



## **Cisco Nexus 2000 Series NX-OS Fabric Extender Configuration Guide for Cisco Nexus 9000 Series Switches, Release 6.x**

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## Preface

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This preface includes the following sections:

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- [Document Conventions, page v](#)
- [Related Documentation for Cisco Nexus 9000 Series Switches, page vi](#)
- [Documentation Feedback, page vi](#)
- [Obtaining Documentation and Submitting a Service Request, page vii](#)

## Audience

This publication is for network administrators who install, configure, and maintain Cisco Nexus switches.

## Document Conventions

Command descriptions use the following conventions:

| Convention    | Description  |
|---------------|--|
| <b>bold</b>   | Bold text indicates the commands and keywords that you enter literally as shown.                         |
| <i>Italic</i> | 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. |
| <i>variable</i> | 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   |
|--|---|
| <code>screen font</code>                 | Terminal sessions and information the switch displays are in screen font.                                 |
| <b><code>boldface screen font</code></b> | Information you must enter is in boldface screen font.  |
| <i><code>italic screen font</code></i>   | 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. |

## Related Documentation for Cisco Nexus 9000 Series Switches

The entire Cisco Nexus 9000 Series switch documentation set is available at the following URL:

[http://www.cisco.com/en/US/products/ps13386/tsd\\_products\\_support\\_series\\_home.html](http://www.cisco.com/en/US/products/ps13386/tsd_products_support_series_home.html)

## Documentation Feedback

To provide technical feedback on this document, or to report an error or omission, please send your comments to [nexus9k-docfeedback@cisco.com](mailto:nexus9k-docfeedback@cisco.com). We appreciate your feedback.

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# CHAPTER

# 1

## New and Changed Information

This chapter provides release-specific information for each new and changed feature in the *Cisco Nexus 2000 Series NX-OS Fabric Extender Configuration Guide for Cisco Nexus 9000 Series Switches*.

- [New and Changed Information, page 1](#)

## New and Changed Information

This table summarizes the new and changed features for the *Cisco Nexus 2000 Series NX-OS Fabric Extender Configuration Guide for Cisco Nexus 9000 Series Switches* and where they are documented.

**Table 1: New and Changed Features**

| Feature                                     | Description  | Changed in Release | Where Documented                            |
|---|--|--------------------|---|
| Support for Cisco Discovery Protocol (CDP). | Added support for Cisco Discovery Protocol (CDP).  | 6.1(2)B(4)         | <a href="#">Protocol Offload, on page 7</a> |
| Support for Cisco Nexus 9372PX device.      | Added support for Cisco Nexus 9372PX device.   | 6.1(2)B(1)         | <a href="#">Overview, on page 3</a>         |
| Support for Cisco Nexus Fabric Extenders.   | <ul style="list-style-type: none"> <li>• Added support for Cisco Nexus B22 Fabric Extender for Dell (NB22DELL).</li> <li>• Added support for Cisco Nexus 2232TM-E Fabric Extender.</li> <li>• Added support for Cisco Nexus 2248PQ Fabric Extender.</li> </ul> | 6.1(2)B(1)         | <a href="#">Overview, on page 3</a>         |

| Feature | Description  | Changed in Release | Where Documented |
|---------|--|--------------------|------------------|
| FEX     | Added support for Cisco Nexus 2000 Series NX-OS Fabric Extender. | 6.1(2)I2(3)        | This document.   |



## Overview

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This chapter provides an architectural overview of the Cisco Nexus 2000 Series Fabric Extender and includes the following sections:

- [Information About the Cisco Nexus 2000 Series Fabric Extender, page 4](#)
- [Fabric Extender Terminology, page 4](#)
- [Fabric Interface Features , page 4](#)
- [Host Interfaces, page 5](#)
- [Host Interface Port Channels, page 5](#)
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- [IGMP Snooping, page 7](#)
- [Switched Port Analyzer, page 7](#)
- [Oversubscription, page 8](#)
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- [Port Channel Fabric Interface Connection, page 11](#)
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- [Fabric Extender Image Management, page 12](#)
- [Licensing Requirements for the Fabric Extender, page 12](#)
- [Guidelines and Limitations for the Fabric Extender, page 12](#)
- [Default Settings, page 13](#)

# Information About the Cisco Nexus 2000 Series Fabric Extender

The Cisco Nexus 2000 Series Fabric Extender, also known as FEX, is a highly scalable and flexible server networking solution that works with Cisco Nexus Series devices to provide high-density, low-cost connectivity for server aggregation. Scaling across 1-Gigabit Ethernet, 10-Gigabit Ethernet, unified fabric, rack, and blade server environments, the Fabric Extender is designed to simplify data center architecture and operations.

The Fabric Extender integrates with its parent switch, which is a Cisco Nexus Series device, to allow automatic provisioning and configuration taken from the settings on the parent device. This integration allows large numbers of servers and hosts to be supported by using the same feature set as the parent device with a single management domain. The Fabric Extender and its parent switch enable a large multipath, loop-free data center topology without the use of the Spanning Tree Protocol (STP).

The Cisco Nexus 2000 Series Fabric Extender forwards all traffic to its parent Cisco Nexus Series device over 10-Gigabit Ethernet fabric uplinks, which allows all traffic to be inspected by policies established on the Cisco Nexus Series device.

No software is included with the Fabric Extender. The software is automatically downloaded and upgraded from its parent device.

## Fabric Extender Terminology

Some terms used in this document are as follows:

- Fabric interface—A 10-Gigabit/40-Gigabit Ethernet uplink port that is designated for connection from the Fabric Extender to its parent switch. A fabric interface cannot be used for any other purpose. It must be directly connected to the parent switch.




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**Note** A fabric interface includes the corresponding interface on the parent switch. This interface is enabled when you enter the **switchport mode fex-fabric** command.

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- Port channel fabric interface—A port channel uplink connection from the Fabric Extender to its parent switch. This connection consists of fabric interfaces that are bundled into a single logical channel.
- Host interface—An Ethernet host interface for connection to a server or host system.




