



FCoE Over FEX

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Overview

The Fibre Channel over Ethernet (FCoE) over Fabric Extenders (FEX) feature allows Fibre Channel traffic to be carried on a FEX port. The FEX is connected to a Cisco Nexus 9000 device that is in FCoE NPV mode through a Fabric Port Channel (FPC). FCoE over FEX enables the provisioning of FCoE on host connections.

For more information about FEX, see the *Cisco Nexus 2000 Series NX-OS Fabric Extender Configuration Guide for Cisco Nexus 9000 Series Switches*.

FCoE Over FEX with vPC

FCoE over FEX with virtual Port Channel (vPC) allows Fibre Channel traffic to be carried over a FEX using a virtual Port Channel (vPC).

LAN Shutdown

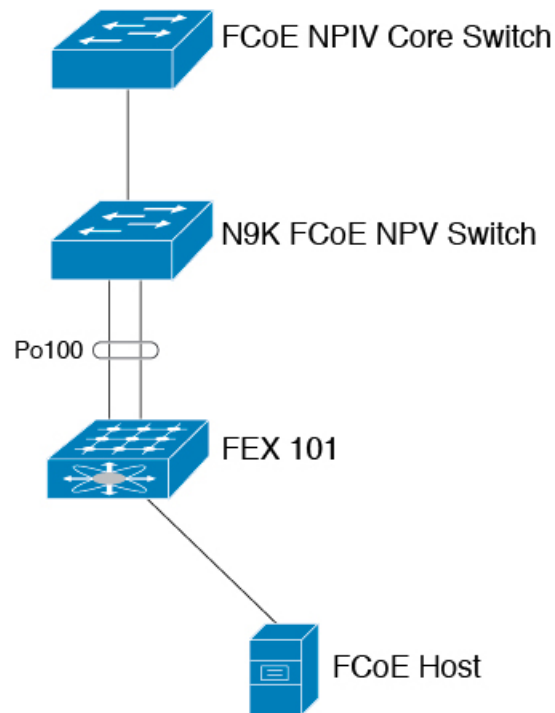
The LAN shutdown feature detects the capability of the FCoE host to support Data Center Bridging (DCBX). DCBX allows the switch to send the LAN Logical Link status (LLS) messages in a type-length-value (TLV) format. The LAN shutdown feature enables bring up and bring down of LAN links on a unified link carrying both FCoE and LAN traffic. When you use the **shutdown lan** command, only the LAN traffic stops while the FCoE traffic continues.

FCoE Over FEX Topologies

FCoE over FEX is supported in the following topologies:

Straight Through FEX with Host Topology

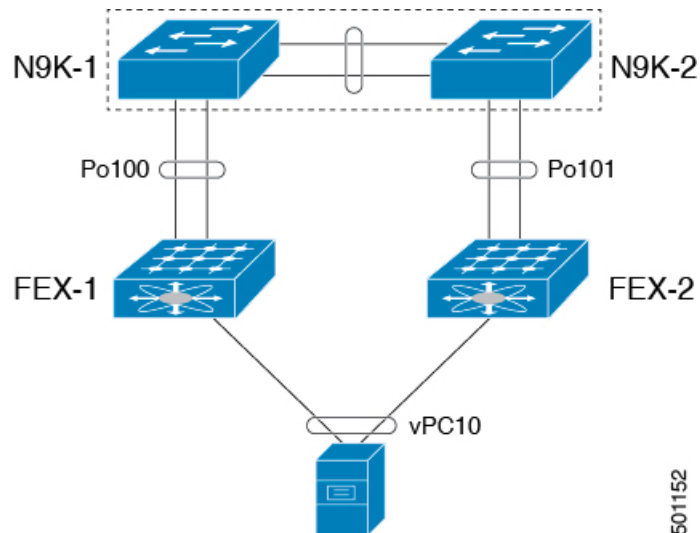
The straight through FEX with host topology is supported with Cisco NX-OS Release 9.3(3) and later.



