By using this document, in addition to any agreements you have with Intel, you accept the terms set forth below.

You may not use or facilitate the use of this document in connection with any infringement or other legal analysis concerning Intel products described herein. You agree to grant Intel a non-exclusive, royalty-free license to any patent claim thereafter drafted which includes subject matter disclosed herein.

INFORMATION IN THIS DOCUMENT IS PROVIDED IN CONNECTION WITH INTEL PRODUCTS. NO LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT. EXCEPT AS PROVIDED IN INTEL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, INTEL ASSUMES NO LIABILITY WHATSOEVER AND INTEL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY, RELATING TO SALE AND/OR USE OF INTEL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

A "Mission Critical Application" is any application in which failure of the Intel Product could result, directly or indirectly, in personal injury or death. SHOULD YOU PURCHASE OR USE INTEL'S PRODUCTS FOR ANY SUCH MISSION CRITICAL APPLICATION, YOU SHALL INDEMNIFY AND HOLD INTEL AND ITS SUBSIDIARIES, SUBCONTRACTORS AND AFFILIATES, AND THE DIRECTORS, OFFICERS, AND EMPLOYEES OF EACH, HARMLESS AGAINST ALL CLAIMS COSTS, DAMAGES, AND EXPENSES AND REASONABLE ATTORNEYS' FEES ARISING OUT OF, DIRECTLY OR INDIRECTLY, ANY CLAIM OF PRODUCT LIABILITY, PERSONAL INJURY, OR DEATH ARISING IN ANY WAY OUT OF SUCH MISSION CRITICAL APPLICATION, WHETHER OR NOT INTEL OR ITS SUBCONTRACTOR WAS NEGLIGENT IN THE DESIGN, MANUFACTURE, OR WARNING OF THE INTEL PRODUCT OR ANY OF ITS PARTS.

Intel may make changes to specifications and product descriptions at any time, without notice. Designers must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined". Intel reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them. The information here is subject to change without notice. Do not finalize a design with this information.

The products described in this document may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request.

Contact your local Intel sales office or your distributor to obtain the latest specifications and before placing your product order.

Copies of documents which have an order number and are referenced in this document, or other Intel literature, may be obtained by calling 1-800-548-4725, or go to: http://www.intel.com/design/literature.htm.

Intel and Intel logo are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

* Other names and brands may be claimed as the property of others.

Copyright © 2014, Intel Corporation. All Rights Reserved.
# Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>June 11, 2014</td>
<td>Initial public release</td>
</tr>
</tbody>
</table>
NOTE: This page intentionally left blank.
# Contents

1.0 Introduction ............................................................................................................. 1
2.0 FCoE Basics............................................................................................................... 1
3.0 Administrative Ownership........................................................................................ 1
4.0 Loading the FCoE Driver and Obtaining the Port and Node WWN in Windows ......... 2
5.0 Setting Up the Network.............................................................................................. 5
6.0 Setting Up the Storage............................................................................................... 6
7.0 Operating System Setup for Windows ....................................................................... 8
8.0 Summary ..................................................................................................................... 10
NOTE: This page intentionally left blank.
1.0 Introduction

This document is a supplement to the Microsoft Server SAN Storage Administrators Guide. It is an introduction to FCoE storage connectivity from a Windows server administrator’s perspective, and shows the basic connection from the Windows operating system to an FCoE storage target.

The goal of this document is to show the connection from a host perspective and the requirements provided by and to the Storage and Network Administrators. It is part of a series of FCoE Quick Connect guides for multiple operating systems.

To better understand the entire process, some limited basic port, zone, and storage grouping configurations are shown from Switch and Storage Administrator perspectives. The information in this document is for experienced System Administrators who are familiar with server, network, data center, and SAN storage concepts and technologies.

2.0 FCoE Basics

Fibre Channel over Ethernet (FCoE) is a computer technology that encapsulates Fibre Channel frames over an Ethernet network.

Fibre Channel is a set of standards that define reliable, high-speed transport for storage. Fibre Channel does not follow the OSI model, but rather utilizes its own five layer model: layer FC0-FC04. Interconnectivity is much like its OSI counterpart, composed of physical, Data Link, Network, Common Services, and Protocol Mapping layers. The FCoE protocol replaces the FC0 and FC1 layers of the Fibre Channel stack with the Physical and Data Link layers of Ethernet. Using Ethernet provides more flexibility and cost reductions to data center usages.

Some notable configuration parameters and conceptual terms for FCoE are: Targets, Zones, and World-Wide Names.

- Targets (or LUNs) are storage partitions assigned to a server from a remote storage array.
- Storage arrays use unique identifiers called World-Wide Names (WWNs) as an addressing schema to access these targets.
- Zoning or zones are the partitioning of a Fibre Channel or FCoE fabric into smaller subsets to restrict interference, add security, and to simplify management.

3.0 Administrative Ownership

Basic FCoE connectivity touches three technology disciplines: server, network, and storage.

The Server Administrator identifies and provides the WWN to both the Network and Storage Administrators. The Network Administrator ensures the network is setup end-to-end, and must provide configurations changes to the FCF-capable switch port and add the WWN to the FCoE fabric's zone. The Storage Administrator creates the LUN and host entity, then assigns each to a storage group to create the LUN masking.

Table 1 lists the responsibilities of the individual technology administrators.
4.0 Loading the FCoE Driver and Obtaining the Port and Node WWN in Windows

This section shows how to load the Intel® Ethernet FCoE driver and obtain the WWN in the Windows Server operating system.

1. Navigate to the **Device Manager** within the **Server Manager** as shown in Figure 1. The Intel® Ethernet Converged Network Adapter X520 is recognized, but note there are no storage controllers. Without the FCoE drivers loaded, there are limited tabs in adapter's properties.

---

### Table 1. Administrative Ownership

<table>
<thead>
<tr>
<th>Owner</th>
<th>Responsibilities</th>
</tr>
</thead>
</table>
| Server Administrator   | 1. Turn on the FCoE service.  
                          | 2. Identify the host’s Port/Node World-Wide Name.  
                          | 3. Provide the host’s Port/Node World-Wide Name to the Network and Storage Administrators. |
| Network Administrator  | 1. Ensure end-to-end L2 connectivity.  
                          | 2. Configure Ethernet port with an FCoE-capable VLAN.  
                          | 3. Add the Port World Wide Name to the appropriate Zone. |
| Storage Administrator  | 1. Create server’s host initiator.  
                          | 2. Create LUN Target.  
                          | 3. Create “Storage Group”:  
                          | a. Assign host entity to the Storage Group.  
                          | b. Assign target LUN to the Storage Group. |

---

**Figure 1. Loading Driver/Obtaining Port and Node WWN - Step 1**
2. Navigate the directory location of the most current Intel® Ethernet CNA X520 adapter driver. Launch the driver, and when prompted, select **FCoE using Data Center Bridging** as shown in Figure 2. Complete the driver install with default settings. These changes add storage controllers and add multiple tabs within the adapter's properties (see Step 4).

![Figure 2. Loading Driver/Obtaining Port and Node WWN - Step 2](image)

3. Return to **Device Manager** view in **Server Manager**. With the FCoE driver loaded, FCoE storage controllers are now available, as shown in Figure 3.

![Figure 3. Loading Driver/Obtaining Port and Node WWN - Step 3](image)
4. Open the properties of Intel® Ethernet CNA X520 adapter port that can now be used for FCoE. Navigating to the Data Center tab to view the adapter properties, as shown in Figure 4. These properties show that there is a valid connection to the switch. The Data Center tab is only available when either FCoE or iSCSI DCB has been enabled.

