



**Hewlett Packard**  
Enterprise

## **HPE Boot from SAN Configuration Guide**

### **Abstract**

This document provides information about implementing the high-availability features of Boot from SAN in ProLiant servers. It is intended for system administrators who are experienced with storage networks.

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# Introduction

Traditionally, servers are configured to install the operating system on internal direct-attached storage devices. With external booting from HBAs or RAID arrays, server-based internal boot devices can be eliminated. Booting from an external device provides high-availability features for the operating system during the boot process by configuring the HBA BIOS with redundant boot paths.

Booting from SAN provides:

- Improved disaster recovery
- Reduced backup time when the boot path is through a SAN
- Additional SAN-managed features

This document is intended to help you configure an HPE server and HPE-supported Fibre Channel HBA or FCoE CNA adapter to boot from a Fibre Channel SAN device using the UEFI or BIOS Option ROM configuration menus. If you are using another method to configure the boot devices and LUNs that an adapter uses (such as Virtual Connect or OneView profiles) then the information in this document does not apply.

# Configuring an HPE server to Boot from SAN

In order for an HPE server to successfully boot from SAN devices some parameters need to be set in the system's ROM-based setup utility (RBSU).

## Configuring Embedded Network Adapters (LOM, ALOM, and BLOM)

For BIOS servers and UEFI servers in Legacy BIOS Mode, any embedded adapter which is performing boot from SAN should have its **Network Boot** setting set to **Enabled** on all ports which show up as FCoE devices in the system configuration menus (usually ports 3 and 4).

### Procedure

1. From the **System Utilities** screen, select **System Configuration -> BIOS/Platform Configuration (RBSU) -> Network Options -> Network Boot Options**.

Press the **Enter** key.

2. Select an embedded NIC port which will be configured to boot from SAN.
3. Select the **Network Boot** option.
4. Repeat steps 2-3 for all embedded NIC ports which will be configured to boot from SAN.
5. Press the **F10** key.

## Configuring FC/FCoE Scan Policy

HPE UEFI system ROMs provide the option to scan all available Fibre Channel LUNs for boot devices when in UEFI mode. However, in large SAN environments it can take an unreasonable amount of time to enumerate all LUNs and scan them for boot partitions in the UEFI environment. In such scenarios, HPE recommends the parameter to be set to **Scan Configured Targets Only**.

### Procedure

1. From the **System Utilities** screen, select **System Configuration -> BIOS/Platform Configuration (RBSU) -> Storage Options -> Fibre Channel/FCoE Scan Policy**.

Press the **Enter** key.

2. Select the **Scan Configured Targets Only** setting.
3. Press the **F10** key.

## Configuring UEFI POST Discovery Mode

In Gen10 servers, HPE offers the ability to decrease boot time by only loading those UEFI drivers which are required to boot. However, this is known to interfere with boot from SAN operations from some adapters. HPE recommends leaving this in the **Auto** setting for best performance or switching this to **Force Full Discovery**, if the system is having problems booting from a SAN device.

### Procedure

1. From the **System Utilities** screen, select **System Configuration -> BIOS/Platform Configuration (RBSU) -> System Options -> Boot Time Optimizations -> UEFI Post Discovery Mode**.

- Press the **Enter** key.
2. Select the **Auto** or **Force Full Discovery** option as required.
  3. Press the **F10** key.

## Configuring Secure Boot

For the OS variants that support the UEFI Secure Boot feature, see the *Secure Boot* section in the *HPE UEFI System Utilities User Guide for HPE ProLiant Gen9 Servers* document available at <http://www.hpe.com/info/UEFI-manuals>. To enable this functionality on your server, follow the server configuration guidelines properly.

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### NOTE:

- The operating system must support the UEFI Secure Boot option.
  - The UEFI Secure Boot option is supported on all ProLiant Gen9+ servers, the DL580 Gen8 servers, and all C-class Gen9+ blade servers.
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For more information on enabling the UEFI secure boot on your server, see the UEFI System Utilities User Guide for your server specific platform.


# Configuring HBAs

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**NOTE:**

- Although the procedures in this chapter refer to HBAs, they apply to all supported adapter types (HBA, CNA, LOM, and mezzanine cards).
- For Windows servers, only one boot path must be configured.

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 **IMPORTANT:** HPE recommends disabling HBA BIOS on HBAs that are not part of BFS.

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HBA, CNA, LOM, and mezzanine cards provide BFS functionality. When adapters are configured to boot from the disk device on the SAN, the server boots as if the SAN disk were a local disk. More than one adapter can be configured for the redundant boot path for the high availability of the boot device. After the link is established with boot LUN no additional failover is performed.

## Configuring Emulex HBAs in BIOS environments

To configure an Emulex boot device for high availability:


### Procedure

1. For specific Emulex product type, press **Alt+E** or **Ctrl+E** to enter Emulex FC, FCoE, or ISCSI BIOS as it appears during the boot process to further configure the boot components.
2. Use the **up** and **down** arrow keys to navigate the list and select the HBA index number, and then press the **Enter** key.

The HBA configuration menu appears.

3. Select **Configure This Adapter's Parameters**.  
The Configure Adapter's Parameters menu appears.
4. Select **Enable or Disable BIOS**.

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 **CAUTION:** If BIOS is enabled, ensure at least one valid BFS LUN is configured, as mentioned in [Step 8](#). Otherwise, the next server boot will take significantly long time.

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5. Press **1** to enable the BIOS.
6. Press the **Esc** key twice to return to the main menu.
7. If not already done, zone and create the boot LUN.
8. Select **Configure Boot Devices**.

