HP Emulex Fibre Channel Host Bus Adapter and Driver Installation Guide

Abstract

This document provides information about installing and configuring Emulex HBAs.

Acknowledgements

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Contents

1 Installing an HBA

This chapter describes the prerequisites and procedure for installing HBAs.

HBA models

Emulex manufactures several models of HBAs for HP. For an up-to-date list of supported models and interoperability information, see the SPOCK website at http://www.hp.com/storage/spock. You must sign up for an HP Passport to enable access.

Prerequisites

Before you begin:

- Obtain a copy of the latest release notes for your HP Emulex HBA at:

  http://h18006.www1.hp.com/storage/saninfrastructure/hba.html

- Be familiar with the operating system under which the HBA is to operate, and have access to standard system documentation.

- Review any restrictions or mandatory hot fixes that apply to your configuration and operating system.

- Obtain an optical multimode cable with an LC-style duplex connector.

- Back up your system data.

- Ensure that your server has an empty PCI bus slot that is based on and compatible with the PCI bus type of the HBA being installed.

  NOTE: The HBAs do not allow data transmission on an optical link unless they are connected to another similar or compatible laser product (that is, multimode to multimode).

Recording reference numbers

Each HBA ships with a unique address identifier that is stored in flash memory. Fibre Channel industry standards issue two unique identifiers: WWPN and WWNN, each of which is derived from the HBA IEEE address. Combined, the WWPN and WWNN create the WWN, which is an 8-byte identifier that uniquely identifies an HBA on an FC circuit.

In addition, each HBA has a unique serial number. The WWN address and serial number are clearly marked on the HBA. Record these numbers below for reference in the unlikely event that the NVRAM is corrupted.

NOTE: The WWN is a permanent identifier that cannot be changed.

WWN address: _____

HBA serial number: _____

Installing an HBA

△   **CAUTION:**   The HBA can be damaged by static electricity. Before handling, observe the ESD precautions as described in "Electrostatic discharge and grounding information" (page 25).

To install an HBA into a server:

1. Power off the server.

⚠ **WARNING!**   Disconnect the server from the power source before installing the HBA. To reduce the risk of personal injury from hot surfaces, allow the internal server or workstation components to cool before touching.

2. Remove the screws on the server cover, and then remove the cover.
3. Wearing an anti-static wrist strap, remove the blank panel from an empty PCI slot.

   NOTE: The HBA comes with a standard PCI bracket installed. A low-profile bracket is included in the box with the HBA. The low-profile mounting bracket is shorter than the standard bracket: approximately 7.90 cm (3.11 inches) compared to 12.06 cm (4.75 inches).

4. If you require a different mounting bracket, change the bracket as follows. Otherwise, proceed to Step 5.
   a. Remove the mounting bracket screws from the top of the HBA.
   b. Remove the bracket and store it for future use.
   c. Align the new mounting bracket tabs with the holes in the HBA.

   ⓘ **IMPORTANT:**   Be careful not to push the bracket past the transceiver housing grounding tabs. Ensure that the LEDs are aligned with the holes in the bracket.

   d. Replace the screws that attach the HBA to the bracket.
5. Insert the HBA into the empty PCI slot. Press firmly until the HBA is seated.

   NOTE: In some HP server models, only PCIe HBAs can be inserted in the optional PCIe riser cards or cages. For instructions on installing the riser card or cage, see your server documentation.

6. Using the panel clip, secure the HBA mounting bracket to the cover.
7. Replace the server cover and tighten the screws.
8. Attach the media:
   a. Connect one end of the fiber optic cable to the LC connector on the HBA.
   b. Connect the other end of the cable to the Fibre Channel device.

   NOTE: The HBA does not allow data transmission on an optical link unless the link is connected to a similar or compatible laser product (that is, multimode to multimode).

9. Verify the installation and apply power to the server:
   a. Verify that the HBA is securely installed in the server slot.
   b. Verify that the media is attached.
   c. Plug in and power on the server.
   d. Observe the LEDs for POST status results.

      For information about the LED indicator code, see "HBA LED POST states" (page 17).

2 HBAs with Windows servers

This chapter describes how to download, install, remove, and upgrade the Windows Smart Component and HBA driver and software.

