter is set correctly:

---

```
# ./hbacmd GetDriverParams <Port WWN>
```

---

Output from the foregoing commands is shown below:

```

# ./hbacmd ListHBAs

Manageable HBA List

Port WWN      : 10:00:00:00:c9:7b:07:52
Node WWN      : 20:00:00:00:c9:7b:07:52
Fabric Name   : 10:00:08:00:88:a0:5c:ad
Flags         : 8000f100
Host Name     : sqa-dl380g5-08
Mfg           : Emulex Corporation
Serial No.    : VM82281959
Port Number   : 0
Mode          : Initiator
. . .

# ./hbacmd Help DriverParams

. . .
SetDriverParam <WWPN> <Flag1> <Flag2> <Param> <Value>
Flag1: {L G}
L: Local (i.e. this adapter only)
G: Global (i.e. all adapters on this host)
Flag2: {P T}
P: Permanent (i.e. Persists across reboot)
T: Temporary
Param: Name of parameter whose value is to be set
Value: Input as decimal, prefix with 0x to input as hex
. . .
./hbacmd SetDriverParam 10:00:00:00:c9:7b:07:52 G P nodev-tmo 1

# ./hbacmd GetDriverParams 10:00:00:00:c9:7b:07:52

Driver Params for 10:00:00:00:c9:7b:07:52. Values in HEX format.
DX string Low High Def Cur Exp Dyn
00: log-verbose 0 ffff 0 0 1 1
01: lun-queue-depth 1 80 1e 1e 1 2
02: scan-down 0 1 1 1 1 2
03: nodev-tmo 0 ff 1e 1 1 1
04: topology 0 6 0 0 1 2
05: link-speed 0 8 0 0 1 2
06: fcp-class 2 3 3 3 1 2
. . .

```

## More information

[www.broadcom.com/support/download-search](http://www.broadcom.com/support/download-search)

## Installing the QLogic HBA/CNA—FC/FCoE

Install the QLogic host bus adapters/converged network adapters in the host based on the documentation provided with the HBAs/CNAs and host.

## Modifying the `qlport_down_retry` parameter—FC/FCoE

### With XenServer 6.2 and earlier:

Use the `scli` utility with the in-box QLogic driver

- **With FC**, the `scli` utility is installed under `/opt/QLogic_Corporation/SANsurferCLI`.
- **With FCoE**, the `scli` utility is installed under `/opt/QLogic_Corporation/QConvergeConsoleCLI`.
- Verify the version installed by using the `rpm` command. For example:

---

```
# rpm -qa scli
scli-1.7.1-23
```

---

Make the following selection from the **scli** menu:

From the **Main Menu**, select **HBA Parameters**.

**With XenServer 6.5 and 7.x:**

Use the `qaucli` utility with the in-box QLogic driver from the Citrix XenServer installation. The `qaucli` utility is installed under `/opt/QLogic_Corporation/QConvergeConsoleCLI`.

## Modifying the `qlport_down_retry` parameter to a value of 14—FC/FCoE

**With XenServer 6.2 and earlier:**

The `scli` utility refers to this parameter as **Port Down Retry Count**. For details about the `scli` utility, see the documentation provided by QLogic.

To set the value to 14, complete the following procedure from the **scli** menu:

**Procedure**

1. Select **Main Menu > HBA Parameters > Configure HBA Parameters**.
2. Select **Port Down Retry Count** from the **Configure Parameters** menu and set it to **14**.
3. Select **Commit Changes** from the **Configure Parameters** menu.
4. Repeat steps 1 through 3 for each HBA installed.
5. To verify changes, use **Display HBA Parameters** from the **HBA Parameters** main menu.
6. Add options `qla2xxx qlport_down_retry=14` to `/etc/modprobe.conf`
7. Re-create initial ramdisk images:

---

**NOTE:** In the following `mkinitrd` command, the ``` character is a backtick and not a single quote.

---

```
# mkinitrd -v -f --theme=/usr/share/splash /boot/initrd-`uname -r`.img `uname -r`
```

---

8. After restarting the host, check `/sys/module/qla2xxx/parameters/qlport_down_retry` to confirm the changes.

---

**NOTE:** With a version earlier than **HPE 3PAR OS 3.1.3**, set the `qlport_down_retry` setting to 1 rather than 14. For example:

---

---

```
# cat /sys/module/qla2xxx/parameters/qlport_down_retry
14
```

---

### With XenServer 6.5 and XenServer 7.x:

The `qaucli` utility refers to this parameter as `Port Down Retry Count`. For details about the `qaucli` utility, see the documentation provided by QLogic.

To set the value to 14, complete the following procedure from the `qaucli` menu:

1. Select **Adapter Configuration > CNA Configuration (CNA only) > CNA FCoE Configuration (CNA only) > HBA Parameters > Configure HBA Parameters**.
2. Select the HBA/CNA port to configure.
3. Select **Configure HBA Parameters**.
4. Select **Port Down Retry Count** from the **Configure Parameters** menu, and then set it to **14**.
5. Select **Commit Changes** from the **Configure Parameters** menu.
6. Repeat steps 1 through 5 for each HBA/CNA port and each HBAs/CNAs installed.
7. To verify changes, use **Display HBA Parameters** from the **HBA Parameters** main menu.
8. Add options `qla2xxx qlport_down_retry=14` to `/etc/modprobe.d/modprobe.conf`.
9. Re-create initial ramdisk images:

---

**NOTE:** In the following `mkinitrd` command, the ``` character is a backtick and not a single quote.

---

### With XenServer 7.x:

---

```
# mkinitrd -v -f /boot/initrd-`uname -r`.img `uname -r`
```

---

### With XenServer 6.5:

---

```
# mkinitrd -v -f --theme=/usr/share/splash /boot/initrd-`uname -r`.img `uname -r`
```

---

10. After restarting the host, check `/sys/module/qla2xxx/parameters/qlport_down_retry` to confirm the changes.

---

**NOTE:** With a version earlier than HPE 3PAR OS 3.1.3, set the `qlport_down_retry` setting to 1 rather than 14. For example:

---

```
# cat /sys/module/qla2xxx/parameters/qlport_down_retry
14
```

---

---

## Setting up multipathing—FC

### Setting up device mapper—FC

Multipath tools and device mapper packages are installed during default Citrix XenServer OS installation. Check for installed device mapper packages by using the `rpm -qa |grep device-mapper` command:

```
# rpm -qa |grep device-mapper
device-mapper-1.02.39-1.el5_5.2
device-mapper-event-1.02.39-1.el5_5.2
device-mapper-multipath-0.4.7-34.xs651
```

### Modifying the `/etc/multipath.conf` file—XenServer 7.x—Generic-ALUA Persona 2—FC/FCoE

The `/etc/multipath.conf` file is used by device mapper where the multipathing parameters have been set.

The default installed `/etc/multipath.conf` file must be edited to make the following changes:

#### Procedure

1. Verify `devnode "*"` in `blacklist` section is commented out or removed.

```
#blacklist {
# devnode "*"
#}
```

2. Edit the `devices` structure to add entries for HPE 3PAR StoreServ Storage array and remove other product entries that are not needed.

After all of the edits are made, the relevant sections of `/etc/multipath.conf` `devices` section should appear as follows:

```
# cat /etc/multipath.conf

defaults {
    polling_interval      10
    find_multipaths      yes
}
devices {
    device {
        vendor            "3PARdata"
        product           "VV"
        features          "0"
        path_selector     "round-robin 0"
        path_grouping_policy "group_by_prio"
        hardware_handler  "1 alua"
        prio              "alua"
        failback          "immediate"
        rr_weight         "uniform"
        no_path_retry     18
        rr_min_io         100
        path_checker      "tur"
        fast_io_fail_tmo  20
        dev_loss_tmo     "infinity"
    }
}
}
```

3. If the host is configured as boot from SAN, re-create initial ramdisk images, and then reboot the host.

**NOTE:** In the following `mkinitrd` command, the ``` character is a backtick and not a single quote.

```
# mkinitrd -v -f /boot/initrd-`uname -r`.img `uname -r`
```

**NOTE:** The `/etc/multipath.conf` file is replaced when installing Citrix XenServer updates to the host. Reapply the `multipath.conf` changes to each host after updates. Hewlett Packard Enterprise recommends creating a backup copy of the `/etc/multipath.conf` file before upgrading to any MU on the host.

If SCSI devices, such as the internal boot disk, need to be excluded from being seen by device mapper, the devices should be added into in `devnode` blacklist structure.

For example: The system is booted through an internal SCSI boot disk and has a device instance `sda`, which is excluded from being seen by the device mapper by adding the `devnode` blacklist structure. The resulting `/etc/multipath.conf` file blacklist section appears as follows:

---

```
# cat /etc/multipath.conf

blacklist {
wwid 26353900f02796769
devnode "^(ram|raw|loop|fd|md|dm-|sr|scd|st) [0-9] *"
devnode "^hd[a-z] "
devnode "^sda$"
devnode "^sda[0-9] "
devnode "^cciss!c[0-9]d[0-9] *"
}
```

---

**NOTE:** Add other devices as necessary to the blacklist structure as per the configured host.

---

## Modifying the `/etc/multipath.conf` file—XenServer 6.x—Generic-ALUA Persona 2—FC/FCoE

The `/etc/multipath.conf` file is used by device mapper where the multipathing parameters have been set.

The default installed `/etc/multipath.conf` file must be edited to make the following changes:

### Procedure

1. Verify `devnode "*" in blacklist section is commented out or removed.`
- 

```
#blacklist {
# devnode "*"
#}
```

---

2. Edit the devices structure to add entries for HPE 3PAR StoreServ Storage array and remove other product entries that are not needed.

After all of the edits are made, the relevant sections of `/etc/multipath.conf` devices section should appear as follows:

**With XenServer 6.5 or 6.2:**

```
# cat /etc/multipath.conf

defaults {
    polling_interval          10
    find_multipaths          yes
}
devices {
    device {
        vendor                "3PARdata"
        product                "VV"
        features                "0"
        path_selector          "round-robin 0"
        path_grouping_policy   "group_by_prio"
        hardware_handler       "1 alua"
        prio                    "alua"
        failback                "immediate"
        rr_weight               "uniform"
        no_path_retry           18
        rr_min_io               100
        path_checker            "tur"
    }
}
}
```

---

### With XenServer 6.1 or 6.0:

---

```
# cat /etc/multipath.conf

defaults {
    polling_interval          10
}
devices {
    device {
        vendor                "3PARdata"
        product                "VV"
        features                "0"
        path_selector          "round-robin 0"
        path_grouping_policy   "group_by_prio"
        hardware_handler       "1 alua"
        prio_callout            "/sbin/mpath_prio_alua /dev/%n"
        failback                "immediate"
        rr_weight               "uniform"
        no_path_retry           18
        rr_min_io               100
        path_checker            "tur"
    }
}
}
```

3. If the host is configured as boot from SAN, re-create initial ramdisk images, and then reboot the host.

**NOTE:** In the following `mkinitrd` command, the ``` character is a backtick and not a single quote.

---

---

```
# mkinitrd -v -f --theme=/usr/share/splash /boot/initrd-`uname -r`.img `uname -r`
```

---

**NOTE:** The `/etc/multipath.conf` file is replaced when installing Citrix XenServer updates to the host. Reapply the `multipath.conf` changes to each host after updates. Hewlett Packard Enterprise recommends creating a backup copy of the `/etc/multipath.conf` file before upgrading to any MU on the host.

---

If SCSI devices, such as the internal boot disk, need to be excluded from being seen by device mapper, the devices should be added into in `devnode` blacklist structure.