The Saved Boot Devices list appears.

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**NOTE:** To clear Saved Boot Devices list, enter **00**.

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9. Use the **up** and **down** arrow keys to navigate to the HBA that needs to be set as the primary boot path, and then enter **1**.  
The created WWN and LUN array, appears.
10. At the **Select Two-Digit Number of the Desired Boot Device** prompt, enter the index of the controller port.



11. When prompted, enter the LUN ID of the starting LUN.
12. When prompted, enter the index of the boot device from the list.
13. Select **Boot this device via WWPN**.
14. Return to the **List of Saved Devices** window.
15. Exit from the BIOS menu and reboot the server.
16. For servers running Windows:
  - a. Complete the operating system build. See **Installing the operating system** on page 17.
  - b. Install the multipathing software.
  - c. Proceed to **Step 17**.

For servers running Linux:

- a. Complete the operating system build. See **Installing the operating system** on page 17.
  - b. If the multipathing software is not already configured, configure multipathing software.
  - c. Proceed to **Step 17**.
17. Configure alternate paths for boot devices by selecting the unused entries and repeat **Step 12** and **Step 13**.
18. Return to the Emulex Adapters in the System menu.
19. Configure other HBAs by repeating **Step 2** through **Step 17**.

## Configuring Emulex HBAs in HPE UEFI Environments

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**NOTE:** The UEFI environment may look and behave differently from other OEM providers.

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To configure a HPE-branded Emulex boot device for high availability in legacy BIOS boot mode (HPE 81E and HPE 82E only):

1. Allow the system to get past the UEFI portion of the boot sequence and enter the legacy BIOS boot module. The system should display the BIOS-style device banners at this point.
2. To complete the configuration process, see **Configuring Emulex HBAs in BIOS environments** on page 8.

The adapters configure their legacy BIOS mode operation via the UEFI HII interfaces. To configure a HPE-branded Emulex boot device for high availability in legacy BIOS boot mode (all other adapters):

To configure the adapters in UEFI boot mode:

1. During the system boot, press the **F9** key to enter the system utilities menu.
2. Select **System Configuration** and then press the **Enter** key.
3. Navigate to one of the desired adapter ports and then press **Enter**.  
The HBAs HII configuration menu should appear.
4. Select **Set Emulex Adapter to Default Settings** and then press **Enter**.

5. Select **Set Adapter Defaults** and then press **Enter**.
6. Select **Set Boot from SAN** and change the option to **Enable**.
7. If needed, change the appropriate FCF parameters to connect to your FC/FCoE network.
8. Select **Add Boot Device** and wait for the adapter to scan and find the bootable targets available on the fabric.
9. Select the desired boot device WWPN and then press **Enter**.
10. Select the desired boot LUN and then press **Enter**.
11. Select **Commit Changes** and then press **Enter**.
12. Press **ESC** until you have returned to the HBAs HII configuration menu.
13. Configure additional boot targets by repeating **Step 6** through **Step 10**.
14. Select **Change Boot Device Order** to verify that all boot devices are configured and saved correctly and that their boot priority is ordered correctly
15. Press **ESC** until you have returned to the system configuration menu.
16. Configure all the applicable FC adapter ports in the system by repeating **Step 3** through **Step 13**.

## Configuring QLogic HBAs in BIOS environments

To configure a QLogic boot device for high availability:

### Procedure

1. For specific QLogic product type, press the **Alt+Q** or **Ctrl+Q** keys to enter QLogic FC, FCoE, or iSCSI BIOS utility as it appears during the boot process to further configure the boot components.  
The Emulex BIOS utility displays Emulex Adapters in the System.
2. Select the HBA to boot and then press the **Enter** key.  
The Fast!UTIL Options menu appears.
3. Select **Configuration Settings** and then press **Enter**.  
The Configuration Settings menu appears.
4. Select **Adapter Settings** and then press **Enter**.  
The Adapter Settings menu appears.
5. Use the arrow keys to select **Host Adapter BIOS** and then press **Enter** to change the setting to **Enabled**.
6. Press **Esc** to return to the Configuration Settings menu.
7. Select **Selectable Boot Settings** and then press **Enter**.  
The Selectable Boot Settings menu appears.
8. Press **Enter** to enable the Selectable Boot option.
9. Move the cursor to Primary Boot Port Name, LUN, and then press **Enter**.  
The Select Fibre Channel Device menu appears.
10. Select the controller Port Name of the array and then press **Enter**.

The Select LUN menu appears.

11. Select the device from which to boot and then press **Enter**.
12. To configure alternate boot paths for Linux servers:
  - a. Return to the Selectable Boot Settings menu.
  - b. Select **Boot Port Name, LUN**.
  - c. Press **Enter** to enable the Selectable Boot option.
  - d. Move the cursor to Secondary Boot Port Name LUN and then press **Enter**.  
The Select Fibre Channel Device menu appears.
  - e. Select the controller Port Name of the next array and then press **Enter**.  
The Select LUN menu appears.
  - f. Select the alternate device from which to boot and then press **Enter**.
13. Repeat **Step 12** for all controller ports in the array.
14. Press the **Esc** key twice to save the changes and then select **Save Changes**.  
The configuration changes to the selected HBA are saved.
15. From the **Fast!UTIL Options** menu, select **Select Host Adapter** and then press **Enter**. Select the other HBAs and repeat **Step 2** through **Step 14**.
16. Press **Esc** twice to save the changes.  
The initial setup is complete.
17. Reboot the server.

