HP StorageWorks Fibre Channel Over Ethernet Application Note

Abstract

This document describes support for HP FCoE products. It provides an overview of the product features, functionality, and configuration rules.

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Legal and notice information

Description

HP offers multiple FCoE solutions, from fabric-edge solutions using FCoE CNAs and CN switches integrated with existing FC target environments, to full FCoE end-to-end solutions using CNAs, CN switches and FCoE storage targets.

The HP FCoE fabric-edge solution deploys FCoE technology in existing Ethernet and FC environments with the benefit of convergence at the server and fabric edge using CNAs and CN switches. This solution provides this benefit in addition to investment protection by allowing FCoE to be integrated with existing HP Fibre Channel SANs.

The HP end-to-end FCoE solution for EVA storage systems provides an FCoE technology implementation from server to storage. This solution consists of FCoE CNAs, CN switches, and FCoE storage targets using the MPX200 Multifunction Router integrated with the EVA family of storage systems. Two FCoE end-to-end configurations are supported:

- **Direct-connect**—Provides 10-GbE FCoE and optionally, iSCSI connectivity for up to two EVA storage systems without requiring any Fibre Channel switches.
- **Fabric-connect**—Provides additional connectivity, allowing for up to four EVA storage systems using a fabric connection between the MPX200 and EVAs.

The FCoE product set consists of the following:

- **HP B-series** and **C-series CN switches**—Provide a bridge function from the CN to separate Ethernet and FC fabrics, or support end-to-end FCoE when used with CNAs and the MPX200 with FCoE target functionality
- **HP CN1000E and CN1000Q CNAs**—Converge Ethernet and FC technologies in the server over 10-GbE links to converged network switches
- **HP MPX200 Multifunction Router FCoE**—Provides FCoE target functionality when integrated with EVA storage systems (for more information, see the *HP StorageWorks SAN Design Reference Guide* and the *HP StorageWorks MPX200 Multifunction Router User Guide*).

Benefits

This section describes some of the benefits of FCoE technology. The convergence of Ethernet and FC provides the same level of connectivity as previous technologies, but requires:

- 50% fewer switches in each server rack—Only two CN ToR switches, compared with four (two network and two FC) switches per rack with separate Ethernet and FC switches
- 50% fewer adapters per server
- 75% fewer cable connections

Figure 1 illustrates a rack with 16 servers using FCoE technology compared to a rack using separate FC and Ethernet with the same level of connectivity. Similarly, Table 1 provides a comparison of cable requirements for these same racks.

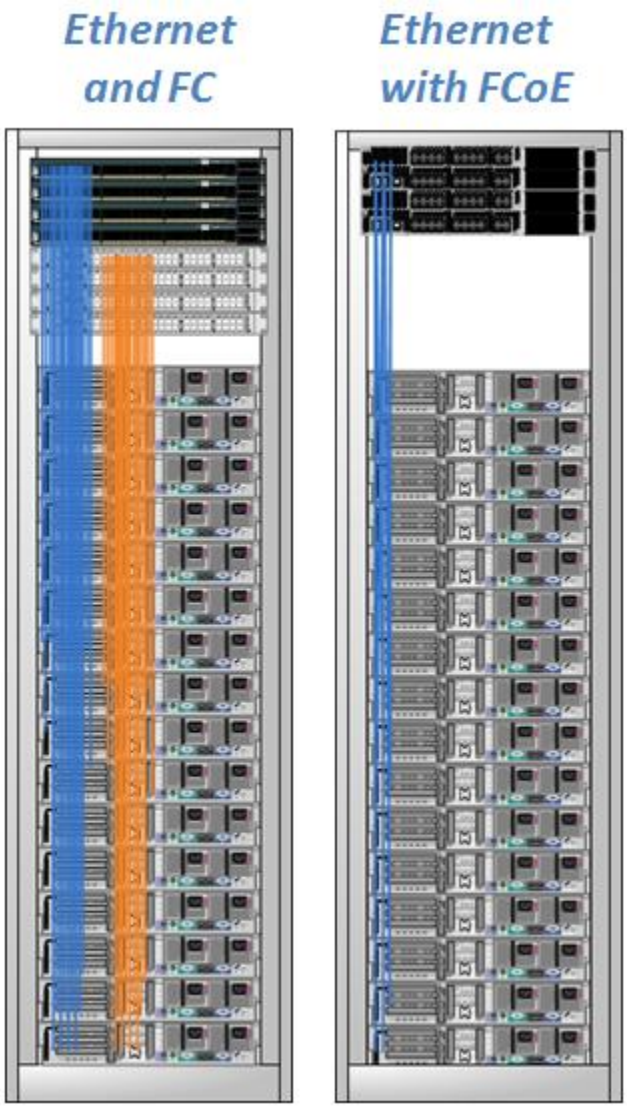

Figure 1 Rack cable comparison

Table 1 Rack cable requirements comparison

Separate FC and Ethernet networks	Converged FCoE network[1]
(4) 4-Gb FC cables (4) 1-GbE NIC cables (8) cables at 20 Gb per server	(2) 10-GbE cables (2) cables at 20 Gb per server
Total of 128 cables for 320 Gb of connectivity	Total of 32 cables for 320 Gb of connectivity

[1]Using copper cables for FCoE connections further reduces the per-port connection cost versus the cost of optical SFP+ transceivers.

Converged network switches

The first generation of FCoE CN switches enable Ethernet and FC to coexist in a fabric and are designed as edge switches or ToR switches. Edge/ToR switches are typically deployed in redundant pairs installed at the top of a server rack (see Figure 1). By using FCoE CN switches, you reduce the number of required switches by replacing separate Ethernet and FC switches with a converged edge/ToR switch. From the edge/ToR switch, ISL connections to the EoR FC and EoR Ethernet/IP switches provide access to the separate core layers of the FC fabric and Ethernet/IP network.

An FCoE blade that resides in a DC or DC04 SAN Director can also be used to integrate FCoE solutions with existing or new FC fabrics.

The following HP FCoE CN switches and blades are available:

- HP StorageWorks 2408 FCoE Converged Network Switch
- HP StorageWorks DC SAN Director Switch 10/24 FCoE Blade
- HP C-series Nexus 5010 Converged Network Switch
- HP C-series Nexus 5020 Converged Network Switch

Converged network switch ports

HP FCoE CN switches have two types of physical ports:

- 10-GbE ports
- 4-Gb or 8-Gb FC ports

FC ports can be used for either ISL connections to an existing FC fabric, or connection directly to an HP storage array.

Table 2 lists the number of ports for each HP FCoE CN switch.

Table 2 Number of ports per switch

HP switch	Number of 10-GbE ports	Number of FC ports
2408 FCoE Converged Network Switch	24	8 (8 Gb/s)
DC SAN Director Switch 10/24 FCoE Blade	24	0 external ports 32 (8 Gb/s) backplane ports
C-series Nexus 5010 Converged Network Switch	20 to 26	0 to 8 (4 Gb/s) 0 to 6 (8 Gb/s)
C-series Nexus 5020 Converged Network Switch	40 to 52	0 to 16 (4 Gb/s) 0 to 12 (8 Gb/s)

NOTE:

All FCoE CN switch models are by design CEE/IEEE DCB switches and are enabled for Ethernet by default. In order to be used for FCoE they must be enabled to forward FC frames to the FC ports.

HP does not support interoperability between different vendors' CN and FC switches:

- 2408 FCoE Converged Network Switch operate with B-series FC switches only.
- C-series Nexus 5010/5020 Converged Network Switches operate with other C-series MDS FC switches only.

NOTE:

The FCoE CN switch firmware update process will result in momentary loss of Ethernet and Fibre Channel port connectivity. HP recommends implementing a dual path configuration with redundant FCoE CN switches to minimize disruption during firmware updates.

HP StorageWorks 2408 FCoE Converged Network Switch

The 2408 FCoE Converged Network Switch is a rebranded version of the Brocade 8000 FCoE Switch (Figure 2).

Figure 2 2408 FCoE Converged Network Switch

Features

- Next-generation Ethernet L2/L3 switch and next-generation FC switch merged into one product
- CEE support
  - Full industry-standard implementation
  - Supports FCoE and FCoE Initialization Protocol (FIP)
- 24 10-GbE and 8 8-Gb/s FC ports
- Uses 1 RU of space
- Leverages existing Brocade fabric operating system (FOS)
- Supports link aggregation (LAG) on DCB ports
- Supports Brocade ISL trunking on FC ports

Considerations

- The port types are fixed. You cannot use 10-GbE ports for FC connections, and you cannot use FC ports for 10-GbE connections.
- L3 routing features are not currently supported.
- 10-GbE ports support virtual F_Ports only (virtual E_Ports are not supported).

