



Configuring Enhanced Virtual Port Channels

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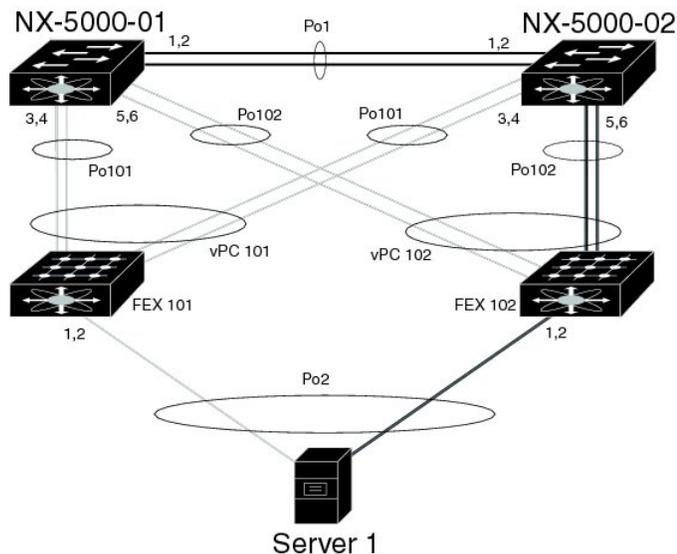
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Information About Enhanced vPCs

Enhanced Virtual Port Channels Overview

The virtual port channel (vPC) feature allows the dual homed connection of a host to two fabric extenders (FEXs) or a dual homed connection of a FEX to two switches. The enhanced vPC feature, or two-layer vPC, allows both dual homing topologies to be combined simultaneously, as shown in the following figure:

Figure 1: Dual Homing Topology



With enhanced vPCs, all available paths from the hosts to the FEXs and from the FEXs to the switches are active and carry Ethernet traffic, maximizing the available bandwidth and providing redundancy at both levels. For information about vPCs, see [Configuring Virtual Port Channels](#).

Supported Platforms and Topologies

Supported Platforms

Enhanced vPC is supported on Cisco Nexus devices.

Any Cisco Nexus Fabric Extender can be used with Enhanced vPC.

Enhanced vPC is compatible with Layer 3 features on the switch.

Supported and Unsupported Topologies

Enhanced vPC supports the following topologies:

- A single homed server connected to a single FEX

- A dual homed server connected by a port channel to a single FEX
- A dual homed server connected by a port channel to a pair of FEXs

This topology allows connection to any two FEXs that are connected to the same pair of switches in a vPC domain. Static port channel and Link Aggregation Control Protocol (LACP)-based port channel are supported.

- A dual homed server connected by Fibre Channel over Ethernet (FCoE) and port channel to a pair of FEXs
- A dual homed server connected by active/standby NIC teaming to a pair of FEXs

Enhanced vPC does not support the following topologies:

- A dual homed server connected to a pair of FEXs that connect to a single switch
Although this topology becomes a functioning system when one switch has failed, it is not recommended in normal operation.
- A multi-homed server connected by a port channel to more than two FEXs
This topology results in increased complexity with little benefit.
- You cannot have a link for non-vPC traffic in parallel with a vPC topology. This can cause errors with the traffic forwarding logic resulting in duplicate or missed packets.

Enhanced vPC Scalability

The scalability of enhanced vPC is similar to that of the dual homed FEX topology.

Each Cisco Nexus device supports up to 24 FEXs with Layer 2 configuration or Layer 3 configuration. In a dual homed FEX topology, such as that in enhanced vPC, each FEX is managed by two switches, so the pair together can support 24 FEXs.

Enhanced vPC Failure Response

The enhanced vPC topology provides a high level of resilience to the failure of system components and links as described in the following scenarios:

- Failure of One or More Port Channel Member Links
When one member link of a port channel fails, the traffic flow is moved to the remaining port channel member links. If all member links of a port channel fail, the traffic flow is redirected to the remaining port channel of the vPC.
- Failure of One FEX
When one FEX fails, the traffic flow from all dual homed hosts is moved to the remaining FEX.
- Failure of One Switch
When one switch fails, the traffic flow from all dual homed FEXs is moved to the remaining switch. Traffic from the hosts is unaffected.
- Failure of Both Uplinks from a Single FEX

When both uplinks from one FEX fails, the FEX shuts down its host ports, and the traffic flow from all dual homed hosts is moved to the other FEX.

- Failure of the vPC Peer Link

When the vPC secondary switch detects the failure of the peer link, it checks the status of the primary switch by the peer-keepalive link. If the primary switch is unresponsive, the secondary switch maintains all traffic flows as before. If the primary switch is active, the secondary switch shuts down its interfaces to the FEXs, and the traffic flow from all dual homed FEXs is moved to the primary switch. Ethernet traffic from the hosts is unaffected in either case.

If the secondary switch carries FCoE traffic and shuts down its interfaces to the FEXs, it also shuts down all virtual Fibre Channel (vFC) interfaces that are bound to the FEX host ports. In this case, the hosts must use multipathing to move SAN traffic to the remaining vFC interface.

- Failure of the vPC Peer-Keepalive Link

A failure of the vPC peer-keepalive link by itself does not affect the traffic flow.

Licensing Requirements for Enhanced vPC

The following table shows the licensing requirements for this feature:

Product	License Requirement
Cisco NX-OS	This feature does not require a 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 a complete explanation of the Cisco NX-OS licensing scheme, see the <i>Cisco NX-OS Licensing Guide</i> .

Configuring Enhanced vPCs

Overview of Configuration Steps for Enhanced vPC

An enhanced vPC configuration consists of a combination of two standard vPC configurations: the dual homed connection of a host to two FEXs and the dual homed connection of a FEX to two switches. The required configuration tasks are listed here, but the detailed procedures for those two standard configurations are presented in the "Configuring Virtual Port Channels" chapter of this document.

To configure enhanced vPC, perform the following steps. Unless noted otherwise, the procedures for each step are given in [Configuring Virtual Port Channels](#).

**Note**

- In procedures where the configuration must be repeated on both switches, the configuration synchronization (config-sync) feature allows you to configure one switch and have the configuration automatically synchronized to the peer switch. For more information about configuration synchronization, see the *Operations Guide* for your device.
- You cannot configure non-vPC interfaces across host ports on two different FEXs.

Procedure

- Step 1** Enable the vPC and LACP features on each switch.
- Step 2** Create required VLANs on each switch.
- Step 3** Assign a vPC domain ID and configure the vPC peer-keepalive link on each switch.
- Step 4** Configure the vPC peer link on each switch.
- Step 5** Configure port channels from the first FEX to each switch.
- Step 6** Configure port channels from the second FEX to each switch.
- Step 7** If the enhanced vPC must accommodate FCoE traffic, associate the first FEX to one switch, and then associate the second FEX to the other switch.
See “Configuring FCoE over Enhanced vPC” in the *Fibre Channel over Ethernet Configuration Guide* for your device.
- Step 8** Configure a host port channel on each FEX.

Verifying Enhanced vPCs

Verifying the Enhanced vPC Configuration

Before bringing up a vPC, the two peer switches in the same vPC domain exchange configuration information to verify that both switches have compatible configurations for a vPC topology. Depending on the severity of the impact of possible mismatched configurations, some configuration parameters are considered as Type 1 consistency check parameters while others are considered as Type 2.

When a mismatch in Type 1 parameters is found, both peer switches suspend VLANs on the vPC ports. When a mismatch in Type 2 parameters is found, a warning syslog message is generated, but the vPC remains up and running.

**Note**

Enhanced vPCs do not support the graceful consistency check.

For enhanced vPCs, the consistency verification for global configuration parameters is the same as for a dual homed FEX topology, and is described in the documentation for dual homed FEX. In addition to the global consistency verification, enhanced vPCs require interface level verification using tasks described in this section.

Use the following commands to verify the enhanced vPC configuration and consistency:

Command	Purpose
switch# show feature	Displays whether vPC is enabled.
switch# show running-config vpc	Displays running configuration information for vPCs.
switch# show vpc brief	Displays brief information on the vPCs.
switch(config)# show vpc consistency-parameters global	Displays the status of global vPC parameters that must be consistent across all vPC interfaces.
switch(config)# show vpc consistency-parameters interface port-channel <i>channel-number</i>	Displays the status of specific port channels that must be consistent across vPC devices.

For detailed information about the fields in the output of these commands, see the command reference for your device.

Verifying the Consistency of Port Channel Numbers

For enhanced vPCs, both switches must use the same port channel number for the dual homed connection to a FEX. If different port channel numbers are used, the port channel and its member ports are suspended on both switches.

Procedure

	Command or Action	Purpose
Step 1	show running-config interface <i>type/slot[, type/slot[, ...]]</i> Example: <pre>switch-1# show running-config interface Ethernet110/1/1, Ethernet111/1/1</pre>	Displays the configuration of the specified list of port channel member ports. Enter this command on both peer switches and compare the reported channel-group numbers to verify that they match between switches. Note If this is a QSFP+ GEM, the <i>slot/port</i> syntax is <i>slot/QSFP-module/port</i> .
Step 2	show interface <i>type/slot</i> Example: <pre>switch-1# show interface Ethernet110/1/1</pre>	Displays the status and configuration of the specified port channel member port. Enter this command on both peer switches and verify the status of the ports. Note If this is a QSFP+ GEM, the <i>slot/port</i> syntax is <i>slot/QSFP-module/port</i> .

This example shows how to verify the consistency of the port channel numbering between the two switches. In this example, the port channel numbering is inconsistent and the member ports are suspended:

```
switch-1# show running-config interface Ethernet110/1/1, Ethernet111/1/1

!Command: show running-config interface Ethernet110/1/1, Ethernet111/1/1
!Time: Sun Aug 28 03:38:23 2011

version 5.1(3)N1(1)

interface Ethernet110/1/1
channel-group 102

interface Ethernet111/1/1
channel-group 102

switch-2# show running-config interface Ethernet110/1/1, Ethernet111/1/1

!Command: show running-config interface Ethernet110/1/1, Ethernet111/1/1
!Time: Sun Aug 28 03:38:23 2011

version 5.1(3)N1(1)

interface Ethernet110/1/1
channel-group 101

interface Ethernet111/1/1
channel-group 101

switch-1# show interface Ethernet110/1/1
Ethernet110/1/1 is down (suspended by vpc)
  Hardware: 100/1000 Ethernet, address: 7081.0500.2402 (bia 7081.0500.2402)
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec
  [...]

switch-2# show interface Ethernet110/1/1
Ethernet110/1/1 is down (suspended by vpc)
  Hardware: 100/1000 Ethernet, address: 7081.0500.2402 (bia 7081.0500.2402)
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec
  [...]
```

Verifying Common Port Channel Members

The port channel from a FEX to the switch pair is up and operational when there is at least one common port channel member between the two switches. Any FEX interfaces that are assigned to the port channel only on one switch will be suspended.

Procedure

	Command or Action	Purpose
Step 1	show port-channel summary Example: switch-1# show port-channel summary	Displays a summary of the port channel interfaces.
Step 2	show interface type/slot Example: switch-1# show interface ethernet 111/1/3	(Optional) Displays the status and configuration of the specified interface. Note If this is a QSFP+ GEM, the <i>slot/port</i> syntax is <i>slot/QSFP-module/port</i> .

	Command or Action	Purpose
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This example shows how to verify the common member ports of the vPC. In this example, the vPC is configured with one port channel member that is not common to both switches. That member port is shown as shut down, and further investigation shows that the member is suspended by the vPC. In this part of the session, the port channel is configured on each switch, with an extra port on the first switch:

```
switch-1(config)# interface ethernet 110/1/3, ethernet 111/1/3
switch-1(config-if)# channel-group 101
switch-1(config-if)# interface port-channel 101
switch-1(config-if)# switchport access vlan 20

switch-2(config)# interface ethernet 110/1/3
switch-2(config-if)# channel-group 101
switch-2(config-if)# interface port-channel 101
switch-2(config-if)# switchport access vlan 20
```

In this part of the session, the extra port is shown to be in the down state, and a display of the port details shows that the port is suspended by the vPC:

```
switch-1# show port-channel summary
Flags: D - Down          P - Up in port-channel (members)
       I - Individual    H - Hot-standby (LACP only)
       s - Suspended     r - Module-removed
       S - Switched      R - Routed
       U - Up (port-channel)
       M - Not in use. Min-links not met

-----
Group Port-      Type      Protocol  Member Ports
Channel
-----
1      Po1(SU)     Eth       LACP      Eth1/1(P)  Eth1/2(P)
[...]
101    Po101(SU)   Eth       NONE      Eth110/1/3(P)  Eth111/1/3(D)
```

```
switch-1# show interface ethernet 111/1/3
Ethernet111/1/3 is down (suspended by vpc)
Hardware: 100/1000 Ethernet, address: 7081.0500.2582 (bia 7081.0500.2582)
MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec
reliability 255/255, txload 1/255, rxload 1/255
```

Verifying Interface Level Consistency for Enhanced vPCs

For enhanced vPCs, you must ensure consistency of the port mode and the shared VLAN in the port channel interface configuration.

Procedure

	Command or Action	Purpose
Step 1	<pre>show vpc consistency-parameters port-channel channel-number</pre> <p>Example:</p> <pre>switch# show vpc consistency-parameters interface port-channel 101 switch(config)#</pre>	For the specified port channel, displays the status information that must be consistent across vPC devices.

This example shows how to display a comparison of the interface configuration across two peers for a vPC. In this case, VLAN 10 is allowed on both peers, but the port mode is mismatched, causing the VLAN to be suspended.

```
switch-1# show vpc consistency-parameters interface port-channel 101
```

Legend:

Type 1 : vPC will be suspended in case of mismatch

Name	Type	Local Value	Peer Value
mode	1	on	on
Speed	1	1000 Mb/s	1000 Mb/s
Duplex	1	full	full
Port Mode	1	access	trunk
MTU	1	1500	1500
Admin port mode	1		
Shut Lan	1	No	No
vPC+ Switch-id	1	3000	3000
Allowed VLANs	-	10	1-57 , 61-3967, 4048-4093
Local suspended VLANs	-	10	-

Enhanced vPC Example Configuration

The following example shows the complete configuration procedure using the topology of the enhanced vPC figure in this chapter. In the topology figure, the number pairs beside each port channel link represent the interface port numbers. For example, the switch link labeled with the numbers "3,4" represents interfaces eth1/3 and eth1/4 on the switch.



Note

In procedures where the configuration must be repeated on both switches, the configuration synchronization (config-sync) feature allows you to configure one switch and have the configuration automatically synchronized to the peer switch. For more information about configuration synchronization, see the operations guide for your device.

Before You Begin

Ensure that the Cisco Nexus Fabric Extenders FEX101 and FEX102 are attached and online.

Procedure

Step 1 Enable the vPC and LACP features on each switch.

Example:

```
switch-1(config)# feature vpc
switch-1(config)# feature lacp

switch-2(config)# feature vpc
switch-2(config)# feature lacp
```

Step 2 Create required VLANs on each switch.

Example:

```
switch-1(config)# vlan 10-20
switch-2(config)# vlan 10-20
```

Step 3 Assign a vPC domain ID and configure the vPC peer-keepalive link on each switch.

Example:

```
switch-1(config)# vpc domain 123
switch-1(config-vpc)# peer-keepalive destination 172.25.182.100

switch-2(config)# vpc domain 123
switch-2(config-vpc)# peer-keepalive destination 172.25.182.99
```

Note When you configure each switch, use the IP address of the peer switch as the peer-keepalive destination.

Step 4 Configure the vPC peer link on each switch.

Example:

```
switch-1(config)# interface eth1/1-2
switch-1(config-if)# channel-group 1 mode active
switch-1(config-if)# interface Po1
switch-1(config-if)# switchport mode trunk
switch-1(config-if)# switchport trunk allowed vlan 1, 10-20
switch-1(config-if)# vpc peer-link

switch-2(config)# interface eth1/1-2
switch-2(config-if)# channel-group 1 mode active
switch-2(config-if)# interface Po1
switch-2(config-if)# switchport mode trunk
switch-2(config-if)# switchport trunk allowed vlan 1, 10-20
switch-2(config-if)# vpc peer-link
```

Step 5 Configure port channels from the first FEX to each switch.

Example:

```
switch-1(config)# fex 101
switch-1(config-fex)# interface eth1/3-4
switch-1(config-if)# channel-group 101
switch-1(config-if)# interface po101
switch-1(config-if)# switchport mode fex-fabric
switch-1(config-if)# vpc 101
switch-1(config-if)# fex associate 101

switch-2(config)# fex 101
switch-2(config-fex)# interface eth1/3-4
switch-2(config-if)# channel-group 101
switch-2(config-if)# interface po101
switch-2(config-if)# switchport mode fex-fabric
switch-2(config-if)# vpc 101
switch-2(config-if)# fex associate 101
```

Step 6 Configure port channels from the second FEX to each switch.

Example:

```
switch-1(config)# fex 102
switch-1(config-fex)# interface eth1/5-6
switch-1(config-if)# channel-group 102
switch-1(config-if)# interface po102
switch-1(config-if)# switchport mode fex-fabric
```

```
switch-1(config-if)# vpc 102
switch-1(config-if)# fex associate 102

switch-2(config)# fex 102
switch-2(config-fex)# interface eth1/5-6
switch-2(config-if)# channel-group 102
switch-2(config-if)# interface po102
switch-2(config-if)# switchport mode fex-fabric
switch-2(config-if)# vpc 102
switch-2(config-if)# fex associate 102
```

Step 7 Configure a host port channel on each FEX.

Example:

```
switch-1(config)# interface eth101/1/1, eth101/1/2
switch-1(config-if)# channel-group 2 mode active
switch-1(config-if)# interface eth102/1/1, eth102/1/2
switch-1(config-if)# channel-group 2 mode active
switch-1(config-if)# int po2
switch-1(config-if)# switchport access vlan 10

switch-2(config)# interface eth101/1/1, eth101/1/2
switch-2(config-if)# channel-group 2 mode active
switch-2(config-if)# interface eth102/1/1, eth102/1/2
switch-2(config-if)# channel-group 2 mode active
switch-2(config-if)# int po2
switch-2(config-if)# switchport access vlan 10
```