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**Note** Do not connect a bridge or switch to a host interface. These interfaces are designed to provide end host or server connectivity.

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- Port channel host interface—A port channel host interface for connection to a server or host system.

## Fabric Interface Features

The FEX fabric interfaces support static port channels. During the initial discovery and association process, SFP+ validation and digital optical monitoring (DOM) are performed as follows:

- The FEX performs a local check on the uplink SFP+ transceiver. If it fails the security check, the LED flashes but the link is still allowed to come up.
- The FEX local check is bypassed if it is running its backup image.
- The parent switch performs SFP validation again when the fabric interface is brought up. It keeps the fabric interface down if SFP validation fails.

After an interface on the parent switch is configured in fex-fabric mode, all other features that were configured on that port and are not relevant to this mode are deactivated. If the interface is reconfigured to remove fex-fabric mode, the previous configurations are reactivated.

## Host Interfaces

### Layer 2 Host Interfaces

The default port mode is Layer 2.

To run a host interface in Layer 2 mode, use the **switchport** command.

The Fabric Extender provides connectivity for computer hosts and other edge devices in the network fabric.

Follow these guidelines when connecting devices to Fabric Extender host interfaces:

- All Fabric Extender host interfaces run as spanning tree edge ports with BPDU Guard enabled and you cannot configure them as spanning tree network ports.
- You can connect servers that use active/standby teaming, 802.3ad port channels, or other host-based link redundancy mechanisms to Fabric Extender host interfaces.
- Any device that is running spanning tree connected to a Fabric Extender host interface results in that host interface being placed in an error-disabled state when a BPDU is received.
- You can connect any edge switch that leverages a link redundancy mechanism not dependent on spanning tree such as vPC (with the BPDU Filter enabled) to a Fabric Extender host interface. Because spanning tree is not used to eliminate loops, you should ensure a loop-free topology below the Fabric Extender host interfaces.

Ingress and egress packet counters are provided on each host interface.

For more information about BPDU Guard, see the *Cisco Nexus 9000 Series NX-OS Layer 2 Switching Configuration Guide*.

## Host Interface Port Channels

### Layer 2 Host Interface Port Channels

The Fabric Extender supports host interface port channel configurations. You can combine up to 8 interfaces in a standard mode port channel and 16 interfaces when configured with the Link Aggregation Control Protocol (LACP).

**Note**

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Port channel resources are allocated when the port channel has one or more members.

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All members of the port channel must be Fabric Extender host interfaces and all host interfaces must be from the same Fabric Extender. You cannot mix interfaces from the Fabric Extender and the parent switch.

Layer 2 mode is supported on host interface port channels.

You can configure Layer 2 port channels as access or trunk ports.

Fabric Extenders support the host vPC feature where a server can be dual-attached to two different FEXs through a port channel. You must configure parent switches that connect each Fabric Extender (one parent switch per FEX) in a vPC domain.

## Load Balancing Using Host Interface Port Channels

The Cisco NX-OS software allows for load balancing traffic across all operational interfaces on a FEX host interface port-channel by hashing the addresses in the frame to a numerical value that selects one of the links in the channel. Port-channels provide load balancing by default.

You can configure the type of load-balancing algorithm used. You can choose the load-balancing algorithm that determines which member port to select for egress traffic by looking at the fields in the frame.

You can configure the load-balancing mode to apply to all Fabric Extenders or to specified ones. If load-balancing mode is not configured, Fabric Extenders use the default system configuration. The per-FEX configuration takes precedence over the load-balancing configuration for the entire system. You cannot configure the load-balancing method per port channel.

**Note**

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The default load-balancing mode for non-IP interfaces is the source and destination MAC address.

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For more details, see the *Cisco Nexus 9000 Series NX-OS Interfaces Configuration Guide, Release 6.x*.

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You can configure the device to use one of the following methods to load balance across the port channel:

- Destination MAC address
- Source MAC address
- Source and destination MAC address
- Destination IP address
- Source IP address
- Source and destination IP address
- Source TCP/UDP port number
- Destination TCP/UDP port number
- Source and destination TCP/UDP port number
- Dot1Q VLAN number

## VLANs

The Fabric Extender supports Layer 2 VLAN trunks and IEEE 802.1Q VLAN encapsulation.

For more information about VLANs, see the *Cisco Nexus 9000 Series NX-OS Layer 2 Switching Configuration Guide*.

**Note**

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Configuring a native VLAN on a FEX fabric interface is not supported.

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## Protocol Offload

To reduce the load on the control plane of the Cisco Nexus Series device, Cisco NX-OS allows you to offload link-level protocol processing to the Fabric Extender CPU. The following protocols are supported:

- Link Layer Discovery Protocol (LLDP)
- Cisco Discovery Protocol (CDP)
- Link Aggregation Control Protocol (LACP)

## Access Control Lists

The Fabric Extender supports the full range of ingress access control lists (ACLs) that are available on its parent Cisco Nexus Series device.

## IGMP Snooping

IGMP snooping is supported on all host interfaces of the Fabric Extender.

The Fabric Extender and its parent switch support IGMPv2 and IGMPv3 snooping based only on the destination IP address. It does not support snooping that is based on the MAC address.

**Note**

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For more information about IGMP snooping, see <http://tools.ietf.org/wg/magma/draft-ietf-magma-snoop/rfc4541.txt>. Also, see the *Cisco Nexus 9000 Series NX-OS Multicast Routing Configuration Guide*.

---

## Switched Port Analyzer

You can configure the host interfaces on the Fabric Extender as Switched Port Analyzer (SPAN) source ports. You cannot configure Fabric Extender ports as a SPAN destination. Up to four SPAN sessions for host interfaces are supported on the same or different Fabric Extenders. Ingress source (Rx) monitoring is supported.

