

**Sun Storage 16 Gb Fibre Channel
ExpressModule Host Bus Adapter,
Emulex Installation Guide For HBA Model
7101690**



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Using This Documentation

- **Overview** – Describes how to install and remove the Sun Storage 16 Gb Fibre Channel ExpressModule Host Bus Adapter, Emulex
- **Audience** – Technicians, system administrators, and authorized service providers
- **Required knowledge** – Advanced experience troubleshooting and replacing hardware

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◆ ◆ ◆ 1 CHAPTER 1

HBA Overview

This chapter provides a basic overview of the Sun Storage 16 Gb FC ExpressModule HBA, which uses Emulex (now Broadcom) technology. This chapter also describes the various operating systems, host platforms, storage, and infrastructure configurations that support the HBA.

This chapter contains the following sections:

- [“Kit Contents” on page 9](#)
- [“HBA Features and Specifications” on page 9](#)
- [“Operating System and Technology Requirements” on page 11](#)
- [“Boot Support” on page 12](#)
- [“System Interoperability” on page 12](#)
- [“Environmental Requirements” on page 15](#)

Kit Contents

- Standard option of the Sun Storage 16 Gb Fibre Channel (FC) ExpressModule HBA, Emulex
- *Accessing Documentation* document
- China RoHS Material Disclosure document

HBA Features and Specifications

The Sun Storage 16 Gb FC ExpressModule HBA, Emulex (marketing part number 7101690) is a standalone PCI Express ExpressModule host bus adapter (HBA).

The board interfaces an eight-lane PCI Express bus, with eight lanes supporting two Fibre Channel (FC) ports. Each independent FC port operates at 16 Gb/sec and features 16/8/4 autonegotiation.

See [Table 1, “HBA Features and Specification,” on page 10](#) for a list of the HBA features.

TABLE 1 HBA Features and Specification

Feature	Description
PCI connector	x8
PCI signaling environment	PCI Express x8 (8 active lanes)
PCI transfer rate (maximum)	PCI Express Generation Three (8 GT/s) x8
PCIe specification compliance	PCI Express Card Version 3.0 Specification
PCIe hot-plug and hot-swap functionality	Supported
Number of ports	Two
Number of devices supported	126 devices per FC loop (not supported at 16 Gb); 510 devices in Fabric mode
FCoE full offload in hardware	Meets requirement
FC bus type (external)	Fiber-optic media, short-wave laser, multi-mode fiber (400 - M5-SN-S)
FC transfer rate	16 Gb/s
FC topologies	Switched fabric (N_Port), arbitrated loop (NL_Port) [FC-AL support for 4 G/8 G only]; and point-to-point (N_Port)
Receive Side Scaling	Supported
MSI-X	Supported
Solaris Dynamic Reconfiguration	Supported
Diagnostic Support	Provided by Oracle VTS software
Boot support	For all supported operating systems. For more information about boot support for the HBA, see Table 3, “HBA Boot Support,” on page 12 .
RAM	1.5 MB, parity protected, per port
BIOS ROM	One 32-MB flash ROM, field-programmable
NVRAM	One 32-KB EEPROM
External connectors	<ul style="list-style-type: none"> ■ SFP+ direct attach copper (DAC) twinaxial (twin-ax) cables from the supported switch manufacturers listed in “Switch Support” on page 15.
Small form-factor pluggable (SFP+)	Supporting options with short range, short-wave, and twin-ax cabling
Maximum FC cable length	At 16 Gb/s, up to 125 meters using 50/125 mm core OM4 fiber. Longer lengths are possible at slower data rates.
LED indicators	Two LEDs per channel (yellow and green) on the front panel as status indicators
	Power LED, Service RequiredLED, and a button on the front panel to support hot-swap functionality
Maximum power consumption	13.3 watts

Feature	Description
Form Factor	PCI Express ExpressModule, single-wide (198 mm x 112 mm x 21 mm)

Operating System and Technology Requirements

The HBA requires the OS and technology levels listed in [Table 2, “Supported Operating System/Technology Versions,” on page 11](#), at minimum.

Note - If you need to contact Oracle Support, first verify that you have a supported OS installed on the host system, and install the latest HBA driver, utility, and firmware versions. Updating the system and HBA to the latest OS, driver, utility, and firmware versions might address the issue, preventing the need to contact Oracle Support about an issue that has already been fixed.

TABLE 2 Supported Operating System/Technology Versions

Operating System/ Technology	Supported Versions (minimum)
Oracle Solaris OS	<ul style="list-style-type: none"> ■ Oracle Solaris 10 1/13 for the x86 (64-bit) platform (+ patches 149168-07 and 149176-11) ■ Oracle Solaris 10 1/13 for the SPARC platform (+ patches 149167-07 and 149175-11) ■ Oracle Solaris 11.1 for the x86 (64-bit) platform (+ SRU 13.4) ■ Oracle Solaris 11.1 for the SPARC platform (+ SRU 13.4) ■ Oracle Solaris 11.2 for the x86 (64-bit) and SPARC platforms ■ Oracle Solaris 11.3 for the x86 (64-bit) and SPARC platforms
Oracle Linux OS	<ul style="list-style-type: none"> ■ Oracle Enterprise Linux 5.9 (Unbreakable Enterprise Kernel (UEK) 2.6.39-400, at minimum) ■ Oracle Enterprise Linux 6.4 (UEK 2.6.39-400, at minimum)
SUSE Linux OS	<ul style="list-style-type: none"> ■ SUSE Linux Enterprise Server (SLES) 10 SP4 ■ SLES 11 SP2
Red Hat Linux OS	<ul style="list-style-type: none"> ■ Red Hat Enterprise Linux (RHEL) 5.9 (64-bit) ■ RHEL 6.4 (64-bit)
Microsoft Windows OS	<ul style="list-style-type: none"> ■ Windows Server 2008 SP2+ (64-bit) ■ Windows Server 2008 R2 including SP1 (64-bit) ■ Windows Server 2012
VMware technology	<ul style="list-style-type: none"> ■ VMware ESX/ESXi 5.1 ■ VMware ESX/ESXi 5.0

Boot Support

FC SAN and FCoE SAN booting through the HBA is supported, as listed in [Table 3, “HBA Boot Support,” on page 12.](#)

TABLE 3 HBA Boot Support

Operating System/Technology	FC SAN Boot Support
Oracle Solaris 10 1/13	Yes
Oracle Solaris 11.1, 11.2, and 11.3	Yes
Oracle Linux 5.9	No
Oracle Linux 6.4	Yes
RHEL 5.9	Yes [†]
RHEL 6.4	Yes [†]
SLES 10 U4	Yes [†]
SLES 11 U2	Yes [†]
Windows Server 2008 SP2+	Yes [†]
Windows Server 2008 R2	Yes [†]
Windows Server 2012	Yes [†]

[†]While using the Driver Update disk during the installation process. Driver Update is available at the Oracle support area of the Emulex web site: <https://www.broadcom.com/support/download-search/?pg=Storage+Adapters,+Controllers,+and+ICs&pf=Fibre+Channel+Host+Bus+Adapters&pn=&po=Oracle&pa=&dk=>

System Interoperability

This section provides information about selected platforms and storage that are compatible with the heterogeneous FC network design of the HBA. This section contains the following topics:

- [“Host Platform Support” on page 12](#)
- [“Storage Support” on page 13](#)
- [“Switch Support” on page 15](#)

Host Platform Support

The HBA is supported by the platforms listed in the table in this section. For up-to-date information, see your system Product Notes and web pages.

