

Lab 4-2: Configuring Cisco NPV Mode and NPIV

Complete this lab activity to practice what you learned in the related lesson.

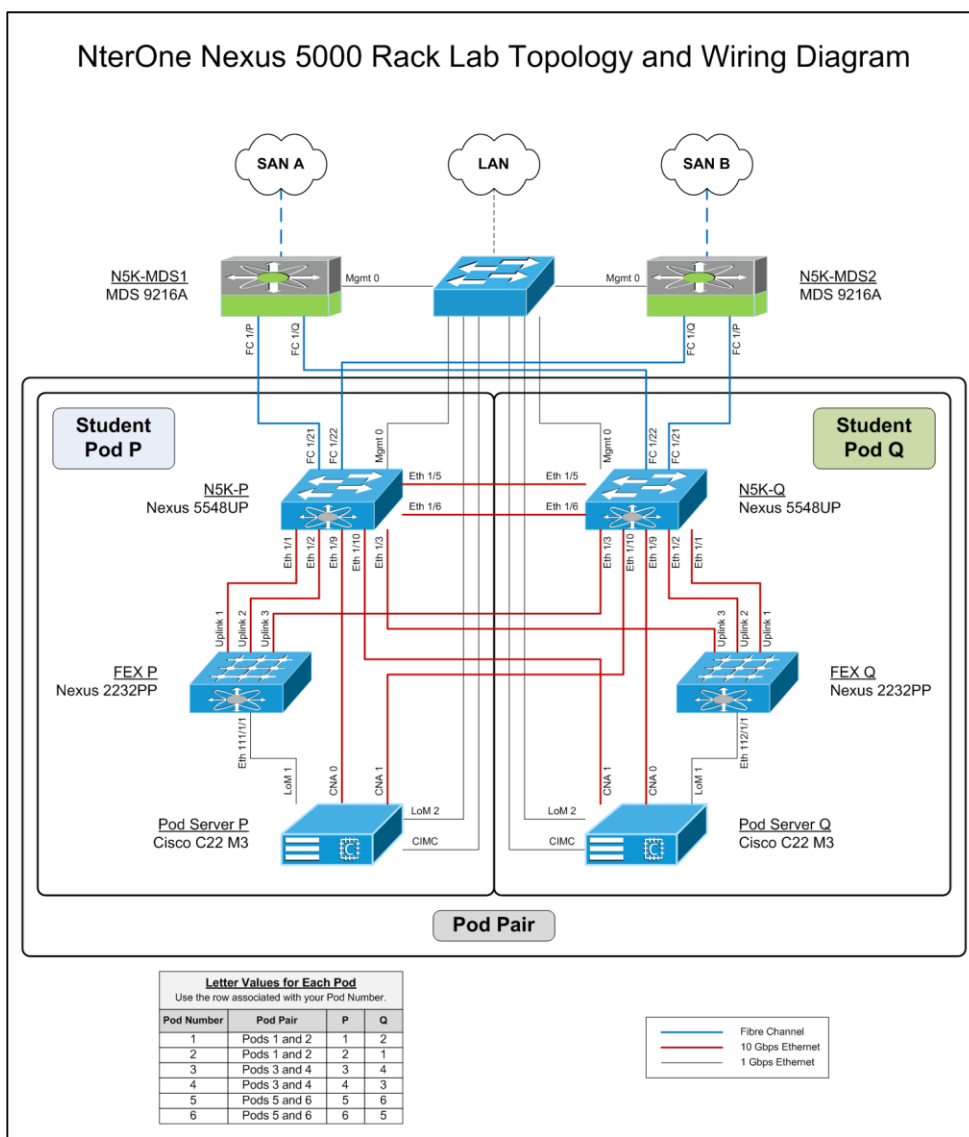
Activity Objective

In this activity, you will configure the Cisco Nexus 5000 Series Switch in Cisco NPV mode and the Cisco MDS 9100 Series Switch for NPIV. After completing this activity, you will be able to meet these objectives:

- Become familiar with, configure, and verify Cisco NPV mode using the CLI of the Cisco Nexus 5000 Series Switch
- Become familiar with, configure, and verify NPIV using the CLI of the Cisco MDS 9124 Switch

Visual Objective

The figure illustrates what you will accomplish in this activity.