For example: The system is booted through an internal SCSI boot disk and has a device instance `sda`, which is excluded from being seen by the device mapper by adding the `devnode` blacklist structure. The resulting `/etc/multipath.conf` file blacklist section appears as follows:

---

```
# cat /etc/multipath.conf

blacklist {
wwid 26353900f02796769
devnode "^ (ram|raw|loop|fd|md|dm-|sr|scd|st) [0-9] *"
devnode "^hd[a-z]"
devnode "^sda$"
devnode "^sda[0-9]"
devnode "^cciss!c[0-9]d[0-9] *"
}
```

---

**NOTE:** Add other devices as necessary to the blacklist structure as per the configured host.

---

## Modifying the `/etc/multipath.conf` file—XenServer 5.6 or 6.x—Generic Persona 1—FC/FCoE

The `/etc/multipath.conf` file is used by device mapper where the multipathing parameters have been set.

The default installed `/etc/multipath.conf` file must be edited to make the following changes:

### Procedure

1. Verify that `devnode "*"` in the blacklist section is commented out or removed.
- 

```
#blacklist {
#     devnode "*"
#}
```

---

2. Edit the devices structure to add entries for HPE 3PAR array and remove other product entries that are not needed.

After all of the edits are made, the relevant sections of `/etc/multipath.conf` devices section should appear as follows:

---

```
# cat /etc/multipath.conf

defaults {
    polling_interval      5
}

devices {
    device {
        vendor            "3PARdata"
        product           "VV"
        no_path_retry     12
        features           "0"
        hardware_handler  "0"
        path_grouping_policy multibus
        path_selector      "round-robin 0"
        rr_weight          uniform
        rr_min_io          100
        path_checker       tur
        failback           immediate
    }
}

```

---

**NOTE:** The `/etc/multipath.conf` file is replaced when installing Citrix XenServer updates to the host. Reapply the `multipath-enabled.conf` changes to each host after updates. Hewlett Packard Enterprise recommends creating a backup copy of the `/etc/multipath.conf` file before upgrading to any MU on the host.

---

If SCSI devices such as the internal boot disk need to be excluded from being seen by device mapper, the devices should be added into in `devnode` blacklist structure.

For example: The system is booted through an internal SCSI boot disk and has a device instance `sda`, which is excluded from being seen by the device mapper by adding the `devnode` blacklist structure. The resulting `/etc/multipath.conf` file blacklist section appears as follows:

---

```
# cat /etc/multipath.conf

blacklist {
    wwid 26353900f02796769
    devnode "^(ram|raw|loop|fd|md|dm-|sr|scd|st) [0-9] *"
    devnode "^hd[a-z]"
    devnode "^sda$"
}

```

---

**NOTE:** Add other devices as necessary to the blacklist structure as per the configured host.

---

## Modifying the `/etc/multipath-enabled.conf` file—XenServer 5.5—Generic Persona 1—FC/FCoE

The `/etc/multipath.conf` file is used by device mapper where the multipathing parameters have been set.

Do **not** modify `/etc/multipath.conf`. Citrix XenServer links it to either `/etc/multipath-enabled.conf` or `/etc/multipath-disabled.conf` depending on whether multipathing is enabled or disabled.

The default installed `/etc/multipath-enabled.conf` file must be edited to make the following changes:

### Procedure

1. Verify `devnode "*" in blacklist` section is commented out or removed.

```
devnode "*"
}
```

2. Edit the devices structure to add entries for HPE 3PAR StoreServ Storage array and remove other product entries that are not needed.

After all of the edits are made, the relevant sections of `/etc/multipath-enabled.conf` devices section should appear as follows:

```
# cat /etc/multipath-enabled.conf

defaults {
    polling_interval      5
}

devices {
    device {
        vendor            "3PARdata"
        product           "VV"
        no_path_retry     12
        features          "0"
        hardware_handler  "0"
        path_grouping_policy multibus
        path_selector      "round-robin 0"
        rr_weight         uniform
        rr_min_io         100
        path_checker       tur
        failback           immediate
    }
}
```

**NOTE:** The `/etc/multipath-enabled.conf` file is replaced when installing Citrix XenServer updates to the host. Reapply the `multipath-enabled.conf` changes to each host after updates. Hewlett Packard Enterprise recommends creating a backup copy of the `/etc/multipath-enabled.conf` file before upgrading to any MU on the host.

If SCSI devices such as the internal boot disk need to be excluded from being seen by device mapper, the devices should be added into in `devnode blacklist` structure.

For example: The system is booted through an internal SCSI boot disk and has a device instance `sda`, which is excluded from being seen by the device mapper by adding the `devnode blacklist` structure. The resulting `/etc/multipath-enabled.conf` file blacklist section appears as follows:

---

```
# cat /etc/multipath-enabled.conf

blacklist {
    wwid 26353900f02796769
    devnode "^(ram|raw|loop|fd|md|dm-|sr|scd|st) [0-9] *"
    devnode "^(hd[a-z] )"
    devnode "^(sda$)"
}
```

---

**NOTE:** Add other devices as necessary to the blacklist structure as per the configured host.

---

## Enabling multipath—FC

If multipathing has not yet been enabled, use the following procedure to enable multipathing on each Citrix host with Citrix XenCenter. For details, see *Citrix XenServer Design: Configuring Multipathing for XenServer* on the Citrix Knowledge Center website:

<http://support.citrix.com/>

### Procedure

1. In the **Resources** pane, select the server and set it to **Maintenance Mode**.
2. On the **General** tab, click **Properties**, then click the **Multipathing tab**.
3. To enable multipathing, select the **Enable multipathing on this server** check box.
4. Click **OK** to apply the new setting and close the dialog box.
5. Exit **Maintenance Mode**.

---

**NOTE:** Multipathing can also be enabled by using the Citrix XenServer CLI. For details, see the *Citrix XenServer Administrator's Guide* on the Citrix Knowledge Center website.

---

### More information

[support.citrix.com/](http://support.citrix.com/)

# Configuring the HPE 3PAR StoreServ Storage and host—iSCSI

**NOTE:** Hewlett Packard Enterprise recommends using the default values to configure the host unless instructed otherwise in the procedures.

## Workflow for configuring the HPE 3PAR StoreServ Storage and host—iSCSI

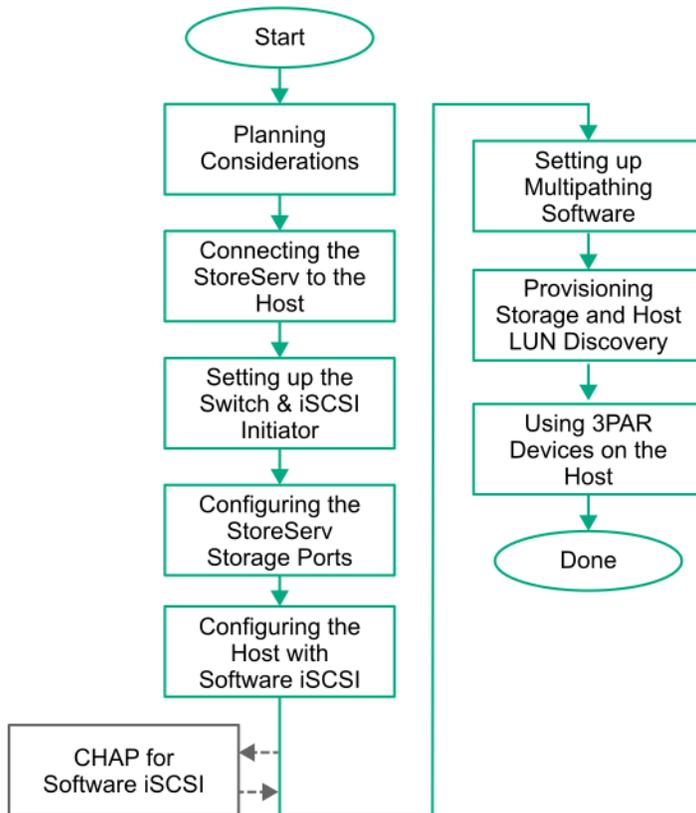


Figure 3: Configuring the HPE 3PAR StoreServ Storage and host\_iSCSI

## Considerations for planning the configuration—iSCSI

When planning your configurations, review the following:

- **Target port limits and specifications—iSCSI** on page 35
- **HPE 3PAR Persistent Ports—iSCSI** on page 35
- **HPE 3PAR Priority Optimization—iSCSI** on page 36

## Target port limits and specifications—iSCSI

To avoid overwhelming a target port and ensure continuous I/O operations, observe the following limitations on a target port:

- Follow the instructions for setting the maximum number of initiator connections supported per array port, per array node pair, and per array as shown in the *HPE 3PAR Support Matrix* documentation on the **SPOCK** website (**SPOCK Home > Other Hardware > 3PAR**).
- Maximum I/O queue depth per port on each HPE 3PAR StoreServ Storage HBA model, as follows:

HBA	Protocol	Array	Bus	Speed	Ports	Max. Queue Depth
QLogic QLA4052C	iSCSI	F200, F400, T400, T800	PCI-X	1 Gbps	2	512
QLogic QLE8242	iSCSI	HPE 3PAR StoreServ 7000, 10000	PCIe	10 Gbps	2	2048
QLogic EP8324	iSCSI	HPE 3PAR StoreServ 8000, 9000, 20000	PCIe	10 Gbps	2	2048

- The I/O queues are shared among the connected host server HBA ports on a first-come, first-served basis.
- When all queues are in use and a host HBA port tries to initiate I/O, it receives a target queue full response from the HPE 3PAR StoreServ Storage port. This condition can result in erratic I/O performance on each host server. If this condition occurs, each host server should be throttled so that it cannot overrun the HPE 3PAR StoreServ Storage port queues when all host servers are delivering their maximum number of I/O requests.

### More information

[www.hpe.com/storage/spock](http://www.hpe.com/storage/spock)

## HPE 3PAR Persistent Ports—iSCSI

**Beginning with HPE 3PAR OS 3.1.3**, the HPE 3PAR Persistent Ports feature is supported for iSCSI.

The HPE 3PAR Persistent Ports (or virtual ports) feature minimizes I/O disruption on an HPE 3PAR StoreServ Storage in response to the following events:

- HPE 3PAR OS firmware upgrade
- Node maintenance that requires the node to be taken offline (for example, adding a new HBA)
- HPE 3PAR node failure
- Array target ports being taken offline administratively

Each iSCSI target storage array port has a partner array port automatically assigned by the system. Partner ports are assigned across array node pairs.

HPE 3PAR Persistent Ports allows an HPE 3PAR StoreServ Storage iSCSI port to assume the identity of a failed port (IP address) while retaining its own identity. Where a given physical port assumes the identity of its partner port, the assumed port is designated as a persistent port. Array port failover and failback with 3PAR Persistent Ports is transparent to most host-based multipathing software, which can keep all of its I/O paths active.

**Beginning with HPE 3PAR OS 3.2.2**, the HPE 3PAR Persistent Port feature for iSCSI has additional functionality to minimize I/O disruption during an array port loss\_sync event by supporting loss\_sync recovery, automatic failover in case of a failure due to a loss of signal or a link going down between the array and the switch.

---

**NOTE:**

- Use of HPE 3PAR Persistent Ports technology does not negate the need for properly installed, configured, and maintained host multipathing software.
- A key element for iSCSI connectivity is that partner ports must share the same IP network.

---

For a more complete description of the HPE 3PAR Persistent Ports feature, its operation, and a complete list of required setup and connectivity guidelines, see the following documents:

- Technical white paper *HPE 3PAR StoreServ Persistent Ports* (Hewlett Packard Enterprise document #F4AA4-4545ENW) on the [Hewlett Packard Enterprise Support Center](#) website.
- *HPE 3PAR Command Line Interface Administrator's Manual* in the "Using Persistent Ports for Nondisruptive Online Software Upgrades" topic on the [Hewlett Packard Enterprise Information Library](#) website.

