Cisco NX-OS FCoE Configuration Guide for Nexus 7000 Series and MDS 9000

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CONTENTS

Preface

The preface contains the following sections:

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:

Convention	Description
bold	Bold text indicates the commands and keywords that you enter literally as shown.
Italic	Italic text indicates arguments for which the user supplies the values.
[x]	Square brackets enclose an optional element (keyword or argument).
[x | y]	Square brackets enclosing keywords or arguments separated by a vertical bar indicate an optional choice.
{x | y}	Braces enclosing keywords or arguments separated by a vertical bar indicate a required choice.

Convention	Description
[x {y | z}]	Nested set of square brackets or braces indicate optional or required choices within optional or required elements. Braces and a vertical bar within square brackets indicate a required choice within an optional element.
variable	Indicates a variable for which you supply values, in context where italics cannot be used.
string	A nonquoted set of characters. Do not use quotation marks around the string or the string will include the quotation marks.

Examples use the following conventions:

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

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.

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New and Changed Information

Overview

This chapter contains the following sections:

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.

CHAPTER 3

Preparing the Switch for Configuring FCoE

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

FIP Operation Code	FIP Subcode	FIP Operation
0x0001	0x01	Discovery Solicitation
	0x02	Discovery Advertisement
0x0002	0x01	Virtual Link Instantiation Request
	0x02	Virtual Link Instantiation Reply
0x0003	0x01	FIP Keepalive
	0x02	FIP Clear Virtual Links
0x0004	0x01	FIP VLAN Request
	0x02	FIP VLAN Notification

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 2: Default FCoE Parameter Settings

Parameters	Default
FCoE feature	Not installed, disabled
FC-Map	0E.FC.00
Fabric priority	128
Advertisement interval	8 seconds

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

Note   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 Advertisment 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:

```
fcoe(config)# fcoe fka-adv-period 8
fcoe#
```

Configures the advertisement interval for the fabric. The default value is 8 seconds. The range is from 4 to 60 seconds.

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

Related Topic	Document Title
Command reference	Cisco NX-OS FCoE Command Reference Guide, Nexus 7000 and MDS 9500
Configuration guide	
Cisco NX-OS licensing	

Standards and RFCs

Standard/RFC	Title
T11 FC BB-5	Fibre Channel Backbone 5

MIBs

MIB	MIBs Link
	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

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Configuring FCoE VLANs and Virtual Fibre Channel Interfaces

Information About Virtual Fibre Channel (VFC) Interfaces

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 3: Default FCoE Parameter Settings

Parameters	Default
FCoE feature	Not installed, disabled
FC-Map	0E.FC.00
Fabric priority	128
Advertisement interval	8 seconds

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.

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
```

Copies 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(configif)# 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.

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
[########################################] 100%
Copy complete.
```

Copies the running configuration to the startup configuration.

Step 6 (Optional) **show running-config interface vfc***id/slot*

Example:

```
awitch# 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-channel540
switchport mode E
no shutdown
```

Displays the virtual Fibre Channel interface configuration information.

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*

Example:

```
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:

```
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. Us the **no** form of this command to dissassociate the connection between the VSAN and virtual Fibre Channel interface or virtual Fibre Channel port channel.

Step 5   (Optional) **show vsan**

Example:

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

Displays information about the VSAN.

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

Example:

```
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:

```
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:

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

Enters configuration mode.

Step 2   **fcoe veloopback**

Example:

```
fcoe(config)# fcoe veloopback
```

Enables the VFID check for all VE ports.

Example

Verifying the Virtual Fibre Channel Interface

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

Command	Purpose
show interface vfc *vfc-id*	Displays the detailed configuration of the specified Fibre Channel interface.
show interface brief	Displays the status of all interfaces.
show vlan fcoe	Displays the mapping of FCoE VLANs to VSANs.