Command List

The table below lists the commands that are used in this activity.

Command	Description
write erase	Erases the saved configuration.
copy bootflash:<file> running-config	Merges the configurations that are contained in the file in bootflash with the running configuration.
copy running-config startup config	Saves the configuration.
show ip interface brief [vrf management]	Displays the IP address of the interfaces in the specified VRF.
show ip route [vrf management]	Displays the routing table for the specified VRF.
show interface brief	Displays a summary of the interfaces.
reload	Reboots the switch.
feature npv	Enables the NPV feature.
feature fcoe	Enables the FCoE Feature.
show npiv status	Displays the state of the NPIV feature.
show interface <type slot/port> brief	Displays a summary of the interfaces.
feature npiv	Enables the NPIV feature.
vsan database	Enters VSAN database mode.
vsan n interface <interface>	Assigns an interface to a VSAN.
slot 1	Selects a slot in the chassis.
port 21-32 type <type>	Defines a unified port.
switchport mode trunk	Defines a port as a VLAN trunk.
switchport trunk allowed vlan <vlan-id>	Defines the VLANs allowed on a trunk.
spanning-tree port type edge trunk	Defines a trunk port as a spanning-tree edge port.
switchport description	Assigns a description to a port.
switchport trunk allowed vsan	Defines the VSANs allowed on a trunk.
bind interface Ethernet 1/3	Binds a VFC to a physical interface.
no shutdown	Enables an interface.
system qos	Enters system QoS configuration mode.
service-policy type qos input fcoe-default-in-policy	Assigns the type QoS input service policy.
service-policy type queuing input fcoe-default-in-policy	Assigns the type queuing input service policy.
service-policy type queuing output fcoe-default-out-policy	Assigns the type queuing output service policy.
service-policy type network-qos fcoe-default-nq-policy	Assigns the type network-qos service policy.
show npv status	Displays the state of the NPV and NPIV features.
show npv external- interface-usage	Displays the server to uplink interface mapping.
show npv flogi-table	Displays the NPV FLOGI database.
show flogi database	Display the list of FLOGIs
fcping fcid <dest fcid>vsan id	Performs an FC Ping to a remote FC-ID
zone default-zone permit vsan P00	Defines the default zoning policy for a VSAN

Task 1: Enable Cisco NPV Mode on the Cisco Nexus 5000 Series Switch

During this task, you will enable Cisco NPV mode on your Cisco Nexus 5000 Series Switch, which will erase the configuration and reset the switch. A baseline configuration will be loaded to prepare for the remaining tasks for this lab.

Activity Procedure

Complete these steps:

Step 1 Connect to the Student Server assigned to you by your instructor for this lab Use the server information and account credentials that are listed in the *Lab Support Document*.

Note Refer to *Accessing the NterOne Lab Equipment* for detailed instructions regarding how to use Remote Desktop Connection (RDC) to connect to your Student Server.

Step 2 Using PuTTY, connect to the console port of your assigned Cisco 5000 Series switch. Login to the switch with the username **admin** and password **Nterone179**.

Step 3 Enable the FCoE feature.

```
N5K-P# conf
Enter configuration commands, one per line. End with CNTL/Z.
N5K-P(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
Enabled FCoE QoS policies successfully
```

Note If FCoE was already enabled, the messages above will not appear.

Step 4 Enable the NPV feature.

Note Enabling the NPV feature erases all configurations except for the management parameters and forces a reload of the switch. Prior to configuring Cisco NPV mode, it is recommended to make a backup copy of your configuration. The configuration can be saved to an external device or to bootflash, or both.

```
N5K-P(config)# feature npv
Verify that boot variables are set and the changes are saved. Changing to npv mode
erases the current configuration and reboots the switch in npv mode. Do you want to
continue? (y/n):y
Shutdown Ports..
  writing reset reason 90,

Broadcast message from root (Fri May 17 05:01:10 2013):

The system is going down for reboot NOW!
```

Note The switch will take approximately 5 minutes to reload.

Step 5 When the switch has rebooted, login with username **admin** and password **Nterone179**.

Step 6 Modify the unified ports Ethernet 1/21 to 1/32 to operate in Fibre Channel mode.

Note The switch will require a reload to implement the change. Ensure that you save your configuration after this step.

```
N5K-P# conf t
Enter configuration commands, one per line. End with CNTL/Z.
N5K-P(config)# slot 1
N5K-P(config-slot)# port 21-32 type fc
N5K-P(config-slot)# end
```

Note When choosing the unified ports to operate in FC mode, it is recommended to allocate only the number of ports that you require in descending order from the highest port number. They must be in a contiguous range.

```
N5K-P# copy running-config startup-config
[#####] 100%
Copy complete, now saving to disk (please wait)...
```

Step 7 Reload your switch in order to enable the fibre channel interfaces.

```
N5K-P# reload
WARNING: This command will reboot the system
Do you want to continue? (y/n) [n] y
2013 May 17 09:10:57 N5K-P %$ VDC-1 %$ %PFMA-2-PFM_SYSTEM_RESET: Manual system
restart from Command Line Interface
Shutdown Ports..
```

Note The switch will take approximately 5 minutes to reload.

Step 8 When the switch has rebooted, login with username **admin** and password **Nterone179**.

Step 9 Verify that the Fibre Channel uplink interfaces are recognized.

```
N5K-P# show interface fc 1/21-22 brief
-----
Interface  Vsan   Admin  Admin  Status      SFP   Oper  Oper  Port
          Mode   Mode   Mode
          Mode
-----
fc1/21     1      NP     off    init        swl   --    --    --
fc1/22     1      NP     off    init        swl   --    --    --
-----
```

Step 10 Copy the lab baseline configuration from the saved file in the bootflash into the running configuration using the command below.

Note Replace "P" with your assigned pod number for this lab

```
N5K-P# copy bootflash:/configs/dcnx5k/dcnx5k-lab-3-11-n5k-P.txt running-config
< ... output omitted ... >
Copy complete, now saving to disk (please wait)...
```

Note You will see a number of what looks like error messages scroll by; this is normal behavior.

Activity Verification

You have completed this task when you attain these results:

- You have reconfigured your assigned switch with the baseline configuration for this lab.
- You have connected to each of the devices in the previous table.

Task 2: Verify the Core SAN Switch Configuration

During this task you will access the core SAN switch to view how it will function when connected to a Cisco NPV mode edge switch. A Cisco NPV mode switch is not logically present in the SAN, making it appear that the SAN core switch is directly connected to the end devices.

Activity Procedure

Complete these steps:

Step 11 Using PuTTY, connect to the Cisco MDS 9100 Series Switches. Use the information in the table below.

Device Name	Device Description	IP Address or URL	Username	Password
N5K-MDS1	Cisco MDS 9124	10.0.0.149	student	Nterone179
N5K-MDS2	Cisco MDS 9124	10.0.0.150	student	Nterone179

Step 12 Use the **show interface description** command to determine the devices that are connected to the MDS switch.

```
N5K-MDS1# show interface description
```

```
-----  
Interface          Description  
-----  
fc1/1              [N5K-1 fc1/21]  
fc1/2              [N5K-2 fc1/21]  
fc1/3              [N5K-3 fc1/21]  
fc1/4              [N5K-4 fc1/21]  
fc1/5              [N5K-5 fc1/21]  
fc1/6              [N5K-6 fc1/21]  
fc1/7              [B4-MDS1 fc1/1]  
fc1/8              --  
fc1/9              --  
fc1/10             --  
fc1/11             --  
fc1/12             --  
fc1/13             --  
fc1/14             --  
fc1/15             --  
fc1/16             --  
fc1/17             --  
fc1/18             --  
fc1/19             --  
fc1/20             --  
fc1/21             --  
fc1/22             --  
fc1/23             --  
fc1/24             --  
  
-----  
Interface          Description  
-----  
mgmt0              --
```