Windows device driver

Downloading the Windows Smart Component

To download the Windows Smart Component:

1. Go to the HP website:

   http:/www.hp.com

2. Under **Support**, click **Download drivers**.
3. Enter your HBA in the **Find my product** search field, and click **Go**.
4. Select your HBA.
5. Select the operating system.
6. Under **Driver - Storage Fibre Channel**, download the driver smart component.

Installing the Windows device driver using the HP Smart Component

To install HBA Windows drivers:

1. Launch the Smart Component CP*xxxx*.exe.
2. Click **Install** to install the driver.
3. Follow the online instructions.
4. Click **Reboot** to complete the installation.

HBA management software

Newer versions of the HBA driver use Emulex OneCommand Manager software for HBA management in place of Emulex HBAnyware software.

Use the OneCommand Manager Smart Component Kit to install the HBA management software.

Downloading the OneCommand Manager Smart Component Kit

To download the OneCommand Manager Smart Component Kit:

1. Go to the HP website:

   http:/www.hp.com

2. Under **Support**, click **Download drivers**.
3. Enter your HBA in the **Find my product** search field, and click **Go**.
4. Select your HBA.
5. Select the operating system.
6. Under **Utility - FC HBA**, download the OneCommand Manager smart component.

Installing OneCommand Manager

To install OneCommand Manager:

1. Double-click the OneCommand Manager executable file.
2. Follow the on-screen instructions to install the driver.

   A reboot is not required for the OneCommand Manager installation to complete.

Starting OneCommand Manager

To launch OneCommand Manager, double-click the OneCommand Manager icon on your desktop or select **Start→OneCommand**.

Removing the device driver

Servers running Windows do not require the removal of the HBA driver prior to an update.

Removing OneCommand Manager

To remove OneCommand Manager:

1. From your server control panel select **Add/Remove software**.
2. Select the software that you want to remove, and then click **Remove**.
3. Follow the on-screen instructions.

Upgrading HBA drivers and software

To upgrade drivers and software, use the download and installation procedures in "Downloading the Windows Smart Component" (page 7) and "Installing the Windows device driver using the HP Smart Component" (page 7).

3 HBAs on Linux servers

This chapter describes how to download, install, configure, remove, and upgrade the Linux driver and HBA software on servers running current Linux versions.

ⓘ **IMPORTANT:** Servers running older Linux versions require additional installation instructions. For more information, see "Additional instructions for HBAs on servers running RHEL 5.2, RHEL 4.*x*, or earlier" (page 23).

Although HP supports the Linux in-box driver (the driver supplied with the OS distribution), not all hardware configurations support it. To determine if your configuration supports the in-box driver, see the *HP HBA Software Support Matrices* available on the HP SPOCK website at http://www.hp.com/storage/spock.

If you are using the in-box drivers, no installation is required. If you must install the out-of-box driver, use the instructions in this chapter. In either case, HP recommends that you install the HP Fibre Channel Enablement Kit because it provides additional features.

To install Linux on a BFS LUN with driver versions that are not supported by the initial OS release, the new driver must be integrated as part of the installation process using a DD-kit. See "Installing the operating system using a DD-kit" (page 11).

ⓘ **IMPORTANT:** If you have both CNAs and Fibre Channel HBAs installed in your system, you must load and use the CNA drivers.

Downloading the Linux driver kit

To download the driver kit:

1. Go to the HP website:

   http:/www.hp.com

2. Under **Support**, click **Download drivers**.
3. Enter your HBA in the **Find my product** search field, and click **Go**.
4. Select your HBA.
5. Select the operating system.
6. Under **Driver - Storage Fibre Channel**, download the driver.

Installing the Linux driver kit

- **.tar.gz file**

  To install the driver kit on servers running RHEL 5.3 or later, RHEL 6 or later, SLES 10 SP3 or later, or SLES 11 SP1 or later; follow the instructions described in the `readme.txt` document that is included in the driver kit.

- **.rpm file**

  To install the Linux lpfc rpm driver, execute the following commands:

  Example:

  1. `# rpm -Uvh kmod-elx-lpfc-10.2.340.0-1.rhel7u0.x86_64.rpm`
  2. `# reboot`

HP Fibre Channel Enablement Kit

The HP Fibre Channel Enablement Kit provides additional libraries and configuration utilities to enable HP Fibre Channel storage arrays to work with Linux. The Fibre Channel Enablement Kit is not required to use the `lpfc` kernel modules, but it does provide configuration scripts that ensure

that your configuration is set properly to work with HP Fibre Channel arrays. The Fibre Channel Enablement Kit also sets the correct `lpfc` kernel module settings that are used with Device Mapper Multipathing.

NOTE: If you are using any HP management applications, you need the `HBAAPI` libraries that come with the hp-fc-enablement RPM.

Downloading the enablement kit

To download the HP Fibre Channel Enablement Kit:

1. Go to the HP website:

   http:/www.hp.com

2. Under **Support**, click **Download drivers**.
3. Enter your HBA in the **Find my product** search field, and click **Go**.
4. Select your HBA.
5. Select the operating system.
6. Under **Software – Storage Controllers – FC HBA**, download the enablement kit.

Installing the enablement kit

- **.tar.gz file**

To install the HP Fibre Channel Enablement Kit (.tar.gz.file):

1. Untar the downloaded enablement kit by executing the command to create the `hp-fc-enablement-yyyy-mm-dd` directory.

   `# tar zxvf hp-fc-enablement-yyyy-mm-dd.tar.gz`

2. Browse to the directory `hp-fc-enablement-yyyy-mm-dd`.
3. Do one of the following to execute the `install.sh` script:

   - If you are not using Device Mapper Multipathing, execute the following command:

     `# ./install.sh -s`

   - If you are using Device Mapper Multipathing, execute the following command:

     `# ./install.sh -m`

- **.rpm file**

   To install the Linux enablement kit rpm, execute the following commands:

   Example:

   1. `# rpm -Uvh HP-CNA-FC-Emulex-Enablement-Kit-6.4.21.2-1.rhel6.x86_64.rpm`
   2. `# reboot`

Verifying the installation

To verify the installation, enter the following commands:

`# rpm -q hp-fc-enablement`

`# rpm -q fibreutils`

NOTE: The driver that comes with the kernel requires fibreutils 3.*x* or later.

Installing the operating system using a DD-kit

Downloading the DD-kit

To download the DD-kit:
1. Go to the HP website:

   http:/www.hp.com
2. Under **Support**, click **Download drivers**.
3. Enter your HBA in the **Find my product** search field, and click **Go**.
4. Select your HBA.
5. Select the operating system.
6. Under **Driver - Storage Controllers - FC HBA**, download the DD-kit.

Using the DD-kit

Use CD burner software to burn the DD-kit image (select the image burning option).

For information about using the DD-kit to install the operating system, see your operating system documentation.

HBA management software

Newer versions of the HBA driver use Emulex OneCommand Manager software for HBA management in place of Emulex HBAnyware software.

Downloading OneCommand Manager

To download OneCommand Manager:
1. Go to the HP website:

   http:/www.hp.com
2. Under **Support**, click **Download drivers**.
3. Enter your HBA in the **Find my product** search field, and click **Go**.
4. Select your HBA.
5. Select the operating system.
6. Under **Utility - FC HBA**, download the OneCommand Manager .tgz file.

Installing OneCommand Manager

To install OneCommand Manager on a Linux system:
1. Unzip the OneCommand file.
2. Use the `chmod +x` command to make the file executable under Linux.
3. Install the application using the resulting .bin file.
4. To launch the application, enter the following command:

   ```
   /usr/sbin/hbanyware/ocmanager
   ```

NOTE: For more information, see the OneCommand Manager online help.

Removing software on servers running Linux

△ **CAUTION:** For BFS configurations, removing the Fibre Channel driver prevents access to the boot LUN upon reboot. HP highly recommends that you back up `initrd` before rebuilding the `ramdisk`.

To remove Linux software from systems running RHEL 5.3 or later, RHEL 6 or later, SLES 10 SP3 or later, or SLES 11 SP1 or later; follow the instructions described in the readme.txt document that is included in the driver kit.

