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CONTENTS

PREFACE  

Preface  v  
  Audience  v  
  Document Conventions  v  
  Documentation Feedback  vi  
  Communications, Services, and Additional Information  vi

CHAPTER 1  
New and Changed Information  1  
  Change Summary  1

CHAPTER 2  
Overview  3  
  Information About Fibre Channel Over Ethernet  3  
  Fibre Channel Forwarder  3  
  Fibre Channel Bridge  4

CHAPTER 3  
Preparing the Switch for Configuring FCoE  5  
  Information About FCoE  5  
    FCoE and FIP  5  
      FCoE Initiation Protocol  5  
      FIP Virtual Link Instantiation  6  
      FCoE Frame Format  6  
      VLAN Tagging for FCoE Frames  6  
      FIP Ethernet Frame Format  6  
    DCBX  7  
      Data Center Bridging Exchange Protocol  7  
    Lossless Ethernet  7  
      Logical Link Up/Down  8
Contents

Converged Network Adapters  8
STP Lite  8
Default Settings for FCoE  9
Guidelines and Limitations  9
Enabling and Disabling FCoE  9
Configuring the FC-Map  9
Configuring the Fabric Priority  10
Setting the Advertisement Interval  10
Disabling LAN Traffic on an FCoE Link  11
Additional References for FCoE  12

CHAPTER 4 Configuring FCoE VLANs and Virtual Fibre Channel Interfaces  13
Information About Virtual Fibre Channel (VFC) Interfaces  13
VF Port  13
VE Port  13
VNP Ports  14
Default Settings for FCoE  14
Guidelines and Limitations  14
Configuring Virtual Interfaces  14
Mapping a VSAN to a VLAN  14
Creating a Virtual Fibre Channel Interface  16
Creating a Virtual Fibre Channel Port Channel Interface  17
Associating a Virtual Fibre Channel Interface to a VSAN  18
Enabling VE Loopback Configuration  19
Verifying the Virtual Fibre Channel Interface  20
Example: Mapping VSANs to VLANs  22
Verifying the FCoE Configuration  23
Additional References for FCoE  24
Preface

The preface contains the following sections:

- Audience, on page v
- Document Conventions, on page v
- Documentation Feedback, on page vi
- Communications, Services, and Additional Information, on page vi

Audience

This publication is for network administrators who configure and maintain Cisco Nexus devices.

Document Conventions

Note

As part of our constant endeavor to remodel our documents to meet our customers' requirements, we have modified the manner in which we document configuration tasks. As a result of this, you may find a deviation in the style used to describe these tasks, with the newly included sections of the document following the new format.

Command descriptions use the following conventions:

<table>
<thead>
<tr>
<th>Convention</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>bold</strong></td>
<td>Bold text indicates the commands and keywords that you enter literally as shown.</td>
</tr>
<tr>
<td><em>Italic</em></td>
<td>Italic text indicates arguments for which the user supplies the values.</td>
</tr>
<tr>
<td>[x]</td>
<td>Square brackets enclose an optional element (keyword or argument).</td>
</tr>
<tr>
<td>[x</td>
<td>y]</td>
</tr>
<tr>
<td>{x</td>
<td>y}</td>
</tr>
<tr>
<td>Convention</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>[x {y</td>
<td>z}]</td>
</tr>
<tr>
<td>variable</td>
<td>Indicates a variable for which you supply values, in context where italics cannot be used.</td>
</tr>
<tr>
<td>string</td>
<td>A nonquoted set of characters. Do not use quotation marks around the string or the string will include the quotation marks.</td>
</tr>
</tbody>
</table>

Examples use the following conventions:

<table>
<thead>
<tr>
<th>Convention</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>screen font</td>
<td>Terminal sessions and information the switch displays are in screen font.</td>
</tr>
<tr>
<td>boldface screen font</td>
<td>Information you must enter is in boldface screen font.</td>
</tr>
<tr>
<td>italic screen font</td>
<td>Arguments for which you supply values are in italic screen font.</td>
</tr>
<tr>
<td>&lt;&gt;</td>
<td>Nonprinting characters, such as passwords, are in angle brackets.</td>
</tr>
<tr>
<td>[ ]</td>
<td>Default responses to system prompts are in square brackets.</td>
</tr>
<tr>
<td>!, #</td>
<td>An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.</td>
</tr>
</tbody>
</table>

This document uses the following conventions:

**Note**

Means reader take note. Notes contain helpful suggestions or references to material not covered in the manual.

**Caution**

Means reader be careful. In this situation, you might do something that could result in equipment damage or loss of data.

## Documentation Feedback

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We appreciate your feedback.

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• To obtain general networking, training, and certification titles, visit Cisco Press.
• To find warranty information for a specific product or product family, access Cisco Warranty Finder.