HP StorageWorks DC SAN Director Switch 10/24 FCoE Blade

The HP DC SAN Director Switch 10/24 FCoE Blade is a rebranded version of the Brocade FCOE10-24 blade (Figure 3).

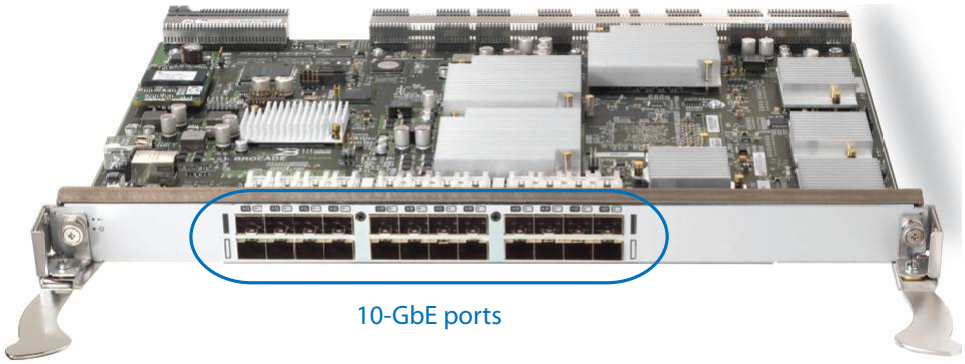

Figure 3 HP DC SAN Director Switch 10/24 FCoE Blade

Features

- 24 10-GbE ports
- 32 8-Gb/s FC ports on the backplane (DC and DC04 SAN Directors only)
- Hot pluggable
- Blade power and status LEDs
- Link status LEDs for each port
- FCoE switching
- CEE switching
- L2 Ethernet protocols STP/MSTP/RSTP, VLAN tagging, and link aggregation
- Standard Ethernet encapsulation

Considerations

- The DC SAN Director Switch 10/24 FCoE Blade has 24 FCoE ports and can be installed in either a DC or DC04 SAN director.
- The DC SAN Director Switch 10/24 FCoE Blade enables server edge connectivity by connecting CNAs directly to any of its 24 Ethernet ports.
- Storage can be connected to:
  - Any other Fibre Channel blade in the same director
  - Any Fibre Channel switch that is in the same fabric as the DC or DC04 SAN Director that contains the DC SAN Director Switch 10/24 FCoE Blade
- The DC SAN Director Switch 10/24 FCoE Blade supports optical cabling and SFP+ transceivers only.
- There are no licensing requirements for this blade.

HP C-series Nexus 5010/5020 Converged Network Switches

HP resells the Cisco Nexus 5010 and 5020 Switches (Figure 4).

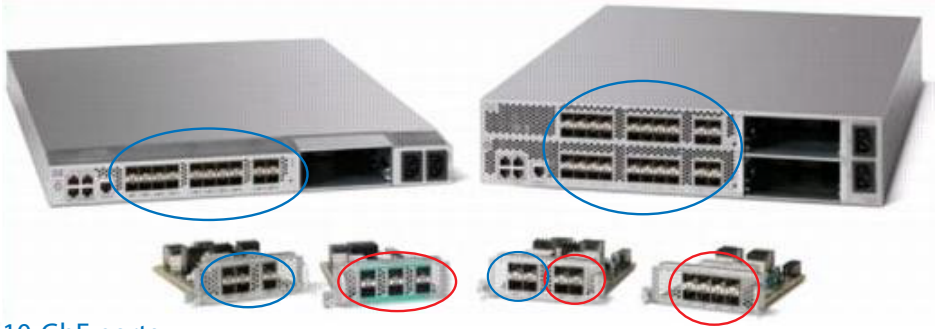

Figure 4 C-series Nexus 5010 and 5020 Converged Network Switches

Features

- L2 access:
  - IEEE DCB and FCoE support
    IEEE DCB is a Cisco unified fabric product with additional proprietary features.
  - NX-OS with combined features from Cisco IOS and Cisco MDS 9000 SAN-OS/NX-OS
- Cisco 5020 (2 RU):
  - 40 10-GbE ports
  - Two optional expansion module slots
  - Up to 52 10-GbE ports, or a combination of 40 10-GbE ports and 16 FC ports
- Cisco 5010 (1 RU):
  - 20 10-GbE ports
  - One optional expansion module slot
  - Up to 26 10-GbE ports, or a combination of 20 10-GbE ports and 8 FC ports
- Optional expansion modules:
  - 6-port 10-GbE expansion module
  - 6-port 8-Gb/s FC expansion module
  - 8-port 4-Gb/s FC expansion module
  - 4-port 4-Gb/s FC and 4-port 10-GbE expansion module

Converged network adapters

Servers with CNAs require fewer adapters per server and, therefore, 75% fewer cable connections for network and FC attachments.

HP offers the HP CN1000E CNA (Figure 5) and the HP CN1000Q CNA (Figure 7). For information about servers that support CNAs, see Server support on page 19.

Table 3 lists the supported HP CNAs.

Table 3 HP CNA part numbers

HP part number	HP model number	Description
AW520A	CN1000E	Dual port converged network adapter (no cable or transceiver is included)
BS668A	CN1000Q	Dual port converged network adapter (no cable or transceiver is included)

HP CN1000E

Figure 5 shows an HP CN1000E CNA.

Figure 5 HP CN1000E CNA

Figure 6 shows a diagram of the internal components of an HP CN1000E CNA.

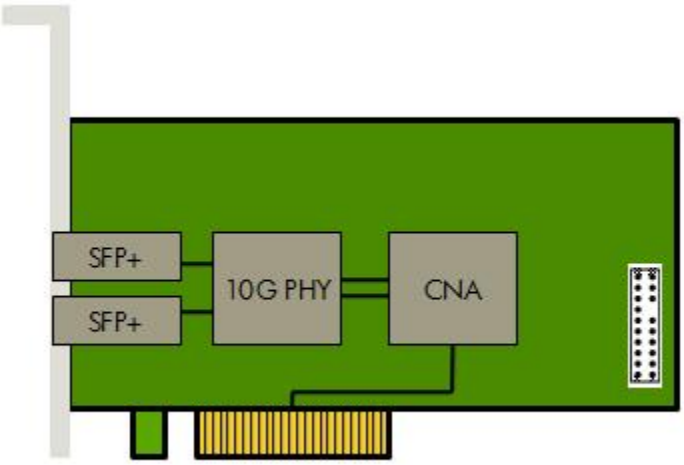

Figure 6 HP CN1000E internal components

Features

The HP CN1000E CNA has the following features:

- Ships with half-height and full-height brackets
- Dual ports for redundancy
- Full 10-Gb/s bandwidth on both ports
- Each port can operate as a NIC and/or FCoE port
- 2 SFP+ connectors
- Supports optical or copper cables

Considerations

- x8 PCI Express Gen2 card
- Requires 14.5 W of power
- 1 GbE is not supported

CN1000Q

Figure 7 shows an HP CN1000Q CNA.

Figure 7 HP CN1000Q CNA

Features

The HP CN1000Q CNA has the following features:

- Ships with half-height and full-height brackets
- Dual ports for redundancy
- Full 10-Gb/s bandwidth on both ports
- Each port can operate as a NIC and/or FCoE port
- 2 SFP+ connectors
- Supports optical or copper cables

Considerations

- x8 PCI Express Gen2 card
- Requires 19 W of power
- 1 GbE is not supported

Configuration rules

This section describes configuration rules for the HP FCoE solution. The rules are defined for the CNAs and each of the FCoE CN switch series.

Figure 8 shows a converged SAN fabric with servers using CNAs only.