For older versions of RHEL, see "Additional instructions for HBAs on servers running RHEL 5.2, RHEL 4.x, or earlier" (page 23).

Removing the Fibre Channel Enablement Kit

To remove the Fibre Channel Enablement Kit:

1. Browse to the directory `hp-fc-enablement-yyyy-mm-dd`.
2. Execute the `install.sh` script with the `-u` flag:

    ```
    # ./install.sh -u
    ```

To manually remove the RPMs in the enablement kit, enter the following commands:

```
# rpm -e hp-fc-enablement
# rpm -e fibreutils
```

4 HBAs on VMware servers

VMware support

HP supports the use of Windows and Linux as a guest operating system on VMware ESX and ESXi hypervisior. When running VMware, Fibre Channel HBAs are supported by the in-box drivers supplied with ESX/ESXi hypervisior. Windows and Linux Fibre Channel HBA drivers are not used on the virtual operating system.

For an up-to-date list of supported models and software requirements, see the HP SPOCK website at http://www.hp.com/storage/spock. You must sign up for an HP Passport to enable access.

To ensure that your HBA is supported by HP and VMware, see the VMware Compatibility Guide website:

http://www.vmware.com/resources/compatibility/search.php

Installing the driver

Typically, you do not need to install the Emulex driver because it ships in-box with the ESX server. However, new products can require driver updates. To download the driver updates:

1. Go to the HP website:

    http:/www.hp.com

2. Under **Support**, click **Download drivers**.
3. Enter your HBA in the **Find my product** search field, and click **Go**.
4. Select your HBA.
5. Select the operating system.
6. Under **Driver - Storage Controllers - FC HBA**, download the driver.

For more information about installing the driver, see http://h18004.www1.hp.com/products/servers/software/vmware/esxi-image.html.

NOTE: VMware ESX and ESXi hypervisior are not supported on the IA64 architecture.

5 HBAs on Citrix XenServers

HP supports the use Citrix XenServers.

For an up-to-date list of supported models and software requirements, see the HP SPOCK website at http://www.hp.com/storage/spock. You must sign up for an HP Passport to enable access.

Installing the driver

Typically, you do not need to install the Emulex driver because it ships in-box. However, new products can require driver updates. For more information, and to download a DUD kit, see the Citrix website http://support.citrix.com.

Restrictions

Citrix XenServers are not supported on the IA64 architecture.

6 Utilities

Fibreutils

`Fibreutils` is a set of utility scripts for Linux that make certain operations, such as information gathering, easier. The following sections describe commands contained in the `Fibreutils` package.

adapter_info

The `adapter_info` command lists information about the Fibre Channel adapters.

Table 1 `adapter_info` **options**

–l	Lists all FC adapters in this system.
–L	Lists all LUNs for each adapter.
–t	Lists all targets seen by each adapter.
-m	Lists each adapter's model.
–v	Verbose.
–h	Prints the help menu.
–d	Prints LUN and verbose information for a specific device. The specific device should be a SCSI host number such as **0** or **6**.

lssd

The `lssd` command lists all bound `/dev/sd*` devices.

Table 2 `lssd` **options**

–c	Prints cached data instead of scanning.
–h	Prints help message.
–l	Prints inquiry page 0 x 83 UUID of devices.
–w	Prints WWNN of devices.

lssg

The `lssg` command lists all bound `/dev/sg*` devices.

Table 3 `lssg` **options**

–c	Prints cached data instead of scanning.
–h	Prints help message.
–l	Prints inquiry page 0 x 83 UUID of devices.
–w	Print WWNN of devices.

hp_rescan

The `hp_rescan` command rescans LUNs on HP supported Fibre Channel adapters.

Table 4 `hp_rescan` **options**

–a	Rescans all adapters.
–h	Prints help message
–i	Rescans a specific adapter instance. The specific device should be a SCSI host number such as 0 or 6.
–l	Lists all FC adapters.
–n	Do not perform **scsi remove-single-device** when executing probe-luns.

HBA management software

For Servers running Windows or Linux, you can use Emulex OneCommand Manager to configure, monitor, and manage your HBAs.

For more information about OneCommand Manager, see the online help or the *Emulex OneCommand Manager Application User Manual* available at the HP Converged Network Adapters Manuals website:

http://h20000.www2.hp.com/bizsupport/TechSupport/DocumentIndex.jsp?
contentType=SupportManual&lang=en&cc=us&docIndexId=64179&taskId=101&
prodTypeId=12169&prodSeriesId=4118472

7 Diagnostics

This chapter provides information that you can use to verify the operational state of the HBA.

HBA LED POST states

The tables in this section describe the HBA LED states.

Table 5 POST LED states for 16-Gb HBAs

Green LED	Yellow LED	State
Off	Off	Boot failure (dead board)
Off	On	POST failure (dead board)
Off	Slow blink	Boot failure after POST
Off	Fast blink	Not defined
Off	Flashing	POST processing in progress
On	Off	Failure in common code module
On	On	Failure in common code module
On	One fast blink	Normal (link up at 2 G FC) (legacy compatibility only)
On	Two fast blinks	Normal (link up at 4 G FC)
On	Three fast blinks	Normal (link up at 8 G FC)
On	Four fast blinks	Normal (Link up at 16 G FC)
On	Flashing	Not defined
Slow blink	Off	Normal—link down
Slow blink	On	Not defined
Slow blink	Slow blink	Not defined
Slow blink	Fast blink	Not defined
Slow blink	Flashing	Not defined
Fast blink	Off	Not defined
Fast blink	On	Not defined
Fast blink	Slow blink	Not defined
Fast blink	Fast blink	Beaconing
Fast blink	Flashing	Not defined

Table 6 POST LED states for 8- and 4-Gb HBAs and mezzanine cards

Yellow LED (1)	Green LED (2)	State
Off	Off	Wake-up failure
On	Off	POST failure
Slow blink (1 Hz)	Off	Wake-up failure
Fast blink (4 Hz)	Off	Failure in POST
Flashing (irregular)	Off	POST processing in progress
Off	On	Failure while functioning

Table 6 POST LED states for 8- and 4-Gb HBAs and mezzanine cards *(continued)*

Yellow LED (1)	Green LED (2)	State
On	On	Failure while functioning
1 fast blink	On	1 Gb link rate; normal; link up
2 fast blinks	On	2 Gb link rate; normal; link up
3 fast blinks	On	4 Gb link rate; normal; link up
4 fast blinks	On	8 Gb link rate; normal; link up
Off	Slow blink	Normal; link down or not started
Slow blink	Slow blink	Offline for download
Fast blink	Slow blink	Restricted offline mode (waiting for restart)
Flashing	Slow blink	Restricted offline mode (test active)

If the LEDs indicate a failure during POST:

1. Ensure that the HBA is seated firmly in the PCI slot.
2. Verify that the cable connection to the HBA is secure.
3. See Table 6 (page 17) to determine the HBA status.
4. If a problem occurs, view the event log troubleshoot and resolve the issue. The following sections describe the location of the event logs.

Using the Windows Event Viewer

The STORport miniport drivers verify the condition of the HBAs. If there is a failure or a suspected failure, an error log entry appears in the Windows Event Log. Use the Event Viewer to access the Event log.

To open the Event Viewer:

1. Select **Start**→**Programs**→**Administrative Tools**→**Event Viewer**, or right-click **My Computer**, and then select **Manage**.
2. Under Computer Management, click **Event Viewer**.

   The Event Viewer window appears.

Linux or Citrix driver events

If the HBA driver detects any fabric or driver events, the information about these events appears in the `var/log/messages` file on the Linux server or Citrix XenServer. Examine this file periodically to review any driver events.

VMware driver events

If the VMware HBA driver detects any fabric or driver events, the information about these events appears in the `var/log/vmkernel` file on the ESX/ESXi hypervisor server. Examine this file periodically to review any VMware driver events.

8 Support and other resources

Contacting HP

HP technical support

For worldwide technical support information, see the HP support website:

http://www.hp.com/support

Before contacting HP, collect the following information:

- Product model names and numbers
- Technical support registration number (if applicable)
- Product serial numbers
- Error messages
- Operating system type and revision level
- Detailed questions

Subscription service

HP recommends that you register your product at the Subscriber's Choice for Business website:

http://www.hp.com/go/wwalerts

After registering, you will receive email notification of product enhancements, new driver versions, firmware updates, and other product resources.