**Note**

All IP multicast traffic on the VLANs that a Fabric Extender host interface belongs to is captured in the SPAN session. You cannot separate the traffic by IP multicast group membership.

If you configure ingress monitoring and egress monitoring for host interfaces on the same Fabric Extender, you might see a packet twice: once as the packet ingresses on an interface with Rx configured, and again as the packet egresses on an interface with Tx configured.

**Note**

Tx monitoring on the FEX host interface (HIF) source is supported only for known Layer2 unicast traffic.

**Note**

An interface that has port ACLs or router ACLs (PACL/RACL) configured with **statistics per-entry** is not supported in a SPAN/ERSPAN session with a configured ACL filter.

For more information about SPAN, see the *Cisco Nexus 9000 Series NX-OS System Management Configuration Guide*.

## Oversubscription

In a switching environment, oversubscription is the practice of connecting multiple devices to the same interface to optimize port usage. An interface can support a connection that runs at its maximum speed. Because most interfaces do not run at their maximum speeds, you can take advantage of unused bandwidth by sharing ports. Oversubscription, which is a function of the available fabric interfaces to active host interfaces, provides cost-effective scalability and flexibility for Ethernet environments.

The Cisco Nexus 2248TP Fabric Extender has 4 10-Gigabit Ethernet fabric interfaces and 48 100/1000BASE-T (100-Mb/1-Gigabit) Ethernet host interfaces. When its host interfaces are running in Gigabit Ethernet mode, it offers the following configurations:

- No oversubscription (40 host interfaces for four fabric interfaces)
- 1.2 to 1 oversubscription (48 host interfaces for four fabric interfaces)
- 4.8 to 1 oversubscription (48 host interfaces for one fabric interface)

The Cisco Nexus 2248TP can be run with no oversubscription when its host interfaces are running in 100-Mb mode.

The Cisco Nexus 2248TP-E Fabric Extender has 4 10-Gigabit Ethernet fabric interfaces and 48 100/1000BASE-T (100-Mb/1-Gigabit) Ethernet host interfaces. When its host interfaces are running in Gigabit Ethernet mode, it offers 1.2 to 1 oversubscription (48 host interfaces for four fabric interfaces).

The Cisco Nexus 2248PQ Fabric Extender has 16 10-Gigabit Ethernet fabric interfaces and 48 10-Gigabit Ethernet host interfaces. All host interfaces use all of the available fabric interfaces. When all host interfaces are sending traffic to all fabric interfaces, the maximum oversubscription ratio for the Cisco Nexus 2248PQ is 3:1.

The Cisco Nexus 2232PP Fabric Extender has 8 10-Gigabit Ethernet fabric interfaces and 32 10-Gigabit Ethernet host interfaces. All host interfaces use all of the available fabric interfaces. (Static pinning is not



supported. Port-channel mode is supported only on fabric interfaces.) When all host interfaces are sending traffic to all fabric interfaces, the maximum oversubscription ratio for the Cisco Nexus 2232PP is 4:1.

The Cisco Nexus 2232TM and Cisco Nexus 2232TM-E Fabric Extenders have 8 10-Gigabit Ethernet fabric interfaces and 32 Gigabit and 10-Gigabit Ethernet host interfaces. All host interfaces use all of the available fabric interfaces. When all host interfaces are sending traffic to all fabric interfaces, the maximum oversubscription ratio for the Cisco Nexus 2232TM and Cisco Nexus 2232TM-E is 4:1.

The Cisco Nexus 2224TP Fabric Extender has 2 10-Gigabit Ethernet fabric interfaces and 24 100/1000BASE-T (100-Mb/1-Gigabit) Ethernet host interfaces. With this system, you can configure a 1.2 to 1 oversubscription (24 host interfaces for 2 fabric interfaces) or higher.

The Cisco Nexus B22 Fabric Extender for HP (NB22HP) has 8 10-Gigabit Ethernet fabric interfaces and 16 1G/10-Gigabit Ethernet host interfaces. All host interfaces use all of the available fabric interfaces. When all host interfaces are sending traffic to all fabric interfaces, the maximum oversubscription ratio for the Cisco Nexus B22 Fabric Extender for HP (N2K-B22HP-P) is 2:1.

The Cisco Nexus B22 Fabric Extender for Dell (NB22DELL) has 8 10-Gigabit Ethernet fabric interfaces and 16 1G/10-Gigabit Ethernet host interfaces. All host interfaces use all of the available fabric interfaces. When all host interfaces are sending traffic to all fabric interfaces, the maximum oversubscription ratio for the Cisco Nexus B22 Fabric Extender for Dell (N2K-B22DELL-P) is 2:1.

## Management Model

The Cisco Nexus 2000 Series Fabric Extender is managed by its parent switch over the fabric interfaces through a zero-touch configuration model. The switch discovers the Fabric Extender by detecting the fabric interfaces of the Fabric Extender.

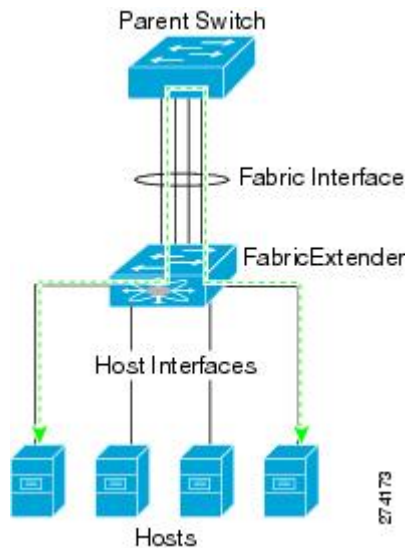
After discovery, if the Fabric Extender has been correctly associated with the parent switch, the following operations are performed:

- 1 The switch checks the software image compatibility and upgrades the Fabric Extender if necessary.
- 2 The switch and Fabric Extender establish in-band IP connectivity with each other.
- 3 The switch pushes the configuration data to the Fabric Extender. The Fabric Extender does not store any configuration locally.
- 4 The Fabric Extender updates the switch with its operational status. All Fabric Extender information is displayed using the switch commands for monitoring and troubleshooting.