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

```
switch# 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):

```
switch# show interface brief
--------------------------------------------------------------------------------
Interface  Vsan   Admin  Admin  Status       SFP   Oper  Oper   Port
                  Mode   Trunk                     Mode  Speed  Channel
                         Mode                            (Gbps)
--------------------------------------------------------------------------------
fc3/1      1      auto   on     trunking     swl   TE    2      --
fc3/2      1      auto   on     sfpAbsent    --    --           --
...
fc3/8      1      auto   on     sfpAbsent    --    --           --
--------------------------------------------------------------------------------
Interface            Status   IP Address     Speed   MTU   Port
                                                           Channel
--------------------------------------------------------------------------------
Ethernet1/1          hwFailure  --           --      1500  --
Ethernet1/2          hwFailure  --           --      1500  --
Ethernet1/3          up         --           10000   1500  --
...
Ethernet1/39         sfpIsAbsen --           --      1500  --
Ethernet1/40         sfpIsAbsen --           --      1500  --
--------------------------------------------------------------------------------
Interface            Status   IP Address     Speed   MTU
--------------------------------------------------------------------------------
mgmt0                up       172.16.24.41   100     1500
--------------------------------------------------------------------------------


--------------------------------------------------------------------------------
Interface  Vsan   Admin  Admin  Status       SFP   Oper  Oper   Port
                  Mode   Trunk                     Mode  Speed  Channel
                         Mode                            (Gbps)
--------------------------------------------------------------------------------
vfc 1      1      F      --     down         --    --           --
...
```

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

```
switch# show vlan fcoe

VLAN     VSAN     Status
```

```
        --------  --------  --------
    15        15        Operational
    20        20        Operational
    25        25        Operational
    30        30        Non-operational
```

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
```

```
Bound interface is Ethernet1/4
Hardware is Virtual Fibre Channel
Port WWN is 20:02:00:0d:ec:6d:95:3f
Port WWN is 20:02:00:0d:ec:6d:95:3f
snmp link state traps are enabled
Port WWN is 20:02:00:0d:ec:6d:95:3f
APort WWN is 20:02:00:0d:ec:6d:95:3f
snmp link state traps are enabled
Port mode is F, FCID is 0x490100
Port vsan is 200
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 Mar 11 04:44:42 2010
```

Verifying the FCoE Configuration

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

Command	Purpose
show fcoe	Displays whether FCoE is enabled on the switch.
show fcoe database	Displays the contents of the FCoE database.
	Note This command is effective when interfaces are configured.
show interface vfc [*number*]	Displays information about the vFC interfaces.
show interface [*interface number*] **fcoe**	Displays the FCoE settings for an interface or all interfaces.

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
------------------------------------------------------------------------
INTERFACE        FCID          PORT NAME              MAC ADDRESS
------------------------------------------------------------------------
vfc3             0x490100      21:00:00:1b:32:0a:e7:b8 00:c0:dd:0e:5f:76
```

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:c0:dd:0e:5f:76
```

Additional References for FCoE

Related Documents

Related Topic	Document Title
Command reference	Cisco NX-OS FCoE Command Reference Guide, Nexus 7000 and MDS 9500
Configuration guide	
Cisco NX-OS licensing	

Standards and RFCs

Standard/RFC	Title
T11 FC BB-5	Fibre Channel Backbone 5

MIBs

MIB	MIBs Link
	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
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.	http://www.cisco.com/support

Storage VDC

This chapter contains the following sections:

Information About Storage VDC

You use a storage virtual device context (VDC) to separate LAN and SAN traffic on the same switch. A VDC allows you to maintain one physical infrastructure but separate logical data paths.

To achieve this configuration, you must perform the following tasks:

• Create a dedicated storage VDC.

• Allocate physical ports to the storage VDC. These can be either ports dedicated to only the storage VDC or ports that are shared between the storage VDC and one other VDC. Dedicated ports can be used to create either VFC E ports (VE ports) or F ports (VF ports). Shared ports can only be used for VFC F ports (VF ports).

Once you share the port to the storage VDC you can create a VFC F-port on top of the shared interface.You cannot modify some details of that port because it must match the underlying shared physical port. If you move the source port to another VDC or delete the VDC, the shared ports are deleted and you must reconfigure them.

Note If the storage VDC restarts or is suspended, any shared Ethernet ports are shut down in the corresponding VDC. These ports come up automatically once the storage VDC is operational.

Licensing Requirements for FCoE

Product	License
Cisco Nexus 7000 Series	Each F Series module that runs FCoE requires an FCoE license. FCoE enabled in a nondefault VDC does not require the Advanced Services License. By default, FCoE does not require an additional VDC and is enabled in the storage VDC. For a complete explanation of the Cisco NX-OS licensing scheme and how to obtain and apply licenses, see the Cisco NX-OS Licensing Guide.

Configuring FCoE VDCs

Licensing an FCoE Module

You must associate an FCoE license with an FCoE module to configure FCoE. You need one license for each module configured for FCoE.

Before you begin

Ensure you have installed the correct license for FCoE.

SUMMARY STEPS

1. **configure terminal**
2. **license fcoe module** *module-number*
3. (Optional) **show license usage** *module-name*
4. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**configure terminal**
	
	Example:
	`switch# configure terminal`
	`swtich(config)#`
		Enters configuration mode.

Step 2	Required: **license fcoe module** *module-number* **Example:** `swtich(config)#  license fcoe module 2`	Associates an FCoE license to a module.

	Command or Action	Purpose
Step 3	(Optional) **show license usage** *module-name* **Example:** swtich(config)# show license usage FCOE-N7K-F132XP	Displays the line card usage used by a storage VDC. For details on license packages, see Cisco NX-OS Licensing Guide. .
Step 4	(Optional) **copy running-config startup-config** **Example:** swtich(config)# copy running-config startup-config	Copies the running configuration to the startup configuration.

Creating a Dedicated Storage VDC

Note   Commands from step 1 to step 7 are performed in the admin VDC.

Commands from step 8 to step 11 are performed in the storage VDC.

Before you begin

• Ensure you have installed the correct license for FCoE.

Note   VE ports must exist on dedicated interfaces. VF ports can exist on either dedicated or shared interfaces.

SUMMARY STEPS

1.   **configure terminal**
2.   **install feature-set fcoe**
3.   **system qos**
4.   **service-policy type network-qos** *policy-map name*
5.   **vdc** *vdc-name* **type storage**
6.   **allocate interface ethernet** *int-numb*
7.   **switchto vdc** *vdc-name*
8.   **feature lldp**
9.   (Optional) **feature lacp**
10.   (Optional) **show feature-set**
11.   (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:**	Enters configuration mode.

	Command or Action	Purpose
	``switch# configure terminal
switch(config)#```	
Step 2	**install feature-set fcoe** **Example:** ```switch(config)# install feature-set fcoe```	Installs the FCoE feature-set.
Step 3	**system qos** **Example:** ```switch(config)# system qos
switch(config-sys-qos)#```	Enters system qos mode.
Step 4	**service-policy type network-qos** *policy-map name* **Example:** ```switch(config-sys-qos)#service-policy type
network-qos default-nq-7e-policy```	Enables no drop queue for FCoE class. **Note** The Cisco MDS 9250i Multiservice Fabric Switch follows a different naming convention which reflects how many ingress queues and egress queues are there in a policy. The name is different, but it is same as the MDS policy. 7e policy is default in MDS and Cisco MDS 9250i Multiservice Fabric Switch, hence it is not shown in **show running-config** command. The 7e policy is not default in Cisco Nexus 7000 Series Switches, hence it is shown in the **show running-config** command.
Step 5	**vdc** *vdc-name* **type storage** **Example:** ```switch(config)# vdc fcoe-vdc type storage
switch(config-vdc)#```	Creates a dedicated storage VDC and enters VDC configuration mode. You can only enable storage features in a storage VDC. You do not need to allow the feature-set or enable it in the storage VDC because this process is handled automatically for a storage VDC. **Note** It is expected that, if feature-set fex is not enabled, "**allocate share fex**" will fail, on VDC reload. User has to un-configure the share and configure it back .
Step 6	**allocate interface ethernet** *int-numb* **Example:** ```switch(config-vdc)# allocate interface ethernet
2/1-2
switch(config-if)#```	Allocates interfaces to the storage VDC as a dedicated FCoE port. You must allocate all interfaces in the port group. You must configure these interfaces in switchport trunk mode as Spanning Tree Protocol (STP) edge ports.
Step 7	**switchto vdc** *vdc-name* **Example:** ```switch(config-vdc)# switchto vdc fcoe-vdc
switchport
switch-fcoe-vdc#```	Switches to the storage VDC.