![Figure 4. Loading Driver/Obtaining Port and Node WWN - Step 4](image)

5. Return to Device Manager view in Server Manager, and go to the Virtual Storage properties to obtain the PWWN as shown in Figure 5.

![Figure 5. Loading Driver/Obtaining Port and Node WWN - Step 5](image)
5.0 Setting Up the Network

The Network Administrator owns network switch port configuration and end-to-end connectivity between the storage array and the server. The overall configuration of a Fibre Channel Forwarder (FCF) switch is outside the parameters of this document, but a basic view of the key SAN administration configurations of the switch provides a valuable view of the FC/FCoE process.

Note: There are no configuration steps in this section, only show commands.

Note: For clarity and accuracy of the configuration, it is recommended to use the Cisco* Nexus* 5000 Series NX-OS Software Configuration Guide.

1. Use the global command show flogi database to verify FCoE VSAN details as shown in Figure 6. The key information to note is the assigned VSAN number and PWWN for zone identification and configuration. This verifies the PWWN we saw in Section 4.0, Step 5.

![Figure 6. Setting Up the Network - Step 1](image)

2. Use the show vlan fcoe command to verify that Ethernet VLAN 110 and VSAN 11 are mapped together to encapsulate Fiber Channel packets onto an Ethernet, as shown in Figure 7. VLAN 110 must be added to the Ethernet interface to participate in VSAN 11.

![Figure 7. Setting Up the Network - Step 2](image)

3. A view of the interface shows the port configured as an edge-type trunk as shown in Figure 8. Note that in VLAN 110, the FCoE VLAN is allowed. Additionally, VLAN 353 is allowed on the port to be used as a traditional IP network, which can be added to host through a VLAN tag.
4. Use the `show zone vsan 11` command to verify that the zone associated with VSAN 11 has been populated with the PWWN of the host, as shown in Figure 9.

6.0 Setting Up the Storage

The Storage Administrator will set up the server initiator record and the target. Full administration is beyond the scope of this document, but the storage group settings provide a helpful visual of target masking.

1. The Storage Administrator will require the Port/Node WWN to configure the target initiator, as shown in Figure 10. The WWN is used as a unique identifier to perform direct path assignment from the host initiator to the target initiator.
2. Create a target LUN within a pool or volume within the storage array, as shown in Figure 11. In this case, a new 10 GB LUN is created in a RAID5 pool.

![Figure 11. Setting Up the Storage - Step 2](image)

3. The target LUN and the host initiator are mapped together in a storage group as shown in Figure 13.

![Figure 12. Setting Up the Storage - Step 3](image)
7.0 Operating System Setup for Windows

This section shows the steps to view and manage the target LUN on the server once both the Storage and Network Administrators have created the storage target and the network has been fully configured.

1. Return to the host, open Server Manager, and navigate to Device Manager. Right-click on Intel (R) Ethernet Virtual Storage Miniport Driver for FCoE and select Properties, as shown in Figure 13.

2. Navigate to the Fabric View tab to view VLAN, target and host WWN, and assigned target LUN, as shown in Figure 14. Drill down to the LUN itself to see detailed LUN information.
3. Navigate to **Disk Management** in the **Storage** area of **Server Manger** to bring the disk on-line and initialize it, as shown in **Figure 15**.

---

**Figure 14.** Operating System Setup for Windows - Step 2

**Figure 15.** Operating System Setup for Windows - Step 3
4. The 10 GB target LUN is now available to create a volume and format it for usage, as shown in Figure 16.

**Figure 16. Operating System Setup for Windows - Step 4**

### 8.0 Summary

The Intel® Ethernet Converged Network Adapter Family offers some of the most flexible and scalable Ethernet adapters available for today’s data centers. These adapters support Unified Networking and fully support a wide range of storage capabilities. Customers get the ease of Ethernet support along with the ability to converge a variety of applications in a single adapter.

For more configuration information on Intel® Ethernet Converged Network Adapters, go to:


For more configuration information on Windows Server Storage Manager, go to: