Dell Networking S5000:

Converge Your LAN and FC SAN Traffic – Hands-on Lab Instructions

Lab Manual

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July 2013

July 2013 | Rev. 1.1

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Summary

- In this lab, we get hands-on experience with an end-to-end converged solution employing Fibre Channel over Ethernet (FCoE) with the Dell Networking S5000 switch, We will touch all nodes of the solution: Dell PowerEdge server, CNA, Dell S5000 switch, Brocade 6505 Fibre Channel (FC) switch, and Dell Compellent storage array (1 x SC8000 Controller & 1 x SC220 disk enclosure). We will configure the Dell S5000 switch as a NPIV Proxy Gateway. Finally, we will test our FCoE and LAN connectivity via 'ping' and passing storage data to the Dell Compellent storage array.
- Estimated time: 25 minutes

Goals

- Access the Dell PowerEdge server running Microsoft Windows Server 2012 and confirm the World Wide Port Name (WWPN) of the CNA port.
- Access the Dell Compellent Storage Array and view storage and server node information.
- Configure the Dell S5000 switch as a NPIV Proxy Gateway and configure for LAN and FCoE traffic.
- On the Dell S5000 switch, confirm connectivity and end-node login to the FC fabric.
- View and confirm zoning configuration on the FC switch.
- Test LAN and SAN connectivity by passing LAN and SAN traffic.

Lab Video

- Dell Networking S5000 Wiki
- Dell Networking TechCenter YouTube Channel

Resources Utilized

- 1 x Dell S5000 switch
- 1 x Dell S4810 switch
- 1 x Dell Compellent storage array (1 x SC8000 Controller & 1 x SC220 Storage Enclosure)
- 1 x Dell PowerEdge R720 Server with Broadcom 57810S CNA (Windows Server 2012)
- 1 x Brocade 6505 FC switch

Network Diagram of Pod 2 Lab Setup

Below is the diagram of the setup we are going to be working on. It consists of a server with a CNA connected to the S5000 converged switch. The S5000 switch is connected to the Dell S4810 for LAN connectivity and a Brocade 6505 FC switch for SAN connectivity. The Brocade 6505 FC switch is connected to a Dell Compellent storage array consisting of one Dell SC8000 controller and one Dell SC220 storage enclosure. The yellow cables show the LAN side of the setup where the S5000 sends all LAN traffic to the S4810 switch. The purple cables show the SAN connectivity from the S5000 to the Compellent Array via the Brocade FC switch.

The Dell S5000 acts as a NPIV Proxy Gateway. NPIV provides FCoE-FC bridging capability on the S5000. The FC switch used must also support NPIV. The Dell S5000 switch is connected to a FC switch and acts as NPIV Proxy Gateway for respective end nodes.

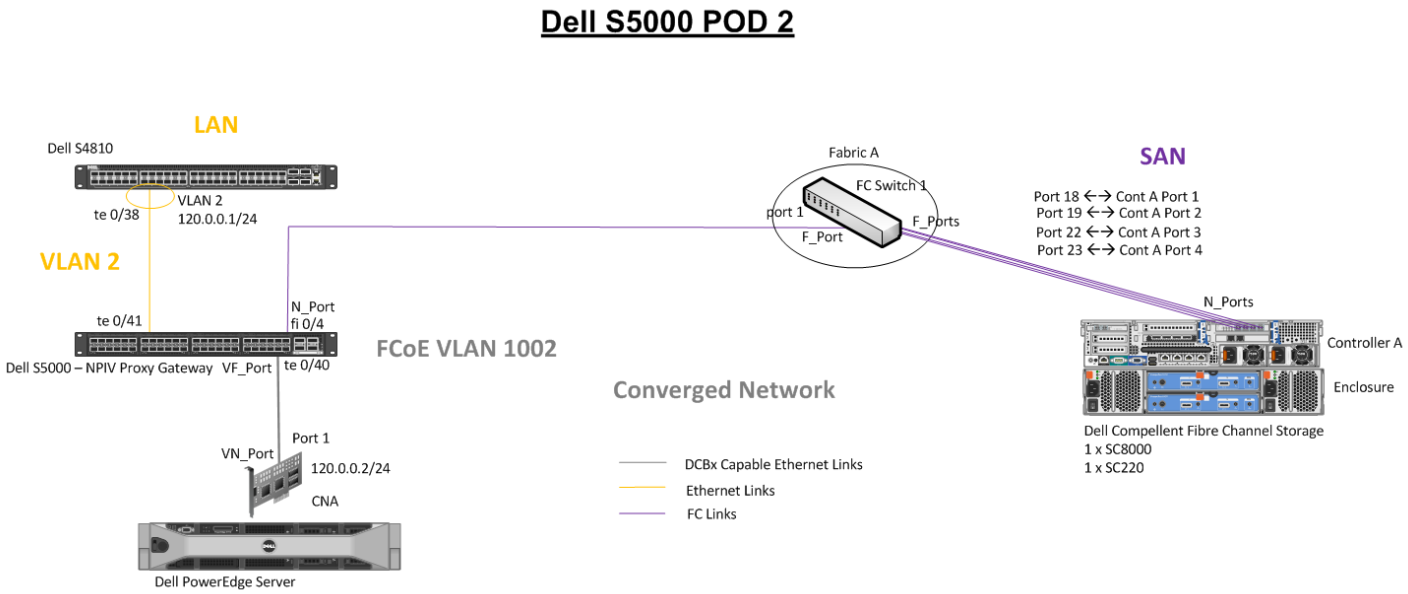

Figure 1: Network Diagram

Lab Exercise

A.) Log into Windows 2012 server and view CNA info.

1. Double click the **'Remote Desktop Connection'** shortcut on the desktop.

2. Enter the login credentials and click **'Connect'**:

   Enter the password when prompted.

   Click **'Yes'** on any pop-up dialogs.

3. Double click the **'Broadcom Advanced Control Suite 4'** icon on the desktop. Make sure **'ALL VIEW'** is selected in the **'Filter'** dropdown box at the top. Click the **'+'** symbol next to **'Adapter2'**. Click the **'+'** symbol next to **'Port0'**. This is the port connected to the Dell S5000 switch. Since we are using NIC partitioning (NPAR) to partition the NIC, here we see that the port has four partitions.

4. Click the **'+'** symbol next to the first entry starting with **'[0142]'**. We now see that both the NIC/LAN and FCoE/SAN adapter is enabled. Click the virtual FCoE adapter (starting with **'[0008]'**. We now see the Worldwide Port_Name (WWPN) of the port on the right, **'20:01:00:0A:F7:06:92:51'**, as shown below. The port is currently down because the Dell S5000 switch is not yet configured.