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Straight Through FEX with Host VPC Topology

The straight through FEX with host VPC topology is supported with Cisco NX-OS Release 9.3(3) and later.



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Dual-Homed FEX Topology (Active/Active FEX Topology)

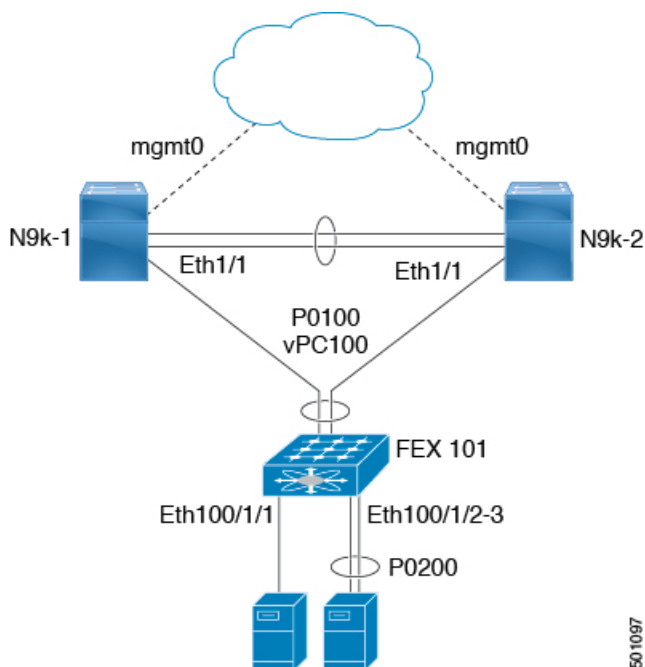
The dual-homed FEX topology is supported with Cisco NX-OS Release 9.3(3) and later with Cisco Nexus 9300-EX and 9300-FX Series switches.

The following topology shows that each FEX is dual-homed with two Cisco Nexus 9000 Series switches. The FEX-fabric interfaces for each FEX are configured as a vPC on both peer switches. The host interfaces on the FEX appear on both peer switches.



Note The host interfaces configuration should be the same on both switches.

Figure 1: Dual-Homed FEX Topology



Operational vPC is mandatory for the dual-homed FEX topology. In the Dual-Homed FEX Active/Active Topology, the vPC is already operational. FEX 101 is dual-homed to both parent switches: N9k-1 and N9k-2 on FEX-fabric interfaces Ethernet 1/1.



Note Only the following support an active-active FEX topology:

- N2K-C2232PP
- N2K-C2348UPQ
- NB22IBM
- NB22HP



Note A port channel within the same FEX is supported on Cisco Nexus 2200 Series Fabric Extenders.

Guidelines and Limitations for FCoE Over FEX

- Starting from Release 7.0(3)I5(1) FCOE over FEX in Straight through mode is supported in the below platforms:
 - N9K-C93180YC-EX
 - N9K-C9332PQ
 - N9K-C9372PX
 - N9K-C9372PX-E
 - N9K-C9396PX
 - N9K-X9464PX line cards
 - N9K-X9564PX line cards
- Starting from Release 7.0(3)I7(2), FCOE over FEX is supported on the N9K-C93180YC-FX platforms in both ST and AA mode.
- SAN boot via FEX HIF port is not supported in below platforms when the HIF port is member of a port-channel and the channel mode is active:
 - N9K-C9332PQ
 - N9K-C9372PX
 - N9K-C9372PX-E
 - N9K-C9396PX
 - N9K-X9464PX line cards
 - N9K-X9564PX line cards
- FCoE over FEX is supported on the following FEXs:
 - N2K-C2348UPQ
 - N2K-C2232PP
 - N2K-B22IBM-P
 - N2K-B22HP-P
- Starting in Release 7.0(3)I6(1), N9K-C93180LC-EX supports FCoE over FEX only on the N2K-C2348UPQ. Other FEX models are not supported with this device.
- FCoE over FEX is not supported on the following:
 - FEX HIF ports only support vFC in F mode. NP mode vFCs are not supported over FEX HIF ports.
 - A Fabric Port Channel cannot exceed a maximum of eight member ports.
 - 4q policies are supported on FCoE over FEX.

- 8q policies are not supported on FCoE over FEX.
- FC ports are not supported on FEX.



Note For information about scalability, see the *Cisco Nexus 9000 Series NX-OS Verified Scalability Guide*.

Information Before Configuring FCoE Over FEX



Note This information is applicable only for Cisco Nexus 9500 switches and the following specific Cisco Nexus 9300 switches (not applicable to other Cisco Nexus 9000 switches):

- N9K-C93180LC-EX
- N9K-C9332PQ
- N9K-C9372PX
- N9K-C9372PX-E
- N9K-C9396PX

-
- Enable the Configuration

Using the **fcoe enable-fex** command results in disabling any load-balancing (based on SID, DID, OXID) on the switch.

The **fcoe enable-fex** command is needed for the FCOE host logins to work properly when connected to the FEX HIF ports. This command is supported and required only on the following Cisco Nexus 9000 FCoE NPVswitches: (N9K-C9332PQ, N9K-C9372PX-E, N9K-C9372PX, N9K-C9396PX, N9K-X9464PX line cards, and N9K-X9564PX line cards).

```
switch(config)# fcoe enable-fex
Warning: Enabling FCoE over FEX may cause traffic drop. Continue [y/n]?
```

- Disable the Configuration

Using the **no fcoe enable-fex** command results in enabling any load-balancing (based on SID, DID, OXID) on the switch.

```
switch(config)# no fcoe enable-fex
Warning: Enabling FCoE over FEX may cause traffic drop. Continue [y/n]?
```

Configuring FCoE Over FEX

Configuring Straight Through FEX with Host



Note Considerations for FEX Fabric Port Channel (FPC):

- Priority flow control (PFC) requires to be enabled explicitly for Pause to work.

```
interface "port-channel"
priority-flow-control mode on
```

- If the switch is connected to a host that does not have DCBX support, PFC needs to be enabled explicitly on HIF interfaces.

```
interface "hif interface"
priority-flow-control mode on
```

- The LLDP feature should be enabled on the switch with the **feature lldp** command.
- First attach the interfaces to the fex-fabric port-channel and then enable the priority-flow-control mode with the **priority-flow-control mode on** command.
- The **foe enable-fex** command is required for the FCoE host logins to work properly when connected to the FEX HIF ports. This command is supported and required only on the following Cisco Nexus 9000 series switches such as N9K-C9332PQ, N9K-C9372PX-E, N9K-C9372PX, N9K-C9396PX, N9K-X9464PX line cards, and N9K-X9564PX line cards.

Before you begin

- Ensure configuration of FEX. For more information, see the *Cisco Nexus 2000 Series NX-OS Fabric Extender Configuration Guide for Cisco Nexus 9000 Series Switches*.
- Ensure the configuration of FCoE NPV. For more information, see the section: *Configuring FCoE NPV*.
- You must apply the QoS policy at the system (global) level and to the Host Interfaces (HIF's) to honor the pause frames in the FCoE traffic.

```
switch(config)# system qos
switch(config-sys-qos)# service-policy type queuing input policy-name
switch(config-sys-qos)# service-policy type queuing output policy-name
switch(config-sys-qos)# service-policy type network-qos policy-name
switch(config-sys-qos)# service-policy type qos input policy-name
```

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	interface port-channel <port_num> Example: switch(config)#interface port-channel 101	Creates port-channel and enters the interface configuration mode.
Step 3	switchport Example: switch(config-if)#switchport	Sets Layer 2 switching port.
Step 4	switchport mode fex-fabric Example: switch(config-if)#switchport mode fex-fabric	Sets the interface type to be a uplink port for a Fabric extender (FEX).
Step 5	fex associate <fex_id> Example: switch(config-if)#fex associate 101	Associates a Fabric Extender (FEX) to a Fabric interface.
Step 6	mtu 9216 Example: switch(config-if)#mtu 9216	Configures the MTU value to that of jumbo frames to carry FCoE traffic through the NIF ports.
Step 7	no shutdown Example: switch(config-if)#no shutdown	Sets the port-channel to up (administratively).
Step 8	exit Example: switch(config-if)#exit	Exits the interface configuration mode.
Step 9	interface ethernet slot/port Example:	Enters interface configuration mode.

	Command or Action	Purpose
	<code>switch(config)#interface Ethernet1/1</code>	
Step 10	switchport Example: <code>switch(config-if)#switchport</code>	Sets Layer 2 switching port.
Step 11	switchport mode fex-fabric Example: <code>switch(config-if)#switchport mode fex-fabric</code>	Sets the interface type to be an uplink port for a fabric extender (FEX).
Step 12	fex associate <fex_id> Example: <code>switch(config-if)#fex associate 101</code>	Associates a Fabric Extender (FEX) to a Fabric interface.
Step 13	mtu 9216 Example: <code>switch(config-if)#mtu 9216</code>	Configures the MTU value to that of jumbo frames to carry FCoE traffic through the NIF ports.
Step 14	channel-group <port_number> Example: <code>switch(config-if)channel-group 101</code>	Sets the Fabric interface a member of the Fabric port channel.
Step 15	no shutdown Example: <code>switch(config-if)#no shutdown</code>	Sets the port-channel to up (administratively).
Step 16	exit Example: <code>switch(config-if)#exit</code>	Exits the interface configuration mode.
Step 17	interface ethernet <i>chassis_id/slot/port_number</i> Example: <code>switch(config)interface ethernet 101/1/1</code>	Configures a FEX satellite interface or HIF (host interface) port and enters interface configuration mode.
Step 18	switchport mode trunk Example:	Sets interface type to be a trunk port.

	Command or Action	Purpose
	<code>switch(config-if)#switchport mode trunk</code>	
Step 19	service-policy type qos input fcoe Example: <code>switch(config-if)# service-policy type qos input fcoe</code>	Sets the QoS policy on the HIF port channel to a no drop policy. Note For more information about queuing policy configurations, see the section: <i>Configuring QoS for no-drop support</i> .
Step 20	no shutdown Example: <code>switch(config-if)#no shutdown</code>	Sets the port-channel to up (administratively).
Step 21	exit Example: <code>switch(config-if)#exit</code>	Exits the interface configuration mode.

Example

The following is an example of FEX bring up in straight through mode with a host.

```
install feature-set fex
feature-set fex

fex 101
  pinning max-links 1
  description "2232PP-1"

interface port-channel101
  switchport
  switchport mode fex-fabric
  fex associate 101
  mtu 9216

interface Ethernet1/1
  switchport
  switchport mode fex-fabric
  fex associate 101
  mtu 9216
  channel-group 101
  no shutdown

interface Ethernet101/1/1
  switchport mode trunk
  service-policy type qos input fcoe-qo-policy
  no shutdown
```

Binding vFC to FEX Interface Explicitly

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: <pre>switch# configure terminal switch(config)#</pre>	Enters global configuration mode.
Step 2	interface vfc <vfc-id> Example: <pre>N9k(config)# interface vfc 1</pre>	Creates a virtual Fibre Channel interface and enters the interface configuration mode. The chassis-id range is from 101 to 199.
Step 3	bind interface ethernet [chassis-id/slot/port] Example: <pre>N9k(config-if)# bind interface ethernet101/1/1</pre>	Explicitly binds the virtual fibre channel interface to the specified interface. Use the no form of the command to unbind the interface. Chassis id range is from 101 to 199.
Step 4	no shutdown Example: <pre>switch(config-if)#no shutdown</pre>	Brings up the interface (administratively).
Step 5	end Example: <pre>N9k(config-if)#end</pre>	Returns to exec mode.

Example

```
interface vfc1
  bind interface ethernet 101/1/1
  switchport trunk mode on
  no shutdown
```

Binding vFC to FEX Interface Implicitly

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: <pre>switch# configure terminal switch(config)#</pre>	Enters global configuration mode.
Step 2	interface vfc < chassis-id>/<slot>/<port> Example: <pre>switch(config)# interface vfc 101/1/1</pre>	Creates a virtual fibre Channel Interface and enters interface configuration mode; implicitly binding it to the underlying Ethernet interface (ethernet chassis-id/slot/port). The chassis-id range is from 101 to 199.
Step 3	no shutdown Example: <pre>switch(config-if)#no shutdown</pre>	Brings up the interface (administratively).
Step 4	end Example: <pre>switch(config-if)#end</pre>	Returns to exec mode.

Example

```
interface vfc101/1/1
  switchport trunk mode on
  no shutdown
```

Binding vFC to MAC Address

A MAC address bound vFC can also be created for a FEX host interface (HIF) port.



Note

A MAC bound vFC can be configured to a host sitting behind a FIP Snooping Bridge (FSB).

When both MAC bound vFC and port-bound vFC are configured for the same interface, the port-bound vFC takes precedence.

As a best practice, you should have either a MAC bound vFC or a port-bound vFC for a physical Ethernet port or a port-channel. However, you cannot have both.

Procedure

	Command or Action	Purpose
Step 1	configure terminal	Enters global configuration mode.
Step 2	interface vfc <number>	Creates a virtual fibre Channel Interface.
Step 3	bind mac-address <mac-address>	Binds the MAC address.

Example

The following example shows how to bind a virtual Fibre Channel interface to a MAC address:

```
switch# configure terminal
switch(config)# interface vfc 2
switch(config-if)# bind mac-address 00:0a:00:00:00:36
```

Configuring Straight Through FEX with Host vPC

Before you begin

- Ensure configuration of vPC between two Cisco Nexus 9000 Series switches. For more information, see the *Cisco Nexus 9000 Series NX-OS Interfaces Configuration Guide*.
- Ensure configuration of FEX. For more information, see the *Cisco Nexus 2000 Series NX-OS Fabric Extender Configuration Guide for Cisco Nexus 9000 Series Switches*.
- Ensure the configuration of FCoE NPV. For more information, see the section: *Configuring FCoE NPV*.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	interface port-channel <port_num> Example: switch(config)#interface port-channel 101	Creates port-channel and enters the interface configuration mode.
Step 3	switchport Example:	Sets Layer 2 switching port.

	Command or Action	Purpose
	<code>switch(config-if)#switchport</code>	
Step 4	switchport mode fex-fabric Example: <code>switch(config-if)#switchport mode fex-fabric</code>	Sets the interface type to be an uplink port for a Fabric extender (FEX).
Step 5	fex associate <fex_id> Example: <code>switch(config-if)#fex associate 101</code>	Associates a Fabric Extender (FEX) to a Fabric interface.
Step 6	mtu 9216 Example: <code>switch(config-if)#mtu 9216</code>	Configures the MTU value to that of jumbo frames to carry FCoE traffic through the NIF ports.
Step 7	no shutdown Example: <code>switch(config-if)#no shutdown</code>	Sets the port-channel to up (administratively).
Step 8	exit Example: <code>switch(config-if)#exit</code>	Exits the interface configuration mode.
Step 9	interface ethernet slot/port Example: <code>switch(config)#interface Ethernet1/1</code>	Enters the interface configuration mode.
Step 10	switchport Example: <code>switch(config-if)#switchport</code>	Sets Layer 2 switching port.
Step 11	switchport mode fex-fabric Example: <code>switch(config-if)#switchport mode fex-fabric</code>	Sets the interface type to be an uplink port for a fabric extender (FEX).
Step 12	fex associate <fex_id> Example:	Associates a Fabric Extender (FEX) to a Fabric interface.

	Command or Action	Purpose
	<code>switch(config-if)#fex associate 101</code>	
Step 13	mtu 9216 Example: <code>switch(config-if)#mtu 9216</code>	Configures the MTU value to that of jumbo frames to carry FCoE traffic through the NIF ports.
Step 14	channel-group <port_number> Example: <code>switch(config-if)channel-group 101</code>	Sets the Fabric interface a member of the Fabric port channel.
Step 15	no shutdown Example: <code>switch(config-if)#no shutdown</code>	Sets the port-channel to up (administratively).
Step 16	exit Example: <code>switch(config-if)#exit</code>	Exits the interface configuration mode.
Step 17	interface ethernet <i>chassis_id/slot/port_number</i> Example: <code>switch(config)interface ethernet 101/1/1</code>	Configures a FEX satellite interface or HIF (host interface) port and enters interface configuration mode.
Step 18	switchport mode trunk Example: <code>switch(config-if)#switchport mode trunk</code>	Sets interface type to be a trunk port.
Step 19	channel group <host_port_num> Example: <code>switch(config-if)# channel group 1</code>	Makes the HIF port a member of a port-channel
Step 20	no shutdown Example: <code>switch(config-if)#no shutdown</code>	Sets the port-channel to up (administratively).
Step 21	exit Example:	Exits the interface configuration mode.

	Command or Action	Purpose
	<code>switch(config-if)#exit</code>	
Step 22	interface port-channel <host_port_number> Example: <code>switch(config)#interface port-channel 1</code>	Creates a HIF port-channel.
Step 23	switchport Example: <code>switch(config-if)#switchport</code>	Sets Layer 2 switching port.
Step 24	switchport mode trunk Example: <code>switch(config-if)#switchport mode trunk</code>	Sets the interface to be a trunk port.
Step 25	service-policy type qos input fcoe Example: <code>switch(config-if)# service-policy type qos input fcoe</code>	Sets the QoS policy on the HIF port channel to a no drop policy. Note For more information about queuing policy configurations, see the section: <i>Configuring QoS for no-drop support</i> .
Step 26	vpc 3	Configures VPC on the HIF port-channel. The VPC id on both the peers should be same for this Host VPC.
Step 27	no shutdown Example: <code>switch(config-if)#no shutdown</code>	Sets the port-channel to up (administratively).
Step 28	exit Example: <code>switch(config-if)#exit</code>	Exits the interface configuration mode.

Example

The following is an example of FEX bring up in straight through mode with a host vPC.

- Configuration on Peer-1

```
install feature-set fex
```

```

feature-set fex

fex 101
  pinning max-links 1
  description "2232PP-1"

interface port-channel101
  switchport mode fex-fabric
  fex associate 101

interface port-channel101
  switchport
  switchport mode fex-fabric
  fex associate 101
  mtu 9216

interface Ethernet1/1
  switchport
  switchport mode fex-fabric
  fex associate 101
  mtu 9216
  channel-group 101
  no shutdown

interface Ethernet101/1/1
  switchport mode trunk
  channel-group 1
  no shutdown

interface port-channel1
  switchport
  switchport mode trunk
  service-policy type qos input fcoe
  vpc 3

interface vfc-pol      /**/ Implicit binding with VFC bound to port-channel ***/
  bind interface port-channel1
  switchport trunk mode on
  no shutdown

interface vfc101/1/1  /**/ Implicit binding with VFC bound to member port ***/
  bind interface ethernet101/1/1
  switchport trunk mode on
  no shutdown

```

• Configuration on Peer-2

```

install feature-set fex
feature-set fex

fex 102
  pinning max-links 1
  description "2348UPQ-2"

interface port-channel102
  switchport
  switchport mode fex-fabric
  fex associate 102
  mtu 9216

interface Ethernet102/1/1
  switchport mode trunk
  channel-group 1

```



```

no shutdown

interface port-channel1
 switchport
 switchport mode trunk
 service-policy type qos input fcoe
 vpc 3

interface vfc1  /** Explicit binding with VFC bound to port-channel */
 bind interface port-channel1
 switchport trunk mode on
 no shutdown

interface vfc2  /** Explicit binding with VFC bound to member port */
 bind interface ethernet102/1/1
 switchport trunk mode on
 no shutdown

```



Note The vFC binding should be either to the port-channel or to the member host interface.

Configuring Dual-Homed FEX

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: <pre>switch# configure terminal switch(config)#</pre>	Enters global configuration mode.
Step 2	fex fex-chassis_ID Example: <pre>switch# fex 101 switch(config)#</pre>	Enters the configuration mode for the specified FEX. The range for fex-chassis_ID is from 101 to 199.
Step 3	fcoe Example: <pre>switch# fcoe switch(config)#</pre>	Configures the FEX to send FCoE traffic only to this switch. Note Cisco recommends that FCOE pinning is configured on the primary vPC switch in case of dual homed FEX.
Step 4	interface port-channel <port_num> Example: <pre>switch(config)#interface port-channel170</pre>	Creates port-channel and enters the interface configuration mode.

	Command or Action	Purpose
Step 5	switchport Example: switch(config-if)#switchport	Sets Layer 2 switching port.
Step 6	switchport mode fex-fabric Example: switch(config-if)#switchport mode fex-fabric	Sets the interface type to be an uplink port for a Fabric extender (FEX).
Step 7	fex associate <fex_id> Example: switch(config-if)#fex associate 170	Associates a Fabric Extender (FEX) to a Fabric interface.
Step 8	mtu 9216 Example: switch(config-if)#mtu 9216	Configures the MTU value to that of jumbo frames to carry FCoE traffic through the NIF ports.
Step 9	vpc 1	Configures VPC on the HIF port-channel.
Step 10	no shutdown Example: switch(config-if)#no shutdown	Sets the port-channel to up (administratively).
Step 11	exit Example: switch(config-if)#exit	Exits the interface configuration mode.
Step 12	interface ethernet slot/port Example: switch(config)#interface Ethernet170/1/18	Enters interface configuration mode.
Step 13	switchport Example: switch(config-if)#switchport	Sets Layer 2 switching port.
Step 14	switchport mode trunk Example: switch(config-if)#switchport mode trunk	Sets the interface to be a trunk port.

	Command or Action	Purpose
Step 15	service-policy type qos input fcoe-qo-policy Example: <pre>switch(config-if)# service-policy type qos input fcoe</pre>	Sets the QoS policy on the HIF port channel to a no drop policy. Note For more information about queuing policy configurations, see the section: <i>Configuring QoS for no-drop support</i> .
Step 16	no shutdown Example: <pre>switch(config-if)#no shutdown</pre>	Sets the port-channel to up (administratively).
Step 17	exit Example: <pre>switch(config-if)#exit</pre>	Exits the interface configuration mode. Note The same configuration should be performed on the other side for the Active-Active FEX to be up on both the sides.

Example



Note Cisco recommends that FCOE pinning is configured on the primary vPC switch in case of dual homed FEX.

- Peer 1

```
fex 170
  pinning max-links 1
  description "2232PP-3 AA"
  fcoe

interface port-channel170
  switchport
  switchport mode fex-fabric
  fex associate 170
  mtu 9216
  vpc 1

interface Ethernet170/1/18
  switchport mode trunk
  service-policy type qos input fcoe-qo-policy
  no shutdown

interface vfc1718    /** Explicit binding */
  bind interface Ethernet170/1/18
  switchport trunk mode on
  no shutdown

interface vfc170/1/18 /** Implicit binding */
```

```
bind interface Ethernet170/1/18
switchport trunk mode on
no shutdown
```

- Peer 2

```
fex 170
  pinning max-links 1
  description "2232PP-3 AA"

interface port-channel170
  switchport
  switchport mode fex-fabric
  fex associate 170
  mtu 9216
  vpc 1

interface Ethernet170/1/18
  switchport mode trunk
  service-policy type qos input fcoe-qo-policy
  no shutdown
```



Note

- HOST vPC is not supported with dual-homed FEX.
 - The vFC binding should be either to the port channel or to the member host interfaces.
-