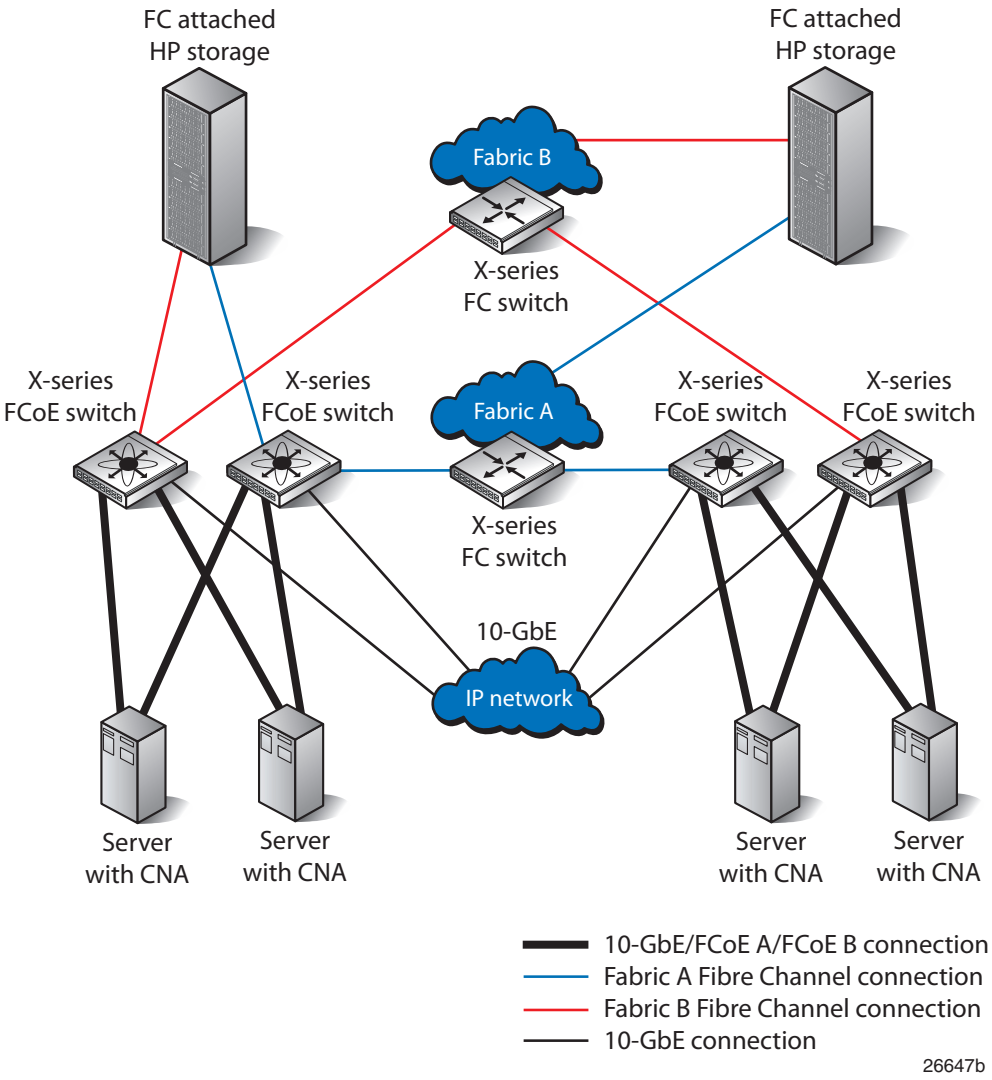

Figure 8 Converged SAN fabric configuration

Figure 9 shows a converged SAN fabric with servers using CNAs connected to a B-series CN switch and a DC SAN Director Switch 10/24 FCoE Blade.

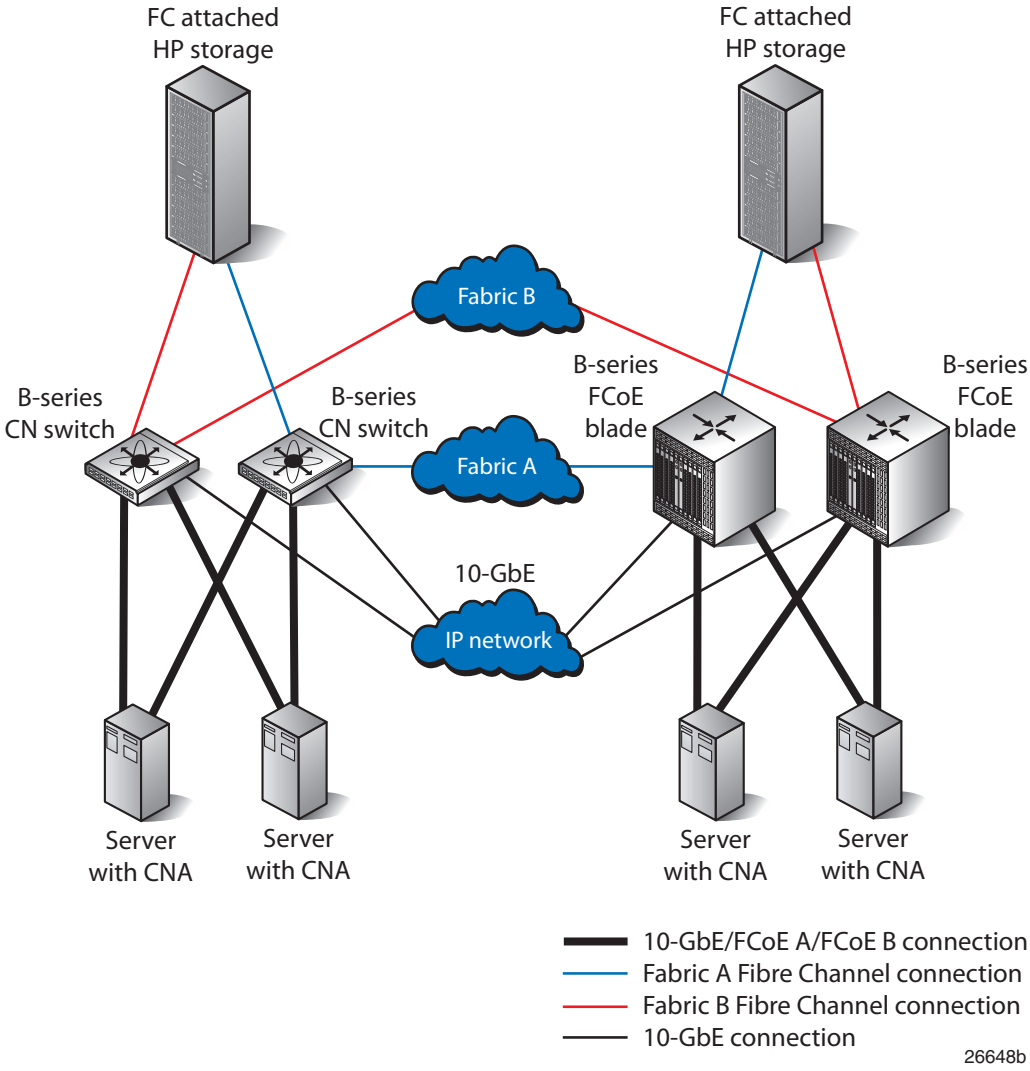

Figure 9 Converged SAN fabric with an FCoE blade

Figure 10 shows a converged fabric that has servers with CNAs and servers with FC HBAs and NICs.

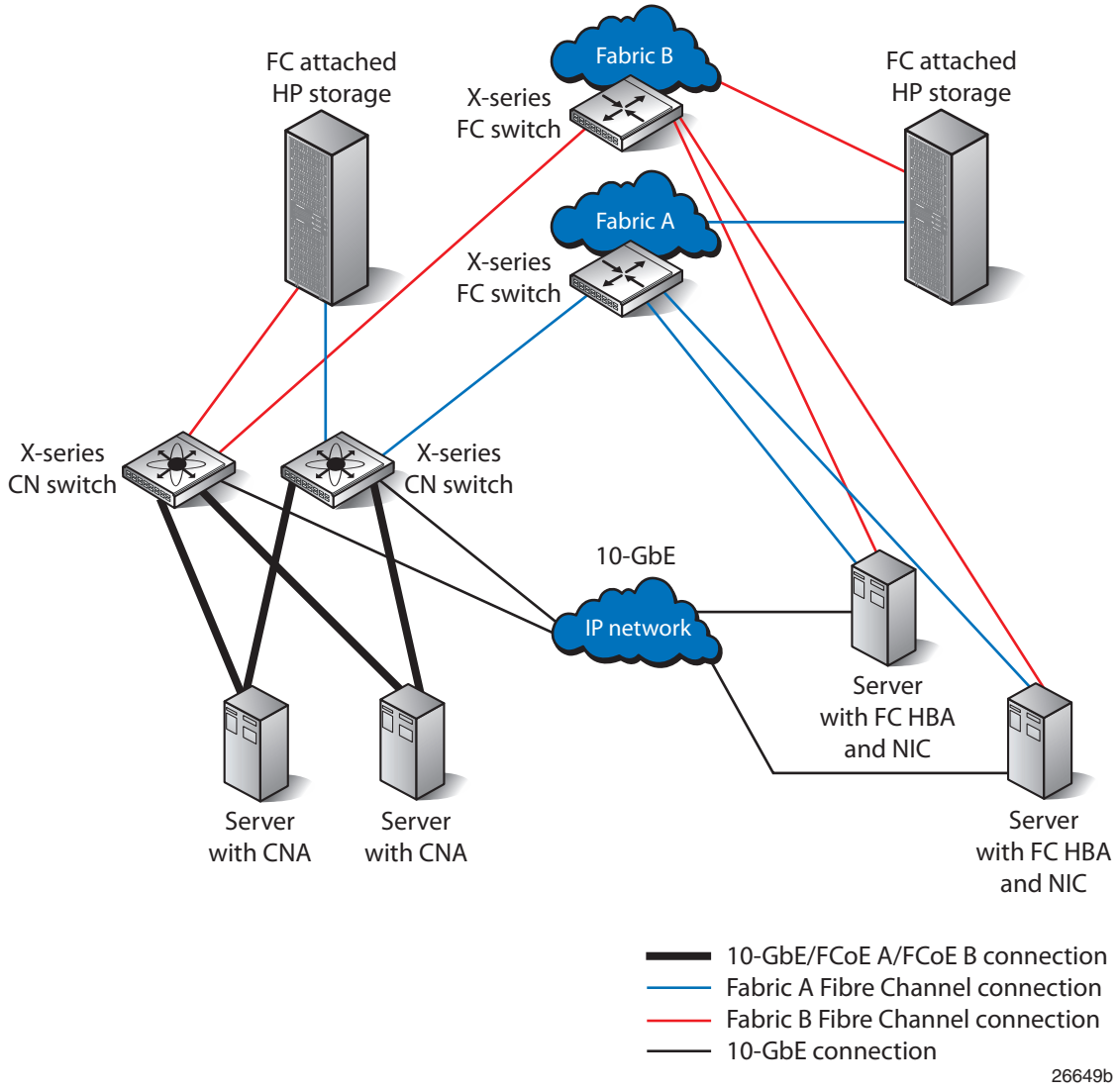

Figure 10 FCoE integrated with FC SAN fabric

Figure 11 shows an FCoE end-to-end direct-connect storage configuration using an MPX200 Multifunction Router and EVA storage systems. This provides 10-GbE FCoE and optionally, iSCSI connectivity for up to two EVA storage systems without requiring any Fibre Channel switches.

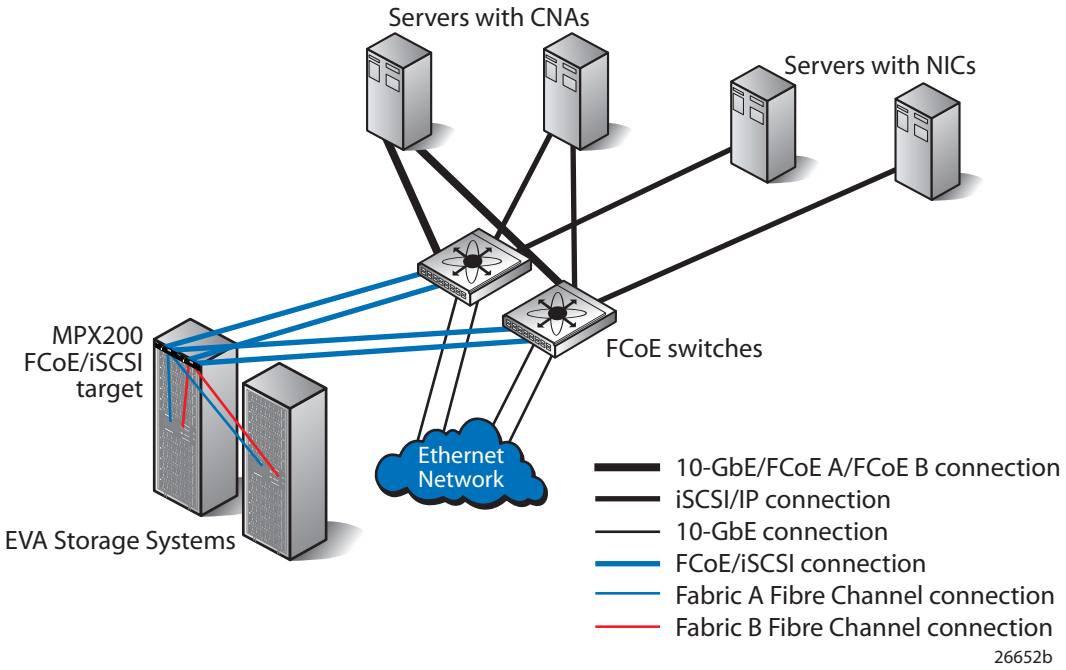

Figure 11 FCoE end-to-end direct-connect EVA storage configuration

The configuration shown in Figure 12 provides additional connectivity, allowing for up to four EVA storage systems using a fabric connection between the MPX200 and EVAs. In addition to FCoE and iSCSI, Fibre Channel connected servers can access the same EVA storage systems through the Fibre Channel fabric. This configuration provides the highest level of multi-protocol support with FCoE, iSCSI, and Fibre Channel connectivity for up to four EVA storage systems.

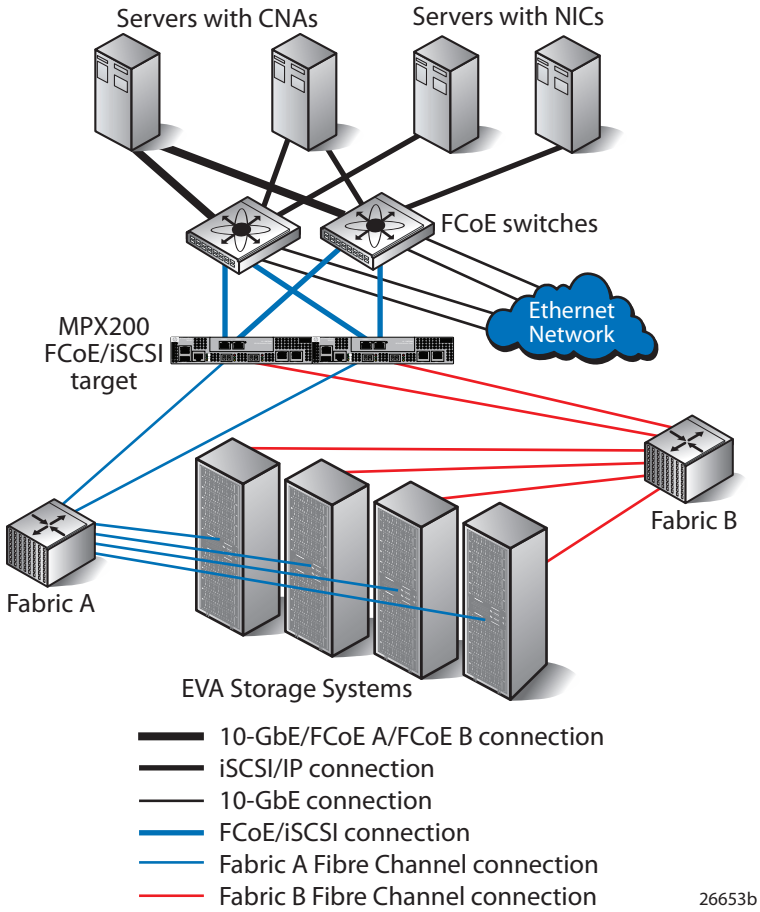

Figure 12 FCoE end-to-end fabric-connect EVA storage configuration

CNA configuration rules

Table 4 HP CNA requirements

Item	Description
Number of CNAs per server (maximum)	2
Cable types	• SFP+ optical • Copper

For current firmware and driver support, see the SPOCK website at http://www.hp.com/storage/spock. You must sign up for an HP Passport to enable access.

FCoE CN switch configuration rules

Table 5 DC SAN Director Switch 10/24 FCoE Blade and 2408 FCoE Converged Network Switch fabric rules

Rule number	Description
1	A 2408 FCoE Converged Network Switch or DC SAN Director Switch 10/24 Blade can be a standalone switch or an edge switch in a Fibre Channel fabric. To attach the switch to an existing Fibre Channel fabric as an edge switch, at least one Fibre Channel port on the FCoE CN switch must be connected to a Fibre Channel switch in the fabric (E_Port). There cannot be any other FCoE or 10-GbE CEE switches in the path to the Fibre Channel switch. Similarly, a DC or DC04 SAN Director with a 10/24 FCoE Blade installed can be a standalone switch, an edge switch, or a core switch in a Fibre Channel fabric. If it is an edge switch or core switch, other switches in the fabric can be attached to any available FC port (E_Port) on other FC blades in the director. For FCoE E_Port connectivity, see the appropriate Fabric OS release notes for the minimum and recommended Fibre Channel switch firmware versions and the supported Fibre Channel switch models. HP recommends Brocade FOS 6.3.0b or later.
2	Server CNAs must be directly connected to the CEE ports on a 2408 FCoE Converged Network Switch or DC SAN Director Switch 10/24 FCoE Blade.
3	Fibre Channel storage can be directly connected to the 2408 FCoE Converged Network Switch (one of the eight FC F_Ports) or to any Fibre Channel switch that is part of the same fabric as the 2408 FCoE Converged Network Switch. With the DC SAN Director Switch 10/24 FCoE Blade, storage can be connected to any of the other FC blades in the same director or to any Fibre Channel switch that is part of the same fabric as the DC SAN Director that contains the DC SAN Director Switch 10/24 FCoE Blade.
4	Supports a maximum of seven switch hops (eight switches) between a CNA and storage.
5	Supports the following CEE media types: • HP B-series hot pluggable, 10-GbE SFP+ Short Reach (SR) and Long Reach (LR) optical transceivers • HP B-series SFP+ 1 m, 3 m, or 5 m copper Twinax active cables (2408 FCoE Converged Network Switch only)
6	Up to 4,000 VLANs, but only one FCoE VLAN is currently supported
7	Only FPMA is currently supported.

Rule number	Description
8	Supports existing B-series Fibre Channel rules and features except for the following: • Advanced Zoning (port-based and QoS) • Extended Fabrics • Adaptive Networking with QoS • Virtual Fabrics • Integrated Fibre Channel Routing • FICON • Access Gateway • Admin Domains • TI Zones • M-EOS Interop • Nondisruptive firmware upgrade
9	A maximum of two DC SAN Director Switch 10/24 FCoE Blades per chassis are supported in DC and DC04 SAN Directors.
10	The DC SAN Director Switch 10/24 FCoE Blade does not support Twinax copper cables (SFP+).
11	DC and DC04 SAN Directors are supported for concurrent installation of the DC SAN Director Switch 10/24 FCoE Blade with the FC8-16, FC8-32, FC8-48 or FC10-6 blades only.

Table 6 C-series FCoE Converged Network switch fabric rules

Rule number	Description
1	A C-series FCoE CN switch can be a standalone switch or an edge switch in a Fibre Channel fabric. To attach the switch to an existing Fibre Channel fabric as an edge switch, at least one Fibre Channel port on the FCoE CN switch must be connected to a Fibre Channel switch in the fabric (E_Port). There cannot be any other FCoE or 10-GbE IEEE DCB switches in the path to the Fibre Channel switch. For FCoE E_Port connectivity, the Fibre Channel switch minimum firmware version is NX-OS 4.1(3)N1(1). All C-series 4 Gb/s or 8 Gb/s switch models are supported when using the minimum firmware version. MDS switches running SAN-OS 3.*x* can be in the Fibre Channel SAN but cannot be connected directly to an FCoE switch.
2	Server CNAs must be connected directly to FCoE CN switch IEEE DCB ports (pre-FIP support only).
3	Fibre Channel storage can be connected directly to the FCoE CN switch (F_Port) or to a Fibre Channel switch (F_Port) in the same fabric as the FCoE CN switch. SAN boot is not supported when storage systems are connected directly to FCoE Fibre Channel ports.
4	Supports a maximum of three switch hops (four switches) between a CNA and storage.
5	Supports the following IEEE DCB media types: • HP C-series hot pluggable, 10-GbE SFP+ Short Reach (SR) optical transceivers • HP C-series SFP+ 3m or 5m copper Twinax passive cables
6	Supports up to 50 switches in a single physical fabric or VSAN
7	Supports up to 40 domains per VSAN

Rule number	Description
8	Supports a maximum of 250 VLANs per switch
9	Supports a maximum of 32 VSANs per switch
10	Supports a maximum of 32 zones per virtual or physical F_Port (includes all VSANs)
11	Supports a maximum of 500 zone sets per switch (includes all VSANs)
12	Supports a maximum of 8,000 zone members per physical fabric (includes all VSANs)
13	Supports a maximum of 8,000 zones per switch (includes all VSANs)
14	Supports up to 52 virtual Fibre Channel interfaces per switch

Server support

FCoE is supported with ProLiant G5, G6, and G7 servers.

For current server support, see the server QuickSpecs at http://www.hp.com/go/quickspecs/.

Storage system support

This section describes storage system support for access from CNA-based servers. These storage systems can be attached to Fibre Channel switches in the fabric or connected to the Fibre Channel ports of an FCoE CN switch.

SAN boot is not supported when storage systems are connected to the Fibre Channel ports of an FCoE CN switch. SAN boot is supported for storage attached to the Fibre Channel ports in a SAN Director that contains a 10/24 FCoE blade and based on the current support listed for Fibre Channel switches.

The following storage systems are supported with HP CN1000E and CN1000Q CNAs:

- MSA2000fc G2 (MSA2312fc/MSA2324fc)
- MSA2000fc (MSA2012fc/MSA2212fc)—Supported on CN1000E only
- P2000 G3
- EVA4400
- EVA4400 with embedded switch[1]
- EVA4100/6100/8100
- EVA6400/8400
- XP10000/12000
- XP20000/24000

[1]The EVA4400 with the embedded switch is not supported for connectivity to C-series Fibre Channel switches or Nexus Converged Network Switches.

For current storage system controller software support, see the SPOCK website at http://www.hp.com/storage/spock. You must sign up for an HP Passport to enable access.

Operating system support

For current operating system support, see the SPOCK website at http://www.hp.com/storage/spock. You must sign up for an HP Passport to enable access.

Boot from SAN support

BFS is not supported for FC arrays attached to 2408 FCoE Converged Network Switches or C-series Nexus 5000 Converged Network Switches at this time. BFS is supported for FC arrays attached to standard FC switches in a fabric that includes CN switches.

DC SAN Director Switch 10/24 FCoE Blade supports BFS from the storage attached to any of the other FC blades in the same director or to any Fibre Channel switch that is part of the same fabric as the DC SAN Director that contains the 10/24 FCoE Blade.

This section provides information about installing BFS software.

Windows 2003 (x86, x64) and 2008 (x86, x64)

- BFS is supported on all supported HP servers.
- The information in *HP StorageWorks Fibre Channel Host Bus Adapters Software Guide for Windows* (available on http://h18006.www1.hp.com/storage/networking/bootsan.html) is accurate for Windows BFS on a CNA based server for Windows 2003 with the following exceptions:
  - You must install an HP CNA driver kit (available for download at the HP website: http://www.hp.com/support/downloads
  - For Windows 2003, press **F6** to prompt for the driver disk
  - For Windows 2008, click **Load Driver** when prompted for the location in which to install Windows (see Figure 13).

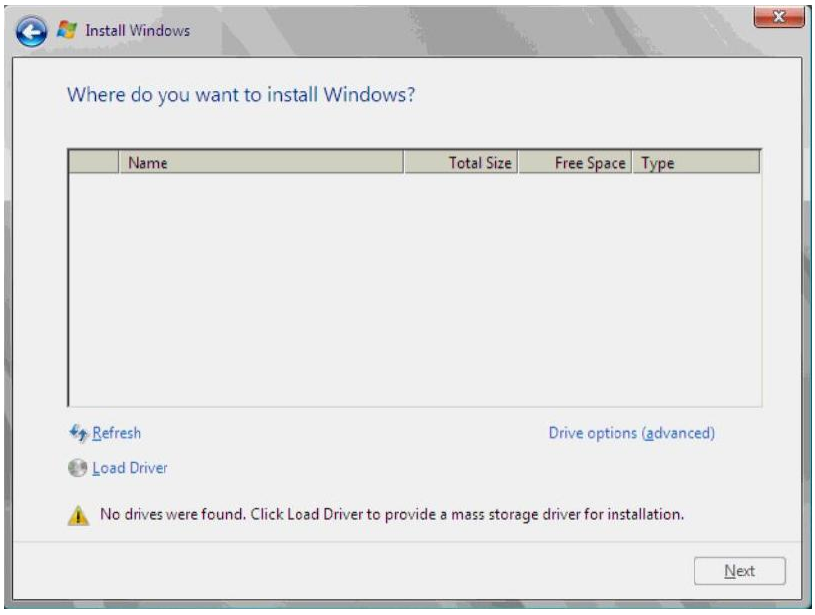

Figure 13 Install Windows 2008 (x86, x64)

Red Hat Enterprise Linux

- BFS is supported on all supported HP servers.
- The information in *HP StorageWorks Fibre Channel Host Bus Adapters Software Guide for Linux* (available at http://h18006.www1.hp.com/storage/networking/bootsan.html) is accurate for BFS on a CNA based server with the following exceptions:
  - You must install an HP CNA driver kit (available for download at the HP website: http://www.hp.com/support/downloads).
  - Use the `linux dd mpath` rather than the `linux mpath` command to prompt to load a driver and enable multipath for the installation.

SUSE Linux Enterprise Server

- BFS is supported on all supported HP servers.
- The information in *HP StorageWorks Fibre Channel Host Bus Adapters Software Guide for Linux* (available at http://h18006.www1.hp.com/storage/networking/bootsan.html) is accurate for BFS on a CNA based server with the following exception:
  - Use the GUI to load the driver (Figure 14).

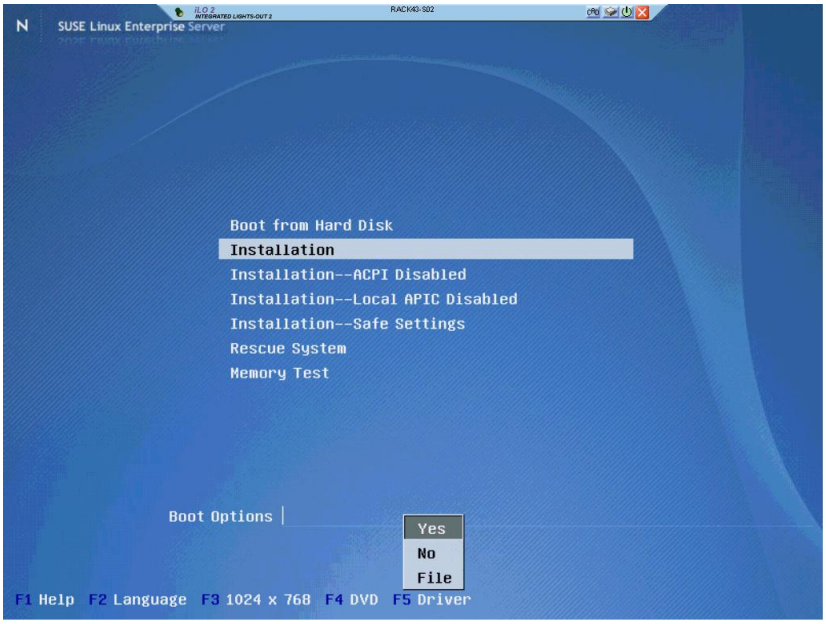

Figure 14 SLES installation

Multipathing software support

For current multipathing software support, see the SPOCK website at http://www.hp.com/storage/spock. You must sign up for an HP Passport to enable access.

Quick-setup instructions

FCoE CN switches have dual capabilities in that they serve as both an Ethernet switch and an FC switch. You must perform a setup procedure to achieve the desired function.

If you are familiar with the FCoE CN switch vendor's FC switches, then you are familiar with the commands required to configure that portion of the FCoE CN switch setup. The procedures in this section are intended as a quick-start guide to configuring the FCoE ports on an FCoE CN switch to access the FC ports on the FCoE CN switch and other attached FC switches.

2408 FCoE Converged Network Switch and DC SAN Director Switch 10/24 FCoE Blade quick setup

This procedure is intended for users who are familiar with Brocade FC switches and have experience merging B-series FC switches into an existing FC fabric. Use this procedure to enable servers with CNAs attached to the 2408 FCoE Converged Network Switch or the DC SAN Director Switch 10/24 FCoE Blade to access devices on the attached B-series FC fabric.

IMPORTANT:

If you are not familiar with Brocade FC switches or you do not have experience merging B-series FC switches into an existing FC fabric, use the detailed instructions found in the switch user guide to set up your switch.

1. Configure LLDP for FCoE (common to all CEE ports).

```
switch:admin> cmsh
switch# enable
switch# config terminal
switch(config)# protocol lldp
switch(conf-lldp)# advertise dcbx-fcoe-app-tlv
switch(conf-lldp)# advertise dcbx-fcoe-logical-link-tlv
switch(conf-lldp)# exit
```

2. Create a CEE map to carry LAN traffic (60%) and SAN traffic (40%) (common to all CEE ports).

```
switch(config)# cee-map default
switch(conf-ceemap)# priority-group-table 1 weight 40 pfc
switch(conf-ceemap)# priority-group-table 2 weight 60
switch(conf-ceemap)# priority-table 2 2 2 1 2 2 2 2
switch(conf-ceemap)# exit
```

3. Create an FCoE VLAN for traffic to and from the FC fabric (required for FCoE).

```
switch(config)# vlan classifier rule 1 proto fcoe encap ethv2
switch(config)# vlan classifier rule 2 proto fip encap ethv2
switch(config)# vlan classifier group 1 add rule 1
switch(config)# vlan classifier group 1 add rule 2
switch(config)# interface vlan 5        (Can be any VLAN number other than 1)
switch(conf-if-vl-5)# fcf forward
switch(conf-if-vl-5)# exit
```

4. Configure interfaces (required for each port being configured).

```
switch(config)# interface tengigabitethernet 0/0          Change Port ID
switch(config-if-te-0/0)# switchport
switch(config-if-te-0/0)# switchport mode converged[1]
switch(config-if-te-0/0)# switchport converged allowed vlan add 5[1]   FCoE Required (Step 3 VLAN)
switch(config-if-te-0/0)# vlan classifier activate group 1 vlan 5[1]
switch(config-if-te-0/0)# cee default[1]
switch(config-if-te-0/0)# exit
```

[1]This command allows the port to access the FCoE VLAN. You can omit this command for non-FCoE ports; however, both FCoE and non-FCoE ports might require a similar command for access to other VLANs.

5. Repeat Step 4 for each interface you are configuring.
6. Perform a port shutdown/no shutdown operation (required for each port for the configuration change to be enabled).

```
switch(config)# interface tengigabitethernet 0/0          Change Port ID
 switch(config-if-te-0/0)# shutdown
 switch(config-if-te-0/0)# no shutdown
 switch(config-if-te-0/0)# exit
```

7. Repeat Step 6 for each interface you are configuring.
8. Save the running configuration to boot flash.

```
switch(config)# exit
switch# copy running-config startup-config
Overwrite the startup config file (y/n): y
Building configuration...
switch#
```

9. Verify that the CEE port link status and VLAN status are correct.

```
switch# show ip interface brief
Interface                  IP-Address       Status                Protocol
=========                  ==========       ======                ========
TenGigabitEthernet 0/0     unassigned       up                    up

switch#show vlan brief

VLAN     Name            State   Ports
                                 (u)-Untagged, (t)-Tagged
======= ================ ======= ================================
1        default          ACTIVE  Te 0/0(u)…
5        VLAN0005         ACTIVE  Te 0/0(u)…

switch# exit
switch:admin>
```

10. Verify the status of the FC and FCoE virtual FC ports.

```
BR8000-01:admin> switchshow
switchName:     BR8000-1
switchType:     76.7
switchState:    Online
switchMode:     Native
switchRole:     Subordinate
switchDomain:   4
switchId:       fffc04
switchWwn:      10:00:00:05:1e:76:77:80
zoning:         ON (Brocade_East)
switchBeacon:   OFF
FC Router:      OFF
FC Router BB Fabric ID: 1

Index Port Address Media Speed State     Proto
==============================================
  0   0   040000   id    N4   Online      FC  E-Port  10:00:00:05:1e:36:2a:70 "BR48-02"
  1   1   040100   id    N4   Online      FC  E-Port  10:00:00:05:1e:36:2a:70 "BR48-02"
  2   2   040200   id    N4   Online      FC  E-Port  10:00:00:05:1e:36:2a:70 "BR48-02"
  3   3   040300   id    N4   Online      FC  E-Port  10:00:00:05:1e:36:2a:70 "BR48-02" (upstream)
  4   4   040400   id    N8   No_Light    FC
  5   5   040500   id    N8   No_Light    FC
  6   6   040600   id    N8   No_Light    FC
  7   7   040700   id    N8   No_Light    FC
  8   8   040800   --    10G   Online     FCoE VF-Port  1 VN-Port(s)
  9   9   040900   --    10G   Online     FCoE VF-Port  1 VN-Port(s)
 10  10   040a00   --    10G   Online     FCoE VF-Port  0 VN-Port(s)
 11  11   040b00   --    10G   Online     FCoE VF-Port  1 VN-Port(s)
 12  12   040c00   --    10G   Online     FCoE VF-Port  1 VN-Port(s)
 13  13   040d00   --    10G   Online     FCoE VF-Port  1 VN-Port(s)
 14  14   040e00   --    10G   Online     FCoE VF-Port  1 VN-Port(s)
 15  15   040f00   --    10G   Online     FCoE VF-Port  1 VN-Port(s)
 16  16   041000   --    10G   Online     FCoE VF-Port  1 VN-Port(s)
 17  17   041100   --    10G   Online     FCoE VF-Port  0 VN-Port(s)
 18  18   041200   --    10G   Online     FCoE VF-Port  0 VN-Port(s)
 19  19   041300   --    10G   Online     FCoE VF-Port  0 VN-Port(s)
 20  20   041400   --    10G   Online     FCoE VF-Port  1 VN-Port(s)
 21  21   041500   --    10G   Online     FCoE VF-Port  1 VN-Port(s)
 22  22   041600   --    10G   Online     FCoE VF-Port  0 VN-Port(s)
 23  23   041700   --    10G   Online     FCoE VF-Port  0 VN-Port(s)
 24  24   041800   --    10G   Online     FCoE VF-Port  0 VN-Port(s)
 25  25   041900   --    10G   Online     FCoE VF-Port  0 VN-Port(s)
 26  26   041a00   --    10G   Online     FCoE VF-Port  0 VN-Port(s)
 27  27   041b00   --    10G   Online     FCoE VF-Port  0 VN-Port(s)
 28  28   041c00   --    10G   Online     FCoE VF-Port  0 VN-Port(s)
 29  29   041d00   --    10G   Online     FCoE VF-Port  0 VN-Port(s)
 30  30   041e00   --    10G   Online     FCoE VF-Port  0 VN-Port(s)
 31  31   041f00   --    10G   Online     FCoE VF-Port  0 VN-Port(s)
```

NOTE:

Ports 8 through 31 are the virtual FC ports. To display the FCoE virtual FC devices connected to those ports, enter the following command.

```
BR8000-01:admin> fcoe --loginshow
================================================================================
Port    Te port        Device WWN              Device MAC        Session MAC
================================================================================
8       Te 0/0    10:00:00:00:c9:93:c9:13  00:00:c9:93:c9:13  0e:fc:00:04:08:01
9       Te 0/1    10:00:00:00:c9:93:c9:2b  00:00:c9:93:c9:2b  0e:fc:00:04:09:01
11      Te 0/3    10:00:00:00:c9:93:c8:b3  00:00:c9:93:c8:b3  0e:fc:00:04:0b:01
12      Te 0/4    10:00:00:00:c9:93:ca:8b  00:00:c9:93:ca:8b  0e:fc:00:04:0c:01
13      Te 0/5    10:00:00:00:c9:93:c9:bf  00:00:c9:93:c9:bf  0e:fc:00:04:0d:01
14      Te 0/6    10:00:00:00:c9:93:ca:e3  00:00:c9:93:ca:e3  0e:fc:00:04:0e:01
15      Te 0/7    10:00:00:00:c9:93:ca:eb  00:00:c9:93:ca:eb  0e:fc:00:04:0f:01
16      Te 0/8    10:00:00:00:c9:93:c9:1b  00:00:c9:93:c9:1b  0e:fc:00:04:10:01
20      Te 0/12   10:00:00:00:c9:93:ca:93  00:00:c9:93:ca:93  0e:fc:00:04:14:01
21      Te 0/13   10:00:00:00:c9:93:c8:43  00:00:c9:93:c8:43  0e:fc:00:04:15:01
BR8000-1:admin>
```

HP C-series Nexus 5010/20 Converged Network Switch quick setup

This procedure is intended for users who are familiar with Cisco MDS FC switches and have experience merging C-series MDS FC switches into an existing MDS FC fabric. Use this procedure to enable servers with CNAs attached to the HP C-series Nexus 5010/20 Converged Network Switch to access devices on the attached C-series FC fabric.

IMPORTANT:

If you are not familiar with Cisco FC switches or you do not have experience merging C-series FC switches into an existing FC fabric, use the detailed instructions found in the switch user guide to set up your switch.

HP recommends that you use the VFC port assignments listed in Table 7.

Table 7 Recommended VFC port assignments

Model	Slot	Number of FCoE ports (maximum)	VFC port assignments (recommended)
HP C-series Nexus 5010 Converged Network Switch	1 (Standard)	20	VFC ports 1 through 20
	2 (Optional expansion module slot[1])	6	VFC ports 41 through 46
HP C-series Nexus 5020 Converged Network Switch	1 (Standard)	40	VFC ports 1 through 40
	2 (Optional expansion module slot[1])	6	VFC ports 41 through 46
	3 (Optional expansion module slot[1])	6	VFC ports 47 through 52

[1]Optional expansion module slots can contain either 10-GbE ports or FC ports.

In the following examples, FCoE is enabled on a C-series Nexus 5010 Converged Network Switch, VLAN 200 is created, and the Ethernet ports are bound to a virtual SAN (VSAN 2) from an 8-port FC expansion module. The commands are the same for the HP C-series Nexus 5020 Switch.

To establish CNA connectivity and enable login to the HP C-series Nexus 5000 Converged Network Switch, configure the IEEE DCB ports as follows:

1. Enable FCoE (disabled by default).

NOTE:

The C-series Nexus 5000 Converged Network Switch will require a reload (reboot).

```
Nexus5010# configure terminal
Nexus5010(config)# feature fcoe
Nexus5010(config)# feature npiv
Nexus5010(config)# 2009 Apr  1 12:05:06 Nexus5010 %$ VDC-1 %$ %PLATFORM-2-
FC_LICENSE_DESIRED: FCoE/FC feature will be enabled after the configuration
is saved followed by a reboot
Nexus5010(config)# exit
Nexus5010# copy running-config startup-config
[########################################] 100%
Packaging and storing to flash: \
Packaging and storing to flash: |
Packaging and storing to flash: /
```

NOTE:

Depending on the NX-OS version, a reload may be required when enabling features. When you execute the `feature` command, a message appears to indicate if a reload is required.

2. Reload the system if you are directed to do so. Otherwise, proceed to Step 3.

```
Nexus5010# reload

WARNING: This command will reboot the system
Do you want to continue? (y/n) [n] y
The system is going down for reboot NOW!
```

3. Create a new VLAN for FCoE.

   By default, all ports are in VLAN 1, however, you must use a different VLAN for FCoE. In the following example, VLAN 200 is created with access to Ethernet ports 1/1 to 1/20, and VFC ports 1–20 are also created.

NOTE:

In the last section of this example, `1/1-20` indicates that the commands that follow apply to multiple ports (in this case, ports 1/1 through 1/20). All 20 ports are set for `switchport mode trunk`, and `switchport trunk allowed` is set for VLANs 1 and 200.

```
Nexus5010# configure terminal
Nexus5010(config)# vlan 200
Nexus5010(config-vlan)# exit
Nexus5010(config)# exit
Nexus5010# show vlan brief
VLAN Name Status Ports
---- -------------------------------- ------- -------------------------
1    default active   Eth1/1, Eth1/2, Eth1/3,
  Eth1/4, Eth1/5, Eth1/6,
  Eth1/7, Eth1/8, Eth1/9,
  Eth1/10, Eth1/11, Eth1/12,
  Eth1/13, Eth1/14, Eth1/15,
  Eth1/16, Eth1/17, Eth1/18,
  Eth1/19, Eth1/20
200  VLAN0200 active

Nexus5010# configure terminal
Nexus5010(config)# interface ethernet 1/1-20
Nexus5010(config-if-range)# switchport mode trunk
Nexus5010(config-if-range)# switchport trunk allowed vlan 1, 200[1]
Nexus5010(config-if-range)# interface vfc 1-20
Nexus5010(config-if-range)# exit
```

[1]This command allows the port to access the FCoE VLAN (VLAN 200 in this example). For non-FCoE ports, you can omit the FCoE VLAN from this command; however, both FCoE and non-FCoE ports might require access to other VLANs.