Cisco Bug Search Tool

Cisco Bug Search Tool (BST) is a web-based tool that acts as a gateway to the Cisco bug tracking system that maintains a comprehensive list of defects and vulnerabilities in Cisco products and software. BST provides you with detailed defect information about your products and software.
New and Changed Information

This chapter contains the following sections:

- Change Summary, on page 1

Change Summary

Overview

This chapter contains the following sections:

• Information About Fibre Channel Over Ethernet, on page 3
• Fibre Channel Forwarder, on page 3
• Fibre Channel Bridge, on page 4

Information About Fibre Channel Over Ethernet

Fibre Channel over Ethernet (FCoE) allows Fibre Channel traffic to be encapsulated over a physical Ethernet link. FCoE and FIP frames use a unique EtherType so that FCoE traffic and standard Ethernet traffic can be carried on the same link.

Classic Ethernet is a best-effort protocol, which means that in a congested network, Ethernet discards packets and relies on higher level protocols to provide retransmission and other reliability mechanisms.

Fibre Channel traffic requires a lossless transport layer; as a data storage protocol, it is unacceptable to lose a single data packet. Native Fibre Channel implements a lossless service at the transport layer using a buffer-to-buffer credit system.

Ethernet links on Cisco NX-OS switches provide two mechanisms to ensure lossless transport for FCoE traffic: link-level flow control and priority flow control.

IEEE 802.3x link-level flow control allows a congested receiver to signal the far end to pause the data transmission for a short period of time. The pause functionality is applied to all traffic on the link.

The priority flow control (PFC) feature on Cisco NX-OS platforms applies pause functionality to specific classes of traffic on the Ethernet link. For example, PFC can provide lossless service for the FCoE traffic and best-effort service for the standard Ethernet traffic using IEEE 802.1p traffic classes.

Fibre Channel Forwarder

Fibre Channel traffic requires a lossless transport layer, which means that it requires a data storage protocol that does not lose a single data packet. A FCoE Forwarder (FCF) communicates with FCoE end devices, such as converged network adapters (CNAs). The FCF accepts the Fibre Channel frame that is encapsulated in an Ethernet packet and forwards that packet over a VLAN across an Ethernet network to a remote FCoE end device. The FCF has a unique FC-MAC address in the FCoE network. An FCF can also assign FC address IDs to the CNAs. An FCF can assign Fabric Provide MAC Addresses (FPMA) to the CNAs consisting of the FC-Map Value for the Fabric and the Fibre Channel IDs (FC IDs) assigned during Fabric Login.
Fibre Channel Bridge

A Fibre Channel Bridge connects an FCoE network to a Fibre Channel network. A Fibre Channel Bridge decapsulates an FCoE frame and sends the Fibre Channel frame to the Fibre Channel network. A Fibre Channel Bridge also encapsulates FC frames from a Fibre Channel network and forwards them to the FCoE network.
Preparation the Switch for Configuring FCoE

- Information About FCoE, on page 5
- Default Settings for FCoE, on page 9
- Guidelines and Limitations, on page 9
- Enabling and Disabling FCoE, on page 9
- Configuring the FC-Map, on page 9
- Configuring the Fabric Priority, on page 10
- Setting the Advertisment Interval, on page 10
- Disabling LAN Traffic on an FCoE Link, on page 11
- Additional References for FCoE, on page 12

Information About FCoE

FCoE provides a method of transporting Fibre Channel traffic over a physical Ethernet connection. FCoE requires the underlying Ethernet to be full duplex and to provide lossless behavior for Fibre Channel traffic.

Note

Lossless behavior on Ethernet is provided by using a priority flow control (PFC) mechanism that prevents packet loss during congestion conditions.

The Cisco NX-OS software supports T11-compliant FCoE on all 10-Gigabit and 40-Gigabit Ethernet interfaces.

FCoE and FIP

FCoE Initiation Protocol

The FCoE Initialization Protocol (FIP) allows the switch to discover and initialize FCoE-capable entities that are connected to an Ethernet LAN. Cisco NX-OS switches support the Converged Enhanced Ethernet Data Center Bridging Exchange (CEE-DCBX) protocol for T11-compliant Generation 2 CNAs.

The following switches do not support Pre-FIP on Generation 1 CNAs:
FIP Virtual Link Instantiation

FIP is used to perform device discovery, initialization, and link maintenance. FIP performs the following tasks:

- **FIP VLAN discovery**—Discovers the FCoE VLAN that will be used by all other FIP protocols as well as by the FCoE encapsulation for Fibre Channel payloads on the established virtual link. FIP VLAN discovery occurs in the native VLAN used by the initiator or target to exchange Ethernet traffic. The FIP VLAN discovery protocol is the only FIP protocol running on the native VLAN; all other FIP protocols run on the discovered FCoE VLANs.

- **FIP FCF discovery**—When a FCoE device is connected to the fabric, it sends a Discovery Solicitation message. A Fibre Channel Forwarder (FCF) or a switch responds to the message with a Solicited Advertisement that provides an FCF MAC address to use for subsequent logins.

- **FCoE virtual link instantiation**—FIP defines the encapsulation of fabric login (FLOGI), fabric discovery (FDISC), logout (LOGO), and exchange link parameter (ELP) frames along with the corresponding reply frames. The FCoE devices use these messages to perform a fabric login.

- **FCoE virtual link maintenance**—FIP periodically sends maintenance messages between the switch and the CNA to ensure that the connection is still valid.