For information about supported OS/technology versions, see [Table 2, “Supported Operating System/Technology Versions,”](#) on page 11.

TABLE 4 Host Platform Support

Platform	Supported OS/Technology
Oracle's SPARC Servers	
Fujitsu M10-1, M10-4, and M10-4S	Oracle Solaris
Fujitsu M10 PCI Expansion Unit	Oracle Solaris
SPARC T4-1 and T4-2	Oracle Solaris
SPARC T5-2, T5-4, and T5-8	Oracle Solaris
SPARC T7-1, T7-2, and T7-4	Oracle Solaris
SPARC M5-32 and M6-32	Oracle Solaris
SPARC M7-8 and M7-16	Oracle Solaris
SPARC 7-2 and 7-2L	Oracle Solaris
Oracle SuperCluster M6-32	Oracle Solaris
Oracle's x86 Servers	
Sun Server X4-2, X4-2L, X4-4, and X4-8	Oracle Solaris, Windows, Linux, VMware
Oracle Server X5-2, X5-2L, X5-4, and X5-8	Oracle Solaris, Windows, Linux, VMware
Oracle Server X6-2 and X6-2L	Oracle Solaris, Windows, Linux, VMware
Oracle Exalytics In-Memory Machine X4-4 and X5-4	Oracle Solaris, Windows, Linux, VMware
Zero Data Loss Recovery Appliance X4, X5, and X6	Oracle Solaris, Windows, Linux, VMware
Oracle's Telco Servers	
Netra SPARC T4-1	Oracle Solaris
Netra SPARC S7-2	Oracle Solaris
Netra X4270 M3	Oracle Solaris, Windows, Linux, VMware
Netra Server X3-2 and X5-2	Oracle Solaris, Windows, Linux, VMware

Storage Support

This section lists the supported arrays and tape storage that can connect to the HBA through a supported switch (see [“Switch Support”](#) on page 15). This section contains the following topics:

- [“Array Support”](#) on page 14
- [“Storage System Support”](#) on page 14
- [“Tape Storage Support”](#) on page 14
- [“Unified Storage”](#) on page 15

Array Support

The HBA supports connecting, through a supported switch, to the following arrays:

- Oracle's Sun Storage 2540 M2
- Oracle's Sun Storage 6140
- Oracle's Sun Storage 6180
- Oracle's Sun Storage 6190
- Oracle's Sun Storage 6540
- Oracle's Sun Storage 6590
- Oracle's StorageTek 6580/6780 with 8 Gb/s FC Host Interface cards

Storage System Support

The HBA supports connecting, through a supported switch, to the following storage systems:

- Oracle's Pillar Axiom 600 storage system
- Oracle's StorageTek 9980/9985/9985V storage system
- Oracle's StorageTek 9990/9990V storage system

Tape Storage Support

The HBA supports connecting, through a supported switch, to the following tape storage:

- Oracle's StorageTek SL24 Tape Autoloader
- Oracle's StorageTek SL48 Tape Library
- Oracle's StorageTek SL500 Modular Library
- Oracle's StorageTek L1400 Tape Library
- Oracle's StorageTek SL3000 Modular Library
- Oracle's StorageTek SL8500 Modular Library
- Oracle's StorageTek Virtual Tape Library: VTL Value and VTL Value Plus
- Oracle's StorageTek T10000B/ T10000C
- Oracle's StorageTek 9840C tape drive
- Oracle's StorageTek 9940B tape drive
- Oracle's StorageTek 9840D tape drive

- IBM LTO4
- IBM LTO5

Unified Storage

The HBA supports connecting, through a supported switch, to the following unified storage:

- Oracle's Sun Storage 7110, 7210, 7310, 7410 System (Target mode only)
- Oracle's Sun ZFS Storage 7120, 7320, 7420, 7720 System

Switch Support

Note - For technical support issues with any switches, refer to the product documentation or contact the switch manufacturer.

The HBA supports connecting to any 16 Gb/s Fibre Channel (FC) switch from any vendor that follows standard FC specifications, and follows 10GbE NIC/FCoE specifications, with the following considerations:

- Direct Access Storage for FC is supported with COMSTAR.
- FC-AL is not supported at 16 Gb/s or faster.

Note - This documentation lists switches that are specifically *not* supported by the HBA, when applicable.

Note - The HBA has been verified to function with Cisco 5xxx switches; however, Oracle Services does not support customers with questions or issues about these switches. Direct all inquiries about the use of Cisco 5xxx switches to Cisco Systems.

Environmental Requirements

The HBA environmental requirements are listed in [Table 5, “HBA Environmental Requirements,”](#) on page 16.

TABLE 5 HBA Environmental Requirements

Specification	Operating	Non-Operating
Temperature	0° to 55°C, non-condensing	-20°C to 85°C, non-condensing
Relative Humidity (RH)	10% to 90% RH, non-condensing, 22°C max wet bulb	5% to 95% RH, non-condensing, 22°C max wet bulb
Altitude	3200 m	12,200 m
Vibration	0.25 g in all axes, 5-500 Hz sine	1.2 g in all axes, 5-500 Hz sine
Shock	5.5 g 11 ms half-sine	33 g 11 ms half-sine

HBA Installation, Configuration, and Removal

This chapter describes the tasks required to install, configure, and remove the HBA. For detailed instructions, refer to your system installation or service manual.