# Forwarding Model

The Cisco Nexus 2000 Series Fabric Extender does not perform any local switching. All traffic is sent to the parent switch that provides central forwarding and policy enforcement, including host-to-host communications between two systems that are connected to the same Fabric Extender as shown in the following figure.

**Figure 1: Forwarding Model**



The forwarding model facilitates feature consistency between the Fabric Extender and its parent Cisco Nexus Series device.



## Note

The Fabric Extender provides end-host connectivity into the network fabric. As a result, BPDU Guard is enabled on all its host interfaces. If you connect a bridge or switch to a host interface, that interface is placed in an error-disabled state when a BPDU is received.

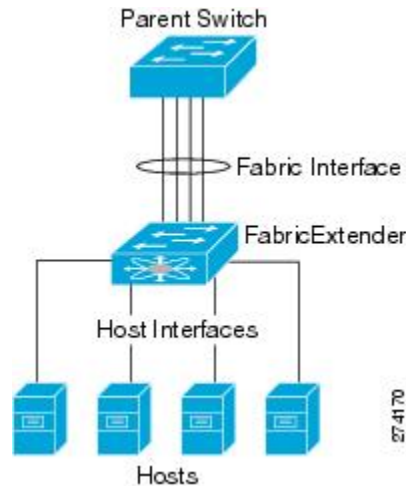
You cannot disable BPDU Guard on the host interfaces of the Fabric Extender.

The Fabric Extender supports egress multicast replication from the network to the host. Packets that are sent from the parent switch for multicast addresses attached to the Fabric Extender are replicated by the Fabric Extender ASICs and are then sent to corresponding hosts.

# Port Channel Fabric Interface Connection

To provide load balancing between the host interfaces and the parent switch, you can configure the Fabric Extender to use a port channel fabric interface connection. This connection bundles 10-Gigabit Ethernet fabric interfaces into a single logical channel as shown in the following figure.

**Figure 2: Port Channel Fabric Interface Connection**



When you configure the Fabric Extender to use a port channel fabric interface connection to its parent switch, the switch load balances the traffic from the hosts that are connected to the host interface ports by using the following load-balancing criteria to select the link:

- For a Layer 2 frame, the switch uses the source and destination MAC addresses.
- For a Layer 3 frame, the switch uses the source and destination MAC addresses and the source and destination IP addresses.



## Note

A fabric interface that fails in the port channel does not trigger a change to the host interfaces. Traffic is automatically redistributed across the remaining links in the port channel fabric interface. If all links in the fabric port channel go down, all host interfaces on the FEX are set to the down state.

## Port Numbering Convention

The following port numbering convention is used for the Fabric Extender:

`interface ethernet chassis/slot/port`

where

- *chassis* is configured by the administrator. A Fabric Extender must be directly connected to its parent Cisco Nexus Series device via a port channel fabric interface. You configure a chassis ID on a port channel on the switch to identify the Fabric Extender that is discovered through those interfaces.

The chassis ID ranges from 101 to 199.



**Note** The chassis ID is required only to access a host interface on the Fabric Extender. A value of less than 101 indicates a slot on the parent switch. The following port numbering convention is used for the interfaces on the switch:

```
interface ethernet slot/port
```

- *slot* identifies the slot number on the Fabric Extender.
- *port* identifies the port number on a specific slot and chassis ID.

## Fabric Extender Image Management

No software ships with the Cisco Nexus 2000 Series Fabric Extender. The Fabric Extender image is bundled into the system image of the parent switch. The image is automatically verified and updated (if required) during the association process between the parent switch and the Fabric Extender.

When you enter the **install all** command, it upgrades the software on the parent Cisco Nexus Series switch and also upgrades the software on any attached Fabric Extender. To minimize downtime as much as possible, the Fabric Extender remains online while the installation process loads its new software image. Once the software image has successfully loaded, the parent switch and the Fabric Extender both automatically reboot.

This process is required to maintain version compatibility between the parent switch and the Fabric Extender.

## Licensing Requirements for the Fabric Extender

The following table shows the licensing requirements for the Cisco Nexus 2000 Series Fabric Extender:

| Product     | License Requirement  |
|-------------|--|
| Cisco NX-OS | The Cisco Nexus 2000 Series Fabric Extender requires no license. Any feature not included in a license package is bundled with the Cisco NX-OS system images and is provided at no extra charge to you. For an explanation of the licensing scheme, see the <i>Cisco NX-OS Licensing Configuration Guide</i> . |

## Guidelines and Limitations for the Fabric Extender

The Cisco Nexus 2000 Series Fabric Extender has the following configuration guidelines and limitations:

- **show** commands with the **internal** keyword are not supported.
- The default port mode was Layer 2.

- You can configure a maximum of eight ports as part of a fabric port channel (the uplink from the Fabric Extender to the switch).
- You can only connect the Fabric Extender to a Cisco Nexus 9396 device or a Cisco Nexus 9372PX device.
- You can configure the Fabric Extender host interfaces as edge ports only. The interface is placed in an error-disabled state if a downstream switch is detected.
- When you connect a FEX to a Cisco Nexus 9000 series device, the queuing capability on the FEX host interface is limited. A router that is connected to a Layer 2 (using SVI interfaces) cannot participate in routing protocol adjacency. The FEX cannot be used as a peer because when congestion occurs on the FEX host interface, the control plane traffic is not prioritized. This limitation also applies to the FEX when it is connected to other Layer 3 devices, such as an ASA firewall, an ACE load balancer, or other Layer 3 networking devices that are running a dynamic routing protocol. Static routes to routers, ASA firewalls, ACE load balancers, and other Layer 3 network devices are supported.
- Cisco Nexus 9300 Series switches do not support FEX on uplink modules (ALE - Application Leaf Engine).
- If you configure the FEX with **speed 100/full-duplex** and you do not explicitly configure the neighboring device with **speed 100/full-duplex**, the data packets might not pass properly even though the link may appear as being "up".

| Interface Configuration | Description  |
|-------------------------|--|
| <b>no speed</b>         | Autonegotiates and advertises all speeds (only full duplex).   |
| <b>speed 100</b>        | Does not autonegotiate; pause cannot be advertised. The peer must be set to not autonegotiate (only 100 Mbps full duplex supported). |
| <b>speed 1000</b>       | Autonegotiates and advertises pause (advertises only for 1000 Mbps full duplex).   |

## Configuration Limits

The configuration limits are documented in the *Cisco Nexus 9000 Series NX-OS Verified Scalability Guide*.

## Default Settings

This table lists the default settings for the Fabric Extender parameters.

**Table 2: Default Cisco Nexus 2000 Series Fabric Extender Parameter Settings**

| Parameters                     | Default  |
|--------------------------------|----------|
| <b>feature-set fex command</b> | Disabled |

| Parameters | Default |
|------------|---------|
| Port mode  | Layer 2 |



## Configuring the Fabric Extender

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This chapter describes how to configure a Cisco Nexus 2000 Series Fabric Extender using a parent device and includes the following sections:

- [Configuring the Cisco Nexus 2000 Series Fabric Extender, page 15](#)
- [Verifying the Configuration, page 22](#)
- [Additional References, page 27](#)

### Configuring the Cisco Nexus 2000 Series Fabric Extender

This section describes how to configure the Fabric Extender.

#### Managing the Fabric Extender Feature Set

You can install and manage the Fabric Extender feature set.

##### SUMMARY STEPS

1. [Installing the Fabric Extender Feature Set, on page 16](#)
2. [Enabling the Fabric Extender Feature Set, on page 16](#)

##### DETAILED STEPS

- 
- |               |  |
|---------------|--|
| <b>Step 1</b> | <a href="#">Installing the Fabric Extender Feature Set, on page 16</a> |
| <b>Step 2</b> | <a href="#">Enabling the Fabric Extender Feature Set, on page 16</a>   |
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## Installing the Fabric Extender Feature Set

### SUMMARY STEPS

1. **configure terminal**
2. **install feature-set fex**
3. **exit**

### DETAILED STEPS

|               | Command or Action   | Purpose   |
|---------------|---|---|
| <b>Step 1</b> | <b>configure terminal</b><br><br><b>Example:</b><br>switch# configure terminal<br>switch(config)# | Enters global configuration mode.   |
| <b>Step 2</b> | <b>install feature-set fex</b><br><br><b>Example:</b><br>switch(config)# install feature-set fex  | To uninstall the Fabric Extender feature set, use the <b>no install feature-set fex</b> command. Before you can uninstall the feature set, you must ensure the following: |
| <b>Step 3</b> | <b>exit</b><br><br><b>Example:</b><br>switch(config)# exit<br>switch#                             | Exits global configuration mode.  |

## Enabling the Fabric Extender Feature Set

You can enable the installed Fabric Extender feature set in any VDC on the device.

### SUMMARY STEPS

1. **configure terminal**
2. **feature-set fex**
3. **exit**



## DETAILED STEPS

|        | Command or Action   | Purpose  |
|--------|---|--|
| Step 1 | <b>configure terminal</b><br><br><b>Example:</b><br><pre>switch# configure terminal switch(config)#</pre> | Enters global configuration mode.  |
| Step 2 | <b>feature-set fex</b><br><br><b>Example:</b><br><pre>switch(config)# feature-set fex</pre>               | <p>Enables the Fabric Extender feature set. The feature set must be installed before it shows as an option to this command.</p> <p>To disable the Fabric Extender feature set, use the <b>no feature-set fex</b> command.</p> <p><b>Note</b> The <b>no feature-set fex</b> command might take some time to complete if the size of the configuration is very large. The command cleans up all of the configurations associated with the Fabric Extender feature set.</p> |
| Step 3 | <b>exit</b><br><br><b>Example:</b><br><pre>switch(config)# exit switch#</pre>                             | Exits global configuration mode.   |

## Associating a Fabric Extender to a Fabric Interface

### Associating a Fabric Extender to a Port Channel

#### Before You Begin

Ensure that you have enabled the Fabric Extender feature.

#### SUMMARY STEPS

1. **configure terminal**
2. **interface port-channel** *channel*
3. **switchport mode fex-fabric**
4. **fex associate** *FEX-number*
5. (Optional) **show interface port-channel** *channel fex-intf*

## DETAILED STEPS

|               | Command or Action   | Purpose  |
|---------------|---|--|
| <b>Step 1</b> | <b>configure terminal</b><br><br><b>Example:</b><br>switch# configure terminal<br>switch(config)#                                     | Enters global configuration mode.  |
| <b>Step 2</b> | <b>interface port-channel <i>channel</i></b><br><br><b>Example:</b><br>switch(config)# interface port-channel 4<br>switch(config-if)# | Specifies a port channel to configure.   |
| <b>Step 3</b> | <b>switchport mode fex-fabric</b><br><br><b>Example:</b><br>switch(config-if)# switchport mode fex-fabric                             | Sets the port channel to support an external Fabric Extender.  |
| <b>Step 4</b> | <b>fex associate <i>FEX-number</i></b><br><br><b>Example:</b><br>switch(config-if)# fex associate 101                                 | Associates a FEX number to the Fabric Extender unit attached to the interface. The range is from 101 to 199. |
| <b>Step 5</b> | <b>show interface port-channel <i>channel</i> fex-intf</b><br><br><b>Example:</b><br>switch# show interface port-channel 4 fex-intf   | (Optional)<br>Displays the association of a Fabric Extender to a port channel interface.                     |

This example shows how to associate the Fabric Extender to a port channel interface on the parent device:

```
switch# configure terminal
switch(config)# interface ethernet 1/28
switch(config-if)# channel-group 4
switch(config-if)# no shutdown
switch(config-if)# exit
switch(config)# interface ethernet 1/29
switch(config-if)# channel-group 4
switch(config-if)# no shutdown
switch(config-if)# exit
switch(config)# interface ethernet 1/30
switch(config-if)# channel-group 4
switch(config-if)# no shutdown
switch(config-if)# exit
switch(config)# interface ethernet 1/31
switch(config-if)# channel-group 4
switch(config-if)# no shutdown
switch(config-if)# exit
switch(config)# interface port-channel 4
switch(config-if)# switchport
switch(config-if)# switchport mode fex-fabric
switch(config-if)# fex associate 101
```

**Tip**

As a best practice, only enter the **flex associate** command from the port channel interface, not from the physical interface.

**Note**

When adding physical interfaces to port channels, all configurations on the port channel and physical interface must match.

This example shows how to display the association of the Fabric Extender and the parent device:

```
switch# show interface port-channel 4 flex-intf
Fabric          FEX
Interface       Interfaces
-----
Po4             Eth101/1/48  Eth101/1/47  Eth101/1/46  Eth101/1/45
                Eth101/1/44  Eth101/1/43  Eth101/1/42  Eth101/1/41
                Eth101/1/40  Eth101/1/39  Eth101/1/38  Eth101/1/37
                Eth101/1/36  Eth101/1/35  Eth101/1/34  Eth101/1/33
                Eth101/1/32  Eth101/1/31  Eth101/1/30  Eth101/1/29
                Eth101/1/28  Eth101/1/27  Eth101/1/26  Eth101/1/25
                Eth101/1/24  Eth101/1/23  Eth101/1/22  Eth101/1/21
                Eth101/1/20  Eth101/1/19  Eth101/1/18  Eth101/1/17
                Eth101/1/16  Eth101/1/15  Eth101/1/14  Eth101/1/13
                Eth101/1/12  Eth101/1/11  Eth101/1/10  Eth101/1/9
                Eth101/1/8   Eth101/1/7   Eth101/1/6   Eth101/1/5
                Eth101/1/4   Eth101/1/3   Eth101/1/2   Eth101/1/1
```

## Disassociating a Fabric Extender from an Interface

### Before You Begin

Ensure that you have enabled the Fabric Extender feature.

### SUMMARY STEPS

1. **configure terminal**
2. **interface {ethernet slot/port | port-channel channel}**
3. **no flex associate**

### DETAILED STEPS

|               | Command or Action   | Purpose   |
|---------------|---|---|
| <b>Step 1</b> | <b>configure terminal</b><br><br><b>Example:</b><br>switch# configure terminal<br>switch(config)#   | Enters global configuration mode.   |
| <b>Step 2</b> | <b>interface {ethernet slot/port   port-channel channel}</b><br><br><b>Example:</b><br>switch(config)# interface port-channel 4<br>switch(config-if)# | Specifies the interface to configure. The interface can be an Ethernet interface or a port channel. |

|               | Command or Action   | Purpose   |
|---------------|---|---|
| <b>Step 3</b> | <b>no fex associate</b><br><br><b>Example:</b><br>switch(config-if)# no fex associate | Disassociates the Fabric Extender unit attached to the interface. |

## Configuring Fabric Extender Global Features

You can configure global features on the Fabric Extender.

### Before You Begin

Ensure that you have enabled the Fabric Extender feature set.

### SUMMARY STEPS

1. **configure terminal**
2. **fex** *FEX-number*
3. (Optional) **description** *desc*
4. (Optional) **no description**
5. (Optional) **no type**
6. (Optional) **serial** *serial*
7. (Optional) **no serial**

### DETAILED STEPS

|               | Command or Action  | Purpose   |
|---------------|--|---|
| <b>Step 1</b> | <b>configure terminal</b><br><br><b>Example:</b><br>switch# configure terminal<br>switch(config)#      | Enters global configuration mode.   |
| <b>Step 2</b> | <b>fex</b> <i>FEX-number</i><br><br><b>Example:</b><br>switch(config)# fex 101<br>switch(config-fex)#  | Enters FEX configuration mode for the specified Fabric Extender. The range of the <i>FEX-number</i> is from 101 to 199.<br><br><b>Note</b> If you need to change the FEX number, you must remove the previous configuration (using the <b>no fex</b> <i>FEX-number</i> command) before applying a new FEX number. |
| <b>Step 3</b> | <b>description</b> <i>desc</i><br><br><b>Example:</b><br>switch(config-fex)# description<br>Rack7A-N2K | (Optional)<br>Specifies the description. The default is the string FEXxxxx where xxxx is the FEX number. If the FEX number is 123, the description is FEX0123.  |

|        | Command or Action   | Purpose  |
|--------|---|--|
| Step 4 | <p><b>no description</b></p> <p><b>Example:</b><br/>switch(config-fex)# no description</p>    | <p>(Optional)<br/>Deletes the description.</p>   |
| Step 5 | <p><b>no type</b></p> <p><b>Example:</b><br/>switch(config-fex)# no type</p>                  | <p>(Optional)<br/>Deletes the FEX type. When a Fabric Extender is connected to the fabric interfaces and does not match the configured type that is saved in the binary configuration on the parent switch, all configurations for all interfaces on the Fabric Extender are deleted.</p>  |
| Step 6 | <p><b>serial serial</b></p> <p><b>Example:</b><br/>switch(config-fex)# serial JAF1339BDSK</p> | <p>(Optional)<br/>Defines a serial number string. If this command is configured, a switch allows the corresponding chassis ID to associate (using the <b>fex associate</b> command) only if the Fabric Extender reports a matching serial number string.</p> <p><b>Caution</b> Configuring a serial number that does not match the specified Fabric Extender forces the Fabric Extender offline.</p> |
| Step 7 | <p><b>no serial</b></p> <p><b>Example:</b><br/>switch(config-fex)# no serial</p>              | <p>(Optional)<br/>Deletes the serial number string.</p>  |

## Configuration Examples

This section contains examples of FEX configurations.

### Configuring a Host Interface in a vPC Topology Connected to Two FEXs

This example shows how to configure a host vPC with a FEX (host vPC attached to two different FEXs):

| Switch 1 Configuration  | Switch 2 Configuration  |
|---|---|
| <pre> config t feature lacp int e101/1/1-2 channel-group 10 mode active no shutdown  Int port-channel10 switchport switchport mode trunk switchport trunk allowed vlan 1-20 vpc 10                     </pre> | <pre> config t feature lacp int e101/1/1-2 channel-group 10 mode active no shutdown  Int port-channel10 switchport switchport mode trunk switchport trunk allowed vlan 1-20 vpc 10                     </pre> |

## Verifying the Configuration

This section describes how to display the configuration of the Fabric Extender and verify the chassis hardware status.

### Verifying the Fabric Extender Configuration

Use the following commands to display configuration information about the defined interfaces on a Fabric Extender:

| Command or Action  | Purpose  |
|--|--|
| <b>show fex</b> [ <i>FEX-number</i> ] [ <b>detail</b> ]                        | Displays information about a specific Fabric Extender or all attached units.                                       |
| <b>show interface</b> <i>type number fex-intf</i>                              | Displays the Fabric Extender ports that are pinned to a specific switch interface.                                 |
| <b>show interface fex-fabric</b>   | Displays the switch interfaces that have detected a Fabric Extender uplink.  |
| <b>show interface ethernet</b> <i>number transceiver</i> [ <b>fex-fabric</b> ] | Displays the SFP+ transceiver and diagnostic optical monitoring (DOM) information for the Fabric Extender uplinks. |
| <b>show feature-set</b>  | Displays the status of the feature sets on the device.   |

#### Configuration Examples for the Fabric Extender

This example shows how to display all the attached Fabric Extender units:

This example shows how to display the detailed status of a specific Fabric Extender:

This example shows how to display the Fabric Extender interfaces pinned to a specific switch interface:

This example shows how to display the switch interfaces that are connected to a Fabric Extender uplink:

This example shows how to display the SFP+ transceiver and diagnostic optical monitoring (DOM) information for Fabric Extender uplinks for an SFP+ transceiver that is plugged into the parent switch interface:

```
switch# show interface ethernet 1/40 transceiver
Ethernet1/40
  sfp is present
  name is CISCO-MOLEX INC
  part number is 74752-9026
  revision is A0
  serial number is MOC13321057
  nominal bitrate is 12000 MBits/sec
  Link length supported for copper is 3 m(s)
  cisco id is --
  cisco extended id number is 4
```

This example shows how to display the SFP+ transceiver and DOM information for Fabric Extender uplinks for an SFP+ transceiver that is plugged into the uplink port on the Fabric Extender:

```
switch# show interface ethernet 1/40 transceiver fex-fabric
Ethernet1/40
  sfp is present
  name is CISCO-MOLEX INC
  part number is 74752-9026
  revision is A0
  serial number is MOC13321057
  nominal bitrate is 12000 Mbits/sec
  Link length supported for 50/125mm fiber is 0 m(s)
  Link length supported for 62.5/125mm fiber is 0 m(s)
  cisco id is --
  cisco extended id number is 4
```

## Verifying the Chassis Management Information

Use the following to display configuration information used on the switch supervisor to manage the Fabric Extender.

| Command or Action  | Purpose   |
|--|---|
| <b>show environment fex</b> {all   <i>FEX-number</i> }<br>[temperature   power   fan]        | Displays the environmental sensor status.   |
| <b>show inventory fex</b> <i>FEX-number</i>  | Displays inventory information for a Fabric Extender.   |
| <b>show module fex</b> [ <i>FEX-number</i> ]   | Displays module information about a Fabric Extender.  |
| <b>show sprom fex</b> <i>FEX-number</i> {all   backplane   powersupply <i>ps-num</i> }   all | Displays the contents of the serial PROM (SPROM) on the Fabric Extender. The unit of the power for the <b>show sprom</b> command is displayed in centi-amperes. |

### Configuration Examples for Chassis Management

This example shows how to display the module information about all connected Fabric Extender units:

This example shows how to display the inventory information about a specific Fabric Extender:

```
switch# show inventory fex 101
NAME: "FEX 101 CHASSIS", DESCR: "N2K-C2248TP-1GE CHASSIS"
PID: N2K-C2248TP-1GE , VID: V00 , SN: SSI13380FSM

NAME: "FEX 101 Module 1", DESCR: "Fabric Extender Module: 48x1GE, 4x10GE Supervisor"
PID: N2K-C2248TP-1GE , VID: V00 , SN: JAF1339BDSK

NAME: "FEX 101 Fan 1", DESCR: "Fabric Extender Fan module"
PID: N2K-C2248-FAN , VID: N/A , SN: N/A

NAME: "FEX 101 Power Supply 2", DESCR: "Fabric Extender AC power supply"
PID: NXK-PAC-400W , VID: 000 , SN: LIT13370QD6
```

This example shows how to display the environment status for a specific Fabric Extender:

```
switch# show environment fex 101

Temperature Fex 101:
-----
```

| Module | Sensor   | MajorThresh<br>(Celsius) | MinorThres<br>(Celsius) | CurTemp<br>(Celsius) | Status |
|--------|----------|--------------------------|-------------------------|----------------------|--------|
| 1      | Outlet-1 | 60                       | 50                      | 33                   | ok     |
| 1      | Outlet-2 | 60                       | 50                      | 38                   | ok     |
| 1      | Inlet-1  | 50                       | 40                      | 35                   | ok     |
| 1      | Die-1    | 100                      | 90                      | 44                   | ok     |

Fan Fex: 101:

| Fan     | Model         | Hw | Status |
|---------|---------------|----|--------|
| Chassis | N2K-C2148-FAN | -- | ok     |
| PS-1    | --            | -- | absent |
| PS-2    | NXK-PAC-400W  | -- | ok     |

Power Supply Fex 101:

Voltage: 12 Volts

| PS | Model        | Power<br>(Watts) | Power<br>(Amp) | Status |
|----|--------------|------------------|----------------|--------|
| 1  | --           | --               | --             | --     |
| 2  | NXK-PAC-400W | 4.32             | 0.36           | ok     |

| Mod | Model           | Power<br>Requested<br>(Watts) | Power<br>Requested<br>(Amp) | Power<br>Allocated<br>(Watts) | Power<br>Allocated<br>(Amp) | Status     |
|-----|-----------------|-------------------------------|-----------------------------|-------------------------------|-----------------------------|------------|
| 1   | N2K-C2248TP-1GE | 0.00                          | 0.00                        | 0.00                          | 0.00                        | powered-up |

Power Usage Summary:

Power Supply redundancy mode: redundant

Total Power Capacity 4.32 W

Power reserved for Supervisor(s) 0.00 W

Power currently used by Modules 0.00 W

Total Power Available 4.32 W

This example shows how to display the SPROM for a specific Fabric Extender:

```
switch# show sprom fex 101 all
DISPLAY FEX 101 SUP sprom contents
Common block:
Block Signature : 0xabab
Block Version   : 3
Block Length    : 160
Block Checksum  : 0x1ale
EEPROM Size     : 65535
Block Count     : 3
FRU Major Type  : 0x6002
FRU Minor Type  : 0x0
OEM String      : Cisco Systems, Inc.
Product Number  : N2K-C2248TP-1GE
Serial Number   : JAF1339BDSK
Part Number     : 73-12748-01
Part Revision   : 11
Mfg Deviation   : 0
H/W Version     : 0.103
Mfg Bits        : 0
Engineer Use    : 0
snmpOID        : 9.12.3.1.9.78.3.0
Power Consump   : 1666
```



```

RMA Code          : 0-0-0-0
CLEI Code         : XXXXXXXXXTBDV00
VID              : V00
Supervisor Module specific block:
Block Signature   : 0x6002
Block Version    : 2
Block Length     : 103
Block Checksum   : 0x2686
Feature Bits     : 0x0
HW Changes Bits  : 0x0
Card Index       : 11016
MAC Addresses    : 00-00-00-00-00-00
Number of MACs   : 0
Number of EPLD   : 0
Port Type-Num    : 1-48;2-4
Sensor #1        : 60,50
Sensor #2        : 60,50
Sensor #3        : -128,-128
Sensor #4        : -128,-128
Sensor #5        : 50,40
Sensor #6        : -128,-128
Sensor #7        : -128,-128
Sensor #8        : -128,-128
Max Connector Power: 4000
Cooling Requirement: 65
Ambient Temperature: 40

DISPLAY FEX 101 backplane sprom contents:
Common block:
Block Signature   : 0xabab
Block Version    : 3
Block Length     : 160
Block Checksum   : 0x1947
EEPROM Size      : 65535
Block Count      : 5
FRU Major Type   : 0x6001
FRU Minor Type   : 0x0
OEM String       : Cisco Systems, Inc.
Product Number   : N2K-C2248TP-1GE
Serial Number    : SSI13380FSM
Part Number      : 68-3601-01
Part Revision    : 03
Mfg Deviation    : 0
H/W Version      : 1.0
Mfg Bits         : 0
Engineer Use     : 0
snmpOID          : 9.12.3.1.3.914.0.0
Power Consump    : 0
RMA Code         : 0-0-0-0
CLEI Code        : XXXXXXXXXTDBV00
VID              : V00
Chassis specific block:
Block Signature   : 0x6001
Block Version    : 3
Block Length     : 39
Block Checksum   : 0x2cf
Feature Bits     : 0x0
HW Changes Bits  : 0x0
Stackmib OID     : 0
MAC Addresses    : 00-0d-ec-e3-28-00
Number of MACs   : 64
OEM Enterprise   : 0
OEM MIB Offset   : 0
MAX Connector Power: 0
WWN software-module specific block:
Block Signature   : 0x6005
Block Version    : 1
Block Length     : 0
Block Checksum   : 0x66
wn usage bits:
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00

```

```

00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
00 00

```

License software-module specific block:

```

Block Signature : 0x6006
Block Version   : 1
Block Length    : 16
Block Checksum  : 0x86f
lic usage bits:
ff ff ff ff ff ff ff ff

```

DISPLAY FEX 101 power-supply 2 sptom contents:

Common block:

```

Block Signature : 0xabab
Block Version   : 3
Block Length    : 160
Block Checksum  : 0x1673
EEPROM Size     : 65535
Block Count     : 2
FRU Major Type  : 0xab01
FRU Minor Type  : 0x0
OEM String      : Cisco Systems Inc   NXK-PAC-400W
Product Number  : NXK-PAC-400W
Serial Number   : LIT13370QD6
Part Number     : 341
Part Revision   : -037
CLEI Code       : 5-01 01 000
VID             : 000
snmpOID         : 12336.12336.12336.12336.12336.12336.12374.12336
H/W Version     : 43777.2
Current         : 36
RMA Code        : 200-32-32-32

```

Power supply specific block:

```

Block Signature : 0x0
Block Version   : 0
Block Length    : 0
Block Checksum  : 0x0
Feature Bits    : 0x0
Current 110v    : 36
Current 220v    : 36
Stackmib OID    : 0

```

## Additional References

This section includes additional information that is related to configuring the Cisco Nexus 2000 Series Fabric Extender.

## Related Documents

| Related Topic           | Document Title  |
|-------------------------|---|
| Cisco NX-OS Licensing   | <i>Cisco NX-OS Licensing Guide</i>                                  |
| Interface configuration | <i>Cisco Nexus 9000 Series NX-OS Interfaces Configuration Guide</i> |
| Command reference       | <i>Cisco Nexus 9000 Series Command References</i>                   |
|                         |   |