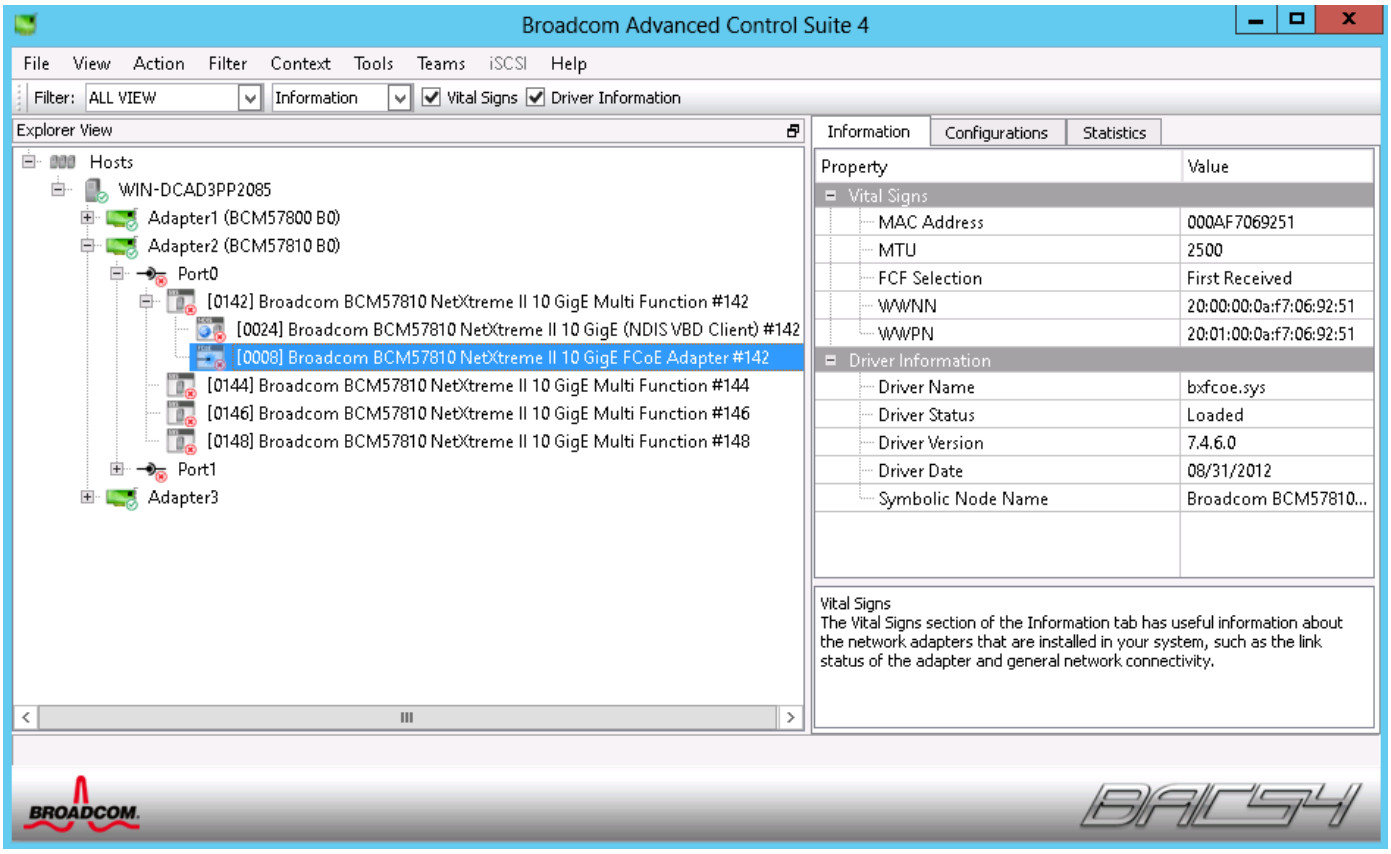

Figure 2: 'Broadcom Advanced Control Suite' management application

5. Double click the **'Computer'** icon on the desktop. Notice, there is only one disk drive listed, **'C:'**. Once we are done configuring the Dell S5000 switch, we will see another disk drive that will represent the remote storage on the Dell Compellent storage array.

6. Next we will access the Dell Compellent storage array via Dell Compellent Storage Manager. We can minimize the Remote Desktop window. We will come back to this later.

B.) Access the Dell Compellent storage array via Dell Compellent Storage Manager and view the volume that will be accessed remotely by the Dell PowerEdge server via FCoE.

1. Double click the Firefox web browser shortcut on the desktop and navigate to the IP address of the Compellent Storage Manager. Enter the correct credentials and click **'LOGIN'**.

   Click **'Yes'** on any dialogs.

2. Click the **'+'** symbol next to **'Controllers'** on the left-side menu. Next, click the **'+'** symbol next to **'SN 60852'**. Click the **'+'** symbol next to **'IO Cards'**. Click the **'+'** symbol next to **'FC'**. We should now see 4 x 8 Gbps FC ports that are in status **'Up'** as shown below.

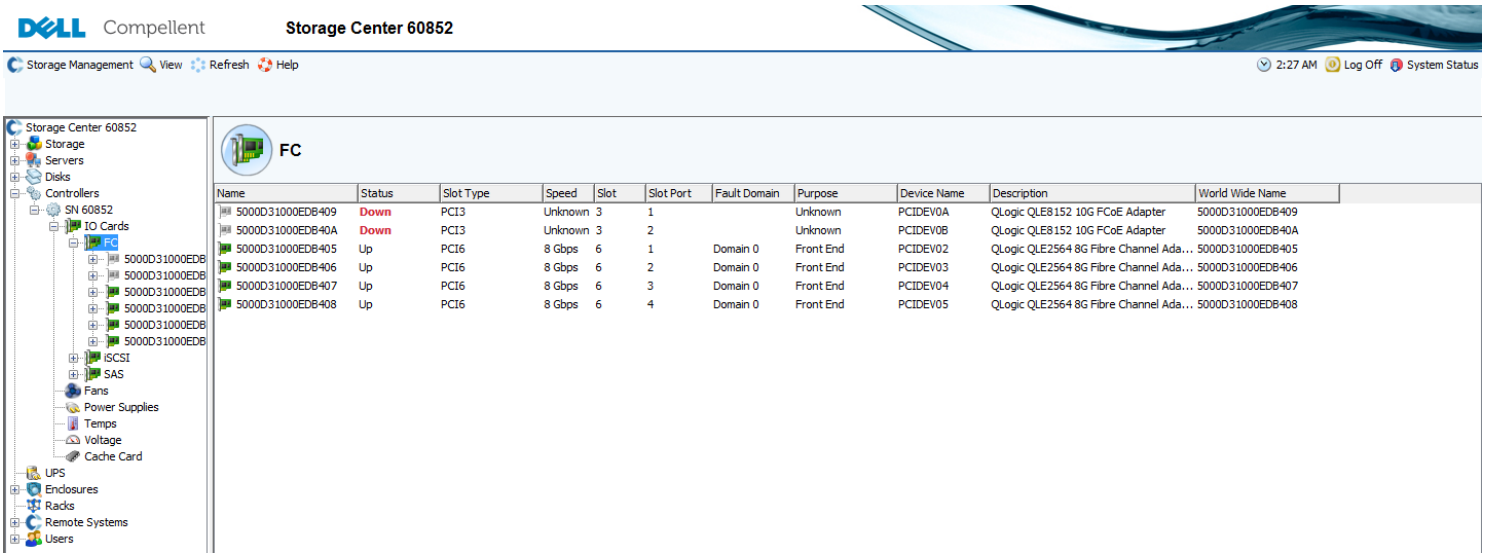

Figure 3: Dell Compellent Storage Manager – Viewing FC ports on Compellent SC8000 controller

3. Click the **'+'** symbol next to **'Storage'** and then click the **'+'** symbol next to **'Volumes'** on the left-side menu. Since this is the **'Pod 2'** lab, the respective volume for this lab is **'Compellent_Pod-2'**. Click the **'Compellent_Pod-2'** volume on the left-side menu. Click the **'General'** button at the top. Note, it is 25 GB in size. Click the **'Mapping'** button at the top. We'll see it is mapped to the **'PowerEdge_Pod-2'** server object. Note, the four Compellent controller paths at the bottom that are used to access the Dell PowerEdge server are currently in **'Down'** status because the Dell S5000 switch has not been configured yet.

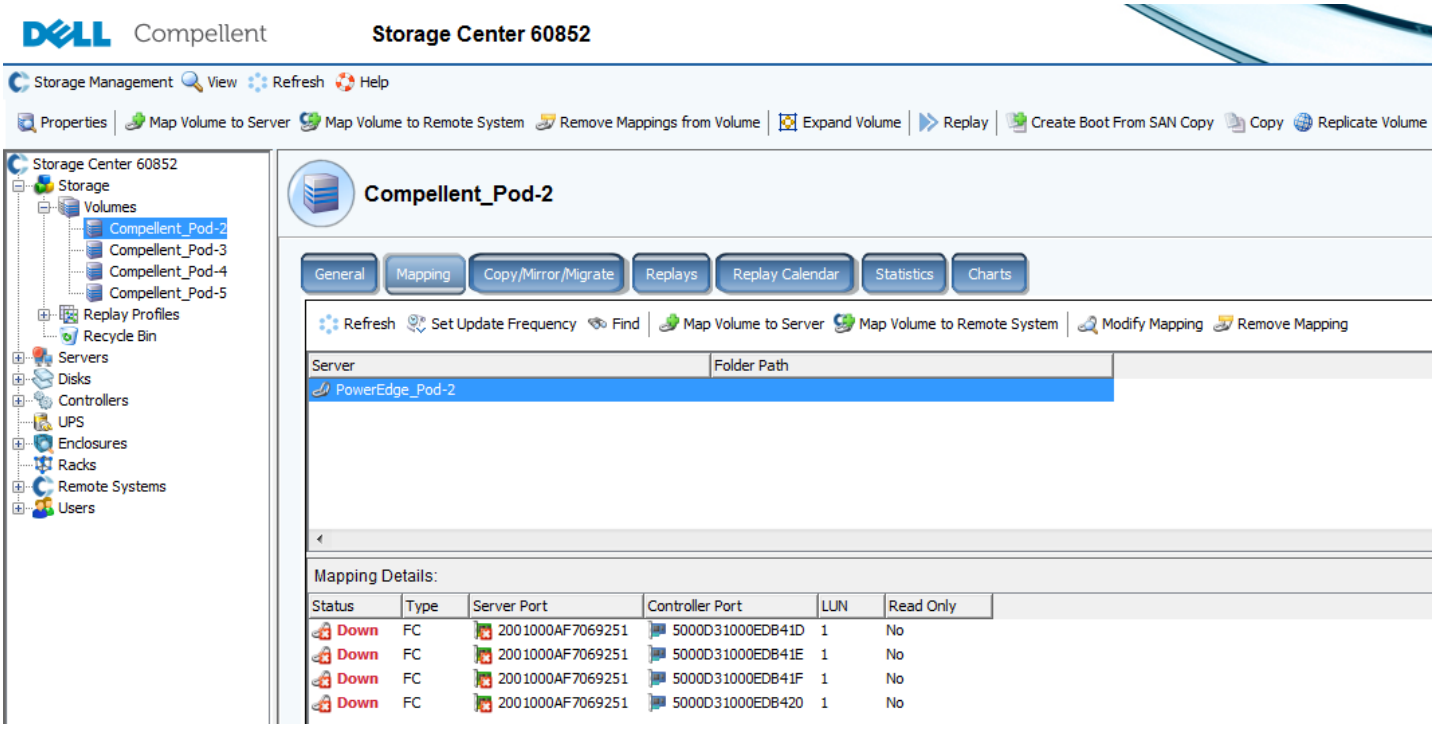

Figure 4: Dell Compellent Storage Manager – Viewing storage volume details

4. Click the **'+'** symbol next to **'Servers'** on the left-side menu. Select **'PowerEdge_Pod-2'**. Click the **'General'** button at the top. Note, the **'Connectivity'** field states **'Disconnected'** and the **'PowerEdge_Pod-2'** icon has a little red **'x'** over it, because the Dell S5000 switch has not yet been configured.

   Click the **'Server HBAs'** button at the top. Note that the **'Server Port'** field includes the CNA FCoE port WWPN we saw earlier on the server. The port is tied to the server object and the server object is mapped to the volume we saw above in step #3. The status shows **'Down'** as the Dell S5000 switch is not yet configured and the port is shut.

   We have completed looking at the Storage Center settings for the Compellent storage array.

C.) Access the Brocade FC switch and view zoning configuration.

1. Double click the putty icon on the desktop. Select **'Session'** on the left-side menu and enter the IP address for the Brocade FC management switch and select **'Telnet'** as the connection type. The **'Port'** field should be set to **'23'**. Click the **'Open'** button. Use the correct credentials to login.

2. Enter the **'zoneshow'** command. Under the **'Effective configuration'** section, we will see the below zoning configuration. Note we will also see configurations for other pods which we can ignore. Take a look at the **'zoneCfg_def'** zoning configuration specific to zone **'def_pod_2'**. This zoning configuration states that only the server CNA port **(WWPN: 20:01:00:0A:F7:06:92:51)** and Compellent storage array ports **(WWPNs: 50:00:d3:10:00:ed:b4:1d, 50:00:d3:10:00:ed:b4:1e; 50:00:d3:10:00:ed:b4:1f; 50:00:d3:10:00:ed:b4:20)** can communicate with each other.

```
zone:  def_pod_2
                20:01:00:0a:f7:06:92:51
                50:00:d3:10:00:ed:b4:1d
                50:00:d3:10:00:ed:b4:1e
                50:00:d3:10:00:ed:b4:1f
                50:00:d3:10:00:ed:b4:20
```

Figure 5: Brocade FC switch zoning information for POD 2

3. We can close this putty session.

D.) Understanding the LAN network

1. Looking at **Figure 1**, we can see there is a Dell S4810 switch in the network. This is only there to demonstrate LAN connectivity. We do not need to do any configuration on this S4810. The only configuration on the S4810 is an interface in VLAN 2. VLAN 2 has an IP address of **120.0.0.1/24**. The PowerEdge server has an IP address of **120.0.0.2/24** on the LAN NIC partition. Once we configure the Dell S5000 switch in the next section, we will test the LAN network by pinging this IP address on the LAN while writing to the Compellent storage array via FCoE.

E.) Configuring the Dell S5000 switch for LAN/SAN traffic

1. Double click the putty icon on the desktop. Select **'Session'** and select **'Telnet'** as the connection type. Enter the **IP address** for the Dell S5000 management port and make sure the **'Port'** is set to '**23'**. Click the **'Open'** button. Use the correct credentials to login.

2. Configure the S5000 switch for LAN/SAN traffic with the commands below. The text in red are the commands we need to input. The text in brackets are comments. Note, we can enter part of the command and then hit the 'Tab' key on the keyboard for autocomplete.

a.) Configure the hostname

- **enable**
- **config**
- **hostname Dell_S5000_2** [Sets the hostname of the switch]

b.) Configure the switch for LAN traffic

- **interface te 0/41** [Port connected to S4810 on the LAN network]
- **switchport** [Puts port in layer 2 mode – we will later tag this port to the LAN VLAN]
- **no shut**
- **exit**

- **interface te 0/40** [Port connected to CNA on server]
- **portmode hybrid** [Allows port to both carry tagged and untagged traffic]
- **switchport** [Puts port in layer 2 mode – port will be part of the LAN VLAN and FCoE VLAN]
- **no shut**
- **exit**

- **interface vlan 2** [Create LAN VLAN]
- **tagged te 0/41** [Tag port going up to S4810 LAN switch to LAN VLAN]
- **tagged te 0/40** [Tag port going to CNA port to LAN VLAN]
- **exit**

c.) Enable Fibre Channel capability

- **feature fc**

d.) Create DCB MAP and configure priority-based flow control (PFC) and enhanced transmission selection (ETS) settings for LAN and SAN traffic.

Priorities are mapped to priority groups using the **'priority-pgid'** command. In this example, priorities 0, 1, 2, 4, 5, 6, and 7 are mapped to priority group 0. Priority 3 is mapped to

priority-group 1.

- **dcb-map SAN_DCB_MAP**
- **priority-group 0 bandwidth 60 pfc off** [60% bandwidth for LAN traffic with PFC off]
- **priority-group 1 bandwidth 40 pfc on** [40% bandwidth for SAN traffic with PFC on]
- **priority-pgid 0 0 0 1 0 0 0 0** [Map FCoE priority 3 to priority group 1]
- **exit**

e.) Create a FCoE VLAN and FCoE MAP. Apply the DCB MAP to the respective interfaces. The FCoE MAP is used to map FCoE traffic to the respective VLAN/interfaces. The FCoE MAP is applied to both **'tengigabitethernet 0/40'** interface going to the respective CNA port and to the FC interface connecting to the FC switch. Note, on S5000, FCoE is always mapped to priority 3.

- **interface vlan 1002** [Create VLAN for FCoE]
- **exit**

- **fcoe-map SAN_FABRIC_A**
- **fabric-id 1002 vlan 1002** [Link the FCoE MAP to the FCoE VLAN]
- **fc-map 0efc02** [Designate the FC-MAP used by S5000 switch (will be first 24 bits of FPMA]
- **exit**

- **interface fi 0/4** [Port connected to Brocade FC switch]
- **fabric SAN_FABRIC_A** [Apply FCoE MAP]
- **no shut**
- **exit**

- **interface te 0/40**
- **dcb-map SAN_DCB_MAP** [Apply DCB MAP]
- **fcoe-map SAN_FABRIC_A** [Apply FCoE MAP]
- **end**

Note, we do not use the 'write mem' command as we plan to erase the config later via the 'reload' command. As this is a lab exercise, we do not want to save this config. In a production environment, you would save the config via 'write mem' command.

F.) Confirm the Dell S5000 switch is configured correctly and passing traffic

1. Use the following commands on the Dell S5000 switch to confirm successful configuration/operation.

a.) To see FIP-snooping end-node information, use the **'show fip-snooping enode'** command

- **show fip-snooping enode**

We will see the below, which shows the CNA port is logged into the fabric.

```
Dell_S5000_2#show fip-snooping enode
Enode MAC           Enode Interface     FCF MAC             VLAN      FC-ID
---------           ---------------     -------             ----      -----
00:0a:f7:06:92:51   Te 0/40             5c:f9:dd:ef:27:07   1002      01:01:01
Dell_S5000_2#
```

Figure 6: 'show fip-snooping enode' output

b.) To see information on NPIV devices logged into the fabric, use the **'show npiv devices'** command as shown below. We can see the CNA WWPN connected to the NPIV Proxy gateway.

- **show npiv devices**

```
Dell_S5000_2#show npiv devices

ENode[0]:
ENode MAC    :   00:0a:f7:06:92:51
ENode Intf   :   Te 0/40
FCF MAC      :   5c:f9:dd:ef:27:07
Fabric Intf  :   Fc 0/4
FCOE Vlan    :   1002
Fabric Map   :   SAN_FABRIC_A
ENode WWPN   :   20:01:00:0a:f7:06:92:51
ENode WWNN   :   20:00:00:0a:f7:06:92:51
FCoE MAC     :   0e:fc:02:01:01:01
FC-ID        :   01:01:01
LoginMethod  :   FLOGI
Secs         :   56
Status       :   LOGGED_IN
Dell_S5000_2#
```

Figure 7: 'show npiv devices' output

c.) To see currently active FIP-snooping sessions, use the **'show fip-snooping sessions'** command.

- **show fip-snooping sessions**

```
Dell_S5000_2#show fip-snooping sessions
Enode MAC          Enode Intf     FCF MAC           FCF Intf       VLAN      FCoE MAC          FC-ID     Port WWPN                Port WWNN
---------          ----------     -------           --------       ----      --------          -----     ---------                ---------
00:0a:f7:06:92:51  Te 0/40        5c:f9:dd:ef:27:07 Fc 0/4         1002      0e:fc:02:01:01:01 01:01:01  20:01:00:0a:f7:06:92:51  20:00:00:0a:f7:06:92:51
Dell_S5000_2#
```

Figure 8: 'show fip-snooping sessions' output

d.) To see a list of configured fcoe-maps, use the **'show fcoe-map brief'** command.

- **show fcoe-map brief**

```
Dell_S5000_2#show fcoe-map brief
    Fabric-Name   Fabric-Id         Vlan-Id     FC-MAP    FCF-Priority  Config-State      Oper-State
   SAN_FABRIC_A        1002            1002     0efc02             128        ACTIVE               UP
Dell_S5000_2#
```

Figure 9: 'show fcoe-map brief' output

e.) To see more detailed information on a given fcoe-map, use the **'show fcoe-map <FCoE_MAP_NAME>'** command. Notice below, we see the priority mapped to FCoE by default is '3'.

- **show fcoe-map SAN_FABRIC_A**

```
Dell_S5000_2#show fcoe-map SAN_FABRIC_A

Fabric Name         SAN_FABRIC_A
Fabric Id           1002
Vlan Id             1002
Vlan priority       3
FC-MAP              0efc02
FKA-ADV-Period      8
Fcf Priority        128
Config-State        ACTIVE
Oper-State          UP
Members
Fc 0/4
Te 0/40
Dell_S5000_2#
```

Figure 10: 'show fcoe-map SAN_FABRIC_A' output

G.) Log into Windows 2012 server and test LAN/SAN connectivity

1. Maximize the Remote Desktop connection window we minimized earlier. Double click the 'Computer' icon on the desktop. Note the **'Compellent_Pod-2'** disk drive now available. This is the remote storage on the Compellent storage array. Leave this window visible.

2. Double click the **'Command Prompt'** icon on the desktop and enter **'ping –t 120.0.0.1'**. We are sending a continuous ping to the IP address on VLAN 2 on the S4810 on the LAN network. Leave the command prompt window visible.

3. Double click the **'Test Files'** folder on the desktop. Select all five test files with the mouse and drag them over to the '**Compellent_Pod-2'** disk.

   We have now successfully configured the Dell S5000 switch for LAN/SAN convergence via the use of FCoE. We have also confirmed this configuration by sending both LAN and SAN traffic from the Dell PowerEdge server to the Dell Compellent storage array.

4. Double click the **'Compellent_Pod-2'** disk icon and delete all five file we just copied over. Close the command prompt window. Close any other open windows in the Remote Desktop session before closing the Remote Desktop session. **Do not simply close the Remote Desktop connection without closing all the windows you opened in the session.**

H.) Remove all configuration from the Dell S5000 switch.

1. On the Dell S5000 switch enter the **'reload'** command.
   - **reload**

When prompted to save the configuration, type 'no' and hit enter. When prompted to confirm reload, type 'yes' and hit enter. Close the putty console connection to the Dell S5000 switch.

Close all browser windows.

Congratulations! We have successfully configured a converged LAN/SAN network using FCoE with the Dell S5000 switch.