This chapter contains the following sections:

- [“Observing ESD and Handling Precautions” on page 17](#)
- [“Best Practices For HBA Installation” on page 18](#)
- [“Installing the Hardware” on page 21](#)
- [“Connecting the Copper Cables” on page 23](#)
- [“Powering on the System” on page 24](#)
- [“Testing the Installation” on page 26](#)
- [“Configuring the HBA for Hot-Plug Operation” on page 28](#)
- [“Removing the Hardware” on page 28](#)

Observing ESD and Handling Precautions



Caution - Damage to the HBA can occur as the result of improper handling or electrostatic discharge (ESD). Always handle the HBA with care to avoid damage to electrostatically sensitive components.

To minimize the possibility of ESD-related damage, use both a workstation antistatic mat and an ESD wrist strap. You can get an ESD wrist strap from any reputable electronics store or from Oracle as part number 250-1007. Observe the following precautions to avoid ESD-related problems:

- Leave the HBA in its antistatic bag until you are ready to install it in the system.
- Always use a properly fitted and grounded wrist strap or other suitable ESD protection when handling the HBA, and observe proper ESD grounding techniques.
- Hold the HBA by the carrier, not by the connectors.

- Place the HBA on a properly grounded antistatic work surface pad when it is out of its protective antistatic bag.

Best Practices For HBA Installation

Before installing the HBA into the system, review the best practices in this section to avoid potential issues:

- [“General Best Practices” on page 18](#)
- [“Best Practices For Switches and Zoning” on page 19](#)
- [“Best Practices For Booting From SAN \(BFS\) Configurations” on page 19](#)
- [“Best Practices For Testing the Environment” on page 20](#)

General Best Practices

Follow these general best practices for installing and configuring the HBA:

- Spread the I/O load amongst multiple HBAs and multiple ports to avoid bottlenecks and promote higher availability.
- Use fixed link speeds instead of auto-negotiation wherever possible. While the HBA supports auto-negotiation, auto-negotiation slows things down in the event of a fabric rebuild.
- Do not configure both tape devices and disks on the same HBA port, even if using a switch and zoning.
- If more than one of a given HBA model is present in the configuration, enable only the OpROM for the first HBA seen in the boot sequence. There is a limited amount of space for OpROMs, so do *not* unnecessarily enable all OpROMs, as space usage issues might occur.
- When installing the HBA, be sure to also install the latest version (version 11.1.218.x or newer) of the command-line utility available from the manufacturer's website (See [“To Upgrade Firmware Using the OneCommand Manager CLI” on page 35](#)). Keep the HBA utilities, firmware, and drivers up-to-date, and update them in that order.
- After installing the OneCommand Manager CLI utility, ensure that the `elxhbmgrd` daemon process is running (The OneCommand Manager utility starts this daemon process, by default, upon installation.). In the event of a failure, the `elxhbmgrd` daemon produces a usable firmware dump for troubleshooting. The location of dump files varies, based on your operating system:
 - Windows: `OneCommandManager-installation-directory\Util\Dump`
 - Oracle Solaris: `/opt/ELXocm/Dump`

- Linux: `/var/log/emulex/ocmanager/Dump`

Firmware dumps are written to Flash memory on the HBA, and the files reside there until you manually extract and clear the files to produce room for new firmware dumps. A firmware dump cannot be overwritten in Flash. With the OneCommand Manager utility installed and running, if a failure occurs on the HBA, the utility captures and collects firmware dumps during boot up, and then automatically clears the Flash memory on the HBA. However, if the failure case does *not* capture the dump file, or the OneCommand Manager utility is *not* running, you can manually run the OneCommand Manager utility in order to collect and capture the dump file.

Best Practices For Switches and Zoning

Follow these best practices for switches and zoning in your environment:

- FC-SW configurations: check with the switch manufacturer for optimal configuration recommendations, including zoning.
- Note that FC-AL is not supported at 16Gb/s or faster. Use FC-P2P instead.
- Use single initiator hard zoning to do the following:
 - Avoid Registered State Change Notification (RSCN) storms.
 - Shield devices from indiscriminate SCSI inquiries.
 - Provide security by avoiding inappropriate access.
- Use meaningful names for zones, and document the entire configuration.
- Use only FCP-2 (also called FC-TAPE or FCP Error Recovery) with tape and/or sequential devices. While FCP-2 might not cause problems for hard disk drives (HDDs), FCP-2 is a sequence-level error recovery mechanism that is irrelevant to HDDs.
- If using FC tape backups, place tape ports and backup servers on the same FC switch to avoid tying up inter-switch links (ISLs).
- SAN switches can be a major source of disruption if you do not take extreme care with respect to configuration. Do not perform updates to switch OSes and/or firmware, or enable new features on SAN switches, until you have first tried the updated switches in a test configuration. The HBA might not support newer switch features, and switch OS and/or firmware updates might require changes to, and/or restoration of, switch configuration settings.

Best Practices For Booting From SAN (BFS) Configurations

If you plan to install a Boot From SAN (BFS) HBA, follow these best practices:

- Some devices and operating systems do not yet support UEFI-based BIOS and can boot only from the Legacy BIOS boot mode. However, many servers with UEFI firmware allow you to enable a legacy BIOS compatibility mode.
- Legacy BIOS issues - many tweaks and patches have been added over the years to resolve various issues, and not all were done with the larger ecosystem (many different types of servers, HBAs, OSes, and so on) in mind.
- Secure Boot (a UEFI-specific feature) can help you control the boot process, preventing unauthorized code from running.
- Larger devices (>2TB) require the use of a GUID Partition Table (GPT) instead of a Master Boot Record (MBR). GPT is the standard for EFI; it can be implemented in legacy BIOSes, but it is more difficult to set up. So, while you might be able to boot from a >2TB device in the legacy BIOS, it might not be seamless. If you are dual-booting with an OS that is already installed in one mode or the other, however, it is good practice to boot in the same boot mode as the one that is already in use.
- Disable OpROM and BIOS for all HBA cards except the one connected to the boot device.
- When installing a Boot From SAN (BFS) HBA, configure a single connection to a single SAN target/LUN, install the boot OS, and get that working before installing other HBAs and storage. If the configuration is complex, finding the root cause for any BFS issues becomes far more complicated.
- Once BFS is installed and working, make sure the HBA driver and firmware are at the latest revision levels. If required, configure a multipath connection, and perhaps one or more alternate boot LUNs.

Best Practices For Testing the Environment

Test the storage environment by doing the following:

- Boot the OS on the host server, and then disable the primary path to the SAN boot device to validate the multipath connection.
- Physically pull the cable from the system.
- Intentionally disrupt zoning at the FC switch that you plan to attach to the HBA.
- If you have installed any alternate boot LUNs, try to boot from those (after disrupting the primary connection(s)).
- Make sure the boot LUN is set as the first boot device in the system BIOS/UEFI settings.