FCoE Frame Format

FCoE is implemented when the switch encapsulates a Fibre Channel frame in an Ethernet packet with a dedicated Ethernet type, 0x8906. The packet has a 4-bit version field. The other header fields in the frame (the source and destination MAC addresses, VLAN tags, and frame markers) are all standard Ethernet fields. Reserved bits pad the FCoE frame to the IEEE 802.3 minimum packet length of 64 bytes.

A Fibre Channel frame consists of 36 bytes of headers and up to 2112 bytes of data for a total maximum size of 2148 bytes. The encapsulated Fibre Channel frame has all the standard headers, which allow it to be passed to the storage network without further modification. To accommodate the maximum Fibre Channel frame in an FCoE frame, the class-fcoe is defined with a default Maximum Transmission Unit (MTU) of 2240 bytes.

VLAN Tagging for FCoE Frames

The Ethernet frames that are sent by the switch to the adapter include the IEEE 802.1Q tag. This tag includes a field for the class of service (CoS) value used by the priority flow control (PFC). The IEEE 802.1Q tag also includes a VLAN field.

The switch expects frames from a FIP T11-compliant CNA to be tagged with the VLAN tag for the FCoE VLAN. Frames that are not correctly tagged are discarded.

**Note**
You cannot map VLAN 1 or the native VLAN to an FCoE VSAN.

FIP Ethernet Frame Format

FIP is encapsulated in an Ethernet packet with a dedicated EtherType, 0x8914. The packet has a 4-bit version field. Along with the source and destination MAC addresses, the FIP packet also contains a FIP operation code and a FIP operation subcode. The following table describes the FIP operation codes and subcodes.
Table 1: FIP Operation Codes

<table>
<thead>
<tr>
<th>FIP Operation Code</th>
<th>FIP Subcode</th>
<th>FIP Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x0001</td>
<td>0x01</td>
<td>Discovery Solicitation</td>
</tr>
<tr>
<td></td>
<td>0x02</td>
<td>Discovery Advertisement</td>
</tr>
<tr>
<td>0x0002</td>
<td>0x01</td>
<td>Virtual Link Instantiation Request</td>
</tr>
<tr>
<td></td>
<td>0x02</td>
<td>Virtual Link Instantiation Reply</td>
</tr>
<tr>
<td>0x0003</td>
<td>0x01</td>
<td>FIP Keepalive</td>
</tr>
<tr>
<td></td>
<td>0x02</td>
<td>FIP Clear Virtual Links</td>
</tr>
<tr>
<td>0x0004</td>
<td>0x01</td>
<td>FIP VLAN Request</td>
</tr>
<tr>
<td></td>
<td>0x02</td>
<td>FIP VLAN Notification</td>
</tr>
</tbody>
</table>

DCBX

Data Center Bridging Exchange Protocol

The Data Center Bridging Exchange (DCBX) protocol is an extension of the Link Layer Discovery Protocol (LLDP). DCBX end points exchange request and acknowledgment messages. For flexibility, parameters are coded in a type-length-value (TLV) format. Cisco NX-OS switches support the Converged Enhanced Ethernet Data Center Bridging Exchange (CEE-DCBX) is supported on all T11-compliant Generation 2 CNAs.

DCBX runs on the physical Ethernet link between the switch and the CNA. By default, DCBX is enabled on Ethernet interfaces. When an Ethernet interface is brought up, the switch automatically starts to communicate with the CNA.

During the normal operation of FCoE between the switch and the CNA, DCBX provides link-error detection.

DCBX is also used to negotiate capabilities between the switch and the CNA and to send configuration values to the CNA.

The CNAs that are connected to a switch are programmed to accept the configuration values that are sent by the switch, allowing the switch to distribute configuration values to all attached CNAs, which reduces the possibility of configuration errors and simplifies CNA administration.

Lossless Ethernet

Standard Ethernet is a best-effort medium which means that it lacks any form of flow control. In the event of congestion or collisions, Ethernet drops packets. The higher level protocols detect the missing data and retransmit the dropped packets.

To properly support Fibre Channel, Ethernet has been enhanced with a priority flow control (PFC) mechanism.
Logical Link Up/Down

On a native Fibre Channel link, some configuration actions (such as changing the VSAN) require that you reset the interface status. When you reset the interface status, the switch disables the interface and then immediately reenables the interface.

Caution:
If an Ethernet link provides FCoE service, do not reset the physical link because this action is disruptive to all traffic on the link.

The logical link up/down feature allows the switch to reset an individual virtual link. The logical link down is signaled with a FIP Clear Virtual Link message.

Caution:
If the CNA does not support the logical link level up/down feature, the CNA resets the physical link, which means that all traffic on the Ethernet interface is disrupted.

Converged Network Adapters

Cisco NX-OS switches support the following CNA types:

• Hardware adapter
  • Works with the existing Fibre Channel host bus adapter (HBA) driver and Ethernet Network Interface Card (NIC) driver in the server.
  • Server operating system view of the network is unchanged; the CNA presents a SAN interface and a LAN interface to the operating system.

• FCoE software stack
  • Runs on existing 10-Gigabit Ethernet adapters.

The following Cisco NX-OS series and platforms support Generation 2 CNAs that use the FIP to exchange information about its available capabilities and to negotiate the configurable values with the switch:

To reduce configuration errors and simplify administration, the switch distributes the configuration data to all the connected adapters.

STP Lite

FCoE does not require full Spanning Tree Protocol (STP) because FCoE has no bridging functionality, which means that no STP loops are created in the network. STP Lite on FCoE interfaces ensures rapid convergence across the network by sending an agreement Bridge Protocol Data Unit (BPDU) whenever it receives a proposal BPDU. The FCoE link sends the identical agreement BPDU in response to either an Multiple Spanning Tree (MST) or a Per VLAN Rapid Spanning Tree Plus (PVRST+) proposal BPDU. Additionally, STP Lite suppresses the MAC address flushing function for FCoE VLANs.

STP Lite is enabled automatically by default across the entire device for FCoE VLANs as soon as the first FCoE VLAN comes up. At the same time, the system automatically converts all FCoE links as the STP-type normal ports. This feature runs only in FCoE VLANs.
Default Settings for FCoE

This table lists the default settings for FCoE parameters.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCoE feature</td>
<td>Not installed, disabled</td>
</tr>
<tr>
<td>FC-Map</td>
<td>0E.FC.00</td>
</tr>
<tr>
<td>Fabric priority</td>
<td>128</td>
</tr>
<tr>
<td>Advertisement interval</td>
<td>8 seconds</td>
</tr>
</tbody>
</table>

Guidelines and Limitations

Enabling and Disabling FCoE

Configuring the FC-Map

You can prevent data corruption due to cross-fabric talk by configuring an FC-Map that identifies the Fibre Channel fabric for this switch. When the FC-Map is configured, the switch discards the MAC addresses that are not part of the current fabric. An FCF can assign Fabric Provide MAC Addresses (FPMA) to the CNAs consisting of the FC-Map Value for the Fabric and the Fibre Channel ID (FCID) assigned during Fabric Login.

In most deployments, changing the fc-map is not needed. We recommend that you use VSAN to VLAN mapping. For more information, see the Mapping a VSAN to a VLAN chapter.

Step 1

configure terminal

Example:

```
fcoe# configure terminal
fcoe(config)#
```

Enters configuration mode.

Step 2

fcoe fcmap fabric-map

Example:

```
fcoe(config)# fcoe fcmap 0x0efc2a
```
Configures the global FC-Map. The default value is 0x0EFC00. The range is from 0x0EFC00 to 0x0EFCFF. Use the `no fcoe map` command to reset to the default value.

---

Example

**Configuring the Fabric Priority**

The FCoE switch advertises its priority. The priority is used by the CNAs in the fabric to determine the best switch to connect to.

---

**Step 1**

configure terminal

*Example:*

```
  fcoe# configure terminal
  fcoe(config)#
```

Enters configuration mode.

**Step 2**

fcoe fcf-priority fabric-priority

*Example:*

```
  fcoe(config)# fcoe fcf-priority 42
```

Configures the global fabric priority. The default value is 128. The range is from 0 (higher) to 255 (lower). Use the `no fcoe fcf-priority` command to reset the global fabric priority to the default value.

---

Example

**Setting the Advertisement Interval**

You can configure the interval for Fibre Channel fabric advertisement on the switch.

---

**Step 1**

configure terminal

*Example:*

```
  fcoe# configure terminal
  fcoe(config)#
```

Enters configuration mode.

**Step 2**

fcoe fka-adv-period interval

*Example:*

...
Disabling LAN Traffic on an FCoE Link

You can disable LAN traffic on an FCoE link.

DCBX allows the switch to send a LAN Logical Link Status (LLS) message to a directly-connected CNA. Enter the `shutdown lan` command to send an LLS-Down message to the CNA. This command causes all VLANs on the interface that are not enabled for FCoE to be brought down. If a VLAN on the interface is enabled for FCoE, it continues to carry SAN traffic without any interruption.

**Step 1**

`configure terminal`

**Example:**

```
switch# configure terminal
switch(config)#
```

Enters configuration mode.

**Step 2**

`interface ethernet slot/port`

**Example:**

```
switch(config)# interface e 2/1
switch(config-if)#
```

Specifies an interface to configure, and enters interface configuration mode. Use `?` to view a list of supported interfaces.

**Step 3**

`shutdown lan`

**Example:**

```
switch(config-if)# shutdown lan
```

Shuts down Ethernet traffic on the interface. If the interface is part of an FCoE VLAN, the shutdown has no impact on the FCoE traffic. Use `no shutdown lan` to reenable Ethernet traffic on this interface.

**Step 4**

(Optional) `show interface`

**Example:**

```
switch(config-if)# show interface
```

Displays information about the interface.

**Step 5**

(Optional) `copy running-config startup-config`

**Example:**

```
switch(config-if)# copy running-config startup-config
```
Copies the running configuration to the startup configuration.