	Command or Action	Purpose
Step 8	**feature lldp** **Example:** `switch(config)# feature lldp`	Enables the LLDP feature in the storage VDC.
Step 9	(Optional) **feature lacp** **Example:** `switch(config)# feature lacp`	Enables the LACP feature in the storage VDC.

Step 10	(Optional) **show feature-set**
	
	Example:
	
	`switch# show feature-set`
	`Feature Set Name    ID       State`
	`------------------- -------- --------`
	`fcoe             2        enabled`
	`fex              3        disabled`
	`switch#`
		Displays the status information about the feature-sets in this VDC.

Step 11	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Allocating the FCoE VLAN Range

Before you begin

- Ensure you have installed the correct license for FCoE.

- Ensure you are in the correct VDC.

SUMMARY STEPS

1. **configure terminal**
2. **vdc** *vdc-name* **type storage**
3. **allocate fcoe-vlan-range** *vlan-range* [**from vdcs** *vdc-name*]
4. (Optional) **show vdc fcoe-vlan-range**
5. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**configure terminal**
	
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

	Command or Action	Purpose

Step 2	**vdc** *vdc-name* **type storage**
	
	Example:
	`switch(config)# vdc fcoe-vdc type storage`
	`switch(config-vdc)#`
		Enters VDC configuration mode. You can only enable storage feature in a storage VDC. You do not need to allow the feature-set or enable it in the storage VDC because this process is handled automatically for a storage VDC.

Step 3	**allocate fcoe-vlan-range** *vlan-range* [**from vdcs** *vdc-name*] **Example:** `switch(config-vdc)# allocate fcoe-vlan-range 10-30`	Allows the VLAN to be used in the storage VDC-I; and allocates the VLANs that can be used for FCoE and mapped to a VSAN. You can optionally allocate the VLANs from another VDC.
Step 4	(Optional) **show vdc fcoe-vlan-range** **Example:** `switch(config-vdc)#  show vdc fcoe-vlan-range`	Displays information about the VLAN range allocated for FCoE.

Step 5	(Optional) **copy running-config startup-config**
	
	Example:
	`switch(config-vdc)# copy running-config`
	`startup-config`
		Copies the running configuration to the startup configuration.

Allocating Shared Interfaces

You can share interfaces between a storage VDC and another VDC.

Before you begin

- Ensure you have installed the correct license for FCoE.

- Ensure you are in the correct VDC.

- Ensure any shared interfaces are from an F-series module.

- Ensure you have allocated the FCoE VLAN range.

- Interfaces can only be shared between the storage VDC and one other VDC.

> **Note**
> - For shared interface, ensure that LLDP feature is enabled in parent VDC also.
>
> - Only VF ports can exist on shared interfaces. VE ports must be on dedicated interfaces.

SUMMARY STEPS

1. **configure terminal**
2. **interface** *if-range*
3. **switchport mode trunk**

4. **spanning-tree port type edge trunk**
5. **no shutdown**
6. **vdc** *vdc-name* **type storage**
7. **allocate shared interface** *if-range*
8. (Optional) **show vdc shared membership**
9. (Optional) **switchto vdc** *vdc-name*
10. **configure terminal**
11. **feature lldp**
12. **interface** *if-range*
13. **no shutdown**
14. (Optional) **show interface** *if-range*
15. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**configure terminal**
	
	Example:
	
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	**interface** *if-range* **Example:** `switch(config)# interface ethernet 2/1`	Enters interface configuration mode for the interface in the Ethernet VDC.
Step 3	**switchport mode trunk** **Example:** `switch(config-if)# switchport mode trunk`	Puts the Ethernet interface into trunk mode.
Step 4	**spanning-tree port type edge trunk** **Example:** `switch(config-if)# spanning-tree port type edge trunk`	Sets the interface to STP-type edge port to support STP Lite for loop prevention.
Step 5	**no shutdown** **Example:** `switch(config-if)# no shutdown`	Administratively enables the Ethernet shared interface.