Installing the Hardware

The hardware installation process involves the following general steps, in the order listed in this section:

- [“To Prepare for HBA Installation” on page 21](#)
- [“To Install the HBA” on page 22](#)
- [“Connecting the Copper Cables” on page 23](#)
- [“Powering on the System” on page 24](#)
- [“To Verify Proper Installation \(Oracle Solaris\)” on page 26](#)

▼ To Prepare for HBA Installation

1. **Record the IEEE address, World Wide Name (WWN), and serial number of the HBA.**

Each HBA is shipped with several numbers clearly marked on the board. These numbers indicate the following:

- IEEE Address
- World Wide Name (WWN)
- Serial number

The IEEE address is a unique 64-bit identifier that you use when configuring your system. The FC industry uses the World Wide Name (WWN) derived from the IEEE address for FC connectivity. If the adapter has two ports, there are two IEEE addresses and two WWNs. Use the serial number when communicating with Oracle Service.

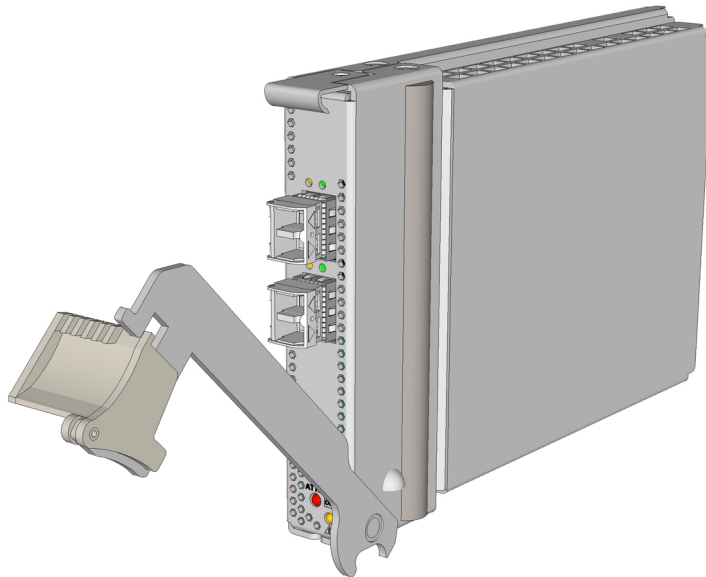
2. **Attach an antistatic strap to your wrist.**
Refer to [“Observing ESD and Handling Precautions” on page 17](#).
3. **Refer to your system installation or service manual to determine an appropriate ExpressModule slot in which to install the HBA.**
4. **Remove power from the system if hot plugging is not supported on the system.**

To see if your system supports hot plugging/hot swapping of PCIe adapter cards, refer to your system documentation.

▼ To Install the HBA

After you have performed the steps in [“To Prepare for HBA Installation” on page 21](#), you can install the adapter in your system.

1. **Attach an antistatic strap to your wrist.**
Refer to [“Observing ESD and Handling Precautions” on page 17](#).
2. **Refer to your system installation or service manual to determine an appropriate ExpressModule slot in which to install the HBA.**
3. **Press down on the plastic tab to release the ExpressModule latch and pull the lever out until it is nearly perpendicular to the ExpressModule front panel.**



4. **Insert the HBA into its slot, being careful that the tooth on the bottom of the lever does not come into contact with the chassis sheet metal during insertion.**
5. **After the HBA is inserted nearly all the way into its slot, push the lever back into its fully closed position, allowing the lever tooth to insert the HBA fully into place.**

Connecting the Copper Cables

You can connect copper cables to the HBA. This section contains the following topic:

- [“To Connect the Copper Cables” on page 23](#)

Note - The HBA will not automatically downgrade to the required FC speed based on cable length, if both links are capable of a higher operating speed. You must downgrade the speed with the appropriate utility or link errors might occur.

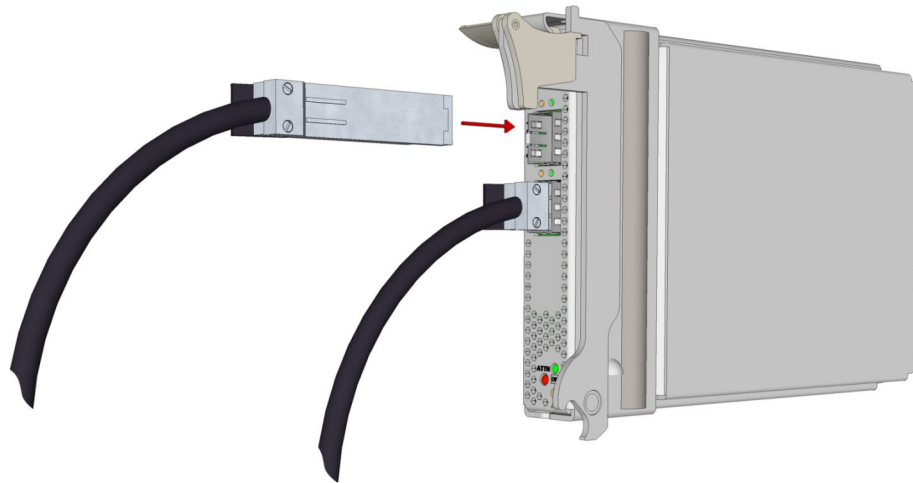
▼ To Connect the Copper Cables

Use any SFP+ direct attach twin-ax copper cables to attach devices to the HBA.

1. **Insert one end of the copper cables into empty SFP+ cages on the HBA.**

Ensure that the cables are fully inserted and secured.

The following figure shows how to connect the HBA with a copper cable.



2. **After the copper cables are connected to the HBA, insert the other end of the cables into the empty SFP+ cages on any FC supported switches.**

Note - Link Aggregation Control Protocol (LACP) cannot be used on the same port as iSCSI.

Powering on the System

This section provides basic instructions on how to apply power to the system. For detailed instructions, see your system documentation.

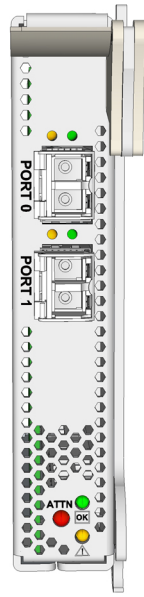
▼ To Apply Power to the System

1. **Verify that the HBA is securely installed in the system.**
For more information, see [“Installing the Hardware” on page 21](#).
2. **Verify that the correct cables are attached to the HBA and to the FC devices.**
For more information, see [“Connecting the Copper Cables” on page 23](#).
3. **Power on the system, as described in the system documentation.**
4. **Observe the light-emitting diode (LED) status for the power-on self test (POST) results as shown in [“Viewing LEDs” on page 24](#).**

Each port has a corresponding set of LEDs that provide a visual indication of the operating state. [Figure 1, “LEDs and Attention \(ATTN\) Button,” on page 25](#) summarizes the LED indicator combinations. Refer to [Figure 1, “LEDs and Attention \(ATTN\) Button,” on page 25](#) to determine the location of the LEDs.