## Configuring QLogic HBAs in UEFI Environments

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**NOTE:** The UEFI environment may look and behave differently from other OEM providers

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To configure a HPE-branded QLogic boot device for high availability in legacy BIOS boot mode (HPE 81Q and HPE 82Q only):

1. Allow the system to get past the UEFI portion of the boot sequence and enter the legacy BIOS boot module. The system should display the BIOS-style device banners at this point.
2. To complete the configuration process, follow the steps under **Configuring QLogic HBAs in BIOS environments** on page 10.

The adapters can configure their legacy BIOS mode operation via the UEFI HII interfaces. To configure a HPE-branded QLogic boot device for high availability in legacy BIOS boot mode (all other adapters):

To configure the adapters in UEFI boot mode:

1. During system boot press the **F9** key to enter the system configuration menu.
2. Select **System Configuration** and then press the **Enter** key.
3. Navigate to one of the desired adapter ports and then press **Enter**.

The HBAs HII configuration menu should appear.

4. Select **Adapter Settings** and then press **Enter**.
5. Reset defaults FC Function.
6. Ensure all the adapter settings match those used by your fibre channel fabric.
7. Select **Save Changes**.
8. Select **Boot Settings** and then press **Enter**.
9. Select **Adapter Driver** and then press **Enter**.  
Set it to **Enabled** and then press **Enter**.
10. Select **Selective Login** and set it to **Enabled**.
11. Select **Selective LUN Login** and set it to **Enabled**.
12. Select **World Login** and set it to **Disabled**.
13. Select **Save Changes** and then press **Enter**.
14. Press **ESC** to return to the HBAs HII configuration menu.
15. Select **Boot Devices** and then press **Enter**.
16. Select a free boot device and enter in the desired target WWPN and LUN number.
17. Repeat **Step 15** for each target port you wish to connect to with this device.
18. Press **ESC** until you return to the system configuration menu.
19. For all adapter ports in the system repeat **Step 3** through **Step 17**

## Configuring Brocade HBAs

Enable or disable BIOS for Boot for SAN, set port speed, and display HBA BIOS settings using BCU commands. By default, BIOS is enabled on all HBA ports.

HPE Brocade BIOS Configuration Utility can be utilized, embedded with the boot code, BCU commands, and the HCM to configure Boot for SAN. For more information about these procedures, see the Boot Code chapter in the *Brocade Adapters Installation and Reference* manual available at <http://www.hpe.com/support/manuals>. To view the document, Under **Storage**, click **Storage Networking**, and then under **Host Bus Adapters**, select your product.

### Procedure

To configure a Brocade boot device for high availability:

1. Enable BIOS.  
By default, BIOS is enabled. However, BIOS must be disabled for arrays that are not configured for Boot for SAN.
2. Enable one of the following boot LUN options:
  - a. **Auto Discover**—When enabled, boot information, such as the location of the boot LUN, is provided by the fabric. This is the default value.
  - b. **Flash Values**—The HBA obtains the boot LUN information from flash memory.
  - c. **First LUN**—The host boots from the first LUN visible to the HBA that is discovered in the fabric.

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**NOTE:** HPE recommends not to use the First LUN option.

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3. Select a boot device from discovered targets.

## Configuring QLogic Ethernet CNA in BIOS (HPE Legacy Boot mode) Environments (Cavium 578xx Adapters Only)

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**NOTE:** The following adapters are Cavium 578xxx Series Adapters:

- HPE FlexFabric 10Gb 2-port 534FLR-SFP+ Adapter
  - HPE FlexFabric 10Gb 2-port 533FLR-T Adapter
  - HPE FlexFabric 10Gb 4-port 536FLR-T Adapter
  - HPE FlexFabric 10Gb 2-port 536FLB Adapter
  - HPE FlexFabric 10Gb 2-port 534M Adapter
  - HPE FlexFabric 20Gb 2-port 630FLB Adapter
  - HPE FlexFabric 20Gb 2-port 630M Adapter
  - HPE StoreFabric CN1100R Dual Port Converged Network Adapter
  - HPE StoreFabric CN1100R 10GBASE-T Dual Port Converged Network Adapter
- 

### Procedure

1. Update server BIOS with the latest version to ensure that the BIOS supports boot from SAN features.

**NOTE:** Boot from SAN feature is NOT available for supported servers using AMD processors.

---

2. During POST, press the **Ctrl+S** key at the Qlogic Ethernet NetXtreme Ethernet Boot Agent banner to invoke CCM interface.

The Qlogic Ethernet Adapter is displayed in the system.

3. Use the navigation keys to select the device for which boot protocol is to be configured and then press the **Enter** key.
4. Select **Device Hardware Configuration** and press **Enter**.
5. Ensure that DCB Protocol is enabled on the device and correct Storage Personality is configured based on the boot protocol being configured. Press the **Esc** key.

**NOTE:** FCoE boot is only supported on DCB enabled configurations.

---

6. Select **MBA Configuration** and press **Enter**.
7. Configure Boot Protocol field to **FCoE** and press **Esc**.
8. Select **FCoE Boot Configuration** and press **Enter**.
9. Select **Target Information** and press **Enter**.
10. From the list, select the first available path and press **Enter**.

11. Set the connect parameter to Enabled. Enter the target WWPN and Boot LUN ID for the target to be used for boot.
12. Note down the initiator WWPN seen at the bottom of the Target information screen.
13. Press **Esc** till prompted to **Exit and save changes**.
14. Provision Storage Access in the SAN

Storage access consists of zone provisioning and storage-selective LUN presentation, each of which is commonly provisioned per initiator WWPN. The two options available for storage access are:

- a. **Pre-provisioning** – To allow appropriate access for the initiator, manually modify fabric zoning and storage-selective LUN presentation by using initiator WWPN.
- b. **Ctrl+R method** – The **Ctrl+R** method allows you to apply the boot initiator to carry the link and login into all available fabrics and targets. Using this method, you can ensure that the initiator is logged into the fabric/target before making any provisioning changes and can provision without manually entering WWPNs.
  - Allows the system to attempt to boot through the selected initiator.
  - After the initiator boot starts, it commences with DCBX sync, FIP Discovery, Fabric Login, Target Login, and LUN readiness checks. If the initiator is unable to complete any of these checks, MBA provides the option to press Ctrl+R. Press **Ctrl+R**.
  - After **Ctrl+R** is activated, the boot initiator maintains the link and allows you to make necessary provisioning corrections and complete the check. If needed, modify fabric zoning and make necessary LUN provisioning changes.

15. Proceed to OS installation after storage access is provisioned in SAN.

## Configuring QLogic CNAs in HPE UEFI Environment (Cavium 578xx Adapters Only)

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**NOTE:** The following adapters are Cavium 578xxx Series Adapters:

- HPE FlexFabric 10Gb 2-port 534FLR-SFP+ Adapter
- HPE FlexFabric 10Gb 2-port 533FLR-T Adapter
- HPE FlexFabric 10Gb 4-port 536FLR-T Adapter
- HPE FlexFabric 10Gb 2-port 536FLB Adapter
- HPE FlexFabric 10Gb 2-port 534M Adapter
- HPE FlexFabric 20Gb 2-port 630FLB Adapter
- HPE FlexFabric 20Gb 2-port 630M Adapter
- HPE StoreFabric CN1100R Dual Port Converged Network Adapter
- HPE StoreFabric CN1100R 10GBASE-T Dual Port Converged Network Adapter

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**NOTE:** The HPE UEFI environment may look and behave differently from other OEM providers.

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To configure an HPE-branded QLogic (QLogic Ethernet) CNA for Boot From San in UEFI boot mode, follow these steps:

1. During system boot, press the **F9** key to enter the system configuration menu.
2. Select **System Configuration** and then press the **Enter** key.
3. Navigate to one of the desired adapter ports and then press **Enter**.  
The CNA's Main Configuration Page should appear.
4. Select **Device Hardware Configuration** and then press **Enter**.
5. Select **Storage Personality** and **UEFI Boot Mode** as **FCoE**.
6. Save changes by pressing **F10**.
7. Press the **ESC** key, select **FCoE Boot Configuration Menu**, and then press **Enter**.
8. Select **FCoE General Parameters** and press **Enter**.
9. Select **Boot to FCoE Target** and set it to **Enabled**.
10. Select **HBA Boot Mode** and set it to **Enabled**.
11. Save changes by pressing **F10**.
12. Press **ESC**, select **FCoE Target Parameters**, and then press **Enter**.
13. Enable the Target establishment by selecting **Connect #**, press **Enter** and set it to **Enabled**.
14. Configure the preferred Target by selecting **WWPN #**, press **Enter** and then select the required Target WWPN.
15. Configure the target boot LUN by selecting **Boot LUN #**, press **Enter** and then type the **LUN Number**.
16. Repeat **Step 13** through **Step 15** for each target port you wish to connect to with this device.
17. Save changes by pressing **F10**.
18. Press **ESC** until you return to the system configuration menu.
19. To configure BFS on all the desired adapter ports in the system, repeat **Step 3** through **Step 18**.

## Configuring QLogic CNAs in HPE UEFI Environment (Cavium 41xxx/45xxx Adapters Only)

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**NOTE:** The following adapters are Cavium 41xxx/45xxx Series Adapters:

- HPE StoreFabric CN1200R 10GBASE-T Converged Network Adapter
- HPE StoreFabric CN1300R 10/25Gb Converged Network Adapter
- HPE Synergy 4820C 10/25Gb CNA
- HPE Synergy 6820C 25/50Gb CNA

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**NOTE:** The HPE UEFI environment may look and behave differently from other OEM providers.

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To configure an HPE-branded QLogic (QLogic Ethernet) CNA for Boot From San in UEFI boot mode, follow these steps:

## Procedure

1. During system boot, press the **F9** key to enter the system configuration menu.
2. Select **System Configuration** and then press the **Enter** key.
3. Navigate to one of the desired adapter ports and then press **Enter**.  
The CNA's Main Configuration Page should appear.
4. Select **Port Level Configuration** and then press **Enter**.
5. Set **Boot Mode** to **FCoE**.
6. Enable **FCoE Offload**.
7. Set **RDMA Operational Mode** to **NONE**.
8. Press the **ESC** key, select **FCoE Configuration**, and then press **Enter**.
9. Press **ESC**, select **FCoE Target Parameters**, and then press **Enter**.
10. Select the **Refresh Target List** option to bring up the available targets. If your target is not visible, check the zoning configuration.
11. Enable the Target establishment by selecting **Connect #**, press **Enter** and set it to **Enabled**.
12. Configure the preferred Target by selecting **WWPN #**, press **Enter** and then select the required Target WWPN.
13. Configure the target boot LUN by selecting **Boot LUN #**, press **Enter** and then type the **LUN Number**.
14. Repeat **Step 10** through **Step 13** for each target port you wish to connect to with this device.
15. Save changes by pressing **F10**.
16. Press **ESC** until you return to the system configuration menu.
17. To configure BFS on all the desired adapter ports in the system repeat **Step 3** through **Step 15**.



# Installing the operating system

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**NOTE:** Although the procedures in this chapter refer to HBAs, they also apply to all supported HBA, CNA, LOM, and mezzanine card types.

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## Best practices

Consider the following:

- Read the release notes for the latest required updates.
- Ensure the HBA management software version is compatible with the driver that is installed.
- Run the latest release version of the SPP before the Boot from SAN process is started to update the server BIOS, HBA, CNA, and LOM firmware to the latest released version as recommended by the server installation document for the server type you are installing on.

The Linux driver logs information about fabric or driver events that it detects in the `/var/log/messages` file.

Only one LUN can be presented to the server for installation. Multiple paths are acceptable for RH and SLES11, but SLES10 must contain one LUN, one path.

For Windows OS, a separate BFS Driver kit must be available to be installed whenever requested.

## Driver installation and upgrade

- The Smart Component creates a log file after the installation is complete. View this log file to verify that the installation was successful.
- Look for any yellow warning flags in the device manager.
- From the Device Manager, open the HBA device to verify that the driver is running properly.
- Use the vendor management utility to verify the driver, firmware, and universal code versions, as well as the driver parameters.

## Linux

Verify that there are multiple paths to the LUNS before installing a Linux operating system.

**NOTE:** Drivers for newly released HBA offerings may not appear in the base installation CD of previous Linux OS releases. In these cases a driver update disk (DUD) must be loaded during the installation.

---

## DUD installation instructions

### Procedure

1. Boot the **Boot RH72 CD**.
2. On the RH72 install screen, enter **e**.
3. On the Linux command line, enter **inst.dd**.
4. Press **Ctrl+ X** to continue with the OS boot.

On the DUD CLI prompt:

1. If using a separate DVD drive for the DUD, select the drive number at the prompt.
2. If using the Remote Desktop Virtual drive:

- a. Unmount install CD image file.
- b. Mount the driver ISO using **Image file**.

Select the following options based on your choice:

```
R = refresh
# select
C - continue
```

- c. Once you see a list of disks, unmount the driver ISO.
- d. Mount the install disk.
- e. Select **Refresh** to refresh the screen or **Continue** to continue with installation.

---

**NOTE:** For more information on DUD kit installations, see the RedHat documentation on the [RedHat Website](#).

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## Red Hat Enterprise Linux

### Procedure

#### Red Hat Enterprise Linux – UEFI and Legacy modes

1. Start the installation of the operating system.
2. From the **Red Hat Installation Summary** Screen, select **Installation Destination**.
3. From the list, select **BFS installation disk**.
4. Select **Done**.
5. Complete the other selections on the installation summary screen and proceed with the installation. Reboot the server when installation is completed.
6. Once the system reboots to RedHat, apply the latest Service Pack for ProLiant (SPP) updating the system drivers and agents.
7. Reboot to activate SPP components.

## SUSE Linux Enterprise Server

### Procedure

#### SLES 12SP2 and SLES 11SP4 OS installation instructions (UEFI boot mode):

1. Boot the **SLES OS** installation media.
2. When the installation selection screen appears, enter **e**.
3. On the Linux command line with keyword **kernel**, add **dud=1**, if you have the driver update disk (DUD).

4. On the Linux command line with keyword **kernel**, add **withfcoe=1**, if a BFS LUN is presented via QLogic NX2 family FCoE card.
5. Use the **F10** key or **Ctrl+X** to start SLES OS installation, you will be prompted to insert DUD, if parameter **dud=1** was specified.
6. If parameter **withfcoe=1** was specified, the **Configure FCoE interfaces** tab will appear. Select the required interfaces.

For more information, see [Managing FCoE Services with YaST](#).

7. To enable each interface for FCoE boot, click **Change Settings**. Ensure that:
  - **FCoE Enable** and **AUTO\_VLAN** are set to **yes**.
  - **DCB required** is set to **no**
  - Click **Create FCoE VLAN Interface**.
8. The rest of installation procedure is the same for FC and FCoE BFS configurations. It includes multipath enablement, NIC configuration, BFS disk selection, partitioning, and so on. Complete SLES OS installation and reboot your server.
9. After OS installation and server reboot, verify the following:
  - The **fipvlan** command performs Fibre Channel over Ethernet (FCoE) Initialization Protocol (FIP) VLAN Discovery over Ethernet interfaces. **fipvlan** can be used as a diagnostic tool to determine which VLANs have FCoE services available on a network, prior to configuring VLAN interfaces and the Open-FCoE initiator.
  - To verify configured interfaces, use **fcoeadm -i**.
  - To verify configured IO path status, use **multipath -l**

#### **SLES 12SP2 and SLES 11SP4 OS installation instructions (Legacy boot mode):**

1. Boot the **SLES OS** installation media.
2. On the installation screen, press **F6** for the DUD. Select **Yes**.
3. In boot options, type **withfcoe=1**, if a Boot from SAN LUN is presented via QLogic NX2 family FCoE card.
4. Select **Installation** to proceed.
5. If DUD option was selected, you will be prompted to inserted.
6. Continue from [Step 6](#) - [Step 9](#) of SLES OS install instructions (UEFI boot mode).

## RHEL6.x Qlogic Ethernet CNAs – Special Instructions (Cavium 578xx Adapters Only)

---

**NOTE:** The following adapters are Cavium 578xxx Series Adapters:

- HPE FlexFabric 10Gb 2-port 534FLR-SFP+ Adapter
  - HPE FlexFabric 10Gb 2-port 533FLR-T Adapter
  - HPE FlexFabric 10Gb 4-port 536FLR-T Adapter
  - HPE FlexFabric 10Gb 2-port 536FLB Adapter
  - HPE FlexFabric 10Gb 2-port 534M Adapter
  - HPE FlexFabric 20Gb 2-port 630FLB Adapter
  - HPE FlexFabric 20Gb 2-port 630M Adapter
  - HPE StoreFabric CN1100R Dual Port Converged Network Adapter
  - HPE StoreFabric CN1100R 10GBASE-T Dual Port Converged Network Adapter
- 

### Procedure

1. From the **What type of device will installation involve** screen, select **Specialized Storage Devices** and then click **Next**.
2. Click **Add Advanced Target**.
3. Select **Add FCoE SAN** and click **Add Drive**.
4. Select each interface intended for FCoE boot and clear **Use DCB**.
5. Select **Use auto vlan** and click **Add FCoE disk(s)**.
6. Ensure that all FCoE-visible disks are seen under **Multipath Devices** or **Other SAN Devices** or both, as appropriate.
7. Repeat steps **2** to **6** for all initiator ports.
8. Click **Next** and complete the installation.
9. The system reboots after installation is complete.
10. Once the system reboots to RedHat, run the following commands to turn on the fcoe service, and turn off the lldpad and libvirt services for FCoE offload:  
  
For RHEL 6.x:  
  

```
chkconfig lldpad off
chkconfig libvirtd off
chkconfig fcoe on
```
11. It is recommended to apply the latest Service Pack for ProLiant (SPP) for updating the system drivers and agents.
12. Reboot to activate SPP components.

---

❗ **IMPORTANT:** Complete **Step 10** before rebooting.

---

13. As an alternative to using the SPP, update the QLogic Ethernet CNA driver using the rpm file obtained from the HPE website, for example: `rpm -Uvh kmod-netxtreme2-7.14.29-1.rhel6u9.x86_64`.

a. Reboot the server.

---

❗ **IMPORTANT:** Complete **Step 10** before rebooting.

---

## RHEL7.x Qlogic Ethernet CNAs – BFS is not supported on RH7.0 through RH7.3 (Cavium 578xx Adapters Only)

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**NOTE:** The following adapters are Cavium 578xxx Series Adapters:

- HPE FlexFabric 10Gb 2-port 534FLR-SFP+ Adapter
  - HPE FlexFabric 10Gb 2-port 533FLR-T Adapter
  - HPE FlexFabric 10Gb 4-port 536FLR-T Adapter
  - HPE FlexFabric 10Gb 2-port 536FLB Adapter
  - HPE FlexFabric 10Gb 2-port 534M Adapter
  - HPE FlexFabric 20Gb 2-port 630FLB Adapter
  - HPE FlexFabric 20Gb 2-port 630M Adapter
  - HPE StoreFabric CN1100R Dual Port Converged Network Adapter
  - HPE StoreFabric CN1100R 10GBASE-T Dual Port Converged Network Adapter
- 

### Procedure

1. From the **Red Hat Installation Summary** Screen, perform the following:

a. Select **Network & Hostname**.

- Turn ENET interfaces to **On**.
- Change Hostname.

b. Select **Installation Destination**.

- Select **Add a Disk**.
- Select **Add FCoE SAN**.
- Uncheck **DCB**.
- Check **Auto-vlan**.

- Select **Add FCoE Disk**.
  - Repeat above steps for all FCoE interfaces.
- c. Complete the other selections on the installation summary screen and proceed with the installation. Reboot the server when the installation is completed.
2. Once the system reboots to RedHat, run the following commands to turn on the fcoe service, and turn off the lldpad and libvirt services for FCoE offload:
- For RHEL 7.x:
- ```
systemctl disable lldpad
systemctl disable libvirt
systemctl enable fcoe
```
3. It is recommended to apply the latest Service Pack for ProLiant (SPP) for updating the system drivers and agents.
4. Reboot to activate SPP components.
- 
- ❗ **IMPORTANT:** Complete **Step 2** before rebooting.
- 
5. As an alternative to using the SPP, update the QLogic Ethernet CNA driver using the rpm file obtained from the hpe website, for example: `rpm -Uvh kmod-netxtreme2-7.14.29-1.rhel6u9.x86_64`
- a. Reboot the server.
- 
- ❗ **IMPORTANT:** Complete **Step 2** before rebooting.
- 

## Windows

---

**NOTE:** For Windows, best practice for installations is to include only a single path and a single LUN.

---

### Installing from the Microsoft CD

Use the following procedures to install the operating system using the Microsoft CD.

### Loading the HBA driver for a Microsoft Windows Server 2003 installation

To load the driver:

#### Procedure

1. Insert the HPE Smart Setup CD.
2. From the EBSU menu, select **Bootable DVD**, and then press **Enter**.
3. Select **Load OEM Boot driver** or press **B** to display the Load OEM Boot Driver window.
4. Select the Fibre Channel HBA and then press the **Enter** key.
5. Press **Tab** once and then press **Enter** to load the driver.

The system displays a message confirming that the driver is loaded.

6. Select **Exit** or press **X** to exit.

## Installing the Microsoft Windows Server 2003 operating system

To install the Microsoft Windows Server 2003 operating system:

### Procedure

1. With the Microsoft Windows Server 2003 CD in the DVD drive, select **Bootable DVD**. Press any key to boot from the CD and start the installation process.

---

**NOTE:** Do not press **F6** to load any mass-storage device drivers.

---

2. When the installation completes, use the latest Smart Setup CD to update the system drivers and agents.
3. To re-install the HBA driver, run the Smart Component by selecting **Drivers**→**Driver for FC HBA**. This sets the Hewlett Packard Enterprise-supported registry parameters.

