Virtual PortChannel

Quick Start Guide

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Overview

A virtual PortChannel (vPC) allows links that are physically connected to two different Cisco Nexus® Family devices to appear as a single PortChannel to a third device. The third device can be a switch, server, or any other networking device that supports EtherChannel. A vPC can provide Layer 2 multipathing, which allows you to create redundancy by increasing bandwidth, enabling multiple parallel paths between nodes and traffic load balancing in cases in which alternative paths exist. After enabling vPC, you need to configure a peer-keepalive link, which sends heartbeat messages between the two vPC peer devices.

A vPC domain includes vPC peer devices, the vPC peer-keepalive link, the vPC peer link, and all the PortChannels in the vPC domain connected to the downstream device. You can have only one vPC domain ID on each pair of Cisco Nexus switches, and the domain IDs need to match.

A vPC provides the following benefits:

- Allows a single device to use a PortChannel across two upstream devices
- Eliminates Spanning Tree Protocol blocked ports
- Provides a loop-free topology
- Uses all available uplink bandwidth
- Provides fast convergence if either the link or a device fails
- Provides link-level resiliency
- Helps ensure high availability

A vPC allows you to create a PortChannel from a switch or server that is dual-homed to a pair of Cisco Nexus 3000 Series Switches. The vPC concepts and configuration steps are identical for the Cisco Nexus 7000 and 5000 Series Switches. The deployment scenario in Figures 1 and 2 creates a vPC between the two ports of an end host server and another vPC between two switch ports. The deployment scenario in Figures 3 and 4 shows a larger deployment with two layers of vPCs. Each pair of switches used for vPC needs to be identical. Figure 3 represents two pairs of Cisco Nexus 3000 Series Switches. Each pair could be also Cisco Nexus 5000 or 7000 Series Switches.

Figure 1. Cisco Nexus 3000 Series Switches Configured as vPC Peers with Two vPC Hosts Attached

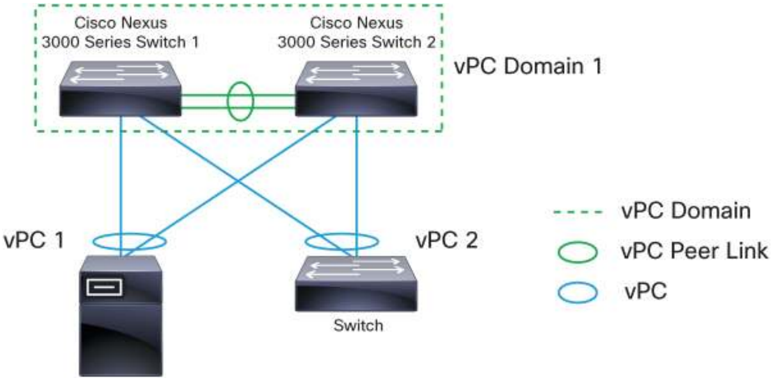


Figure 2. Logical Equivalent of Figure 1 from the Perspective of the Attached Switch and Server