# Additional References for FCoE

## Related Documents

<table>
<thead>
<tr>
<th>Related Topic</th>
<th>Document Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command reference</td>
<td>Cisco NX-OS FCoE Command Reference Guide, Nexus 7000 and MDS 9500</td>
</tr>
<tr>
<td>Configuration guide</td>
<td></td>
</tr>
<tr>
<td>Cisco NX-OS licensing</td>
<td></td>
</tr>
</tbody>
</table>

## Standards and RFCs

<table>
<thead>
<tr>
<th>Standard/RFC</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>T11 FC BB-5</td>
<td>Fibre Channel Backbone 5</td>
</tr>
</tbody>
</table>

## MIBs

<table>
<thead>
<tr>
<th>MB</th>
<th>MIBs Link</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>To locate and download MIBs for selected platforms, Cisco IOS releases,</td>
</tr>
<tr>
<td></td>
<td>and feature sets, use Cisco MIB Locator found at the following URL:</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a></td>
</tr>
</tbody>
</table>

## Technical Assistance

<table>
<thead>
<tr>
<th>Description</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The Cisco Support website provides</td>
</tr>
<tr>
<td></td>
<td>extensive online resources, including</td>
</tr>
<tr>
<td></td>
<td>documentation and tools for troubleshooting</td>
</tr>
<tr>
<td></td>
<td>and resolving technical issues with</td>
</tr>
<tr>
<td></td>
<td>Cisco products and technologies.</td>
</tr>
<tr>
<td></td>
<td>To receive security and technical</td>
</tr>
<tr>
<td></td>
<td>information about your products, you can</td>
</tr>
<tr>
<td></td>
<td>subscribe to various services, such as</td>
</tr>
<tr>
<td></td>
<td>the Product Alert Tool (accessed from</td>
</tr>
<tr>
<td></td>
<td>Field Notices), the Cisco Technical</td>
</tr>
<tr>
<td></td>
<td>Services Newsletter, and Really Simple</td>
</tr>
<tr>
<td></td>
<td>Syndication (RSS) Feeds.</td>
</tr>
<tr>
<td></td>
<td>Access to most tools on the Cisco Support</td>
</tr>
<tr>
<td></td>
<td>website requires a Cisco.com user ID and</td>
</tr>
<tr>
<td></td>
<td>password.</td>
</tr>
</tbody>
</table>
Fibre Channel over Ethernet (FCoE) allows Fibre Channel and Ethernet traffic to be carried on the same physical Ethernet connection between the switch and the servers.

The Fibre Channel portion of FCoE is configured as a virtual Fibre Channel interface. Logical Fibre Channel features (such as interface mode) can be configured on virtual Fibre Channel interfaces.

A virtual Fibre Channel (vfc) interface must be bound to an interface before it can be used. The binding is to a physical Ethernet interface when the converged network adapter (CNA) is directly connected to the switch or port channel when the CNA connects to the Fibre Channel Forwarder (FCF) over a virtual port channel (vPC).

**VF Port**

A virtual fabric (VF) port in an FCoE network acts as a fabric port that connects to a peripheral device (host or disk) operating as an N port. A VF port can be attached to only one N port.

**VE Port**

A virtual expansion (VE) port acts as an expansion port in an FCoE network. VE ports can connect multiple FCoE switches together in the network. You can bind a VE port to a physical ethernet port or a port channel.
Traffic is load balanced across equal cost E_Ports and VE_Ports based on SID, DID, and OXID. Traffic across members of a port channel that a VE_Port is bound to is load balanced based on SID, DID, and OXID.

**VNP Ports**

Connectivity from an FCoE NPV bridge to the FCF is supported only over point-to-point links. These links can be individual Ethernet interfaces or port channel interfaces. For each FCF connected to an Ethernet/port-channel interface, a vFC interface must be created and bound to it. These vFC interfaces must be configured as VNP ports.

On the VNP port, the FCoE NPV bridge emulates an FCoE-capable host with multiple FCoE nodes (ENodes), each with a unique ENodes MAC address. By default, the VNP port is enabled in trunk mode.

Multiple VSANs can be configured on the VNP port. The FCoE VLANs that correspond to the VNP port VSANs must be configured on the bound Ethernet interface.

**Default Settings for FCoE**

This table lists the default settings for FCoE parameters.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCoE feature</td>
<td>Not installed, disabled</td>
</tr>
<tr>
<td>FC-Map</td>
<td>0E.FC.00</td>
</tr>
<tr>
<td>Fabric priority</td>
<td>128</td>
</tr>
<tr>
<td>Advertisement interval</td>
<td>8 seconds</td>
</tr>
</tbody>
</table>

**Guidelines and Limitations**

**Configuring Virtual Interfaces**

**Mapping a VSAN to a VLAN**

A unique, dedicated VLAN must be configured at every converged access switch to carry traffic for each virtual fabric (VSAN) in the SAN (for example, VLAN 1002 for VSAN 10, VLAN 1003 for VSAN 2, and so on). If you enable MST, you must use a separate Multiple Spanning Tree (MST) instance for FCoE VLANs.