Viewing LEDs

Through the openings in the mounting bracket of the HBA, you can view green and yellow LEDs, for each port, and you can view the Service Required and OK/Power LEDs. The green LED near each port indicates firmware operation, and the yellow LED near each port indicates port activity or link speed. Each port has a corresponding set of green and yellow LEDs, as shown in [Figure 1, “LEDs and Attention \(ATTN\) Button,” on page 25](#). At the bottom of the HBA mounting bracket, you'll see the OK/Power and Service Required LEDs plus an Attention (ATTN) button.

FIGURE 1 LEDs and Attention (ATTN) Button

Each port has a corresponding set of LEDs that provide a visual indication of the operating state.

Table 6, “LED Indicator Combinations,” on page 25 summarizes the LED indicator combinations, and their meanings. Refer to Figure 1, “LEDs and Attention (ATTN) Button,” on page 25 to determine the location of the LEDs.

TABLE 6 LED Indicator Combinations

Green LED	Yellow LED	Status
Off	Off	No power or normal link down
Off	On	POST failure or invalid SFP configuration
Off	On	Normal (Link up with no activity on the link)
Blink	On	Normal (Link up with activity on the link)

Note - In order to tell the difference between a POST failure and a link up condition with no activity, you must remove the SFP+ transceiver or copper cable. If the LED pattern persists, it is a POST failure condition. If the yellow LED was indicating a link up with no activity condition, it will turn off, which indicates a normal link down.

Table 7, “OK/Power LED States,” on page 26 lists the OK/Power LED states.

TABLE 7 OK/Power LED States

LED State	Meaning	Removal Status
Off	No power to the HBA	Removal is permitted, or the HBA must be configured
Flashing	Hot-plug in process	Removal is not permitted
Solid green	HBA is properly configured	Removal is not permitted

POST Results

Power-on self test (POST) is the default mode of self-test for the Sun Storage 16 Gb FC ExpressModule HBA. No jumpers or connectors are necessary for this test to run. These tests perform a quick confidence level check of the HBA before running the operational software.

At a minimum, the following tests are performed by POST:

- Flash boot image checksum test
- Internal ASIC RAM tests for proper ECC and parity operation
- NL Port loopback test

Testing the Installation

This section contains the following topics:

- [“To Verify Proper Installation \(Oracle Solaris\)” on page 26](#)
- [“To Configure the HBA \(Oracle Solaris\)” on page 27](#)
- [“To Verify Attached Storage \(Oracle Solaris\)” on page 27](#)

▼ To Verify Proper Installation (Oracle Solaris)

- Use the `cfgadm` command to verify proper HBA installation.

If the HBA is properly installed and connected, you will see output similar to the following:

```
cfgadm
```

Ap_Id	Type	Receptacle	Occupant	Condition
c3	fc	connected	configured	ok
c4	fc	connected	configured	ok
pcie5	fibre/hp	connected	configured	ok

▼ To Configure the HBA (Oracle Solaris)

- If the HBA is shown as unconfigured or disconnected, use the `cfgadm -c` command to configure the HBA.

▼ To Verify Attached Storage (Oracle Solaris)

- Use the `cfgadm -al` command to verify attached storage.

If the HBA is properly installed and storage is connected properly, you will see output similar to the following example. In this example, one port of a HBA is connected through a fabric switch to two ports of a disk array.

```
cfgadm -al
```

Ap_Id	Type	Receptacle	Occupant	Condition
c3	fc-fabric	connected	configured	unknown
c3::200600a0b816005e	disk	connected	configured	unknown
c3::200700a0b816005e	disk	connected	configured	unknown
c4	fc	connected	unconfigured	unknown
pcie5	fibre/hp	connected	configured	ok

If the HBA is shown as unconfigured or disconnected, see [“To Configure the HBA \(Oracle Solaris\)” on page 27](#).

Configuring the HBA for Hot-Plug Operation

Follow the procedure in this section to configure the HBA for hot-plug operation.

▼ To Configure the HBA for Hot-Plug Operation

1. **Locate the green OK/Power LED indicator near the bottom of the HBA front panel, as shown in [Figure 1, “LEDs and Attention \(ATTN\) Button,” on page 25](#).**
The OK/Power LED indicator status is shown in [Table 7, “OK/Power LED States,” on page 26](#).
2. **If the green OK/Power indicator is not illuminated, briefly press the Attention (ATTN) button near the bottom of the HBA front panel.**
The green OK/Power LED will blink for approximately five seconds and then remain on, indicating that the HBA is properly configured.
3. **To cancel the operation, press the Attention (ATTN) button again before it stops blinking.**

Removing the Hardware

The following procedure describes how to remove the HBA, if you need to do so for any reason. For detailed removal instructions, refer to your system documentation.

The hardware removal process involves these general steps:

1. If you plan to perform a hot-plug removal, and Emulex OneCommandManager is in use in your environment, stop the OneCommandManager process prior to attempting the hot-plug removal by issuing the `stop_ocmanager` command, located in this installation directory:
 - **Oracle Solaris** - `/opt/ELXocm`
 - **Linux** - `/usr/sbin/ocmanager`If you do not stop the OneCommandManager process first, the hot-plug removal might fail, or a system panic might occur.
2. Either halt the operating system and remove power from the system, or prepare the HBA for hot-plug removal with one of the following:

- The HBA Attention (ATTN) button, as described in [“To Prepare the HBA for Removal Using the Attention \(ATTN\) Button” on page 29](#)
 - The Oracle Solaris OS, as described in [“To Prepare the HBA for Hot-Plug Removal \(Oracle Solaris\)” on page 29](#)
 - The Windows Server OS, using the Safely Remove Hardware menu
3. Remove the HBA from the system.

▼ To Prepare the HBA for Removal Using the Attention (ATTN) Button

1. **Attach an antistatic strap to your wrist.**

For more information, refer to [“Observing ESD and Handling Precautions” on page 17](#).

2. **Press and release the Attention (ATTN) button near the bottom of the HBA front panel (see [Figure 1, “LEDs and Attention \(ATTN\) Button,” on page 25](#)).**

The green OK/Power LED near the button will blink for approximately five seconds, indicating that the HBA is being prepared for removal.

