



Configuring FCoE NPV

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Information About FCoE NPV

FCoE NPV is supported on the Cisco Nexus devices. The FCoE NPV feature is an enhanced form of FIP snooping that provides a secure method to connect FCoE-capable hosts to an FCoE-capable FCoE forwarder (FCF) switch. The FCoE NPV feature provides the following benefits:

- FCoE NPV does not have the management and troubleshooting issues that are inherent to managing hosts remotely at the FCF.
- FCoE NPV implements FIP snooping as an extension to the NPV function while retaining the traffic-engineering, vsan-management, administration and trouble-shooting aspects of NPV.

- FCoE NPV and NPV together allow communication through FC and FCoE ports at the same time. This provides a smooth transition when moving from FC to FCoE topologies.

You can enable FCoE NPV by choosing one of the following methods:

- **Enable FCoE and then enable NPV**—This method requires that you enable FCoE first using the **feature fcoe** command and then you enable NPV by using the **feature npv** command. When FCoE is enabled, the default mode of operation is FC switching and when you enable NPV, the mode changes to NPV mode. Switching to NPV mode automatically performs a write erase and reloads the system. After the reload, the system comes up in NPV mode. To exit NPV mode and return to FC switching mode, enter the **no feature npv** command. Exiting NPV mode also triggers a write erase and a switch reload. This method requires the Storage Protocols Services Package (FC_FEATURES_PKG) license.
- **Enable FCoE NPV**—When you enable FCoE NPV using the **feature fcoe-npv** command, the mode changes to NPV. When you use this method, a write erase and reload does not occur. This method requires a separate license package (FCOE_NPV_PKG). This license is also included in the Storage Protocol Services License.

Method	License	Write Erase	Reload
Enable FCoE and then Enable NPV	Storage Protocols Services Package (FC_FEATURES_PKG)	Yes	Yes
Enable FCoE NPV	(FCOE_NPV_PKG)	No	No

Interoperability with FCoE-Capable Switches

The Cisco Nexus device interoperates with the following FCoE-capable switches:

- Cisco MDS 9000 Series Multilayer switches enabled to perform FCF functions (EthNPV and VE)
- Cisco Nexus 7000 Series switches enabled to perform FCF functions (EthNPV and VE)
- Cisco Nexus 4000 Series switches enabled for FIP Snooping

For detailed information about switch interoperability, see the [Cisco Data Center Interoperability Support Matrix](#).

Licensing

The following table shows the licensing requirements for FCoE NPV:

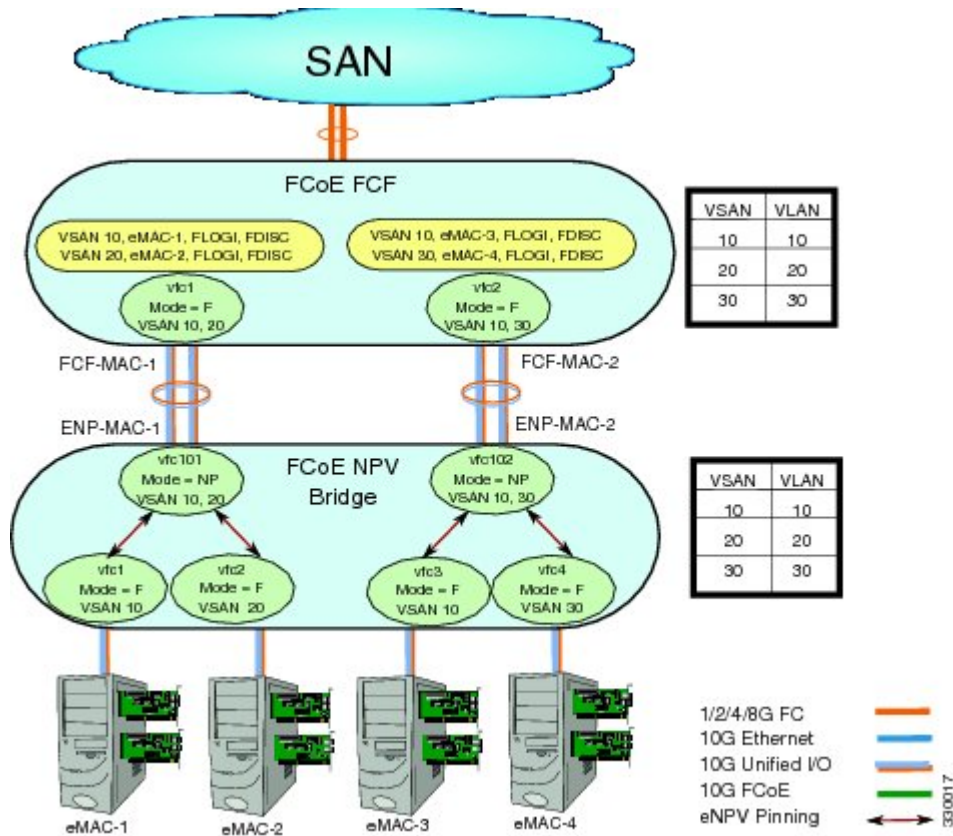
Product	License Requirement
NX-OS	<p>FCoE NPV requires a separate license (FCOE_NPV_PKG). The FCoE NPV license is also included in the Storage Protocol Services License.</p> <p>FCoE and NPV require the Storage Protocols Services Package (FC_FEATURES_PKG).</p> <p>For detailed information about features that require licensing and Cisco NX-OS license installation, see the Cisco NX-OS Licensing Guide.</p> <p>For information about troubleshooting licensing issues, see the Troubleshooting Guide for your device.</p>

FCoE NPV Model

The following figure shows the FCoE NPV bridge connecting hosts and FCFs. From a control plane perspective, FCoE NPV performs proxy functions towards the FCF and the hosts in order to load balance logins from the

hosts evenly across the available FCF uplink ports. An FCoE NPV bridge is VSAN-aware and capable of assigning VSANs to the hosts.

Figure 1: FCoE NPV Model



Mapping Requirements

VSANs and VLAN-VSAN Mapping

VSANs from the hosts must be created and for each VSAN, a dedicated VLAN must also be created and mapped. The mapped VLAN is used to carry FIP and FCoE traffic for the corresponding VSAN. The VLAN-VSAN mapping must be configured consistently in the entire fabric. The Cisco Nexus device supports 32 VSANs.

FC Mapping

The FC-MAP value associated with a SAN fabric must be configured on the FCoE NPV bridge which helps the FCoE NPV bridge isolate misconnections to FCFs in other fabrics.

Port Requirements

VF Ports

For each host directly connected over Ethernet interfaces on the FCoE NPV bridge, a virtual Fibre Channel (vFC) interface must be created and bound to the Ethernet interface. By default, the vFC interface is configured in the F mode (VF port).

The VF port must be configured with the following parameters:

- A VF port must be bound to a VLAN trunk Ethernet interface or a port-channel interface. The FCoE VLAN must not be configured as the native VLAN on the Ethernet interface.
- A port VSAN must be configured for the VF port.
- The administrative state must be up.

VNP Ports

Connectivity from an FCoE NPV bridge to the FCF is only supported over point-to-point links. These links can be individual Ethernet interfaces or members of an Ethernet port channel interface. For each FCF connected Ethernet interfaces, a vFC interface must be created and bound to the Ethernet interface. These vFC interfaces must be configured as VNP ports. On the VNP port, an FCoE NPV bridge emulates an FCoE-capable host with multiple enodes, each with a unique enode MAC address. A VNP port interface binding to MAC address is not supported. By default, the VNP port is enabled in trunk mode. Multiple VSANs can be configured on the VNP port. The FCoE VLANs that correspond to the VNP port VSANs must be configured on the bound Ethernet interface.

**Note**

The spanning-tree protocol (STP) is automatically disabled in the FCoE VLAN on the interfaces that the VNP port are bound to.

NPV Features

The following NPV features apply for the FCoE NPV feature:

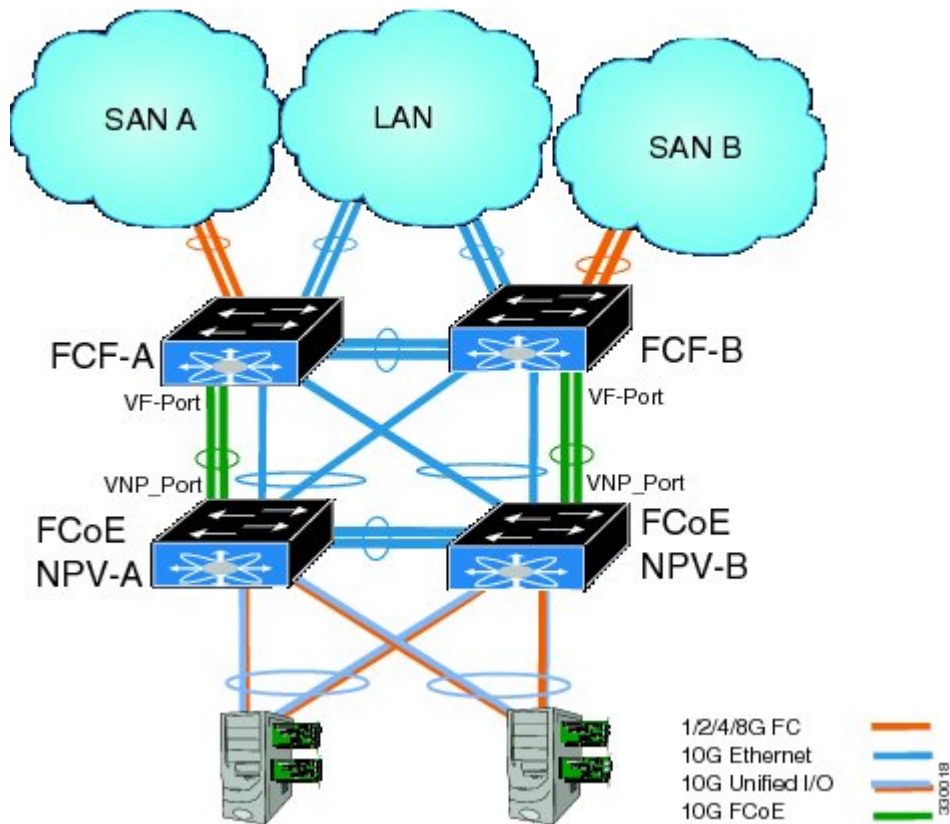
- Automatic Traffic Mapping
- Static Traffic Mapping
- Disruptive Load Balancing
- FCoE Forwarding in the FCoE NPV Bridge
- FCoE frames received over VNP ports are forwarded only if the L2_DA matches one of the FCoE MAC addresses assigned to hosts on the VF ports otherwise they're discarded.

vPC Topologies

When VNP ports are configured vPC topologies between an FCoE NPV bridge and an FCF, the following limitations apply:

- vPC spanning multiple FCFs in the same SAN fabric is not supported.
- For LAN traffic, dedicated links must be used for FCoE VLANs between the FCoE NPV bridge and the FCF connected over a vPC.
- FCoE VLANs must not be configured on the inter-switch vPC interfaces.
- VF port binding to a vPC member port is not supported for an inter-switch vPC.

Figure 2: VNP Ports in an Inter-Switch vPC Topology



Supported and Unsupported Topologies

FCoE NPV supports the following topologies:

Figure 3: Cisco Nexus Device As An FCoE NPV Device Connected to a Cisco Nexus Device Over A Non- vPC Port Channel

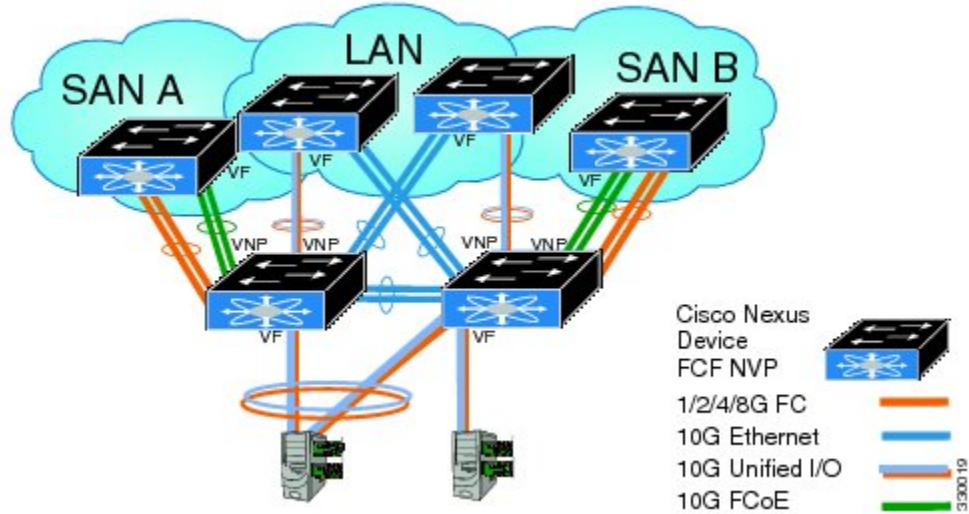


Figure 4: Cisco Nexus Device As An FCoE NPV Device Connected Over a vPC To Another Cisco Nexus Device

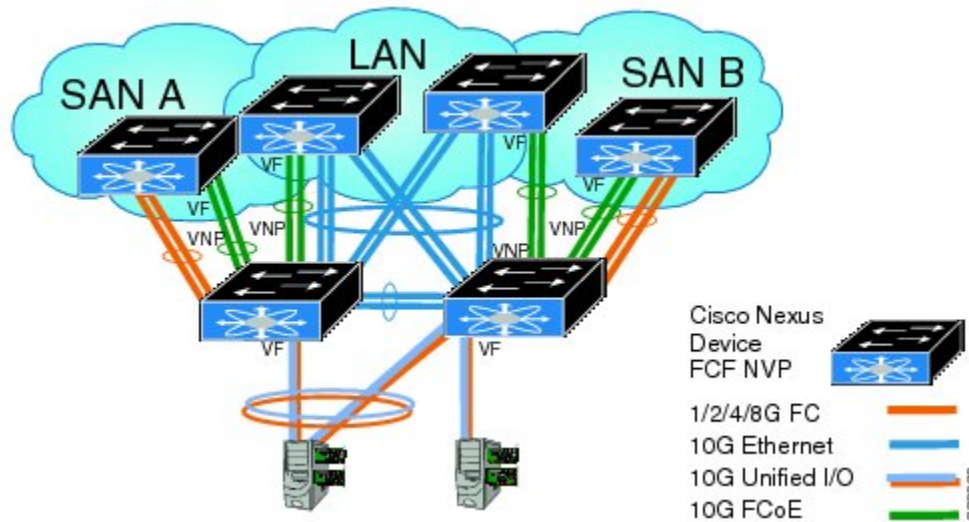


Figure 5: Cisco Nexus Device With A 10GB Fabric Extender As An FCoE NPV Device Connected to a Cisco Nexus Device Over A Non- vPC Port Channel

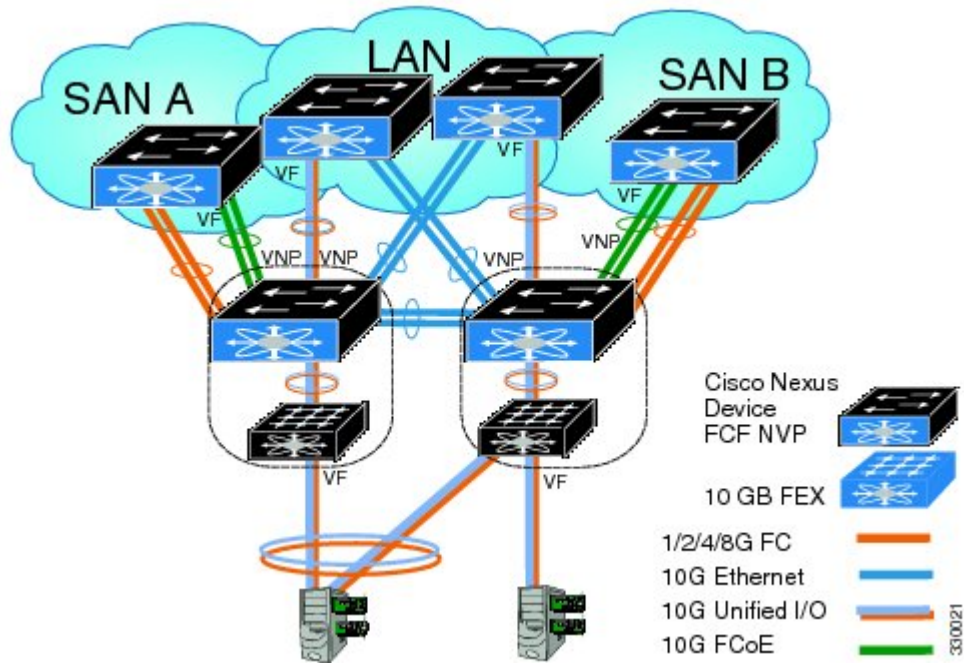


Figure 6: Cisco Nexus Device With A 10GB Fabric Extender as an FCoE NPV Device Connected Over a vPC to Another Cisco Nexus Device

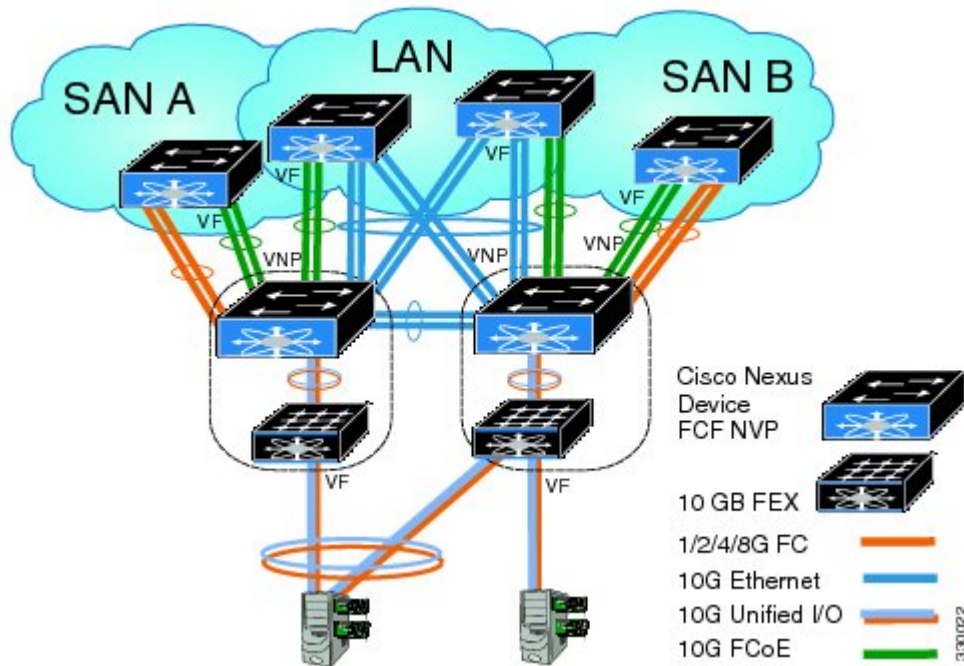
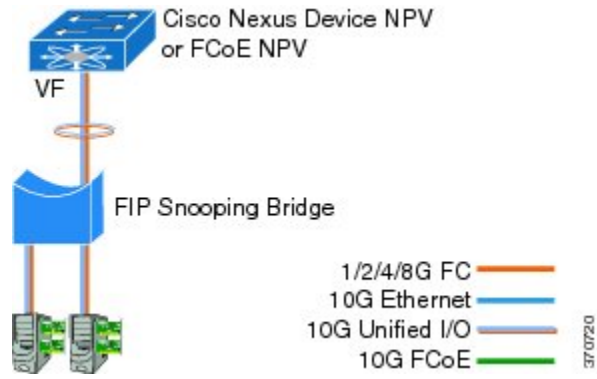


Figure 7: Cisco Nexus Device As An FCoE NPV Bridge Connecting to a FIP Snooping Bridge



Unsupported Topologies

FCoE NPV does not support the following topologies:

Figure 8: 10GB Fabric Extender Connecting To The Same FCoE NPV Bridge Over Multiple VF Ports

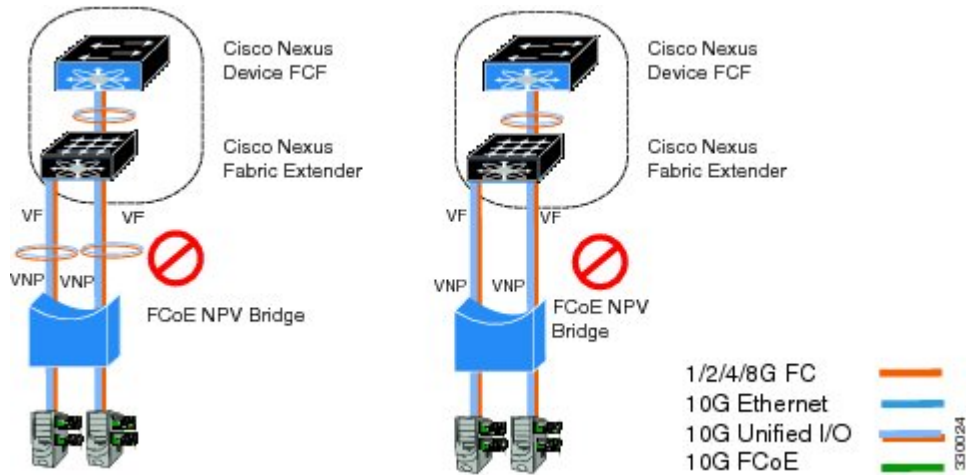


Figure 9: Cisco Nexus Device As An FCoE NPV Bridge Connecting To A FIP Snooping Bridge Or Another FCoE NPV Bridge

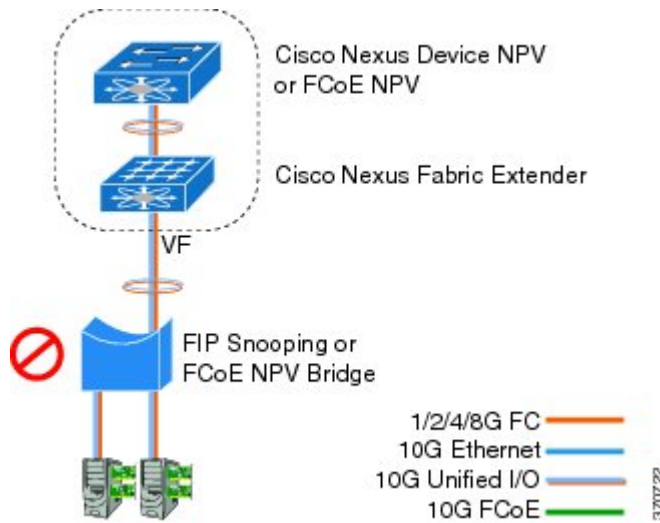


Figure 10: VF Port Trunk To Hosts In FCoE NPV Mode

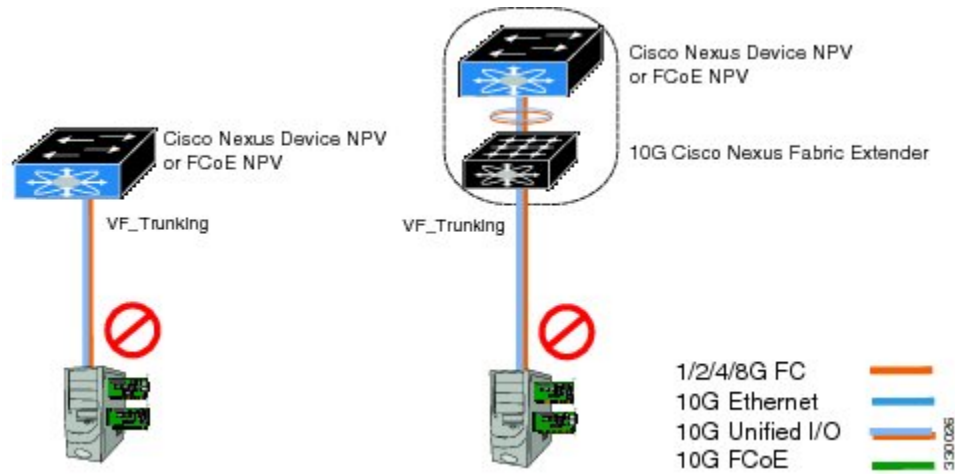
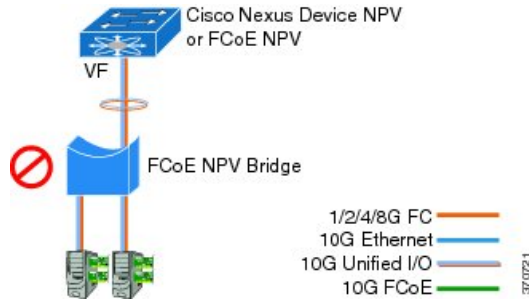


Figure 11: Cisco Nexus Device As An FCoE NPV Bridge Connecting to an FCoE NPV Bridge



Guidelines and Limitations

The FCoE NPV feature has the following configuration guidelines and limitations:

- When FCoE NPV mode is configured on a switch, the FCoE feature cannot be enabled. A warning is displayed to reload the system first in order to enable FCoE.

The FCoE NPV feature has the following upgrade and downgrade guidelines and limitations:

- You can not perform an in-service software downgrade (ISSD) to Cisco NX-OS Release 5.0(3)N1(1) or an earlier release if FCoE NPV is enabled and if VNP ports are configured.
- A warning is displayed if an ISSD is performed to Cisco NX-OS Release 5.0(3)N1(1) or an earlier release when FCoE NPV is enabled but VNP ports are not configured.
- Before performing an ISSU on an FCoE NPV bridge, use the **disable-fka** command to disable the timeout value check (FKA check) on the core switch.

FCoE NPV Configuration Limits

The following table lists the FCoE configuration limits over Ethernet, Ethernet port channel, and virtual Ethernet interfaces.

Table 1: VNP Port Configuration Limits

Interface Type	Cisco Nexus 5500 Platform	Cisco Nexus 2000 Series (10G interfaces)
VNP port bound to Ethernet interface	16 VNP ports	Not Supported
VNP port bound to Ethernet port channel interface	16 VNP ports	Not Supported
VNP port bound to virtual Ethernet (vEth) interface	Not Supported	Not Supported

The configuration limits guidelines are as follows:

- The number of VF port and VN port interfaces that can be supported between a given FCF and an FCoE NPV bridge also depends on the FCF to MAC advertising capability of the FCF:
 - If an FCF advertises the same FCF-MAC address over all of its interfaces, then the FCoE NPV bridge can connect to it over one VNP Port. In this scenario, we recommend that one port channel interface be used for redundancy.
 - If an FCF advertises multiple FCF-MAC addresses, then the limits in the previous table apply. For additional information, see the best practices recommendations for the FCF switch.
- The total number of supported VSANs is 31 (excluding the EVFP VSAN).
- The total number of supported FCIDs is 2048.

Default Settings

The following table lists the default settings for FCoE NPV parameters.

Table 2: Default FCoE NPV Parameters

Parameters	Default
FCoE NPV	Disabled
FCoE	Disabled
NPV	Disabled
VNP port	Disabled
FIP Keep Alive (FKA)	Disabled

Enabling FCoE and Enabling NPV

You can enable FCoE first and then enable NPV. This method requires the full Storage Services License. A write erase reload occurs when this method is used. This method allows both FCoE and FC upstream and host NPV connections. You must also configure class-fcoe in all QoS policy types.

1 Enable FCoE.

```
switch# configure terminal
switch(config)# feature fcoe
FC license checked out successfully
fc_plugin extracted successfully
FC plugin loaded successfully
FCoE manager enabled successfully
FC enabled on all modules successfully
Warning: Ensure class-fcoe is included in qos policy-maps of all types
```

2 Enable NPV.

```
switch# configure terminal
switch(config)# feature npv
```

Enabling FCoE NPV

You can enable FCoE NPV using the **feature fcoe-npv** command. We recommend this method in topologies that include all FCoE connections. A write erase reload does not occur when you use this method and a storage service license is not required. Enabling FCoE NPV using the **feature fcoe-npv** command requires an installed FCOE_NPV_PKG license.

Before You Begin

FCoE NPV has the following prerequisites:

- Ensure that the correct licenses are installed.
- For the Cisco Nexus 5500 Platform switches, ensure that the FCF supports multiple FC ports and multiple logins (FLOGI) on a single physical VF port.
- Configure the VNP ports.

Procedure

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters global configuration mode.
Step 2	feature fcoe-npv	Enables FCoE NPV.
Step 3	exit	Exits configuration mode.

	Command or Action	Purpose
Step 4	switch(config)# copy running-config startup-config	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

This example shows how to enable FCoE NPV using the **feature fcoe-npv** command.

```
switch# configure terminal
switch(config)# feature fcoe-npv
FCoE NPV license checked out successfully
fc_plugin extracted successfully
FC plugin loaded successfully
FCoE manager enabled successfully
FCoE NPV enabled on all modules successfully
```

This example shows how to enable FCoE NPV using the **feature fcoe** and **feature npv** commands.

```
switch# configure terminal
switch(config)# feature fcoe
switch(config)# feature npv
```

Configuring NPV Ports for FCoE NPV

You can configure NPV port for FCoE NPV.

- 1 Create a vFC port.

```
switch# config t
switch(config)# interface vfc 20
switch(config-if)#
```

- 2 Bind the vFC to an Ethernet port.

```
switch(config-if)# bind interface ethernet 1/20
switch(config-if)#
```

- 3 Set the port mode to NP.

```
switch(config-if)# switchport mode NP
switch(config-if)#
```

- 4 Bring up the port:

```
switch(config-if)# interface vfc 20 no shutdown
switch(config-if)#
```

Verifying FCoE NPV Configuration

To display FCoE NPV configuration information, perform one of the following tasks:

Command	Purpose
show fcoe database	Displays information about the FCoE database.

Command	Purpose
show interface Ethernet x/y fcoe	Displays FCoE information for a specified Ethernet interface including the following: <ul style="list-style-type: none"> • FCF or associated enode MAC address • Status • Associated VFC information
show interface vfc x	Displays information about the specified vFC interface including attributes and status.
show npv status	Displays the status of the NPV configuration including information about VNP ports.
show fcoe-npv issu-impact	Displays the impact of FCoE NPV on an ISSU.
show running-config fcoe_mgr	Displays the running configuration information about FCoE.
show startup-config fcoe_mgr	Displays the startup configuration information about FCoE.
show tech-support fcoe	Displays troubleshooting information about FCoE.
show npv flogi-table	Displays information about N port virtualization (NPV) fabric login (FLOGI) session
show fcoe	Displays the status of Fibre Channel over Ethernet (FCoE) configurations.

For detailed information about the fields in the output from these commands, refer to the command reference for your device.

Configuration Examples for FCoE NPV

This example shows how to enable FCoE NPV, LACP, QoS for no drop queuing, and VLAN/VSAN mapping:

```
switch# config t
switch(config)# feature fcoe-npv
FCoE NPV license checked out successfully
fc_plugin extracted successfully
FC_plugin loaded successfully
FCoE manager enabled successfully
FCoE NPV enabled on all modules successfully

switch(config)# feature lacp

switch# config t
switch(config)# system qos
switch(config-sys-qos)# service-policy type qos input fcoe-default-in-policy
switch(config-sys-qos)# service-policy type queuing input fcoe-default-in-policy
```

```
switch(config-sys-qos)# service-policy type queuing output fcoe-default-out-policy
switch(config-sys-qos)# service-policy type network-qos fcoe-default-nq-policy
```

```
switch(config)# vsan database
switch(config-vsan-db)# vsan 50-51
switch(config-vsan-db)# vlan 50
switch(config-vlan)# fcoe vsan 50
switch(config-vlan)# vlan 51
switch(config-vlan)# fcoe vsan 51
```

This example shows a summary of the interface configuration information for trunked NP ports:

```
switch# show interface brief | grep TNP
fc2/5      400    NP     on     trunking      swl    TNP    2     --
fc2/6      400    NP     on     trunking      swl    TNP    2     --

vfc130    1      NP     on     trunking      --     TNP    auto  --
switch#
```

This example shows the running configuration information about FCoE:

```
switch# show running-config fcoe_mgr

!Command: show running-config fcoe_mgr
!Time: Wed Jan 20 21:59:39 2013

version 6.0(2)N1(1)

interface vfc1
  bind interface Ethernet1/19

interface vfc2
  bind interface Ethernet1/2

interface vfc90
  bind interface Ethernet1/9

interface vfc100
  bind interface Ethernet1/10

interface vfc110
  bind interface port-channel110

interface vfc111
  bind interface Ethernet1/11

interface vfc120
  bind interface port-channel120

interface vfc130
  bind interface port-channel130

interface vfc177
  bind interface Ethernet1/7
fcoe fka-adv-period 16
```

This example shows the FCoE VLAN to VSAN mappings:

```
switch# show vlan fcoe
```

Original VLAN ID	Translated VSAN ID	Association State
-----	-----	-----
400	400	Operational
20	20	Operational
100	100	Operational
500	500	Operational
200	200	Operational
300	300	Operational

This example shows the information about the vFC 130 interface including attributes and status:

```
switch# show interface vfc 130
vfc130 is trunking (Not all VSANs UP on the trunk)
  Bound interface is port-channel130
  Hardware is Virtual Fibre Channel
  Port WWN is 20:81:00:05:9b:74:bd:bf
  Admin port mode is NP, trunk mode is on
  snmp link state traps are enabled
  Port mode is TNP
  Port vsan is 1
  Trunk vsans (admin allowed and active) (1,20,100,200,300,400,500)
  Trunk vsans (up) (500)
  Trunk vsans (isolated) ()
  Trunk vsans (initializing) (1,20,100,200,300,400)
  1 minute input rate 0 bits/sec, 0 bytes/sec, 0 frames/sec
  1 minute output rate 0 bits/sec, 0 bytes/sec, 0 frames/sec
    15 frames input, 2276 bytes
    0 discards, 0 errors
    7 frames output, 1004 bytes
    0 discards, 0 errors
  last clearing of "show interface" counters Tue May 31 20:56:41 2011

  Interface last changed at Wed Jun  1 21:53:08 2011
```

This example shows the information about the vFC 1 interface including attributes and status:

```
switch# show interface vfc 1
vfc1 is trunking (Not all VSANs UP on the trunk)
  Bound interface is Ethernet1/19
  Hardware is Virtual Fibre Channel
  Port WWN is 20:00:00:05:9b:74:bd:bf
  Admin port mode is F, trunk mode is on
  snmp link state traps are enabled
  Port mode is TF
  Port vsan is 20
  Trunk vsans (admin allowed and active) (1,20,100,200,300,400,500)
  Trunk vsans (up) (20)
  Trunk vsans (isolated) ()
  Trunk vsans (initializing) (1,100,200,300,400,500)
  1 minute input rate 0 bits/sec, 0 bytes/sec, 0 frames/sec
  1 minute output rate 0 bits/sec, 0 bytes/sec, 0 frames/sec
    355278397 frames input, 573433988904 bytes
    0 discards, 0 errors
    391579316 frames output, 572319570200 bytes
    0 discards, 0 errors
  last clearing of "show interface" counters Tue May 31 20:56:41 2011

  Interface last changed at Wed Jun  1 20:25:36 2011
```

This example shows the information about the NPV FLOGI session:

```
switch# show npv flogi-table
-----
SERVER
INTERFACE VSAN FCID                PORT NAME                NODE NAME                EXTERNAL
-----
vfc1      20    0x670000 21:01:00:1b:32:2a:e5:b8 20:01:00:1b:32:2a:e5:b8 fc2/6
-----
Total number of flogi = 1.
```

This example shows the status of the NPV configuration including information about VNP ports:

```
switch# show npv status

npiv is enabled

disruptive load balancing is disabled

External Interfaces:
=====
  Interface: fc2/5, State: Trunking
           VSAN:  1, State: Up
```

```

        VSAN: 200, State: Up
        VSAN: 400, State: Up
        VSAN: 20, State: Up
        VSAN: 100, State: Up
        VSAN: 300, State: Up
        VSAN: 500, State: Up, FCID: 0xa10000
Interface: fc2/6, State: Trunking
        VSAN: 1, State: Up
        VSAN: 200, State: Up
        VSAN: 400, State: Up
        VSAN: 20, State: Up
        VSAN: 100, State: Up
        VSAN: 300, State: Up
        VSAN: 500, State: Up, FCID: 0xa10001
Interface: vfc90, State: Down
Interface: vfc100, State: Down
Interface: vfc110, State: Down
Interface: vfc111, State: Down
Interface: vfc120, State: Down
Interface: vfc130, State: Trunking
        VSAN: 1, State: Waiting For VSAN Up
        VSAN: 200, State: Up
        VSAN: 400, State: Up
        VSAN: 100, State: Up
        VSAN: 300, State: Up
        VSAN: 500, State: Up, FCID: 0xa10002

```

Number of External Interfaces: 8

Server Interfaces:

```

=====
Interface: vfc1, VSAN: 20, State: Up
Interface: vfc2, VSAN: 4094, State: Down
Interface: vfc3, VSAN: 4094, State: Down
Interface: vfc5000, VSAN: 4094, State: Down
Interface: vfc6000, VSAN: 4094, State: Down
Interface: vfc7000, VSAN: 4094, State: Down
Interface: vfc8090, VSAN: 4094, State: Down
Interface: vfc8191, VSAN: 4094, State: Down

```

Number of Server Interfaces: 8

This example shows the running configuration of port channel 130:

```

switch# show running-config interface port-channel 130

!Command: show running-config interface port-channel130
!Time: Wed Jan 30 22:01:05 2013

version 6.0(2)N1(1)

interface port-channel130
 switchport mode trunk
 switchport trunk native vlan 2
 no negotiate auto

```

This example shows the impact of FCoE NPV on an ISSU:

```

switch# show fcoe-npv issu-impact
show fcoe-npv issu-impact
-----

```

Please make sure to enable "disable-fka" on all logged in VFCs
Please increase the FKA duration to 60 seconds on FCF

Active VNP ports with no disable-fka set

```

-----
vfc90
vfc100
vfc110
vfc111

```

```
vfc120  
vfc130
```

```
ISSU downgrade not supported as feature fcoe-npv is enabled  
switch#
```