4. Create a new VSAN that includes the FC and VFC ports.

   By default, all ports are in VSAN 1. HP recommends that you use a different VSAN for SAN connectivity. In this example, VSAN 2 is created and includes FC ports 2/1 through 2/8 and VFC ports 1 through 20.

NOTE:

VFC ports must be FCoE ports. FC ports cannot be VFC ports.

```
Nexus5010# configure terminal
Nexus5010(config)# vsan database
Nexus5010(config-vsan-db)# vsan 2
Nexus5010(config-vsan-db)# vsan 2 interface fc2/1-8
Nexus5010(config-vsan-db)# vsan 2 interface vfc 1-20
Nexus5010(config-vsan-db)# exit
Nexus5010(config)# exit
Nexus5010# show vsan membership
vsan 1 interfaces:

vsan 2 interfaces:
fc2/1   fc2/2   fc2/3   fc2/4   fc2/5   fc2/6   fc2/7   fc2/8
vfc1    vfc2    vfc3    vfc4    vfc5    vfc6    vfc7    vfc8
vfc9    vfc10   vfc11   vfc12   vfc13   vfc14   vfc15   vfc16
vfc17   vfc18   vfc19   vfc20

vsan 4094(isolated_vsan) interfaces:
```

5. Associate the VLAN with the VSAN.

   In this example, VLAN 200 is associated with VSAN 2.

```
Nexus5010# configure terminal
Nexus5010(config)# vlan 200
Nexus5010(config-vlan)# fcoe vsan 2
Nexus5010(config-vlan)# exit
Nexus5010(config)# exit
Nexus5010# show vlan fcoe

VLAN      VSAN      Status
--------  --------  --------
200       2         Operational
```

6. Bind each VFC port to a unique Ethernet port by issuing the following commands on each port:

```
interface vfc n
bind interface ethernet slot/port
exit
```

NOTE:

Depending on your switch, up to 52 VFC ports may be available.

In Example 1, VFC ports 1 through 8 are created and are bound to Ethernet ports 1/1 through 1/8, respectively. Example 2 shows a more complex configuration in which the VFC ports are not sequential.

Example 1. Creating and binding consecutive VFC ports

```
Nexus5010# configure terminal
Nexus5010(config)# interface vfc 1
Nexus5010(config-if)# bind interface ethernet 1/1
Nexus5010(config-if)# exit
Nexus5010(config)# interface vfc 2
Nexus5010(config-if)# bind interface ethernet 1/2
Nexus5010(config-if)# exit
Nexus5010(config)# interface vfc 3
Nexus5010(config-if)# bind interface ethernet 1/3
Nexus5010(config-if)# exit
Nexus5010(config)# interface vfc 4
Nexus5010(config-if)# bind interface ethernet 1/4
Nexus5010(config-if)# exit
Nexus5010(config)# interface vfc 5
Nexus5010(config-if)# bind interface ethernet 1/5
Nexus5010(config-if)# exit
Nexus5010(config)# interface vfc 6
Nexus5010(config-if)# bind interface ethernet 1/6
Nexus5010(config-if)# exit
Nexus5010(config)# interface vfc 7
Nexus5010(config-if)# bind interface ethernet 1/7
Nexus5010(config-if)# exit
Nexus5010(config)# interface vfc 8
Nexus5010(config-if)# bind interface ethernet 1/8
Nexus5010(config-if)# exit
Nexus5010(config)# interface vfc 1-8
Nexus5010(config-if)# no shutdown
Nexus5010(config-if)# exit
```

IMPORTANT:

Example 2 is provided for reference only. It shows an alternate method of performing this step.

In Example 2, VFC ports 1 through 6, 10, and 20 through 25 are created, and each VFC port is bound to an Ethernet port. Because the VFC ports are not sequential, multiple `interface vfc` commands are required.

Example 2. Creating and binding nonconsecutive VFC ports

```
Nexus5020# configure terminal
Nexus5020(config)# interface vfc 1
Nexus5020(config-if)# bind interface ethernet 1/1
Nexus5020(config-if)# exit
Nexus5020(config)# interface vfc 2
Nexus5020(config-if)# bind interface ethernet 1/2
Nexus5020(config-if)# exit
Nexus5020(config)# interface vfc 3
Nexus5020(config-if)# bind interface ethernet 1/3
Nexus5020(config-if)# exit
Nexus5020(config)# interface vfc 4
Nexus5020(config-if)# bind interface ethernet 1/4
Nexus5020(config-if)# exit
Nexus5020(config)# interface vfc 5
Nexus5020(config-if)# bind interface ethernet 1/5
Nexus5020(config-if)# exit
Nexus5020(config)# interface vfc 6
Nexus5020(config-if)# bind interface ethernet 1/6
Nexus5020(config-if)# exit
Nexus5020(config)# interface vfc 10
Nexus5020(config-if)# bind interface ethernet 1/10
Nexus5020(config-if)# exit
Nexus5020(config)# interface vfc 20
Nexus5020(config-if)# bind interface ethernet 1/20
Nexus5020(config-if)# exit
Nexus5020(config)# interface vfc 21
Nexus5020(config-if)# bind interface ethernet 1/21
Nexus5020(config-if)# exit
Nexus5020(config)# interface vfc 22
Nexus5020(config-if)# bind interface ethernet 1/22
Nexus5020(config-if)# exit
Nexus5020(config)# interface vfc 23
Nexus5020(config-if)# bind interface ethernet 1/23
Nexus5020(config-if)# exit
Nexus5020(config)# interface vfc 24
Nexus5020(config-if)# bind interface ethernet 1/24
Nexus5020(config-if)# exit
Nexus5020(config)# interface vfc 25
Nexus5020(config-if)# bind interface ethernet 1/25
Nexus5020(config-if)# exit
Nexus5020(config)# interface vfc 1-6
Nexus5020(config-if)# no shutdown
Nexus5020(config-if)# exit
Nexus5020(config)# interface vfc 10
Nexus5020(config-if)# no shutdown
Nexus5020(config-if)# exit
Nexus5020(config)# interface vfc 20-25
Nexus5020(config-if)# no shutdown
Nexus5020(config-if)# exit
```

7. Enable the FC ports.

   In this example, FC ports 2/1 through 2/8 are enabled.

```
Nexus5010(config)# interface fc 2/1-8
Nexus5010(config-if)# no shutdown
Nexus5010(config-if)# exit
Nexus5010(config)# exit
```

8. Copy the running configuration to the startup configuration location.

```
Nexus5010# copy running-config startup-config
[########################################] 100%
```

9. Copy the running configuration to a backup location.

```
Nexus5010# copy running-config ftp://10.10.20.1/backup.txt
```

10. Verify the configuration.

```
Nexus5010# show interface brief

Nexus5010# show running-config
```

Glossary of terms

3PO	third-party option
ASIC	application-specific integrated circuit
BFS	boot from SAN
CEE	converged enhanced Ethernet
CN	converged network
CNA	converged network adapter
DCB	Data Center Bridging
DSM	device-specific module
EoR	End of Row (switch)
FC	Fibre Channel
FCoE	Fibre Channel over Ethernet
FF	full-featured
FIP	FCoE Initialization Protocol
FOS	Fabric Operating System (Brocade)
FPMA	Fabric Provided MAC Addressing
GbE	Gigabit Ethernet
HBA	host bus adapter
IOS	Internetwork Operating System (Cisco)
ISL	interswitch link
LAG	link aggregation group
LLDP	Link Layer Discovery Protocol
LR	Long Reach (optical)
NIC	network interface card
QoS	quality of service
RHEL	Red Hat Enterprise Linux
RU	rack unit
SAN	storage area network
SAN-OS	SAN Operating System (Cisco)
SFP+	small form-factor pluggable, plus (transceiver)

SLES	SUSE Linux Enterprise Server
SR	Short Reach (optical)
ToR	Top of Rack (switch)
unified fabric	IEEE DCB enabled network (Cisco)
VFC	virtual Fibre Channel
VLAN	virtual LAN