#### More information

[www.hpe.com/support/hpesc](http://www.hpe.com/support/hpesc)

[www.hpe.com/info/storage/docs](http://www.hpe.com/info/storage/docs)

## HPE 3PAR Persistent Ports setup and connectivity guidelines—iSCSI

### Beginning with HPE 3PAR OS 3.1.3:

- The HPE 3PAR Persistent Ports feature is supported for iSCSI.
- The HPE 3PAR Persistent Ports feature is enabled by default for HPE 3PAR StoreServ Storage iSCSI ports during node-down events.

### Beginning with HPE 3PAR OS 3.2.2:

The HPE 3PAR Persistent Port feature for iSCSI has additional functionality to minimize I/O disruption during an array port loss\_sync event triggered by a loss of array port connectivity to the fabric.

Follow the specific cabling setup and connectivity guidelines for HPE 3PAR Persistent Ports to function properly.

The key element for iSCSI connectivity follows:

The partner ports must share the same IP network.

## HPE 3PAR Priority Optimization—iSCSI

**Beginning with HPE 3PAR OS 3.1.2 MU2**, the HPE 3PAR Priority Optimization feature was introduced. This feature is an efficient and dynamic solution for managing server workloads and can be used as an

alternative to setting host I/O throttles. When using this feature, a storage administrator can share storage resources effectively by enforcing quality of service limits on the array.

No special settings are needed on the host side to obtain the benefit of HPE 3PAR Priority Optimization, although certain per-target or per-adapter throttle settings might need to be adjusted in rare cases.

For complete details of how to use HPE 3PAR Priority Optimization (Quality of Service) on HPE 3PAR StoreServ Storage systems, see the *HPE 3PAR Priority Optimization* technical white paper.

## More information

[www.hpe.com/info/3PAR-Priority-Optimization](http://www.hpe.com/info/3PAR-Priority-Optimization)

# Configuring the HPE 3PAR StoreServ Storage ports—iSCSI

## 1 Gb iSCSI ports

To configure 1 Gb iSCSI target ports on the HPE 3PAR StoreServ Storage for connection to an iSCSI initiator, perform the following procedure:

### Procedure

1. Check the current settings of the iSCSI ports by using the `showport -iscsi` command. The following examples are for the 1 Gb iSCSI ports on the array.

```
# showport -iscsi
N:S:P State      IPAddr  Netmask  Gateway  TPGT  MTU  Rate  DHCP  iSNS_Primary  iSNS_Secondary
iSNS_Port
0:3:1 offline     0.0.0.0  0.0.0.0  0.0.0.0  31    1500  n/a   0    0.0.0.0      0.0.0.0      3205
0:3:2 loss-sync  0.0.0.0  0.0.0.0  0.0.0.0  32    1500  n/a   0    0.0.0.0      0.0.0.0      3205
1:3:1 offline     0.0.0.0  0.0.0.0  0.0.0.0  131   1500  n/a   0    0.0.0.0      0.0.0.0      3205
1:3:2 loss-sync  0.0.0.0  0.0.0.0  0.0.0.0  132   1500  n/a   0    0.0.0.0      0.0.0.0      3205
```

2. Set up the IP address and netmask address of the iSCSI target ports by using the `controliscsiport addr <ipaddr> <netmask> [-f] <node:slot:port>` command.

```
# controliscsiport addr 10.0.100.101 255.255.255.0 -f 0:3:1
# controliscsiport addr 10.0.101.201 255.255.255.0 -f 1:3:1
```

3. Verify the changed settings by using the `showport -iscsi` command.

```
# showport -iscsi
N:S:P State      IPAddr      Netmask      Gateway  TPGT  MTU  Rate  DHCP  iSNS_Primary  iSNS_Secondary
iSNS_Port
0:3:1 ready        10.0.100.101 255.255.255.0 0.0.0.0  31    1500  1Gbps  0    0.0.0.0      0.0.0.0      3205
0:3:2 loss-sync   0.0.0.0      0.0.0.0      0.0.0.0  32    1500  n/a    0    0.0.0.0      0.0.0.0      3205
1:3:1 ready        10.0.100.201 255.255.255.0 0.0.0.0  131   1500  1Gbps  0    0.0.0.0      0.0.0.0      3205
1:3:2 loss-sync   0.0.0.0      0.0.0.0      0.0.0.0  132   1500  n/a    0    0.0.0.0      0.0.0.0      3205
```

4. If the host is connected to the IP fabric and its Ethernet interface has been configured, use the `ping` command to verify that the Ethernet switch ports, where the HPE 3PAR StoreServ Storage iSCSI target ports and iSCSI Initiator host connect, are visible to each other.

## 10 Gb iSCSI ports

10 Gb iSCSI ports on HPE 3PAR StoreServ 20000, 10000, 9000, 8000, and 7000 arrays require a one-time configuration using the `controlport` command. HPE 3PAR S-Class, T-Class, and F-Class do not

support 10 Gb HBAs. Use the `showport` and `showport -i` commands to verify the configuration setting. For example:

```
cli % showport

N:S:P      Mode      State ----Node_WWN---- -Port_WWN/HW_Addr- Type
Protocol
0:3:1 suspended config_wait          -          - cna
-
0:3:2 suspended config_wait          -          - cna
-

cli % showport -i

N:S:P Brand  Model   Rev Firmware   Serial          HWType
0:3:1 QLOGIC QLE8242 58  0.0.0.0   PCGLT0ARC1K3SK CNA
0:3:2 QLOGIC QLE8242 58  0.0.0.0   PCGLT0ARC1K3SK CNA
```

**NOTE:** The procedure for configuring iSCSI software on the HPE 3PAR StoreServ Storage iSCSI ports to connect to a Host with Software iSCSI initiator are the same as for a Host with Hardware iSCSI initiator.

1. If the `State` value is `config_wait` or the `Firmware` value is `0.0.0.0`, enter the `controlport config iscsi <n:s:p>` command to configure the iSCSI ports. For example:

```
cli % controlport config iscsi 0:3:1
cli % controlport config iscsi 1:3:1
```

2. Confirm that the port is configured by entering the following commands: `showport` and `showport -i`. A successful configuration shows the `State` value as `ready` and the `Firmware` value displays the firmware version. For example:

```
cli % showport

N:S:P      Mode      State ----Node_WWN---- -Port_WWN/HW_Addr- Type
Protocol
...
0:3:1 target ready          -          2C27D7521F3E iscsi  iSCSI
1:3:1 target ready          -          2C27D7521F3A iscsi  iSCSI

cli % showport -i

...
N:S:P Brand  Model   Rev Firmware   Serial          HWType
...
0:3:1 QLOGIC QLE8242 58  4.8.76.48015 PCGLT0ARC1K3U6 CNA
1:3:1 QLOGIC QLE8242 58  4.8.76.48015 PCGLT0ARC1K3U6 CNA
```

3. Check the current settings of the iSCSI ports by using the `showport -iscsi` command. For example:

```
cli % showport -iscsi
```

N:S:P	State	IPAddr	Netmask	Gateway	TPGT	MTU	Rate	DHCP	iSNS_Primary	iSNS_Sec	iSNS_Port
0:3:1	offline	0.0.0.0	0.0.0.0	0.0.0.0	31	1500	n/a	0	0.0.0.0	0.0.0.0	3205
0:3:2	loss_sync	0.0.0.0	0.0.0.0	0.0.0.0	32	1500	n/a	0	0.0.0.0	0.0.0.0	3205
1:3:1	offline	0.0.0.0	0.0.0.0	0.0.0.0	131	1500	n/a	0	0.0.0.0	0.0.0.0	3205
1:3:2	loss_sync	0.0.0.0	0.0.0.0	0.0.0.0	132	1500	n/a	0	0.0.0.0	0.0.0.0	3205

---

```
4
```

- To set up the IP address and netmask address of the iSCSI target ports, run the `controliscsiport addr <ipaddr> <netmask> [-f] <node:slot:port>` command. For example:

```
cli % controliscsiport addr 10.100.0.101 255.255.0.0 -f 0:3:1
cli % controliscsiport addr 10.101.0.201 255.255.0.0 -f 1:3:1
```

- Verify the changed settings by using the `showport -iscsi` command.

```
cli % showport -iscsi
```

N:S:P	State	IPAddr	Netmask	Gateway	TPGT	MTU	Rate	DHCP	iSNS_Primary	iSNS_Sec	iSNS_Port
0:3:1	ready	10.100.0.101	255.255.0.0	0.0.0.0	31	1500	10Gbps	0	0.0.0.0	0.0.0.0	3205
0:3:2	loss_sync	0.0.0.0	0.0.0.0	0.0.0.0	32	1500	n/a	0	0.0.0.0	0.0.0.0	3205
1:3:1	ready	10.101.0.201	255.255.0.0	0.0.0.0	131	1500	10Gbps	0	0.0.0.0	0.0.0.0	3205
1:3:2	loss_sync	0.0.0.0	0.0.0.0	0.0.0.0	132	1500	n/a	0	0.0.0.0	0.0.0.0	3205

---

```
4
```

- Verify that the switch ports where the HPE 3PAR StoreServ Storage iSCSI target ports and iSCSI initiator host connection are visible to each other by using the `controliscsiport ping <ipaddr> <node:slot:port>` command. For example:

```
cli % controliscsiport ping 10.0.100.101 0:3:1

Ping succeeded
```

**NOTE:** When the iSCSI initiator host port and the HPE 3PAR StoreServ Storage target port are in different IP subnets, the gateway address for the HPE 3PAR StoreServ Storage port should be configured in order to avoid unexpected behavior.

See the *HPE 3PAR Command Line Interface Reference* or the *HPE 3PAR Management Console User Guide* for complete instructions on using the `controliscsiport` command.

These documents are available on the [Hewlett Packard Enterprise Information Library](#) website.

## More information

[www.hpe.com/info/storage/docs](http://www.hpe.com/info/storage/docs)

## HPE 3PAR vLAN tagging—iSCSI

To configure the HPE 3PAR StoreServ Storage ports for iSCSI personality with vLAN tagging, follow these steps:

## Procedure

1. Issue the following command:

```
# controlport config iscsi -f N:S:P
```

2. Check the current iSCSI port settings by issuing the `showport -iscsi` command. The following example shows ports offline and unconfigured (no IP address or vLAN tag) after the ports have been set up with the iSCSI personality in the previous step.

```
# showport -iscsi
N:S:P State IPAddr Netmask/PrefixLen Gateway TPGT MTU Rate iSNS_Addr iSNS_Port
STGT VLAN
0:6:1 offline :: 0 :: 61 1500 10Gbps :: 3205
61 -
0:6:2 offline :: 0 :: 62 1500 10Gbps :: 3205
62 -
1:6:1 offline :: 0 :: 161 1500 10Gbps :: 3205
161 -
1:6:2 offline :: 0 :: 162 1500 10Gbps :: 3205
162 -
-----
--
4
```

3. Issue the `controliscsiport addr` command to set the IP addresses, prefix length, and vLAN tag of the iSCSI target ports. For example:

```
# controliscsiport addr 10.100.0.101 255.255.0.0 -vlan 816 -f
0:6:1
```

4. To display the IP address and vLAN tag of port 0:6:1, use the `iscsivlan` option in the `showport` command. For example:

```
# showport -iscsivlans 0:6:1
N:S:P VLAN IPAddr Netmask/PrefixLen Gateway MTU TPGT STGT iSNS_Addr
iSNS_Port
0:6:1 816 10.100.0.101 255.255.0.0 :: 1500 61 61 :: 3205
```

To see that port 0:6:1 is ready, issue the `showport -iscsi` command:

```
# showport -iscsi 0:6:1
N:S:P State IPAddr Netmask/PrefixLen Gateway TPGT MTU Rate iSNS_Addr iSNS_Port STGT VLAN
0:6:1 ready :: 0 :: 61 1500 10Gbps :: 3205
61 Y
-----
1
```

# Creating the host definition—Software iSCSI

**NOTE:** If multiple initiator ports are used, add the following to `/etc/sysctl.conf` on the host:

```
net.ipv4.conf.all.arp_filter = 1
```

## Procedure

1. Verify that the iSCSI Initiator is connected to the iSCSI target port with the HPE 3PAR CLI `showhost` command.

```
cli % showhost

Id      Name Persona -----WWN/iSCSI_Name----- Port
--
        iqn.2010-07.com.dl380g5-11:dd59da96  0:3:1
        iqn.2010-07.com.dl380g5-11:dd59da96  1:3:1
```

## NOTE:

Operating System	3PAR OS 3.1.2 and earlier host persona	3PAR OS 3.1.3 MU1 and later and 3.2.1 host persona	3PAR OS 3.2.2 host persona	3PAR OS 3.3.1 host persona (RM)
Citrix XenServer 5.6	Generic Persona 1	Generic Persona 1	Generic Persona 1	Generic Persona 1
Citrix XenServer 6.x and 7.x	Generic Persona 1	Generic Persona 1 Generic-ALUA Persona 2 <sup>1</sup>	Generic Persona 1 <sup>2</sup> Generic-ALUA Persona 2 <sup>3</sup>	Generic Persona 1 <sup>4</sup> Generic-ALUA Persona 2

<sup>1</sup> **Only for XenServer 6.5 and later with HPE 3PAR OS 3.1.3 MU1 and later and HPE 3PAR OS 3.2.1**, host Generic-ALUA Persona 2 is supported.

<sup>2</sup> **For any version of Citrix XenServer 6.x and later after HPE 3PAR OS 3.2.2 and its MUs**, host Generic Persona 1 will **not** be supported .

<sup>3</sup> **For all supported versions of Citrix XenServer 6.x with HPE 3PAR OS 3.2.2 and later**, Hewlett Packard Enterprise recommends host Generic-ALUA Persona 2.

<sup>4</sup> **For any version of Citrix XenServer 6.x and later after HPE 3PAR OS 3.2.2 and its MUs**, host Generic Persona 1 will **not** be supported .

For information about migrating the Citrix XenServer host from host Generic Persona 1 to host Generic-ALUA Persona 2, see [Host Persona migration](#) on page 68.

2. Create an iSCSI host definition entry by using the HPE 3PAR CLI `createhost -iscsi -persona 2 <host name> <iSCSI Initiator name>` command. For example:

---

```
cli % createhost -iscsi -persona 2 DL380g5-11_Xen-iscsi iqn.
2010-07.com.dl380g5-11:dd59da96
```

---

**NOTE: With XenServer 5.6 or 6.x, get the iSCSI initiator name from:**

---

```
# cat /etc/iscsi/initiatorname.iscsi

InitiatorName=iqn.2010-07.com.dl380g5-11:dd59da96
InitiatorAlias=sqa-dl380g5-11
```

---

3. Verify that the host entry has been created.
- 

```
Id Name Persona -----WWN/
iSCSI Name----- Port
0 DL380g5-11_Xen-iscsi Generic-ALUA iqn.
2010-07.com.dl380g5-11:dd59da96
0:3:1
2010-07.com.dl380g5-11:dd59da96 1:3:1 iqn.
```

---

## Configuring the host—Software iSCSI

### Configuring XenServer 7.x, 6.x, or 5.6—Software iSCSI

#### Discovering LUNs with XenServer 6.x or 5.6—Software iSCSI

With XenServer 6.x or 5.6, iSCSI is installed by default. The `iscsiadm` utility is a command-line tool that allows discovery and login to iSCSI targets. This tool also provides access and management of the `open-iscsi` database. To discover LUNs, the following procedure is required:

##### Procedure

1. Discover targets at a given IP address.
2. Establish iSCSI login with the node record ID found during the target discovery process.
3. Record iSCSI session statistics information.

---

**NOTE:** HPE 3PAR storage systems do not support hardware iSCSI with Citrix XenServer.

---

#### Setting up iSCSI for XenServer—Software iSCSI

Manually create the `initiatorname.iscsi` file under `/etc/iscsi`.

1. Create the `/etc/iscsi/initiatorname.iscsi` file.
2. Add a line with the `InitiatorName` information:

---

```
InitiatorName= [InitiatorName from XenCenter]
```

---

For example:

---

```
InitiatorName=iqn.2011-10.com.3pardata:f8b6f263
```

---

It is possible to adjust the iSCSI timers for better iSCSI session management and iSCSI I/O path management. iSCSI timers and session parameters are specified in `/etc/iscsi/iscsid.conf` file.

The `replacement_timeout` iSCSI timeout parameter prevents I/O errors from propagating to the application by controlling how long the iSCSI layer should wait for a timed-out path/session to reestablish itself before failing any commands on it. The default `replacement_timeout` value is 120 seconds.

Adjust the iSCSI timers:

### Procedure

1. Open `/etc/iscsi/iscsid.conf` and edit the following line to adjust `replacement_timeout`:
- 

```
node.session.timeo.replacement_timeout = [replacement_timeout]
```

---

2. Set this parameter to 15 seconds for a faster failover:
- 

```
node.session.timeo.replacement_timeout = 15
```

---

**NOTE:** With a version earlier than HPE 3PAR OS 3.1.3, set the `replacement_timeout` setting to 5 rather than 15.

---

3. To control how often a ping is sent by the iSCSI initiator to the iSCSI target, change the following parameter:
- 

```
node.conn[0].timeo.noop_out_interval = [replacement_timeout]
```

---

To detect problems quickly in the network, the iSCSI layer sends iSCSI pings to the target. If the ping times out, the iSCSI layer responds by failing to run commands on the path where the pings failed.

4. Set this parameter to 10 seconds:
- 

```
node.conn[0].timeo.noop_out_interval = 10
```

---

5. To specify the time to wait for a Nop-out response before failing the connection, change the following parameter: `node.conn[0].timeo.noop_out_timeout = [noop_out_timeout]`
6. **With 3PAR OS 3.1.3 or later**, set this parameter to 5 seconds:  
`node.conn[0].timeo.noop_out_timeout = 5`
7. To set the host log into the iSCSI nodes every time the iSCSI daemon is started or the host is restarted, edit the iSCSI configuration in `/etc/iscsi/iscsid.conf` and change the values of the following default settings:

```
node.startup = automatic
node.conn[0].startup = automatic
```

---

**NOTE:** The `node.conn[0].startup` variable is optional and not defined in the default `iscsid` configuration file. See the Citrix document CTX122852, *iSCSI Service (open-iscsi) Startup Best Practices for XenServer* for full details on configuring iSCSI startup on the Host. For more details, see the Citrix XenServer configuration limits at the Citrix Knowledge Center website.

---

8. To prevent one host from using up all the I/O buffers, throttle the host I/O by reducing the `node.session.cmds_max` and `node.session.queue_depth` values.
9. Enable any other configuration changes such as CHAP authentication. For details, see **Configuring host CHAP (optional)—iSCSI** on page 46.

#### More information

[support.citrix.com/](http://support.citrix.com/)

### Configuring XenServer 7.x, 6.x or 5.6 iSCSI settings with device mapper multipathing—Software iSCSI

To configure XenServer 7.x, 6.x, or 5.6 iSCSI settings using device mapper multipathing, see **Setting up multipathing—FC** on page 26.

### Starting the iSCSI daemon for XenServer 6.2 and earlier—Software iSCSI

Start the iSCSI daemon for the Citrix host:

#### Procedure

1. Start the `open-iscsi` module:

```
# service open-iscsi start

Starting iSCSI initiator service:                [ OK ]
Setting up iSCSI targets: iscsiadm: No records found!
iscsiadm: no records found!
```

---

**NOTE:** XenServer 6.5 and later does not use the `open-iscsi` module.

---

2. After `open-iscsi` is started, check the state of the open-iSCSI service run level information with the `chkconfig` command. Run level 5 should be on. For example:

---

```
# chkconfig --list | grep iscsi  
iscsi 0:off 1:off 2:off 3:off 4:off 5:on 6:off
```

---

If `iscsi` is not 'ON', run the following command:

```
#chkconfig iscsi on
```

## Creating the iSCSI connection in XenServer 7.x, 6.x, or 5.6—Software iSCSI

After connecting the host to the HPE 3PAR StoreServ Storage iSCSI target port, use the `iscsiadm` command to create the iSCSI connection:

### Procedure

1. Discover the target node using the `iscsiadm` command in discovery mode:

---

```
# iscsiadm -m discovery -t sendtargets -p <target ip address>:<iscsi port>
```

---

For example:

---

```
# iscsiadm -m discovery -t sendtargets -p 10.0.100.101:3260  
10.0.100.101:3260,31 iqn.2000-05.com.3pardata:20310002ac000079
```

---

2. The contents of the discovery can be viewed using the `iscsiadm -m discovery` command. For example:

---

```
# iscsiadm -m discovery  
10.0.100.101:3260 via sendtargets
```

---

3. Identify the iSCSI node login that record has been discovered from the discovery process.

`iscsiadm -m node -T <targetname> -p <target ip address>:<iscsiport> -l`. For example:

---

```
# iscsiadm -m node -T iqn.2000-05.com.3pardata:20310002ac000079 -p 10.0.100.101:3260 -l  
Logging in to [iface: default, target: iqn.2000-05.com.3pardata:20310002ac000079, portal: 10.0.100.101,3260]  
Login to [iface: default, target: iqn.2000-05.com.3pardata:20310002ac000079, portal: 10.0.100.101,3260]:  
successful
```

---

4. The content of the login node can be viewed using the `iscsiadm` command. For example:

---

```
# iscsiadm -m node -T iqn.2000-05.com.3pardata:20310002ac000079 -p
10.0.100.101:3260

10.0.100.101:3260,31 iqn.2000-05.com.3pardata:20310002ac000079
```

---

5. Now examine the iSCSI session and content session of the node info by using the `iscsiadm -m session` command. For example:

---

```
# iscsiadm -m session

tcp: [1] 10.0.100.101:3260,31 iqn.2000-05.com.3pardata:20310002ac000079
```

---

## Discovering iSCSI devices and creating storage repositories—XenServer 7.x, 6.x, or 5.6—Software iSCSI

---

**NOTE:** With XenServer 5.5, iSCSI is not supported. Discover iSCSI devices and create storage repositories with Citrix XenCenter:

### Procedure

1. In the **Resources** pane, select the server to create a new storage repository.
2. On the toolbar, click **Storage**, and then click **New SR**.
3. Select **Software iSCSI**, and then click **Next**.
4. Change the default name if necessary, and then click **Next**.
5. Enter the IP address of the target host for iSCSI storage, and then click **Discover IQNs**.
6. Select an appropriate IQN, and then click **Discover LUNs**. The host starts scanning for LUNs.
7. Choose a discovered LUN on which to create a new storage repository.
8. Click **Finish** to create a new storage repository.

For details, see *Citrix XenServer Design: Configuring Multipathing for XenServer* at the *Citrix* website.

### More information

[support.citrix.com/](http://support.citrix.com/)

## Configuring host CHAP (optional)—iSCSI

Two CHAP (Challenge-Handshake Authentication Protocol) authentication configurations are available: Host CHAP authentication, where the 3PAR StoreServ Storage iSCSI target port authenticates the iSCSI Initiator host when it tries to connect to it, and bidirectional (mutual) CHAP authentication, where both the iSCSI target and host authenticate each other when the host tries to connect to the target.

Create an iSCSI host definition on the HPE 3PAR StoreServ Storage before setting and configuring CHAP for the iSCSI host.

### More information

[Creating the host definition—Software iSCSI](#) on page 41

## Setting the host CHAP authentication on the HPE 3PAR StoreServ Storage—iSCSI

To set the host CHAP authentication, an iSCSI host definition must have been created on the HPE 3PAR StoreServ Storage, and the HPE 3PAR CLI `sethost initchap` command must be used to set the host CHAP secret.

For HPE 3PAR OS 3.1.x, the output shows:

```
cli % showhost

Id Name          Persona -----WWN/iSCSI_Name----- Port
0 Citrix         Generic iqn.2010-07.com.dl380g5-11:dd59da96 ---
```

The following example uses the host CHAP password `host_secret0` for the host. Be aware that CHAP secret must be at least 12 characters long.

- Set the host CHAP secret.

```
cli % sethost initchap -f host_secret0 Citrix
```

- Verify the host CHAP secret.

```
cli % showhost -chap

Id Name          -Initiator_CHAP_Name-   -Target_CHAP_Name-
0 Citrix         Citrix                   --
```

## Setting the host CHAP—Software iSCSI

Set the host CHAP for Citrix:

### Procedure

1. Go to the iSCSI Initiator host console, or, at a terminal, edit the `/etc/iscsid.conf` file and enable CHAP authentication:

```
# To enable CHAP authentication set node.session.auth.authmethod
# to CHAP. The default is None.
node.session.auth.authmethod = CHAP
```

2. Configure the host CHAP password for the discovery and login session by again editing the configuration file `/etc/iscsid.conf` file.

---

```
# To set a discovery session CHAP username and password for the initiator
# authentication by the target(s), uncomment the following lines:
discovery.sendtargets.auth.username = Citrix
discovery.sendtargets.auth.password = host_secret0
# To set a CHAP username and password for initiator
# authentication by the target(s), uncomment the following lines:
node.session.auth.username = Citrix
node.session.auth.password = host_secret0
```

---

**NOTE:** The `OutgoingPassword` must be the same as the `host CHAP secret` configured on the HPE 3PAR StoreServ Storage.

---

3. Perform discovery and login as described in **Discovering iSCSI devices and creating storage repositories—XenServer 7.x, 6.x, or 5.6—Software iSCSI** on page 46.

If the targets have been discovered previously, log out of the iSCSI sessions, delete the node, and send target records before performing discovery and login. Complete the following procedure for each individual iSCSI login sessions:

a. Perform an iSCSI Logout:

---

```
# iscsiadm -m node --logout -p 10.0.100.101
```

---

b. Remove the iSCSI Node:

---

```
# iscsiadm -m node -o delete -T iqn.2000-05.com.3pardata:20310002ac000079 -p
10.0.100.101,3260
```

---

c. Remove the SendTarget iSCSI Discovery:

---

```
# iscsiadm -m discovery -o delete -p 10.0.100.101
```

---

d. Stop and start the iSCSI daemon:

---

```
# service open-iscsi stop

Stopping iSCSI daemon:

# service open-iscsi start

Turning off network shutdown. Starting iSCSI daemon: [ OK ]
[ OK ]
```

---

e. To rediscover the iSCSI target nodes and to create the iSCSI login sessions, repeat the procedure as described in **Setting the host CHAP authentication on the HPE 3PAR StoreServ Storage—iSCSI** on page 47.

## Setting up the bidirectional CHAP—iSCSI

The HPE 3PAR CLI `sethost initchap` and `sethost targetchap` commands must be used to set bidirectional CHAP on the HPE 3PAR StoreServ Storage.

Set bidirectional CHAP (mutual):

### Procedure

1. Verify that a host definition has been created on the HPE 3PAR StoreServ Storage. The following example uses `host_secret0` for the host CHAP password and `target_secret0` for the target CHAP password.

---

**NOTE:** The following example uses the host CHAP password `host_secret0` for the host. Be aware that CHAP secret must be at least 12 characters long.

---

2. Set the host CHAP secret.

```
cli % sethost initchap -f host_secret0 Citrix
```

---

3. Set the target CHAP secret.

```
cli % sethost targetchap -f target_secret0 Citrix
```

---

4. Verify the host and target CHAP secret.

```
cli % showhost -chap

Id Name           -Initiator_CHAP_Name-   -Target_CHAP_Name-
0 Citrix Citrix                S121
```

---

## Setting the bidirectional CHAP—Software iSCSI

To configure the bidirectional CHAP for Citrix, go to the iSCSI Initiator host console, or, at a terminal, edit the `/etc/iscsi/iscsid.conf` file, and then configure the host and target CHAP passwords for discovery and login sessions by completing the following procedure:

---

**NOTE:** Notice that two `DiscoveryAddress` variables with the same IP address for the HPE 3PAR StoreServ Storage iSCSI target port are required: one for the host CHAP username and password variables (`OutgoingUsername` and `OutgoingPassword`) and another one for target CHAP username and password variables (`IncomingUsername` and `IncomingPassword`).

---

### Procedure

1. Perform the CHAP configuration settings for the host initiator:

---

```
# To enable CHAP authentication set node.session.auth.authmethod
# to CHAP. The default is None.
node.session.auth.authmethod = CHAP

# To set a discovery session CHAP username and password for the initiator
# authentication by the target(s), uncomment the following lines:
discovery.sendtargets.auth.username = Citrix
discovery.sendtargets.auth.password = host_secret0

# To set a CHAP username and password for initiator
# authentication by the target(s), uncomment the following lines:
node.session.auth.username = Citrix
node.session.auth.password = host_secret0
```

---

## 2. Perform the CHAP configuration setting for the target:

---

```
# To enable CHAP authentication for a discovery session to the target
# set discovery.sendtargets.auth.authmethod to CHAP. The default is None.
discovery.sendtargets.auth.authmethod = CHAP

# To set a discovery session CHAP username and password for target(s)
# authentication by the initiator, uncomment the following lines:
discovery.sendtargets.auth.username_in = S121
discovery.sendtargets.auth.password_in = target_secret0

# To set a CHAP username and password for target(s)
# authentication by the initiator, uncomment the following lines:
node.session.auth.username_in = S121
node.session.auth.password_in = target_secret0
```

---

### NOTE:

- S121 is the target CHAP name, which can be displayed on the HPE 3PAR StoreServ Storage by using the `showhost -chap` command.
  - The `OutgoingUsername` and `IncomingUsername` variables can be set to anything desired, but the `OutgoingPassword` and `IncomingPassword` must match the host CHAP password and target CHAP password configured on the HPE 3PAR StoreServ Storage.
- 

## 3. Perform discovery and login as describe in [Discovering iSCSI devices and creating storage repositories—XenServer 7.x, 6.x, or 5.6—Software iSCSI](#) on page 46.

If the targets have been discovered previously, log out of the iSCSI sessions, delete the node, and send target records before performing discovery and login. Complete the following procedure for each individual iSCSI login sessions:

### a. Perform an iSCSI Logout.

---

```
# iscsiadm -m node --logout -p 10.0.100.101
```

---

### b. Remove the iSCSI Node.

---

```
# iscsiadm -m node -o delete -T iqn.2000-05.com.3pardata:20310002ac000079 -p  
10.0.100.101,3260
```

---

- c. Remove the SendTarget iSCSI Discovery.
- 

```
# iscsiadm -m discovery -o delete -p 10.0.100.101
```

---

- d. Stop and start the iSCSI daemon.

To stop the iSCSI daemon:

---

```
# service open-iscsi stop  
  
Stopping iSCSI daemon:  
# service open-iscsi start
```

---

- e. Repeat the procedure as described in **Creating the iSCSI connection in XenServer 7.x, 6.x, or 5.6—Software iSCSI** on page 45 to rediscover the iSCSI target nodes and create the iSCSI login sessions.

# Allocating storage for the host

## Creating storage on the HPE 3PAR StoreServ Storage

The following topics describe the general procedures and commands that are required to create the virtual volumes (VVs) that can then be exported for discovery by the host.

For more information, see the *HPE 3PAR Command Line Interface Administrator's Manual*. For a comprehensive description of HPE 3PAR OS commands, see the *HPE 3PAR Command Line Interface Reference* on the [Hewlett Packard Enterprise Information Library](http://www.hpe.com/info/storage/docs) website.

### More information

[www.hpe.com/info/storage/docs](http://www.hpe.com/info/storage/docs)

## Creating virtual volumes

Virtual volumes (VVs) are the only data layer visible to hosts. After devising a plan for allocating space for the Citrix host, create the VVs on the HPE 3PAR StoreServ Storage.

Create volumes that are provisioned from one or more Common Provisioning Groups (CPGs). Optionally, specify a CPG for snapshot space for provisioned volumes.

### Creating Virtual Volumes using the HPE 3PAR Management Console (MC)

#### Procedure

1. From the menu bar, select:  
**Actions > Provisioning > Virtual Volume > Create Virtual Volume**
2. Use the **Create Virtual Volume** wizard to create a base volume.
3. Select one of the following options from the list:
  - a. **Fully Provisioned**
  - b. **Thinly Provisioned**
  - c. **Thinly Deduplicated** (Supported with HPE 3PAR OS 3.2.1 MU1 and later)
  - d. **Thinly Compressed** (from HPE 3PAR OS 3.3.1 and later)

### Creating Virtual Volumes using the HPE 3PAR StoreServ Management Console (SSMC)

1. On the main menu, select:  
**Block Persona > Virtual Volume**
2. Click **+ Create virtual volume** or select **Create** on the **Actions** menu.
3. Follow the instructions on the dialog that opens and select one of the following virtual volume options:
  - **Fully Provisioned**
  - **Thinly Provisioned**
  - **Thinly Deduplicated** (Supported with HPE 3PAR OS 3.2.1 MU1 and later)

## Creating Virtual Volumes using the HPE 3PAR CLI

Create a fully provisioned or TPVV:

```
cli % createvv [options] <usr_CPG> <VV_name> [.<index>] <size>[g|G|t|T]
```

For example:

```
cli % createvv -cnt 5 testcpg TESTLUNS 5g
```

For complete details on creating volumes for the HPE 3PAR OS version that is being used on the HPE 3PAR StoreServ Storage, see the following documents:

- *HPE 3PAR StoreServ Management Console User Guide*
- *HPE 3PAR Management Console User Guide*
- *HPE 3PAR OS Command Line Interface Reference*

These documents are available at the [Hewlett Packard Enterprise Information Library](#) website.

**NOTE:** The commands and options available for creating a VV might vary for earlier versions of the HPE 3PAR OS.

### More information

[www.hpe.com/info/storage/docs](http://www.hpe.com/info/storage/docs)

### Restrictions on volume size and number

Follow the guidelines for creating virtual volumes (VVs) and virtual logical unit numbers (VLUNs) in the *HPE 3PAR Command Line Interface Administrator' Guide* while adhering to these cautions and guidelines.

- Beginning with HPE 3PAR OS 3.3.1 the maximum volume size has changed. See the *HPE 3PAR StoreServ Storage Concepts Guide* and the *HPE 3PAR OS 3.3.1 Release Notes* for details.
- This configuration supports sparse LUNs (meaning that LUNs might be skipped). LUNs might also be exported in non-ascending order (such as 0, 5, 7, 3).
- The HPE 3PAR StoreServ Storage supports the exportation of VLUNs with LUNs in the range from 0 to 16383.
- The maximum LUN size that can be exported to a host is 16 TB when the installed HPE 3PAR OS version is 3.2.x or 3.1.x. A LUN size of 16 TB on a host is dependent on the installed version and update, since some older versions will not support a volume greater than 2 TB.

### More information

[support.citrix.com/](http://support.citrix.com/)

## Creating thinly provisioned virtual volumes

**!** **IMPORTANT:** To create TPVVs, an HPE 3PAR Thin Provisioning license is required.

To create thinly provisioned virtual volumes (TPVVs), see the following documents:

- *HPE 3PAR StoreServ Storage Concepts Guide*
- *HPE 3PAR Command Line Interface Administrator' Guide*
- *HPE 3PAR OS Command Line Interface Reference*

These documents are available on the [Hewlett Packard Enterprise Information Library](#) website.

## Creating thinly compressed virtual volumes

---

**NOTE: With HPE 3PAR OS 3.3.1 and later**, HPE 3PAR compressed virtual volumes are supported. To create compressed volumes, an HPE 3PAR All-Inclusive Software License is required.

---

HPE 3PAR Thin Compression allows the creation of compressed virtual volumes from solid-state drive (SSD) common provisioning groups (CPGs). The compression feature is available on thinly provisioned (TPVV) virtual volumes. Virtual volumes can be marked for compression during their creation, or an existing virtual volume can be updated with the compression feature at run time.

## Exporting LUNs to the host

The following topics describe how to export LUNs to the host as VVs, referred to as virtual LUNs (VLUNs).

To export VVs as VLUNs, use the following command:

```
createvlun [-cnt] <number of LUNs> <name_of_virtual_LUNs> [.int]  
<starting_LUN_number> <hostname/hostdefinition>
```

where:

- [-cnt] specifies the number of identical VVs to create by using an integer from 1 through 999. If not specified, one VV is created.
- <name\_of\_virtual\_LUNs> specifies the name of the VV exported as a virtual LUN.
- <starting\_LUN\_number> indicates the starting LUN number.

For example:

---

```
cli % createvlun -cnt 5 TESTLUN.0 0 <hostname>
```

---

To verify that VLUNs were created, use the `showvlun` command.

```

cli % showvln
Active VLUNs
Lun VVName          HostName          -----Host_WWN/iSCSI_Name-----  Port
Type
  0 TESTLUNS.0      Citrixhost        210100E08B31901B                    0:4:1
host
  1 TESTLUNS.1      Citrixhost        210100E08B31901B                    0:5:1
host
  2 TESTLUNS.2      Citrixhost        210100E08B31901B                    1:2:1
host
  3 TESTLUNS.3      Citrixhost        210100E08B31901B                    1:4:1
host
  4 TESTLUNS.4      Citrixhost        210100E08B31901B                    1:5:1
host
  0 TESTLUNS.0      Citrixhost        210000E08B31901B                    0:4:1
host
  1 TESTLUNS.1      Citrixhost        210000E08B31901B                    0:5:1
host
  2 TESTLUNS.2      Citrixhost        210000E08B31901B                    1:2:1
host
  3 TESTLUNS.3      Citrixhost        210000E08B31901B                    1:4:1
host
  4 TESTLUNS.4      Citrixhost        210000E08B31901B                    1:5:1
host
-----
--
  10
total

VLUN Templates
Lun VVName          HostName          -Host_WWN/iSCSI_Name-                Port
Type
  0 TESTLUNS.0      Citrixhost        -----
host
  1 TESTLUNS.1      Citrixhost        -----
host
  2 TESTLUNS.2      Citrixhost        -----
host
  3 TESTLUNS.3      Citrixhost        -----
host
  4 TESTLUNS.4      Citrixhost        -----
host
-----
--
  5 total

```

In the example above, there are five paths to the HPE 3PAR StoreServ Storage from each HBA port.

### More information

[www.hpe.com/support/hpesc](http://www.hpe.com/support/hpesc)

## Discovering FC devices and creating storage repositories

Discover FC devices and create storage repositories with a Citrix XenServer host using Citrix XenCenter:

### Procedure

1. In the **Resources** pane, select the server to create a new storage repository.
2. On the toolbar, click **Storage**, and then click **New SR**.
3. Select **Hardware HBA**, and then click **Next**.

4. Change the default name if necessary, and then click **Next**. The host starts scanning for LUNs.
5. Choose a discovered LUN on which to create a new storage repository.
6. Click **Finish** to create a new storage repository.

# Modifying HPE 3PAR devices on the host

## Displaying detailed device mapper node information

To obtain node information, use Citrix XenServer or the CLI provided by Citrix.

If applicable, use the `sg3_utils` packaged with the Citrix XenServer installation to collect details.

---

**NOTE:** In the following examples, `multipath` and `dmsetup` usage provides information only; do not use these commands to change the node setting.

---

To list devices, use the `multipath -l` command.

To get detailed device mapper node information, use the `dmsetup` command.

For example:

---

```
# multipath -l
350002ac001b40031
[size=5 GB][features="1 queue_if_no_path"][hwhandler="0"]
\_ round-robin 0 [active]
\_ 0:0:0:0 sda 8:0 [active]
\_ 1:0:0:0 sdb 8:16 [active]
```

---

**NOTE:** If the device status is `[undef]` in the output, this is an Citrix defect about which Citrix has been notified. Instead, use the `multipath -ll` command, which shows the correct device status as `ready`.

---

The `dmsetup` command can be used with various options to get more information on device mapper mappings. For example:

---

```
# dmsetup table
350002ac001b40031: 0 10485760 multipath 1 queue_if_no_path 0 1 1 round-robin 0 2 1 8:0 100 8:16
100

# dmsetup ls --target multipath
350002ac0004b0079          (253, 7)

# dmsetup info 350002ac0004b0079
Name:          350002ac0004b0079
State:         ACTIVE
Read Ahead:    256
Tables present: LIVE
Open count:    1
Event number:  0
Major, minor:  253, 7
Number of targets: 1
UUID: mpath-350002ac0004b0079

# dmsetup table --target multipath
350002ac0004b0079: 0 10485760 multipath 1 queue_if_no_path 0 1 1 round-robin 0 2 1 8:32 100 8:48
100
```

---

## Removing a storage volume from the host

Use one of the following methods to remove a storage volume from the host if using device mapper.

Citrix XenServer provides the following methods for removing virtual volumes (VVs) and storage repositories:

- Method 1—Detach
- Method 2—Forget
- Method 3—Destroy

After removing the storage volume device instance from the host, remove the VLUN from the HPE 3PAR StoreServ Storage by using the `removevln <VVname> <LUN> <host>` command.

---

```
cli % removevln testvln 0 Citrixhost
```

---

**NOTE:** The removed SCSI device is updated in `/proc/scsi/scsi`, `/proc/partitions`, and `/sys/device path`.

---

## Citrix XenCenter

Citrix XenCenter provides the following methods for removing virtual volumes (VVs) and storage repositories:

- Method 1—Detach
- Method 2—Forget
- Method 3—Destroy

## Removing a storage repository by using Citrix XenCenter

### Procedure

- In the **Resources** pane, right-click the storage repository to remove.
  - To detach the storage repository, click **Detach**.
  - To remove the storage repository (without deleting any of the storage-repository contents), right-click the detached storage repository, and then click **Forget**.

## Citrix XenServer (host Console tab)

Citrix XenServer provides the following methods for removing VVs and storage repositories with a CLI operation.

- Method 1—Detach
- Method 2—Forget
- Method 3—Destroy

To manage storage repositories, see the *Citrix Administrator's Guide* for CLI operations.

## Space Reclaim (UNMAP) Support for Citrix XenServer 6.5 or later

From Citrix XenServer documentation:

The Reclaim freed space option in XenCenter enables you to free up unused blocks (for example, deleted virtual disks in an SR) on a LUN that is thinly provisioned by the storage array. Once released, the reclaimed space can then be reused by the array. The Reclaim freed space operation is only available for LVM-based SRs that are thinly provisioned on the array (that is, iSCSI, Fibre Channel, or Local LVM). This feature is not enabled on file-based SRs such as NFS and Ext3 as these SR types do not require a manual space reclamation operation.

To reclaim freed space:

1. Select the Infrastructure view and then click on the host or the pool that contains the SR.
2. Click on the **Storage** tab.
3. Select the **SR** from the list, and then click **Reclaim freed space**.

---

ⓘ **IMPORTANT:** Reclaiming freed space is an intensive operation and can affect the performance of the storage array. You should perform this operation only when space reclamation is required on the array. Citrix recommends that you schedule this work outside the peak array demand hours.

---

4. Click **Yes** to confirm the operation. To view the status of this operation, click **Notifications** and then **Events**.

# Booting the host from the HPE 3PAR StoreServ Storage

The following topics provide only a general overview of the procedures required to boot the XenServer operating system from the SAN.

Booting from the HPE 3PAR StoreServ Storage is supported from version 5.6 Feature Pack 1 onwards and on fabric and direct connect topologies.

For details, see the *Citrix Installation Guide* on the Citrix website.

Citrix XenServer boots to a remote disk on a SAN with `multipathing` enabled.

A starting LUN can be exported from the array on any number from 0 to 255. Verify that enough space has been allocated, when creating the VVs, to be able to install XenServer 6.x or XenServer 5.6FP1 OS.

Refer to the [HPE Boot from SAN Configuration Guide](#) for the latest information.

## More information

[support.citrix.com/](http://support.citrix.com/)

## Installing from PXE

During the Citrix XenServer installation, perform the following procedure:

1. On the **Welcome to XenServer** screen, press **F2**.
2. At the boot prompt, enter `multipath`.
3. When installing from PXE, add the following command to the PXE Linux configuration file:  
`device_mapper_multipath=yes`.

## Host HBA BIOS setup considerations

The HBA BIOS needs to be set up properly to handle booting from the HPE 3PAR StoreServ Storage.

## Booting from the HPE 3PAR StoreServ Storage using QLogic HBAs

### Procedure

1. During the host boot, press **Ctrl+C** or **Alt+Q** when prompted for the QLogic Fast!UTIL HBA utility.
2. From the QLogic Fast!UTIL screen, choose **Select Host Adapter** menu and select the host adapter from which to boot.
3. When the **Fast!UTIL Options** menu appears, select **Configuration Settings**.
4. Select **Adapter Settings**.
5. Select **Host Adapter BIOS > Enabled**, and then press **Esc**.
6. From the Configuration Settings menu, select **Selectable Boot Settings**.
7. From the Selectable Boot Settings menu, select **Selectable Boot>Enabled**.
8. Arrow down to the next field, **(Primary) Boot Port Name,LUN**, and then press **Enter**.

9. From the **Select Fibre Channel Device** menu, the 3PAR device under **ID0** with its **Rev**, **Port Name**, and **Port ID** should be shown. Press **Enter**.
10. From the **Select LUN** menu, select the first line **LUN 0** with a status of **Supported**, and press **Enter**.
11. Press **Esc** twice to return to **Configuration Settings Modified**.
12. Select **Save changes**.
13. Return to the **Fast!UTIL Options** menu and select **Select host Adapter**.
14. Select the next HBA port to boot from, and then repeat these steps.
15. When completed, from the **Fast!UTIL Options** menu, complete the following:
  - a. Select **Exit Fast!UTIL**
  - b. Select **Reboot system**

The settings will be saved and the host is restarted.

## Booting from the HPE 3PAR StoreServ Storage using Emulex HBAs

### Procedure

1. During the host boot, press **Alt+E** or **Ctrl+E** when prompted by the Emulex HBA Utility, a screen appears that shows the Emulex adapters in the system. Select **<Adapter #>** and press **Enter**.
  - a. A screen displays: **The BIOS of the Adapter is Disabled**. If the screen says, **The BIOS of the Adapter is Enabled**, then skip to step 2.
  - b. Select option 2 **Configure This Adapter's Parameters** and press **Enter**.
  - c. From the next screen Select option 1 **Enable or Disable BIOS** and press **Enter**.  
The following appears:  
**The BIOS is Disabled!!**  
Enable **Press 1**, Disable **Press 2**:
  - d. Select 1 and press **Enter**.  
The following appears:  
**The BIOS is Enabled!!**
  - e. Press **Esc** twice.
2. Select option 1 **Configure Boot Devices**, then press **Enter**.  
The following appears:  
**List of Saved Boot Devices**
3. Select option 1. **Unused DID:<all zeros> WWPN: <all zeros> LUN:00 Primary Boot** and press **Enter**.  
The following appears:  
**01. DID:<did\_value> WWPN:<3PAR Port WWPN> Lun:00 3PARdataVV 0000**
4. Select the two digit number of the desired boot device 01 and press **Enter**.  
The following appears:

**Enter two digits of starting LUN (Hex):**

5. Type 00 and press **Enter**.

The following appears:

**DID: XXXXXX WWP: <3PAR port WWP>**

**01.Lun:00 3PARdataVV0000**

- a. Select 01 and press **Enter**.

The following appears:

**1. Boot this device via WWP**

**2. Boot this device via DID**

- b. Select 1 and press **Enter**. The following appears:

**List of saved boot devices**

**1 Used DID:000000 WWP:<3PAR Port WWP> Lun:00 Primary Boot**

6. Press **Esc** twice to return to the Emulex Adapters in the System menu.
7. Select the next HBA port to boot from, and then repeat these steps.
8. When done, press **x** to exit.
9. A prompt appears to restart the system. Select **Y**.

After the system comes up, verify that the Citrix XenServer installation CD is in the drive tray to continue with the process.

## Booting from the HPE 3PAR StoreServ Storage using Brocade HBAs

When booting from the HPE 3PAR StoreServ Storage using a Brocade HBA, complete the following procedure:

### Procedure

1. During the host boot, press **Ctrl+B** or **Alt+B** when prompted for the **QLogic Fast!UTIL HBA** utility.
2. From the **Brocade BIOS** config menu, choose the **Adapter port** from which to boot.
3. From the **Adapter configuration** menu, select **Adapter settings**.
4. Select **Adapter Settings**.
5. Configure the following: **BIOS Enabled**, **Port Speed Auto**, and **Boot LUN Flash Values**. Press **Esc** to return to the previous menu.
6. From the **Adapter configuration** menu select **Boot Device settings**.
7. Select **ID0**, followed by the target device to boot from, and then press **Enter**.
8. Select the next HBA port from which to boot, and then repeat these steps.
9. Use **Alt+S** to save the configuration.
10. Restart the system.

# Configuring the Brocade HBA using the BCU utility

This section describes how to configure the Brocade HBA using the BCU utility.

Brocade provides a CLI utility to configure their HBAs. This is also available as a GUI. These tools, once installed, can be used to configure many HBA and driver parameters. For instructions on using the BCU CLI and GUI utilities, see the documentation at the *Brocade* website.

For Brocade FC HBA, the default `Path TOV` parameter is set to 30 seconds. Hewlett Packard Enterprise recommends to change this value to 14 seconds. To change the value of this parameter, it is required to use Brocade BCU command line utility. For example:

## Procedure

1. This is a per-port setting. List the available ports by using the `bcu port --list` command:

```
# bcu port --list
-----
Port#  FN Type  PWWN/MAC  FC Addr/  Media State Spd
      Eth dev
-----
1/0 -  fc 10:00:8c:7c:ff:30:41:60 036100 sw Linkup 4G
   0  fc 10:00:8c:7c:ff:30:41:60 036100 sw Linkup 4G
1/1 -  fc 10:00:8c:7c:ff:30:41:61 036000 sw Linkup 4G
   1  fc 10:00:8c:7c:ff:30:41:61 036000 sw Linkup 4G
-----
```

2. Set the `path_tov` value for each port by using the `bcu fcpim --pathtov <pcifn> <tov>` command:

```
# bcu fcpim --pathtov 1/0 14
path timeout is set to 14
```

**NOTE:** Changing the `path_tov` value is **not** supported with XenServer 6.0.

## More information

[www.broadcom.com](http://www.broadcom.com)

# Configuring additional HPE 3PAR software features

## HPE 3PAR All Flash Array

Starting with HPE 3PAR OS 3.2.1, HPE 3PAR introduced All-Flash-Arrays that deliver significant improvements in performance, density, resiliency and data mobility.

Applications like OLTP, VDI, business analytics and various other data services are taking advantage of the improvements that these HPE 3PAR All-Flash-Arrays offer. To benefit from these improvements, no array special settings are needed.

For more information on HPE 3PAR All-Flash-Arrays, see the white paper *HPE 3PAR StoreServ: Optimized for Flash*, available at the [Hewlett Packard Enterprise Information Library](#) website.

**NOTE:** For volumes on All-Flash-Arrays, executing a utility or command which defragments or attempts to optimize data placement should be avoided. Such actions unnecessarily contribute to SSD device wear. Unlike spinning media, an SSD device inherently has no rotational latency and, therefore, defragmentation or optimization provides no benefit. As to whether data management commands recognize SSD devices, consult the documentation or the vendor for your host OS and adjust their behavior accordingly.

## HPE 3PAR Peer Persistence

For complete description of the HPE 3PAR Peer Persistence feature and how to configure HPE 3PAR StoreServ Storage for HPE 3PAR Peer Persistence with Automatic Transparent Failover and Manual Transparent Switchover, see the *HPE 3PAR Remote Copy Software User Guide* on the [Hewlett Packard Enterprise Information Library](#) website.

For information about supported HPE 3PAR Peer Persistence configurations for Citrix XenServer and exceptions, see the *HPE 3PAR Peer Persistence* support matrix on the [SPOCK](#) website ([SPOCK Home > Software > Array SW: 3PAR](#)).

For information about supported hardware and software platforms, see the HPE 3PAR StoreServ Storage Interoperability for Citrix XenServer on the [SPOCK](#) website ([SPOCK Home > Explore Storage Interoperability With SPOCK > Explore 3PAR StoreServ Storage interoperability](#)).

❗ **IMPORTANT: With Citrix XenServer versions prior to XenServer 7.x and with HPE 3PAR Peer Persistence**, an occurrence of an automatic transparent failover can result in the Citrix XenServer hosts not being able to automatically recover all standby paths after the failover is complete.

To recover the lost standby paths, manually rescan the SCSI bus on each Citrix XenServer host for all LUNs in the HPE 3PAR StoreServ Storage. The `rescan-scsi-bus.sh` script can be used to rescan for all LUNs.

```
# /usr/bin/rescan-scsi-bus.sh --nooptscan
```

Verify that the lost standby paths have been successfully reinstated using the `multipath` command before recovering and restoring the affected remote-copy volume groups.

```
# multipath -ll
```

---

**NOTE:**

- Host Generic-ALUA persona 2 is required for Citrix XenServer hosts configured as part of HPE 3PAR Peer Persistence configurations.
- Configuration of Citrix XenServer hosts for HPE 3PAR Peer Persistence should follow this *HPE 3PAR Citrix XenServer Implementation Guide*.

---

**More information**

[www.hpe.com/info/storage/docs](http://www.hpe.com/info/storage/docs)

[www.hpe.com/storage/spock](http://www.hpe.com/storage/spock)

# Configuring Citrix XenServer resource pools

HPE 3PAR supports the use of Citrix XenServer resource pools.

On the HPE 3PAR StoreServ Storage, LUNs for the pool must be exported to each host in the pool using the `createvln` command.

The following example shows the exporting of `poolLun.0` to a pool with two hosts, `poolHost1` and `poolHost2`.

---

```
# createvln poolLun.0 0 poolHost1
# createvln -f poolLun.0 0 poolHost2
```

---

For setup instructions, see the Citrix online help topic *Configuring Resource Pools*.

# Using Citrix High Availability

HPE 3PAR supports the use of Citrix High Availability (HA).

There are no special setup considerations for the HPE 3PAR StoreServ Storage.

For installation and setup instructions, see documentation at the *Citrix* website.

## More information

[support.citrix.com/](http://support.citrix.com/)

# Host Persona migration

The following topics provide guidance for successfully migrating your Citrix XenServer hosts on HPE 3PAR StoreServ Storage from host Generic Persona 1 to host Generic-ALUA Persona 2 to ensure a seamless HPE 3PAR host persona transition.

---

❗ **IMPORTANT:** Please refer to the *SPOCK* website for XenServer versions and required HPE 3PAR OS versions supported with host Generic-ALUA Persona 2.

---

**NOTE:** Target-XenServer host refers to the XenServer host on which the host persona is being changed. Temporary-XenServer refers to the XenServer host used to temporarily host the virtual machines from the Target-XenServer.

---

## Methods for changing host persona

There are two methods for changing host persona, online process and offline process. The first paragraph describes online process, and the second paragraph describes offline process.

- **Online Process**

Using Citrix XenMotion technology, the virtual machines on the selected Target-XenServer host are first migrated to a Temporary-XenServer host in a resource pool environment sharing the same HPE 3PAR storage system. The Target-XenServer host is first configured to enable ALUA-multipathing. The requisite host persona change is made for the Target-XenServer host definition on the HPE 3PAR StoreServ Storage system. The Target-XenServer host is then rebooted, while virtual machines continue to have access to HPE 3PAR StoreServ Storage system via the Temporary-XenServer host in the resource pool. After the migration completes, all of its virtual machines are restored back from the Temporary-XenServer host using Citrix XenMotion.

When you use this method, during the migration process there will be a mix of Generic Persona 1 and Generic-ALUA Persona 2 based hosts in the resource pool. Resources pools with heterogeneous host persona definitions are supported for this migration process.

- **Offline Process**

The offline process requires any associated active virtual machines to be shutdown. This approach is to power off any associated virtual machines on the host, and to configure Target-XenServer to enable ALUA multipathing. The requisite host persona change is then made for the Target-XenServer host definition on the HPE 3PAR StoreServ Storage system. Reboot the Target-XenServer host to complete persona migration. After the change, the Target-XenServer host and its virtual machines are restarted.

## Migrating using online method

The following steps must be applied for each XenServer host having its host persona migrated.

### Procedure

1. Launch XenCenter to manage the Target-XenServer host and Temporary-XenServer host(s).
2. Using Citrix XenMotion technology to migrate all virtual machines (VM) from the Target-XenServer host to a Temporary-XenServer host in the same resource pool. Verify all the VMs have been migrated successfully before continuing to the next step.
3. If high availability (HA) is enabled on the resource pool, follow the steps below to disable it.

- In XenCenter, select the pool in the **Resource** pane
  - Select the **HA** tab, and then click **Disable HA**.
4. On the Target-XenServer host, stop all host I/O.
  5. Edit the devices structure for HPE 3PAR array. After all of the edits are made, the relevant sections of `/etc/multipath.conf` devices section should appear as follows:

**With XenServer 7.x:**

---

```
# cat /etc/multipath.conf

defaults {
    polling_interval          10
    find_multipaths          yes
}
devices {
    device {
        vendor                "3PARdata"
        product               "VV"
        features               "0"
        path_selector          "round-robin 0"
        path_grouping_policy   "group_by_prio"
        hardware_handler       "1 alua"
        prio                   "alua"
        failback               "immediate"
        rr_weight               "uniform"
        no_path_retry          18
        rr_min_io              100
        path_checker           "tur"
        fast_io_fail_tmo       20
        dev_loss_tmo           "infinity"
    }
}
```

---

**With XenServer 6.5 or 6.2:**

---

```
# cat /etc/multipath.conf

defaults {
    polling_interval          10
    find_multipaths          yes
}
devices {
    device {
        vendor                "3PARdata"
        product               "VV"
        features               "0"
        path_selector          "round-robin 0"
        path_grouping_policy  "group_by_prio"
        hardware_handler      "1 alua"
        prio                   "alua"
        failback               "immediate"
        rr_weight              "uniform"
        no_path_retry          18
        rr_min_io              100
        path_checker           "tur"
    }
}
}
```

---

#### With XenServer 6.1 or 6.0:

---

```
# cat /etc/multipath.conf

defaults {
    polling_interval          10
}
devices {
    device {
        vendor                "3PARdata"
        product               "VV"
        features               "0"
        path_selector          "round-robin 0"
        path_grouping_policy  "group_by_prio"
        hardware_handler      "1 alua"
        prio_callout           "/sbin/mpath_prio_alua /dev/%n"
        failback               "immediate"
        rr_weight              "uniform"
        no_path_retry          18
        rr_min_io              100
        path_checker           "tur"
    }
}
}
```

---

6. If the Target-XenServer host is configured as boot from SAN, re-create initial ramdisk images.

**NOTE:** In the following `mkinitrd` command, the ``` character is a backtick and not a single quote.

---

#### With XenServer 7.x:

---

```
# mkinitrd -v -f /boot/initrd-`uname -r`.img `uname -r`
```

---

### With XenServer 6.1 or 6.0:

---

```
# mkinitrd -v -f --theme=/usr/share/splash /boot/initrd-`uname -r`.img `uname -r`
```

---

7. On the HPE 3PAR array, run the HPE 3PAR CLI `sethost` command to change the `host persona` to 2 for the Target-XenServer host:
- 

```
# sethost -persona 2 <xenserver-hostname>
```

---

Verify that the change was successful with the `showhost` command. The persona for the Target-XenServer host should now show as Generic-ALUA.

---

```
# showhost <xenserver-hostname>
```

---

8. Reboot the Target-XenServer host, and then run the `showhost` command to verify that the XenServer host is reconnected to the target ports.
- 

```
# showhost <xenserver-hostname>
```

---

9. From XenCenter, verify that the Target-XenServer host reconnected to the resource pool successfully and all SRs recover.
  10. Verify the target devices have been claimed properly and that the persona setting is correct using the `multipath` commands. `hwhandler` should now show as `1 alua`, and `prio` shows as 50.
- 

```
# multipath -ll
```

---

11. XenMotion all VMs back to the Target-XenServer host.
12. Repeat the above procedure for each XenServer host until all XenServer hosts in the resource pool are migrated to host Generic-ALUA Persona 2.
13. After all XenServer hosts have migrated to host Generic-ALUA Persona 2, re-enable HA if needed.

## Migrating using offline method

The following steps must be applied for each XenServer host having its host persona migrated.

### Procedure

1. Launch XenCenter to manage the Target-XenServer host. Shut down all the VMs on the host.
2. On the Target-XenServer host, stop all host I/O.

3. Edit the devices structure for HPE 3PAR array. After all of the edits are made, the relevant sections of `/etc/multipath.conf` devices section should appear as follows:

**With XenServer 7.x:**

---

```
# cat /etc/multipath.conf

defaults {
    polling_interval          10
    find_multipaths          yes
}
devices {
    device {
        vendor                "3PARdata"
        product               "VV"
        features               "0"
        path_selector          "round-robin 0"
        path_grouping_policy   "group_by_prio"
        hardware_handler       "1 alua"
        prio                   "alua"
        failback               "immediate"
        rr_weight               "uniform"
        no_path_retry          18
        rr_min_io               100
        path_checker            "tur"
        fast_io_fail_tmo       20
        dev_loss_tmo            "infinity"
    }
}
```

**With XenServer 6.5 or 6.2:**

---

```
# cat /etc/multipath.conf

defaults {
    polling_interval          10
    find_multipaths          yes
}
devices {
    device {
        vendor                "3PARdata"
        product               "VV"
        features               "0"
        path_selector          "round-robin 0"
        path_grouping_policy   "group_by_prio"
        hardware_handler       "1 alua"
        prio                   "alua"
        failback               "immediate"
        rr_weight               "uniform"
        no_path_retry          18
        rr_min_io               100
        path_checker            "tur"
    }
}
```

**With XenServer 6.1 or 6.0:**

---

```
# cat /etc/multipath.conf

defaults {
    polling_interval          10
}
devices {
    device {
        vendor                "3PARdata"
        product                "VV"
        features                "0"
        path_selector          "round-robin 0"
        path_grouping_policy   "group_by_prio"
        hardware_handler       "1 alua"
        prio_callout            "/sbin/mpath_prio_alua /dev/%n"
        failback                "immediate"
        rr_weight               "uniform"
        no_path_retry           18
        rr_min_io               100
        path_checker            "tur"
    }
}
}
```

4. If the Target-XenServer host is configured as boot from SAN, re-create initial ramdisk images.

**NOTE:** In the following `mkinitrd` command, the ``` character is a backtick and not a single quote.

**With XenServer 7.x:**

```
# mkinitrd -v -f /boot/initrd-`uname -r`.img `uname -r`
```

**With XenServer 6.x:**

```
# mkinitrd -v -f --theme=/usr/share/splash /boot/initrd-`uname -r`.img `uname -r`
```

5. On the HPE 3PAR array, run the HPE 3PAR CLI `sethost` command to change the `host persona` to 2 for the Target-XenServer host:

```
# sethost -persona 2 <xenserver-hostname>
```

Verify that the change was successful with the `showhost` command. The Persona for the Target-XenServer host should now show as `Generic-ALUA`.

```
# showhost <xenserver-hostname>
```

6. Reboot the Target-XenServer host, and then run the `showhost` command to verify that the XenServer host is reconnected to the target ports.

---

```
# showhost <xenserver-hostname>
```

---

7. From XenCenter, verify that the Target-XenServer host reconnected to the resource pool successfully and all SRs recover.
  8. Verify the target devices have been claimed properly and that the persona setting is correct using the multipath commands. `hwhandler` should now show as `1 alua`, and `prio` shows as `50`.
- 

```
# multipath -ll
```

---

9. Restart all the VMs.
10. Repeat the above procedure for each XenServer host until all XenServer hosts are migrated to host Generic-ALUA Persona 2.

# Websites

## General websites

Hewlett Packard Enterprise Information Library

[www.hpe.com/info/EIL](http://www.hpe.com/info/EIL)

Single Point of Connectivity Knowledge (SPOCK) Storage compatibility matrix

[www.hpe.com/storage/spock](http://www.hpe.com/storage/spock)

Storage white papers and analyst reports

[www.hpe.com/storage/whitepapers](http://www.hpe.com/storage/whitepapers)

For additional websites, see [Support and other resources](#).

# Support and other resources

## Accessing Hewlett Packard Enterprise Support

- For live assistance, go to the Contact Hewlett Packard Enterprise Worldwide website:  
<http://www.hpe.com/assistance>
- To access documentation and support services, go to the Hewlett Packard Enterprise Support Center website:  
<http://www.hpe.com/support/hpesc>

### Information to collect

- Technical support registration number (if applicable)
- Product name, model or version, and serial number
- Operating system name and version
- Firmware version
- Error messages
- Product-specific reports and logs
- Add-on products or components
- Third-party products or components

## Accessing updates

- Some software products provide a mechanism for accessing software updates through the product interface. Review your product documentation to identify the recommended software update method.
- To download product updates:  
**Hewlett Packard Enterprise Support Center**  
[www.hpe.com/support/hpesc](http://www.hpe.com/support/hpesc)  
**Hewlett Packard Enterprise Support Center: Software downloads**  
[www.hpe.com/support/downloads](http://www.hpe.com/support/downloads)  
**Software Depot**  
[www.hpe.com/support/softwaredepot](http://www.hpe.com/support/softwaredepot)
- To subscribe to eNewsletters and alerts:  
[www.hpe.com/support/e-updates](http://www.hpe.com/support/e-updates)
- To view and update your entitlements, and to link your contracts and warranties with your profile, go to the Hewlett Packard Enterprise Support Center **More Information on Access to Support Materials** page:  
[www.hpe.com/support/AccessToSupportMaterials](http://www.hpe.com/support/AccessToSupportMaterials)

---

**!** **IMPORTANT:** Access to some updates might require product entitlement when accessed through the Hewlett Packard Enterprise Support Center. You must have an HPE Passport set up with relevant entitlements.

---

## Customer self repair

Hewlett Packard Enterprise customer self repair (CSR) programs allow you to repair your product. If a CSR part needs to be replaced, it will be shipped directly to you so that you can install it at your convenience. Some parts do not qualify for CSR. Your Hewlett Packard Enterprise authorized service provider will determine whether a repair can be accomplished by CSR.

For more information about CSR, contact your local service provider or go to the CSR website:

<http://www.hpe.com/support/selfrepair>

## Remote support

Remote support is available with supported devices as part of your warranty or contractual support agreement. It provides intelligent event diagnosis, and automatic, secure submission of hardware event notifications to Hewlett Packard Enterprise, which will initiate a fast and accurate resolution based on your product's service level. Hewlett Packard Enterprise strongly recommends that you register your device for remote support.

If your product includes additional remote support details, use search to locate that information.

### Remote support and Proactive Care information

#### HPE Get Connected

[www.hpe.com/services/getconnected](http://www.hpe.com/services/getconnected)

#### HPE Proactive Care services

[www.hpe.com/services/proactivecare](http://www.hpe.com/services/proactivecare)

#### HPE Proactive Care service: Supported products list

[www.hpe.com/services/proactivecaresupportedproducts](http://www.hpe.com/services/proactivecaresupportedproducts)

#### HPE Proactive Care advanced service: Supported products list

[www.hpe.com/services/proactivecareadvancedsupportedproducts](http://www.hpe.com/services/proactivecareadvancedsupportedproducts)

#### Proactive Care customer information

##### Proactive Care central

[www.hpe.com/services/proactivecarecentral](http://www.hpe.com/services/proactivecarecentral)

##### Proactive Care service activation

[www.hpe.com/services/proactivecarecentralgetstarted](http://www.hpe.com/services/proactivecarecentralgetstarted)

## Warranty information

To view the warranty information for your product, see the links provided below:

#### HPE ProLiant and IA-32 Servers and Options

[www.hpe.com/support/ProLiantServers-Warranties](http://www.hpe.com/support/ProLiantServers-Warranties)

#### HPE Enterprise and Cloudline Servers

[www.hpe.com/support/EnterpriseServers-Warranties](http://www.hpe.com/support/EnterpriseServers-Warranties)

#### HPE Storage Products

[www.hpe.com/support/Storage-Warranties](http://www.hpe.com/support/Storage-Warranties)

#### HPE Networking Products

[www.hpe.com/support/Networking-Warranties](http://www.hpe.com/support/Networking-Warranties)

# Regulatory information

To view the regulatory information for your product, view the *Safety and Compliance Information for Server, Storage, Power, Networking, and Rack Products*, available at the Hewlett Packard Enterprise Support Center:

[www.hpe.com/support/Safety-Compliance-EnterpriseProducts](http://www.hpe.com/support/Safety-Compliance-EnterpriseProducts)

## Additional regulatory information

Hewlett Packard Enterprise is committed to providing our customers with information about the chemical substances in our products as needed to comply with legal requirements such as REACH (Regulation EC No 1907/2006 of the European Parliament and the Council). A chemical information report for this product can be found at:

[www.hpe.com/info/reach](http://www.hpe.com/info/reach)

For Hewlett Packard Enterprise product environmental and safety information and compliance data, including RoHS and REACH, see:

[www.hpe.com/info/ecodata](http://www.hpe.com/info/ecodata)

For Hewlett Packard Enterprise environmental information, including company programs, product recycling, and energy efficiency, see:

[www.hpe.com/info/environment](http://www.hpe.com/info/environment)

# Documentation feedback

Hewlett Packard Enterprise is committed to providing documentation that meets your needs. To help us improve the documentation, send any errors, suggestions, or comments to Documentation Feedback ([docsfeedback@hpe.com](mailto:docsfeedback@hpe.com)). When submitting your feedback, include the document title, part number, edition, and publication date located on the front cover of the document. For online help content, include the product name, product version, help edition, and publication date located on the legal notices page.