iSCSI DCB with Dell SC Series Arrays using SCOS 7.0

Dell Storage Engineering
April 2016

A Dell Best Practices Guide

Revisions

Date	Description
April 2016	Initial release

Acknowledgement:

This paper was produced by the following members of the Dell Storage Engineering team:

Steven Lemons, Richard Golasky and Tony Ansley

Table of contents

Executive summary

The Dell™ Storage portfolio continues to expand with additional platform offerings as well as provide increased functionality on those platforms. A feature included with the release of the Dell Storage Center Operating System (SCOS) 7.0 is support for the iSCSI over Data Center Bridging (DCB) Institute of Electrical and Electronics Engineers (IEEE) standards within the Dell Storage SC Series arrays. While the IEEE DCB standard has been supported on the Dell PS Series, the support of DCB is new for the Dell SC Series controllers and corresponding management software, Dell Storage Manager (DSM). This document provides an overview of how to configure DCB in a SCOS 7.0 SAN environment.

With the release of SCOS 7.0 and this document, DCB is only supported on the Dell SC9000 model. Support for the IEEE DCB standard within existing Dell SC Series, such as the Dell SC8000 model, is not planned.

1 Introduction

Data Center Bridging (DCB) is a set of networking standards that were created to enable the transmissions of Fibre Channel over Ethernet (FCoE) networks to ensure lossless delivery of Fibre Channel (FC) traffic from Ethernet hosts to FC or FCoE native storage targets. Over recent years, this technology has been extended to deliver similar benefits for iSCSI storage solutions and continues to gain acceptance with storage networking device manufacturers and customers. With the release of SCOS 7.0 and DSM 2016 R1, Dell supports DCB for iSCSI on the Dell SC Series platform. Given that all network elements in a DCB-enabled iSCSI SAN need to support DCB, Dell offers PowerEdge™ converged network adapters (CNAs) and Dell Ethernet switches that support DCB for iSCSI. A complete listing of all Ethernet switches and CNAs validated for DCB compliance with Dell Storage SC Series can be found in the *Dell Storage Compatibility Matrix*.

1.1 Objective

This document provides configuration details of the DCB requirements for SCOS 7.0 and assists with identifying and verifying DCB configuration steps in a Dell Storage SAN. This information may be used to ensure that DCB is properly enabled and configured across all devices in a SAN.

Note: For an in-depth tutorial of DCB, refer to *Data Center Bridging: Standards, Behavioral Requirements, and Configuration Guidelines with Dell EqualLogic iSCSI SANs*.

1.2 Audience

This paper was written for solution architects, storage network engineers, system administrators, and IT managers who are interested in implementing DCB practices on Dell Storage. It is expected that the reader has a working knowledge of DCB, iSCSI, and SAN network design.

1.3 Terminology

CEE: Converged enhanced Ethernet (CEE) is an enhanced single interconnect Ethernet technology developed to converge a variety of applications in data centers. Dell Storage SC Series do not support the CEE standard for converged networking.

CNA: Converged Network Adapter

CoS: Class of Service, which is a 3-bit field in the VLAN tag (Also known as Priority Code Point) as per IEEE 802.1Q Standard

DCB: Data Center Bridging

DCBX: Data Center Bridging Exchange Protocol (IEEE 802.1Qaz).

ETS: Enhanced Transmission Selection, IEEE 802.1Qaz, provides a common management framework for assignment of bandwidth to frame priorities.

FCoE: Fibre Channel over Ethernet

FCoE TLV: Refers to support of FCoE protocol in the application priority TLV.

iSCSI TLV: Refers to support of iSCSI protocol in the application priority TLV.

LLDP: Link Layer Discovery Protocol (IEEE 802.1AB)

NDIS: Network Driver Interface Specification is an application programming interface (API) for network interface cards (NICs) that is only supported by Microsoft.

NIC: Network Interface Card

PCP: Priority Code Point, which is a 3-bit field in the VLAN tag (Also known as Class of Service)

PFC: Priority-based Flow Control provides independent traffic priority pausing and enablement of lossless packet buffers/queueing for iSCSI (IEEE 802.1Qbb).

PG: Priority Group (an obsolete CEE version term)

TC: Traffic Class (IEEE version term; Also known as Priority Group in CEE version)

TLV: Type Length Value is an Ethernet control frame format used by LLDP.

VLAN ID: Virtual LAN Identifier, a packet header to identify which VLAN the packet belongs to, more specifically which port(s) and or interface(s) to send a broadcast packet to (IEEE 802.1Q).

2 DCB configuration guidelines

2.1 DCB requirements summary

It is required that all devices in a Dell Storage SAN support DCB for iSCSI when this functionality is enabled. If any device in the SAN does not support DCB, then DCB must be disabled on the switches for the entire SAN. Once all devices in the SAN are DCB compliant, then DCB can be re-enabled. Devices that are designated as DCB Supported in the *Dell Storage Compatibility Matrix* have been fully validated by Dell to ensure compatibility for Dell Storage SANs. DCB capable devices must support the following DCB version IEEE standards:

- **VLAN tagging** within an iSCSI SAN where DCB configuration values are embedded within the Ethernet header (IEEE 802.1Q).
- **DCBX:** DCB protocol (which is dependent upon LLDP) that performs discovery, configuration and mismatch resolution using the Link Layer Discovery Protocol (IEEE 802.1Qaz).
- **iSCSI application priority:** Support for the iSCSI protocol in the application priority DCBX Type Length Value (TLV). Advertises the priority value (IEEE 802.1p CoS, PCP field in VLAN tag) for iSCSI protocol. End devices identify and tag Ethernet frames containing iSCSI data with this priority value.
- **ETS:** (IEEE 802.1Qaz) Provides minimum, guaranteed bandwidth allocation per traffic class/priority group during congestion and permits additional bandwidth allocation during non-congestion.
- **PFC:** (IEEE 802.1Qbb) Independent traffic priority pausing and enablement of lossless packet buffers/queueing for iSCSI.

Note: With the release of SCOS 7.0, only the DCBX IEEE version is supported, not the CEE pre-standard DCBX version.

2.2 SCOS 7.0 and DSM 2016 R1 configuration process overview

Note: With all network configuration changes, there is the possibility of service interruptions within a SAN. Network changes required to properly configure DCB for SCOS 7.0 will result in a temporary loss of connectivity within a SAN. Dell strongly recommends that all network environment changes are performed during a planned maintenance window.

This section provides required steps to configure DCB for SCOS 7.0 and DSM 2016 R1 while section 3 contains detailed steps for specific Dell switches as well as other models. Sections 4 and 4.2 contain detailed steps for configuring QLogic® 57810 and Intel® X520 CNAs for those iSCSI hosts within a SAN needing DCB support.

These steps apply to both new deployments and existing deployments that use DCB. It is important to verify that all components in the SAN are listed in the *Dell Storage Compatibility Matrix* as validated for use with DCB. If multiple switches are in the path between iSCSI Hosts and SC Series arrays then all configuration steps in section 3 must be applied to these switches. For SAN deployments with two or

more switch hops, refer to the *Data Center Bridging: Standards, Behavioral Requirements, and Configuration Guidelines with Dell EqualLogic iSCSI SANs* document for additional configuration guidance and considerations.

2.3 iSCSI fault domain configuration

The first step to configure DCB on the SC9000 is to create a fault domain. This paper focuses on two FDs, each within their own respective subnet and the same VLAN. It is possible to have both FDs within the same subnet and VLAN. Multiple FDs can be created in the Dell SC9000 that can be added to any configured subnet assigned to the same array. The implementation of multiple fault domains prevents a single point of failure in the network so that I/O is never impacted during times of hardware failure. Dell recommends a minimum of two fault domains for fault tolerance.

A fault domain is used to create redundant paths between a host server and the array. The implementation of multiple fault domains prevents a single point of failure in the network so that I/O is never impacted during times of hardware failure. The fault domains can also be configured to use unique network subnets and allow an administrator to segment server access to the array.

For the purposes of this paper, the Dell SC9000 was configured through DSM with two iSCSI FDs.

Table 1 iSCSI Fault Domain IPv4 Configuration

Port identification	Virtual management IPv4 address	Top controller IPv4 iSCSI SAN address	Bottom controller IPv4 iSCSI SAN address
iSCSI FD01 (172.16.31.0/24)			
T520 Dual Port 10Gb iSCSI	172.16.31.100	172.16.31.101*	172.16.31.102*
iSCSI FD02 (172.16.32.0/24)			
T520 Dual Port 10Gb iSCSI	172.16.32.100	172.16.32.101*	172.16.32.102*

*Shown in Figure 2 and Figure 3.

From within DSM, select **Storage** in the top menu and then expand **Fault Domains**. Click **Create iSCSI Fault Domain** from the top right-hand menu.

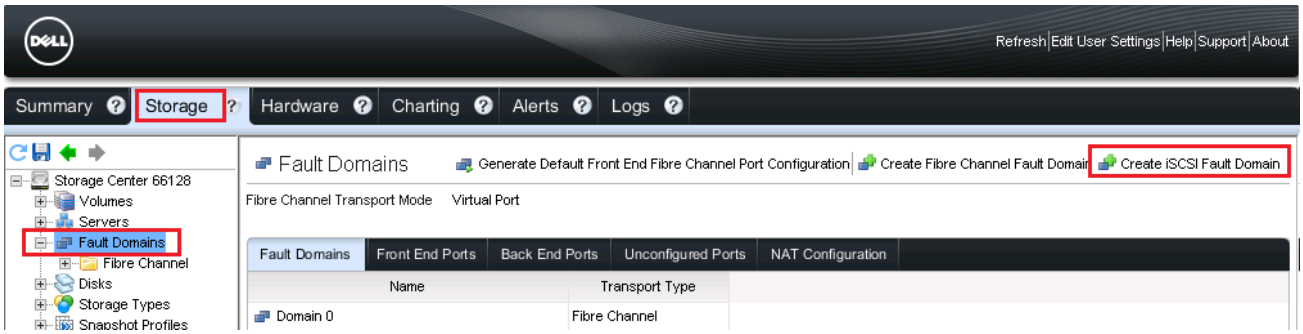

Figure 1 DSM 2016 R1 - iSCSI fault domain creation

Within the **Create Fault Domain** window, create a logical name for this iSCSI fault domain, configure the IPv4 virtual management address, the VLAN ID for the iSCSI SAN, and the physical iSCSI ports that will make up this unique fault domain.

Note: Do not edit or change the **Class of Service Priority** default value of 0when configuring any iSCSI FD for DCB. Ensure the proper VLAN ID has been provided so the Dell SC9000 can receive the DCB configuration information from the SAN switches.

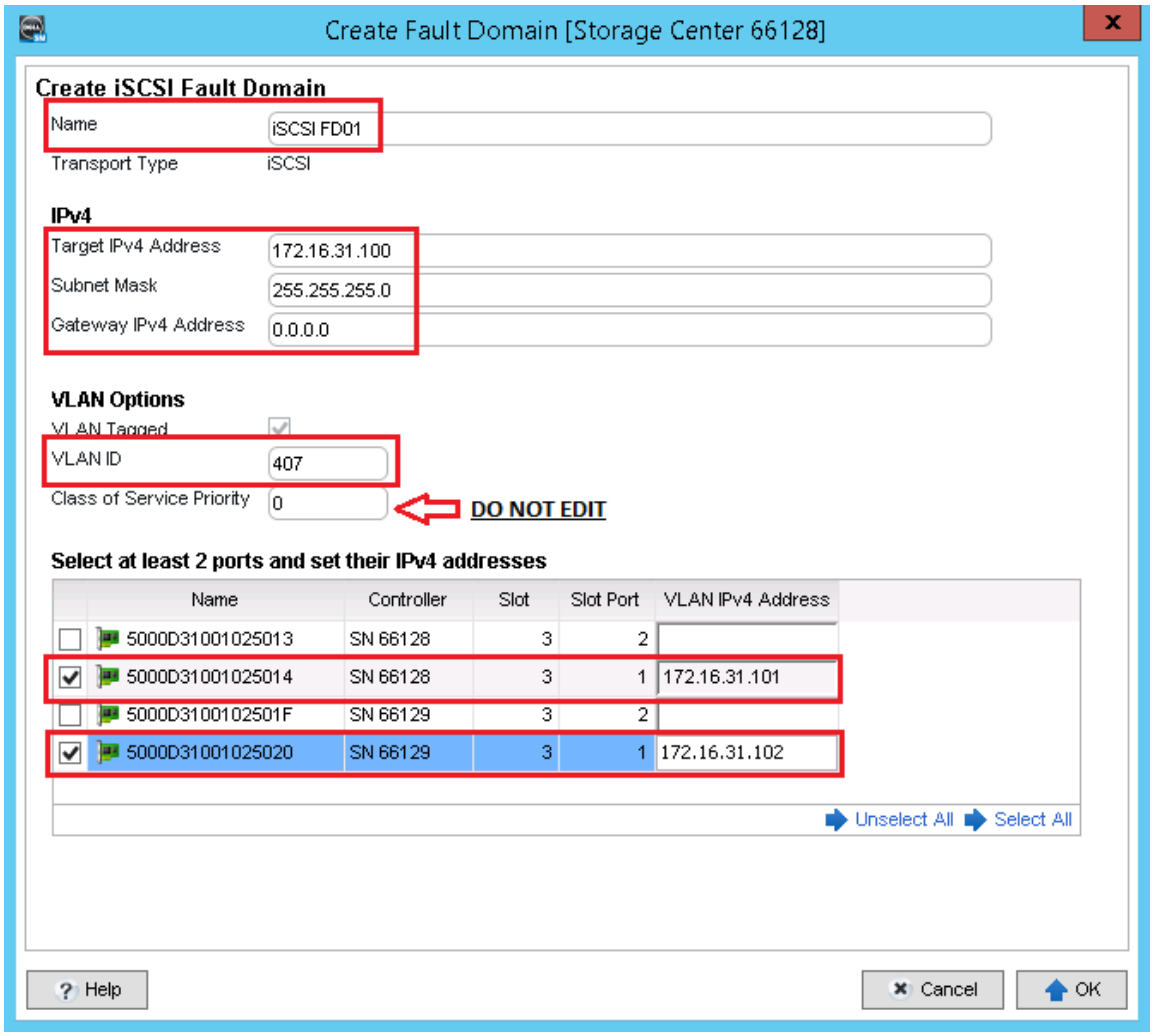

Figure 2 DSM 2016 R1 – iSCSI FD01 creation

Repeat the steps above to create a secondary iSCSI FD within DSM. Figure 3 provides a screenshot showing the creation of the secondary iSCSI FD.

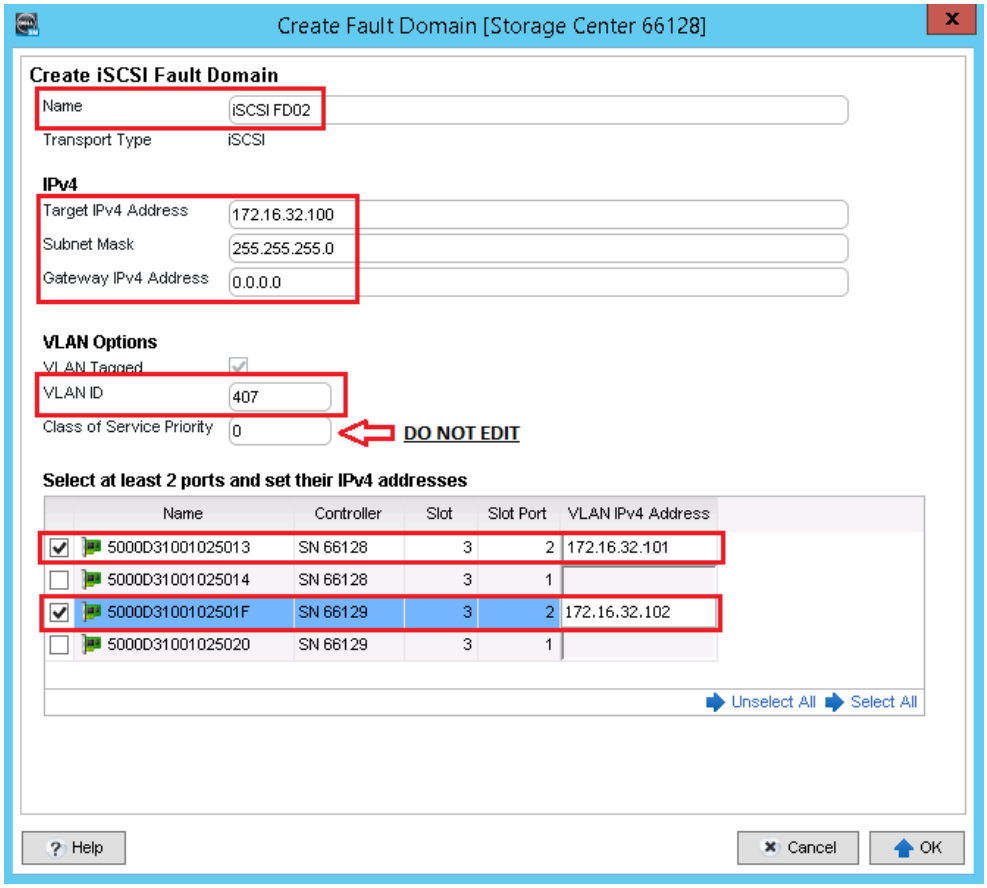

Figure 3 DSM 2016 R1 – iSCSI FD02 creation

2.4 iSCSI fault domain MTU settings

Once both iSCSI FDs have been created, Dell recommends configuring Jumbo Frames for the MTU in each iSCSI FD, however this is not a requirement. From DSM select **Storage** from the top menu and expand **Fault Domains** to display both of the previously created iSCSI FDs. Each one lists the default MTU of 1500 (Standard). Click the first iSCSI FD01 and select **Edit Settings** from the top-right menu.

Note: Set the MTU (Jumbo Frame) size on each iSCSI FD to match the MTU size on each port in the Ethernet switch configuration as well as the Host CNA configuration. If the MTU size in all three components (server, switch and host) do not match, anomalous behavior can occur in the iSCSI SAN.

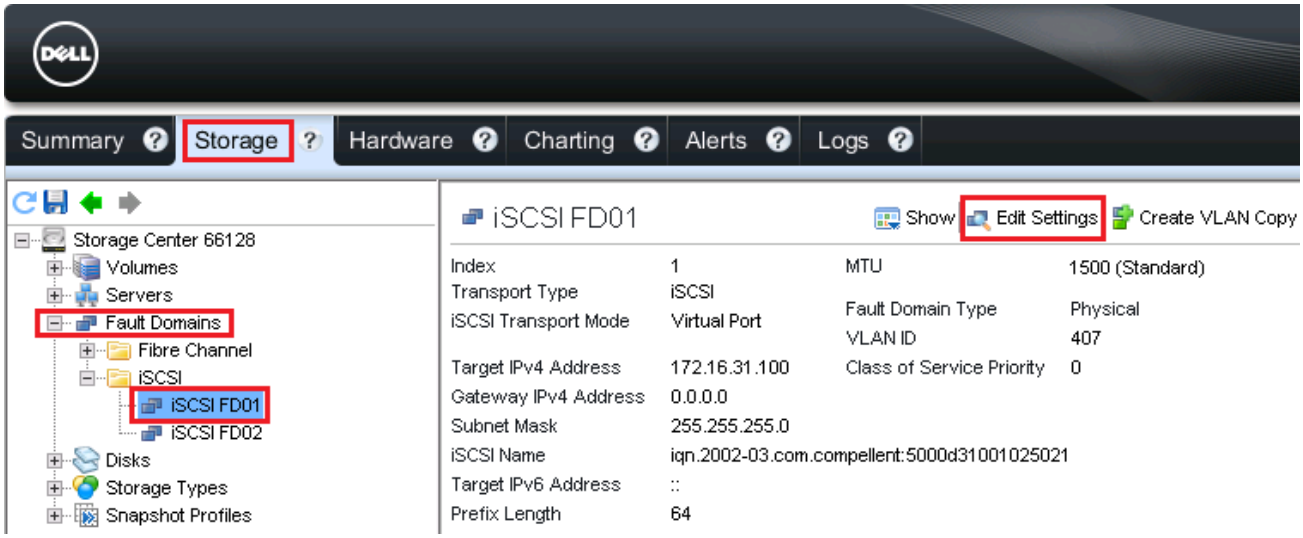

Figure 4 DSM 2016 R1 – iSCSI FD01 configuration

In the **Edit Fault Domain Settings** window select **9000 (Jumbo)** from the drop-down menu to the right of the MTU callout and click **OK**.

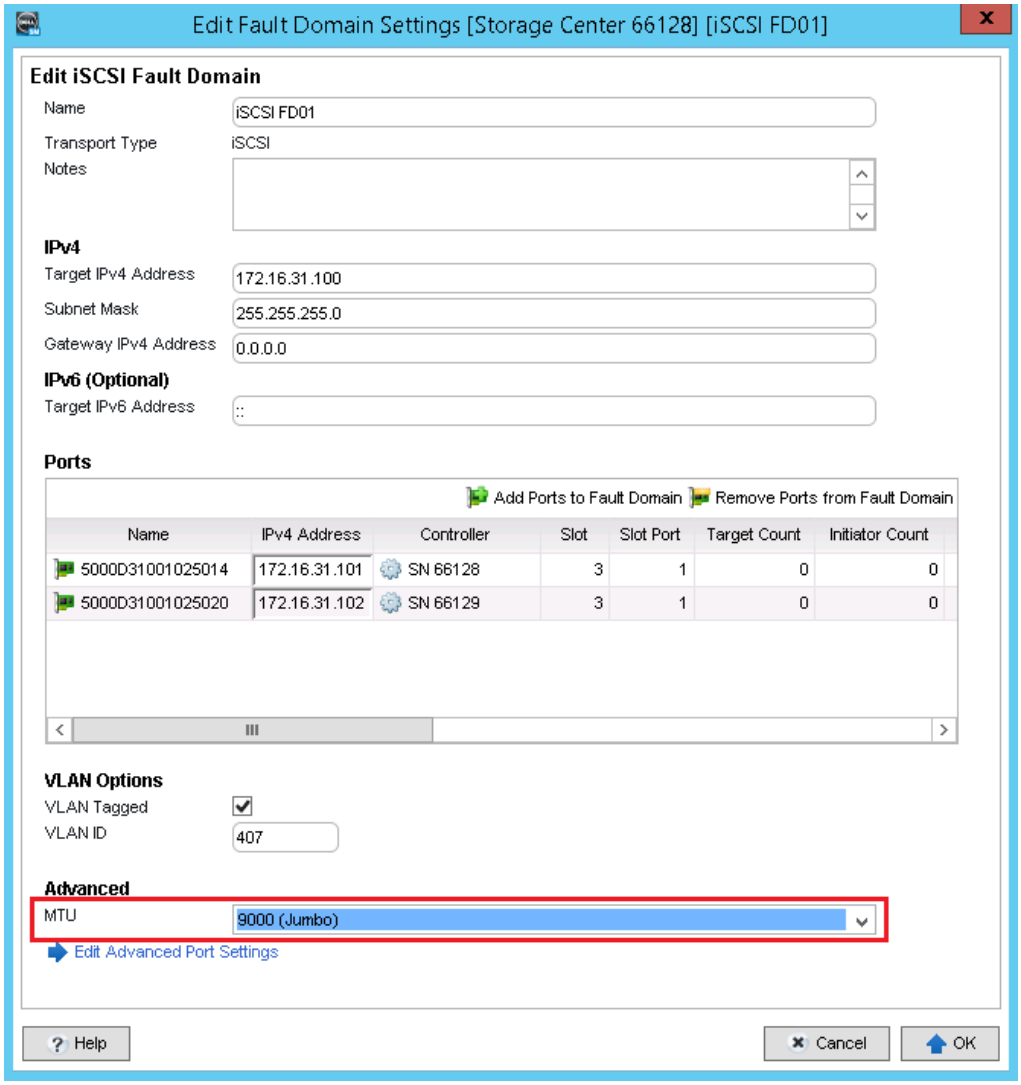

Figure 5 DSM 2016 R1 – iSCSI FD01 MTU Configuration

The correct MTU size is displayed when viewing the configuration of the first iSCSI FD in DSM.