Step 6	**vdc** *vdc-name* **type storage**
	
	Example:
	
	`switch(config-if)# vdc fcoe-vdc type storage`
	`switch(config-vdc)#`
		Enters VDC configuration mode.

Step 7	**allocate shared interface** *if-range* **Example:** `switch(config-vdc)# allocate shared interface ethernet 2/1`	Allocates interfaces that are shared with another VDC for FCoE traffic. You must allocate the shared interfaces to one of the VDC included in the FCoE VLAN allocation. You can only use the **shutdown** or the **switchport trunk**

	Command or Action	Purpose
		allowed vlan commands on shared interfaces in the storage VDC.
Step 8	(Optional) **show vdc shared membership** **Example:** `switch(config-vdc)#  show vdc shared membership`	Displays the interfaces that are shared for FCoE.

Step 9	(Optional) **switchto vdc** *vdc-name*
	
	Example:
	
	`switch(config-vdc)# switchto vdc fcoe-vdc`
	`switch-fcoe-vdc#`
		Switches to the storage VDC.

Step 10	**configure terminal**
	
	Example:
	
	`switch-fcoe-vdc# configure terminal`
	`switch-fcoe-vdc(config)#`
		Enters configuration mode.

Step 11	**feature lldp** **Example:** `switch-fcoe-vdc(config)# feature lldp`	Enables the LLDP feature in the storage VDC.
Step 12	**interface** *if-range* **Example:** `switch-fcoe-vdc(config)# interface ethernet 2/1`	Enters interface configuration mode for the shared interface in the storage VDC.
Step 13	**no shutdown** **Example:** `switch-fcoe-vdc(config-if)# no shutdown`	Administratively enables the FCoE shared interface.

Step 14	(Optional) **show interface** *if-range*
	
	Example:
	
	`switch-fcoe-vdc(config-if)#  show interface`
	`ethernet 2/1`
		Displays information about the shared interface.

Step 15	(Optional) **copy running-config startup-config**
	
	Example:
	
	`switch-fcoe-vdc(config-if)# copy running-config`
	`startup-config`
		Copies the running configuration to the startup configuration.

Example: Storage VDC Configuration

Ethernet VDC Configuration

```
!Enable the interface to share:
switch(config-sys-qos)# interface ethernet 2/1
```

```
!Initially ethernet 2/1 is allocated to ethernet VDC
switch(config-if)# switchport
switch(config-if)# switchport mode trunk

!Allocate resources in admin VDC:
Switch(conf)# vdc storage fcoe_vdc
switch(config-if)# allocate fcoe-vlan-range 10-20 from vdc switch
switch(config-vdc)# allocate shared interface ethernet 2/1
Switch(conf)# show vdc shared membership

!Switch to storage VDC and bring up the shared interface:
switch(config-vdc)# switchto vdc fcoe_vdc
switch-fcoe_vdc# configure terminal
switch-fcoe_vdc(config)# interface ethernet 2/1
switch-fcoe_vdc(config-if)# no shutdown

!A VFC interface is created on top of Ethernet interface. The VFC interface can be created
 in 2 ways: implicit and explicit.

!Implicit:
switch-fcoe_vdc(config)# interface vfc 2/1
switch-fcoe_vdc(config-if)# switchport mode f

!Explicit:
switch-fcoe_vdc(config)# interface vfc2
switch-fcoe_vdc(config-if)# bind interface eth2/1
switch-fcoe_vdc(config-if)# switchport mode f
```

Note Ethernet 2/1 must be from an F-series module.

Example: Storage VDC Configuration

Feature History by Platform

This chapter contains the following sections:

Guidelines and Limitations

This chapter includes the following sections: