

Intel® FCoE/DCB User Guide

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Last revised: 29 April 2014

Overview: Intel® FCoE/DCB User Guide

[FCoE VN to VN Support](#)

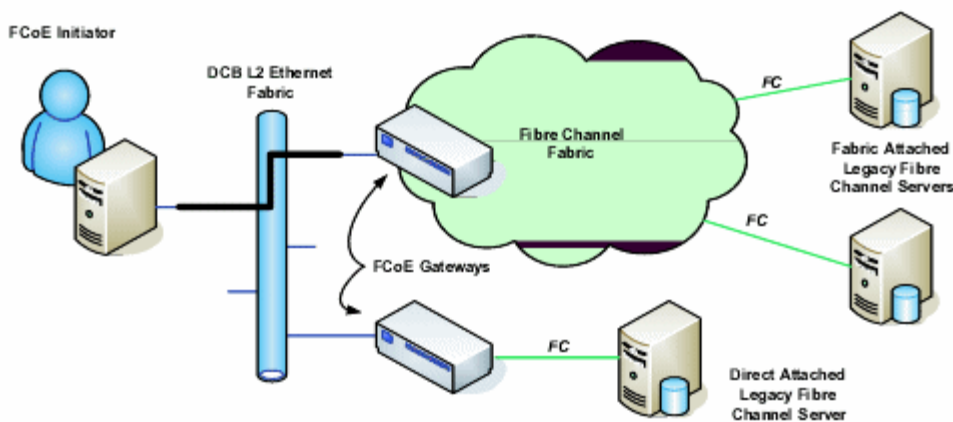
[Installation Overview](#)

[FCoE Infrastructure - Installation and Configuration](#)

Intel® FCoE (Fibre Channel Over Ethernet) is designed for 82599- and X540-based PCI-Express Server Adapters. This guide covers hardware and software installation, setup procedures, and troubleshooting tips for installing and booting the system using these adapters.

Fibre Channel over Ethernet (FCoE) is defined as the encapsulation of standard Fibre Channel (FC) protocol frames as data within standard Ethernet frames. This link level encapsulation, teamed with an FCoE-aware Ethernet-to-FC gateway, acts to extend an FC fabric to include Ethernet based host connectivity. The FCoE specification focuses on encapsulation of FC frames specific to storage class traffic, as defined by the Fibre Channel FC-4 FCP specification. FC is a market leading technology used to create Storage Area Networks (SANs).

[Data Center Bridging \(DCB\)](#) is a collection of standards-based extensions to classical Ethernet. It provides a lossless data center transport layer that enables the convergence of LANs and SANs onto a single unified fabric. In addition to supporting Fibre Channel Over Ethernet (FCoE) and iSCSI over DCB, it enhances the operation of other business-critical traffic.



FCoE VN to VN Support

The terms used in this section are defined below.

N_Port	A device port that generates/terminates FC-4 channel traffic
ENode (FCoE Node)	A Fibre Channel node (FC-FS-3) that is able to transmit FCoE frames using one or more ENode MACs
FCoE_LEP (FCoE Link End-Point)	The data forwarding component of an FCoE Entity that handles FC frame encapsulation/decapsulation and transmission/reception of encapsulated frames through a single Virtual Link
Lossless Ethernet network	An Ethernet network composed only of full-duplex links, Lossless Ethernet MACs, and Lossless Ethernet bridging elements
Virtual Link	The logical link connecting two FCoE_LEPs
VN_Port (Virtual N_Port)	An instance of the FC-2V sublevel of Fibre Channel that operates as an N_Port (see FC-FS-3) and is dynamically instantiated on successful completion of a FIP FLOGI or FIP NPIV FDISC Exchange
VN_Port MAC address	The MAC address used by an ENode for a particular VN_Port

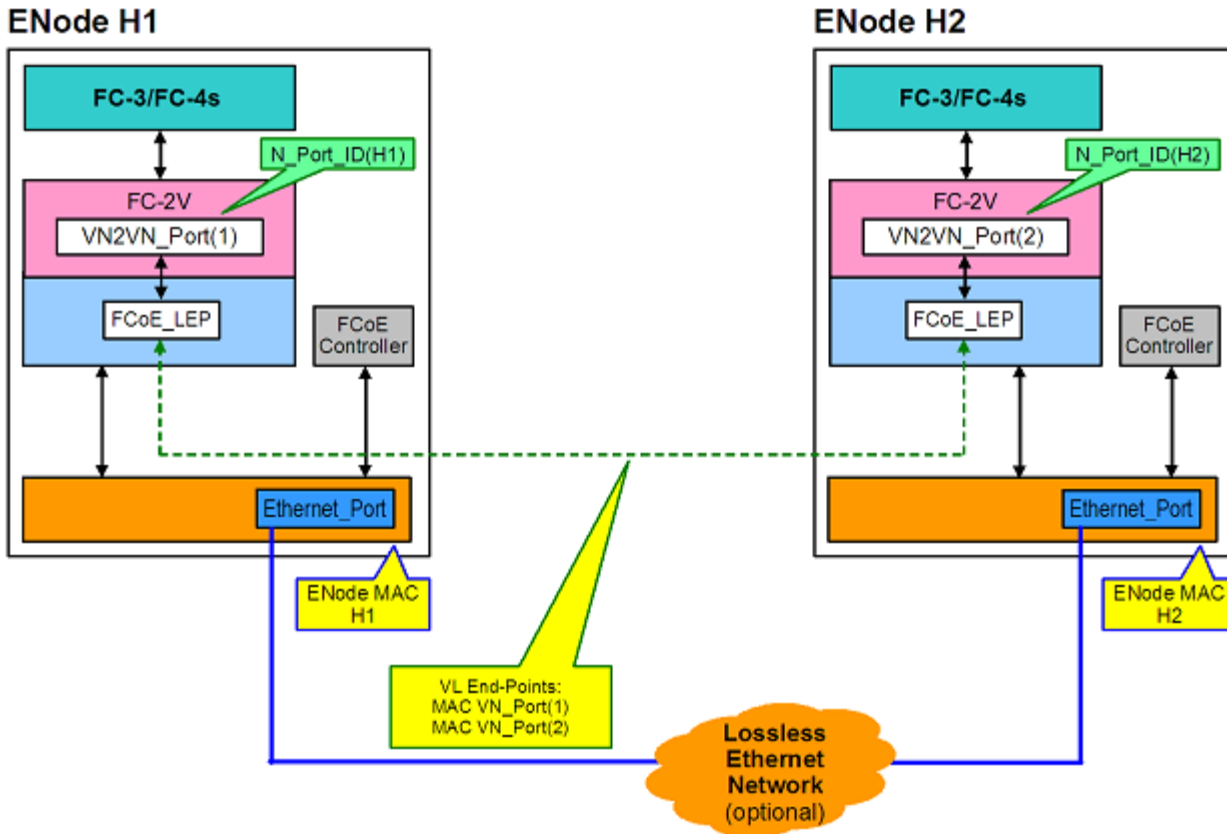
What is VN to VN?

FCoE VN to VN (VN2VN) support is a new proposal standard by T11 for connecting two end-nodes (ENodes) directly using FCoE. An ENode can create a VN2VN virtual link with another remote ENode without connecting to FC or FCoE switches (FCFs) in between, so neither port zoning nor advance fibre channel services are required. Storage software controls the access and security of LUNs using LUN masking. The VN2VN fabric may have a lossless Ethernet switch between the ENodes. This allows multiple ENodes to participate in creating more than one VN2VN virtual link in the VN2VN fabric. VN2VN has two operational modes: Point to Point (PT2PT) and Multipoint.

NOTE: The mode of operation is used only during initialization.

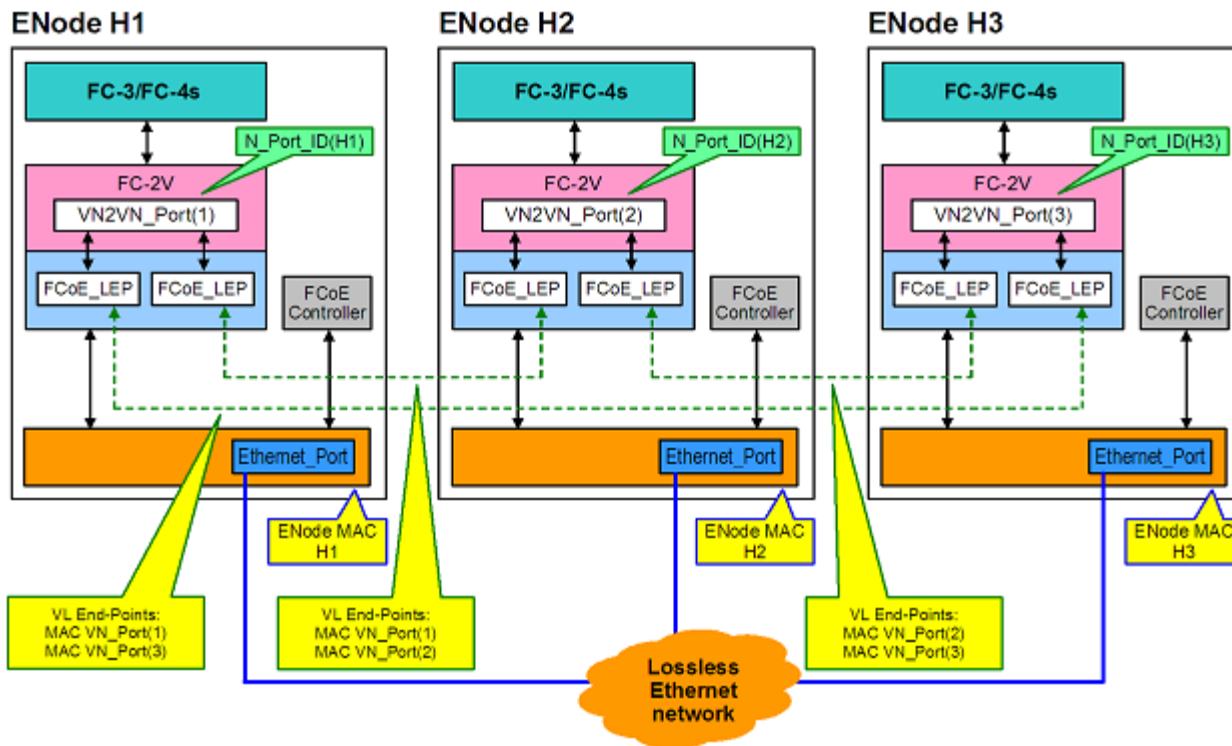
Point to Point (PT2PT) Mode

In Point to Point mode, there are only two ENodes. They are connected either directly or thru a lossless Ethernet switch:



MultiPoint Mode

If more than two ENodes are detected in the VN2VN fabric, then all nodes should operate in Multipoint mode:



Installation Overview

For information on System Requirements see [System Requirements](#).

1. Install FCoE-capable adapters in the system. For a list of supported adapters, see [Supported Intel® Network Adapters](#).
2. After following the above step if you are having problems, refer to [Known Issues](#).

FCoE Infrastructure - Installation and Configuration

The following is a typical FCoE setup flow:

1. Typical FCoE-enabled [Fabric Switch Configuration](#).
2. If you want to boot from an FCoE LUN:
 - o See [Intel® Ethernet FCoE Boot Configuration](#)
 - o Configure Intel® Ethernet FCoE Boot Options from [Intel® PROSet for Windows* Device Manager](#)
3. Install operating system:
 - o [Linux Installation and Configuration](#)
 - o [Microsoft* Windows* Server Installation and Configuration](#)
4. Configure Intel Ethernet FCoE/DCBx:
 - o Configure DCBx
 - o Configure FCoE

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System Requirements: Intel® FCoE/DCB User Guide

Before installing Intel® Server Adapters and Intel® Ethernet FCoE Protocol Driver, check your system for the following minimum configuration requirements.

[System Hardware Compatibility for Network Adapters](#)

[Supported Intel® Network Adapters](#)

[Supported 32-bit Operating Systems](#)

[Supported Intel® 64 Architecture Operating Systems](#)

System Hardware Compatibility for Network Adapters

- An FCoE-capable Intel® 82599- or X540-based Network Adapter. A list of supported Intel Server Adapters can be found below in Supported Intel® Network Adapters.
 - One of the following slot types, depending on your adapter:
 - A PCI Express slot (v1.0a or newer), x4, x8 or x16
 - The latest BIOS for your computer.
 - FCoE requires at least 4GB of RAM for optimum performance.
 - 10Gb network connection
-

Supported Intel® Network Adapters

Intel® FCoE is supported on the following Intel® 82599- and X540-based Network Adapters:

- Intel® Ethernet Server Adapter X520-2
- Intel® Ethernet X520 10GbE Dual Port KX4-KR Mezz
- Intel® Ethernet 2P X520 Adapter
- Intel® Gigabit 4P X520/I350 rNDC
- Intel® Ethernet 10G 2P X540-t Adapter
- Intel® Ethernet 10G 4P X540/I350 rNDC (I350 ports only)
- Intel® Gigabit 4P I350 bNDC



NOTE: When using FCoE Boot with an Intel networking adapter, a Brocade Host Bus Adapter (HBA) must not be installed in the system.

Intel® FCoE is *not* supported on the following adapters:

- Intel® Gigabit ET Dual Port Server Adapter
 - Intel® Gigabit ET Quad Port Server Adapter
 - Intel® Ethernet X520 10GbE Dual Port KX4 Mezz
 - Intel® Ethernet Server Adapter X520-T2
 - Intel® Gigabit 4P X520/I350 rNDC
 - Intel® Gigabit 4P X540/I350 rNDC
 - Intel® Gigabit 4P I350-t Mezz
 - Intel® Gigabit 2P I350-t Adapter
 - Intel® Gigabit 4P I350-t Adapter
 - Intel® Gigabit 4P I350-t rNDC
 - Intel® Gigabit 4P I350 bNDC
 - Intel® Gigabit 2P I350 LOM
-

Supported 32-bit Operating Systems

Intel® Ethernet FCoE Protocol Driver and Intel FCoE Remote Boot are supported on the following IA-32 operating systems:

- Microsoft* Windows* Server 2008 (with latest service pack and Hyper-V role) - Standard, DataCenter, or Enterprise
 - Microsoft Windows Server 2008 Core
-

Supported Intel® 64 Architecture (Intel® 64) Operating Systems

Intel® Ethernet FCoE Protocol Driver and Intel FCoE Remote Boot are supported on the following Intel® 64 operating systems:

- Microsoft* Windows Server* 2012
 - Microsoft Windows Server 2008 (with latest service pack and Hyper-V role) - Standard, DataCenter, or Enterprise
 - Microsoft Windows Server 2008 R2 SP1 (with latest service pack and Hyper-V role) - Standard, DataCenter, or Enterprise
 - Novell SUSE* Linux Enterprise 11, SP3
-

Jumbo Frames

The base driver supports FCoE mini-Jumbo Frames (2.5k bytes) independent of the LAN Jumbo Frames setting.

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Switch Configuration for Intel® Ethernet FCoE Protocol Driver: Intel® FCoE/DCB User Guide

[Nexus/Cisco Switch Platform](#)

[Brocade Switch Platform](#)

NOTES:

- In the following examples, the assumption is made that the VLAN and VSAN configurations have already been performed.
 - For more installation details check with your switch vendor's documentation:
 - [Cisco Nexus*](#)
 - [Brocade*](#)
-

Cisco Nexus* 5000 Series Switch Platform

For the Nexus/Cisco switch platform, a virtual interface is needed to bind the Ethernet port to the FC forwarder or FCF. Assume port 1/3 in the following example.

Commands to enable trunk mode for an Ether port:

```
configure
interface ethernet 1/3
switchport mode trunk
spanning-tree port type edge trunk
exit
```


Commands to create a VFC:

```
configure
interface vfc 3
bind interface ethernet 1/3
no shutdown
exit
```

Brocade* 8000 Series FCoE Switch

For the Brocade 8000 series FCoE switch, assuming port 1/3, vlan 101 for FCoE, use:

```
configure terminal
interface TenGigabitEthernet 1/3
switchport
switchport mode converged
vlan classifier activate group 1 vlan 101
no shutdown
cee default
exit
```

 **NOTES:** The "cmsh" command must be issued before the "configure terminal" command will function properly.

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Installation and Setup: Intel® FCoE/DCB User Guide

This section provides information for installing and setting up Intel® FCoE components. Follow the detailed instructions in [Microsoft* Windows Setup](#) or [Linux Setup](#).

Installing Firmware

In order to enable FCoE Boot, the firmware should be loaded as Option ROM while booting the BIOS in the system. "Intel(R) Ethernet FCoE Remote Boot" followed by the firmware version number is displayed, if the firmware is installed correctly.

 **NOTE:** If you are updating firmware from version 13.x, you must first update to version 14.0.12 before updating to firmware version 14.5.x or later.

See instructions on [installing firmware](#).

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Intel® Ethernet FCoE Boot: Intel® FCoE/DCB User Guide

[Upgrading an FCoE-Booted System](#)

[Preparing the Adapter for FCoE Boot](#)

[Intel® Ethernet FCoE Boot Option Rom Setup](#)

[Microsoft* Windows* Setup for Intel® FCoE Boot](#)

[Installing Windows Server from a Remote Disk \(Diskless Install\)](#)

[Installing Windows Server with Local Disk](#)

[Crash Dump Support](#)

[Intel® Ethernet Flash Firmware Utility](#)

Intel® Ethernet FCoE Boot allows the user to install FCoE to boot an operating system from a remote target. The following information refers specifically to Intel® Ethernet FCoE Boot. To configure the OS, go to: [Windows](#) or [Linux](#).



NOTE: If you are using FCoE boot, the FCoE must be installed and enabled. For information on how to install and enable the FCoE boot, see the [BootUtil](#) guide.

Booting from Targets Larger than 2TB

You can connect and boot from a target LUN that is larger than 2 Terabytes with the following restrictions:

- The block size on the target must be 512 bytes.
- The following operating systems are supported:
 - VMware* ESX 5.0, or later
 - SUSE* Enterprise Linux 11SP2, or later
 - Microsoft* Windows Server* 2012, or later
- You may be able to access data only within the first 2 TB.



NOTE: The Crash Dump driver does not support target LUNs larger than 2TB.

Upgrading an Intel® Ethernet FCoE-Booted System

Upgrading an FCoE-booted system can only be done via the Intel® PROSet for Windows* Device Manager installer. A reboot is required to complete the upgrade. You cannot upgrade a port's Windows driver and software package if the port is in the path to the virtual memory paging file and is also part of a Microsoft Server 2012 NIC Team (LBFO Team). To complete the upgrade, remove the port from the LBFO team and restart the upgrade.



Warning: Do not update the base driver via the Windows Update method

Doing so may render the system inoperable, generating a blue screen. The FCoE Stack and base driver need to be matched. The FCoE stack may get out of sync with the base driver if the base driver is updated via Windows Update.

Preparing the Adapter for FCoE Boot

Flash the adapter with FCoE Option ROM.



NOTE: If you are updating firmware from version 13.x, you must first update to version 14.0.12 before updating to firmware version 14.5.x or later.

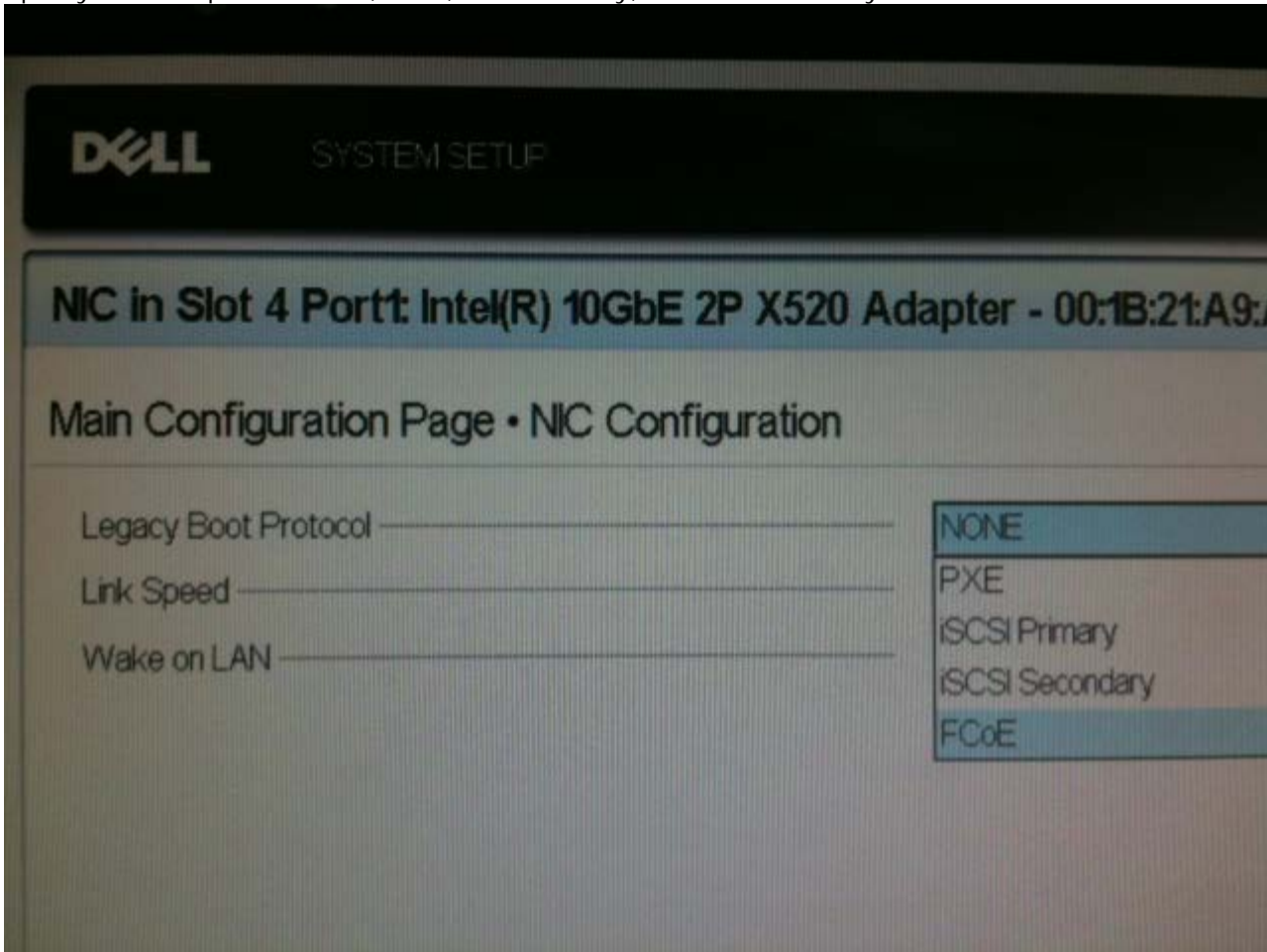
For the following adapters, FCoE is enabled through the uEFI environment.

- Intel® Ethernet 10G 2P X520 Adapter
- Intel® Ethernet 10G 2P X520-k bNDC

- Intel® Ethernet 10G 4P X520/I350 rNDC
- Intel® Ethernet 10G 2P X540-t Adapter
- Intel® Ethernet 10G 4P X540/I350 rNDC

To do this:

- Go to System Setup.
- Choose a port and go to configuration.
- Specify the boot protocol: PXE, FCoE, iSCSI Primary, or iSCSI Secondary.



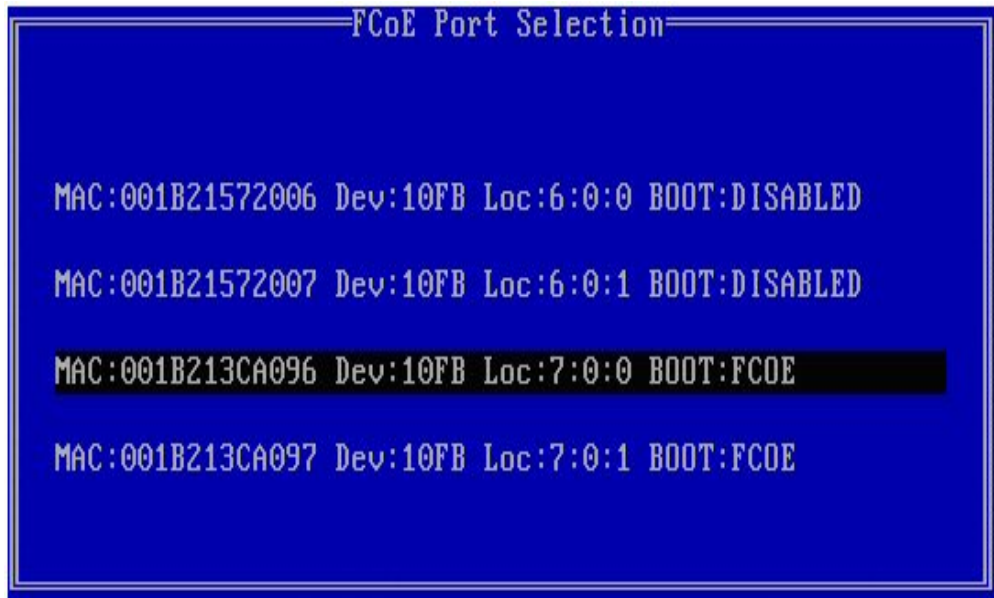
For other adapters, go to the Intel Ethernet drivers CD: \Bootutil\Bootutil /?.

Intel® Ethernet FCoE Boot Option Rom Setup

To configure Intel® Ethernet FCoE Boot, power-on or reset the system and press the Ctrl-D key when the message "Press <Ctrl-D> to run setup..." is displayed. After pressing the Ctrl-D key, you will be taken to the Intel® Ethernet FCoE Boot Port Selection Setup Menu.

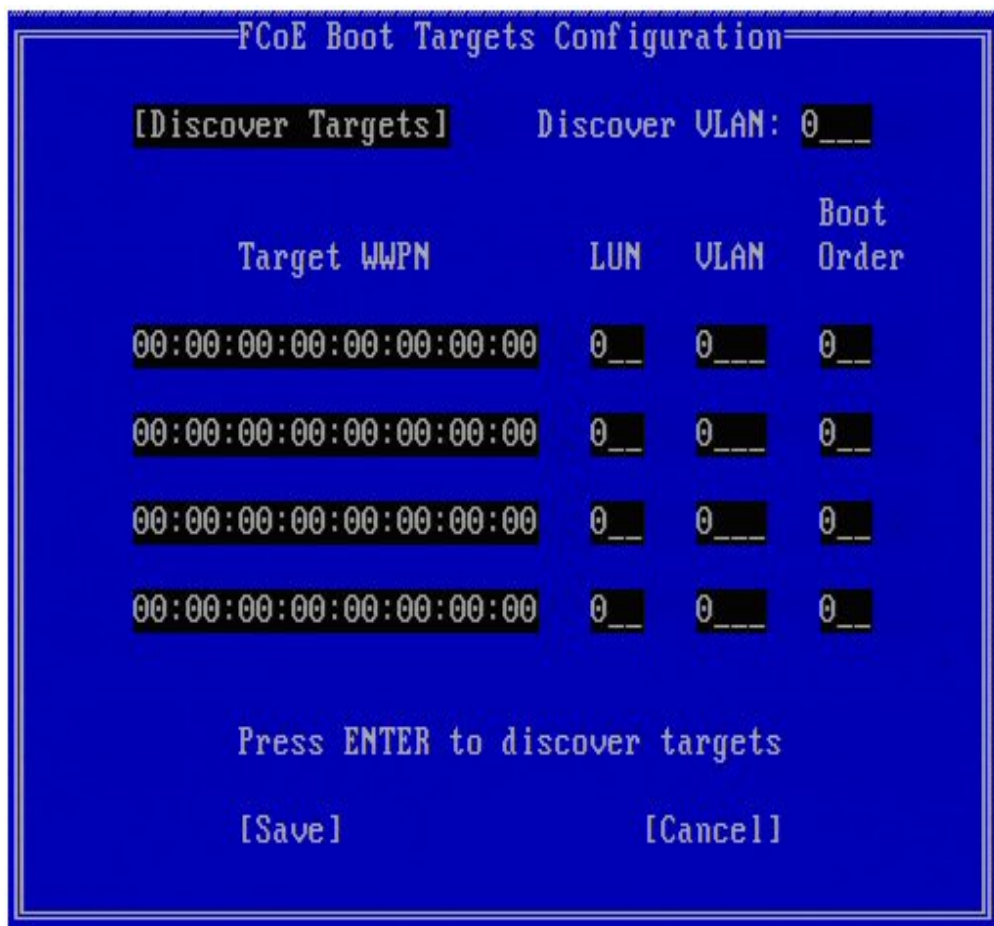
FCoE Port Selection Menu

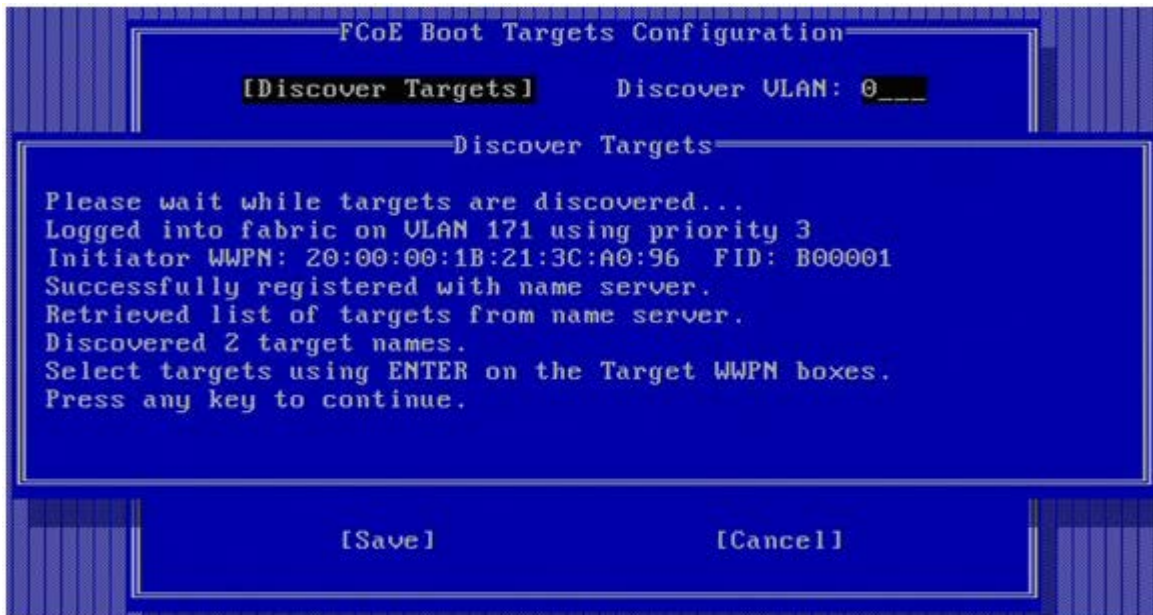
The first screen of the Intel® Ethernet FCoE Boot Setup Menu displays a list of Intel® FCoE Boot-capable adapters. For each adapter port, the associated SAN MAC address, PCI device ID, PCI bus/device/function location, and a field indicating FCoE Boot status is displayed. Up to 10 FCoE Boot-capable ports can be displayed within the Port Selection Menu. If there are more Intel® FCoE Boot-capable adapters, these are not listed in the setup menu. Highlight the desired port and press **Enter**.



FCoE Boot Targets Configuration Menu

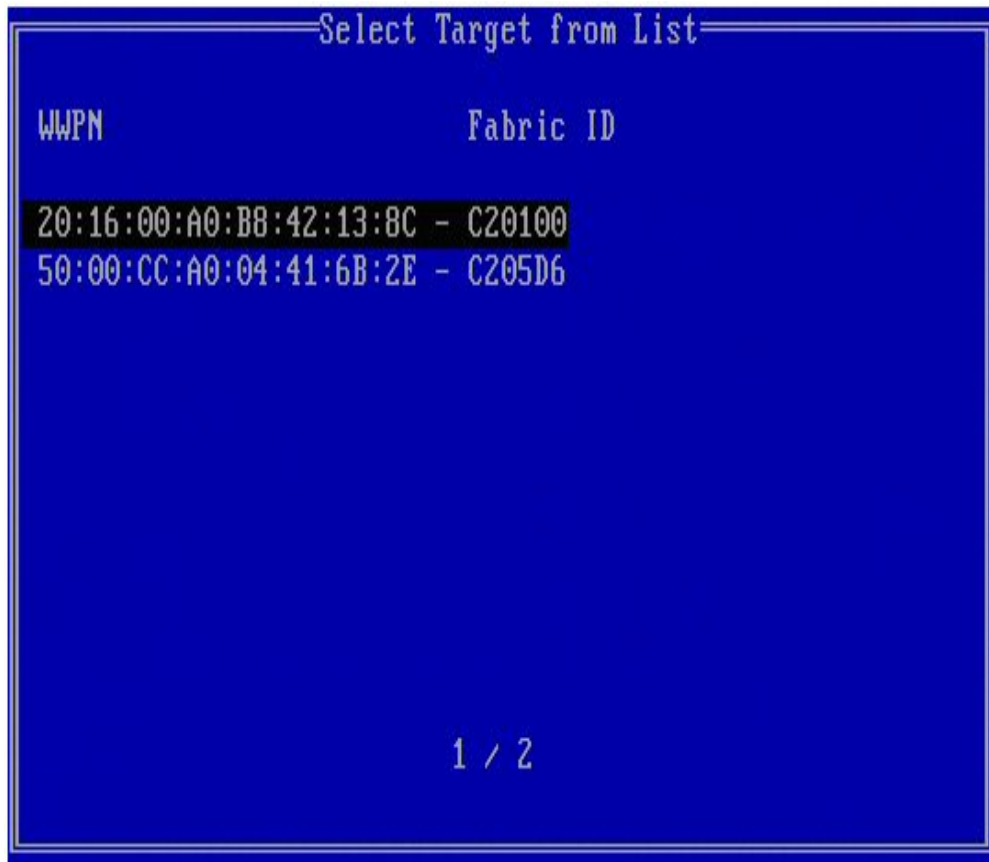
FCoE Boot Targets Configuration: **Discover Targets** is highlighted by default. If the **Discover VLAN** value is not what you want, enter the correct value. Highlight **Discover Targets** and then press **Enter** to show targets associated with the **Discover VLAN** value. Under **Target WWPN**, if you know the desired WWPN you can manually enter it or press **Enter** to display a list of previously discovered targets.





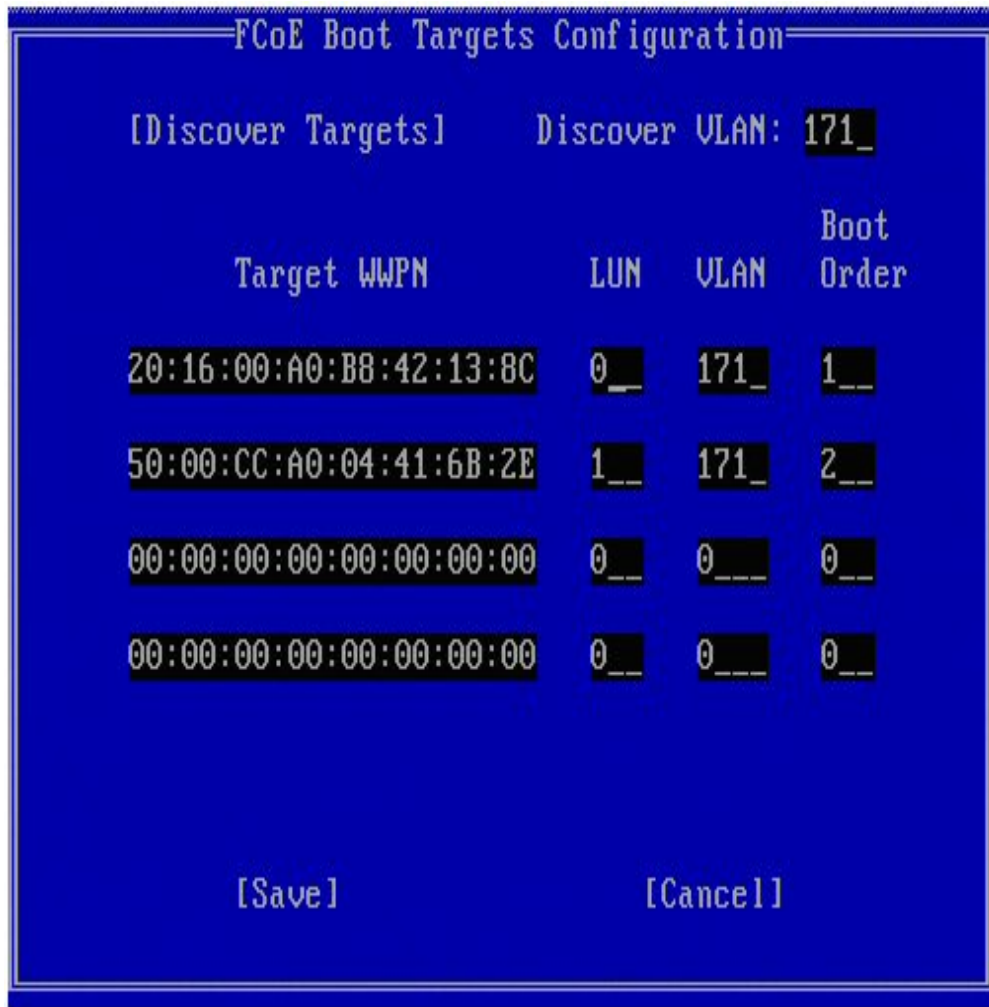
FCoE Target Selection Menu

From the FCoE Target Selection menu, highlight the desired **Target** from the list and press **Enter**.



From the FCoE Boot Targets Configuration menu, manually fill in the **LUN** and **Boot Order** values. Hit **Save**.

- VLAN** Value is 0 by default. Discover Targets may be performed, which will display a VLAN. If the VLAN displayed is not the one desired, enter the VLAN manually and perform Discover Targets on that VLAN.
- Boot Order** Valid values are 0 through 4, where a value of 0 means no boot order or ignore the target. A 0 value also indicates that this port should not be used to connect to the target. Boot order values of 1 through 4 can only be assigned once to targets across all FCoE boot enabled ports.



To configure another target, select the desired target from the list or the same target with a different LUN. This process can be repeated until all desired targets have been configured.

NOTE: After the **Discover Targets** function is executed, the Option ROM will attempt to remain logged into the fabric until the **FCoE Boot Targets Configuration Menu** is exited.

NOTE: For more detailed instructions and description of a typical installation and setup click [here](#).

Keyboard Shortcuts

Up/Down, TAB and SHIFT-TAB	Move between the controls.
Left/Right/Home/End/Del/Backspace	Move in the edit boxes.
Esc key	Leave the screen.

Intel® PROSet for Windows* Device Manager

Many of the functions of the Intel® FCoE Boot Port Selection Setup Menu can also be configured or revised using Intel® PROSet for Windows Device Manager. For details on installing and using Intel® PROSet for Windows Device Manager, see the Intel® Network Adapters User Guide.

- Intel® Ethernet FCoE boot version is displayed on the **Boot Options** tab if the combo image supports FCoE boot.
- Intel® Ethernet FCoE Boot is an **Active Image** option if FCoE boot is supported by the combo image.
- The **Active Image** setting enables/disables FCoE boot in the EEPROM.
- Intel® Ethernet FCoE boot settings are displayed if **FCoE Boot** is the active image.

Microsoft* Windows* Setup for Intel® FCoE Boot




Requirements

1. Follow installation steps to install the Intel® Ethernet FCoE Boot-capable adapters with Intel® Ethernet FCoE Boot firmware support.
 2. Create a disk target (LUN) on an available Fibre Channel target. Configure this LUN to be accessible to the WWPN address of the initiator of the host being booted.
 3. Make sure the Intel® FCoE initiator of the host system starts the Intel® Ethernet FCoE Boot firmware. The firmware should be configured properly, be able to connect to Fibre Channel target, and detect the boot disk.
 4. To set up a system boot directly to an FCoE disk ("diskless install"), follow the steps in [Installing Windows Server from a Remote Disk](#).
 5. To set up Windows Server* boot system when a local disk is available, follow the steps in [Installing Windows Server with Local Disk](#).
-

Installing Windows Server from a Remote Disk (Diskless Install)

 **NOTE:** This section only applies to Microsoft Windows Server 2008 R2 and later.

After the Option Rom is installed, if you wish to install Windows Server 2008 R2 directly to the FCoE disk, do the following:

1. Locate the FCoE drivers in \FCOEBOOT\Winx64\Setup. You may copy all the files in the Setup directory to a floppy, CD/DVD or USB media.
 2. Boot the install media.
 3. Perform a Custom install and proceed to the "Where do you want to install Windows?" screen.
 4. Use **Load Driver** to load the FCoE drivers. Go to the location where you copied the file from the Setup directory to (Step 1) and load the following two drivers in the specified order:
 - a. Intel® Ethernet Setup Driver for FCoE.
 -  **NOTE:** Duplicate entries may be displayed if there are multiple FCoE-capable ports present. Select any one entry to continue.
 - b. Intel® Ethernet Virtual Storage Miniport Driver for FCoE.
 -  **NOTE:** The FCoE drivers will block any other network traffic from the FCoE-supported ports until after you have performed step 7. Do not attempt to install an NDIS miniport for any FCoE-supported ports prior to step 7 of this process.
 5. You should now see the FCoE disk or disks appear in the list of available install targets. All disks accessible by this initiator through the boot port should appear.
 6. Select the FCoE disk configured for boot in the Option ROM and continue the install until Windows is installed and you are at the desktop.
 7. Follow the instructions for installing Windows Server and the [FCoE stack](#). This will install the network drivers and configure the FCoE drivers to work with them.
 -  **NOTE:** You cannot deselect the FCoE feature. You will be prompted to reboot at the end of the installation process.
 8. Windows may prompt you to reboot once again after it returns to the desktop.
-

Installing Windows Server with Local Disk

After the Option Rom is installed, if you wish to install Windows Server 2008 or Windows Server 2012 with local disk, do the following:

1. Follow the instructions for installing Windows Server and the [FCoE stack](#).
2. Verify that the FCoE boot disk is available in the **Fabric View** tab of Intel® PROSet for Windows Device Manager and verify that the FCoE Target LUN has been recognized as a disk by Windows Disk Management and is online.
3. Open a command prompt, run the fcoeprep.bat batch file. The batch file is located in \Program Files\Intel\Umb\Win32\FCOEBOOT or \Program Files\Intel\Umb\Winx64\FCOEBOOT.
4. Shut Windows down and capture the OS image to a local disk partition.

The image file must be on a separate local disk other than the operating system boot disk. The OS may have an additional system reserved partition that needs to be included in the image file. Thus, it is advisable to image the OS disk rather than just the OS partition. For more information, see [Detailed Instructions for Installing Windows Server with Local Disk](#).

5. Copy the image from the local hard drive to the FCoE target, making sure that the FCoE target LUN is larger than the image size. This may be done from within the local Windows installation after the image files was created.
6. For Windows 2008 R2 SP1 or later: Run bcdboot.exe from the local Windows installation to make the FCoE disk bootable.
 - o If a System Reserved partition exists on the FCoE disk, type: `bcdboot F:\Windows /s E:`
where E: is the FCoE System Reserved partition and F: is the FCoE partition with the Windows directory.
 - o If a System Reserved partition does not exist, type: `bcdboot E:\Windows /s E:`
where E: is the FCoE partition with the Windows directory.
7. Shut down and remove the local disk.
8. Configure the system BIOS to boot from the FCoE disk and boot.

Crash Dump Support

Crash dump file generation is supported in this release.

 **NOTE:** Crash dumps will work with up to 8 GB of system memory.

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Microsoft* Windows* Installation and Configuration: Intel® FCoE/DCB User Guide

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Upgrading Windows Drivers on an Intel® FCoE-Booted System

Upgrading an FCoE-booted system can only be done via the Intel® Network Connections Installer. A reboot is required to complete the upgrade. You cannot upgrade a port's Windows driver and software package if the port is in the path to the virtual memory paging file and is also part of a Microsoft Server 2012 NIC Team (LBFO Team). To complete the upgrade, remove the port from the LBFO team and restart the upgrade.



WARNING: Do not update the base driver via the Windows Update method.

Doing so may render the system inoperable, generating a blue screen. The FCoE Stack and base driver need to be matched. The FCoE stack may get out of sync with the base driver, if the base driver is updated via Windows Update.

Validation and Storage Certification

The software components for Intel® Ethernet FCoE are comprised of two major components: the Ethernet base driver and the FCoE Driver. They are developed and validated as an ordered pair. Users are strongly encouraged to avoid scenarios, either through upgrades or Windows update, where the Ethernet driver version is not the version released with the corresponding Intel® Ethernet FCoE driver. For more information, visit the download center at <http://downloadcenter.intel.com>.



NOTES:

- Individually upgrading/downgrading the Intel® Ethernet FCoE driver will not work and may cause a blue screen; the entire FCoE package must be the same version. Upgrade the entire FCoE package using Intel® Network Connections only.
- If you uninstalled the Intel® Ethernet Virtual Storage Miniport Driver for FCoE component, just find the same version that you uninstalled and re-install it; or uninstall and then re-install the entire FCoE package.

Intel and the storage vendors spend considerable effort ensuring that their respective products operate with each other as expected for every version that we release. However, given the sheer number of releases and each respective organization's differing schedules, users are **strongly encouraged** to use their storage vendor's support matrix to ensure that the versions that they are deploying for the Intel® Ethernet Protocol Driver, the switch and storage vendor have been tested as an integrated set.

Windows* Server Installation

From the setup.exe install menu: Click the FCoE over Data Center Bridging checkbox to install Intel® Ethernet FCoE Protocol Driver and DCB. The MSI Installer installs all FCoE and DCB components including the Base Driver.



NOTES:

- FCoE is supported on 82599- and X540-based Intel® Network Connections.
- It is recommended to install using the latest storage qualified image.
- For current drivers and documentation, visit the [Customer Support](#) site.

Microsoft Hotfixes

The following Microsoft hotfixes have been found to be needed for specific use cases:

All Windows Server 2008 (R1 and R2)

- KB983554 - High-performance storage devices fix

Windows Server 2008 R2

- KB2708811 - Data corruption occurs under random write stress

Multipath I/O (MPIO)

Windows Server 2008 R1 SP2

- KB970525 - MPIO
- KB972797 - MS DSM
- KB974646 - NTFS
- KB976748 - MPIO - reboot fix
- KB979743 - MPIO - write errors
- KB981379 - MS DSM - target issues

Windows Server 2008 R2

- KB979743 - MPIO - write errors
- KB981379 - MS DSM - target issues

Windows Server 2008 R2 SP1

- KB2406705

Configuring MPIO Timers: <[http://technet.microsoft.com/en-us/library/ee619749\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/ee619749(WS.10).aspx)> contains additional information about these registry settings.

Set the PathRecoveryInterval value to 60.

iSCSI Over DCB - QOS Binding

Windows 2008 R1 SP2

- KB2518021

Configuration Using Intel® PROSet for Windows* Device Manager

[Storage Adapter Miniport Device Property Window Tabs](#)

[Network Adapter Miniport Device Property Window Tabs](#)

Many FCoE functions can also be configured or revised using Intel PROSet for Windows Device Manager, from the **FCoE Properties** button within the **Data Center** tab. You can use the Intel PROSet for Windows Device Manager to perform the following tasks:

- Configure FCoE initiator-specific settings
- Go to the corresponding port driver
- Review FCoE initiator information
- Obtain general information
- Review statistics
- Obtain information about the initiator
- Obtain information about attached devices
- FIP discovered VLANs and status

In addition, FCoE RSS performance settings are available in the base driver Advanced tab. If FCoE is installed, FCoE RSS is enabled and applies to FCoE receive processing that is shared across processor cores. If your adapter supports FCoE RSS, the following configuration settings can be viewed and changed under the Performance Options of the Advanced tab of the Network Adapter device properties:

- **Starting NUMA Node.** This setting specifies the NUMA node on which the first FCoE queue is allocated.
- **NUMA Node Count.** This setting specifies the total number of NUMA nodes to be used to assign FCoE queues.
- **Starting RSS Core Offset.** This setting specifies the core number on the starting NUMA node on which the first FCoE queue is allocated.

Instructions for installing and using Intel® PROSet for Windows Device Manager are described in the Intel® Network Adapters User Guide.

NOTE: PROSetCL.EXE is used for DCB/FCoE configuration on Microsoft* Windows Server* 2008 Core, Microsoft Windows Server 2008 R2 Core, and Microsoft Windows Server 2012 operating systems.

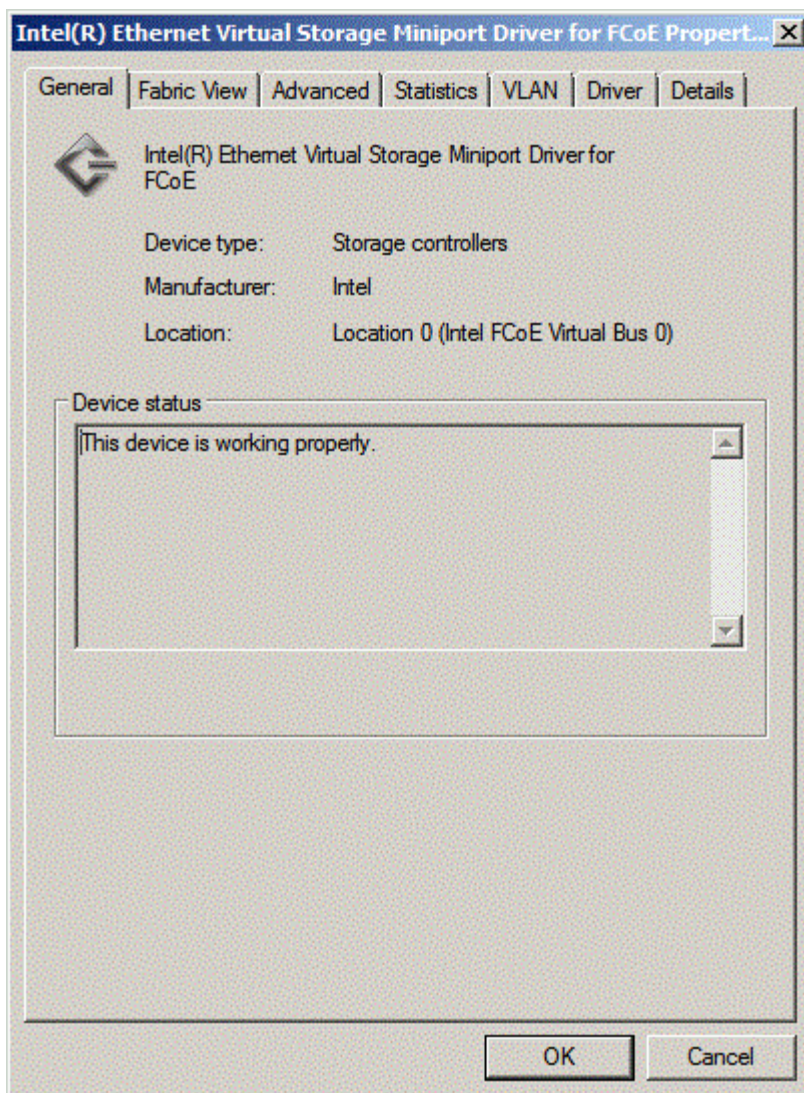
NOTE: From the **Boot Options Tab**, the user will see the **Flash Information Button**. Clicking on the **Flash Information Button** will open the **Flash Information Dialog**. From the **Flash Information Dialog**, clicking on the **Update Flash** button in the Boot Options tab allows Intel® iSCSI Boot, Intel® Boot Agent (IBA), Intel® FCoE Boot, and CLP to be written. The update operation writes a new image to the adapter's Flash and modifies the EEPROM, which may temporarily disable the operation of the Windows* network device driver. You might need to reboot the computer following this operation.

You cannot update the flash image of a LOM; this button will be disabled.

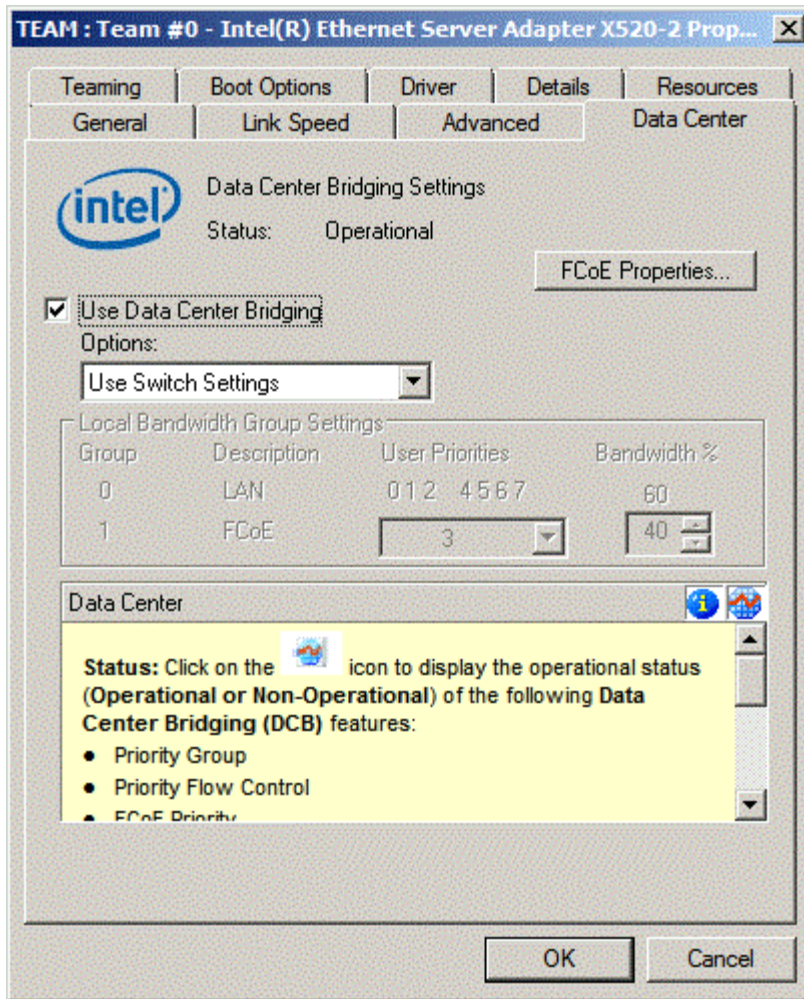
Storage Adapter Miniport Device's Property Window Tabs

There are two ways to navigate to the FCoE properties:

- Through the Intel Ethernet Virtual Storage Miniport Driver for FCoE Storage Controllers properties from the Windows Device Manager.



- Through the network adapter properties Data Center tab.



Fabric View Tab

The Fabric View tab displays FC fabrics, VN2VN fabrics, physical ports, targets, and LUNs:

- If *FC fabric* is selected, the FCoE GUI displays the information in the "Fabric Information" group box (World Wide Node Name, World Wide Port Name, FCID)
- If *VN2VN fabric* is selected, the FCoE GUI displays the information in the "Fabric Information" group box (FC Map).
- If a *physical port* is selected, the FCoE GUI displays the information in the "Physical Port" group box (World Wide Node Name, World Wide Port Name, FCID).
- If a *target* is selected, the FCoE GUI displays the information in the "Target Information" group box (World Wide Node Name, World Wide Port Name).
- If a *LUN* is selected, the FCoE GUI displays the information in the "LUN Information" group box (LUN ID, OS Device Name, Capacity, Block Size).

For general information about VN2VN, see [FCoE VN to VN Support](#).

Advanced Tab

The Advanced Tab displays information about all the settings configurable from the host. These include Timeout Value, DeviceQDepth and Linkdown Timeout.

Statistics Tab

The Statistics Tab displays information about FCoE statistics and errors since the initialization of the FCoE stack.

VLAN Tab

VLAN IDs are obtained through FIP VLAN discovery. This is a read-only page.

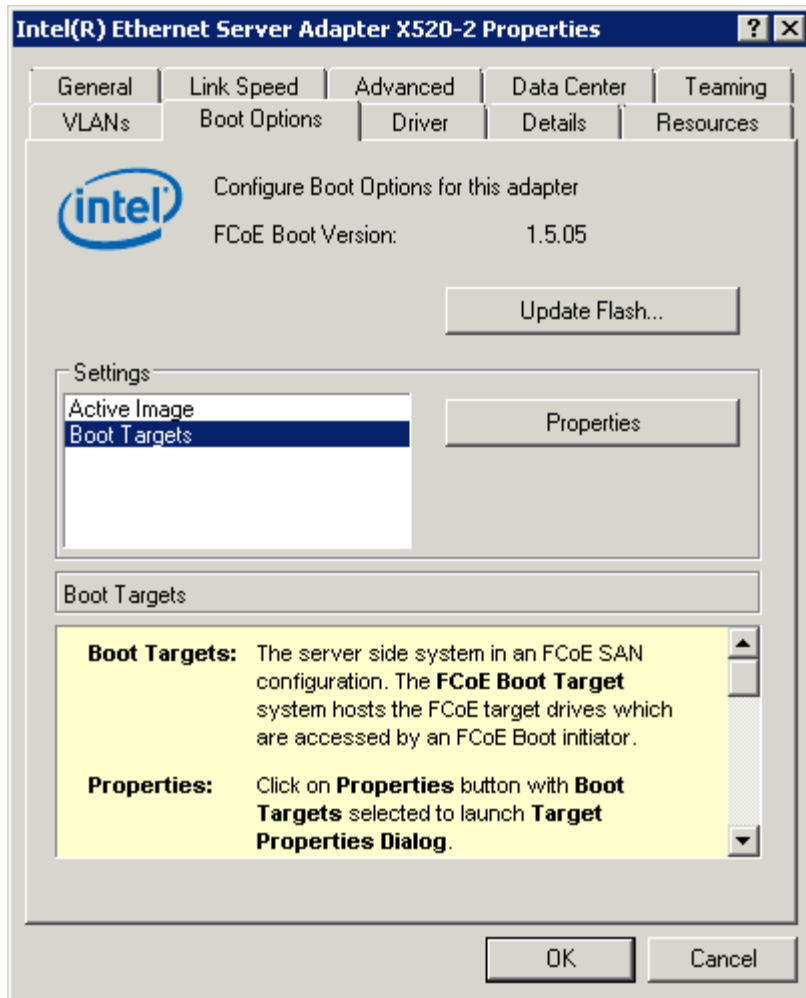
Virtual Ports Tab

A list of the Virtual Ports associated with the HBA has a column for the WWPN and FCID for each Virtual Port. "Not Connected" is displayed in the FCID column if it is not logged in to a target.


Network Adapter Device's Property Window Tabs

Boot Options Tab

From the Boot Options tab, you can obtain Target information and update the Flash.



Properties Button Click on **Properties** button with Boot Targets selected to launch **Target Properties Dialog**.

 **NOTE:** This button displays if you have either iSCSI or FCoE boot enabled and a target selected in the Settings list.

Target Properties Dialog

Target: Each **Target** field contains WWPN numbers for the FCoE boot targets discovered on the network and None Selected.

LUN: Each **LUN** field displays the LUNs on the selected target. If no target is selected, the **LUN** field is empty.

Boot Order: Boot Order field options are 1, 2, 3, 4, and Not Set.

LUN and **Boot Order** fields are disabled and cleared when target is set to **None Selected**.

Intel Ethernet® FCoE Boot cannot be enabled on an adapter that has a VLAN or is in a team. If the current adapter is in a team or has a VLAN, then all fields are disabled.

Active Image

Enables/disables the boot options in the EEPROM. The update operation modifies the EEPROM to enable an option ROM, already contained within the flash. This may temporarily disable the operation of the Windows* network device driver. You might need to reboot the computer following this operation.

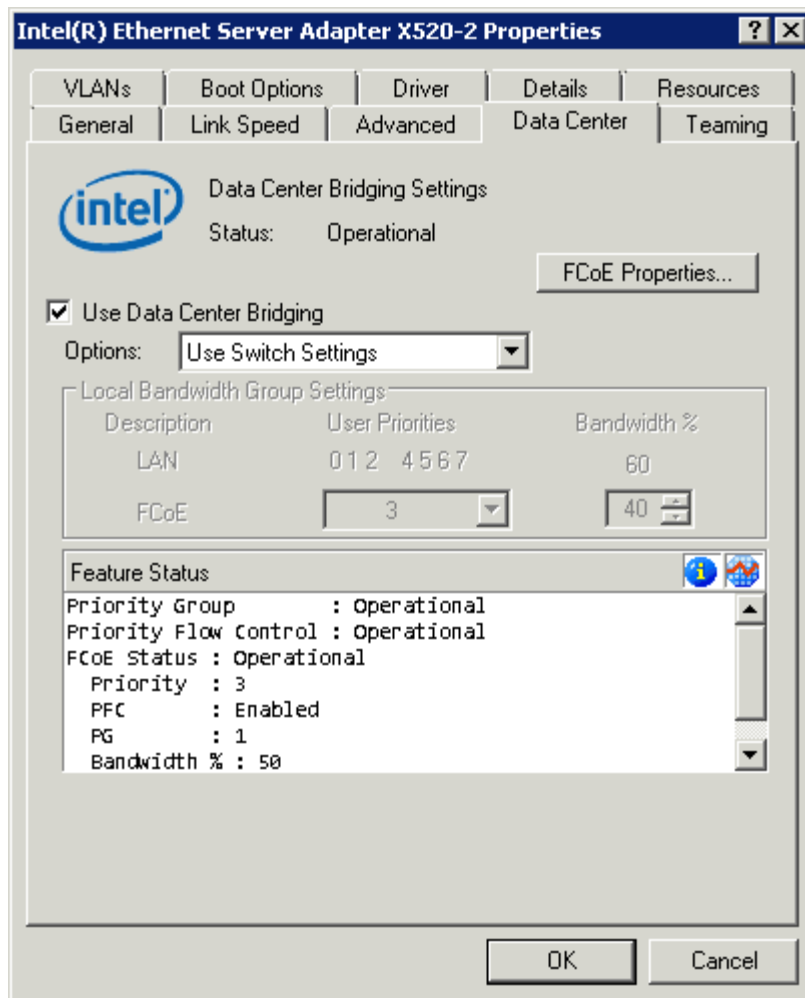
Boot Targets

The server-side system in an FCoE SAN configuration. The FCoE Boot Target system hosts the FCoE target drives that are accessed by an FCoE Boot initiator.

Data Center Tab

From the Data Center tab, you can enable/disable Data Center Bridging (DCB), view DCB Feature status, and access the storage adapter miniport device's FCoE properties tabs.

The **Use Data Center Bridging** box must be checked (DCB enabled) to use Intel FCoE.



Options

When **Using Advanced Settings** is indicated, Data Center Bridging (DCB) was configured locally, using a tool like SNMP, in a way which does not match the Use Switch Settings template. The Use Switch Settings template is Enabled, Advertising, and Willing for all DCB features.

If you select **Use Switch Settings**, any Advanced configuration is overwritten.

NOTES: You cannot disable DCB while the system is booted from an FCoE drive or if the system paging file is on an FCoE drive. The options on the Data Center tab will be grayed out if you try.

DCB Feature Status

A non-operational status is most likely to occur when Use Switch Settings is selected or Using Advanced Settings is active. This is generally a result of one or more of the DCB features not getting successfully exchanged with the switch. Possible problems include:

1. One of the features is not supported by the switch.
2. The switch is not advertising the feature.
3. The switch or host has disabled the feature (this would be an advanced setting for the host).

The **DCBx Version Number** will be one of the following:

- IEEE 802.1Qaz (<https://standards.ieee.org/findstds/standard/802.1Qaz-2011.html>)
- CEE (<http://www.ieee802.org/1/files/public/docs2008/dcb-baseline-contributions-1108-v1.01.pdf>)
- CIN/Pre-CEE



NOTES: The OS DCBx stack will default to CEE DCBx. If a peer is transmitting IEEE TLVs, it automatically transitions to IEEE DCBx.

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Detailed Instructions for Installing Microsoft* Windows* Server: Intel® FCoE/DCB User Guide

[Requirements](#)

[Detailed Instructions for Installing Windows Server with Local Disk](#)

[Appendix 1: WinPE](#)


[Appendix 2: ImageX](#)

[Appendix 3: DiskPart](#)

Requirements

- [Microsoft ImageX](#)
 - [Microsoft WinPE](#) v2.1 or later
-

Detailed Instructions for Installing Windows Server with Local Disk

 **NOTE:** Follow these steps to install Intel® Ethernet FCoE Boot for Windows. Please be sure to read the Appendix information when directed; they contain important details.

Prepare for partition imaging

1. On the test server, set up the local disk drives. These instructions will cover imaging with a partition imaging tool, so at a minimum a second partition will be needed to store the captured image. If the entire Windows disk will be captured, then a second local disk will be required.

Prepare the adapter for FCoE boot

 **NOTE:** If the FCoE Option ROM does not find the FCoE LUN, perform steps 2-4. Otherwise, skip to step 5.

2. Flash adapter with FCoE Option ROM.
 - a. Intel® Ethernet drivers CD: \BootUtil\Bootutil /?
 - b. For the following adapters, FCoE is enabled through the uEFI environment.
 - Intel® Ethernet 10G 2P X540-t Adapter
 - Intel® Ethernet 10G 4P X540/I350 rNDC
 - Intel® Ethernet 10G 2P X520 Adapter
 - Intel® Ethernet 10G 2P X520-k bNDC
 - Intel® Ethernet X520 10GbE Dual Port KX4-KR Mezz

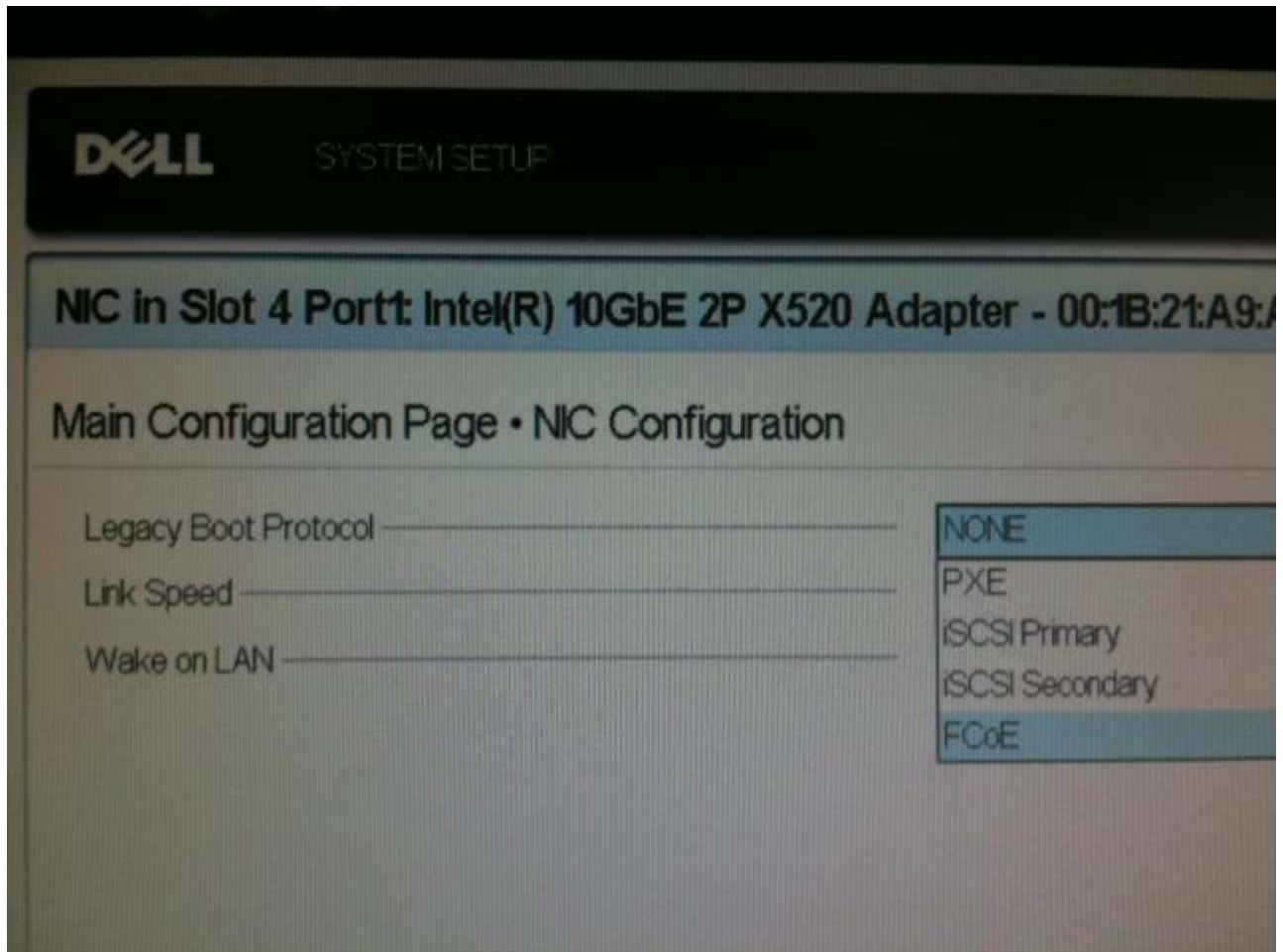
To do this:

- i. Go to System Setup.
- ii. Choose a port and go to configuration.
- iii. Specify the boot protocol: PXE, FCoE, iSCSI Primary, or iSCSI Secondary.


 **NOTE:** The following adapters do not support the FCoE boot protocol:

- Intel® Gigabit ET Dual Port Server Adapter
- Intel® Gigabit ET Quad Port Server Adapter
- Intel® Ethernet X520 10GbE Dual Port KX4 Mezz
- Intel® Ethernet Server Adapter X520-T2
- Intel® Gigabit 4P X520/I350 rNDC
- Intel® Gigabit 4P X540/I350 rNDC
- Intel® Ethernet X520 10GbE Dual Port KX4 Mezz
- Intel® Gigabit 4P I350-t Mezz

- Intel® Gigabit 2P I350-t Adapter
- Intel® Gigabit 4P I350-t Adapter
- Intel® Gigabit 4P I350-t rNDC
- Intel® Gigabit 4P I350 bNDC
- Intel® Gigabit 2P I350 LOM



3. Configure the Option ROM to boot from an FCoE LUN:
 - a. Input Ctrl+D during boot message.
 - b. Select the boot port.
 - c. Select Discover Targets.
 - d. Choose a target, enter its LUN and set its boot order to 1.

 **NOTE:** Once Intel® Ethernet FCoE drivers are installed, in order to uninstall them the Option ROM must not be allowed to connect to an FCoE LUN. Either disable the boot port in the Option ROM or set all boot orders to 0.

4. During POST ensure that the FCoE Option ROM loads and finds the LUN.
5. Ensure local disk is set as first boot option in system BIOS boot menu.

Install the OS and drivers

6. Install Windows Server on the first local drive.
7. Boot to the OS on the local disk. Install Intel® Ethernet drivers via CD, selecting **FCoE Using Data Center Bridging**. Windows 2008 may ask to install an update and request a reboot. Click **OK** and reboot at the prompt. After rebooting, re-run Intel® Ethernet driver FCoE/DCB installation.
8. Using Disk Management, verify that FCoE LUNs are mounted.
9. Reboot.

Prepare Windows for imaging

10. As administrator: Open a command window. Navigate to Intel® Ethernet drivers “\FCOEBOOT\Win32” or “\FCOEBOOT\Winx64” depending on installed OS. Run fcoeprep.bat and verify no error messages.

The following steps capture the image that was created on drive C: to the secondary partition.

11. Reboot and ensure the server boots to a copy of WinPE. See [Appendix 1](#) for WinPE information.



NOTE: This step is performed right after running fcoeprep. If the server boots back into Windows, fcoeprep must be run again. This is because Windows resets the settings every time it boots.

12. From the WinPE command line, capture the local Windows installation with ImageX. See [Appendix 2](#) for ImageX information. Assuming WinPE mounts the Windows disk as C: and the secondary partition or disk as D:, use the following command line:

```
imagex /capture /check /compress fast c: d:\fcoeboot.wim "FCoE Boot Image"
```

13. **For Windows Server 2008 R2 or later.** Windows 2008 R2 may be installed onto two partitions: the normal Windows partition and a smaller partition called System Reserved. System Reserved contains files necessary to boot Windows. Assuming WinPE mounts the System Reserved partition as C: and the secondary partition as D:, use the following command line to capture the System Reserved partition:

```
imagex /capture /check /compress fast c: d:\fcoesr.wim "FCoE Boot System Reserved"
```

Note that in this case WinPE should mount the System Reserved partition as C:, and the Windows partition may be mounted as D or E.

14. ImageX usually takes about 15 minutes. Reboot to Windows when finished.

The following steps write the image to the FCoE LUN.

15. Open **Disk Management** and verify that the boot LUN on the FCoE Target is online. Note the drive letter assigned to the FCoE LUN.
16. Open a command prompt. Use **DiskPart** to create the necessary partition(s) on the FCoE LUN. If a System Reserved partition was captured, then one should be created on the FCoE LUN. See [Appendix 3](#) for DiskPart information.
17. Assuming the image was saved to drive D: and the FCoE LUN was mounted as drive E:, use the following command line:

```
imagex /apply d:\fcoeboot.wim 1 e:\
```

18. **For Windows Server 2008 R2 or later.** If the System Reserved partition was captured above, it should be applied. In this case, you may need to use **Disk Management** to assign a drive letter to this partition on the FCoE LUN. Assuming the FCoE LUN System Reserved partition is mounted as drive F:, use the following command line:

```
imagex /apply d:\fcoesr.wim 1 f:\
```

19. **For Windows Server 2008 R2 or later.** Run bcdboot.exe from the local Windows installation to make the FCoE disk bootable.
 - a. Open Disk Management
 - b. If a System Reserved partition exists on the FCoE LUN, type: bcdboot F:\Windows /s E (where E: is the FCoE System Reserved partition and F: is the FCoE partition with the Windows directory).
 - c. If a System Reserved partition does not exist, type: bcdboot E:\Windows /s E: (where E: is the FCoE partition with the Windows directory).

Boot the system from the FCoE LUN

20. Shut down the system.
21. Use the BIOS settings to configure the server to boot from the FCoE LUN.



NOTE: If the server still boots from the local drive, then remove the local drives.

22. Boot to the OS on the FCoE LUN.

Appendix 1: WinPE

WinPE is used to run ImageX to capture the local Windows partitions. WinPE versions 2.1 or later is required.

The simplest way to boot WinPE is with a Windows Server install DVD. A bootable WinPE USB flash drive may also be created and used.

For install DVD installation only. After booting, proceed to perform a “Custom” installation. When Windows setup displays

the drive selection screen, input SHIFT-F10 to open a command prompt.

Important: At the command prompt, cycle through the drive letters and use the dir command to identify which disk partitions are mounted with which driver letters. WinPE may use different drive letters than Windows, so no assumptions can be made.

Once the partitions are identified, ImageX can be used to capture the image.

Appendix 2: ImageX

ImageX is available as part of the Microsoft Assessment and Deployment Kit (ADK). To get ImageX:

1. Download and install the Windows Assessment and Deployment Kit (ADK) for Windows* 8 from the Microsoft web site.
2. Run the downloaded adksetup file.
3. Select Deployment Tools to install.
4. After the installation has completed, imagex.exe may be found in one of the following paths:
 - o 32-bit: c:\Program Files (x86)\Windows Kits\8.0\Assessment and Deployment Kit\Deployment Tools\x86\DISM
 - o 64-bit: c:\Program Files (x86)\Windows Kits\8.0\Assessment and Deployment Kit\Deployment Tools\amd64\DISM
5. Copy the appropriate ImageX to portable media for use during the imaging process.

ImageX is documented at Microsoft Technet: <http://technet.microsoft.com>

Appendix 3: DiskPart

If a partition image tool is used to copy Windows to the FCoE LUN, then **DiskPart** must be used to create partitions on the FCoE LUN. There are two sets of instructions below. The first covers creating one partition, while the second covers the case where a System Reserved partition is captured in addition to the Windows partition.

To identify the FCoE LUN disk number within DiskPart, use the LIST DISK command. Alternatively, Disk Management also shows the disk numbers.

Windows Server 2008 or Later without System Reserved partition

The following sequence of commands in **DiskPart** will create a Windows partition on an FCoE LUN, suitable for imaging Windows Server when no System Reserved partition is used (assumes FCoE LUN is disk 1, and only C: and D: are already used by Windows):

1. Select disk 1.
2. Clean



WARNING: This will destroy everything on the disk, so be sure the correct disk is selected!

3. Create partition primary.



NOTE: Add SIZE=nnn to the end of the line to create a partition of size nnn in MB.

4. Select partition 1.
5. Active.
6. Format FS=NTFS QUICK.
7. Assign LETTER=E.
8. Exit.

Windows Server 2008 and Later with a System Reserved partition

The following sequence of commands in **DiskPart** will create a System Reserved and Windows partition on an FCoE LUN, suitable for imaging Windows 2008 R2 (assumes FCoE LUN is disk 1, and only C: and D: are already used by Windows):

1. Select disk 1.
2. Clean



WARNING: This will destroy everything on the disk, so be sure the correct disk is selected!

3. Create partition primary SIZE=100.
4. Select partition 1.
5. Active.
6. Format FS=NTFS QUICK.
7. Assign LETTER=E.
8. Create partition primary.



NOTE: Add SIZE=nnn to the end of the line to create a partition of size nnn in MB.

9. Select partition 2.
10. Format FS=NTFS QUICK.
11. Assign LETTER=F.
12. Exit.

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Linux Installation on Intel® Fibre Channel Over Ethernet (FCoE): Intel® FCoE/DCB User Guide


[SLES 11 FCoE Installation](#)
[RHEL 6.0 FCoE Installation](#)
[Linux FCoE Configuration](#)

SLES 11 FCoE Installation

Select FCoE During OS Installation


1. In Installation Settings, click the **Software** headline to go to **Software Selection and System Tasks**.
2. In Software Selection and System Tasks, click **Details** to enter a new window.
3. Enter **Search** tab.
4. In Search box, type "fcoe" and click **Search**.
5. Select open-fcoe package and click **Accept**.
6. Click **OK** for questions to get back to **Installation Settings**.

Using Yast to Install after OS Installation

 **NOTE:** If FCoE is installed during OS installation, then this is not required.

1. Select **Software** in the left pane.
 2. Select **Software Management** in the right pane.
 3. Type "fcoe" in the search box, then click **Search** button.
 4. "open-fcoe" package will show in right pane.
 5. Select "open-fcoe" package, then click **Accept**.
 6. Verify "Automatic Changes" and click **OK**.
 7. Click **Install** to install package.
-

Linux Intel® Ethernet FCoE Configuration

 **NOTE:** The following examples assume that the network interface named "eth3" is the FCoE interface. Your interface name is likely to be different. Please substitute your interface name when "eth3" is used below.


Verifying the Network Interface

After the FCoE package has been installed activate the interface. Then ensure that link is established and active at 10G link speed to the network switch.

```
root# ifconfig eth3 up
root# ethtool eth3

Settings for eth3:

Speed: 10000Mb/s
Link detected: yes
```


 **NOTE:** If you do not see link detected, check cabling and correct before proceeding.

Configuring Link Layer Discovery Protocol agent daemon (lldpad)


lldpad is a utility used to initiate and configure the Link Layer Discovery Protocol (LLDP). LLDP enables the IEEE Data Center Bridging extensions (DCBx) so that FCoE VLAN discovery, parameter negotiations and session initiation can be accomplished.

1. Start lldpad service and configure to start at boot time.

```
root# service lldpad start
Starting lldpad: [done]
root# chkconfig lldpad on
```

 **NOTE:** There is no output from this command but it will enable lldpad to automatically start when the system is booted.

2. Adjust DCB settings on every physical interface to be used for FCoE with these commands:

 **NOTE:** dcbtool makes change to /var/lib/lldpad/lldpad.conf.

```
root# dcbtool sc eth3 dcb on
root# dcbtool sc eth3 dcb on
Version: 2
Command: Set Config
Feature: DCB State
Port: eth3
Status: Successful
```

```
root# dcbtool sc eth3 app:fcoe e:1
root# dcbtool sc eth3 app:fcoe e:1
Version: 2
Command: Set Config
Feature: Application FCoE
Port: eth3
Status: Successful
```

root# dcbtool sc eth3 pfc e:1 a:1 w:1 (this optional command ensures pfc is configured in the default way not necessary to do no a fresh system)

```
root# dcbtool sc eth3 pfc e:1 a:1 w:1
Version: 2
Command: Set Config
Feature: Priority Flow Control
Port: eth3
Status: Successful
```

root# dcbtool go eth3 pfc (this optional command is used to verify that the settings are correct)(


```
root# dcbtool go eth3 pfc
Version: 2
Command: Get Oper
Feature: Priority Flow Control
Port: eth3
Status: Successful
Oper Version: 0
Max Version: 0
Errors: 0x00 - none
Oper Mode: true
Syncd: true
pfcup: 0 0 0 1 0 0 0 0
```

root# dcbtool go eth3 app:fcoe (this optional command is used to verify that the settings are correct)

```
root# dcbtool go eth3 app:fcoe
Version: 2
Command: Get Oper
Feature: Application FCoE
Port: eth3
Status: Successful
Oper Version: 0
Max Version: 0
Errors: 0x00 - none
Oper Mode: true
Syncd: true
appcfg: 08
```

Configuring Intel® Ethernet FCoE

1. Create a configuration file for the VLAN interface. To copy cfg file, run command:

 **NOTE:** The sample file is cfg-ethx. Copy it to a file which reflects your FCoE network interface name (eg. cfg-eth3).

```
root# cp /etc/fcoe/cfg-ethx /etc/fcoe/cfg-eth3
```


2. Start fcoe service and configure to start at boot time.

```
root# service fcoe start
```


```
Starting FCoE initiator service: [ OK ]
```

```
root# service fcoe status
```

```
Created interfaces: eth3.100-fcoe
```

 **NOTE:** In the example above, an FCoE interface was created for eth3 using VLAN 100. "No interfaces added" indicates that the FIPVLAN protocol was not able to acquire a vlan and therefore an interface was not created. This must be corrected before continuing. This issue may be because you are not connected to a DCB enabled switch or DCB is disabled on this switch port. Contact your network administrator for further help.


```
root# chkconfig fcoe on
```

 **NOTE:** There is no output from this command but it will enable FCoE to automatically start when the system is booted.


3. Verify that a vlan interface has been created.

```
root# ifconfig -a
```

```
eth3 Link encap:Ethernet HWaddr 00:1B:21:60:62:75
...
eth3.100-fcoe Link encap:Ethernet HWaddr 00:1B:21:60:62:75
...
...
```

 **NOTE:** The interface name "eth3.100-fcoe" indicates that the FCoE Initialization Protocol (FIP) negotiated with the switch and established an FCoE session using VLAN 100. This process usually happens automatically for all DCBx enabled switches.

```
No FCoE ports configured
```


 **NOTE:** This message indicates that the FIP VLAN Discovery failed. Please see your network administrator and ensure that this port is configured for DCBx and FCoE.

4. Check that vlan interface can obtain FC-ID. Run command.

```
root# fcoeadm -i
```

```
Description: 82599EB 10-Gigabit Network Connection
Revision: 01
Manufacturer: Intel Corporation
Serial Number: 001B21606274
Driver: ixgbe 2.0.62-k2
Number of Ports: 2
```

```
Symbolic Name: fcoe v0.1 over eth3.100-fcoe
OS Device Name: host3
Node Name: 0x1000001B21606277
Port Name: 0x2000001B21606277
FabricName: 0x2064000DECA33A01
Speed: 10 Gbit
Supported Speed: 10 Gbit
MaxFrameSize: 2112
FC-ID (Port ID): 0x4A0064
State: Online
```


 **NOTE:** The important values to note are that the state is "Online", the Port Name and the FC-ID. Your storage administrator may need the Port Name and the FC-ID in order to identify your connection when allocating zones for you.

If you see the FCoE interface and an FCID from the switch, you are ready to zone and provision your storage. Please see your storage administrator. Once your storage administrator has properly provisioned your storage, you may continue to configure.

5. Verify that you have been assigned on a storage target.

```
root# fcoeadm -t
Interface: eth3.100-fcoe
...
FC-ID (Port ID): 0x4A06EF
State: Online
```

```
LUN ID Device Name Capacity Block Size Description
-----
0 /dev/sdb 25.00 GB 512 DGC RAID 10 (rev 0429)
```

 **NOTE:** This example shows that a LUN has been provisioned and assigned to /dev/sdb. This may happen automatically but usually you must request a LUN from your storage administrator.

6. Verify that the file system has identified the SAN storage.

```
root# lsscsi
[0:0:0:0] cd/dvd TSSTcorp CDDVDW SH-S223L SB02 /dev/sr1
[1:0:0:0] disk ATA ST3160811AS 3.AA /dev/sda
[2:0:1:0] cd/dvd MATSHITA DVD-ROM SR-8178 PZ16 /dev/sr0
[3:0:0:0] disk DGC RAID 10 0429 /dev/sdb
```

Basic Intel® Ethernet FCoE Commands

show interface info: fcoeadm -i

```
root# fcoeadm -i
Description: 82599EB 10-Gigabit Network Connection
Revision: 01
Manufacturer: Intel Corporation
Serial Number: 001B21606274
Driver: ixgbe 2.0.62-k2
Number of Ports: 2

Symbolic Name: fcoe v0.1 over eth3.100-fcoe
OS Device Name: host3
Node Name: 0x1000001B21606277
Port Name: 0x2000001B21606277
FabricName: 0x2064000DECA33A01
Speed: 10 Gbit
Supported Speed: 10 Gbit
MaxFrameSize: 2112
FC-ID (Port ID): 0x4A0064
State: Online
```

show LUNs: fcoeadm -l

```
root# fcoeadm -l
Interface: eth3.100-fcoe
Roles: FCP Target
Node Name: 0x50060160C46029CC
Port Name: 0x50060160446029CC
Target ID: 0
MaxFrameSize: 2048
OS Device Name: rport-3:0-1
FC-ID (Port ID): 0x4A06EF
State: Online

LUN #0 Information:
OS Device Name: /dev/sdb
Description: DGC RAID 10 (rev 0429)
Ethernet Port FCID: 0x4A0064
Target FCID: 0x4A06EF
Target ID: 0
LUN ID: 0
Capacity: 25.00 GB
Capacity in Blocks: 52428799
Block Size: 512 bytes
Status: Attached
```

show targets: fcoeadm -t

```
root# fcoeadm -t
Interface: eth3.100-fcoe
Roles: FCP Target
Node Name: 0x50060160C46029CC
Port Name: 0x50060160446029CC
Target ID: 0
MaxFrameSize: 2048
OS Device Name: rport-3:0-1
FC-ID (Port ID): 0x4A06EF
State: Online

LUN ID Device Name Capacity Block Size Description
-----
0 /dev/sdb 25.00 GB 512 DGC RAID 10 (rev 0429)
```


show statistics: fcoeadm -s

```
root# fcoeadm -s eth3.100-fcoe 1
```

```
eth3.100-fcoe interval: 1 Err Inv IvTx Link Cntl Input Input Output Output
Seconds TxFrames TxBytes RxFrames RxBytes Frms CRC Byte Fail Reqs Requests MBytes
-----
0 102 5424 103 6444 0 0 0 0 6 79 526 0 0
1 102 5424 103 6444 0 0 0 0 6 79 526 0 0
2 102 5424 103 6444 0 0 0 0 6 79 526 0 0
```

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[fcoeadm](#)

[fcoemon](#)

The Intel® Ethernet FCoE Linux Management Tools included in this package are:

fcoeadm - program to create, reset, destroy, and display FCoE interfaces

fcoemon - program to monitor the events from the DCB daemon

Requirements

The user is not required to download and build from source if you are using a distribution (SLES).

If building from source, the HBAAPI library and the HBAAPI vendor library source must be built and installed before you can build the management tools. The HBAAPI vendor library, libhbalinux, may be downloaded from www.Open-FCoE.org. The instructions in the package describe how to download and build the libraries. See the man pages for other requirements.

fcoeadm

The fcoeadm command is intended to be the FCoE management tool for the Linux systems. The -c, -d, and -r options are used to create, destroy, and reset an FCoE instance on a given network interface. The other options are used to query the information of the FCoE instance which includes the interface information, target information, LUN information, and port statistics. The fcoeadm command invokes the HBAAPI library routines to obtain this information. The HBAAPI library routines invoke the vendor-specific library, libhbalinux, to grab the information from the /sys file system. In other words, the fcoeadm command requires having libHBAAPI and libhbalinux installed on the system to work.

The libhbalinux is maintained at <http://www.Open-FCoE.org>. The installation instructions of libhbalinux also instruct how to download the HBAAPI source code, build and install with the libhbalinux. The last option -h is used to show a brief usage message of the supported command syntax.

Options

-c -create <ethX>	Creates an FCoE instance based on the given <ethX>.
-d, -destroy <ethX>	Destroys an FCoE instance based on the given <ethX>.
-r, -reset <ethX>	Resets the fc_host associated with the FCoE interface given by <ethX>.
-i, -interface <ethX>	Shows the information of the FCoE instances created at <ethX>. If <ethX> is not specified the command will show the information of all the FCoE instances created on the system.
-t, -target <ethX>	Shows the information of all the discovered targets from the FCoE instances created at <ethX>. If <ethX> is not specified the command will show the information of all the discovered targets from all the FCoE instances created.
-l, -lun <target_port_id> <lun_id>	Shows the detailed information of a specific LUN with <lun_id> at the target with port id <target_port_id>. Port id is also known as FC-ID. If <lun_id> is not specified, all the LUNs associated with the target will be shown.
-s, -stats <ethX> -n <interval>	Show the statistics (including FC4 statistics) of the FCoE instances created at <ethX>. The information will be displayed in one line on the screen per given time interval. <interval> should be specified in whole integers greater than 0. It specifies the time interval in the unit of second. If <interval> is not

	specified, the default interval is one second.
-v, -version	Displays the version of the fcoeadm command.
-h, -help	Displays the usage message of the fcoeadm command where <ethX> is the network interface name, such as eth0, eth1, etc.

Examples

Creates an FCoE instance on eth2:

```
$ fcoeadm -c eth2
```

Destroys the FCoE instance on eth2:

```
$ fcoeadm -d eth2
```

Resets the FCoE instance on eth2:

```
$ fcoeadm -r eth2
```

Shows the information of all the adapters and their ports having FCoE instances created.

```
$ fcoeadm -i
```

Shows the information of a specific interface eth3. If eth3 has no FCoE instances created, the command will show the error "No fc_host found for eth3".

```
$ fcoeadm -i eth3
```

Shows the information of all the discovered targets from all the ports having FCoE instances created (they may be on different adapter cards). Discovered LUNs are listed after the target they are associated with, if any.

```
$ fcoeadm -t
```

Shows the information of all the discovered targets from a given port (eth3) having FCoE instance created. Discovered LUNs are listed after each target they are associated with, if any.

```
$ fcoeadm -t eth3
```

Shows the detailed information of all the LUNs associated with a specific target. The target is identified by its port id (aka -FC-ID) 0xD700EF.

```
$ fcoeadm -l 0xD700EF
$ fcoeadm -l D700EF
$ fcoeadm -l 0xd700ef
$ fcoeadm -l d700ef
```

Show the detailed information of a LUN associated with a specific target. The target is identified by its port id (aka FC-ID) 0xD700EF and the LUN is identified by its LUN id.

```
$ fcoeadm -l 0xD700EF 1
```

Show the statistics information of a specific port eth3 having FCoE instances created. The statistics are displayed one line per time interval. The default interval is one second if -n option is not specified.

```
$ fcoeadm -s eth3
$ fcoeadm -s eth3 \3
$ fcoeadm -s eth3 \3
```

Reporting Bugs

If you have identified a defect, please either file a bug or engage the development mailing list at <http://www.Open-FCoE.org>.

Support

Open-FCoE is maintained at <http://www.Open-FCoE.org>. There are resources available for both developers and users at that site.

fcoemon

The fcoemon command is an FCoE management tool provided by the Open-FCoE package.

fcoemon is the daemon of the fcoe system service. When fcoemon starts, it establishes a socket connection with the DCB daemon. It then sends commands to, and receives responses and event from the DCB daemon.

Since fcoemon depends on the existence of DCB service, there are settings required for DCB before fcoemon can be started. See the DCB Settings section below.

Notice that the fcoe system service does not depend on lldpad service. However, the fcoemon daemon will be started by the fcoe service only if any one of the Ethernet port requires DCB service. In this case, fcoe service depends on lldpad service. If none of the Ethernet ports requires DCB service, the fcoemon will not be started and, in this case, the fcoe service does not depend on lldpad service.

Options

-h -v --version	Shows the version of the fcoemon command.
-f --foreground	Runs fcoemon in the foreground.
-d --debug <path -of -fcoeplumb -script>	PFC - The DCB Priority Flow Control feature. App: FCoE - The DCB Fibre Channel over Ethernet feature. LLINK - The DCB Logical Link TLV (or Logical Link) feature. Applicable to DCBX version 1. multiq - See Documentation/networking/multiqueue.txt of linux kernel 2.6.28 or higher. skbedit - See Documentation/networking/multiqueue.txt of linux kernel 2.6.28 or higher.

Installation Requirements

The DCB and FCoE kernel configuration options must be enabled, these were introduced in v2.6.29. Both the linux kernel and iproute2 must support multiq and skbedit. The DCB must be installed with version 0.9.4 and higher.

Supported DCB Events

In response to each supported event from the DCB daemon, the fcoemon collects the current settings from the DCB daemon and decide whether to delete and re-add the multiq queue discipline and skbedit filter. The fcoemon does not destroy, reset, or create FCoE interfaces during the DCB event processing.

FEATURE_APP

If an event message is received from lldpad and if the feature code in the event message is FEATURE_APP (5), and if the subtype field is APP_FCOE_STYPE (0), then this indicates a mode or configuration change event of the FCoE application. The fcoemon will then issue queries to the DCB daemon to collect the current mode and configuration information.

FEATURE_PFC

If an event message is received from lldpad and if the feature code in the event message is FEATURE_PFC (3), then this indicates a mode or configuration change event of the Priority Flow Control (PFC) feature. The fcoemon will then issue queries to the DCB daemon to collect the current mode and configuration information.

FEATURE_LLINK

If an event message is received from lldpad and if the feature code in the event message is FEATURE_LLINK (6), and if the subtype field is LLINK_FCOE_STYPE (0), then this indicates a mode or configuration change event of the Logical Link TLV feature. The fcoemon will then issue queries to the DCB daemon to collect the current mode and configuration information.

Criteria of Creating, Resetting and Destroying FCoE Interface

In this section the dcbtool is used to describe the conditions of the DCB feature status because the meaning is more understandable and precise. Although you may also issue the commands at run-time, the commands are intended only to be used for description purpose.

PFC and App:FCoE

DCB is configured correctly if

1. The command `dcbtool gc ethX dcb` shows DCB State: "on"
2. The command `dcbtool gc ethX app:0` shows "Enable:true, Advertise:true, Willing:true."
3. The command `dcbtool go ethX app:0` shows "OperMode:true."
4. The command `dcbtool go ethX pfc` shows "OperMode:true" and the values of pfcup.
5. The command `dcbtool go ethX app:0` shows appcfg. The bits set to 1 are also set to 1 in pfcup found in (4).

Logical Link TLV

The Logical Link TLV feature is configured correctly if

1. The command `dcbtool gc ethX ll:0` shows "Enable:true, Advertise:true, Willing:true."
2. The command `dcbtool go ethX ll:0` shows "OperMode:true."
3. The command `dcbtool gp ethX ll:0` shows "Link Status:up."

Criteria to create FCoE interface

If DCB is required at the Ethernet port, an FCoE interface may be created only if the DCB and the Logical Link TLV feature are configured correctly. If DCB is not required at the Ethernet port, the FCoE interface may be created. FCoE interfaces are normally created by the fcoe system service.

Criteria to Destroy FCoE Interface

An FCoE interface will only be destroyed when the fcoe system service is stopped.

Criteria to reset FCoE interface

The fcoe system service does not reset any FCoE interfaces.

Changing DCB Configuration, Qdisc and Filters

Changing the DCB configuration, qdisc, and filter are considered to be administrative actions. When the fcoe system service starts up, it sets up the default DCB configuration, qdisc, and filter for reliable FCoE operations. Administrators may alter the configuration while the service is running.

Changing the DCB parameters may cause the fcoemon daemon to delete the existing multiq queue discipline, skbedit filter and re-add; but the fcoe service will not touch (for example, destroy or reset) the FCoE interface. Changing the DCB configuration, qdisc, and filter should be avoided while I/O traffic are in progress.

Files

The Installation of the Open-FCoE management tools includes the following files:

- SLES11 SP3
 - /usr/sbin/fcoemon
 - /usr/sbin/fcoeadm
 - /sbin/lldpad
 - /sbin/dcbtool

/etc/fcoe/config

This is the common configuration file for the fcoe system service. This file will be read by the /etc/init.d/fcoe script, the etc/fcoe/scripts/fcoeplumb script, and the fcoemon daemon. The default options in this file are:

DEBUG="yes" and BUSE_SYSLOG="yes".

The former is used to enable (select yes) or disable (select no) debugging messages of fcoemon, the fcoe service script, and the fcoeplumb script. The latter is to indicate if the log messages of fcoemon, the fcoe service script, and the fcoeplumb script are to be output to the system log. Use editor to set the desired yes/no values.

/etc/fcoe/cfg-ethX

There is one of these files for each Ethernet interface ethX found in the output of cat /proc/net/dev at the time of installation. The file will be read by the /etc/init.d/fcoe script and the fcoemon daemon. The default options in this file are:

FCOE_ENABLE="no" and DCB_REQUIRED="yes". The former is used to enable (select yes) or disable (select no) the FCoE service at the ethX port. The latter is to indicate if the DCB service is required (select yes) or not required (select no) at the ethX port. If the former is set to no, the latter is ignored. The selection of the settings should match the settings of the FCoE switch port connected to the local Ethernet ethX port. Use editor to set the desired yes/no values for the ethX interfaces.

/etc/init.d/fcoe

This is the fcoe system service shell script. This script is invoked by the init process or by the service command.

/sbin/fcoemon

This is the fcoemon daemon only invoked by the fcoe system service script.

/sbin/fcoeadm

This is the program used by the fcoe system service to create or destroy FCoE interfaces.

Reporting Bugs

If you have identified a defect please either file a bug or engage the development mailing list at <http://www.Open-FCoE.org>.

Support

Open-FCoE is maintained at <http://www.Open-FCoE.org>. There are resources available for both developers and users at that site.

Please read all [restrictions and disclaimers](#).

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Data Center Bridging (DCB) for Intel® Network Connections: Intel® FCoE/DCB User Guide

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Overview

Data Center Bridging is a collection of standards-based extensions to classical Ethernet. It provides a lossless data center transport layer that enables the convergence of LANs and SANs onto a single Unified Fabric. In addition to supporting Fibre Channel Over Ethernet (FCoE), it enhances the operation of other business-critical traffic.

Data Center Bridging is a flexible framework that defines the capabilities required for switches and end points to be part of a data center fabric. It includes the following capabilities:

- Priority-based flow control (PFC; IEEE 802.1Qbb)
- Enhanced transmission selection (ETS; IEEE 802.1Qaz)
- Congestion notification (CN)
- Extensions to the Link Layer Discovery Protocol standard (IEEE 802.1AB) that enable Data Center Bridging Capability Exchange Protocol (DCBX)

There are two supported versions of DCBX:

- Version 1: This version of DCBX is referenced in Annex F of the FC-BB-5 standard (FCoE) as the version of DCBX used with pre-FIP FCoE implementations.
- Version 2: The specification can be found as a link within the following document:
<http://www.ieee802.org/1/files/public/docs2008/dcb-baseline-contributions-1108-v1.01.pdf>

For more information on DCB, including the DCB Capability Exchange Protocol Specification, go to <http://www.intel.com/technology/eedc/> or <http://www.ieee802.org/1/pages/dcbbridges.html>.

For system requirements go [here](#).

DCB for Windows

Configuration

Many DCB functions can be configured or revised using Intel® PROSet for Windows Device Manager, from the Data Center tab. You can use the Intel® PROSet for Windows Device Manager to perform the following tasks:

- Display status
 - Priority Group
 - Priority Flow Control
 - FCoE Priority
 - iSCSI Priority


Non-operational status: If the Status indicator shows that DCB is non-operational, there may be a number of possible reasons.

1. DCB is not enabled. Select the checkbox to enable DCB.
2. At least one of the DCB features is in a non-operational state. The features that contribute to the non-operational status are PFC and APP:FCoE.

A non-operational status is most likely to occur when **Use Switch Settings** is selected. This is generally a result of one or more of the DCB features not getting successfully exchanged with the switch. Possible problems include:

- One of the features is not supported by the switch.
 - The switch is not advertising the features.
 - The switch or host has disabled the feature (this would be an advanced setting for the host).
- Disable/enable DCB
 - Troubleshooting information


Hyper-V (DCB and VMQ)

 **NOTE:** Configuring a device in VMQ + DCB mode reduces the number of VMQs available for guest OSes.

DCB Installation on Windows Server

To install the DCB component on Windows Server 2008 or Windows Server 2012 operating system,

1. Double click on the setup.exe file.
2. Select the option to install DCB (FCoE).

 **NOTE:** By default, the [Dell Update Package \(DUP\)](#) does not install the DCB component of the Intel driver due to the requirement of a Microsoft initiated reboot. To install the DCB (FCoE) component,

1. Go to the **Control Panel** and select **Add/Remove Programs**.
2. Select the **Intel Network Connections** program and click the Modify button.
3. Select the option to install DCB (FCoE).

DCB for Linux

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Background

In the 2.4.x kernel, qdiscs were introduced. The rationale behind this effort was to provide QoS in software, as hardware did not provide the necessary interfaces to support it. In 2.6.23, Intel pushed the notion of multiqueue support into the qdisc layer. This provides a mechanism to map the software queues in the qdisc structure into multiple hardware queues in underlying devices. In the case of Intel adapters, this mechanism is leveraged to map qdisc queues onto the queues within our hardware controllers.

Within the Data Center, the perception is that traditional Ethernet has high latency and is prone to losing frames, rendering it unacceptable for storage applications.

In an effort to address these issues, Intel and a host of industry leaders have been working on addressing these problems. Specifically, within the IEEE 802.1 standards body there are a number of task forces working on enhancements to address these concerns. Listed below are the applicable standards bodies:

- Enhanced Transmission Selection
 - IEEE 802.1Qaz
- Lossless Traffic Class
 - Priority Flow Control: IEEE 802.1Qbb
 - Congestion Notification: IEEE 802.1Qau
- DCB Capability exchange protocol: IEEE 802.1Qaz

The software solution that is being released represents Intel's implementation of these efforts. It is worth noting that many of these standards have not been ratified - this is a pre-standards release, so users are advised to check Sourceforge often. While we have worked with some of the major ecosystem vendors in validating this release, there are many vendors which still have solutions in development. As these solutions become available and standards get ratified, we will work with ecosystem partners and the standards body to ensure that the Intel solution works as expected.

Requirements

- SLES 11 SP2 or later.
- Linux kernel version 2.6.29 or later.
- Linux ixgbe driver (for Intel® 82599-based and X540-based adapters) from kernel 2.6.29 or later.
- 2.6.29 or newer version of the "iproute2" package should be downloaded and installed in order to obtain a multi-queue aware version of the 'tc' utility.
 - Check for new versions at: <http://www.linuxfoundation.org/en/Net:Iproute2>
- Version 2.5.33 of Flex should be installed (to support iproute2). The latest Flex source can be obtained from <http://flex.sourceforge.net/>
- An up to date netlink library needs to be installed in order to compile Ildpad.
- Intel® 82599-based or X540-based adapter.

Functionality

Ildpad

- Executes the Link Layer Discovery Protocol (LLDP) over all supported interfaces.
- Executes the DCB capabilities exchange protocol to exchange DCB configuration with the peer device using LLDP.
- Supports the versions of the DCB capabilities exchange protocol described here:
 - Pre-CEE version: <no link available>
 - CEE Version: <<http://www.ieee802.org/1/files/public/docs2008/az-wadekar-dcbx-capability-exchange-discovery-protocol-1108-v1.01.pdf>>
 - IEEE Version: IEEE Std 802.1Qaz-2011 <no link available>
- Retrieves and stores DCB configuration to a configuration file.
- Controls the DCB settings of the network driver based on the operation of the DCB capabilities exchange protocol. Interaction with a supporting network driver is achieved via DCB operations added to the rtnetlink interface in kernel 2.6.29.
- Supports the following DCB features: Enhanced Transmission Selection, Priority Flow Control, FCoE, and FCoE Logical Link Status.
- Provides an interface for client applications to query and configure DCB features. Generates client interface events when the operational configuration or state of a feature changes.

Ildptool

dcbtool

- Interacts with dcbd via the client interface.
- Queries the state of the local, operational and peer configuration for the supported DCB features.
- Supports configuring the supported DCB features.
- Interactive mode allows multiple commands to be entered interactively, as well as displaying event messages.
- Enables or disables DCB for an interface.

Options

Ildpad has the following command line options:

- h show usage information
- f configfile: use the specified file as the config file instead of the default file - /etc/sysconfig/dcbd/dcbd.conf
- d run dcbd as a daemon
- v show dcbd versionSetup
- k terminate current running Ildpad
- s remove Ildpad state records

Setup

1. Load the ixgbe module.
2. Verify Ildpad service is functional. If Ildpad was installed, do "service Ildpad status" to check, "service Ildpad start" to start, or run "Ildpad -d" from the command line to start.
3. Enable DCB on the selected ixgbe port: dcbtool sc ethX dcb on.
4. The dcbtool command can be used to query and change the DCB configuration (for example, various percentages to different queues). Use dcbtool -h to see a list of options.

DCBX Operation

Ildpad and dcbtool can be used to configure a DCB capable driver, such as the ixgbe driver, which supports the rnetlink DCB interface. Once the DCB features are configured, the next step is to classify traffic to be identified with an 802.1p priority and the associated DCB features. This can be done by using the 'tc' command to set up the qdisc and filters to cause network traffic to be transmitted on different queues.

The skbedit action mechanism can be used in a tc filter to classify traffic patterns to a specific queue_mapping value from 0-7. The ixgbe driver will place traffic with a given queue_mapping value onto the corresponding hardware queue and tag the outgoing frames with the corresponding 802.1p priority value.

Set up the multi-queue qdisc for the selected interface:

```
# tc qdisc add dev ethX root handle 1: multiq
```

Setting the queue_mapping in a TC filter allows the ixgbe driver to classify a packet into a queue. Here are some examples of how to filter traffic into various queues using the flow ids:

```
# tc filter add dev ethX protocol ip parent 1: u32 match ip dport 80 \
 0xffff action skbedit queue_mapping 0
# tc filter add dev ethX protocol ip parent 1: u32 match ip dport 53 \
 0xffff action skbedit queue_mapping 1
# tc filter add dev ethX protocol ip parent 1: u32 match ip dport 5001 \
 0xffff action skbedit queue_mapping 2
# tc filter add dev ethX protocol ip parent 1: u32 match ip dport 20 \
 0xffff action skbedit queue_mapping 7
```

Here is an example that sets up a filter based on EtherType. In this example the EtherType is 0x8906.

```
# tc filter add dev ethX protocol 802_3 parent 1: handle 0xfc0e basic match \
 'cmp(u16 at 12 layer 1 mask 0xffff eq 35078)' action skbedit queue_mapping 3
```

Testing

To test in a back-to-back setup, use the following tc commands to set up the qdisc and filters for TCP ports 5000 through 5007. Then use a tool, such as iperf, to generate UDP or TCP traffic on ports 5000-5007.

Statistics for each queue of the ixgbe driver can be checked using the ethtool utility: ethtool -S ethX

```
# tc qdisc add dev ethX root handle 1: multiq
# tc filter add dev ethX protocol ip parent 1: \
 u32 match ip dport 5000 0xffff action skbedit queue_mapping 0
```

```

# tc filter add dev ethX protocol ip parent 1: \
u32 match ip sport 5000 0xffff action skbedit queue_mapping 0
# tc filter add dev ethX protocol ip parent 1: \
u32 match ip dport 5001 0xffff action skbedit queue_mapping 1
# tc filter add dev ethX protocol ip parent 1: \
u32 match ip sport 5001 0xffff action skbedit queue_mapping 1
# tc filter add dev ethX protocol ip parent 1: \
u32 match ip dport 5002 0xffff action skbedit queue_mapping 2
# tc filter add dev ethX protocol ip parent 1: \
u32 match ip sport 5002 0xffff action skbedit queue_mapping 2
# tc filter add dev ethX protocol ip parent 1: \
u32 match ip dport 5003 0xffff action skbedit queue_mapping 3
# tc filter add dev ethX protocol ip parent 1: \
u32 match ip sport 5003 0xffff action skbedit queue_mapping 3
# tc filter add dev ethX protocol ip parent 1: \
u32 match ip dport 5004 0xffff action skbedit queue_mapping 4
# tc filter add dev ethX protocol ip parent 1: \
u32 match ip sport 5004 0xffff action skbedit queue_mapping 4
# tc filter add dev ethX protocol ip parent 1: \
u32 match ip dport 5005 0xffff action skbedit queue_mapping 5
# tc filter add dev ethX protocol ip parent 1: \
u32 match ip sport 5005 0xffff action skbedit queue_mapping 5
# tc filter add dev ethX protocol ip parent 1: \
u32 match ip dport 5006 0xffff action skbedit queue_mapping 6
# tc filter add dev ethX protocol ip parent 1: \
u32 match ip sport 5006 0xffff action skbedit queue_mapping 6
# tc filter add dev ethX protocol ip parent 1: \
u32 match ip dport 5007 0xffff action skbedit queue_mapping 7
# tc filter add dev ethX protocol ip parent 1: \
u32 match ip sport 5007 0xffff action skbedit queue_mapping 7

```

dcbtool Overview

dcbtool is used to query and set the DCB settings of a DCB capable Ethernet interface. It connects to the client interface of dcbd to perform these operations. dcbtool will operate in interactive mode if it is executed without a command. In interactive mode, dcbtool also functions as an event listener and will print out events received from dcbd as they arrive.

Synopsis

```

dcbtool -h
dcbtool -v
dcbtool [-rR]
dcbtool [-rR] [command] [command arguments]

```

Options

- h Shows the dcbtool usage message.
- v Shows dcbtool version information.
- r Displays the raw dcbd client interface messages as well as the readable output.
- R Displays only the raw dcbd client interface messages.

Commands

help	Shows the dcbtool usage message.
ping	Test command. The dcbd daemon responds with "PONG" if the client interface is operational.

license	Displays dcbtool license information.
quit	exit from interactive mode.

The following commands interact with the lldpad daemon to manage the daemon and DCB features on DCB capable interfaces.

lldpad general configuration commands:

<gc go> dcbx	Gets the configured or operational version of the DCB capabilities exchange protocol. If different, the configured version will take effect (and become the operational version) after dcbd is restarted.
sc dcbx v: [1 2]	Sets the version of the DCB capabilities exchange protocol which will be used the next time dcbd is started. Information about version 2 can be found at: http://www.ieee802.org/1/files/public/docs2008/az-wadekar-dcbx-capability-exchange-discovery-protocol-1108-v1.01.pdf .

DCB-per interface commands:

go <ifname> <feature>	Gets configuration of feature on interface ifname.
go <ifname> <feature>	Gets operational status of feature on interface ifname.
gp <ifname> <feature>	Gets peer configuration of feature on interface ifname.
sc <ifname> <feature> <args>	Sets the configuration of feature on interface ifname.

Feature may be one of the following:

dcb	DCB state of the port
pg	Priority Groups
pfc	Priority Flow Control
app: <subtype>	Application Specific Data
ll: <subtype>	Logical Link Status

Subtype can be:

O|fcoe Fibre Channel over Ethernet (FCoE)

Args can include:

e: <0 1>	Controls feature enable.
a: <0 1>	Controls whether the feature is advertised via DCBX to the peer.
w: <0 1>	Controls whether the feature is willing to change its operational configuration based on what is received from the peer.
[feature specific args]	Arguments specific to a DCB feature.

Feature specific arguments for dcb:

On/off enable or disable for the interface. The go and gp commands are not needed for the dcb feature. Also, the enable, advertise and willing parameters are not required.

Feature specific arguments for pg:

pgid: xxxxxxxx	Priority Group ID for the 8 priorities. From left to right (priorities 0-7), x is the corresponding Priority Group ID value, which can be 0-7 for Priority Groups with bandwidth allocations or f (Priority Group ID 15) for the unrestricted Priority Group.
	Priority Group percentage of link bandwidth. From left to right (Priority Groups 0-7), x is the

pgpct:x,x,x,x,x,x,x,x	percentage of link bandwidth allocated to the corresponding Priority Group. The total bandwidth must equal 100%.
uppct:x,x,x,x,x,x,x,x	Priority percentage of Priority Group bandwidth. From left to right (priorities 0-7), x is the percentage of Priority Group bandwidth allocated to the corresponding priority. The sum of percentages for priorities which belong to the same Priority Group must total 100% (except for Priority Group 15).
strict:xxxxxxx	Strict priority setting. From left to right (priorities 0-7), x is 0 or 1. 1 indicates that the priority may utilize all of the bandwidth allocated to its Priority Group.
up2tc:xxxxxxx	Priority to traffic class mapping. From left to right (priorities 0-7), x is the traffic class (0-7) to which the priority is mapped.

Feature specific arguments for pfc:

pfcup:xxxxxxx	Enable/disable priority flow control. From left to right (priorities 0-7), x is 0 or 1. 1 indicates that the corresponding priority is configured to transmit priority pause.
---------------	---

Feature specific arguments for app:< subtype>:

appcfg:xx	xx is a hexadecimal value representing an 8-bit bitmap where bits set to 1 indicate the priority which frames for the applications specified by subtype should use. The lowest order bit maps to priority 0.
-----------	--

Feature specific arguments for ll:<subtype>:

status: [0 1]	For testing purposes, the logical link status may be set to 0 or 1. This setting is not persisted in the configuration file.
------------------	--

Examples

Enable DCB on interface eth2

```
dcbtool sc eth2 dcb on
```

Assign priorities

Assign priorities 0-3 to Priority Group 0, priorities 4-6 to Priority Group 1 and priority 7 to the unrestricted priority. Also, allocate 25% of link bandwidth to Priority Group 0 and 75% to group 1.

```
dcbtool sc eth2 pg pgid:0000111f pgpct:25,75,0,0,0,0,0,0
```

Enable transmit of Priority Flow Control

Enable transmit of Priority Flow Control for priority 3 and assign FCoE to priority 3.

```
dcbtool sc eth2 pfc pfcup:00010000
dcbtool sc eth2 app:0 appcfg:08
```

FAQ

How did Intel verify their DCB solution?

Answer - The Intel solution is continually evolving as the relevant standards become solidified and more vendors introduce DCB capable systems. That said, we initially used test automation to verify the DCB state machine. As the state machine became more robust and we had DCB capable hardware, we began to test back to back with our adapters. Finally, we introduced DCB capable switches in our test bed.

Known Issues

Prior to kernel 2.6.26, tso will be disabled when the driver is put into DCB mode.

A TX unit hang may be observed when link strict priority is set when a large amount of traffic is transmitted on the link strict priority.

License

dcdb and dcbtool - DCB daemon and command line utility DCB configuration
Copyright(c) 2007-2013 Intel Corporation.

Portions of dcdb and dcbtool (basically program framework) are based on:

hostapd-0.5.7
Copyright (c) 2004-2007, Jouni Malinen <j@w1.fi>

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Known Issues: Intel® FCoE/DCB User Guide

[Windows Issues](#)
[FCoE Boot Issues](#)

Windows Issues

- **Intel® Ethernet Virtual Storage Miniport Driver for FCoE may disappear from Device Manager**

The Intel® Ethernet Virtual Storage Miniport Driver for FCoE may disappear from the Device Manager after either:

- A virtual network is removed.
- The underlying Intel NIC adapter settings are modified.

This can occur when the corresponding Intel adapter is virtualized to create a new virtual network or delete or modify an existing Virtual Network. It can also happen when the underlying Intel NIC adapter settings are modified, including disabling or re-enabling the adapter.

As a workaround, the user should remove all the resource dependency of the Intel® Ethernet Virtual Storage Miniport Driver for FCoE that are currently being used by the system before making any changes to the Intel adapter for virtualization. For example, in one use case scenario, the user may have assigned the FCoE disk(s) from the FCoE storage driver to run one of its Virtual Machines, and at the same time the user wants to alter the configuration of the same Intel adapter for virtualization. In this scenario the user must remove the FCoE disks(s) from the Virtual Machine before altering the Intel adapter configuration.

- **Virtual Port may disappear from Virtual Machine**

When the Virtual Machine starts, it asks the Intel® Ethernet Virtual Storage Miniport Driver for FCoE ("the driver") to create a Virtual Port. If the driver is subsequently disabled, the Virtual Port may disappear. The only way to get the Virtual Port back is to enable the driver and reboot the Virtual Machine.

- **In Windows Server 2008 with Hyper-V, the storage miniport driver does not load when an adapter is added or removed as a vNIC.**

In Windows Server 2008 with Hyper-V, the storage miniport driver may not automatically load after adding or removing a DCB/FCoE adapter as a shared external virtual device. To load the storage miniport driver, reset the adapter.

- **When installing FCoE after installing ANS and creating an AFT Team, Storports are not installed.**

If the user installs ANS and creates an AFT team and then installs FCoE/DCB, the result is that DCB is off by default. If the user then enables DCB on one port, the OS detects Storports and the user must manually click on the new hardware wizard prompts for each of them to install. If the user does not do that, DCB status is non-operational and the reason given is no peer.

- **Link Aggregation teams are not supported with existing FCoE Switches.**

- **Intel® PROSet for Windows Device Manager is not synched with FCoE CTRL-D Utility.**

When the user disables FCoE via the control-D menu, the Intel PROSet for Windows Device Manager User Interface states that the flash contains an FCoE image, but that the flash needs to be updated. Updating the flash with the FCoE image again, re-enables FCoE and returns the user to the state where all the FCoE settings are available.

If the user uses the control-D menu to disable FCoE, then they should use the control-D menu to enable it because Intel PROSet for Windows Device Manager does not support enabling or disabling FCoE.

- **82599-based and X540-based adapters do not display as SPC-3 compliant in Windows MPIO configuration.**

Since the FCoE initiator is a virtualized device it does not have its own unique hardware ID and thus is not displayed as an SPC-3 compliant device in Windows MPIO configuration.

- **When removing ALB teaming, all FCOE functions fail, all Intel® PROSet for Windows Device Manager tabs are grayed out, and both adapter ports fail**

For ANS teaming to work with Microsoft Network Load Balancer (NLB) in unicast mode, the team's LAA must be set to cluster node IP. For ALB mode, Receive Load Balancing must be disabled. For further configuration details, refer to

[Microsoft article 278431](#).

ANS teaming will work when NLB is in multicast mode, as well. For proper configuration of the adapter in this mode, refer to [http://technet.microsoft.com/en-ca/library/cc726473\(Ws.10\).aspx](http://technet.microsoft.com/en-ca/library/cc726473(Ws.10).aspx).

- **FCoE and TCP/IP traffic on the same VLAN may not work on some switches**

This is a known switch design and configuration issue.

- **Reboot Prompt Appears when modifying the Performance Profile**

In Microsoft* Windows Server*, after modifying the performance profile, a reboot prompt may appear. The Intel® Ethernet FCoE boot was configured and there is no need to reboot. The base driver reloads are blocked if FCoE boot is configured and the system is connected to an FCoE target, even if the system was booted locally.

FCoE Boot Issues

Option ROM Known Issues

- **Discovery problems with multiple FCoE VLANs**

The FCoE Option ROM may not discover the desired VLAN when performing VLAN discovery from the Discover Targets function. If the Discover VLAN box is populated with the wrong VLAN, then enter the desired VLAN before executing Discover Targets.

Windows Known Issues

- **Brocade switch support in Release 16.4**

Intel® Ethernet FCoE does not support Brocade switches in Release 16.4. If necessary, please use Release 16.2.

- **Windows uses a paging file on the local disk.**

After imaging, if the local disk is not removed before booting from the FCoE disk then Windows may use the paging file from the local disk.

- **Crash dump to FCoE disks is only supported to the FCoE Boot LUN.**

The following scenarios are not supported:

- Crash dump to an FCoE disk if the Windows directory is not on the FCoE Boot LUN.
- Use of the DedicatedDumpFile registry value to direct crash dump to another FCoE LUN.

- **Stopping the Intel DCB service may cause the OS to hang or crash.**

Do not stop the DCB service if the system is FCoE booted.

- **FCoE uninstall from a local disk may be blocked because installer inaccurately reports system is booted from FCoE.**

When the FCoE Option ROM connects to an FCoE disk during boot, the Windows installer may be unable to determine if the system was booted from FCoE or not and will block the FCoE uninstall. To uninstall, configure the Option ROM so that it does not connect to an FCoE disk.

- **Unable to create VLAN interfaces with Intel® Ethernet FCoE Boot enabled.**

When booted with FCoE, a user cannot create VLANs and/or Teams for other traffic types. This prevents converged functionality for non-FCoE traffic.

- **Server adapter configured for FCoE Boot available as External-Shared vnic via Hyper-V.**

If a port is set as a boot port, when the user installs the Hyper V role in the system and then goes into the Hyper V Network Manager to select which port to externally virtualize, the boot port displays, which it should not.

When setting the port to a boot port in Intel® PROSet for Windows Device Manager, a message shows that the user should restart the system for the changes to be effective but does not force a restart. As a result the user level applications are in boot mode (for example, Data Center Tab is greyed out) but kernel level drivers have not been

restarted to indicate to the OS that the port is a boot port. When the user then adds the Hyper V service to the system, the OS takes a snap shot of the ports available. This is the snap shot that it uses after the Hyper V role is added, the system restarted and the user goes into the Hyper V Virtual Network Manager to virtualize the ports. As a result, the boot port also shows up.

Solutions:

Restart the system after setting a port to a boot port and before adding the Hyper V role. The port does not appear in the list of virtualizable ports in the Hyper V Virtual network manager.

Disable/enable the port in Device Manager after setting it to boot and before adding the Hyper V role. The port does not appear in the list of virtualizable ports in the Hyper V Virtual network manager.

- **FCoE Linkdown Timeout fails prematurely when remote booted**

If and FCoE-booted port loses link for longer than the time specified in the Linkdown Timeout advanced setting in Intel® Ethernet Virtual Storage Miniport Driver, the system will crash. Linkdown Timeout values greater than 30 seconds may not provide extra time before a system crash.

- **Windows fails to boot properly after using the image install method**

The following situation may arise when installing Windows for FCoE Boot using the imaging method. Windows boots successfully from the FCoE LUN when the local drive is installed, but when the local drive is removed, Windows seems to boot but fails before reaching the desktop.

In this case, it is likely that the Windows installation resides on both the FCoE LUN and local drive. This can be verified by booting from the FCoE LUN with the local drive installed, then comparing the drive letter in the path of files on the desktop with the drive letter for the boot partition in the Windows Disk Management tool. If the drive letters differ, the Windows installation is split between the two disks.

If this occurs, ensure that **fcoeprep** is run prior to capturing the image and that the system is not allowed to boot locally between running **fcoeprep** and capturing the image. In addition, the local drive could be removed from the system prior to the first boot from the FCoE LUN.

For detailed instructions on installing using the imaging method, see [Installing Windows Server with Local Disk](#).

Linux Issues

Intermittent Failure to Remote Boot with X540 Adapter on SLES 11 SP3

Remote boot with SuSE11 SP3 and a x540 adapter can intermittently fail to complete. This is due to a timing issue involving DCB in some hardware configurations.

A fix for this issue can be found at [SuSE FCoE Bootable Driver Kit](#).

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Support: Intel® FCoE/DCB User Guide

Web and Internet Sites

<http://www.support.dell.com>

Customer Support Technicians

If the [troubleshooting procedures](#) do not resolve the problem, please contact Dell Inc. for technical assistance. Refer to system documentation for Dell customer support phone numbers.

Before you call...

You need to be at your computer with your software running and the product documentation at hand.

The technician may ask for the following:

- Your address and telephone number
 - The name and model number of the product you are calling about
 - The serial number of the product
 - The names and version numbers of the software you are using to operate the product
 - The name and version number of the operating system you are using
 - The computer type (manufacturer and model number)
 - Expansion boards or add-in cards in your computer
 - The amount of memory in your computer
-

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Glossary: Intel® FCoE/DCB User Guide

This Glossary defines terms, abbreviations, and acronyms that apply directly to Intel® Ethernet FCoE.

TERMS	DEFINITIONS
ARP	Address Resolution Protocol
Boot Targets	The server-side system in an FCoE SAN configuration. The FCoE Boot Target system hosts the FCoE target drives which are accessed by an FCoE Boot initiator.
CEE	Converged Enhanced Ethernet
Data Link Interface	Interface to the chip at the MAC layer.
DCB	Data Center Bridging
DCBX	DCB Exchange Protocol
DDP	Direct Data Placement
Descriptor Queues	Descriptor queues are used by software to submit work requests like send and receive and get completion status.
DLL	Dynamic Linked Libraries
DPT	Diamond Peak Technology
ETS	Enhanced Transmission Selection
FC	Fibre Channel
FCF	Fibre Channel Forwarder
FCoE	Fibre Channel over Ethernet
HBA	Host Bus Adapter
IPC	Inter-Process Communication
IRP	IO Request Packet
iSCSI	Internet SCSI
LLDP	Link Layer Discovery Protocol, IEEE802.1AB
LUN	Logical Unit Number. LUN is the identifier of a device which is being addressed by protocols such as Fibre Channel and iSCSI.
MPA	Marker Based PDU Alignment. This protocol runs on top of TCP and provides framing and data integrity.
Native OS Stack	OS stack that represents a particular function implemented purely in software (for example, native OS TCP/IP stack, native OS iSCSI stack).
Native TCP/IP Stack	TCP/IP stack implemented in software and provided as part of the operating system.
NFS	Network File System
NIC	Network Interface Controller
ODM	Offload Device Manager
Offload Stack	Components that make up the offload stack.
OPS	Offload Protocol Switch
Packet Buffers	Packet buffers are hardware FIFOs that either receive or transmit packets. Each packet buffer can be associated with one or more traffic classes
PCI	Peripheral Components Interface

PDU	Protocol Data Unit
PFC	Priority Flow Control
Raw Packet Driver	Standard Ethernet MAC driver.
RDMA	Remote Direct Memory Access
RDMAC	RDMA Consortium
RSS	Receive Side Scaling is a mechanism for hardware to distribute receive packets to queues that are associated with a specific processor core and thereby distributing the processing load.
RX	Receive
SAN	Storage Area Network
SCSI	Small Computer System Interface
SNMP	Simple Network Management Protocol
TLV	Type Length Value
Transport Interface	Interface to the chip at the transport layer.
TX	Transmit
ULP	Upper Layer Protocol
VBD	Virtual Bus Driver. The VBD exposes two virtual physical devices on a single physical device and enables sharing of LAN and SAN traffic on a common Ethernet port.
VFT	Virtual Fabric Tagging. This is a Fibre Channel defined extended frame header.
VLAN	Virtual LAN (VLAN) is a group of hosts with a common set of requirements that communicate as if they were attached to the same broadcast domain, regardless of their physical location.
VMDq	Virtual Machine Device Queues
VT	Vanderpool Technology, also known as Virtualization. VT is an Intel-wide effort to support multiple virtual platforms on a single physical platform. This requires both software and hardware support to implement efficiently.

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Intel® Ethernet Flash Firmware Utility

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Overview

The Intel® Ethernet Flash Firmware Utility (BootUtil) is a utility that can be used to program the PCI option ROM on the flash memory of supported Intel PCI Express based network adapters and to update configurations. BootUtil replaces existing utilities and provides the functionality of the older IBAUTIL, ISCSIUTL, LANUTIL, and FLAUTIL. It supports all adapters supported by the previous utilities.

NOTES:

- Updating the adapter's flash memory using BootUtil will erase any existing firmware image from the flash memory.
- If you are updating firmware from version 13.x, you must first update to version 14.0.12 before updating to firmware version 14.5.x.
- After updating the firmware using the Lifecycle Controller or running the Firmware Driver Update Package, the system must be completely powered down (A/C power removed) and restarted for all changes to take effect.

Intel provides the following flash firmware in FLB file format for programming to the flash memory:

- Intel® Boot Agent as PXE Option ROM for legacy BIOS (<http://www.intel.com/support/network/adapter/pro100/bootagent/>)
- Intel® Ethernet iSCSI Boot as iSCSI Option ROM for legacy BIOS (<http://www.intel.com/support/network/iscsi/remotboot/>)
- Network Connectivity, UEFI network driver (<http://www.intel.com/support/network/sb/cs-006120.htm>)

OEMs may provide custom flash firmware images for OEM network adapters. Please refer to the instructions given by OEMs.

BootUtil allows the user to flash supported firmware to the adapter from the included master FLB file. This option ROM includes PXE, iSCSI, FCoE and UEFI drivers, and the image is programmed to the flash memory at once. BootUtil will also build the required combo images for supported adapters and program those images to the flash, as well. Since both discrete and combo images are supported, the -BOOTENABLE command ONLY works on combo images.

The Master FLB file (BOOTIMG.FLB) is the new container for all the Intel(R) boot Option ROMs. This file replaces the existing FLB files for PXE, iSCSI, FCoE and EFI.

 **NOTE:** BootUtil supports older flb files to maintain backwards compatibility with the previous utilities.

BootUtil without command line options will display a list of all supported Intel network ports in the system. BootUtil will also allow the user to enable or disable the flash memory on specific ports by using -FLASHENABLE or -FLASHDISABLE option in order to control access to the firmware from the system.


BootUtil allows the user to individually set iSCSI Boot configurations using -NIC=xx -[OPTION]=[VALUE] options. The -I option is iSCSI specific and will not work for PXE configurations.

NOTES:

- BootUtil can display up to 128 adapter ports.
- No configuration settings are supported for the UEFI driver.
- Functionality from the previous utilities, such as IBAUTIL, is preserved in BootUtil, but the syntax for some commands may have changed.

BootUtil is located on the software installation CD in the \BOOTUTIL directory. Always check the Dell Customer Support website (<http://www.support.dell.com>) for the latest information and component updates.

Dell also provides a Firmware Dell Update Package (FW-DUP) that can be used to update the flash. For more information on the FW-DUP, click [here](#).

 **NOTE:** All Intel 10 gigabit server adapters shipped by Dell are shipped with the boot option ROM disabled for FCoE, iSCSI Boot, and PXE. Intel gigabit server adapters shipped by Dell are shipped with the boot option ROM disabled for iSCSI Boot and PXE.

Running BootUtil

The syntax for issuing BootUtil command line options in DOS is: `BootUtil [-option] or -[OPTION]=[VALUE]`


To run the Linux version of BootUtil, the qv driver must be loaded first. If the qv driver is not installed, follow the steps below load it.

1. Log in as root and create a temporary directory to build the Intel® Network Connections Tools driver.
2. Copy 'install' and the appropriate iqvlinux.tar.gz file for your platform to the temporary directory. The versions of Linux supported are Linux 32 (x86) and Linux64e (x64). The appropriate iqvlinux.tar.gz file is located in the corresponding directory for your platform.
3. Go to the temporary directory and run the command: `./install`
The qv driver is now installed and the files in the temporary directory can be removed.
4. Copy the correct version of BootUtil from the appropriate directory of the CD to your system.


Command Line Parameters

BootUtil accepts one executable parameter and its associated non-executable options in an execution. If conflicting executable options are supplied (such as `-FLASHENABLE` and `-UPDATE` used together), BootUtil exits with an error.

The options, where applicable, are listed in logical groups.

 **NOTE:** On the following adapters, only one image, either iSCSI Boot or PXE Option ROM, is allowed for all ports since the ports share the same flash. You cannot have one port with a flash image for iSCSI Boot and the other with a flash image for PXE Option ROM.

Intel® PRO/1000 PT Dual Port Server Adapter
 Intel® PRO/1000 PT Server Adapter
 Intel® PRO/1000 PF Server Adapter
 Intel® 10 Gigabit XF SR Server Adapter
 Intel® 10 Gigabit AT Server Adapter
 Intel® 10 Gigabit AF DA Dual Port Server Adapter





 **NOTE:** If you enter BootUtil without any command line options, the utility displays a list of all supported Intel network adapters found in your system.


General Options	
Parameter	Description
<code>-HELP</code> or <code>-?</code>	Displays a list of options.
<code>-EXITCODES</code>	Displays exit codes returned to the operating system by BootUtil.
<code>-IMAGEVERSION</code> or <code>-IV</code>	Displays firmware types and version numbers from a resource image. If used with the <code>-ALL</code> option, each resource image is continuously displayed for all adapters. If used with the <code>-NIC</code> option, the resource image is in the adapter flash. If used with the <code>-FILE</code> option, the resource image is in the FLB file.
<code>-E</code>	Enumerates all supported network ports in the system.


-O=[FILENAME]	<p>Redirects all text output to the specified filename. It must be used with the -E or -NIC option.</p> <p>If used with the -E option, a list of all NICs and their MAC addresses are saved to the specified file.</p> <p>If used with the -NIC option, all iSCSI Boot configuration options are saved for the specified NIC to the file.</p>
-I=[FILENAME]	Reads iSCSI Boot configuration options from the specified script file and program settings on the selected port.
-FILE=[FILENAME]	Specifies the file name for -SAVEIMAGE, -RESTOREIMAGE, -SAVECONFIG and -RESTORECONFIG options.
-P	Pauses the screen after displaying every 25th line. In pause mode, the last line of the screen will contain information that the screen has been paused and that the user can press Enter to continue.
-NODPL	With this parameter, BootUtil will not display the PCI device location.

Flash Programming Options	
Parameter	Description
-SAVEIMAGE	Saves the existing firmware image in the flash memory of the adapter specified by the -NIC option to a disk file. The destination file is specified by the -FILE option.
-RESTOREIMAGE	Restores the previously saved firmware image to the same network adapter using the -NIC option. The source file is specified by the -FILE option.
-QUIET	Runs BootUtil without confirmation prompts. This option is used with the -IMAGEVERSION, -UP, -UPDATE, -RESTOREIMAGE, or -HELP option.

Power Management Options	
Parameter	Description
-WOLDISABLE or -WOLD	Disables Wake On LAN functionality on the selected port.
-WOLENABLE or -WOLE	Enables Wake On LAN functionality on the selected port.

Adapter Flash Enable/Disable Options	
Parameter	Description
-FLASHENABLE or -FE	<p>Enables the capability to run flash firmware on the selected adapter.</p> <p> NOTE: This parameter is not supported on adapters using the combo Option ROM.</p> <p> NOTE: This parameter is not supported on the following adapters.</p> <ul style="list-style-type: none"> Intel® Gigabit ET Quad Port Mezzanine Card Intel® Gigabit 4P I350-t Mezz Intel® Ethernet X520 10GbE Dual Port KX4 Mezz Intel® Ethernet X520 10GbE Dual Port KX4-KR Mezz Intel® Ethernet 10G 2P X520-k bNDC Intel® Ethernet 10G 2P X540-t Adapter Intel® Ethernet 10G 4P X540/I350 rNDC
-FLASHDISABLE or -FD	<p>Disables the capability to run flash firmware on the selected adapter.</p> <p> NOTE: This parameter is not supported on adapters using the combo Option ROM.</p> <p> NOTE: This parameter is not supported on the following adapters.</p>


	<p>Intel® Gigabit ET Quad Port Mezzanine Card Intel® Gigabit 4P I350-t Mezz Intel® Ethernet X520 10GbE Dual Port KX4 Mezz Intel® Ethernet X520 10GbE Dual Port KX4-KR Mezz Intel® Ethernet 10G 2P X520-k bNDC Intel® Ethernet 10G X540-t Adapter Intel® Ethernet 10G 4P X540/I350 rNDC</p>
<pre>-BOOTENABLE=[iSCSIPRIMARY iSCSISECONDARY PXE FCoE disabled]</pre>	<p>Selects the flash firmware type to enable or disable on the selected port. The combo option ROM could have all capabilities. The monolithic option ROM has either PXE, iSCSI or FCoE capability but not all. This command will not work on monolithic Option ROMs.</p> <p> NOTE: This manual command is not applicable to the UEFI network driver. The UEFI network driver is enabled by default and loaded automatically unless network ports are already used by other flash firmware.</p> <p>BOOTENABLE=DISABLED Disables FCoE, iSCSI and PXE functionalities for legacy BIOS.</p> <p>BOOTENABLE=ISCSIPRIMARY Enables iSCSI primary and disables PXE and FCoE for legacy BIOS.</p> <p>BOOTENABLE=PXE Enables PXE and disables iSCSI and FCoE boot for legacy BIOS.</p> <p>BOOTENABLE=FCOE Enables FCoE and disables iSCSI and PXE for legacy BIOS.</p>

Adapter Selection Options	
Parameter	Description
-ALL	Selects all supported network ports found in system.
-NIC=XX	Selects a specific network port in the system. If used without any executable option, it prints the iSCSI boot configuration of the selected port or saves it to a file when the -O option is used.
-TARGET=XX	This is an FCoE-specific selection option. Legal values are 1,2,3, and 4. This option is required for configuration commands -WWPN, -FCOELUN, -FCOEVLAN, and -BOOTORDER.
-BLINK	Blinks the LED on the selected port for ten seconds and provides a method to identify an adapter. This parameter should be used with either the -NIC or -ALL option.  NOTE: This parameter is not supported on Intel® Ethernet Mezzanine Cards.

FCoE Remote Boot Options

FCoE Remote Boot Configuration Options	
FCoE General Configuration Options	Description
-[OPTION]=[VALUE]	These options must be used with the -NIC=XX option. They cannot be used with the -ALL option.
-WWPNPREFIX	Specifies the prefix to use the WWPN. The prefix of 4 hexadecimal digits. Separators, "-" or ":", are allowed but are optional. For example, BOOTUTIL -NIC=1 -WWPNPREFIX=20-00.
-WWNNPREFIX	Specifies the prefix to use the WWNN. The prefix of 4 hexadecimal digits. Separators, "-" or ":", are allowed but are optional. For example, BOOTUTIL -NIC=1 -

	WWNNPREFIX=10-00.
-SHOWFCOE	Displays the FCoE Target Configurations for the selected NIC.

FCoE Target Configuration Options	Description
-[OPTION]=[VALUE]	These options must be used with both the -NIC=XX option and the -TARGET=XX option. They cannot be used with the -ALL option.
-WWPN	Specifies the WWPN for the selected target. The WWPN consists of 16 hexadecimal digits or 8 bytes. Each byte can be separated with "-" or ":" as an optional separator. Example, BOOTUTIL -NIC=1 -TARGET=1 -WWPN=00-11-22-33-44-55-66-77
-FCOELUN	Specifies the LUN for the selected FCoE Target. Valid range is 0 through 255.
-FCOEVLAN	Specifies the VLAN to use in order to connect to the selected target. Valid range is 0 through 4094. Example, BOOTUTIL -NIC=1 -TARGET=2 -WWPN=0011223344556677 -FCOELUN=0 -FCOEVLAN=1 -BOOTORDER=2
-BOOTORDER	Specifies the boot order for the selected target. Valid range is 1 through 4. If a value of 0 is specified, then this target will be excluded from the boot order. Boot order values of 1 through 4 can only be assigned once to target(s) across all FCoE boot-enabled ports.  NOTE: These commands can be used on the same command line to configure an entire target in one shot. Example, BOOTUTIL -NIC=1 -TARGET=2 -WWPN=0011223344556677 -FCOELUN=0 -FCOEVLAN=1 -BOOTORDER=2

Examples

The following examples show how to enter some typical BootUtil command lines.

Example 1:

To enable the flash firmware on the first network adapter so that the system will be capable of executing the flash firmware:

```
BootUtil -NIC=1 -FLASHENABLE
```

Example 2:

To disable the flash firmware on all the network adapters:

```
BootUtil -ALL -FD
```

Example 3:

To display BootUtil embedded flash firmware types and versions:

```
BootUtil -IMAGEVERSION
```

Example 4:

To disable the firmware on the second network port in the system:

```
BootUtil -NIC=2 -BOOTENABLE=DISABLED
```



NOTE: This command will work only on an adapter using a combo Option ROM and not a discrete Option ROM.

Example 5:

To get help:

```
BootUtil -?
```

DOS Exit Codes

BootUtil returns exit codes to the DOS environment. Possible exit codes are listed below:

Code Name	Value
All BootUtil operations completed successfully	0
Bad command line parameter	1
No supported network adapters detected	2
Invalid network port selected	3
Flash operation failed	4
EEPROM read operation failed	5
EEPROM write operation failed	6
File content is missing or corrupt	7
Operator termination	8
LOM not supported for selected operation	9
Network port is not bootable	10
Programming iSCSI boot configurations failed	13
System memory allocation failed	14
File operation failed	15
FCoE operation failed	16


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Dell Update Package for Intel Adapter Firmware

The Dell Update Package (DUP) for Intel Adapter Firmware is provided by Dell. It includes all support files and EEPROM and Flash images needed in a self-extracting file that silently updates the firmware.

In order to use the package on Linux Systems, the following is required:

- DKMS must be installed.
- A Dell supported kernel or kernel sources must be installed.

 **NOTE:** If the kernel is not a Dell supported kernel, the compile and make packages also need to be included.

 **NOTE:** This DUP is not supported on ESX and Citrix XenServer. However, these operating systems can be updated with the Update Package through the Lifecycle Controller.

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