



Dell S5000 w/ PowerEdge Rack Servers – Full Fabric Mode Example
with Configs

Dell S5000 in Full Fabric Mode: Converged Infrastructure (LAN and SAN)



Humair Ahmed

Dell Technical Marketing – Data Center Networking

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Revisions

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Summary

- The lab setup referenced in this document was built and used for hands-on lab environments for several Dell events. This document was created to accompany the hands-on lab and is provided publicly for reference purposes.
- In this lab, you will get hands-on experience with an end-to-end converged solution employing Fibre Channel over Ethernet (FCoE) with the Dell S5000 switch. You will touch all nodes of the solution: Dell PowerEdge server, CNA, Dell S5000 switch, and Dell PowerVault storage array. You will configure the Dell S5000 switch in Full Fabric Mode. Finally, you will test your FCoE and LAN connectivity via 'ping' and passing storage data to the Dell PowerVault storage array.
- Estimated time: 30 minutes

Goals

- Access the Dell PowerEdge server running Microsoft Windows Server 2008 R2 Enterprise and confirm the World Wide Port Name (WWPN) of the CNA port.
- Access the Dell PowerVault Storage Array and view storage and server node information.
- Configure the Dell S5000 switch as Full Fabric Mode and configure for LAN and FCoE traffic.
- Connect two S5000s via ISL links and build a small FC SAN fabric.
- On the Dell S5000 confirm connectivity and end-node login to the FC fabric.
- View and confirm zoning configuration on the S5000 switch.
- Test LAN and SAN connectivity by passing LAN and SAN traffic.

Resources Utilized

- 2 x Dell S5000 switch
- 1 x Dell S4810 switch
- 1 x Dell PowerVault storage array (1 x MD3660f)
- 1 x Dell PowerEdge R620 server with Broadcom 57810S CNA (Windows Server 2008)

Network Diagram of Pod 1 Lab Setup

In this lab, the Dell S5000 switch is configured in Full Fabric mode or FCoE Forwarder mode (FCF), providing Full Fabric Services such as Fabric Login Server, Name Server, Zoning, and ISL links.

Below is the diagram of the setup you are going to be working on. It consists of a rack server with a CNA connected to a Dell S5000 converged switch via 10 GbE port. The Dell S5000 switch is connected to the Dell S4810 for LAN connectivity and to another S5000 switch via FC ISL links. The second S5000 switch is connected to a Dell PowerVault storage array consisting of two controllers with 4 x FC ports each.

Note, although possible, it's not necessary to connect two S5000s together like this. In this lab, the S5000s are connected together to demonstrate E_port functionality and to demonstrate that it is possible to build a small SAN via S5000 switches. The yellow cables show the LAN side of the setup where the S5000 connected to the MXL sends all LAN traffic to the S4810 switch. The purple cables show the SAN connectivity from the first S5000 to the second and from the second S5000 to the to the PowerVault FC storage array

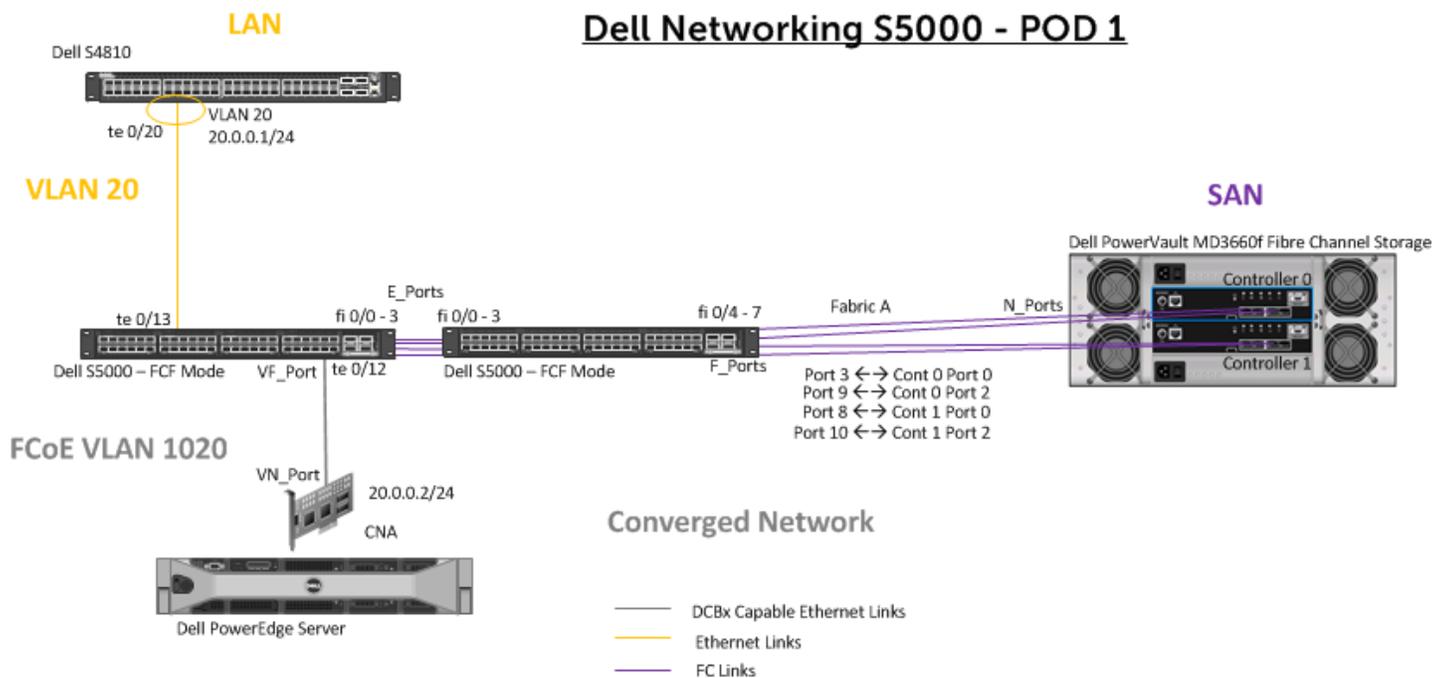


Figure 1: Network Diagram

Lab Exercise

A.) Log into Windows 2008 server and view CNA info. DO NOT MAKE CHANGES, READ ONLY SECTION

1. Open the **'Remote Desktop Connection'** in Windows ('Start->All Programs->Accessories->Remote Desktop Connection').
2. Enter the IP address of the server and click **'Connect'**. Use the correct credentials to login.

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. Note, although not required, NIC partitioning (NPAR) is utilized here and that's why you see four partitions under the port. The adapter is in **'multi-function mode'** and FCoE is enabled on the first partition.

- Click the '+' symbol next to the first entry starting with '[0130]'. You now see both the virtual NIC/LAN and FCoE/SAN ports. Click the virtual FCoE adapter (starting with '[0002]'). You now see the Worldwide Port Name (WWPN) of the port on the right, '20:01:00:0a:f7:06:9b:b1', as shown below. The port is currently down because the Dell S5000 switch is not yet configured.

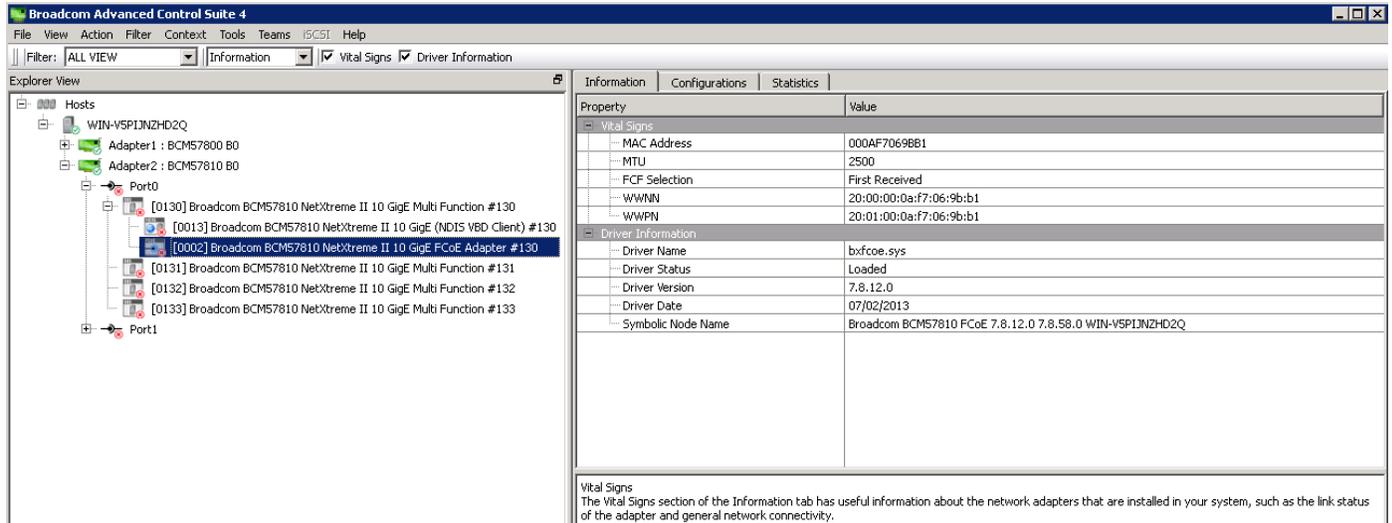


Figure 2: 'Broadcom Advanced Control Suite' management application

- Double click the '**Computer**' icon on the desktop. Notice, there is only one disk drive listed, '**C:**'. Once you are done configuring the Dell S5000 switches you will see another disk partition that will represent the remote storage on the Dell PowerVault storage array.
- Next you will access the Dell PowerVault storage array via **Dell PowerVault Modular Disk Storage Manager** on the remote server.

B.) Access the Dell PowerVault storage array via Dell PowerVault Modular Disk Storage Manager and view the volume that will be accessed remotely by the Dell PowerEdge server via FCoE. DO NOT MAKE CHANGES, READ ONLY SECTION.

- Double click the '**Modular Disk Storage Manager Client**' icon on the desktop and ensure the '**Devices**' tab is selected. Ensure '**PowerVault-1**' displays on the right and the status is '**Optimal**' as shown below.

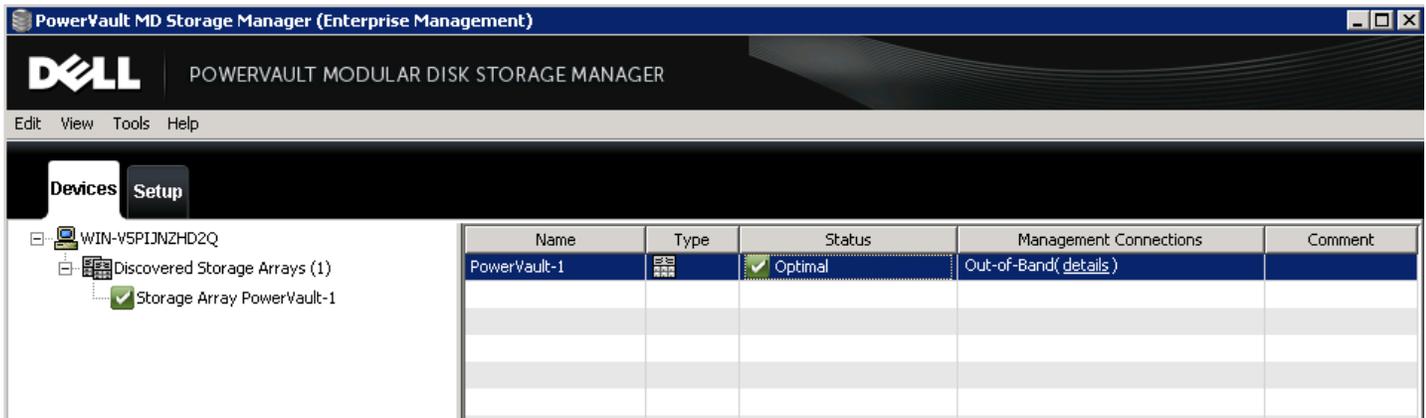


Figure 3: 'Dell PowerVault Modular Disk Storage Manager' application

2. Right-click 'PowerVault-1' and select 'Manage Storage Array'. You should see the below.

Monitor

- Storage Array status is optimal
- No Operations in Progress
- Management Software Version: 10.84.G6.25
- RAID Controller Module Firmware Version: 07.84.44.60
- [View Firmware Inventory](#)
- [View Storage Array Profile](#)
- [View Event Log](#)
- [Collect all Support Data](#)

Capacity

Total Capacity: 1,102,000 GB

- Unconfigured: 0.000 MB
- Free: 1,032,000 GB
- Configured: 70.000 GB

[Create Virtual Disk](#)

Storage & Copy Services

- Disk Pools / Virtual Disks on Disk Pools: 1 / 3
- Disk Groups: 0
- Standard Virtual Disks (Used/Allowed) 3 / 512
- Base: 3
- Repository: 0
- Thin Virtual Disks (Used/Allowed): 0 / 512

Host Mappings

- Storage Partitions (Used/Allowed): 3/64
- Host Groups: 1
- Configured Hosts: 5
- Host-to-Virtual Disk Mappings: 7
- Mapped Virtual Disks: 4
- Total Mappable Virtual Disks: 4

Premium Features

- Trials Available: 3
- Trials Active: 0
- Enabled: 1
- Disabled: 2
- [Manage Premium Features](#)

Hardware

- RAID Controller Modules: 2
- Enclosures: 1
- Physical Disks: 24
- Assigned: 24
- Unassigned: 0
- Media Type: HDD: 24
- Interface Type: SAS: 24

Information Center

- [Online Help](#)
- [Storage Concepts Tutorial](#)
- [Planning Your Configuration](#)
- [Configuring Your Storage Array](#)
- [Essential Terms to Know](#)

Figure 4: Summary view on 'Dell PowerVault Modular Disk Storage Manager' application

- Click **'Storage & Copy Services'** tab and then the **'+'** symbol next to **'Disk Pools'** and then click the **'+'** symbol next to **'Disk_Pool_1'** on the left-side menu. Since this is the **'Pod 1'** lab, the respective volume for this lab is **'S5000_Pod-1'**. Click the **'S5000_Pod-1'** volume on the left-side menu to see the details of the volume displayed on the right. Note, it is 20 GB in size.

The screenshot shows the Dell PowerVault Modular Disk Storage Manager interface. The top navigation bar includes 'Storage Array', 'Storage', 'Host Mappings', 'Hardware', 'Monitor', 'Upgrade', and 'Help'. The main navigation tabs are 'Summary', 'Storage & Copy Services', 'Host Mappings', 'Hardware', and 'Setup'. The 'Storage & Copy Services' tab is active, showing a tree view on the left and a details pane on the right.

The tree view on the left shows the following structure:

- Storage Array PowerVault-1
 - All Logical Objects
 - SSD Cache
 - Disk Pools
 - Disk_Pool_1 (1,108.000 GB)
 - Free Capacity (1,012.000 GB)
 - Finance (25.000 GB)
 - S5000_Pod-1 (20.000 GB)**
 - S5000_Pod-2 (20.000 GB)
 - Support (25.000 GB)

The details pane on the right shows the following information for the **Virtual Disk "S5000_Pod-1"**:

[View Associated Physical Components](#)