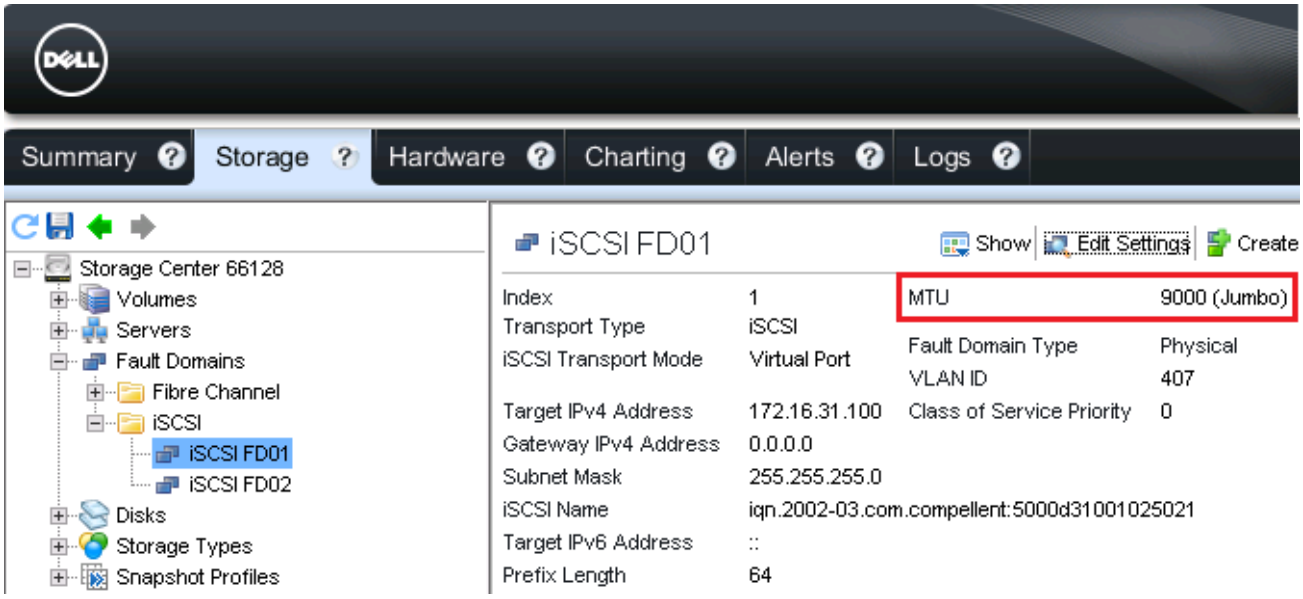

Figure 6 DSM 2016 R1 – iSCSI FD01 MTU Size

Repeat the above MTU configuration steps for iSCSI FD02 (the secondary iSCSI Fault Domain) to ensure that both have the same MTU size as the Ethernet switch and Host CNAs within the SAN.

2.5 iSCSI fault domain DCB verification

To verify that the iSCSI FDs receive the correct DCB configuration from the upstream Ethernet switch, view each individual iSCSI adapter port in the DSM **Hardware** tab. Select one of the iSCSI adapter ports to display two options in the top right-hand menu, **Data Center Bridging Information** and **Link Layer Discovery Protocol Information** as shown below.

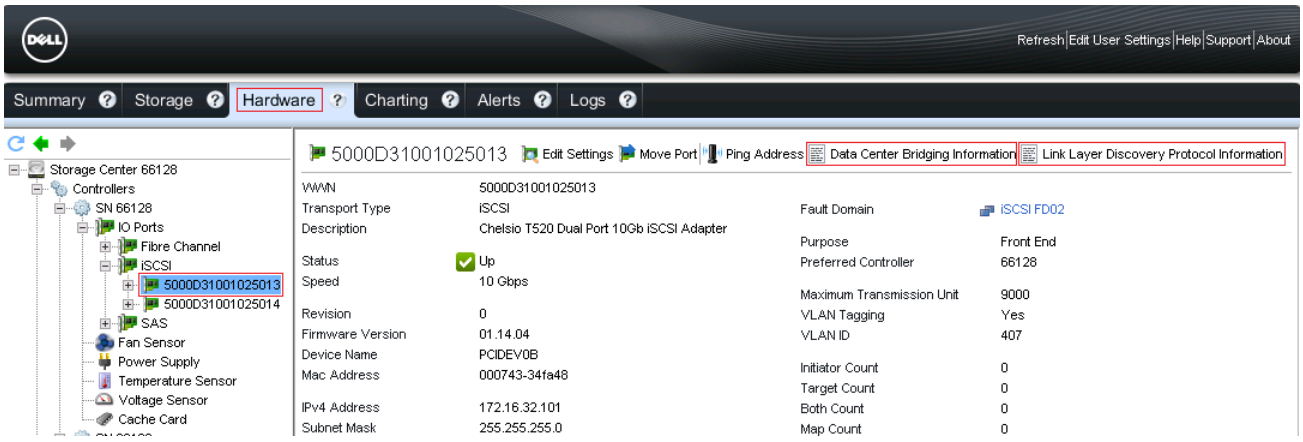

Figure 7 DSM 2016 R1 – iSCSI FD DCB Verification

Click **Data Center Bridging Information** to display the values received from the previously configured DCB upstream Ethernet switch.

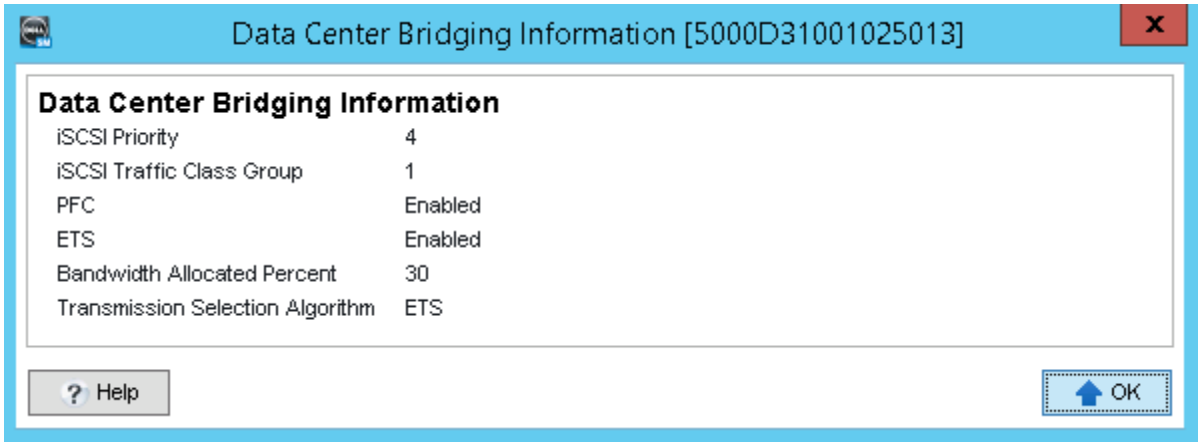

Figure 8 DSM 2016 R1 – iSCSI adapter DCB information

Click **Link Layer Discovery Protocol Information** to display the values received from the DCB configured upstream Ethernet switch.

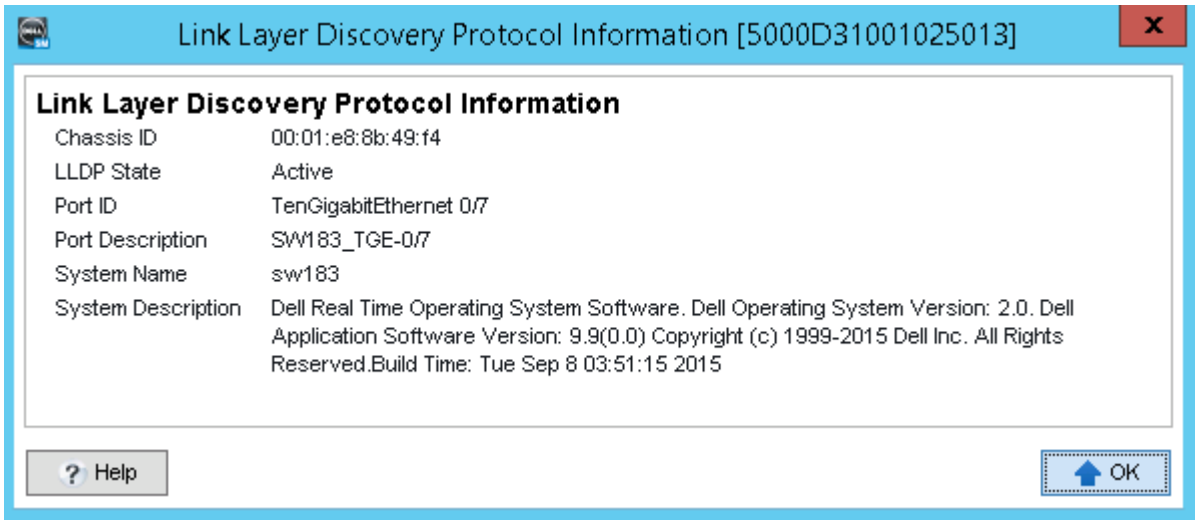

Figure 9 DSM 2016 R1 – iSCSI adapter Link Layer Discovery Protocol Information

3 Switch specific configuration references

In this section, switch-specific configuration guides are referenced for DCB setup of the Dell Storage SAN or to disable DCB completely. The steps below are not a comprehensive set of configuration commands for Dell Storage deployments.

3.1 Configuration for switches with DCB support

The Switch Configuration Guides homepage lists switches that feature DCB with the requirements necessary to fully support Dell Storage systems.

Note: For a complete list of Dell supported switches review the *Dell Storage Compatibility Matrix.*

3.2 Dell Networking OS9 CLI for DCB configuration and verification

For testing presented in this paper, two Dell Networking S4810 switches were used with a Link Aggregation Group (LAG). The switches were interconnected using two of the 40 GbE Quad Small Form-factor Pluggable (QSFP) uplink ports and the LAG was configured for Dynamic Link Aggregation Control Protocol (LACP). Dell Networking OS version 9.9(0.0) was used when testing DCB functionality within the iSCSI SAN. The commands provided may vary on other Dell S-Series networking products. The minimum version of Dell Networking OS for DCB support on SCOS 7.0 is 9.9(0.0).

```
sw183#show version
Dell Real Time Operating System Software
Dell Operating System Version:  2.0
Dell Application Software Version:  9.9(0.0)
Copyright (c) 1999-2015 by Dell Inc. All Rights Reserved.
Build Time: Tue Sep  8 03:51:15 2015
Build Path: /sites/eqx/work/swbuild01_1/patch02/E9-9-0/SW/SRC
Dell Networking OS uptime is 1 week(s), 6 day(s), 22 hour(s), 48 minute(s)
```

Figure 10 Dell Networking S4810 Dell Networking OS version 9.9(0.0)

3.2.1 DCB status

To display the DCB status of the Dell Networking S4810 switch, along with number of PFC-enabled ports and number of PFC-enabled queues, the `show dcb stack-unit` command is used. Sample command syntax and output are displayed below.

Command Syntax: `show dcb [stack-unit unit-number]`

```
sw183#show dcb stack-unit 0

DCB Status: Enabled, PFC Queue Count: 2

stack-unit Total Buffer PFC Total Buffer PFC Shared Buffer PFC Available Buffer
      PP            (KB)             (KB)              (KB)                (KB)
-------------------------------------------------------------------------------
0     0    7787         6592             832               3156
```

Figure 11 Dell Networking S4810 CLI – show dcb stack-unit

3.2.2 DCBX configuration

To display the DCBX configuration on an interface of the Dell Networking S4810 switch, the `show interface dcbx` command is used. Sample command syntax and output are displayed below.

Command Syntax: `show interface port-type slot/port dcbx detail`

```
sw183#show interfaces tengigabitethernet 0/11 dcbx detail

E-ETS Configuration TLV enabled                 e-ETS Configuration TLV disabled
R-ETS Recommendation TLV enabled                r-ETS Recommendation TLV disabled
P-PFC Configuration TLV enabled                 p-PFC Configuration TLV disabled
F-Application priority for FCOE enabled         f-Application Priority for FCOE disabled
I-Application priority for iSCSI enabled        i-Application Priority for iSCSI disabled
-------------------------------------------------------------------------------------------

Interface TenGigabitEthernet 0/11
   Remote Mac Address 00:0a:f7:31:2c:a3
    Port Role is Manual
   DCBX Operational Status is Enabled
   Is Configuration Source? FALSE
   Local DCBX Compatibility mode is CEE
   Local DCBX Configured mode is AUTO
   Peer Operating version is CEE
   Local DCBX TLVs Transmitted: ErPfI
```

Figure 12 Dell Networking S4810 CLI – show interface dcbx

3.2.3 ETS configuration

To display the ETS configuration applied to egress traffic on an interface of the Dell Networking S4810 switch, including priority groups with priorities and bandwidth allocations defined, the `show interface ets` command is used. Sample command syntax and output are displayed below.

Command Syntax: `show interface port-type slot/port ets {summary | detail}`

```
sw183#show interfaces tengigabitethernet 0/11 ets summary

Interface TenGigabitEthernet 0/11
Max Supported TC is 4
Number of Traffic Classes is 8
Admin mode is on

Admin Parameters :
------------------
Admin is enabled

PG-grp      Priority#          Bandwidth      TSA
----------  -----------------------------------
0           0,1,2,3,5,6,7      70 %           ETS
1           4                  30 %           ETS
2                              -              -
3                              -              -
4                              -              -
5                              -              -
6                              -              -
7                              -              -
15                             -              -
```

Figure 13 Force10 S4810 show interface ets

3.2.4 PFC configuration

To display the PFC configuration applied to ingress traffic on an interface of the Dell Networking S4810 switch, including priorities and link delays, the `show interface pfc` command is used. Sample command syntax and output of the `statistics` and `summary` options are displayed below.

Command Syntax: `show interface port-type slot/port pfc {buffer-threshold | detail | statistics | summary}`

```
sw183#show interfaces tengigabitethernet 0/11 pfc statistics

Interface TenGigabitEthernet 0/11

Interface   Priority   Rx XOFF Frames   Rx Total Frames   Tx Total Frames
---------------------------------------------------------------------
Te 0/11     P0         0                0                 0
Te 0/11     P1         0                0                 0
Te 0/11     P2         0                0                 0
Te 0/11     P3         0                0                 0
Te 0/11     P4         5                10                0
Te 0/11     P5         0                0                 0
Te 0/11     P6         0                0                 0
Te 0/11     P7         0                0                 0
```

Figure 14 Force10 S4810 CLI – show interface pfc

4 Host adapter configuration for DCB

4.1 QLogic 57810 (previously Broadcom) configuration

Configuring the QLogic 57810 adapter for iSCSI and DCB requires the use of the QLogic Control Suite (QCS) utility. For this paper, the following software versions were used: QCS version 17.0.14.0, QLogic driver version 7.12.32.0 and QLogic firmware version 7.12.19. QCS software and CNA drivers can be found at the Dell support site: https://support.dell.com.

4.1.1 DCB enablement

If either of the ports on the QLogic 57810 adapter show DCB as disabled, the DCB option must be enabled using the firmware boot menu by pressing [**Ctrl**] and [**S**] during a server POST request.

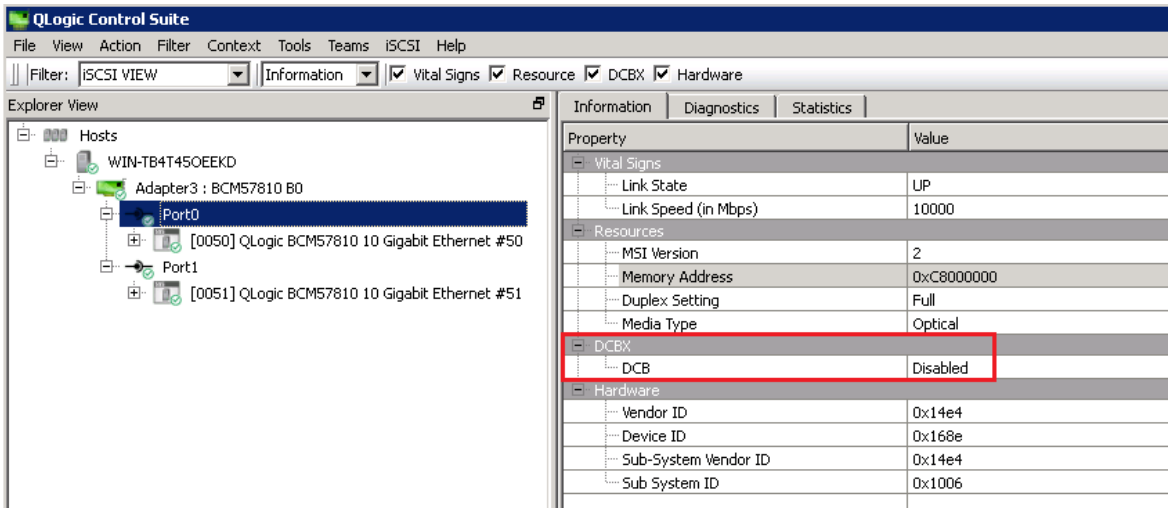

Figure 15 QLogic 57810 DCB Disabled

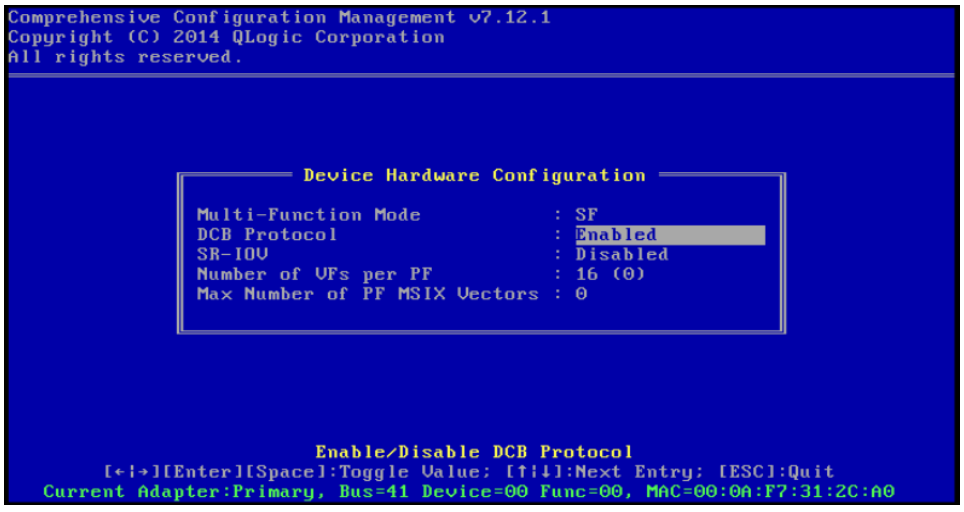

Figure 16 QLogic 57810 DCB Enablement via firmware boot menu

4.1.2 iSCSI Offload Engine enablement

The QLogic 57810 adapter requires enabling the iSCSI Offload Engine (iSOE) for a DCB SAN environment. By offloading the iSCSI and TCP/IP stacks, the QLogic adapter does not need to compete with upper-layer applications. If a port in QCS only displays an NDIS VBD client designation, then that port has not had iSOE enabled. The figure below shows a single adapter that has one port with and one without iSOE enabled.

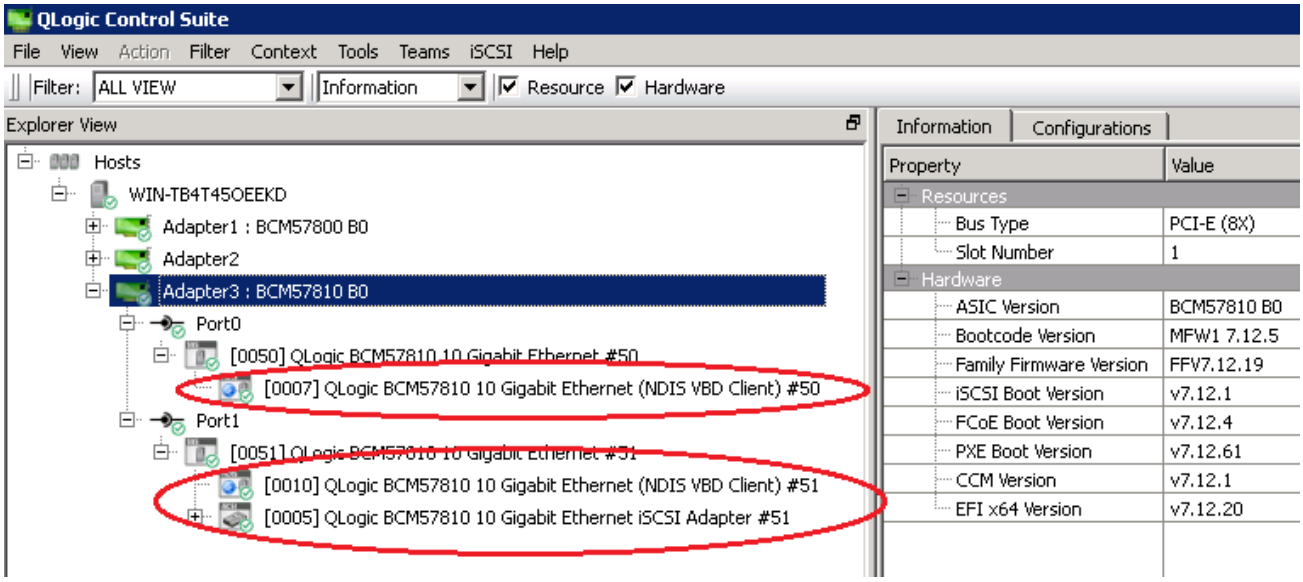

Figure 17 QLogic 57810 iSCSI Offload configuration

To configure iSOE on a QLogic 57810 port:

1. Highlight the port, open the **Configurations** tab and click **Configure**.

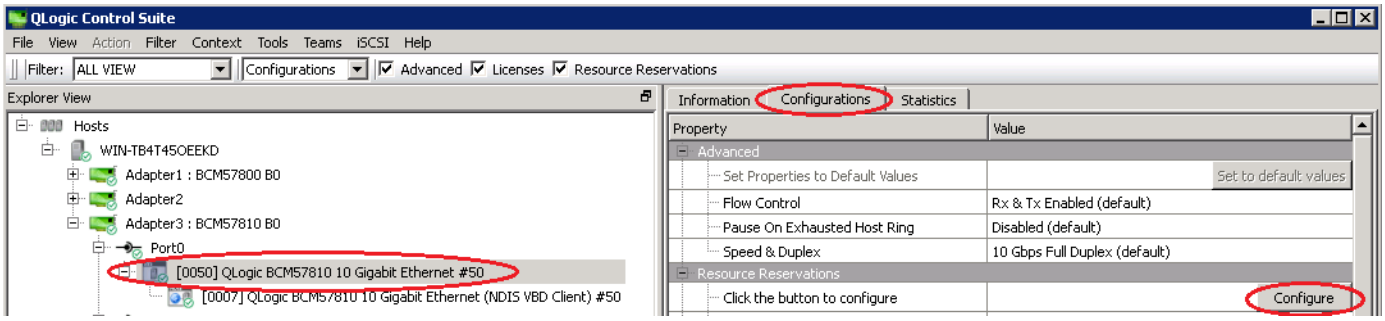

Figure 18 QLogic 57810 port configuration

2. When the QLogic **Hardware and Resource Configuration Wizard** is presented, enable iSOE by checking the box to the right of the iSCSI protocol.