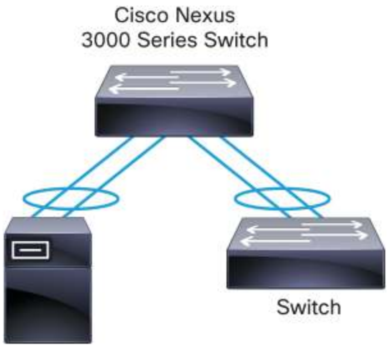


Figure 3. Dual Layer vPC with Two Cisco Nexus Switch Pairs

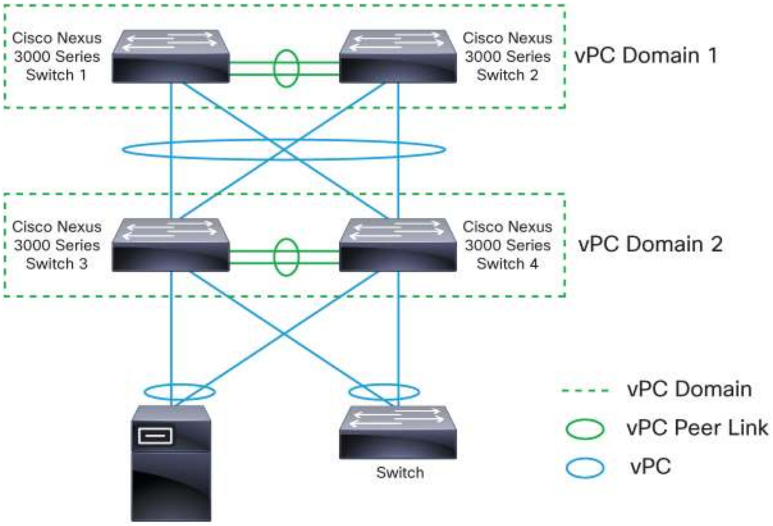
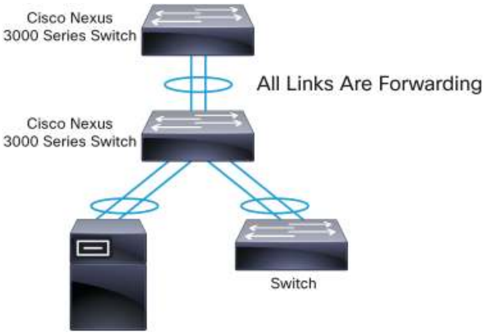


Figure 4. Logical Equivalent of Figure 3 from the Perspective of the Attached Switch and Server



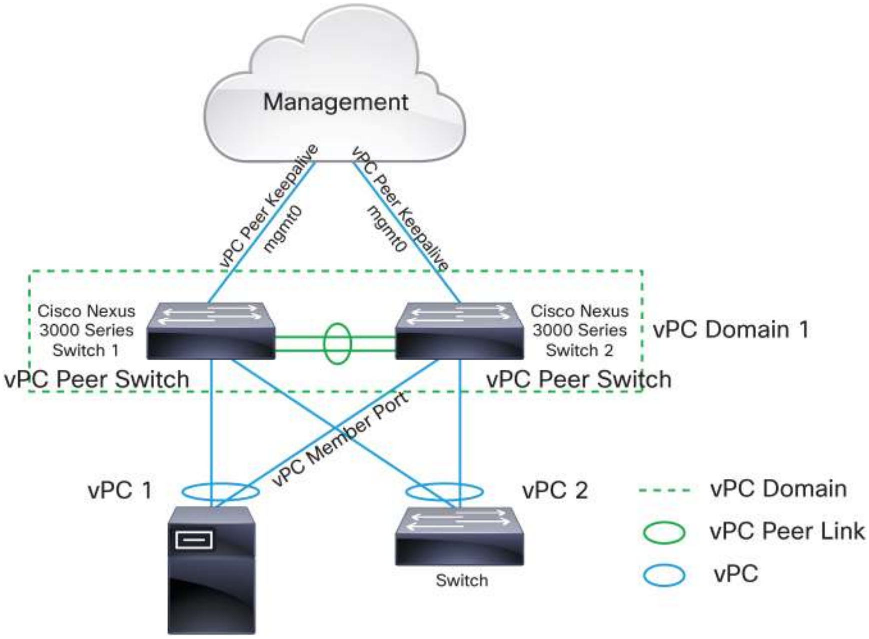
vPC Concepts

The following list defines critical vPC concepts:

- **vPC:** vPC refers to the combined PortChannel between the vPC peer devices and the downstream device.
- **vPC peer switch:** The vPC peer switch is one of a pair of switches that are connected to the special PortChannel known as the vPC peer link. One device will be selected as the primary device, and the other will be the secondary device.
- **vPC peer link:** The vPC peer link is the link used to synchronize states between the vPC peer devices. The vPC peer link carries control traffic between two vPC switches and also multicast, broadcast data traffic. In some link failure scenarios, it also carries unicast traffic. You should have at least two 10 Gigabit Ethernet interfaces for peer links.
- **vPC domain:** The vPC domain includes both vPC peer devices, the vPC peer-keepalive link, and all the PortChannels in the vPC connected to the downstream devices. It is also associated with the configuration mode that you must use to assign vPC global parameters.
- **vPC peer keepalive:** The vPC peer-keepalive link monitors the vitality of a vPC peer switch. The peer-keepalive link sends periodic keepalive messages between vPC peer devices. The vPC peer-keepalive link can be a management interface or switched virtual interface (SVI). No data or synchronization traffic moves over the vPC peer-keepalive link; the only traffic on this link is a message that indicates that the originating switch is operating and running vPC.
- **vPC member port:** vPC member ports are interfaces that belong to the vPCs.

Figure 5 illustrates these concepts.

Figure 5. vPC Terminology



vPC Configuration

vPC configuration on the Cisco Nexus 5000 Series includes these steps:

1. Enter the global configuration mode.
2. Enable the vPC feature.
3. Create a vPC domain and enter the vPC domain mode.
4. Configure the vPC peer-keepalive link.
5. (Optional) Configure the system priority.
6. (Optional) Configure the vPC role priority.
7. (Optional) Configure the vPC peer gateway
8. Create the vPC peer link.
9. Create a PortChannel and configure it as a vPC.

Table 1 provides details about these steps.

Table 1. vPC Configuration Steps

Step	Command	Purpose
1	Configure terminal	Enter the global configuration mode.
2	**feature vpc** **feature lacp**	Enable the vPC feature. The vPC feature must be enabled before it can be configured. Link Aggregation Control Protocol (LACP) needs to be enabled (it is disabled by default).
3	**vpc domain** *domain-id* *Example:* **switch(config)# vpc domain 1**	Create a vPC domain and assign a domain ID.
4	**peer-keepalive destination** *ipaddress* [**hold-timeout** *secs* | **interval** *msecs* {**timeout** *secs*} | {**precedence** {*prec-value* | **network** | **internet** | **critical** | **flash-override** | **flash** | **immediate priority** | **routine**}} | **tos** {*tos-value* | **max-reliability** | **max-throughput** | **min-delay** | **min-monetary-cost** | **normal**}} |**tos-byte** *tos-byte-value*} | **source** *ipaddress* | **vrf {management** | **default**}] *Example:* **Management interface for peer-keepalive link:** **switch(config-vpc-domain)# peer-keepalive destination 172.28.230.85** **switch(config-vpc-domain)#** SVI for peer-keepalive link: **switch(config-vpc-domain)#peer-keepalive destination 172.28.1.100 source 172.28.1.120 vrf default**	Configure the IPv4 address for the remote end of the vPC peer- keepalive link. The system does not create the vPC peer link until you configure a vPC peer-keepalive link. The Cisco Nexus 5000 Series does not support creation or configuration of additional Virtual Route Forwarding (VRF) instances. Two VRF instances are created when the system boots: **management** and **default**. The management interface is in the VRF **management** instance, and all SVIs are in the VRF **default** instance. Both management interfaces and SVIs can be used for peer-keepalive links. The management interface and VRF **management** instance are the defaults. The second example shows how to configure the SVI as the keepalive link. The source address must be specified when the VRF **default** instance is used for peer keepalive communication.
5 (Optional)	system-priority *priority* *Example:* switch(config-vpc-domain)# system-priority 4000 switch(config-vpc-domain)#	(Optional) Enter the system priority that you want for the specified vPC domain. The range of values is 1 to 65535. The default value is 32667. You should manually configure the vPC system priority when you are running LACP to help ensure that the vPC peer devices are the primary devices on LACP. When you manually configure the system priority, make sure that you configure the same priority value on both vPC peer devices. If these values do not match, vPC will not be activated.

Step	Command	Purpose
6 (Optional)	**role priority** *priority* *Example:* **switch(config-vpc-domain)# role priority 2000** **switch(config-vpc-domain)#**	(Optional) Enter the role priority that you want for this vPC switch. The range of values is 1 to 65636, and the default value is 32667. The switch with lower priority will be elected as the vPC primary switch. If the peer link fails, the vPC peer will detect whether the peer switch is alive through the vPC peer-keepalive link. If the vPC primary switch is alive, the vPC secondary switch will suspend its vPC member ports to prevent potential looping, and the vPC primary switch will keep all its vPC member ports active.
7 (Optional)	**peer-gateway** *Example:* **switch(config-vpc-domain)# peer-gateway**	Enter the global configuration mode.
8	**interface port-channel** *channel-number* **vpc peer-link** *Example:* **switch(config)# interface port-channel 20** **switch(config-if)# vpc peer-link**	Select the PortChannel that you want to use as the vPC peer link for this device, and enter the interface configuration mode. Configure the selected PortChannel as the vPC peer link. Repeat the same operation on the peer switch.
9	**interface port-channel** *channel-number* **vpc** *number* *Example:* **switch(config)#interface e1/1** **switch(config-if)channel-group 1** **switch(config-if)# interface port-channel 1** **switch(config-if)# vpc 1**	Add the interface to the PortChannel and then move the PortChannel to the vPC to connect to the downstream device. The vPC number ranges from 1 to 4096. The vPC number does not need to match the PortChannel number, but it must match the number of the vPC peer switch for that vPC bundle. A PortChannel is needed even if there is only one member interface for the PortChannel. When there is only one member for the PortChannel, the hardware PortChannel resource will not be created.

vPC Configuration Example

This vPC configuration example is based on the topology shown in Figure 3: two vPC pairs in two different domains, interconnected with four links, and with a dual attached server in a PortChannel. In this example, the two switches in vPC domain 1 are also configured for Hot Standby Router Protocol (HSRP), and therefore the peer-gateway feature is enabled.

The configuration commands are shown here:

```
n3k-1# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
n3k-1(config)# feature vpc
n3k-1(config)# feature lacp
n3k-1(config)# vpc domain 1
n3k-1(config-vpc-domain)# peer-gateway
n3k-1(config-vpc-domain)# peer-keepalive destination 10.29.176.98 vrf management
n3k-1(config-vpc-domain)# int e1/30-31
n3k-1(config-if-range)# channel-group 12 mode active
n3k-1(config-if-range)# int po 12
n3k-1(config-if)# vpc peer-link
n3k-1(config-if)# switchport mode trunk  *
n3k-1(config)# int e1/49-50
n3k-1(config-if-range)# channel-group 1234 mode active
n3k-1(config-if-range)# int po 1234
n3k-1(config-if)# vpc 1234
n3k-1(config-if)# switchport mode trunk
```

```
n3k-2# conf t
n3k-2(config)# feature vpc
n3k-2(config)# feature lacp
n3k-2(config)# vpc domain 1
n3k-2(config-vpc-domain)#peer-gateway
n3k-2(config-vpc-domain)# peer-keepalive destination 10.29.176.97 vrf management
n3k-2(config-vpc-domain)# int e1/30-31
n3k-2(config-if-range)# channel-group 12 mode active
n3k-2(config-if-range)# int po 12
n3k-2(config-if)# vpc peer-link
n3k-2(config-if)#switchport mode trunk *
n3k-2(config)# int e1/49-50
n3k-2(config-if-range)# channel-group 1234 mode active
n3k-2(config-if-range)# int po 1234
n3k-2(config-if)# vpc 1234
n3k-2(config-if)# switchport mode trunk
```

```
n3k-3# conf t
n3k-3(config)# feature vpc
n3k-3(config)# feature lacp
n3k-3(config)# vpc domain 2
n3k-3(config-vpc-domain)# peer-keepalive destination 10.29.176.163 vrf management
n3k-3(config-vpc-domain)# int e1/30-31
n3k-3(config-if-range)# channel-group 34 mode active
n3k-3(config-vpc-domain)# int po 34
n3k-3(config-if)# vpc peer-link
n3k-3(config-if)# switchport mode trunk *
n3k-3(config-if)# int e1/49-50
n3k-3(config-if-range)# channel-group 1234 mode active
n3k-3(config-if-range)# int po 1234
n3k-3(config-if)# vpc 1234
n3k-3(config-if)# switchport mode trunk
n3k-3(config-if)# int e1/1
n3k-3(config-if-range)# channel-group 1 mode active
n3k-3(config-if-range)# int po 1
n3k-3(config-if)# vpc 1
```

```
n3k-4# conf t
n3k-4(config)# feature vpc
n3k-4(config)# feature lacp
n3k-4(config)# vpc domain 2
n3k-4(config-vpc-domain)# peer-keepalive destination 10.29.176.162 vrf management
n3k-4(config-vpc-domain)# int e1/30-31
n3k-4(config-if-range)# channel-group 34 mode active
n3k-4(config-if-range)# int po 34
```

```
n3k-4(config-if)# vpc peer-link
n3k-4(config-if)# switchport mode trunk *
n3k-4(config-if)# int e1/49-50
n3k-4(config-if-range)# channel-group 1234 mode active
n3k-4(config-if-range)# int po 1234
n3k-4(config-if)# vpc 1234
n3k-4(config-if)# switchport mode trunk
n3k-4(config-if)# int e1/1
n3k-4(config-if-range)# channel-group 1 mode active
n3k-4(config-if-range)# int po 1
n3k-4(config-if)# vpc 1
```

* This step is necessary if more than one VLAN will be configured on the vPCs. All the VLANs allowed on the vPCs need to be allowed on the vPC peer link.

Verifying the vPC Configuration

The commands shown in Table 2 are useful for displaying the vPC configuration information.

Table 2. Commands for Displaying the vPC Configuration

Command	Purpose
show feature	Reports whether or not vPC is enabled
show vpc brief	Displays brief information about the vPCs
show vpc consistency-parameters	Displays the status of those parameters that must be consistent across all vPC interfaces
show running-config vpc	Displays running configuration information for vPCs
show port channel capacity	Reports the number of PortChannels that are configured and the number that are still available on the device
show vpc statistics	Displays statistics about the vPCs
show vpc peer-keepalive	Displays information about the peer-keepalive messages
show vpc role	Displays the peer status, role of the local device, vPC system MAC address and system priority, and MAC address and priority for the local vPC device

Here is an example of configuration verification:

```
n3k-1# show vpc brief
Legend:
                (*) - local vPC is down, forwarding via vPC peer-link

vPC domain id                   : 1
Peer status                     : peer adjacency formed ok
vPC keep-alive status           : peer is alive
Configuration consistency status: success
Per-vlan consistency status     : success
Type-2 consistency status       : success
vPC role                        : primary
Number of vPCs configured       : 1
Peer Gateway                    : Enabled
Dual-active excluded VLANs      : -
Graceful Consistency Check      : Enabled
```

```
vPC Peer-link status
---------------------------------------------------------------------
id   Port   Status Active vlans
--   ----   ------ --------------------------------------------------
1    Po12   up     1-100

vPC status
----------------------------------------------------------------------------
id     Port        Status Consistency Reason                     Active vlans
------ ----------- ------ ----------- -------------------------- -----------
1234   Po1234      up     success     success                    1-100

n3k-2(config-if)#  sh vpc brief
Legend:
                (*) - local vPC is down, forwarding via vPC peer-link

vPC domain id                   : 1
Peer status                     : peer adjacency formed ok
vPC keep-alive status           : peer is alive
Configuration consistency status: success
Per-vlan consistency status     : success
Type-2 consistency status       : success
vPC role                        : secondary
Number of vPCs configured       : 1
Peer Gateway                    : Enabled
Dual-active excluded VLANs      : -
Graceful Consistency Check      : Enabled

vPC Peer-link status
---------------------------------------------------------------------
id   Port   Status Active vlans
--   ----   ------ --------------------------------------------------
1    Po12   up     1-100

vPC status
----------------------------------------------------------------------------
id     Port        Status Consistency Reason                     Active vlans
------ ----------- ------ ----------- -------------------------- -----------
1234   Po1234      up     success     success                    1-100

n3k-2# show vpc brief
Legend:
                (*) - local vPC is down, forwarding via vPC peer-link

vPC domain id                   : 1
Peer status                     : peer adjacency formed ok
vPC keep-alive status           : peer is alive
```

```
Configuration consistency status: success
Per-vlan consistency status     : success
Type-2 consistency status       : success
vPC role                        : secondary
Number of vPCs configured       : 1
Peer Gateway                    : Enabled
Dual-active excluded VLANs      : -
Graceful Consistency Check      : Enabled

vPC Peer-link status
---------------------------------------------------------------------
id   Port   Status Active vlans
--   ----   ------ --------------------------------------------------
1    Po12   up     1-100

vPC status
----------------------------------------------------------------------------
id     Port        Status Consistency Reason                     Active vlans
------ ----------- ------ ----------- -------------------------- -----------
1234   Po1234      up     success     success                    1-100




n3k-3# show vpc brief
Legend:
                (*) - local vPC is down, forwarding via vPC peer-link

vPC domain id                   : 2
Peer status                     : peer adjacency formed ok
vPC keep-alive status           : peer is alive
Configuration consistency status: success
Per-vlan consistency status     : success
Type-2 consistency status       : success
vPC role                        : primary
Number of vPCs configured       : 2
Peer Gateway                    : Disabled
Dual-active excluded VLANs      : -
Graceful Consistency Check      : Enabled

vPC Peer-link status
---------------------------------------------------------------------
id   Port   Status Active vlans
--   ----   ------ --------------------------------------------------
1    Po34   up     1-100

vPC status
```

```
----------------------------------------------------------------------------
id     Port        Status Consistency Reason                     Active vlans
------ ----------- ------ ----------- -------------------------- -----------
1      Po1         up     success     success                    1
1234   Po1234      up     success     success                    1-100

n3k-4# show vpc brief
Legend:
                (*) - local vPC is down, forwarding via vPC peer-link

vPC domain id                   : 2
Peer status                     : peer adjacency formed ok
vPC keep-alive status           : peer is alive
Configuration consistency status: success
Per-vlan consistency status     : success
Type-2 consistency status       : success
vPC role                        : secondary
Number of vPCs configured       : 2
Peer Gateway                    : Disabled
Dual-active excluded VLANs      : -
Graceful Consistency Check      : Enabled

vPC Peer-link status
---------------------------------------------------------------------
id   Port   Status Active vlans
--   ----   ------ --------------------------------------------------
1    Po34   up     1-100

vPC status
----------------------------------------------------------------------------
id     Port        Status Consistency Reason                     Active vlans
------ ----------- ------ ----------- -------------------------- -----------
1      Po1         up     success     success                    1
1234   Po1234      up     success     success                    1-100
```

vPC Consistency Checks

Many configuration and operation parameters must be identical on all interfaces of the vPC. You should configure the Layer 2 PortChannels that you use for the vPC peer link in the trunk mode.

After you enable the vPC feature and configure the peer link on both vPC peer devices, Cisco® Fabric Services messages provide a copy of the configuration on the local vPC peer device to the remote vPC peer device. The system then determines whether any of the crucial configuration parameters differ on the two devices.

Enter the **show vpc consistency-parameters** command to display the configured values on all interfaces in the vPC. The displayed configurations are only those configurations that would prevent the vPC peer link and vPC from operating.

There are two types of configuration parameters from a vPC compatibility perspective. The first type of parameters must be identical on both vPC switches, and any difference will prevent the vPC peer link or vPC from functioning. The configuration of the second type of parameters should be identical on both switches; any differences in these parameters will result in undesired behavior.

Configuration Parameters That Must Be Identical

The configuration parameters listed in this section must be configured identically on both devices of the vPC peer link; otherwise, the vPC will enter the suspend mode. The devices automatically check for compatibility of some of these parameters on the vPC interfaces. The per-interface parameters must be consistent per interface, and the global parameters must be consistent globally.

- PortChannel mode
  - On
  - Off
  - Active
- Link speed per PortChannel
- Duplex mode per PortChannel
- Trunk mode per PortChannel
  - Native VLAN
- Spanning Tree Protocol mode
- Spanning Tree Protocol region configuration for Multiple Spanning Tree (MST) Protocol
- Enabled or disabled state per VLAN
- Spanning Tree Protocol global settings
  - Bridge assurance setting
  - Port type setting (you should set all vPC interfaces as network ports)
  - Loop guard settings
- Spanning Tree Protocol interface settings
  - Port type setting
  - Loop guard
  - Root guard
- Quality-of-service (QoS) configuration and parameters
  - Priority flow control (PFC)
  - Strict priority queuing and Deficit Weighted Round Robin (DWRR)
  - Maximum transmission unit (MTU)

If any of these parameters is not enabled or defined on either device, the vPC consistency check ignores those parameters.

Configuration Parameters That Should Be Identical

When any of the following parameters are not configured identically on both vPC peer devices, a misconfiguration may cause undesirable behavior in the traffic flow:

- MAC address aging timers
- Static MAC address entries
- All access control list (ACL) configurations and parameters
- Spanning Tree Protocol interface settings
    - Bridge Protocol Data Unit (BPDU) filter
    - BPDU guard
    - Cost
    - Link type
    - Priority
    - VLANs (Rapid Per-VLAN Spanning Tree Plus [PVST+])
- Internet Group Management Protocol (IGMP) snooping

To help ensure that all the configuration parameters are compatible, you should display the configuration information for each vPC peer device after you configure the vPC.

Here is an example of the configuration information display for each vPC peer device:

```
n3k-1# show vpc consistency-parameters global

    Legend:
        Type 1 : vPC will be suspended in case of mismatch

Name                        Type  Local Value            Peer Value
-------------               ----  ---------------------- -----------------------
QoS                         2     ([], [], [], [], [],   ([], [], [], [], [],
                                  [], [], [])            [], [], [])
Network QoS (MTU)           2     (9216, 0, 0, 0, 0, 0)  (9216, 0, 0, 0, 0, 0)
Network Qos (Pause)         2     (F, F, F, F, F, F)     (F, F, F, F, F, F)
Output Queuing (Bandwidth)  2     (100, 0, 0, 0, 0, 0)   (100, 0, 0, 0, 0, 0)
Output Queuing (Absolute    2     (F, F, F, F, F, F)     (F, F, F, F, F, F)
Priority)
STP Mode                    1     Rapid-PVST             Rapid-PVST
STP Disabled                1     None                   None
STP MST Region Name         1     ""                     ""
STP MST Region Revision     1     0                      0
STP MST Region Instance to  1
 VLAN Mapping
STP Loopguard               1     Disabled               Disabled
STP Bridge Assurance        1     Enabled                Enabled
STP Port Type, Edge         1     Normal, Disabled,      Normal, Disabled,
BPDUFilter, Edge BPDUGuard        Disabled               Disabled
STP MST Simulate PVST       1     Enabled                Enabled
Allowed VLANs               -     1-100                  1-100
Local suspended VLANs       -     -                      -
n3k-1#
```

vPC Peer Gateway

You can configure vPC peer devices to act as the gateway even for packets that are destined for the vPC peer device's MAC address. The **peer-gateway** command is used to configure this feature.

Some network-attached storage (NAS) devices or load balancers may have features to optimize the performance of particular applications. Essentially these features avoid performing a routing-table lookup when responding to a request that originated form a host not locally attached to the same subnet. Such devices may reply to traffic using the MAC address of the sender Cisco Nexus 7000 Series device rather than the common HSRP gateway. Such behavior is not complaint with some basic Ethernet RFC standards. Packets reaching a vPC device for the nonlocal router MAC address are sent across the peer link and may be dropped by the built-in vPC loop-avoidance mechanism if the final destination is behind another vPC.

The vPC peer-gateway capability allows a vPC switch to act as the active gateway for packets that are addressed to the router MAC address of the vPC peer. This feature enables local forwarding of such packets without the need to cross the vPC peer link. In this scenario, the feature optimizes use of the peer link and avoids potential traffic loss.

The peer-gateway feature needs to be configured on both the primary and secondary vPC peers and does not disrupt the operations of the device or the vPC traffic. The vPC peer-gateway feature can be configured globally under the vPC domain submode.

When enabling this feature, you must disable IP redirects on all interface VLANs mapped over a vPC VLAN to avoid generation of IP-redirect messages for packets switched through the peer-gateway router. When the feature is enabled in the vPC domain, the user is notified of such a requirement through an appropriate message.

Packets arriving at the peer-gateway vPC device will have their time-to-live (TTL) value decremented, so packets with TTL = 1 may be dropped in transit due to TTL expiration. This behavior needs to be considered when the peer-gateway feature is enabled and particular network protocols sourcing packets with TTL = 1 operate on a vPC VLAN.

vPC Delay Restore

The First Hop Routing Protocols (FHRP) interoperate with vPCs. The HSRP and Virtual Router Redundancy Protocol (VRRP) all interoperate with vPCs. As a best practice, you should dual-attach all Layer 3 devices to both vPC peer devices.

The primary FHRP device responds to Address Resolution Protocol (ARP) requests, even though the secondary vPC device forwards the data traffic.

To simplify initial configuration verification and vPC and HSRP troubleshooting, you can configure the primary vPC peer device with the highest priority of the FHRP active router.

In addition, you can use the **priority** command in the **if-hsrp** configuration mode to configure failover thresholds for instances when a group state enabled on a vPC peer link is the standby or listen state. You can configure lower and upper thresholds to prevent the interface from going up and down.

VRRP behaves similarly to HSRP when running on vPC peer devices. You should configure VRRP the same way that you configure HSRP. When the primary vPC peer device fails over to the secondary vPC peer device, the FHRP traffic continues to flow with no perceptible change. Configure a separate Layer 3 link for routing from the vPC peer devices, rather than using a VLAN network interface for this purpose. You should not configure the burned-in MAC address option (**use-bia**) for HSRP or manually configure virtual MAC addresses for any FHRP instance in a vPC environment because these configurations can adversely affect the vPC load balancing. The **hsrp use-bia** command is not supported on vPCs. When you are configuring custom MAC addresses, you must configure the same MAC address on both vPC peer devices.

You can configure a restore timer that will prevent the vPC from coming back up until after the peer adjacency forms and the VLAN interfaces are back up. This delay avoids packet drops that can occur when the routing tables are not converged before the vPC is again passing traffic. Use the **delay restore** command under the **vpc-domain** configuration to configure this feature.

Note: In the event of a data center outage, if HSRP is enabled before the vPC has successfully come up, traffic loss can occur. You need to enable an HSRP delay to give the vPC time to stabilize. If you enable both an HSRP delay and a preemption delay, then the Cisco Nexus 3000 Series devices will allow Layer 2 switching only after both timers expire.

See the Cisco Nexus 3000 Series NX-OS Unicast Routing Configuration Guide for more information about FHRP and routing.

vPC Peer-Keepalive Best Practices

The Cisco NX-OS Software uses the peer-keepalive link between the vPC peers to transmit periodic, configurable keepalive messages. You must have Layer 3 connectivity between the peer devices to transmit these messages. The system cannot bring up the vPC peer link unless the peer-keepalive link is already up and running.

The Cisco Nexus 3000 Series Switches support VRF-lite with the Base or LAN Enterprise license installed. This capability allows you to create a VRF and assign a specific interface to the VRF. Without this feature, two VRF instances are created by default: VRF management and VRF default. The mgmt0 interface and all SVIs reside in VRF management and default.

Make sure that both the source and destination IP addresses used for the peer-keepalive message are unique in your network, and that these IP addresses can be reached from the VRF instance associated with the vPC peer-keepalive link.

The best practice is to use the management VRF with the mgmt0 interface when possible, through out-of-band management. Otherwise, for inband management, using the 10 Gigabit Ethernet switch ports, configure a separate VRF instance and put a Layer 3 port from each vPC peer switch in that VRF instance for the vPC peer-keepalive link. This approach will use a dedicated pair of front-facing 10 Gigabit Ethernet ports. Make sure not to use the peer link itself to send vPC peer-keepalive messages because doing so will create problems. For more information about creating and configuring vPC, see the Cisco Nexus 3000 Series NX-OS Layer 2 Switching Configuration Guide. For more information about configuring the VRF instances, see the Cisco Nexus 3000 Series NX-OS Unicast Routing Configuration Guide.

vPC Configuration Limits

The Cisco Nexus 3000 Series Switches are equipped with up to 64 10 Gigabit Ethernet ports. Each port can be part of a vPC. The maximum number of vPCs configurable on the Cisco Nexus 3000 Series Switches is 64. This number cannot be achieved, however, because at least two links need to be used for the vPC peer link. Therefore, you can assume that the limit on the number of vPCs configurable is bound to the physical number of ports present on the switch.

The command **show port-channel capacity** displays the utilization statistics and remaining free resources. An example of this command is shown here:

```
n3k-1# show port-channel capacity
Port-channel resources
    64 total    2 used    62 free    3% used
```

For More Information

- http://www.cisco.com/go/nexus3000
- http://www.cisco.com/go/nexus5000
- http://www.cisco.com/go/nexus7000

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