**Before you begin**

- Ensure you have installed the correct license for FCoE.
- Ensure you have enabled FCoE.
Configuring FCoE VLANs and Virtual Fibre Channel Interfaces

Mapping a VSAN to a VLAN

---

**Step 1**

`configure terminal`

**Example:**

```
switch# configure terminal
switch(config)#
```

Enters configuration mode.

**Step 2**

`vsan database`

**Example:**

```
switch(config)# vsan database
switch(config-vsan-db)#
```

Enters VSAN database configuration mode.

**Step 3**

`vsan vsan-id`

**Example:**

```
switch(config-vsan-db)# vsan 200
```

Defines the VSAN. The VSAN number range is from 1 to 4094.

**Step 4**

`vlan vlan-id`

**Example:**

```
switch(config-vsan-db)# vlan 200
switch(config-vlan)#
```

Enters VLAN configuration mode. The VLAN number range is from 1 to 4096.

**Step 5**

`fcoe [vsan vsan-id]`

**Example:**

```
switch(config-vlan)# fcoe vsan 200
```

Enables FCoE for the specified VLAN and configures the mapping from this VLAN to the specified VSAN. If you do not specify a VSAN number, a mapping is created from this VLAN to the VSAN with the same number.

**Step 6**

`exit`

**Example:**

```
switch(config-vlan)# exit
switch(config)#
```

**Step 7**

(Optional) `show vlan fcoe`

**Example:**

```
switch(config-vlan)# show vlan fcoe
```

Displays information about the FCoE configuration for a VLAN.

**Step 8**

(Optional) `copy running-config startup-config`

**Example:**

```
switch(config-vlan)# copy running-config startup-config
```
Copying the running configuration to the startup configuration.

Example

Creating a Virtual Fibre Channel Interface

To use FCoE, you must first create Virtual Fibre Channel (VFC) interfaces. Then, you must bind the VFC interfaces to physical interfaces before FCoE can be used.

Before you begin

• Ensure you have installed the correct license for FCoE.
• Ensure you have enabled FCoE.

Step 1 configure terminal

Example:

switch# configure terminal
switch(config)#

Enters configuration mode.

Step 2 interface vfc vfc-id

Example:

switch(config)# interface vfc 4
switch(config-if)#

Creates a virtual Fibre Channel interface (if it does not already exist) and enters interface configuration mode. The vfc-id range is from 1 to 8192.

Step 3 switchport mode mode

Example:

switch(config-if)# switchport mode e

Configures the switchport mode for a virtual Fibre Channel interface. The mode is E or F. The default is F mode.

Step 4 bind {interface {ethernet slot/port | ethernet-port-channel number}}

Example:

switch(config-if)# bind interface ethernet 1/4

Binds the virtual Fibre Channel interface to the specified interface. Use ? to see the supported interfaces and port channels. Use the no form of this command to unbind the virtual Fibre Channel interface from the specified interface.

Step 5 (Optional) show interface vfc

Example:

switch(config-if)# show interface vfc
Displays information about the virtual Fibre Channel interfaces.

**Step 6** *(Optional)*  
**copy running-config startup-config**

**Example:**
```
switch(config)# copy running-config startup-config
```
Copies the running configuration to the startup configuration.

---

**Example**

This example shows how to bind a virtual Fibre Channel interface to an Ethernet interface:
```
switch# configure terminal  
switch(config)# interface vfc 4  
switch(config-if)# bind interface ethernet 1/4
```

This example shows how to delete a virtual Fibre Channel interface:
```
switch# configure terminal  
switch(config)# no interface vfc 4
```

---

**Creating a Virtual Fibre Channel Port Channel Interface**

You can create a virtual Fibre Channel port channel interface that automatically binds to the port channel with the same interface number.

**Step 1**  
**configure terminal**

**Example:**
```
switch# configure terminal  
switch(config)#
```
Enters configuration mode.

**Step 2**  
**interface vfc-port-channel int-number**

**Example:**
```
switch(config)# interface vfc-port-channel 2  
switch(config-if)#
```
Creates a virtual Fibre Channel interface (if it does not already exist) that is bound to the port channel with the same interface number and enters interface configuration mode.

The default switchport mode for this interface is E.

**Step 3**  
**switchport mode mode**

**Example:**
```
switch(config-if)# switchport mode e
```
Configures the switchport mode for a virtual Fibre Channel interface. The *mode* is E or F. The default is F mode.
**Associating a Virtual Fibre Channel Interface to a VSAN**

You must configure unique, dedicated VLAN at every converged access switch to carry traffic for each Virtual Fabric (VSAN) in the SAN (for example, VLAN 1002 for VSAN 1, VLAN 1003 for VSAN 2, and so on). If you enable MST, you must use a separate MST instance for FCoE VLANs.

---

**Step 1**

`configure terminal`

**Example:**

```
switch# configure terminal
switch(config)#
```

Enters configuration mode.

**Step 2**

`vsan database`

**Example:**

```
switch(config)# vsan database
switch(config-vsan-db)#
```

Enters VSAN configuration mode.

**Step 3**

(Optional) `vsan vsan-id`

---

**Associating a Virtual Fibre Channel Interface to a VSAN**

You must configure unique, dedicated VLAN at every converged access switch to carry traffic for each Virtual Fabric (VSAN) in the SAN (for example, VLAN 1002 for VSAN 1, VLAN 1003 for VSAN 2, and so on). If you enable MST, you must use a separate MST instance for FCoE VLANs.

---

**Step 4**

(Optional) `show interface vfc-port-channel int-number`

**Example:**

```
switch(config-if)# show interface vfc-port-channel 2
```

Displays information about the virtual Fibre Channel interfaces bound to port channel interfaces.

---

**Step 5**

(Optional) `copy running-config startup-config`

**Example:**

```
switch(config)# copy running-config startup-config
```

Copies the running configuration to the startup configuration.

---

**Step 6**

(Optional) `show running-config interface vfcid/slot`

**Example:**

```
switch# show running-config interface vfc-po540
!Command: show running-config interface vfc-po540
!Time: Fri Dec 2 15:36:07 2016

version 7.3(0)D1(1)
interface vfc-po540
bind interface ethernet-port-channel1540
switchport mode E
no shutdown
```

Displays the virtual Fibre Channel interface configuration information.
Example:

```bash
switch(config-vsan-db)# vsan 2
```

Creates the VSAN. The `vsan-id` range is from 1 to 4094 and must map to a VLAN on the physical Ethernet interface that is bound to the virtual Fibre Channel interface.

**Step 4**
Enter one of the following commands:

- `vsan vsan-id interface vfc vfc-id`
- `vsan vsan-id interface vfc-port-channel vfc-id`

**Example:**

```bash
switch(config-vsan-db)# vsan 2 interface vfc 4
```

Configures the association between the VSAN and virtual Fibre Channel interface or virtual Fibre Channel port channel. The `vsan-id` range is from 1 to 4094 and must map to a VLAN on the physical Ethernet interface or port channel that is bound to the virtual Fibre Channel interface or virtual Fibre Channel port channel. The `vfc-id` range is from 1 to 8192. Use the `no` form of this command to disassociate the connection between the VSAN and virtual Fibre Channel interface or virtual Fibre Channel port channel.

**Step 5** *(Optional)* **show vsan**

**Example:**

```bash
switch(config-vsan-db)# show vsan
```

Displays information about the VSAN.

**Step 6** *(Optional)* **copy running-config startup-config**

**Example:**

```bash
switch(config-vsan-db)# copy running-config startup-config
```

Copies the running configuration to the startup configuration.

---

**Example**

This example shows how to associate a virtual Fibre Channel interface to a VSAN:

```bash
switch# configure terminal
switch(config)# vsan database
switch(config-vsan-db)# vsan 2 interface vfc 4
```

---

**Enabling VE Loopback Configuration**

The VFID check verifies that the VSAN configuration is correct on both ends of a VE link. You can turn off the VFID check for VE ports to allow VE loopback configuration between to VE ports on the same switch.

**Step 1** **configure terminal**

**Example:**

```bash
```
Step 2  \texttt{fcoe veloopback}

\textbf{Example:}

\texttt{fcoe(config)# fcoe veloopback}

Enables the VFID check for all VE ports.

---

\textbf{Example}

\section*{Verifying the Virtual Fibre Channel Interface}

To display configuration information about virtual Fibre Channel interfaces, perform one of the following tasks:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>\texttt{show interface vfc vfc-id}</td>
<td>Displays the detailed configuration of the specified Fibre Channel interface.</td>
</tr>
<tr>
<td>\texttt{show interface brief}</td>
<td>Displays the status of all interfaces.</td>
</tr>
<tr>
<td>\texttt{show vlan fcoe}</td>
<td>Displays the mapping of FCoE VLANs to VSANs.</td>
</tr>
</tbody>
</table>

This example shows how to display a virtual Fibre Channel interface bound to an Ethernet interface:

```
switch# \texttt{show interface vfc 3}

vfc3 is up
Bound interface is Ethernet1/37
Hardware is Virtual Fibre Channel
Port WWN is 20:02:00:0d:ec:6d:95:3f
Admin port mode is F, trunk mode is on
snmp link state traps are enabled
Port mode is F, FCID is 0x490100
Port vsan is 931
1 minute input rate 0 bits/sec, 0 bytes/sec, 0 frames/sec
1 minute output rate 0 bits/sec, 0 bytes/sec, 0 frames/sec
0 frames input, 0 bytes
0 discards, 0 errors
0 frames output, 0 bytes
0 discards, 0 errors
Interface last changed at Thu May 21 04:44:42 2009
```
This example shows how to display the status of all the interfaces on the switch (some output has been removed for brevity):

```bash
switch# show interface brief
```

<table>
<thead>
<tr>
<th>Interface</th>
<th>Vsan</th>
<th>Admin Status</th>
<th>SFP Mode</th>
<th>Port Mode</th>
<th>Trunk Mode</th>
<th>Speed</th>
<th>Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>fc3/1</td>
<td>1</td>
<td>auto on trunking</td>
<td>swl TE</td>
<td>2</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>fc3/2</td>
<td>1</td>
<td>auto on</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>fc3/8</td>
<td>1</td>
<td>auto on</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interface</th>
<th>Status</th>
<th>IP Address</th>
<th>Speed</th>
<th>MTU</th>
<th>Port Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet1/1</td>
<td>hwFailure</td>
<td>--</td>
<td>1500</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Ethernet1/2</td>
<td>hwFailure</td>
<td>--</td>
<td>1500</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Ethernet1/3</td>
<td>up</td>
<td>--</td>
<td>10000</td>
<td>1500</td>
<td>--</td>
</tr>
<tr>
<td>Ethernet1/39</td>
<td>sfpIsAbsent</td>
<td>--</td>
<td>1500</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Ethernet1/40</td>
<td>sfpIsAbsent</td>
<td>--</td>
<td>1500</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

This example shows how to display the mapping between the VLANs and VSANs on the switch:

```bash
switch# show vlan fcoe
```

<table>
<thead>
<tr>
<th>VLAN</th>
<th>VSAN</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example: Mapping VSANs to VLANs

The following example shows how to configure the FCoE VLAN and a virtual Fibre Channel interface:

Step 1
Enable the associated VLAN and map the VLAN to a VSAN.

```
switch(config)# vlan 200
switch(config-vlan)# fcoe vsan 200
switch(config-vlan)# exit
```

Step 2
Configure the VLAN on a physical Ethernet interface.

```
switch# configure terminal
switch(config)# interface ethernet 1/4
switch(config-if)# spanning-tree port type edge trunk
switch(config-if)# switchport mode trunk
switch(config-if)# switchport trunk allowed vlan 1,200
switch(config-if)# exit
```

Step 3
Create a virtual Fibre Channel interface and bind it to a physical Ethernet interface.

```
switch(config)# interface vfc 4
switch(config-if)# bind interface ethernet 1/4
```

**Note** By default, all virtual Fibre Channel interfaces reside on VSAN 1. If the VLAN to VSAN mapping is to a VSAN other than VSAN 1, then proceed to Step 4.

Step 4
Associate the virtual Fibre Channel interface to the VSAN.

```
switch(config)# vsan database
switch(config-vsan)# vsan 200 interface vfc 4
switch(config-vsan)# exit
```

Step 5
(Optional) Display membership information for the VSAN.

```
switch# show vsan 200 membership
vsan 200 interfaces
    vfc 4
```

Step 6
(Optional) Display the interface information for the virtual Fibre Channel interface.

```
switch# show interface vfc 4
vfc4 is up
```
Verifying the FCoE Configuration

To display FCoE configuration information, perform one of these tasks in the context of storage VDC:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>show fcoe</td>
<td>Displays whether FCoE is enabled on the switch.</td>
</tr>
<tr>
<td>show fcoe database</td>
<td>Displays the contents of the FCoE database.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong> This command is effective when interfaces are configured.</td>
</tr>
<tr>
<td>show interface vfc [number]</td>
<td>Displays information about the vFC interfaces.</td>
</tr>
<tr>
<td>show interface [interface number] fcoe</td>
<td>Displays the FCoE settings for an interface or all interfaces.</td>
</tr>
</tbody>
</table>

This example shows how to verify that the FCoE capability is enabled:

```
switch# show fcoe
Global FCF details
    FCF-MAC is 00:0d:ec:6d:95:00
    FC-MAP is 0e:fc:00
    FCF Priority is 128
    FKA Advertisement period for FCF is 8 seconds
```

This example shows how to display the FCoE database:
switch# show fcoe database

<table>
<thead>
<tr>
<th>INTERFACE</th>
<th>FCID</th>
<th>PORT NAME</th>
<th>MAC ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>vfc3</td>
<td>0x490100</td>
<td>21:00:00:1b:32:0a:e7:b8 00:00:0e:5f:76</td>
<td></td>
</tr>
</tbody>
</table>

This example shows how to display the FCoE settings for an interface.

switch# show interface ethernet 1/37 fcoe
Ethernet1/37 is FCoE UP
  vfc3 is Up
    FCID is 0x490100
    PWWN is 21:00:00:1b:32:0a:e7:b8
    MAC addr is 00:00:0e:5f:76

### Additional References for FCoE

#### Related Documents

<table>
<thead>
<tr>
<th>Related Topic</th>
<th>Document Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command reference</td>
<td>Cisco NX-OS FCoE Command Reference Guide, Nexus 7000 and MDS 9500</td>
</tr>
<tr>
<td>Configuration guide</td>
<td></td>
</tr>
<tr>
<td>Cisco NX-OS licensing</td>
<td></td>
</tr>
</tbody>
</table>

#### Standards and RFCs

<table>
<thead>
<tr>
<th>Standard/RFC</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>T11 FC BB-5</td>
<td>Fibre Channel Backbone 5</td>
</tr>
</tbody>
</table>

#### MIBs

<table>
<thead>
<tr>
<th>MB</th>
<th>MIBs Link</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a></td>
</tr>
</tbody>
</table>
**Technical Assistance**

<table>
<thead>
<tr>
<th>Description</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</td>
<td><a href="http://www.cisco.com/support">http://www.cisco.com/support</a></td>
</tr>
</tbody>
</table>