---

**NOTE:** For single-path configurations, skip **Step 4**.

---

4. Install multipathing software.
5. Reboot the server to complete the installation.
6. Complete the installation and connect other HBAs, if there are any.

## Installing the Microsoft Windows Server 2008/2008 R2/2012/2012 R2/2016 operating system

To install the Microsoft Windows Server operating system:

### Procedure

1. Boot the Microsoft Windows Server CD and press any key to start the installation process.

---

**NOTE:** If installing using QLogic Ethernet adapters to create a custom Microsoft Windows CD, see [\*\*Injecting \(Slipstreaming\) HPE QLogic Ethernet 10/20 GbE CNA Multifunction Drivers into Microsoft Windows Server 2008/2008 R2/2012/2012 R2/2016 Image Files\*\*](#). Additionally, **Step 3** can be skipped.

---

2. When prompted, click **Custom (Advanced)** to install a clean copy of Windows.
3. Browse to the appropriate driver folder and select the driver.
4. Select the disk on which you want to install the operating system, and then click **Next**.
5. Post installation, use the latest HPE Service Pack for ProLiant (SPP) to update the system drivers and agents. Next, run Microsoft Windows Update and follow the recommended updates.
6. Install multipathing software.
7. Reboot the server.
8. Return to the HBA BIOS utility and complete the configuration of the additional boot paths.

# Injecting (Slipstreaming) HPE QLogic Ethernet 10/20 GbE CNA Multifunction Drivers into Microsoft Windows Server 2008/2008 R2/2012/2012 R2/2016 Image Files (Cavium 578xx Adapters Only)

**NOTE:** The following adapters are Cavium 578xxx Series Adapters:

- HPE FlexFabric 10Gb 2-port 534FLR-SFP+ Adapter
- HPE FlexFabric 10Gb 2-port 533FLR-T Adapter
- HPE FlexFabric 10Gb 4-port 536FLR-T Adapter
- HPE FlexFabric 10Gb 2-port 536FLB Adapter
- HPE FlexFabric 10Gb 2-port 534M Adapter
- HPE FlexFabric 20Gb 2-port 630FLB Adapter
- HPE FlexFabric 20Gb 2-port 630M Adapter
- HPE StoreFabric CN1100R Dual Port Converged Network Adapter
- HPE StoreFabric CN1100R 10GBASE-T Dual Port Converged Network Adapter

To obtain the correct version of HPE QLogic Ethernet 10/20GbE CNA Multifunction Windows driver, refer to the latest driver package from the release CD or search for your adapter on HPE.com and select the package <https://support.hpe.com/hpsc/public/home> for the appropriate operating system version.

To inject the drivers into the Windows image file:

## Procedure

1. Create a working directory on the local machine that you will be using to build the Windows Slipstream iso file.
2. Extract driver package to the working directory. Refer to the section [Extracting Driver Packages](#) for details.
3. From the extracted package, unzip "Qlogic\_slipstream.zip" to obtain the "slipstream.bat" file.
4. Download the latest Windows Assessment and Deployment Kit from <https://docs.microsoft.com/en-us/windows-hardware/get-started/adk-install>.
5. Install the Windows ADK on a supported computer.

It is recommended to use the default installation folder for installing the ADK.

6. Open a command prompt (with administrator privileges) and navigate to the folder containing the script file `slipstream.bat`.
7. Execute the script file with the following command:

```
slipstream.bat <DriveLetter> <Path>
```

where

<DriveLetter> points to the root drive where the OS installation media is available/mounted.

<Path> points to the sub-folder (under the extracted folder in [step 1](#)) containing the platform specific drivers.



---

**NOTE:** OS installation media is expected to be available as a local drive. Network paths for OS installation media are not supported.

For Example: `slipstream.bat H "C:\Temp"`

---

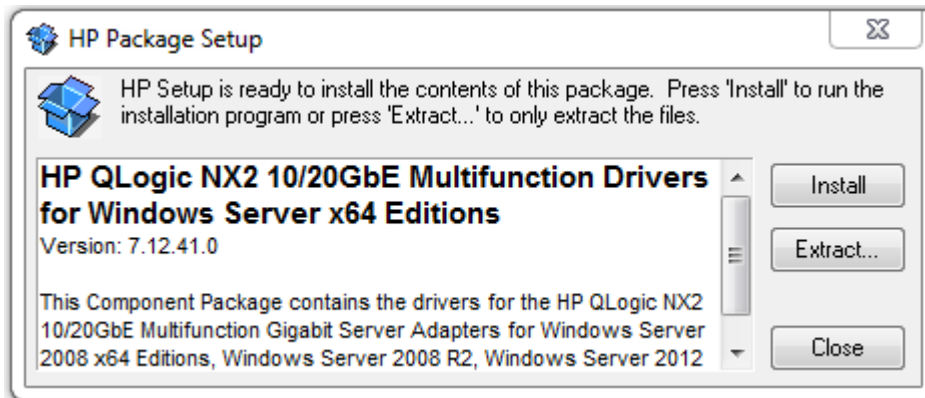
**NOTE:** The script injects the driver components in all the SKUs that are supported by the OS installation media.

---

8. After the script completes execution, the .iso file is generated and located in the current folder (from where the script was executed).
9. Burn the .iso file to a DVD using any DVD-creation software.
10. Install the applicable Windows Server OS version using the new DVD or .iso created.