If you want to cancel the operation, press the Attention (ATTN) button again before the LED stops blinking.

3. **After the OK/Power LED goes dark, remove the HBA, as described in [“To Remove the HBA Hardware” on page 30](#).**

▼ To Prepare the HBA for Hot-Plug Removal (Oracle Solaris)

If you want to remove the HBA without first halting the operating system and removing power from the associated system, prepare the HBA for removal as follows:

1. **Use the `cfgadm` command to identify the HBA to be removed.**

`cfgadm`

Ap_Id	Type	Receptacle	Occupant	Condition
pcie5	fibre/hp	connected	configured	ok
pcie6	fibre/hp	connected	configured	ok

2. **Use the `cfgadm -c unconfigure` command to unconfigure the attachment point ID (Ap_Id) for the HBA.**
3. **Use the `cfgadm -c disconnect` command to prepare the HBA for removal.**

A flashing OK/Power LED indicates that the HBA is being prepared for removal. A dark OK/Power LED indicates that the HBA is ready to be removed, as described in [“To Remove the HBA Hardware” on page 30](#).

▼ To Remove the HBA Hardware

1. **Disconnect all cables.**
2. **Press the HBA latch to disengage the HBA, and then pull forward and down to eject it.**

You can now remove the HBA.

Software Installation

After you have completed the HBA hardware installation and powered on the system, follow the instructions in this chapter to install any HBA utilities, firmware, and operating system-specific drivers, in that order, that might be required by the HBA.

Note - Software listed in this chapter as being located at the Oracle designated web site will only be available at the web site if required by the HBA.

This chapter contains the following topics:

- [“Utilities for Upgrading the BIOS and Firmware ” on page 31](#)
- [“Installing Diagnostic Software” on page 36](#)
- [“Installing Drivers” on page 39](#)

Utilities for Upgrading the BIOS and Firmware

Use the OneCommand Manager command-line interface (CLI) or the OneCommand Manager graphical user interface (GUI) to update the BIOS and firmware for the HBA. These utilities provide support for the following functions:

- Discover local and remote hosts, HBAs, targets, and LUNs.
- Reset HBAs.
- Set HBA driver parameters.
- Update firmware.
- Enable or disable the system BIOS.
- Run diagnostic tests on HBAs.
- Manage out-of-band HBAs.
- Manage local and in-band remote HBAs.

For more information about the HBAnyware and OneCommandManager utilities, download their user manuals from the Emulex (Broadcom) support site for Oracle at: <https://www.broadcom.com/support/oem/oracle-fc/>.

▼ To Install Utilities for Updating the BIOS or Firmware:

1. **Go to the Emulex (now Broadcom) support site for Oracle at:**
<https://www.broadcom.com/support/oem/oracle-fc/>
2. **Click the type of HBA, and then click the model number of the HBA for which you want to install utility software.**
3. **In the Utilities section, click the utility for the OS that you want, and download the utility to a local file system.**
4. **Install the utility as described in the Emulex documentation, located on the Emulex (Broadcom) web site.**

Upgrading Firmware

This section provides basic instructions on how to update HBA firmware using the OneCommand Manager graphical user interface (GUI) and command-line interface (CLI). For detailed information, see the Emulex OneCommand Manager application documentation, located at the Oracle support area of the Emulex web site: <https://www.broadcom.com/support/download-search/?pg=Storage+Adapters,+Controllers,+and+ICs&pf=Fibre+Channel+Host+Bus+Adapters&pn=&po=Oracle&pa=&dk=>

If the HBA is in the CNA operating protocol mode and is installed in a system running the Oracle Linux UEK or Oracle VM operating systems, you must use the `elxf` toolkit to update firmware. This toolkit and instructions are available at the Oracle support area of the Emulex web site: <https://www.broadcom.com/support/oem/oracle-fc/>

If the HBA is in a configuration that allows multiple virtual functions, note that firmware can only be upgraded in the primary function domain. Any attempt to do so in a virtual function domain might cause the system to hang.

This section contains the following topics:

- [“To Upgrade Firmware Using the OneCommand Manager GUI” on page 33](#)
- [“To Upgrade Firmware Using the OneCommand Manager CLI” on page 35](#)

▼ To Upgrade Firmware Using the OneCommand Manager GUI

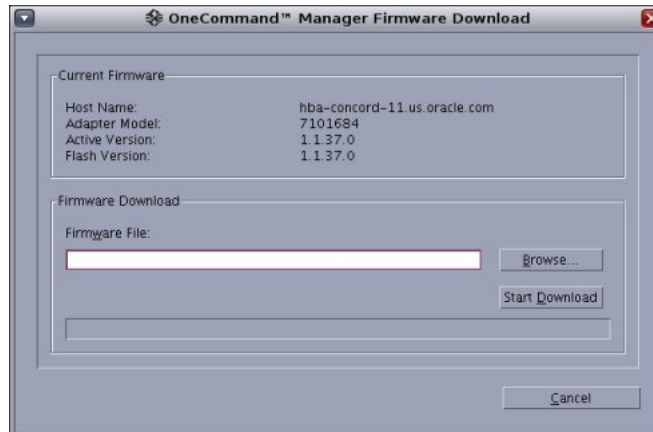
From the Maintenance or Firmware tab of the OneCommand Manager GUI, you can update firmware on local and remote HBAs.

Before You Begin Before performing this procedure, ensure the following is true:

- The HBA driver is installed, as described earlier in this chapter.
- The OneCommand Manager application is installed and the application is NOT running in read-only mode.
- The HBA firmware zip file is downloaded from the Oracle support area of the Emulex web site, unzipped, and extracted to a folder on a local drive.
- If the HBA is already connected to a boot device, the system is in a state in which this type of maintenance can be performed:
 - I/O activity on the bus is stopped.
 - Cluster software, or any other software that relies on the HBA to be available, is stopped or paused.

1. **From the OneCommand Manager GUI, select Host or Fabric view.**
2. **In the discovery-tree, select the HBA for which you want to upgrade firmware.**
3. **Select the Maintenance or Firmware tab and click Download Firmware.**
4. **If the warning screen appears, click Yes.**

The Firmware Download dialog box is displayed.



5. **From the Firmware Download dialog box, navigate to the unzipped, extracted firmware file you want to use for the upgrade.**

You can navigate to the firmware image by clicking Browse or by typing the path to the file in the Firmware File field in the dialog box.

6. **After you have found the file and it is populated in the Firmware File field, click Start Download.**

A warning dialog box is displayed.

7. **On the warning dialog box, click Yes.**

A status bar shows the progress of the download, and the HBA in the discovery tree is displayed in black text when the update is complete.

Note - If the HBA is offline, the HBA is displayed in red text in the discovery tree.

8. **Click Close.**

The Firmware tab displays the upgraded firmware information for the selected HBA.

Note - If the state of the boot code on the board has changed, this change is reflected immediately on the Port Information tab.

▼ To Upgrade Firmware Using the OneCommand Manager CLI

This section describes how to update firmware using the OneCommand Manager noninteractive and interactive command-line interface (CLI). Before performing this procedure, ensure the prerequisites are met, as described in [“To Upgrade Firmware Using the OneCommand Manager GUI” on page 33](#).

- **Do one of the following:**

- **From the noninteractive OneCommand Manager CLI, type the following command:**

```
hbacmd Download <the-WWPN-of-the-HBA> <full-path-and-name-of-firmware-file>
```

- **From the interactive OneCommand Manager CLI (for the Oracle Solaris OS), follow these steps:**

- a. **Navigate to the directory containing the `emlxadm` file (path: `/opt/EMLXemlxu/bin`), and run the `emlxadm` utility.**

For example:

```
root@<host-name>:/opt/EMLXemlxu/bin# ./emlxadm
```

The available HBAs are listed.

- b. **Select the HBA you want to upgrade (you need to do this only once per device).**

```
EMLXADM Device Management Utility, Version: 1.08.4.0
Copyright (c) 2004-2012 Emulex. All rights reserved.
```

Available Emulex HBA's:

1. SFS:emlxs0 : /devices/pci@78,0/pci8086,3c04@2/pci10df,e20e@0/fp@0,0
(CONNECTED)
2. SFS:emlxs1 : /devices/pci@78,0/pci8086,3c04@2/pci10df,e20e@0, 1/fp@0,0
(CONNECTED)
3. SFS: emlxs10 : /devices/pci@78,0/pci8086,3c0a@3,2/pci10df,e20e@0/fp@0,0
(CONNECTED)

Enter an HBA number or zero to exit: 1

- c. **Upgrade the firmware on the selected HBA by issuing the following command:**

```
emlxadm> download_fw <full-path-and-name-of-firmware-file>
```

- d. **At the prompt, type `y` to confirm you want to upgrade the firmware.**

A message is displayed upon completion of the upgrade.

```
Download may take several minutes. Do not interrupt.  
Downloading...  
Done.
```

- e. **Type `q` to quit, or type `hba` to select a different HBA to update.**
- f. **After you have updated all HBAs, type `q` to quit the `emlxadm` utility, and perform a full power reboot of the system.**

Installing Diagnostic Software

This section contains the following topics:

- “Diagnostic Support for the Oracle Solaris OS” on page 36
- “Diagnostic Support for All Other Supported Operating Systems” on page 37
- “Using the OneCommand Manager CLI for Troubleshooting a Fatal Error” on page 38

Diagnostic Support for the Oracle Solaris OS

In an Oracle Solaris OS environment, diagnostic support for the HBA is included in the Oracle VTS software. Oracle VTS software is available for download at: <https://support.oracle.com/>

For information about the Oracle VTS software, see the Oracle VTS documentation at: <http://docs.oracle.com/cd/E19719-01/index.html>

For information about diagnostic options using the OneCommand Manager utilities, see “Diagnostic Support for All Other Supported Operating Systems” on page 37.

The `emlxtest` utility in Oracle VTS supports the following functions:

- Connectivity verification
- Firmware version and checksum test

- Self-test
- Loopback tests
 - External (all HBAs (FC mode only) present in the system)
 - Internal, single-bit
 - Internal, 10-bit
 - Mailbox

Diagnostic Support for All Other Supported Operating Systems

Diagnostic support for the HBA with all supported operating systems other than the Oracle Solaris OS is available through version 11.1.218.x, or newer, of the OneCommand Manager application graphical user interface (GUI) or the OneCommand Manager application command-line interface (CLI) application. These applications support the following functions:

- Discover local and remote hosts, HBAs, targets, and LUNs.
- Reset HBAs.
- Set HBA driver parameters.
- Update firmware.
- Enable or disable the system BIOS.
- Run diagnostic tests on HBAs.
- Manage out-of-band HBAs.
- Manage local and in-band remote HBAs.

For detailed information about performing any of these functions through the OneCommand Manager applications, see the Emulex OneCommand Manager application documentation, located at the Oracle support area of the Emulex web site: <https://www.broadcom.com/support/download-search/?pg=Storage+Adapters,+Controllers,+and+ICs&pf=Fibre+Channel+Host+Bus+Adapters&pn=&po=Oracle&pa=&dk=>

▼ To Install Diagnostic Support Utilities for a Supported OS Other Than the Oracle Solaris OS:

1. **Go to the Emulex (now Broadcom) support site for Oracle at:**
<https://www.broadcom.com/support/oem/oracle-fc/>
2. **Click the type of HBA, and then click the model number of the HBA for which you want to install diagnostic software.**

3. In the **Utilities** section, click the **diagnostic support utility for the OS that you want**, and download the diagnostic utility to a local file system.
4. Install the diagnostic utility as described in the **Emulex documentation**, located on the **Emulex (Broadcom) web site**.

Using the OneCommand Manager CLI for Troubleshooting a Fatal Error

In the event of a failure, the OneCommand Manager application command-line interface (CLI) produces a usable firmware (FW) dump that you can send to Emulex (now Broadcom) for troubleshooting. The default location of the firmware dump varies by operating system:

- Windows – /Util/Dump subdirectory of the OneCommand Manager installation directory
- Oracle Solaris – /opt/ELXocm/Dump
- Linux – /var/log/emulex/ocmanager/Dump

About Automatic Firmware Dumps

This section lists the requirements for producing automatic firmware dumps, and provides general information about the OneCommand Manager CLI firmware dumps.

Requirements:

- OneCommand Manager application command-line interface, version 11.1.218.x, or newer
- `elxhbmgrd` process must be running in the background (The ECD installer or system boot starts the process, by default.)

General Information:

- Firmware dumps are written to Flash memory on HBA.
- Firmware dumps reside in the dump directory until you manually extract and clear the firmware dumps.
- A firmware dump cannot be overwritten in Flash.
- You must extract and clear firmware dumps from the HBA Flash in order to make room for new firmware dump files.

Dump Collection if the OneCommand Manager application command-line interface (CLI) is Installed:

- During boot up, the OneCommand Manager CLI clears the flash region upon successful dump capture.
- If the failure occurs on the HBA, and the OneCommand Manager CLI is already installed, the OneCommand Manager CLI captures collect firmware dumps and automatically clears the flash region.
- If the failure case did not capture the dump file, or if the OneCommand Manager CLI is not running, you can manually run the OneCommand Manager CLI to collect the dump file.

Installing Drivers

This section contains the following topics:

- [“Installing Drivers for the Oracle Solaris OS” on page 39](#)
- [“Installing Drivers for All Other Supported Operating Systems” on page 39](#)

Installing Drivers for the Oracle Solaris OS

Before using the HBA, update the HBA driver software for the Oracle Solaris OS with the following SRU version or patches, at minimum:

- Oracle Solaris 11.1 OS for the SPARC and x86 platforms - SRU13.4
- Oracle Solaris 10 1/13 OS for the SPARC platform - Patches 149167-07 and 149175-11
- Oracle Solaris 10 1/13 OS for the x86 platform - Patches 149168-07 and 149176-11

The latest available SRU versions and patches are located at: <http://support.oracle.com/>

Before downloading any SRUs, install the utilities and then the firmware, in that order, for the HBA. You can then download and install the latest SRUs from this web site: <https://support.oracle.com>.

▼ Installing Drivers for All Other Supported Operating Systems

If drivers for specific operating systems are required by the HBA, the drivers will be available for download at the Emulex (now Broadcom) support site for Oracle. Before installing any drivers, install the utilities and then the firmware, in that order, for the HBA. For more

information about installing utilities and firmware, see “[To Install Utilities for Updating the BIOS or Firmware:](#)” on page 32.

1. **After installing the utilities and the latest firmware for the HBA, go to the Emulex (now Broadcom) support site for Oracle at:**
<https://www.broadcom.com/support/oem/oracle-fc/>
2. **Click the type of HBA, and then click the model number of the HBA for which you want to install a driver.**
3. **In the Driver section, click the OS driver that you want, and download the driver files to a local file system.**
4. **Install the driver for OS, as described in the Emulex documentation, located on the Emulex web site.**

Known Issues

This chapter provides supplementary and workaround information about the HBA. Specific bug identification numbers are provided for service personnel.

This chapter contains the following topics:

- [“System Hangs When Performing a Hot Plug Operation ” on page 41](#)
- [“Link Aggregation Control Protocol \(LACP\) Cannot Be Used In Certain Conditions” on page 43](#)
- [“SAN Boot Fails Via Direct Attached Storage on Oracle SPARC Systems” on page 44](#)

System Hangs When Performing a Hot Plug Operation

Bug 15811563

Conditions:

- System Platform: All supported systems using the Oracle Unbreakable Linux operating system
- Operating Protocol Mode of HBA: FC, CNA
- Environment: HBA connected directly to supported storage

Issue:

If you are attempting a hot plug operation, and the HBA is installed in a system that is running the Oracle Unbreakable Linux OS, you might encounter a system hang. This is due to the method in which you are performing the hot plug operation.

Workaround:

Perform hot plug procedures for the Linux OS as follows:

1. At a terminal window, issue the `modprobe fakephp` command to load the hot plug driver on your system.

After you load the hot plug driver on your system, you will see slots listed in the `/sys/bus/pci/slots` directory.

2. Review the available Emulex PCI device IDs by issuing the `lspci` command.
This command lists the devices that are available for hot plugging.

```
# lspci |grep -i Emulex
08:00.0 Fibre Channel: Emulex Corporation Lancer-X: LightPulse Fibre Channel Host
Adapter (rev 10)
08:00.1 Fibre Channel: Emulex Corporation Lancer-X: LightPulse Fibre Channel Host
Adapter (rev 10)
```

3. Use the `cd` command to navigate to the directory where slots are listed, and issue the `ls` command to review the available PCI devices.

```
# cd /sys/bus/pci/slots
# ls
```

4. From the slots that are displayed, map the listed slots to the device IDs that were listed in Step 2.
5. Verify the power status of the slots by issuing the `cat slot-device-ID/power` command for each available slot.

```
# cat 0000\:08\:00.0/power
# 1
# cat 0000\:08\:00.1/power
# 1
```

In this example, the output of 1 indicates the slots are powered up.

6. Issue the `echo 0 > slot-device-ID /power` command to power down the slot that you want to use for hot plugging.
7. Verify that you have powered down the slot by issuing the `ls` command.

```
# ls
0000:08:00.1
```

In this example, you can see the first slot is powered down, because only the second slot is listed.

8. Perform the hot plug operation by inserting the card into the slot that you powered down.
9. Issue the `cd` command to navigate to the directory of the powered down slot, and then issue the `echo 1 > slot-device-ID /power` command to power up the slot.

```
# echo 1 > 0000\:08\:00.0/power
```

10. To verify that the slot is powered up, issue the `ls` command.

```
# ls
0000:08:00.0
0000:08:00.1
```

The hot plug procedure is completed without a system hang.

As an alternative, you can also use the Attention button to perform hot plug/hot unplug operations as follows:

- To perform a hot unplug operation – Press the Attention button on the HBA and wait. The OK LED will blink for 5 seconds, and then remain off.
- To perform a hot plug operation – Press the Attention button on the HBA and wait. The OK LED will blink for 5 seconds, and then remain on.

In the event you would like to cancel an Attention button hot plug/hot unplug operation, press the Attention button again, after pressing the button to initiate the operation.

Link Aggregation Control Protocol (LACP) Cannot Be Used In Certain Conditions

Bug 18707752

Conditions:

- System Platform: All supported systems using the Oracle Solaris driver
- Operating Protocol Mode of HBA: FC, CNA
- Environment: HBA connected directly to supported storage

Issue:

LACP cannot be used on the same port as FCoE or iSCSI.

Workaround:

None.

SAN Boot Fails Via Direct Attached Storage on Oracle SPARC Systems

Bug 15809064

Conditions:

- System Platform: Oracle SPARC systems
- Operating Protocol Mode of HBA: FC
- Environment: HBA connected directly to supported storage
- Boot Method: SAN boot via the HBA

Issue:

When the HBA is in Fibre Channel (FC) mode in an Oracle SPARC Enterprise T4-1 or T4-2 system, and a direct connection is made with a fiber-optic cable from the HBA to a storage device, the system might not detect any bootable volume on that storage device. When you attempt to boot using the storage device, an error message is displayed.

ERROR: boot-read fail

Workaround:

Do not boot from a bootable volume on a storage device if that storage device is directly connected to the HBA. Instead, if you want to boot using the storage attached to the HBA, use a SAN topology that includes one or more FC switches connected in the path between the HBA and the target storage device.

You can use a direct connection to storage as long as the system is booting the Oracle Solaris operating system from a boot device that is not connected directly to the HBA.