Step 13 View the state of the NPIV feature.

```
N5K-MDS1# show npiv status
NPIV enabled
```

Step 14 View the VSANs that are configured and the ports assigned to use these VSANs.

```
N5K-MDS1# show vsan membership
vsan 1 interfaces:
    fc1/13          fc1/15          fc1/16          fc1/17
    fc1/18          fc1/19          fc1/20          fc1/21
    fc1/22          fc1/23          fc1/24

vsan 11 interfaces:
    fc1/1           fc1/3           fc1/5           fc1/7
    fc1/9           fc1/11          fc1/14

vsan 12 interfaces:
    fc1/2           fc1/4           fc1/6           fc1/8
    fc1/10          fc1/12

vsan 4079(evfp_isolated_vsan) interfaces:

vsan 4094(isolated_vsan) interfaces:
```

Step 15 View the state of the interfaces connected to your Nexus 5000 Series switch. Use the **show interface description** command to determine which interfaces these are.

```
N5K-MDS1# show interface fc1/X-Y brief
```

```
-----
Interface  Vsan   Admin  Admin  Status      SFP   Oper  Oper  Port
          Mode   Mode   Trunk                               Mode  Speed  Channel
          Mode                                     (Gbps)
-----
fc1/X      11     auto   on     up           sw1   F     4     --
fc1/Y      12     auto   on     up           sw1   F     4     --
-----
```

Note These interfaces will not be fully functional until the edge switch is configured.

Activity Verification

You have completed this task when you attain these results:

- You have enabled NPIV on the core SAN switch.
- You have configured the core SAN switch links to the edge switch to be members of a VSAN.

Task 3: Configure FCoE

During this exercise you will configure FCoE on your Cisco Nexus 5000 Series Switch.

Activity Procedure

Complete these steps:

Step 16 On your pod Nexus 5000 Series switch display the VLANs currently defined on the switch.

```
N5K-P# show vlan brief
```

VLAN Name	Status	Ports
1 default	active	Eth1/1, Eth1/2, Eth1/3, Eth1/4 Eth1/5, Eth1/6, Eth1/7, Eth1/8 Eth1/11, Eth1/12, Eth1/13 Eth1/14, Eth1/15, Eth1/16 Eth1/17, Eth1/18, Eth1/19 Eth1/20, Eth2/1, Eth2/2, Eth2/3 Eth2/4, Eth2/5, Eth2/6, Eth2/7 Eth2/8, Eth2/9, Eth2/10, Eth2/11 Eth2/12, Eth2/13, Eth2/14 Eth2/15, Eth2/16
300 Servers	active	Eth1/5, Eth1/6, Eth1/9, Eth1/10

Step 17 Create a new VLAN 1X that will be used for FCoE traffic. Refer to the table below to determine the value of “X” for your assigned pod.

Pod Number	X	FCoE VLAN Number	FC VSAN Number
1, 3, 5	1	11	11
2, 4, 6	2	12	12

Note Replace “X” with the value in this table in the rest of this lab.

```
N5K-P# conf
N5K-P(config)# vlan 1X
N5K-P(config-vlan)# no shutdown
N5K-P(config-vlan)# name FCoE-SAN-1X
```

Step 18 Refer to your topology diagram. Interfaces Ethernet 1/9 and Ethernet 1/10 on each Cisco Nexus 5000 Series Switch connects to the server CNAs. Configure these interfaces as 802.1Q trunks.

```
N5K-P(config-vlan)# interface ethernet 1/9-10
N5K-P(config-if-range)# switchport mode trunk
N5K-P(config-if-range)# switchport trunk allowed vlan 300,1X
N5K-P(config-if-range)# switchport trunk native vlan 300
N5K-P(config-if-range)# spanning-tree port type edge trunk
Warning: Edge port type (portfast) should only be enabled on ports connected to a
single
host. Connecting hubs, concentrators, switches, bridges, etc... to this
interface when edge port type (portfast) is enabled, can cause temporary bridging
loops.
Use with CAUTION
```

Step 19 Create virtual Fibre Channel interfaces for the FCoE traffic to the interfaces connected to the Pod Servers. Each vFC interface will be associated to a physical Ethernet interface, which together form the FCoE trunk.

```
N5K-P(config-if-range)# interface vfc 9
N5K-P(config-if)# switchport description FCoE to Server P CNA 0
N5K-P(config-if)# switchport trunk allowed vsan 1X
N5K-P(config-if)# bind interface ethernet 1/9
N5K-P(config-if)# no shutdown
N5K-P(config-if)# interface vfc 10
N5K-P(config-if)# switchport description FCoE to Server Q CNA 1
N5K-P(config-if)# switchport trunk allowed vsan 1X
N5K-P(config-if)# bind interface ethernet 1/10
N5K-P(config-if)# no shutdown
```

Step 20 VSANs must be created for connectivity to the SAN core switch. Each vFC interface must be assigned to a VSAN.

```
N5K-P(config-if)# vsan database
N5K-P(config-vsan-db)# vsan 1X
N5K-P(config-vsan-db)# vsan 1X interface vfc 9
N5K-P(config-vsan-db)# vsan 1X interface vfc 10
N5K-P(config-vsan-db)# exit
```

Step 21 FCoE traffic from the server CNA arrives on a VFC interface, but is inside the FCoE VLAN. The FCoE VLAN must be mapped to a VSAN to enable connectivity to the SAN core.

```
N5K-P(config)# vlan 1X
N5K-P(config-vlan)# fcoe vsan 1X
N5K-P(config-vlan)# end
```

Step 22 Confirm the VLAN to VSAN FCoE assignment.

```
N5K-P# show vlan fcoe
```

Original VLAN ID	Translated VSAN ID	Association State
1X	1X	Operational

Step 23 Display the interface membership for all VSANs.

```
N5K-P# show vsan membership
vsan 1 interfaces:
  fc1/21      fc1/22      fc1/23      fc1/24
  fc1/25      fc1/26      fc1/27      fc1/28
  fc1/29      fc1/30      fc1/31      fc1/32

vsan 1X interfaces:
  vfc9        vfc10

vsan 4079(evfp_isolated_vsan) interfaces:
```

```
vsan 4094(isolated_vsan) interfaces:
```

Step 24 Verify the state of the VFC interfaces.

```
N5K-P# show interface vfc 9-10 brief
```

Interface	Vsan	Admin Mode	Admin Trunk Mode	Status	SFP	Oper Mode	Oper Speed (Gbps)	Port Channel
vfc9	11	F	on	errDisabled	--	--		--
vfc10	11	F	on	errDisabled	--	--		--

Note The VFC interfaces will not be operational until the edge switch uplink ports to the SAN core are configured in the next task.

Step 25 Verify the FCoE enabled QoS service policies are configured.

```
N5K-P# show run ipqos | no-more
```

```

!Command: show running-config ipqos
!Time: Fri May 17 06:02:39 2013

version 5.1(3)N2(1)
class-map type qos class-fcoe
class-map type queuing class-fcoe
  match qos-group 1
class-map type queuing class-all-flood
  match qos-group 2
class-map type queuing class-ip-multicast
  match qos-group 2
class-map type network-qos class-fcoe
  match qos-group 1
class-map type network-qos class-all-flood
  match qos-group 2
class-map type network-qos class-ip-multicast
  match qos-group 2
system qos
  service-policy type queuing input fcoe-default-in-policy
  service-policy type queuing output fcoe-default-out-policy
  service-policy type qos input fcoe-default-in-policy
  service-policy type network-qos fcoe-default-nq-policy

```

Note Without FCoE service policies enabled, the VFC interfaces will never function.

Step 26 Enable the NPIV feature.

```

N5K-P# conf
Enter configuration commands, one per line. End with CNTL/Z.
N5K-P(config)# feature npiv
N5K-P(config)# end

```

Activity Verification

You have completed this task when you attain these results:

- You have configured and verified the operation of the VFC interface
- You have configured FCoE between the edge switch Ethernet interface and the Server CNA.
- You have mapped the FCoE VLAN to a VSAN
- You have enabled the required QoS policies to support FCoE You have enabled NPIV on the edge switch.

Task 4: Configure the NP Uplinks

Activity Procedure

During this exercise you will enable Fibre Channel connectivity to the SAN core switch via NP uplinks on a Cisco NPV mode edge switch.

Complete these steps:

Step 27 Verify that the Fibre Channel uplinks to the core are enabled.

```

N5K-P# show interface fc 1/21-22 brief

```

```

-----
Interface  Vsan   Admin  Admin  Status      SFP   Oper  Oper  Port
          Mode   Mode   Trunk                               Mode  Speed Channel
                               Mode                                     (Gbps)

```

```
-----
fc1/21      1      NP      off      init      swl      --      --
fc1/22      1      NP      off      init      swl      --      --
-----
```

Note Each VSAN present on the switch requires an operational NP uplink in the same VSAN. If an uplink port in the same VSAN is not available, all interfaces in the VSAN will remain down. At this time, the VFC interfaces are in VSAN 1X while the NP uplinks are in VSAN 1.

Step 28 Map both of the NP uplinks to the FCoE VSAN.

```
N5K-P# conf
Enter configuration commands, one per line. End with CNTL/Z.
N5K-P(config-if)# vsan database
N5K-P(config-vsan-db)# vsan 11
N5K-P(config-vsan-db)# vsan 12
N5K-P(config-vsan-db)# vsan 11 interface fc1/21
N5K-P(config-vsan-db)# vsan 12 interface fc1/22
N5K-P(config-vsan-db)# end
```

Step 29 Verify that the Fibre Channel uplinks to the core are up and operating in NP mode.

```
N5K-P# show interface fc1/21-22 brief
```

```
-----
Interface  Vsan   Admin  Admin  Status      SFP   Oper  Oper  Port
          Mode   Mode   Trunk                                     Mode  Speed Channel
          Mode                                     (Gbps)
-----
fc1/21     11     NP     off    up          swl   NP    4    --
fc1/22     12     NP     off    up          swl   NP    4    --
-----
```

Step 30 Verify the state of the VFC interfaces.

```
N5K-P# show interface vfc 9-10 brief
```

```
-----
Interface  Vsan   Admin  Admin  Status      SFP   Oper  Oper  Port
          Mode   Mode   Trunk                                     Mode  Speed Channel
          Mode                                     (Gbps)
-----
vfc9       11     F      on     trunking    --    TF    auto --
vfc10      11     F      on     trunking    --    TF    auto --
-----
```

Activity Verification

You have completed this task when you attain these results:

- You have configured the Cisco NPV mode edge switch uplinks to the SAN core as NP uplinks and verified their operation.

Task 5: Cisco NPV Mode and NPIV Verification

Activity Procedure

During this exercise you will verify the operation of the edge Cisco NPV mode switch and the core NPIV enabled SAN switch.

Complete these steps:

Step 31 Verify that the Fibre Channel operation of the edge switch is enabled for Cisco NPV mode. The NPV-enabled switch is no longer aware of the fabric or its operation.

```
N5K-P# show flogi database
^
% Invalid command at '^' marker.
N5K-P# show fcdomain domain-list
^
% Invalid command at '^' marker.
N5K-P# show fspf ?
^
% Invalid command at '^' marker.
N5K-P# show zone active vsan 11
^
% Invalid command at '^' marker.
```

Step 32 The status of NPV and NPIV can be verified with the following command on both the edge and SAN core switch.

```
N5K-P# show npv status

npiv is enabled

disruptive load balancing is disabled

External Interfaces:
=====
Interface: fc1/21, VSAN: 11, FCID: 0x9c0100, State: Up
Interface: fc1/22, VSAN: 12, FCID: 0x3e0000, State: Up

Number of External Interfaces: 2

Server Interfaces:
=====
Interface: vfc9, VSAN: 11, State: Up
Interface: vfc10, VSAN: 11, State: Up

Number of Server Interfaces: 2
```

Step 33 View the server to external interface pinnings.

```
N5K-P# show npv external-interface-usage

NPV Traffic Usage Information:
-----
Server-If      External-If
-----
vfc9           fc1/21
vfc10          fc1/21
-----
```

Step 34 View the NPV flogi table.

```
N5K-P# show npv flogi-table
-----
SERVER
INTERFACE VSAN FCID          PORT NAME          NODE NAME          EXTERNAL
INTERFACE
-----
vfc9       1X   0x9c0102 20:00:00:00:00:99:01:02 20:00:00:00:00:99:01:01 fc1/21
vfc10      1X   0x9c0101 20:00:00:00:00:99:02:03 20:00:00:00:00:99:02:01 fc1/21
```

Total number of flogi = 2.

Note All FLOGIs received by a Cisco NPV enabled edge switch are relayed over an available NP uplink to the SAN core switch and processed there. The Cisco NPV mode edge switch snoops and keeps a local NPV FLOGI table, which is only a mapping of which NP uplink port the FLOGI was sent via.

Step 35 The SAN core switch FLOGI table lists all devices that are connected to the core switch and all devices that are connected to the Cisco NPV mode edge switch. All devices appear as if they were directly connected to the SAN core switch.

```
N5K-MDS1# show flogi database
```

```
-----  
INTERFACE          VSAN    FCID          PORT NAME          NODE NAME  
-----  
fc1/1              11      0x9c0100     20:15:00:2a:6a:09:fa:40 20:0b:00:2a:6a:09:fa:41  
fc1/1              11      0x9c0101     20:00:00:00:00:99:02:03 20:00:00:00:00:99:02:01  
fc1/1              11      0x9c0102     20:00:00:00:00:99:01:02 20:00:00:00:00:99:01:01  
fc1/2              12      0x3e0000     20:16:00:2a:6a:09:fa:40 20:0c:00:2a:6a:09:fa:41  
fc1/3              11      0x9c0200     20:15:00:2a:6a:0e:fd:40 20:0b:00:2a:6a:0e:fd:41  
fc1/4              12      0x3e0100     20:16:00:2a:6a:0e:fd:40 20:0c:00:2a:6a:0e:fd:41  
fc1/4              12      0x3e0101     20:00:00:00:00:99:02:02 20:00:00:00:00:99:02:01  
fc1/4              12      0x3e0102     20:00:00:00:00:99:01:03 20:00:00:00:00:99:01:01  
<... output omitted ...>
```

Q1) What feature allows multiple FLOGI to be processed on the same port of the SAN core switch?

Note This feature was enabled on the Cisco MDS 9124 Series Switch.

Step 36 Determine the FC-ID assigned to one of the servers that are attached to the edge switch.

```
N5K-P# show interface ethernet1/9 fcoe  
Ethernet1/9 is FCoE UP  
  vfc9 is Up  
    FCID is 0x9c0102  
    PWWN is 20:00:00:00:00:99:01:02  
    MAC addr is 7c:ad:74:27:c4:65
```

Step 37 Verify FC reachability from the SAN core switch to the VFC viewed in the previous step.

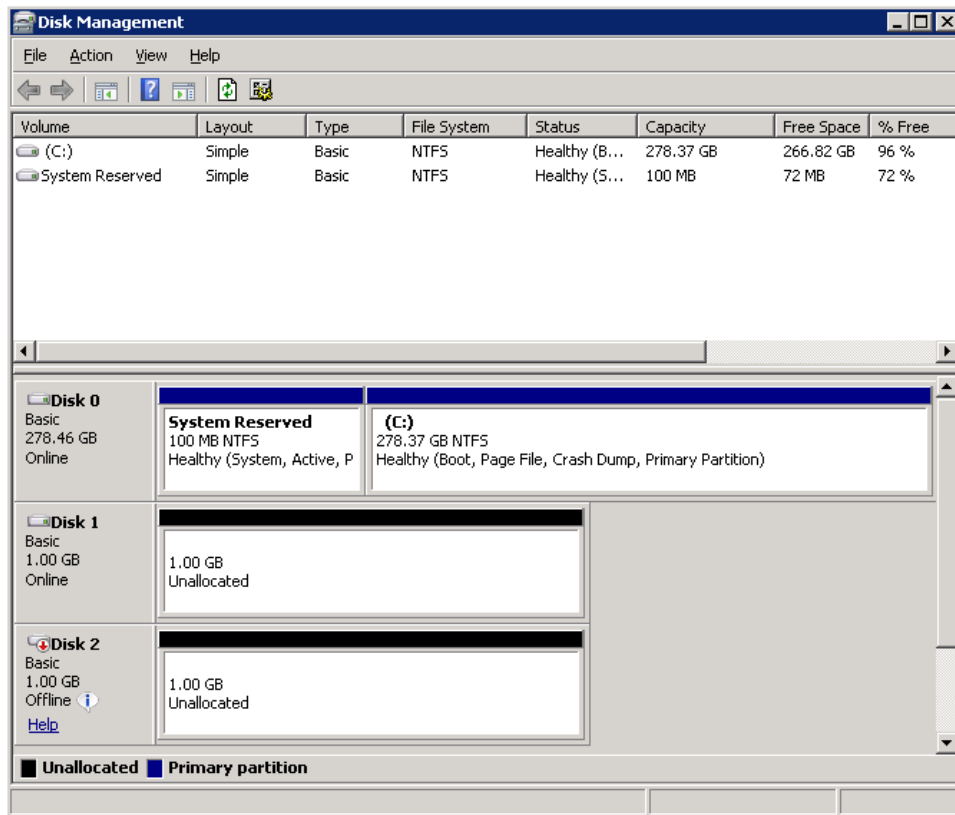
Note Use the FCID value from your current VFC interface, NOT the example given below.

```
N5K-MDS1# fcping fcid 0x9c0102 vsan 11  
28 bytes from 0x9c0102 time = 1016 usec  
28 bytes from 0x9c0102 time = 959 usec  
28 bytes from 0x9c0102 time = 958 usec  
28 bytes from 0x9c0102 time = 958 usec  
28 bytes from 0x9c0102 time = 955 usec
```

```
5 frames sent, 5 frames received, 0 timeouts  
Round-trip min/avg/max = 955/969/1016 usec
```

Step 38 From your Student Server use Remote Desktop Client to connect to your Pod Server, which is at 10.0.0.15P. Use the account name **student** and the password **Nterone179**.

Step 39 From your Pod Server open the Disk Management tool by clicking the start button and then entering “**diskmgmt.msc**” in the “Search programs and files” field directly above the Start button. The Disk Management will appear and look *similar* to the image below.



Step 40 The 1 GB Basic disks are the Fibre Channel connected storage targets. If these disks are visible, the Pod Server has a connection to the SAN verifying the FCoE link is working

Step 41 Exit the Pod Server.

Activity Verification

You have completed this task when you attain these results:

- You have verified that the edge switch has minimal Fibre Channel functionality when enabled in Cisco NPV mode.
- You have verified the operation of the NP uplinks to the SAN core.
- You have verified the VFC to NP uplinks traffic distribution to the SAN core. You have verified Fibre Channel connectivity from the SAN core switch.
- You have verified that the servers have access to the SAN based storage targets.