## Extracting Driver Packages

1. Double-click on the HPE SPP containing the relevant drivers.
2. Click on the **Extract** button.



3. Enter the path to extract the files. For example, `C:\Temp`.
4. Upon completion, the extracted drivers will be available under `C:\Temp`.

## VMware

### Procedure

1. Download the latest supported HPE Custom Image-ESXi installer image.
2. Insert the ESXi installer image.
3. Restart the machine and boot the ESXi installer.
4. From the **VMware VMvisor Boot** menu, select **ESXi installer** and press **Enter**.
5. From the **VMware ESXi Installation** menu, press **Enter** to continue.
6. In the **End User License Agreement (EULA)** menu, press **F11** to accept **VMware EULA**.
7. From the **Select a Disk to Install** screen, locate and scroll down to the selected Boot Lun where you want the ESXi installed and press **Enter**.
8. Select the appropriate layout of the keyboard and press **Enter**.

9. Enter the root password and confirm password, ensure that the passwords match. Press **Enter** to continue.
10. Press **F11** to confirm the installation to start the installation process.
11. Once the Installation is complete, press **Enter** on the **Installation Complete** screen to reboot your server.
12. Remove the installation media.

## VMware Best Practices

- Follow Hewlett Packard Enterprise recommendation from the specific server booting from a SAN.
- Enable and configure the adapter correctly, to allow it to access the boot LUN.
- Each host must have access to its own boot LUN only and not others. Use storage system software to ensure the host accesses only its designated LUNs.
- Multipathing to a boot LUN on active-passive arrays is not supported because multipathing is not supported by BIOS and is unable to activate a standby path.
- SAN connections must be made through a switched topology if the array is not certified for direct connect topology. If an array is certified for direct connect topology, SAN connections can be made directly to the array.

---

**NOTE:** Boot from SAN is supported for both switched topology and direct connect topology if these topologies are certified for the specific array.

---

## Citrix

For procedures to install Citrix XenServer, see the version-specific Citrix XenServer installation guide available at <http://support.citrix.com/productdocs/>.

# Support and other resources

## Accessing Hewlett Packard Enterprise Support

- For live assistance, go to the Contact Hewlett Packard Enterprise Worldwide website:  
[www.hpe.com/assistance](http://www.hpe.com/assistance)
- To access documentation and support services, go to the Hewlett Packard Enterprise Support Center website:  
[www.hpe.com/support/hpesc](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, go to either of the following:
  - Hewlett Packard Enterprise Support Center **Get connected with updates** page:  
[www.hpe.com/support/e-updates](http://www.hpe.com/support/e-updates)
  - Software Depot website:  
[www.hpe.com/support/softwaredepot](http://www.hpe.com/support/softwaredepot)
- 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)

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

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# Websites

| Website                                                                        | Link                                                                                                       |
|--------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Hewlett Packard Enterprise Information Library                                 | <a href="http://www.hpe.com/info/enterprise/docs">www.hpe.com/info/enterprise/docs</a>                     |
| Hewlett Packard Enterprise Support Center                                      | <a href="http://www.hpe.com/support/hpesc">www.hpe.com/support/hpesc</a>                                   |
| Contact Hewlett Packard Enterprise Worldwide                                   | <a href="http://www.hpe.com/assistance">www.hpe.com/assistance</a>                                         |
| Subscription Service/Support Alerts                                            | <a href="http://www.hpe.com/support/e-updates">www.hpe.com/support/e-updates</a>                           |
| Software Depot                                                                 | <a href="http://www.hpe.com/support/softwaredepot">www.hpe.com/support/softwaredepot</a>                   |
| Customer Self Repair                                                           | <a href="http://www.hpe.com/support/selfrepair">www.hpe.com/support/selfrepair</a>                         |
| Insight Remote Support                                                         | <a href="http://www.hpe.com/info/insightremotesupport/docs">www.hpe.com/info/insightremotesupport/docs</a> |
| Serviceguard Solutions for HP-UX                                               | <a href="http://www.hpe.com/info/hpux-serviceguard-docs">www.hpe.com/info/hpux-serviceguard-docs</a>       |
| Single Point of Connectivity Knowledge (SPOCK)<br>Storage compatibility matrix | <a href="http://www.hpe.com/storage/spock">www.hpe.com/storage/spock</a>                                   |
| Storage white papers and analyst reports                                       | <a href="http://www.hpe.com/storage/whitepapers">www.hpe.com/storage/whitepapers</a>                       |

## 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:

[www.hpe.com/support/selfrepair](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.

For more information and device support details, go to the following website:

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

## 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.

# Glossary

**BCU**

Brocade Configuration Utility.

**BFS**

Boot from SAN.

**CNA**

Converged network adapter.

**DCB**

Data Center Bridging

**EBSU**

EFI-Based Setup Utility.

**EFI**

Extensible Firmware Interface.

**FC**

Fibre Channel. A network technology primarily used for SANs.

**HBA**

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

**HCM**

Host Connectivity Manager.

**iLO**

Integrated lights out.

**LOM**

LAN on Motherboard.

**LUN**

Logical unit number. An identification scheme for storage disks.

**MBA**

Multi-Boot Agent

**POST**

Power on Self Test

**RBSU**

ROM BIOS Setup Utility.

**SAN**

Storage area network. An intelligent infrastructure that connects heterogeneous servers and shared, heterogeneous storage systems.

**USB**

Universal serial bus. A serial bus standard used to interface devices.

**WWN**

Worldwide name. A unique identifier assigned to a Fibre Channel device.

**WWPN**

Worldwide port name. A unique 64-bit address used in a FC storage network to identify each device in a FC network.