Documentation feedback

HP welcomes your feedback.

To make comments and suggestions about product documentation, please send a message to **storagedocsfeedback@hp.com**. All submissions become the property of HP.

Related information

The following documents and websites provide related information:

- *HP Emulex Adapters Release Notes*
- White papers and best practice documents

Table 7 Related documentation websites

Topic	HP website
HBAs and switches	http://h18006.www1.hp.com/storage/saninfrastructure.html
HBAs	http://www.hp.com/support/FibreChannelHBAs
Storage array systems	• http://h18006.www1.hp.com/storage/arraysystems.html • http://www.hp.com/support/FibreChannelHBAs
Server blades	• http://h18004.www1.hp.com/products/blades/components/c-class-components.html • http://h18004.www1.hp.com/products/blades/components/c-class-bladeservers.html
HP SAN Design Reference Guide	http://hp.com/go/sdgmanuals
Additional documentation	http://www.hp.com http://www.hp.com/go/hpsc
Product information	http://www.hp.com/support

Typographic conventions

Table 8 Document conventions

Convention	Uses
Blue text: Table 8 (page 22)	Cross-reference links
Blue, underlined text: http://www.hp.com	Website addresses
Blue, bold, underlined text: **storagedocsfeedback@hp.com**	Email addresses
Bold text	- Keys that are pressed - Text typed into a GUI element, such as a box - GUI elements that are clicked or selected, such as menu and list items, buttons, tabs, and check boxes
Italic text	Text emphasis
`Monospace` text	- File and directory names - System output - Code - Commands, their arguments, and argument values
`Monospace, italic` text	- Code variables - Command variables
`Monospace, bold` text	Emphasized monospace text
. . .	Indication that the example continues.

⚠ **WARNING!** Indicates that failure to follow directions could result in bodily harm or death.

⚠ **CAUTION:** Indicates that failure to follow directions could result in damage to equipment or data.

ⓘ **IMPORTANT:** Provides clarifying information or specific instructions.

NOTE: Provides additional information.

A Additional instructions for HBAs on servers running RHEL 5.2, RHEL 4.x, or earlier

Before installing the driver kit, verify that the **gcc compiler** and the **kernel sources**, or the **kernel development package** is installed on the system.

There are three modes in which to install the driver kit:

- Default mode
- Single-path mode
- Failover (multi-path) mode

Default mode

If you do not specify a mode and an Emulex driver is already loaded in memory, the script uses the currently loaded configuration. Otherwise, the driver defaults to failover (multi-path) mode.

Single-path mode

When the driver is operating in single-path mode, all paths to the LUNs appear as separate device files.

For example: `/dev/sdX`

Failover mode

Failover mode provides multi-path redundancy.

Installing the Linux driver kit

1. Uncompress and untar the downloaded driver kit using the following command:

   `# tar zxvf hp_lpfc-`*yyyy-mm-dd*`.tar.gz`

2. Browse to the `hp_lpfc-`*yyyy-mm-dd* directory.
3. Execute the `INSTALL` command.

   The `INSTALL` command syntax varies depending on your configuration. If a previous driver kit is installed, you can invoke the `INSTALL` command without any arguments and the script will use the currently loaded configuration:

   `# ./INSTALL`

   To force the installation to failover (multi-path) mode, use the `-m` flag:

   `# ./INSTALL -m`

   To force the installation to single-path mode, use the `-s` flag:

   `# ./INSTALL -s`

   Use the `-h` option of the `INSTALL` script for a list of all supported arguments. The `INSTALL` script installs the appropriate driver RPM for your configuration, as well as the appropriate fibreutils RPM.

4. When the `INSTALL` script completes, you must enter the `# reboot` command to reboot your server.

Removing the HBA Emulex driver, MultiPulse, and HBAnyware

To remove the drivers and software that were installed with the Linux driver kit:

1. From the directory where the HP Emulex driver kit is located on your hard disk, enter the following command:

   `# cd `*KIT_NAME date*

> **TIP:** Copy `/opt/hp/hp-lpfc/make_initrd` to `/var/tmp` for future use.

2. Enter the following command to remove `lpfc`, `lpfcmpl`, and `hbanyware`:

   `# ./INSTALL -u`

3. Remake the `initrd` file.

> **TIP:** Use `/var/tmp/make_initrd`

4. Reboot the server.

Manually removing RPMs

You can manually remove the individual kit contents by entering the following commands:

`# rpm -e fibreutils`

`# rpm -e hp-lpfc`

`# rpm -e hp-multipulse`

> **NOTE:** To revert to the base HBA driver, only remove the `hp-multipulse` RPM, and make the `initrd` using `/opt/hp/hp-lpfc/make_initrd`.

Path management

After installing HP Emulex MultiPathing software, all I/Os to the LUNs are statically load balanced using optimized paths. One of the optimized paths is the primary path and all I/Os to the LUN are routed through this path. All other available paths are secondary paths. In the event of a primary path failure, one of the secondary paths is used. If you are using HBAnyware, a secondary path can be assigned as primary path for better SAN/fabric load balancing.

To modify the primary I/O path:

1. Start HBAnyware.
2. On the left pane of the window, select an HBA .
3. Expand the HBA.
4. Expand the Storage.
5. Select the LUN.
6. On the right pane of the window, select the **MultiPulse Configuration** tab.
7. On the Route Path List, select a secondary path.

> **NOTE:** The secondary path becomes the new primary path, and remains the primary path through the reboot process.

8. Click **Make Primary Static**.

B Electrostatic discharge and grounding information

Electrostatic discharge

To prevent damage to the system, be aware of the precautions you need to follow when setting up the system or handling parts. A discharge of static electricity from a finger or other conductor may damage system boards or other static-sensitive devices. This type of damage may reduce the life expectancy of the device.

To prevent electrostatic damage, observe the following precautions:

- Avoid hand contact by transporting and storing products in static-safe containers.
- Keep electrostatic-sensitive parts in their containers until they arrive at static-free workstations.
- Place parts on a grounded surface before removing them from their containers.
- Avoid touching pins, leads, or circuitry.
- Be sure to be grounded when touching a static-sensitive component or assembly. See "Grounding methods" (page 25).

Grounding methods

There are several methods for grounding. Use one or more of the following methods when handling or installing electrostatic-sensitive parts:

- Use a wrist strap connected by a ground cord to a grounded workstation or computer chassis. Wrist straps are flexible straps with a minimum of 1 megohm (±10 percent) resistance in the ground cords. To provide proper ground, wear the strap snug against the skin.
- Use heel straps, toe straps, or boot straps at standing workstations. Wear the straps on both feet when standing on conductive floors or dissipating floor mats.
- Use conductive field service tools.
- Use a portable field service kit with a folding static-dissipating work mat.

If you do not have any of the suggested equipment for proper grounding, have an HP-authorized reseller install the part.

NOTE: For more information on static electricity, or assistance with product installation, contact your HP-authorized reseller.

C HBA specifications

Environmental specifications

Table 9 Environmental specifications

Environment	Range
Operating temperature	0°C/32°F to 55°C/131°F
Storage temperature	−20°C/−40°F to 70°C/158°F
Relative humidity (non-condensing)	5% to 95%
Airflow	100 lf/minute (minimum)

Physical specifications

Table 10 Physical specifications

Parameter	Range
Media interface	The controller interfaces to the physical media through an FC-0 Media Interface (FC-PI compliant transceiver), and then connects through a single or dual optical fiber LC connector.
Physical dimension	Low-profile MD2 form factor, 6.600 inches by 2.536 inches. Accommodates both the full-height and low-profile bracket.

Table 10 Physical specifications *(continued)*

Parameter	Range
Power requirements	PCIe slot • In a PCI/PCIe, Mode 1, 66 MHz: 　◦ 1.5 W (typical at 3.3 V dc) 　◦ 3.7 W (typical at 5.0 V dc) 　◦ 5.6 W total • In a PCI/PCIe, Mode 2, 100/133 MHz: 　◦ 1.5 W (typical at 3.3 V dc) 　◦ 4.1 W (typical at 5.0 V dc) 　◦ 6.0 W total • In a PCI/PCIe, Mode 2, 133 MHz: 　◦ 1.5 W (typical at 3.3 V dc) 　◦ 4.3 W (typical at 5.0 V dc) 　◦ 6.0 W total
Agency approvals	• Class 1 Laser Product per DHHS 21CFR (J) & EN60825-1 • UL recognized to UL60950-1:2003 • CUR recognized to CSA 22.2, No. 60950-1-03 • Baurt-certified by TUV to 60950-1 • FCC Rules, Part 15, Class A • Industry Canada, ICES-003, Class A • EMC Directives 89/336/EEC and 2004/108/EC (CE Mark) • EN55022, Class A • EN55024 • Australian EMC Framework (C-Tick Mark) • AS/NZS CISPR22:2002 Class A • Japan VCCI, Class A • Taiwan BSMI, Class A • Korea MIC, Class A

HBA media specifications

Use multimode fiber optic cable with short-wave lasers, that adheres to the specifications listed in Table 11 (page 28).

Table 11 Media specifications

Fiber Optic cable	Maximum length	Minimum length	Connector
16-Gb HBAs			
62.5/125 µm (multimode) 200 MHz/km bandwidth	15 meters at 14.0250 Gb/s		
50/125 µm (multimode) 500 MHz/km bandwidth	35 meters at 14.0250 Gb /s		
4- and 8-Gb HBAs and mezzanine cards			
62.5/125 µm (multimode) 200 MHz/km bandwidth	300 meters at 1.0625 Gb/s 150 meters at 2.125 Gb/s 70 meters at 4.25 Gb/s 21 meters at 8.5 Gb/s	0.5 meters	LC
50/125 µm (multimode) 500 MHz/km bandwidth cable	500 meters at 1.0625 Gb/s 300 meters at 2.125 Gb/s 150 meters at 4.25 Gb/s 50 meters at 8.5 Gb/s	0.5 meters	LC

D Regulatory information

For safety, environmental, and regulatory information, see *Safety and Compliance Information for Server, Storage, Power, Networking, and Rack Products*, available on the HP Support Center website at http://www.hp.com/support/Safety-Compliance-EnterpriseProducts.

Belarus Kazakhstan Russia marking

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Manufacturer and Local Representative Information

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Turkey RoHS material content declaration

Türkiye Cumhuriyeti: EEE Yönetmeliğine Uygundur

Ukraine RoHS material content declaration

Обладнання відповідає вимогам Технічного регламенту щодо обмеження використання деяких небезпечних речовин в електричному та електронному обладнанні, затвердженого постановою Кабінету Міністрів України від 3 грудня 2008 № 1057

Warranty information

HP Storage Products

http://www.hp.com/support/Storage-Warranties

Glossary

B

BFS   Boot from SAN.

D

DMA   Direct memory access.

E

ESD   Electrostatic discharge.

F

FC   Fibre Channel. A comprehensive set of standards for concurrent communication among servers, storage systems, and peripheral devices.

H

HBA   Host bus adapter. A hardware device that connects the host server to the fabric.

I

ISA/EISA   Industry Standard Architecture/Extended Industry Standard Architecture.

L

LC   Lucent connector. An industry-standard connector for fiber optic cable connections.
LUN   Logical unit number. An identification scheme for storage disks.

N

NVRAM   Nonvolatile RAM.

P

PCIe   PCI Express.
POST   Power-on self-test.

S

SAN   Storage area network. An intelligent infrastructure that connects heterogeneous servers and shared, heterogeneous storage systems.
SFP   A 2 Gb or 4 Gb small form-factor pluggable transceiver.

W

WWN   Worldwide name. A unique identifier assigned to a Fibre Channel device, created by combining the WWPN and the WWNN.
WWNN   Worldwide node name. A unique identifier assigned to a Fibre Channel device, derived from the device IEEE address.
WWPN   Worldwide port name. A unique identifier assigned to a Fibre Channel device, derived from the device IEEE address.

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