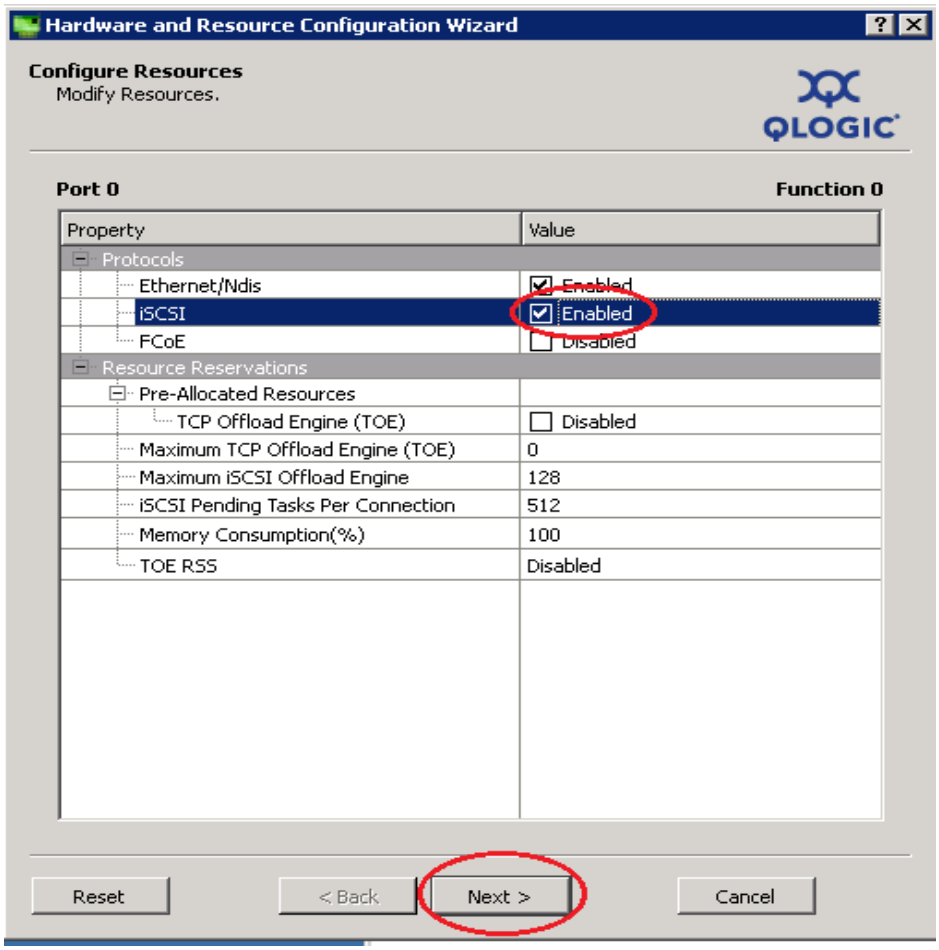

Figure 19 QLogic 57810 iSCSI Offload Enablement

3. Click **Next** and then **Apply**. To continue, click **Yes** to acknowledge the following warning.

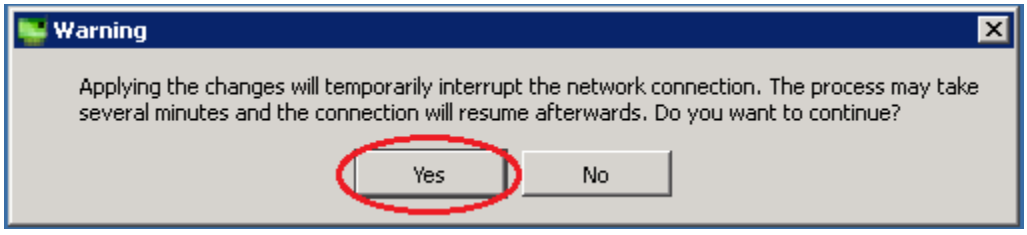

Figure 20 QLogic iSCSI enablement warning

4. Configure the iSCSI Adapter using QCS for the network assignment in the iSCSI SAN.

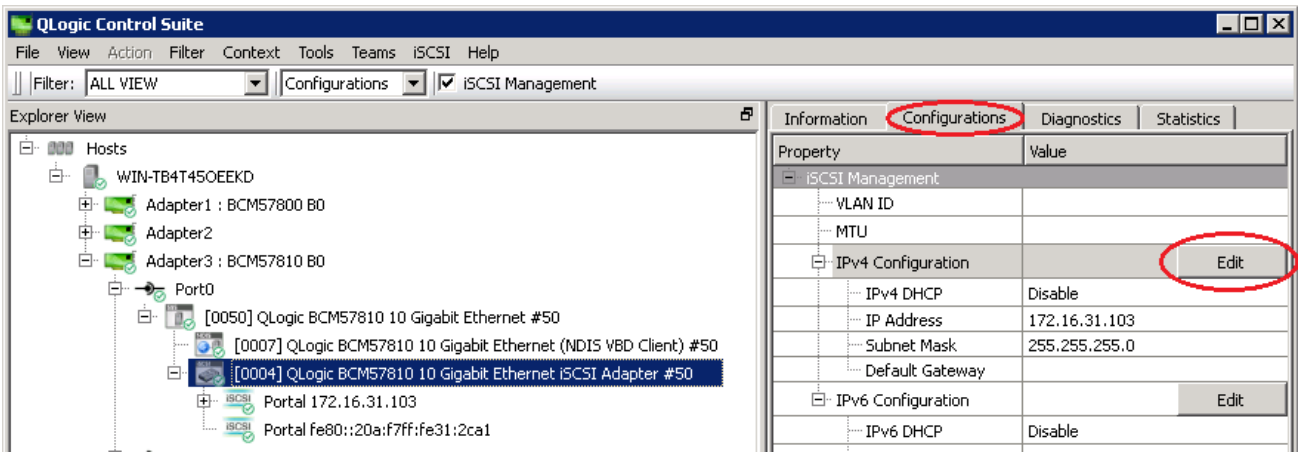

Figure 21 QLogic iSCSI Adapter Network Configuration

5. Configure the iSCSI VLAN ID as well as the MTU size by clicking in the value box to the right of the property field.

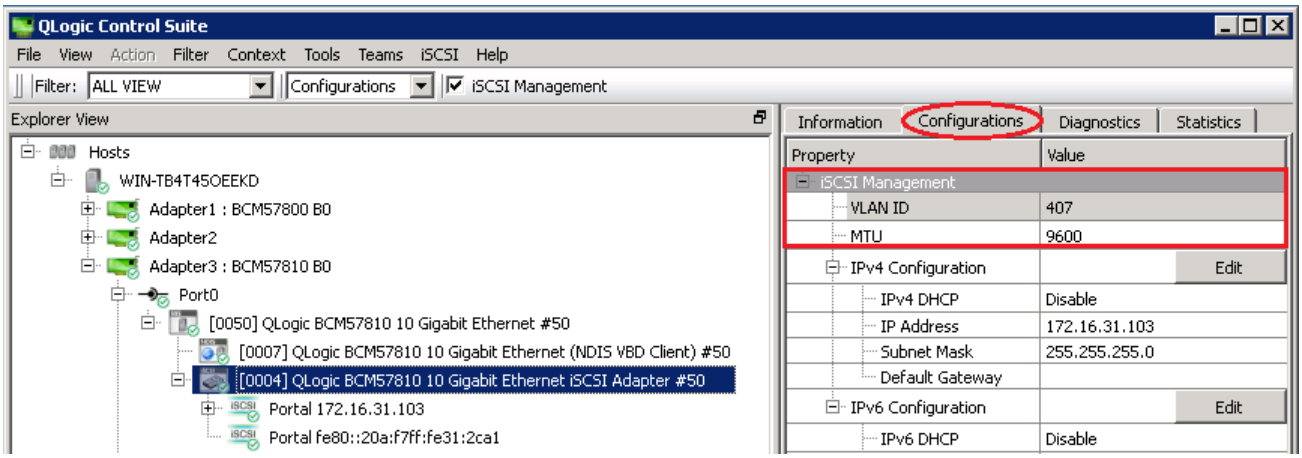

Figure 22 QLogic iSCSI VLAN and MTU configuration

Note: The entered VLAN ID must match the VLAN ID on the configured switch and storage target. Possible VLAN ID numbers range from 1 to 4094 regardless of the number of IDs supported by the switch. VLAN IDs 0 and 1 are often reserved.

6. After the iSCSI adapter has been configured, run an iSCSI Ping Test from the **Diagnostic** tab. This test confirms that the iSCSI card has been configured correctly and can access all target ports within the target fault domain of the storage array.

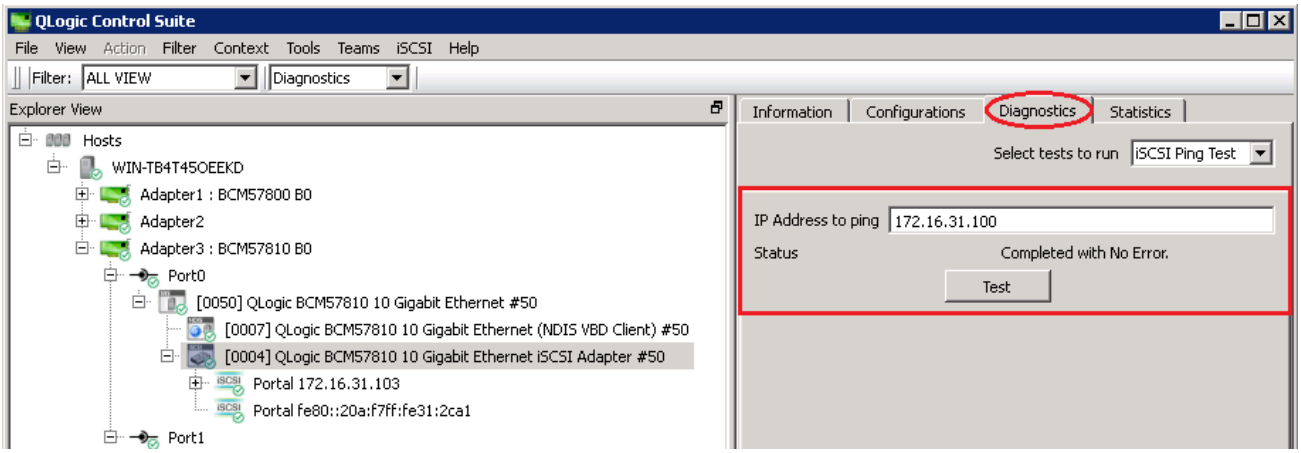

Figure 23 QLogic iSCSI SAN connectivity test

4.1.3 QLogic 57810 DCBX verification

QCS is used to confirm that DCB is operational. To verify the priority group bandwidth allocations and priority mappings, open the **Information** tab on the same selected port.

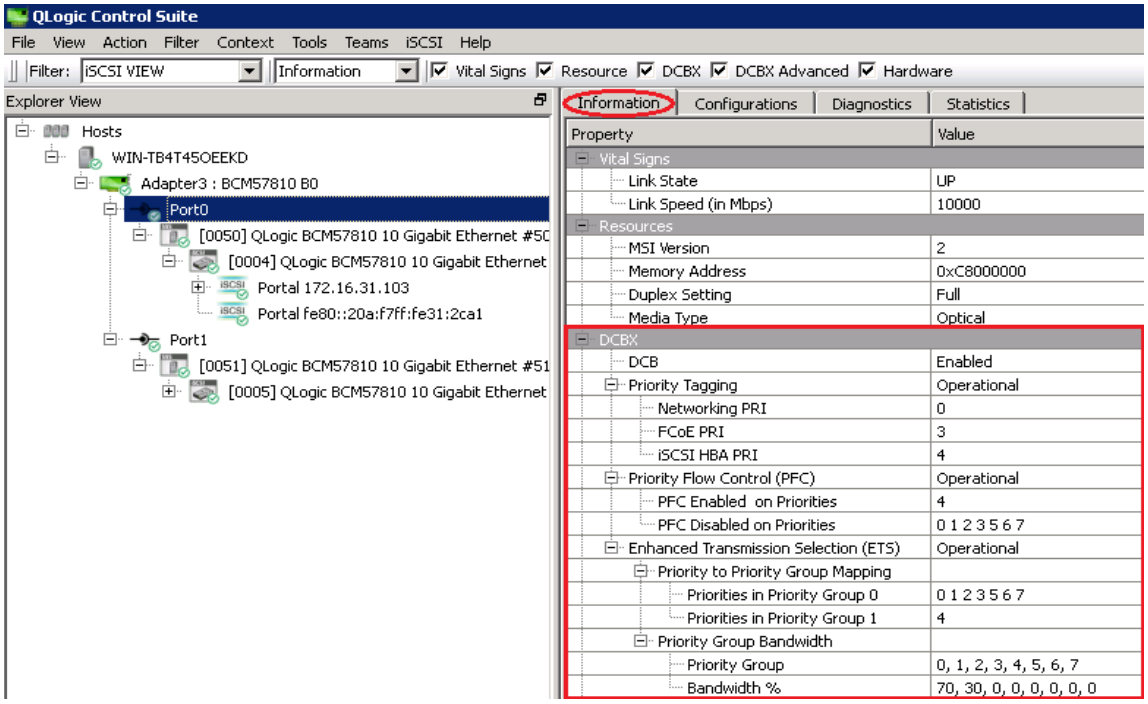

Figure 24 QLogic 57810 configuration showing bandwidth allocation and priority mapping

4.1.4 QLogic 57810 IPv4 LAN assignment

Once the QLogic 57810 adapter has been configured for iSOE to support SAN traffic in the converged network, configure the NDIS (LAN) IPv4 network. While the iSOE/SAN interface is for lossless traffic, the NDIS/LAN interface is for non-iSCSI traffic (for example LAN).

1. There are two QLogic BCM57810 10 Gigabit Ethernet (NDIS VBD Client) devices listed in the Network Connections panel. Right-click on the first available device and click **Properties** from the drop-down.

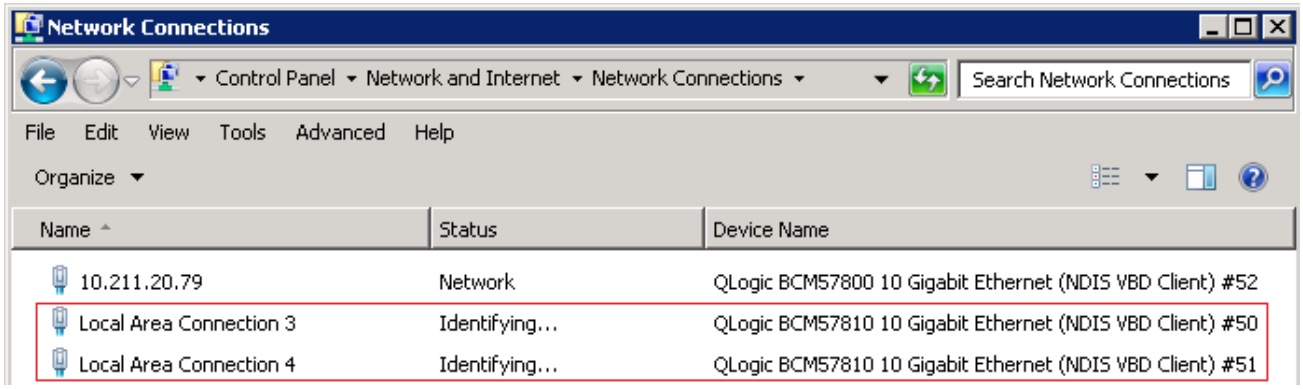

Figure 25 QLogic 57810 NDIS (LAN) devices

2. In the Local Area Connection 3 Properties window, locate and select **Internet Protocol Version 4 (TCP/IPv4)** from the list and then click **Properties**.

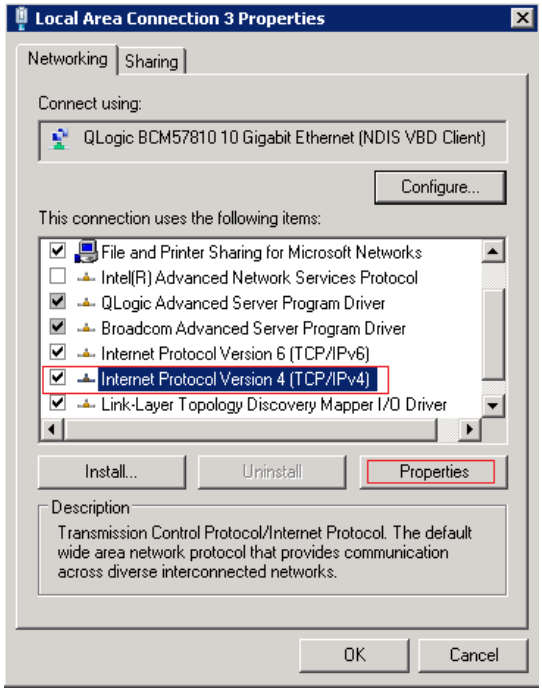

Figure 26 QLogic 57810 NDIS IPv4

3. In the Internet Protocol Version 4 (TCP/IPv4) Properties window, configure the adapter with the appropriate IP information for this particular port and click **OK**.
4. Select an option for this NDIS interface:
   - Same VLAN as the iSCSI SAN

- Different VLAN than iSCSI SAN, specifically for LAN traffic. Ensure Ethernet switch is also configured for this VLAN ID.

Note: If multiple VLANs are used in the SAN to separate iSCSI from LAN traffic, the Ethernet switches must be configured to support multiple VLANs.

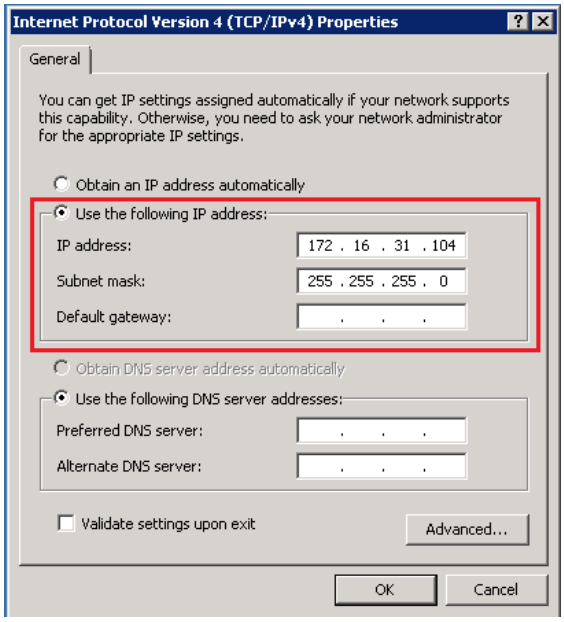

Figure 27 QLogic 57810 NDIS LAN IPv4 configuration

Once the first port of the adapter is configured with an IPv4 address in the iSCSI SAN, repeat steps in section 4.1.4 for the second port in the second network.

4.2 Intel 10G dual-port X520

Configuring the Intel 10G dual-port (2P) X520 adapter for iSCSI and DCB requires the use of the Intel PROSet software. For this paper, the following software versions were used: Intel PROSet version 20.7.67.0, Intel driver version 17.0.0 for Windows® 64-bit Operating Systems and Intel firmware version 17.0.0.

Intel PROSet software and NIC family version 17.0.0 drivers can be found at support.dell.com

4.2.1 Driver and software installation

Installing the drivers and Intel PROSet software requires selecting **iSCSI using Data Center Bridging** during the installation process.

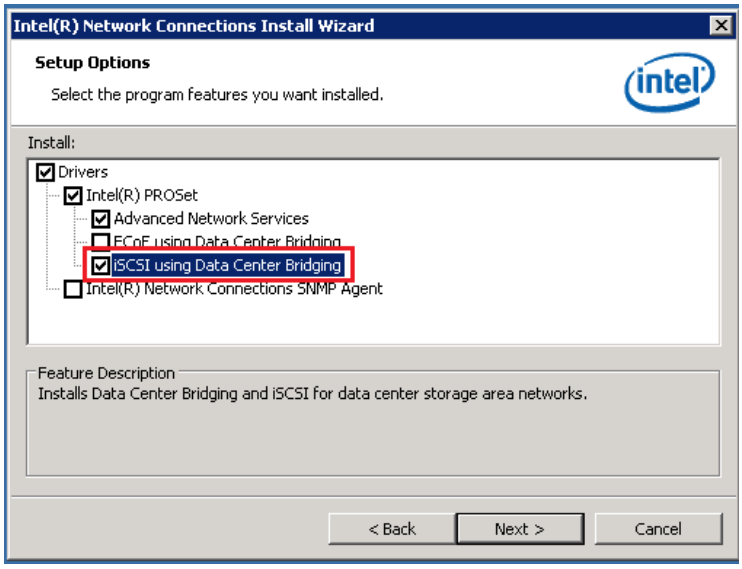

Figure 28 Intel 10G 2P X520 Driver/Software Installation

4.2.2 VLAN configuration

Once the driver installation is complete, two new adapter listings in the **Network Connections** panel appear for the Intel 10G 2P X520.

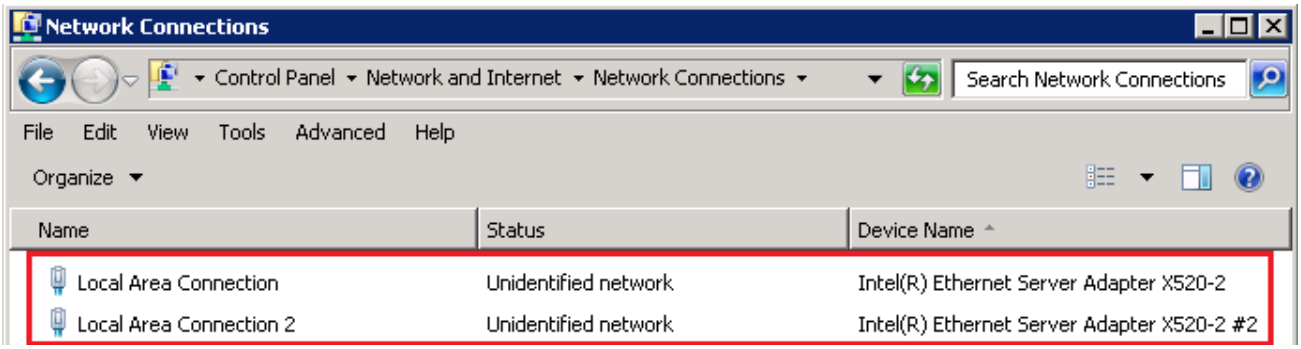

Figure 29 Intel 10G 2P X520 driver installation

Configure each NIC port to function in the existing iSCSI SAN VLAN.

1. Right-click one of the adapter ports, select **Properties** and then click **Configure** to access the Intel PROSet software configuration options.

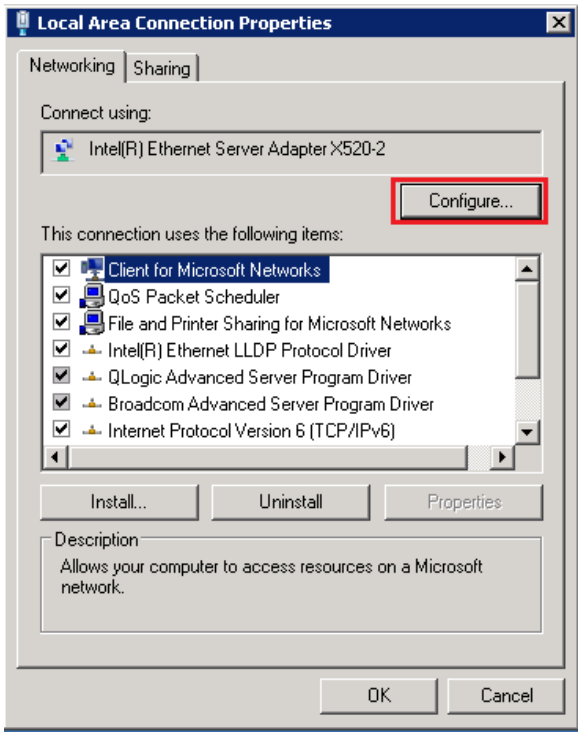

Figure 30 Intel 10G 2P X520 Configuration

2. Select the **VLANs** tab from the Intel Ethernet Server Adapter X520-2 Properties window.
3. Click **New** below the associated VLANs table to enter the tagged VLAN ID for the iSCSI SAN.

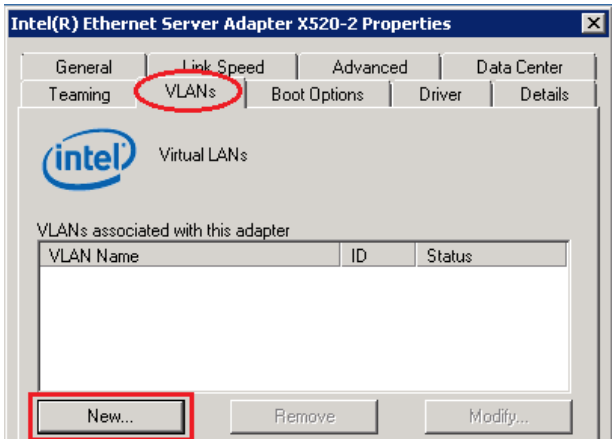

Figure 31 Intel 10G 2P X520 VLAN association

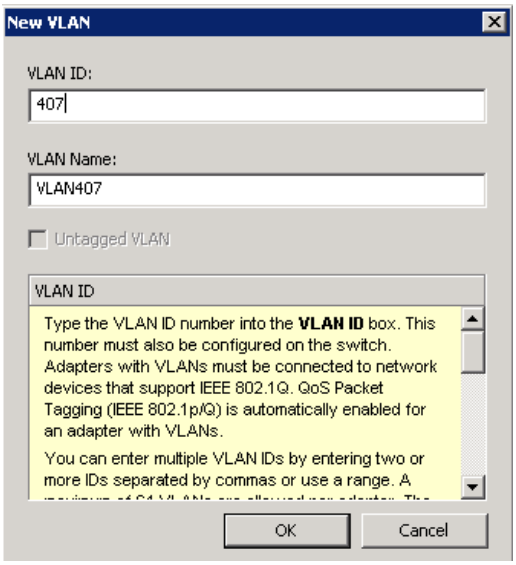

Figure 32 Intel 10G 2P X520 tagged VLAN configuration

Note: The entered VLAN ID must match the VLAN ID on the configured switch and storage target. Possible VLAN ID numbers range from 1 to 4094 regardless of the number of IDs supported by the switch. VLAN IDs 0 and 1 are often reserved. The VLAN Name is limited to 256 characters and used for informational purposes only; it does not have to match the name of the switch. Intel PROSet must be used to add or remove a VLAN ID to the X520 adapter. Do not use the Network and Dial-up Connections dialog box to enable or disable VLANs because this will result in the VLAN driver not being correctly enabled or disabled.

Once the VLAN ID has been applied to a respective port, there will be an additional virtual Intel VLAN adapter created within the Network Connections configuration screen.

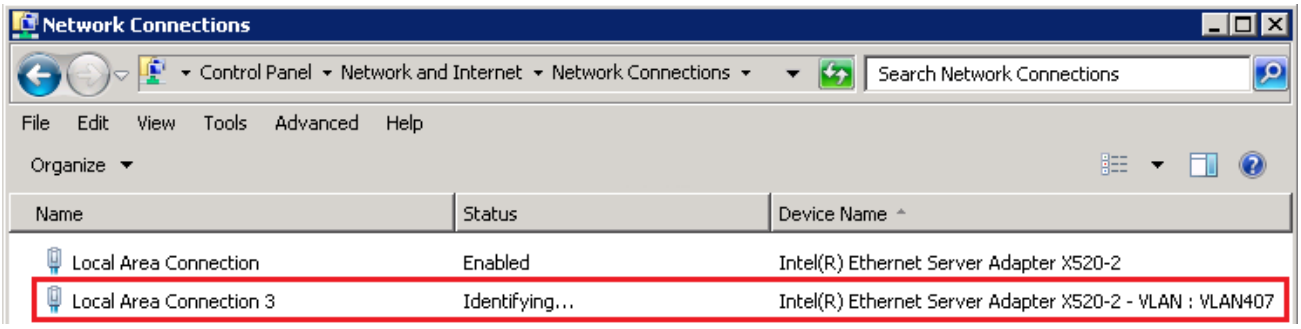

Figure 33 Intel 10G 2P X520 Virtual VLAN Adapter

This virtual tagged VLAN adapter is configured with an IP in the iSCSI SAN, covered in Section 4.2.3

4.2.3 iSCSI configuration

The created virtual VLAN adapter needs to be configured with an IP in the iSCSI SAN network. Right-click on the virtual tagged VLAN adapter and select **Properties**. Scroll down and click **Internet Protocol Version**

4 (TCP/IPv4) and then **Properties**. Configure the adapter with the appropriate IP information for this particular port and click **OK**.

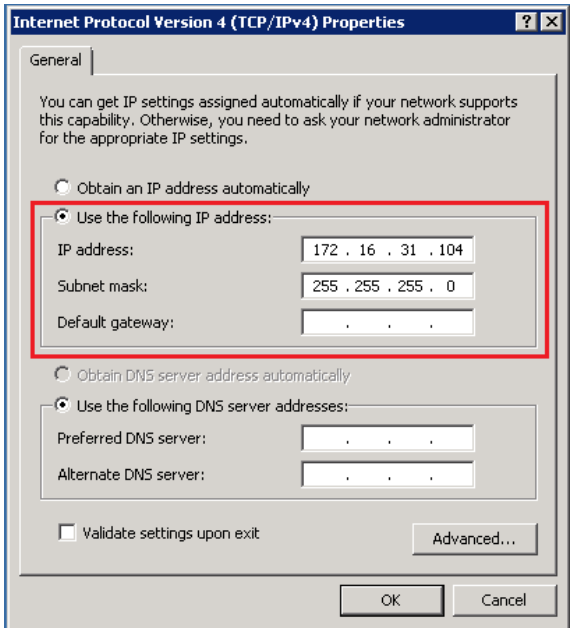

Figure 34 Intel 10G 2P X520 virtual adapter iSCSI IP configuration

4.2.4 DCB confirmation

Right-click on the non-VLAN adapter for the recently configured port within the iSCSI SAN, Click **Properties** and then **Configure** to access the Intel PROSet configuration options. Once the Intel(R) Ethernet Server Adapter X520-2 Properties window is available, open the **Data Center** tab to view the DCB settings received from the switch, as shown below.

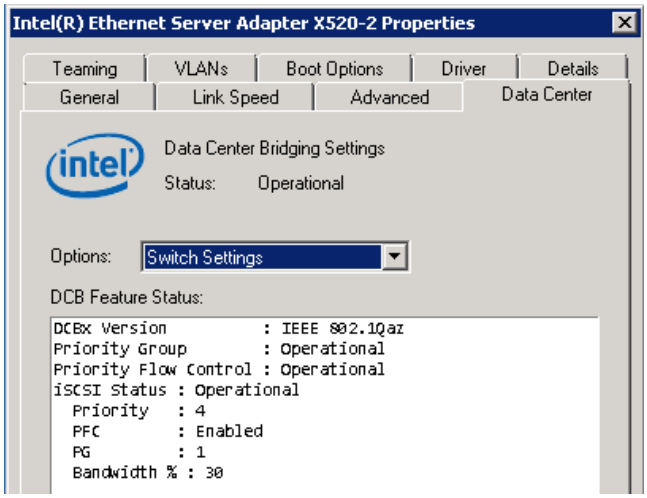

Figure 35 Intel 10G 2P X520 DCB Confirmation

5 Storage, switch and host DCB testing

The following tests were conducted in order to verify DCB operations between the host servers, switch and storage controllers. Three common scenarios were demonstrated: An I/O workload consisting of only iSCSI traffic, an I/O workload consisting of only LAN traffic, and then an I/O workload consisting of both iSCSI and LAN traffic, otherwise known as converged traffic. In the first test, involving just iSCSI traffic, an I/O workload of sequential reads was generated between the receiving server and storage controller. This was performed to show that throughput can achieve a line rate of 100% bandwidth. Second, the receiving server received LAN traffic from the source server. This confirmed that the server was capable of receiving LAN traffic at a 100% line rate. Third, the receiving server demonstrated its ability to simultaneously handle both LAN and iSCSI traffic on the same physical network segment while adhering to the DCB policy map defined on the switches.

5.1 Testing definitions

The tool used to generate iSCSI traffic during testing was vdbench. The tool to generate non-iSCSI TCP traffic to simulate other LAN traffic was iPerf.

The iSCSI I/O traffic tested was sequential read, had a block size of 256K of a 100% read and a 0% write ratio. The sequential read traffic is designed to imitate large-block, high throughput scenarios such as video streaming or backups.

5.2 Testing topology

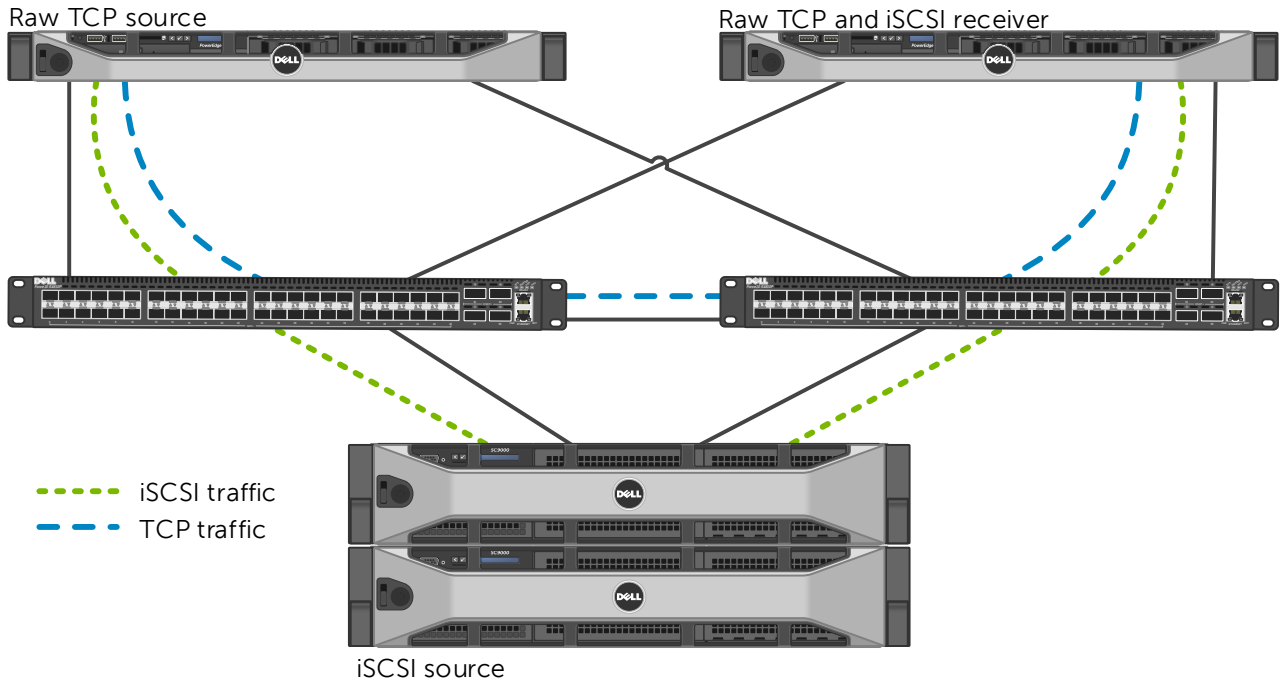

Figure 36 Testing topology

In this topology, a pair of SC9000 arrays were used. All physical network connections were cabled in accordance with SC Series best practices. These switches were then inter-connected through a high speed LAG of 2 x 40 GbE ports, providing sufficient bandwidth for any traffic traversing the inter-switch link. A source host was used to provide TCP traffic to the receiver host, ensuring that the converged traffic would occur on the proper links with DCB bandwidth allocation applied.

Both source and receiver host were configured with a QLogic 57810 CNA. The receiver host had eight iSCSI volumes from the SC9000 array. The DCB policy on the Force10 S4810 switches were configured for 70% non-iSCSI and 30% iSCSI traffic.

5.3 Testing methodology

The first test, involving just iSCSI traffic, showed an I/O workload of sequential reads generated between the receiving server and storage controller.

```
C:\vdbench502>vdbench -f c:\scripts\vdbench-256k-reads-8vol.dat


Vdbench distribution: vdbench50401
For documentation, see 'vdbench.pdf'.

13:12:30.085 input argument scanned: '-fc:\scripts\vdbench-256k-reads-8vol.dat'
13:12:30.195
13:12:30.195 Adjusted default JVM count for host=localhost from jvms=1 to jvms=8 because of iorate=max and a total of 8 sds.
13:12:30.210
13:12:30.241 Starting slave: C:\vdbench502\vdbench SlaveJvm -m localhost -n localhost-10-160329-13.12.29.898 -l localhost-0 -p
13:12:30.273 Starting slave: C:\vdbench502\vdbench SlaveJvm -m localhost -n localhost-11-160329-13.12.29.898 -l localhost-1 -p
13:12:30.304 Starting slave: C:\vdbench502\vdbench SlaveJvm -m localhost -n localhost-12-160329-13.12.29.898 -l localhost-2 -p
13:12:30.335 Starting slave: C:\vdbench502\vdbench SlaveJvm -m localhost -n localhost-13-160329-13.12.29.898 -l localhost-3 -p
13:12:30.366 Starting slave: C:\vdbench502\vdbench SlaveJvm -m localhost -n localhost-14-160329-13.12.29.898 -l localhost-4 -p
13:12:30.397 Starting slave: C:\vdbench502\vdbench SlaveJvm -m localhost -n localhost-15-160329-13.12.29.898 -l localhost-5 -p
13:12:30.429 Starting slave: C:\vdbench502\vdbench SlaveJvm -m localhost -n localhost-16-160329-13.12.29.898 -l localhost-6 -p
13:12:30.460 Starting slave: C:\vdbench502\vdbench SlaveJvm -m localhost -n localhost-17-160329-13.12.29.898 -l localhost-7 -p
13:12:30.787 All slaves are now connected
13:12:32.001 Starting RD=rd1; I/O rate: Uncontrolled MAX; elapsed=10800; For loops: threads=5

Mar 29, 2016  interval        i/o   MB/sec   bytes   read     resp     read    write     resp     resp queue  cpu%  cpu%
                            rate  1024**2     i/o    pct     time     resp     resp      max   stddev depth sys+u   sys
13:12:37.080        1     9266.80  2316.70  262144 100.00    4.268    4.268    0.000   85.496    1.987  39.6   1.8   1.2
13:12:42.033        2     9368.20  2342.05  262144 100.00    4.239    4.239    0.000   21.271    1.371  39.7   2.4   1.2
13:12:47.018        3     9425.40  2356.35  262144 100.00    4.240    4.240    0.000   28.329    1.296  40.0   1.3   1.1
13:12:52.033        4     9434.00  2358.50  262144 100.00    4.238    4.238    0.000   23.148    1.068  40.0   1.6   1.2
13:12:57.033        5     9433.80  2358.45  262144 100.00    4.237    4.237    0.000   27.487    1.155  40.0   1.2   1.1
13:13:02.018        6     9433.60  2358.40  262144 100.00    4.240    4.240    0.000   27.787    1.213  40.0   1.2   0.9
```

Figure 37 First test showing line rate of 100% bandwidth of iSCSI traffic

The second test, involving just LAN traffic, showed the receiver host receiving LAN traffic from the source host. This confirmed the receiver host was capable of receiving LAN traffic at a 100% line rate.

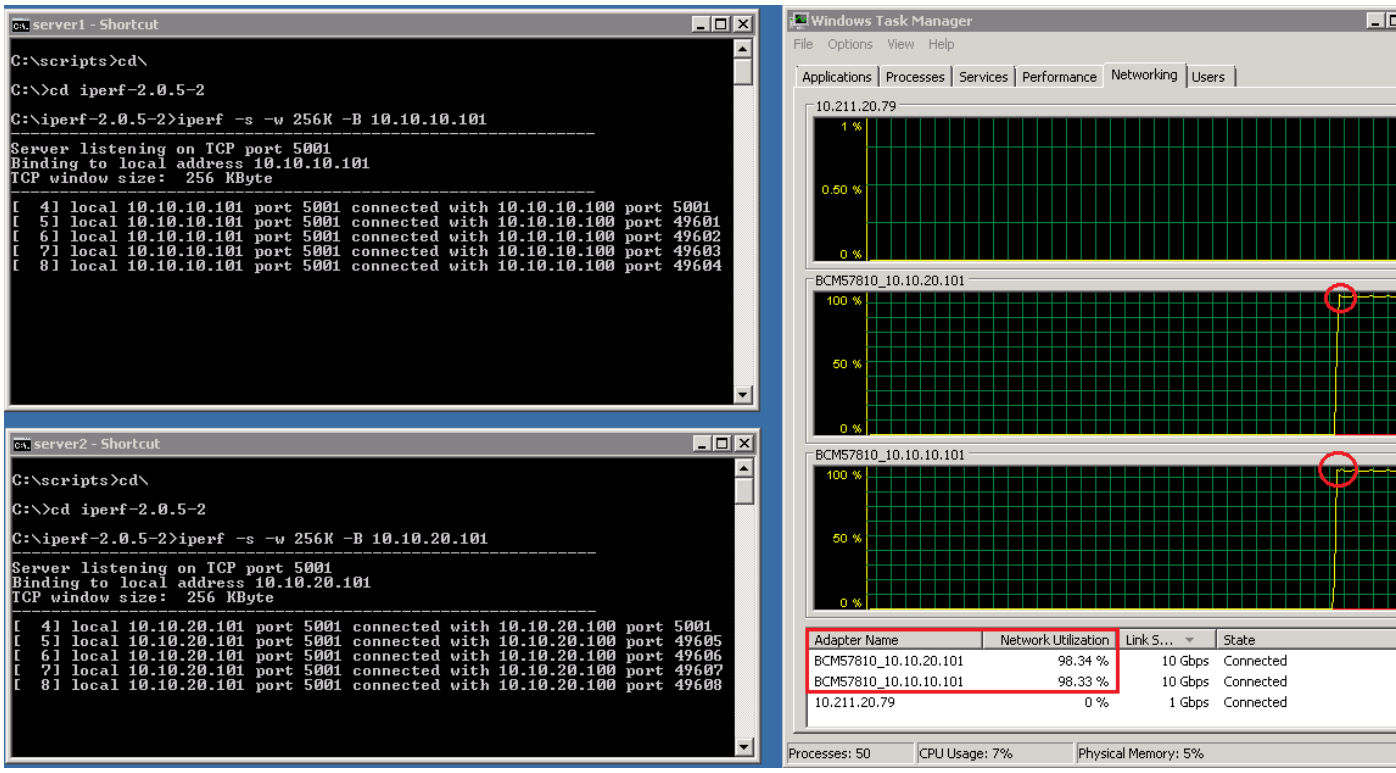

Figure 38 Second test showing line rate of 100% bandwidth of LAN traffic

The third test demonstrated the ability of the receiving host to simultaneously handle both LAN and iSCSI traffic on the same physical network segment while adhering to the 70% LAN/30% iSCSI DCB policy map defined on the switches.

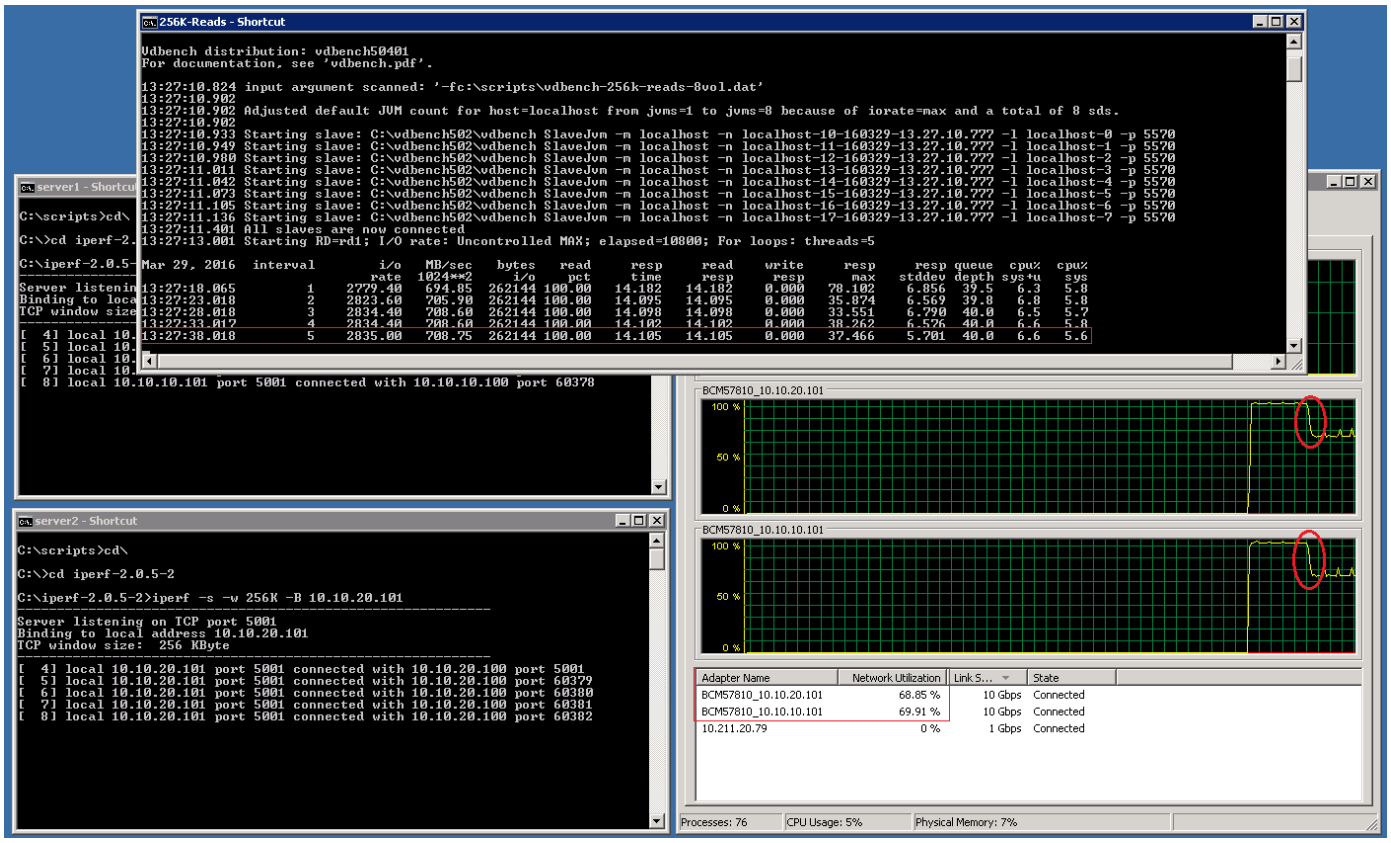

Figure 39 Third test showing converged LAN and iSCSI traffic adhering to the DCB policy map

A Additional resources

A.1 Technical support

Dell.com/support is focused on meeting customer needs with proven services and support. For additional support information on specific array models, see the following table.

Dell Storage	Online support	Email	Phone support (US only)
SC Series and Compellent	https://customer.compellent.com	support@compellent.com	866-EZ-STORE (866-397-8673)
SCv Series	http://www.dell.com/support	Specific to service tag	800-945-3355
XC Series	http://www.dell.com/support	Specific to service tag	800-945-3355
PS Series (EqualLogic)	http://eqlsupport.dell.com	eqlx-customer-service@dell.com	800-945-3355

Dell TechCenter is an online technical community where IT professionals have access to numerous resources for Dell software, hardware and services.

Storage Solutions Technical Documents on Dell TechCenter provide expertise that helps to ensure customer success on Dell Storage platforms.

A.2 Additional Resources

See the following referenced or recommended Dell publications:

- *Dell Storage Compatibility Matrix*: http://en.community.dell.com/dell-groups/dtcmedia/m/mediagallery/19856862.aspx
- *Data Center Bridging: Standards, Behavioral Requirements, and Configuration Guidelines with Dell EqualLogic iSCSI SANs*: http://en.community.dell.com/dell-groups/dtcmedia/m/mediagallery/20283700/download.aspx
- *Switch Configuration Guides for EqualLogic or Compellent*: http://en.community.dell.com/techcenter/storage/w/wiki/4250.switch-configuration-guides-for-EqualLogic-or-compellent-sans.aspx

A.3 Feedback

We encourage readers of this publication to provide feedback on the quality and usefulness of this information by sending an email to StorageSolutionsFeedback@dell.com.