Virtual Disk status:	<input checked="" type="checkbox"/> Optimal
Thin provisioned:	No
Capacity:	20.000 GB
Virtual Disk world-wide identifier:	69:0b:11:c0:00:0e:56:26:00:00:0d:78:53:34:ca:31
Subsystem ID (SSID):	3
RAID level:	6
LUN:	1
Accessible By:	Host Group S5000_Pod-1
Physical Disk media type:	Physical Disk
Physical Disk interface type:	Serial Attached SCSI (SAS)
Enclosure loss protection:	No
Drawer Loss Protection:	No
Secure:	No
Preferred owner:	RAID Controller Module in slot 1
Current owner:	RAID Controller Module in slot 1

Figure 5: Viewing volume information using 'Dell PowerVault Modular Disk Storage Manager' application

- Click the **'Host Mappings'** tab at the top. Next click the **'+'** sign next to the **'Host Group S5000_Pod-1'** Host Group on the left. Click on the icon labeled **'Host S5000_Server_Pod-1'**. This represents the Dell PowerEdge R620 server. If you right click it and click **'Properties'**, you will see the WWPN of the CNA port on the server as shown below.

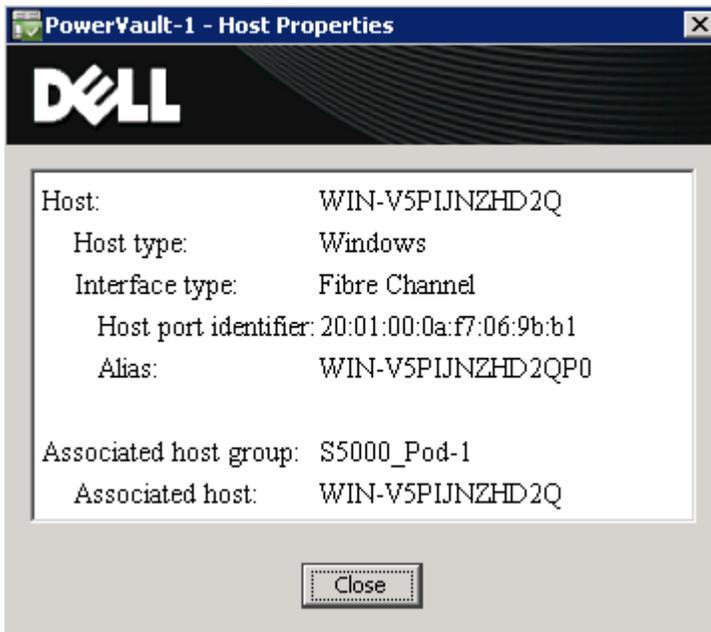


Figure 6: Host information using 'Dell PowerVault Modular Disk Storage Manager' application

- Click the **Close** button. Note on the right-side view this server is mapped to have access to the **S5000_Pod-1** volume you took a look at in the prior step.



Figure 7: Viewing host mapping information using 'Dell PowerVault Modular Disk Storage Manager' application

You have completed looking at the settings for the PowerVault storage array. Close the **PowerVault Modular Disk Storage Manager** by clicking **Storage Array->Exit** on the top menu and then again **Edit->Exit** on the top menu.

C.) Understanding the LAN network

- Looking at **Figure 1** you can see there is a Dell S4810 switch in the network. This is only there to demonstrate LAN connectivity. You do not need to do any configuration on this S4810. The only configuration on the S4810 is an interface in VLAN 20. VLAN 20 has an IP address of **20.0.0.1/24**. The PowerEdge server has an IP address of **20.0.0.2/24** on the virtual LAN NIC. Once you configure the Dell S5000 switches in the following sections, we will test the LAN network by pinging this IP address on the LAN while writing to the PowerVault storage array via FCoE.

D.) Configuring the Dell S5000 switch connecting to the PowerVault storage array

- In this section you will configure the S5000 switch connecting to the PowerVault FC storage array. Note, there is not much configuration needed on this switch as it simply has the FC storage connected and ISL links to the other S5000 switch which is connecting to the server. This S5000 switch just needs the respective FC ports and Fabric Services enabled. As mentioned prior, we could have connected the FC storage directly to the other S5000 switch as there are plenty of FC ports available, however, the purpose of this lab is also to demonstrate ISL links and the creation of a small FC SAN fabric via S5000 switches.

Double click the putty icon on the desktop. Select **'Session'** on the left-side menu and select **'Pod 1 – Dell S5000 2'** from the saved sessions and click the **'Load'** button. Click the **'Open'** button. Use the correct credentials to login.

2. Configure the S5000 switch connecting to the PowerVault FC storage array in Full Fabric mode.
 - a.) Configure the hostname
 - **enable** [Enable password is 'force10']
 - **terminal monitor** [Display messages on the monitor]
 - **config**
 - **hostname S5000_2_1** [Sets the hostname of the switch]
 - b.) Enable Fibre Channel capability and Full Fabric mode
 - **feature fc**
 - **fc switch-mode fabric-services**
 - c.) Enable FC ports connecting to PowerVault FC storage array and FC ports connecting to other S5000 switch via ISL links.
 - **interface range fi 0/0 - 7** [Select the range of FC ports to configure]
 - **no shut** [Enable FC ports]

Do not use the 'write mem' command. We do not want to save this config!

E.) Configuring the Dell S5000 switch connecting to the MXL blade switch

1. In this section you will configure the S5000 switch connecting to the MXL switch. The S5000 switch is a FCoE Forwarder (FCF), providing bridging between FCoE and FC. The converged traffic comes up from the server and the S5000 sends the LAN traffic up to the S4810 and de-encapsulates the FC from FCoE and switches it via the FC ports. The S5000 is also providing the fabric services such as Fabric Login Server, Name Server, Zoning, and ISL links.

Double click the putty icon on the desktop. Select **'Session'** on the left-side menu and select **'Pod 2 – Dell S5000 1'** from the saved sessions and click the **'Load'** button. Click the **'Open'** button. Use the correct credentials to login.

2. Configure the S5000 switch connecting to the to the MXL switch in Full Fabric mode.

a.) Configure the hostname

- **enable** [Enable password is 'force10']
- **config**
- **hostname S5000_1_1** [Sets the hostname of the switch]

b.) Configure the switch for LAN traffic. One 10 GbE interface is used to connect to the server for the converged traffic, and one 10 GbE interface is used to connect up to the S4810 for the LAN connectivity.

- **interface range te 0/12** [Port connected to 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 te 0/13** [Go under the interface connecting to the S4810 LAN switch]
- **switchport** [Put port in layer 2 mode – you will later tag this port to the LAN VLAN]
- **no shut**
- **exit**

- **interface vlan 20** [Create LAN VLAN]
- **tagged te 0/13** [Tag port going to S4810 to LAN VLAN]
- **tagged te 0/12** [Tag port channel going down to server to LAN VLAN]
- **exit**

c.) Enable Fibre Channel capability and Full Fabric mode

- **feature fc**
- **fc switch-mode fabric-services**

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

Priorities or Class of Service (CoS) 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 edit the default 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 the '**TenGigabitEthernet**' interface connecting to the server. By default the default FCoE MAP is also applied to all FC interfaces and does not need to be manually applied. Note, on S5000, FCoE is always mapped to priority 3.

- **interface vlan 1020** [Create VLAN for FCoE]
- **exit**
- **fcoe-map default_full_fabric** [Edit the default FCoE MAP]
- **fabric-id 1020 vlan 1020** [Link the FCoE MAP to the FCoE VLAN]

The fc-map is used as the first 24-bits of the Fabric Provided MAC Address (FPMA) that gets assigned to the CNA port. The second 24-bits (FC-ID) comes from the FC switch providing the fabric services. In this case the Dell S5000 switch is providing the fabric services so also provides the other 24-bits or FC-ID.

- **fc-map 0efc20** [Designate the FC-MAP used by the S5000 switch]
- **exit**
- **interface range fi 0/0 - 3** [Select FC ports connecting to other S5000]
- **no shut**
- **exit**
- **interface te 0/12** [Select port connecting to server]
- **dcb-map SAN_DCB_MAP** [Apply DCB MAP]
- **fcoe-map default_full_fabric** [Apply FCoE MAP]
- **exit**

f.) Create and apply the zoning configuration. By default on S5000 Enodes cannot communicate with each other until zoning is configured. You can use the '**show fc ns fabric**' command to see all Enodes and respective WWPNs logged into the fabric. This information can then be used for zoning purposes. Below we create a zone containing the WWPNs of the Broadcom CNA on the server, and the WWPNs of the four FC ports being connected to on the PowerVault FC storage.

Note, when zoning configuration is applied on one S5000 in the FC fabric, the zoning configuration is updated on all other S5000s so they all have the same zoning applied.

- **fc zone S5000_Pod-1** [Create a zone]
- **member 20:01:00:0a:f7:06:9b:b1** [WWPN of Broadcom CNA port on server]
- **member 20:14:90:b1:1c:04:a4:84** [WWPN of FC port on PowerVault FC storage controller]
- **member 20:34:90:b1:1c:04:a4:84** [WWPN of FC port on PowerVault FC storage controller]
- **member 20:15:90:b1:1c:04:a4:84** [WWPN of FC port on PowerVault FC storage controller]
- **member 20:35:90:b1:1c:04:a4:84** [WWPN of FC port on PowerVault FC storage controller]
- **exit**

- **fc zoneset S5000_Storage_Pod-1** [Create zoneset]
- **member S5000_Pod-1** [Add zone to zoneset]
- **exit**

- **fcoe-map default_full_fabric** [Edit default FCoE MAP]
- **fc-fabric** [Enter FC-Fabric configuration]
- **activate-zoneset S5000_Storage_Pod-1** [Activate zoneset]
- **end**

Do not use the 'write mem' command. We do not want to save this config!

F.) Confirm the Dell S5000s switches and MXL switch is configured correctly

1. Use the following commands on the Dell S5000 switch to confirm successful configuration/operation.
 - a.) To see all FCoE end-node (ENodes), use the '**show fip-snooping enode**' command.

- **show fip-snooping enode**

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

```
S5000_1_1#show fip-snooping enode
Enode MAC           Enode Interface     FCF MAC           VLAN           FC-ID
-----
00:0a:f7:06:9b:b1   Te 0/12             5c:f9:dd:ef:39:09  1020           01:36:00
S5000_1_1#
```

Figure 8: 'show fip-snooping enode' output

- b.) To see currently active FCoE VN_Port sessions, use the '**show fip-snooping sessions**' command.
 - **show fip-snooping sessions**

```

S5000_1_1#show fip-snooping sessions
Enode MAC          Enode Intf      FCF MAC          FCF Intf        VLAN    FCoE MAC        FC-ID           Port WWPN        Port WWNN
-----
00:0a:f7:06:9b:b1  Te 0/12        5c:f9:dd:ef:39:09  Fc 0/6          1020    0e:fc:20:01:36:00  01:36:00       20:01:00:0a:f7:06:9b:b1  20:00:00:0a:f7:06:9b:b1
S5000_1_1#

```

Figure 9: 'show fip-snooping sessions' output

c.) To see brief information on the default FCoE-MAP use the '**show fcoe-map brief**' command.

- **show fcoe-map brief**

```

S5000_1_1#show fcoe-map brief
Fabric-Name      Fabric-Id      Vlan-Id      FC-MAP      FCF-Priority  Config-State  Oper-State  UP
default_full_fabric  1020          1020          1020          Defc20        128          ACTIVE
S5000_1_1#

```

Figure 10: 'show fcoe-map brief' output

d.) To see more detailed information on the default fcoe-map, use the '**show fcoe-map default_full_fabric**' command. Notice below, we see the priority mapped to FCoE by default is '**3**'.

- **show fcoe-map default_full_fabric**

```

S5000_1_1#show fcoe-map default_full_fabric

Fabric Name          default_full_fabric
Fabric Type          full-fabric
Fabric Id            1020
Vlan Id              1020
Vlan priority        3
FC-MAP               0efc20
FKA-ADV-Period       8
Fcf Priority          128
Config-State         ACTIVE
Oper-State           UP
=====
Switch Config Parameters
=====
R_A_TOV (ms)         10000
R_T_TOV (ms)         100
E_D_TOV (ms)         2000
DomainID             1
DomainID-Locked      OFF
Principal-Pri        254
=====
Switch Zoning Parameters
=====
Default Zone Mode:   Deny
Active Zoneset:      S5000_Storage_pod-1
=====
Members
Fc 0/0 Fc 0/1 Fc 0/2 Fc 0/3 Fc 0/4 Fc 0/5 Fc 0/6 Fc 0/7 Fc 0/8 Fc 0/9 Fc 0/10 Fc 0/11
Te 0/12
=====
S5000_1_1#

```

Figure 11: 'show fcoe-map default_full_fabric' output

e.) To see the active zoneset and respective zones use the '**show fc zoneset active**' command.

- **show fc zoneset active**

```

$5000_1_1#show fc zoneset active

Active Zoneset: S5000_Storage_pod-1

ZoneName                ZoneMember
=====
S5000_pod-1
                        *20:01:00:0a:f7:06:9b:b1
                        *20:14:90:b1:1c:04:a4:84
                        *20:34:90:b1:1c:04:a4:84
                        *20:15:90:b1:1c:04:a4:84
                        *20:35:90:b1:1c:04:a4:84

$5000_1_1#

```

Figure 12: 'show fc zoneset active' output

f.) To see all device logged into the nameserver through this S5000 only, use the '**show fc ns switch**' command

```

$5000_1_1#show fc ns switch

Total number of devices =      1

Switch Name              10:00:5c:f9:dd:ef:39:00
Domain Id                1
Switch Port              Te 0/12
FC-Id                   01:36:00
Port Name                20:01:00:0a:f7:06:9b:b1
Node Name                20:00:00:0a:f7:06:9b:b1
Class of Service         8
Symbolic Port Name       Broadcom Port0 pWWN 20:01:00:0a:f7:06:9b:b1
Symbolic Node Name       Broadcom BCM57810 FCoE 7.8.12.0 7.8.58.0 WIN-V5PIJN2HD2Q
Port Type                 N_Port

$5000_1_1#

```

Figure 13: 'show fc ns switch' output

- g.) To see all device logged into the nameserver through all S5000s in the fabric, use the **'show fc ns fabric'** command
- h.) Pull up the terminal for the second S5000 switch connecting directly to the PowerVault storage array. If you have been logged-out of the switch due to in-activity, please log back in. Use the **'show fc zoneset active'** and **'show fc ns fabric'** commands to confirm you see the same results as on other S5000 switch.

G.) Test LAN/SAN connectivity from the Windows 2008 server

1. Double click the **'Computer'** icon on the desktop. Note the **'S5000_Pod-1'** disk drive now available. This is the remote storage on the PowerVault storage array. Leave this window visible.
2. Double click the **'Command Prompt'** icon on the desktop and enter **'ping -t 20.0.0.1'**. You are sending a continuous ping to the IP address on VLAN 20 on the S4810 on your 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 **'S5000_Pod-1'** disk.

You have now successfully configured a converged network via FCoE with the Dell S5000 switch in Full Fabric mode. You have also confirmed this configuration by sending both LAN and SAN traffic from the Dell PowerEdge server to the Dell PowerVault storage array.

4. Double click the **'S5000_Pod-1'** disk icon and delete all five files you 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 S5000s and the Dell MXL switch.

1. On both Dell S5000 switches enter the **'reload'** command. If you have been logged-out of any switch due to in-activity, please log back in and reload the switch.
 - **reload**

On both switches, 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 both switches.

Close all browser windows.

Congratulations! You have successfully configured a converged LAN/SAN network using FCoE with the Dell S5000 switch in Full Fabric mode.