Chelsio Communications

Accelerate

Chelsio Unified Boot

Installation and User's Guide

Chelsio Communications (Headquarters)
209 North Fair Oaks Avenue,
Sunnyvale, CA 94085
U.S.A

www.chelsio.com

Tel: 408.962.3600
Fax: 408.962.3661

Chelsio (India) Private Limited
Subramanya Arcade, Floor 3, Tower B
No. 12, Bannerghatta Road,
Bangalore-560029
Karnataka,
India

Tel: +1-91-80-4039-6800

Chelsio KK (Japan)
Yamato Building 8F,
5-27-3 Sendagaya,
Shibuya-ku,
Tokyo 151-0051,
Japan

Sales
For all sales inquiries please send email to sales@chelsio.com

Support
For all support related questions please send email to support@chelsio.com

Document History

Version	Revision Date
1.0.0	05/18/2012
1.0.1	07/30/2012
1.0.2	10/05/2012
1.0.3	16/05/2012
1.0.4	07/31/2013
1.0.5	04/29/2014
1.0.6	09/05/2014
1.0.7	09/26/2014
1.0.8	10/13/2014
1.0.9	02/24/2015
1.1.0	05/05/2015
1.1.1	07/07/2015
1.1.2	09/22/2016
1.1.3	11/18/2016
1.1.4	09/29/2017

TABLE OF CONTENTS

I. Unified Boot Option ROM

1. Introduction

Thank you for choosing Chelsio Unified Wire adapters. These high speed, single chip, single firmware cards provide enterprises and data centers with high performance solutions for various Network and Storage related requirements.

The **Terminator** series is Chelsio's next generation of highly integrated, hyper-virtualized 1/10/25/40/50/100GbE controllers. The adapters are built around a programmable protocol-processing engine, with full offload of a complete Unified Wire solution comprising NIC, TOE, iWARP RDMA, iSCSI, FCoE and NAT support. It scales to true 40Gb line rate operation from a single TCP connection to thousands of connections, and allows simultaneous low latency and high bandwidth operation thanks to multiple physical channels through the ASIC.

Ideal for all data, storage and high-performance clustering applications, the Unified Wire adapters enable a unified fabric over a single wire by simultaneously running all unmodified IP sockets, Fibre Channel and InfiniBand applications over Ethernet at line rate.

Designed for deployment in virtualized data centers, cloud service installations and high-performance computing environments, Chelsio adapters bring a new level of performance metrics and functional capabilities to the computer networking industry.

PXE is short for Preboot eXecution Environment and is used for booting computers over an Ethernet network using a Network Interface Card (NIC). FCoE SAN boot process involves installation of an operating system to an FC/FCoE disk and then booting from it. iSCSI SAN boot process involves installation of an operating system to an iSCSI disk and then booting from it.

This section of the guide explains how to configure and use Chelsio Unified Boot Option ROM which flashes PXE, iSCSI and FCoE Option ROM onto Chelsio's converged network adapters (CNAs). It adds functionalities like PXE, FCoE and iSCSI SAN boot.

1.1. Hardware Requirements

1.1.1. Supported Adapters

The following are the currently shipping Chelsio Adapters that are compatible with Chelsio Unified Boot Option ROM software:

- T62100-CR
- T62100-LP-CR
- T62100-SO-CR*
- T6425-CR
- T6225-CR
- T6225-LL-CR
- T6225-SO-CR*

- T580-OCP-SO*
- T520-OCP-SO*
- T520-BT
- T580-CR
- T520-LL-CR
- T520-SO-CR*
- T520-CR
- T540-CR
- T580-LP-CR
- T580-SO-CR*

** Only PXE supported*

1.1.2. Supported Hardware

The following hardware platforms are supported by Chelsio Unified Boot Option ROM software:

- Dell T5600
- DELL PowerEdge 2950
- DELL PowerEdge T110
- DELL PowerEdge T710
- DELL PowerEdge R220
- DELL PowerEdge R720
- IBM X3650 M2
- IBM X3650 M4*
- HP Proliant DL180 gen9
- HP ProLiant DL385G2
- Supermicro X7DWE
- Supermicro X8DTE-F
- Supermicro X8STE
- Supermicro X8DT6
- Supermicro X9SRL-F
- Supermicro X9SRE-3F
- Supermicro-X10DRi
- ASUS P5KPL
- ASUS P8Z68
- Lenovo X3650 M5
- Intel DQ57TM

* If system BIOS version is lower than 1.5 and both Legacy and uEFI are enabled, system will hang during POST. Please upgrade the BIOS version to 1.5 or higher to avoid this issue.

1.1.3. Supported Switches

The following switches are supported by Chelsio Unified Boot Option ROM software:

- Cisco Nexus 5010 with 5.1(3) N1 (1a) firmware.

- Arista DCS-7124S-F
- Mellanox SX_PPC_M460EX

Other platforms/switches have not been tested and are not guaranteed to work.

1.2. Software Requirements

Chelsio Unified Boot Option ROM software requires Disk Operating System to flash Option ROM onto Chelsio adapters.

1.3. Pre-requisites

A DOS bootable USB flash drive or Floppy Disk is required for updating firmware, option ROM, creating DUD, etc.

1.4. Package Contents

Chelsio Unified Boot Option ROM package contains the following:

- **OptionROM**: This directory contains Unified Boot Option ROM image (*cubt4.bin*), uEFI driver (*ChelsioUD.efi*), default boot configuration file (*bootcfg*) and a flash utility (*cfut4.exe*), which can be used to flash the option ROM onto Chelsio's adapters. It also contains Firmware files.
- **ESXi**: Chelsio offline driver bundle for ESXi.
- **LinuxDUD:** This directory contains files required to update drivers for Linux distributions.
- **WindowsDrivers:** This directory contains network driver packages to be added to WDS server and boot images.
- **EULA:** Chelsio’s End User License Agreement.
- **docs:** The docs directory contains support documents - README, Release Notes and User’s Guide (this document) for the software package.

2. Hardware Installation

i. Shutdown/power off your system.
ii. Power off all remaining peripherals attached to your system.
iii. Unpack the Chelsio adapter and place it on an anti-static surface.
iv. Remove the system case cover as per the system manufacturer's instructions.
v. Remove the PCI filler plate from the slot where you will install the Ethernet adapter.
vi. For maximum performance, it is highly recommended to install the adapter into a PCIe x8/x16 slot.

Note *All 4-ports of T6425-CR adapter will be functional only if PCIe x8 -> 2x PCIe x4 slot bifurcation is supported by the system and enabled in BIOS. Otherwise, only 2-ports will be functional.*

vii. Holding the Chelsio adapter by the edges, align the edge connector with the PCI connector on the motherboard. Apply even pressure on both edges until the card is firmly seated. It may be necessary to remove the SFP (transceiver) modules prior to inserting the adapter.
viii. Secure the Chelsio adapter with a screw, or other securing mechanism, as described by the system manufacturer's instructions. Replace the case cover.
ix. After securing the card, ensure that the card is still fully seated in the PCIE x8/x16 slot as sometimes the process of securing the card causes the card to become unseated.
x. Connect a fiber/twinax cable, multi-mode for short range (SR) optics or single-mode for long range (LR) optics, to the Ethernet adapter or regular Ethernet cable for the 1Gb Ethernet adapter.
xi. Power on your system.
xii. On Linux systems, run *update-pciids* command to download the current version of PCI ID list

```
[root@[redacted] ~]# update-pciids
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100  227k  100  227k    0     0  68592      0  0:00:03  0:00:03 --:--:-- 68610
Done.
```

xiii. Verify if the adapter was installed successfully:
- On Linux and ESXi systems, run *lspci* command and you should see a similar output:

```
[root@[redacted] ~]# lspci | grep -i Chelsio
81:00.0 Ethernet controller: Chelsio Communications Inc T62100-LP-CR Unified Wire Ethernet Controller
81:00.1 Ethernet controller: Chelsio Communications Inc T62100-LP-CR Unified Wire Ethernet Controller
81:00.2 Ethernet controller: Chelsio Communications Inc T62100-LP-CR Unified Wire Ethernet Controller
81:00.3 Ethernet controller: Chelsio Communications Inc T62100-LP-CR Unified Wire Ethernet Controller
81:00.4 Ethernet controller: Chelsio Communications Inc T62100-LP-CR Unified Wire Ethernet Controller
81:00.5 SCSI storage controller: Chelsio Communications Inc T62100-LP-CR Unified Wire Storage Controller
81:00.6 Fibre Channel: Chelsio Communications Inc T62100-LP-CR Unified Wire Storage Controller
```

- On Windows systems, follow these steps:
  a. Open **Device Manager** in **Control Panel**.
  b. Under **Other devices** section, Chelsio adapter should be listed as ***Ethernet Controller.*** If the adapter is not listed, right-click on the system name or click on the **Actions** menu and select ***Scan for hardware changes.***

For Chelsio adapters, the physical functions are currently assigned as:

- Physical functions 0 - 3: for the SR-IOV functions of the adapter
- Physical function 4: for all NIC functions of the adapter
- Physical function 5: for iSCSI
- Physical function 6: for FCoE
- Physical function 7: Currently not assigned

xiv. Based on the operating system, install the appropriate network driver. Install and load *cxgb4* for Linux systems, *VBD* and *NDIS* for Windows systems, and *cxl* for ESXi systems.

xv. Finally, verify if the card is discovered:

- For Linux systems, examine the output of *dmesg* and you should see a similar output:

```
[ 1119.854346] cxgb4 0000:81:00.4: Chelsio T62100-LP-CR rev 0
[ 1119.854347] cxgb4 0000:81:00.4: S/N: RE41160042, P/N: 11012106003
[ 1119.854348] cxgb4 0000:81:00.4: Firmware version: [redacted]
[ 1119.854349] cxgb4 0000:81:00.4: Bootstrap version: 255.255.255.255
[ 1119.854350] cxgb4 0000:81:00.4: TP Microcode version: 0.1.23.2
[ 1119.854351] cxgb4 0000:81:00.4: No Expansion ROM loaded
[ 1119.854351] cxgb4 0000:81:00.4: Serial Configuration version: 0x7002000
[ 1119.854352] cxgb4 0000:81:00.4: VPD version: 0x52
[ 1119.854354] cxgb4 0000:81:00.4: Configuration: NIC MSI-X, non-Offload capable
[ 1119.854355] eth0: Chelsio T62100-LP-CR (eth0) 100GBASE-CR4_QSFP
```

  The above output indicates the hardware configuration of the adapters as well as the Serial numbers.

- For Windows systems, open **Device Manager** again. Expand **Network adapters** section and now Chelsio adapter should be listed.
- For ESXi systems, examine the output of *dmesg* and you should see a similar output:

```
2017-09-26T04:09:20.207Z cpu6:66032)cxl1.0: cxl_port_init:874: mbox 0 pf 0 chan 0 viid c0
2017-09-26T04:09:20.209Z cpu6:66032)DMA: 646: DMA Engine 'cxl-0000:04:00.0' created using mapper 'DMANull'.
2017-09-26T04:09:20.209Z cpu6:66032)cxl1.0: cxl_config_queues:1091: max_filters 120
2017-09-26T04:09:20.209Z cpu6:66032)VMK_PCI: 765: device 0000:04:00.0 allocated 32 MSIX interrupts
2017-09-26T04:09:20.209Z cpu6:66032)cxl1.0: cxl_intr_alloc_msix:2581: net q 14 rss q 16 non rss q 13 tx q 8
2017-09-26T04:09:20.211Z cpu6:66032)cxl1.0: cxl_rss_do_init:5221: pool 0 rss viid c1
2017-09-26T04:09:20.212Z cpu6:66032)cxl1.0: cxl_rss_init:2501: pool 0 rss mode 31
2017-09-26T04:09:20.212Z cpu6:66032)Chelsio T6225-CR rev 0 25G NIC PCIe 8 GT/s x8 MSI-X S/N: RE35160002, P/N: 11012096002
```

Note

Network device names for Chelsio's physical ports are assigned using the following convention: the port farthest from the motherboard will appear as the first network interface. However, for T5 40G adapters, the association of physical Ethernet ports and their corresponding network device names is opposite. For these adapters, the port nearest to the motherboard will appear as the first network interface.

3. Secure Boot

Secure Boot, a high-performance computing software solution is a method to restrict which binaries can be executed to boot the system. With Secure Boot, the system BIOS will only allow the execution of boot loaders that carry the cryptographic signature of trusted entities. In other words, anything run in the BIOS must be "signed" with a key that the system knows is trustworthy. With each reboot of the server, every executed component is verified.

The following example describes the method to enable Secure Boot on HP ProLiant servers. Steps may differ slightly on other platforms:

i. During system boot, press F9 to run the **System Utilities**.
ii. Select **System Configuration**.
iii. Select **BIOS/Platform Configuration (RBSU)**.
iv. Select **Server Security**.
v. Select **Secure Boot Settings**.
vi. Select **Advanced Secure Boot Options**.
vii. Provide the Platform Key (PK), Key Exchange Key (KEK) and Allowed Signature Database (DB) to the respective uEFI NVRAM variables.
    - **Windows**:
        - PK: Will be generated at the discretion of the platform owner (OEM). Click here for more information.
        - KEK: http://www.microsoft.com/pkiops/certs/MicCorKEKCA2011_2011-06-24.crt
        - Windows DB: http://www.microsoft.com/pkiops/certs/MicWinProPCA2011_2011-10-19.crt
        - uEFI DB: http://www.microsoft.com/pkiops/certs/MicCorUEFCA2011_2011-06-27.crt
        - Signature GUID for all the above keys: 77fa9abd-0359-4d32-bd60-28f4e78f784b
    - **Linux**:
        - Use the same values for PK, KEK, Windows DB, uEFI DB and Signature ID as mentioned above.
        - In addition, provide the following values:
            - chcert.cer: Provided in *Chelsio-Uboot-x.x.x.xx/chelsio_key/*
            - Signature GUID for chcert.cer: 0b74ace7-6136-a493-19a9-6104d6d1e432
viii. Reboot the system, run **System Utilities** and go to **Secure Boot Settings**.
ix. Select and enable **Secure Boot Enforcement**.
x. Reboot the system.

4. Flashing Firmware and Option ROM

Depending on the boot mode selected, Chelsio Unified Boot provides two methods to flash firmware and option ROM onto Chelsio adapters: Flash utility *cfut4* for Legacy mode and *HII* for uEFI mode. On HP machines, you can also use Firmware Manager Protocol (FMP), in addition to HII. These methods also provide the functionality to update/erase Hardware configuration and Phy Firmware files.

4.1. Preparing USB flash drive

This document assumes that you are using a USB flash drive as a storage media for the necessary files. Follow the steps below to prepare the drive:

xi. Create a DOS bootable USB flash drive. (Click here for instructions)

xii. Create a directory *CHELSIO* on the USB flash drive.

xiii. If you haven't done already, download *Chelsio-Uboot-x.x.x.xx.zip* from Chelsio Download Center

xiv. Unzip the downloaded package and change your working directory to *OptionROM* directory.

```
[root@host~]# cd Chelsio-Uboot-x.x.x.xx/OptionROM
```

xv. Copy all the files and place them in the *CHELSIO* directory created on the USB flash drive.

xvi. Plug-in the USB flash drive in the system on which the Chelsio CNA is installed.

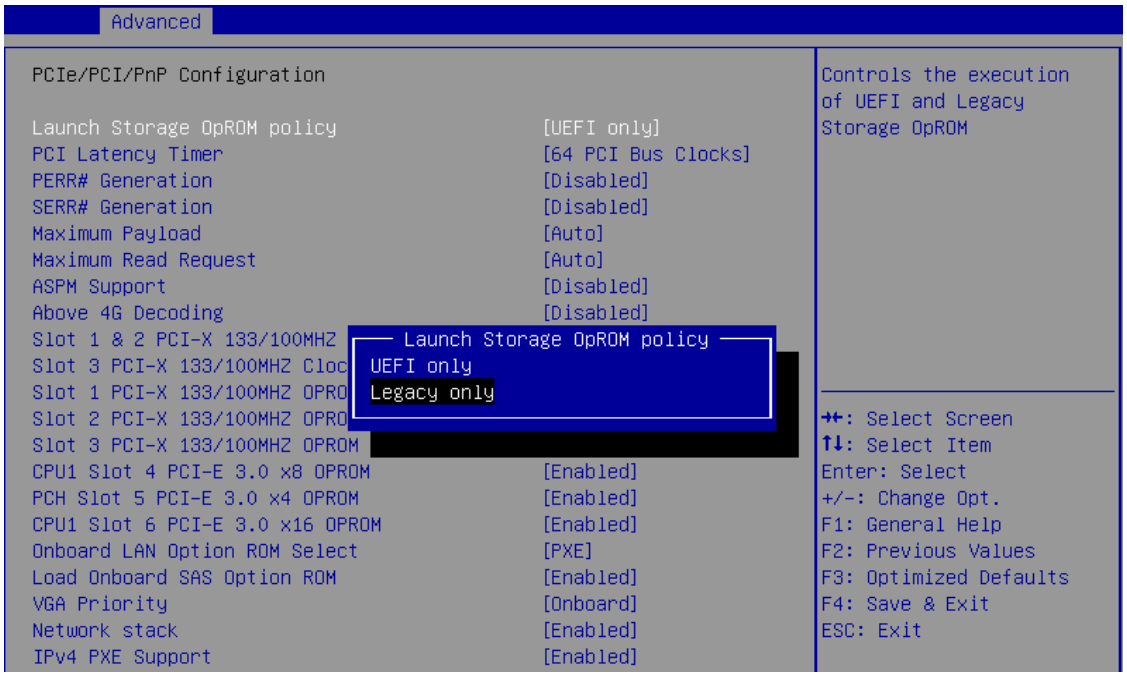
xvii. Reboot the system and go into the BIOS setup.

xviii. Make the USB flash drive as the primary boot device.

xix. Save the changes.

4.2. Legacy

i. In BIOS, configure the system having Chelsio CNA to boot in Legacy mode.



ii. Once the system boots from the USB flash drive, change your working directory to *CHELSIO* directory:

```
C:\>cd CHELSIO
```

iii. Run the following command to list all Chelsio CNAs present on the system. The list displays a unique index for each CNA found.

```
C:\CHELSIO>cfut4 -l
```

iv. Delete any previous version of Option ROM flashed onto the CNA:

```
C:\CHELSIO>cfut4 -d <idx> -xb
```

Here, `idx` is the CNA index found in step iii (0 in this case)

```
C:\CHELSIO>cfut4 -d 0 -xb

 Chelsio T5/T6 Flash Utility v1.5

 Erasing serial flash sector(s) ... Done
 Reboot machine for changes to take effect
```

v. Delete any previous firmware using the following command:

```
C:\CHELSIO>cfut4 -d <idx> -xh -xf
```

```
C:\CHELSIO>cfut4 -d 0 -xh -xf

 Chelsio T5/T6 Flash Utility v1.5

 Erasing serial flash sector(s) ... Done
 Erasing serial flash sector(s) ... Done
 Reboot machine for changes to take effect
```

vi. Delete any previous Option ROM settings:

```
C:\CHELSIO>cfut4 -d <idx> -xc
```

```
C:\CHELSIO>cfut4 -d 0 -xc

 Chelsio T5/T6 Flash Utility v1.5

 Erasing serial flash sector(s) ... Done
 Reboot machine for changes to take effect
```

vii. Run the following command to flash the appropriate firmware.

```
C:\CHELSIO>cfut4 -d <idx> -uf <firmware_file>.bin
```

Here, `firmware_file` is the firmware image file present in the *CHELSIO* directory.

```
C:\CHELSIO>cfut4 -d 0 -uf T6FW-1~1.BIN

 Chelsio T5/T6 Flash Utility v1.5

 Erasing serial flash sector(s) ... Done
 Writing Image at Base 00080000 ... Done
 Writing Image at Base 00088000 ... Done
 Writing Image at Base 00090000 ... Done
 Writing Image at Base 00098000 ... Done
 Writing Image at Base 000a0000 ... Done
 Writing Image at Base 000a8000 ... Done
 Writing Image at Base 000b0000 ... Done
 Writing Image at Base 000b8000 ... Done
 Writing Image at Base 000c0000 ... Done
 Writing Image at Base 000c8000 ... Done
 Writing Image at Base 000d0000 ... Done
 Writing Image at Base 000d8000 ... Done
 Writing Image at Base 000e0000 ... Done
 Writing Image at Base 000e8000 ... Done
 Writing Image at Base 000f0000 ... Done
 Writing Image at Base 000f8000 ... Done
 Reboot machine for changes to take effect
```

viii. Flash the unified option ROM onto the Chelsio CNA using the following command:

```
C:\CHELSIO>cfut4 -d <idx> -ub cubt4.bin
```

Here, `cubt4.bin` is the unified option ROM image file present in the *CHELSIO* directory.

```
C:\CHELSIO>cfut4 -d 0 -ub cubt4.bin

 Chelsio T5/T6 Flash Utility v1.5

 Erasing serial flash sector(s) ... Done
 Writing Image at Base 00000000 ... Done
 Writing Image at Base 00008000 ... Done
 Writing Image at Base 00010000 ... Done
 Writing Image at Base 00018000 ... Done
 Writing Image at Base 00020000 ... Done
 Writing Image at Base 00028000 ... Done
 Writing Image at Base 00030000 ... Done
 Writing Image at Base 00038000 ... Done
 Writing Image at Base 00040000 ... Done
 Writing Image at Base 00048000 ... Done
 Writing Image at Base 00050000 ... Done
 Writing Image at Base 00058000 ... Done
 Writing Image at Base 00060000 ... Done
 Writing Image at Base 00068000 ... Done
 Erasing serial flash sector(s) ... Done
 Writing Image at Base 00070000 ... Done
 Reboot machine for changes to take effect
```

ix. Reboot the system for changes to take effect.

x. To configure the base MAC address (optional), use the below command:

```
C:\CHELSIO>cfut4 -d <idx> -um <Hex MAC Address>
```

Here, *idx* is the CNA index found in step (c)

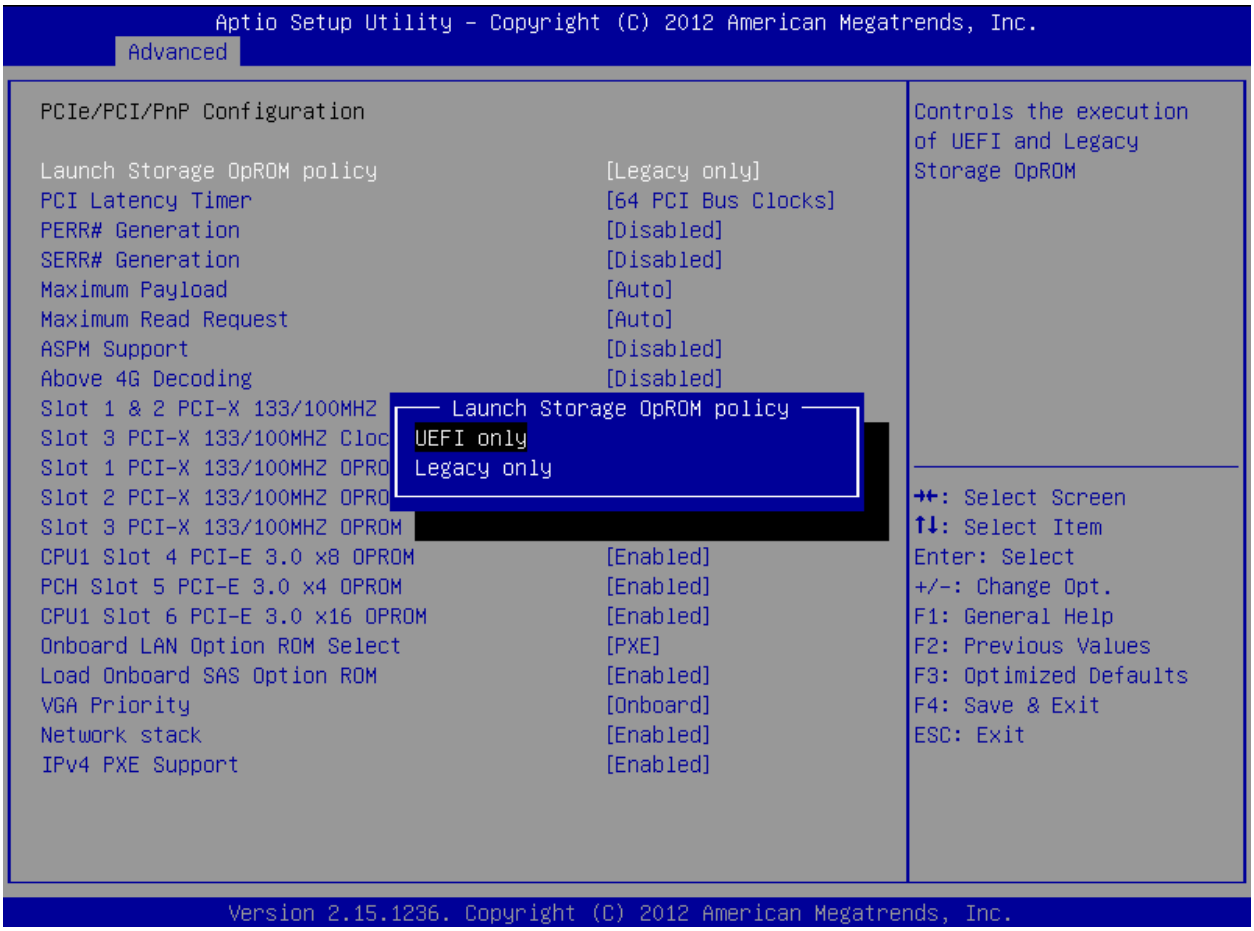
Example:

```
C:\CHELSIO>cfut4 -d 0 -um 000743000123
```

4.3. uEFI

i. Reboot the system and go into BIOS setup.

ii. Configure the system having Chelsio CNA to boot in uEFI mode.



Note *For Supermicro systems, enable **Network Stack*** as well before proceeding.

iii. Boot to EFI Shell.

```
EFI Shell version 2.31 [4.654]
Current running mode 1.1.2
Device mapping table
  fs0  :Removable HardDisk - Alias hd83b0f0b blk0
        PciRoot(0x0)/Pci(0x1d,0x0)/USB(0x1,0x0)/USB(0x5,0x0)/HD(1,MBR,0x0fdb738d,0x800,0x78b800)
  blk0 :Removable HardDisk - Alias hd83b0f0b fs0
        PciRoot(0x0)/Pci(0x1d,0x0)/USB(0x1,0x0)/USB(0x5,0x0)/HD(1,MBR,0x0fdb738d,0x800,0x78b800)
  blk1 :HardDisk - Alias (null)
        PciRoot(0x0)/Pci(0x1f,0x2)/Sata(0x0,0x0)/HD(1,MBR,0x00092b0c,0x3f,0x9c25fe)
  blk2 :HardDisk - Alias (null)
        PciRoot(0x0)/Pci(0x1f,0x2)/Sata(0x0,0x0)/HD(2,MBR,0x00092b0c,0x9c263d,0x88b8fdc)
  blk3 :HardDisk - Alias (null)
        PciRoot(0x0)/Pci(0x1f,0x2)/Sata(0x0,0x0)/HD(3,MBR,0x00000000,0x927be19,0x14019e7)
  blk4 :HardDisk - Alias (null)
        PciRoot(0x0)/Pci(0x1f,0x2)/Sata(0x0,0x0)/HD(4,MBR,0x00000000,0xa67d83f,0x13fe849)
  blk5 :BlockDevice - Alias (null)
        PciRoot(0x0)/Pci(0x1f,0x2)/Sata(0x0,0x0)
  blk6 :Removable BlockDevice - Alias (null)
        PciRoot(0x0)/Pci(0x1d,0x0)/USB(0x1,0x0)/USB(0x5,0x0)

Press ESC in 1 seconds to skip startup.nsh, any other key to continue.
Shell> _
```

iv. Issue command `drivers` to determine if Chelsio uEFI driver is loaded. If the driver is loaded (as shown in the image below), continue to step (v)

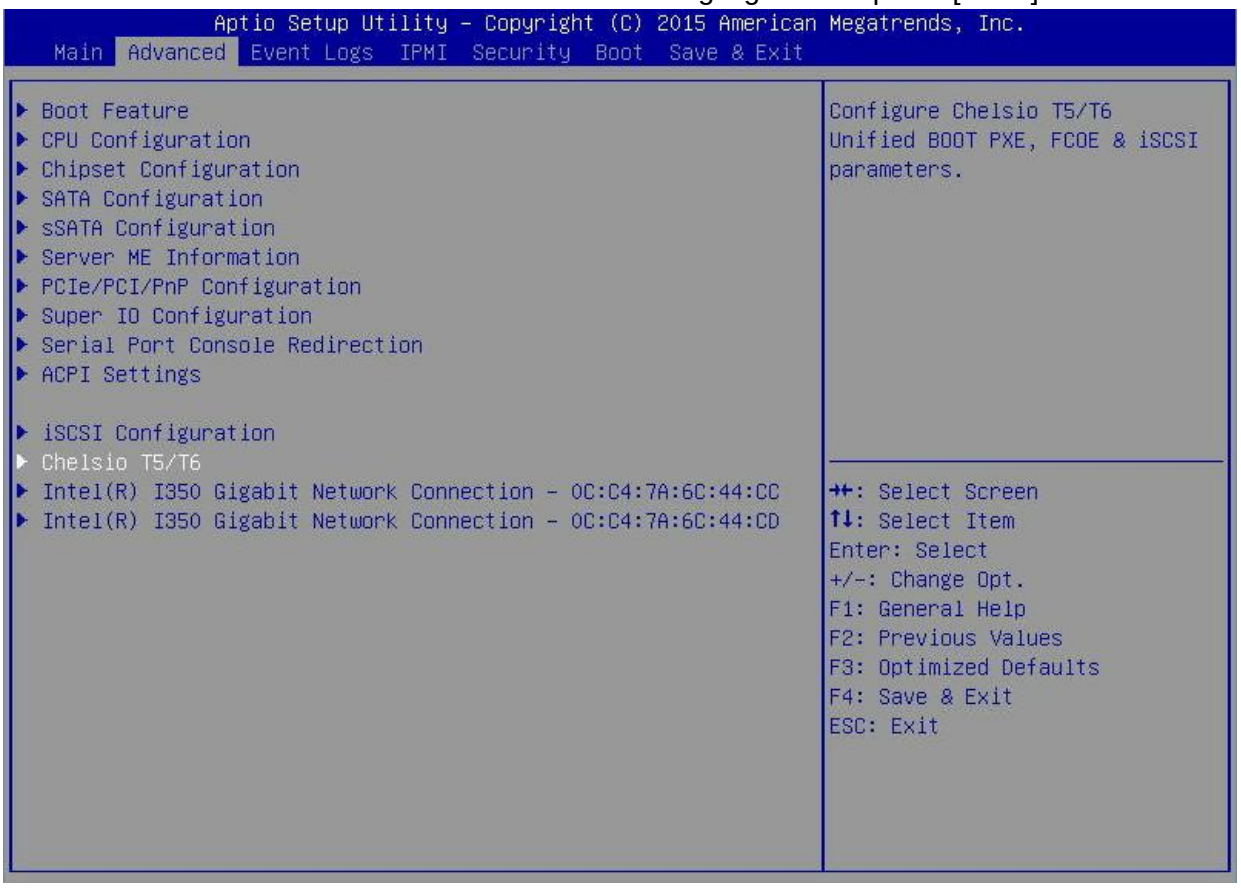
```
A4 00000001 ? - -  -  - <UNKNOWN>                          SBDXE
A6 00000010 B - -  5  5 AMI Console Splitter Driver         ConSplitter
A9 00000010 D - -  1  - <UNKNOWN>                          GraphicsConsole
AA 0000000A D - -  4  - Generic Disk I/O Driver            DiskIoDxe
AB 0000000B B - -  1  3 Partition Driver(MBR/GPT/El Torito) PartitionDxe
AC 00000010 D - -  2  - PCH Serial ATA Controller Initializ SataController
AE 00000010 B - -  1  2 AMI Generic LPC Super I/O Driver    GenericSio
B0 00000001 ? - -  -  - AMI IDE BUS Driver                 IdeBusSrc
B2 00000010 ? - -  -  - AMI PS/2 Driver                    PS2Main
B4 00A50105 B - -  2 72 <UNKNOWN>                          PciBus
B6 00000010 B - -  2  2 <UNKNOWN>                          TerminalSrc
B7 00000010 B - -  1  1 <UNKNOWN>                          TerminalSrc
B8 0000000A D - -  2  - Simple Network Protocol Driver      SnpDxe
B9 0000000A B - -  2  8 MNP Network Service Driver          MnpDxe
BA 0000000A B - -  2  2 ARP Network Service Driver          ArpDxe
BB 0000000A B - -  2  2 DHCP Protocol Driver                Dhcp4Dxe
BC 0000000A D - -  2  - IP4 CONFIG Network Service Driver   Ip4ConfigDxe
BD 0000000A B - -  2 18 IP4 Network Service Driver          Ip4Dxe
BE 0000000A B - -  4  4 MTFTP4 Network Service              Mtftp4Dxe
BF 0000000A B - - 12 20 UDP Network Service Driver          Udp4Dxe
C0 0000000A D - -  1  - FAT File System Driver              Fat
C1 0000000A D - -  2  - iSCSI Driver                        IScsiDxe
C2 0000000A D - -  2  - iSCSI Driver                        IScsiDxe
C4 0000000A ? - -  -  - SCSI Bus Driver                     ScsiBus
C5 0000000A ? - -  -  - Scsi Disk Driver                    ScsiDisk
FA 00000010 ? - -  -  - AMI CSM Block I/O Driver            CsmBlockIo
FB 00000024 B - -  1  1 BIOS[INT10] Video Driver            CsmVideo
FC 00000010 ? - -  -  - <UNKNOWN>                          <UNKNOWN>
158 0100005E B X X  3  3 Chelsio Unified Driver             Offset(0x3834,0x1D
```

If the driver is not loaded, load the uEFI driver (*ChelsioUD.efi*) found in the CHELSIO directory, and try again.

```
fs0:\CHELSIO> load ChelsioUD.efi
load: Image fs0:\CHELSIO\ChelsioUD.efi loaded at 7F2BA000 - Success
```

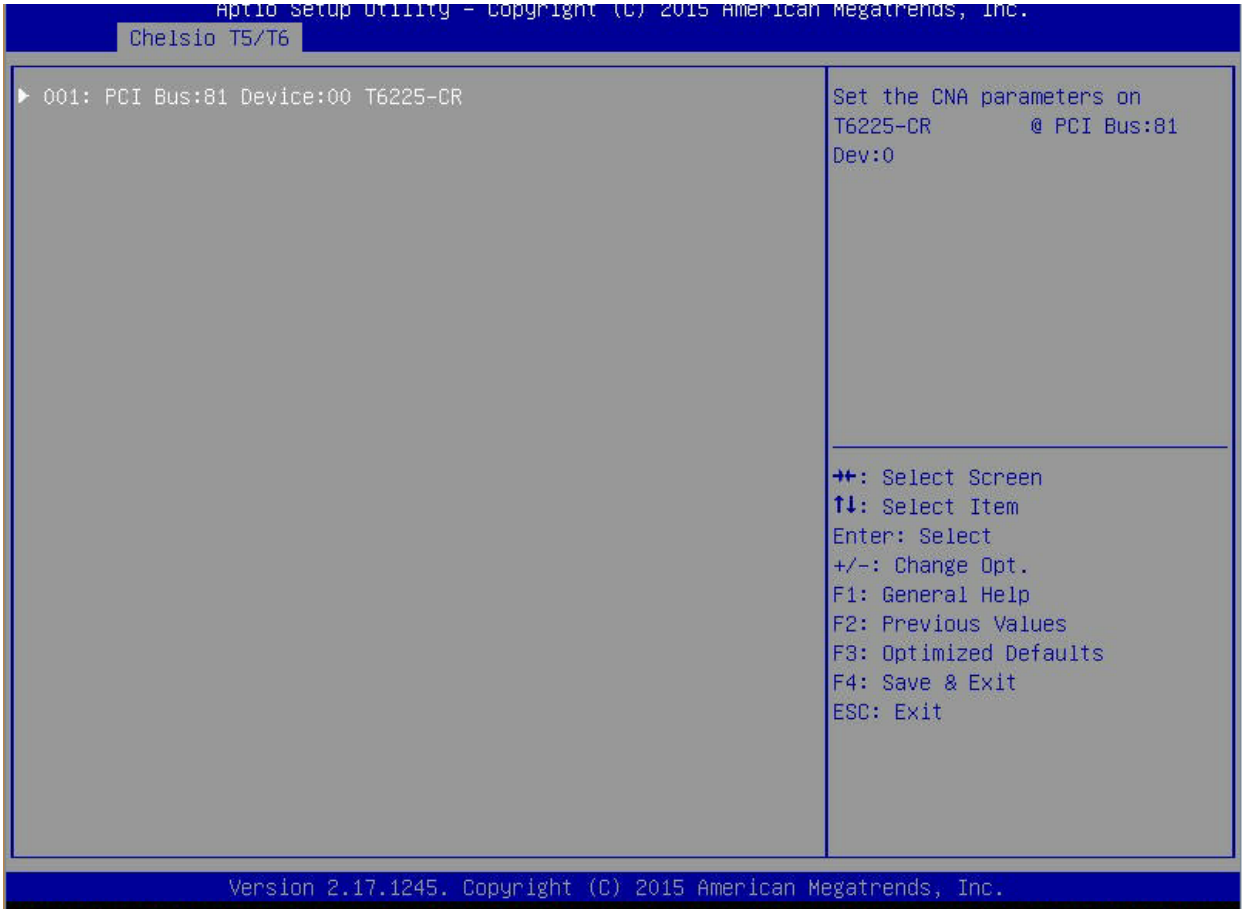
v. Reboot the system and go into BIOS setup.

vi. Chelsio HII should be listed as ***Chelsio T5/T6***. Highlight it and press [Enter].

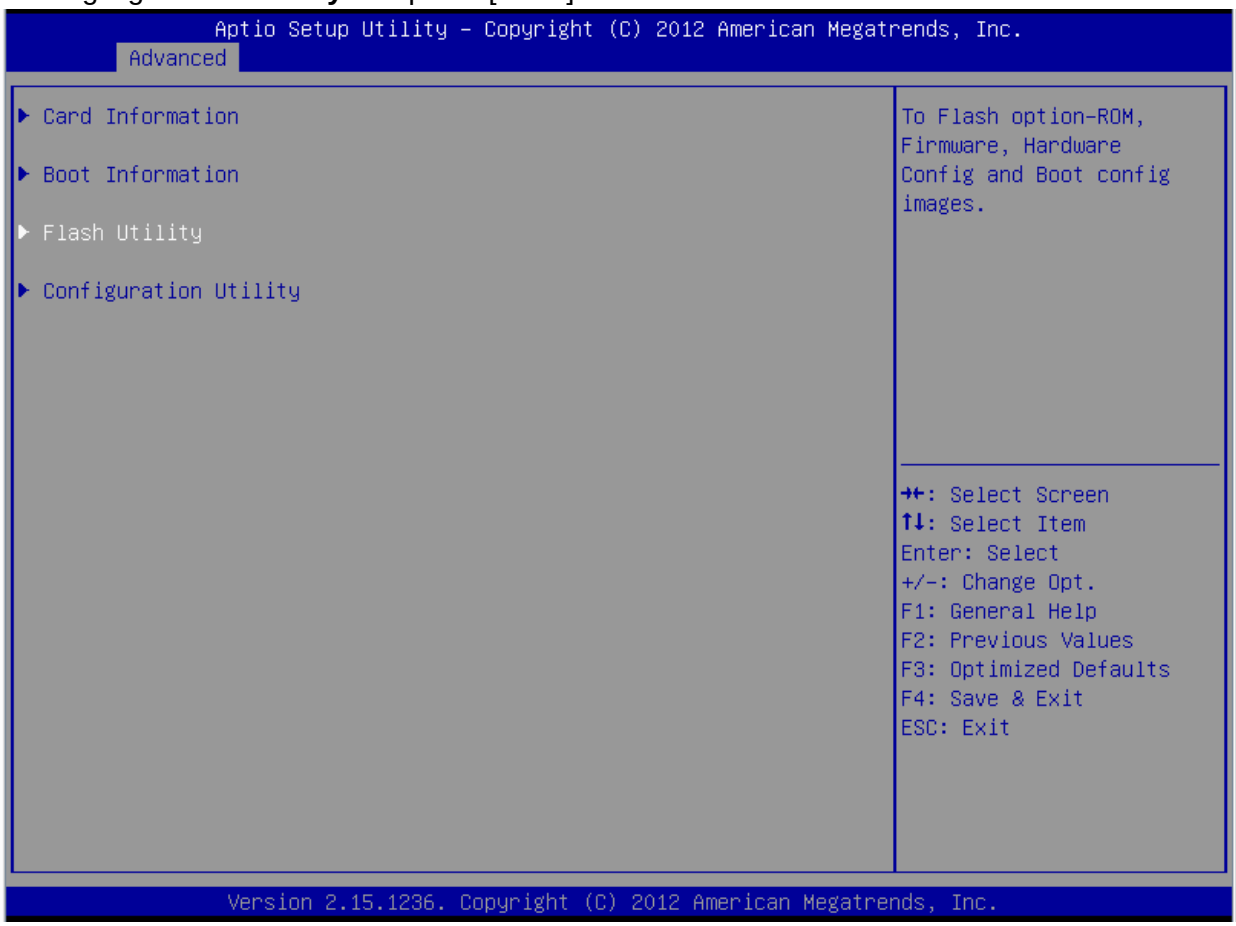


Note *If Chelsio T5/T6 is not listed, please ensure that Chelsio uEFI driver is loaded correctly as mentioned* ***here*** *in the* ***Flashing Firmware and Option ROM*** *section.*

vii. Highlight the Chelsio adapter to be configured and press [Enter].



viii. Highlight **Flash Utility** and press [Enter].



ix. Erase or update firmware using the methods explained below:

a. Erase existing firmware

i. Select [Erase] as Flash Operation
ii. Select [FW File] as Flash File Type
iii. Select Update/Erase
iv. Press [Y] to confirm.
v. Reboot system.

b. Update firmware

i. Select [Update] as Flash Operation
ii. Select [FW File] as Flash File Type
iii. Enter full path to the firmware file for Enter File Name, e.g., CHELSIO\t6fw-1.16.29.0.bin.
iv. Press [Enter]
v. Select Update/Erase
vi. Press [Y] to confirm.
vii. Reboot system

Similarly, you can use the above method to update/erase Option ROM, Hardware Configuration and Phy Firmware file.

4.4. HP Firmware Management Protocol (FMP)

Enabling FMP

For HP machines with Unified Boot v1.0.0.99 and below installed, FMP must be manually enabled. For v2.0.0.1 and above, you can skip to the next sub-section for instructions on how to upgrade firmware using FMP.

i. Prepare USB flash drive as described here.
ii. Boot system to EFI shell and change your working directory to *CHELSIO*.
iii. Issue command `drivers` to determine if Chelsio uEFI driver is loaded. If loaded, you should see a similar output:

```
16E 0000000A D N N   1   0 Usb Keyboard Driver                Fv(CDBB7B35-6833-4ED6-9AB2-57D2ACDDF6
F0)/FvFile(2D2E62CF-9ECF-43B7-8219-94E7FC713DFE)
16F 00000011 D N N   1   0 Usb Mass Storage Driver            Fv(CDBB7B35-6833-4ED6-9AB2-57D2ACDDF6
F0)/FvFile(9FB4B4A7-42C0-4BCD-8540-9BCC6711F83E)
170 0000000A D N N   1   0 Usb Mouse Driver                   Fv(CDBB7B35-6833-4ED6-9AB2-57D2ACDDF6
F0)/FvFile(2D2E62AA-9ECF-43B7-8219-94E7FC713DFE)
171 0000000A D N N   4   0 Usb Bus Driver                     Fv(CDBB7B35-6833-4ED6-9AB2-57D2ACDDF6
F0)/FvFile(240612B7-A063-11D4-9A3A-0090273FC14D)
172 00000030 D N N   1   0 Usb Xhci Driver                    Fv(CDBB7B35-6833-4ED6-9AB2-57D2ACDDF6
F0)/FvFile(B7F50E91-A759-412C-ADE4-DCD03E7F7C28)
173 0000000A D N N   2   0 SCSI Bus Driver                    Fv(CDBB7B35-6833-4ED6-9AB2-57D2ACDDF6
F0)/FvFile(0167CCC4-D0F7-4F21-A3EF-9E64B7CDCE8B)
174 0000000A D N N   1   0 Scsi Disk Driver                   Fv(CDBB7B35-6833-4ED6-9AB2-57D2ACDDF6
F0)/FvFile(0A66E322-3740-4CCE-AD62-BD172CECCA35)
175 00000001 D N N   1   0 iLO GLP SIO Driver                 Fv(CDBB7B35-6833-4ED6-9AB2-57D2ACDDF6
F0)/FvFile(09DA2344-B8AF-4BFE-B5CB-FBBA4F2C056D)
177 0000000A ? N N   0   0 HPE Dual 8GB microSD EM USB Kit Dri Fv(CDBB7B35-6833-4ED6-9AB2-57D2ACDDF6
F0)/FvFile(AEF50382-4A3A-7109-E901-AF991118551C)
18D 00000018 B N N   1   1 G200eH Matrox Graphics UEFI Driver Fv(CDBB7B35-6833-4ED6-9AB2-57D2ACDDF6
F0)/FvFile(56A1B86F-0D4A-485D-87DE-AD0EBA1C8C2A)
191 00000882 B N Y   1   1 Smart Array SAS Driver v8.82       PciRoot(0x0)/Pci(0x1,0x0)/Pci(0x0,0x0
)/Offset(0x4000,0x1C3FF)
198 06071100 B Y Y   1   1 Intel(R) PRO/1000 6.7.11 PCI-E     PciRoot(0x0)/Pci(0x2,0x3)/Pci(0x0,0x0
)/Offset(0x1E000,0x3E3FF)
19A 06071100 B Y Y   1   1 Intel(R) PRO/1000 6.7.11 PCI-E     PciRoot(0x0)/Pci(0x2,0x3)/Pci(0x0,0x1
)/Offset(0x1E000,0x3E3FF)
1A1 01000063 ? Y Y   0   0 Chelsio Unified Driver             PciRoot(0x0)/Pci(0x3,0x2)/Pci(0x0,0x0
)/Offset(0x3800,0x1D1FF)
1D1 00000001 D N N   1   0 iLO 4 Function 2 Driver            PciRoot(0x0)/Pci(0x1C,0x2)/Pci(0x0,0x
2)/Offset(0x0,0xA1FF)
```

iv. Note the handle and unload the driver using the following syntax:

```
FS1:\CHELSIO\> unload -n <driver_handle>
```

Example:

```
FS1:\CHELSIO\> unload -n 1A1
Unload - Handle [72892A18] Result Success.
```

v. Load the uEFI driver (*ChelsioUD.efi*) present in the CHELSIO directory.

```
FS1:\CHELSIO\> load ChelsioUD.efi
Image 'FS1:\CHELSIO\ChelsioUD.efi' loaded at 77588000 - Success
```

vi. If Chelsio uEFI driver was loaded successfully in the previous step, run the command `fwupdate -l` and Chelsio T6 CNA should be listed as shown below:

```
FS1:\CHELSIO\> fwupdate -l
* [BIOS] System ROM - U20 v2.20 (05/05/2016)
* [RAID.Slot.2.1]Slot 2 : Smart HBA H240 Controller - V2.52_B0
* [NIC.LOM.1.3]Embedded LOM 1 : HP Ethernet 1Gb 2-port 361i Adapter - NIC - 1.1067.0
* [NIC.Slot.3.1]Slot 3 : Chelsio T6 Controller - NIC - [illegible]
```

Upgrading Firmware

Using CLI

i. Use the adapter's device name to update the firmware:

```
FS1:\CHELSIO\> fwupdate -d <device_name> -f cubt4.bin
```

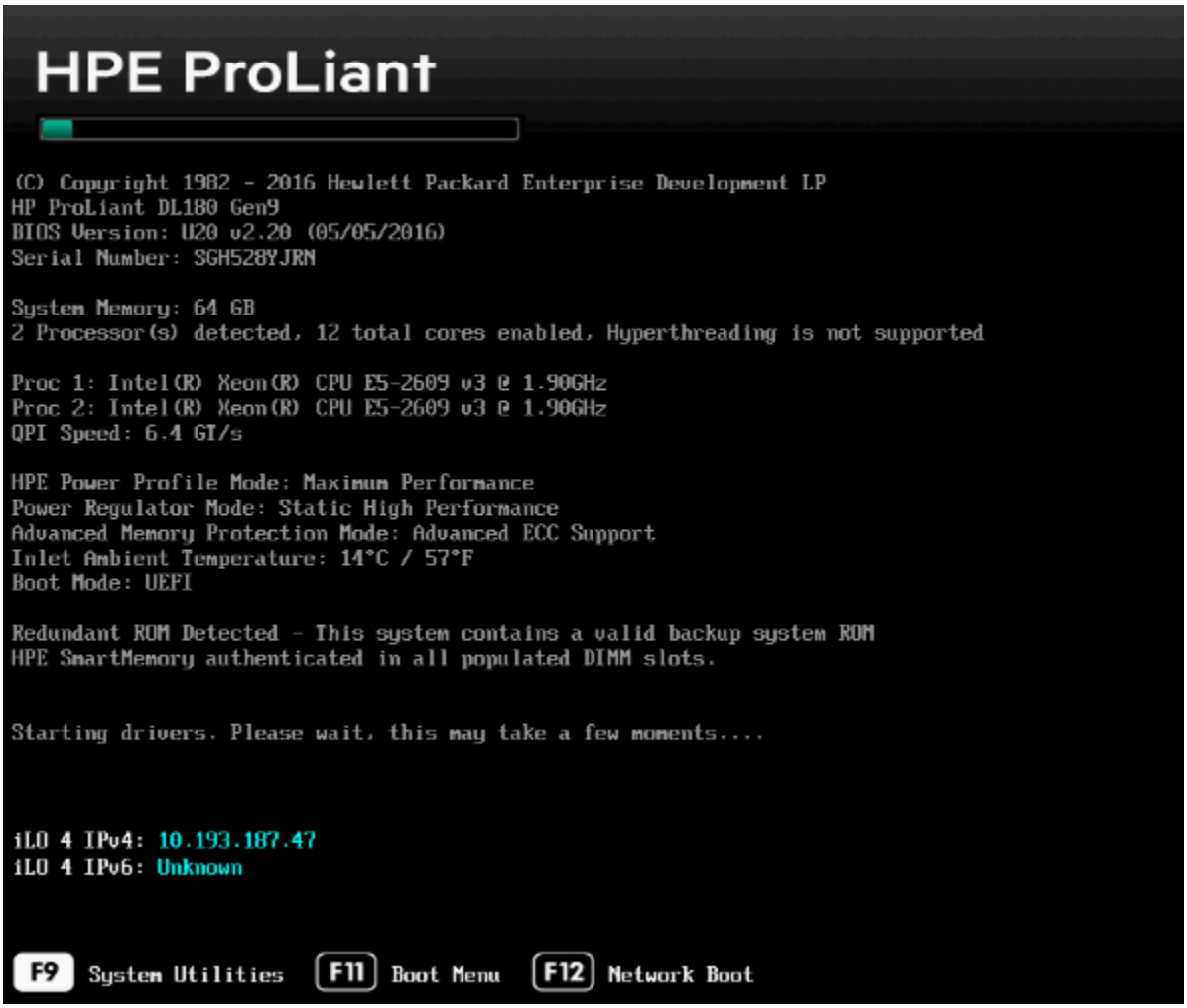
Example:

```
FS1:\CHELSIO\> fwupdate -d NIC.Slot.3.1 -f cubt4.bin
Loading firmware file 'cubt4.bin'. It might take several minutes.
Current Firmware Version is [illegible].
Continue with firmware update? (y/n):y
Firmware update completed successfully.
```

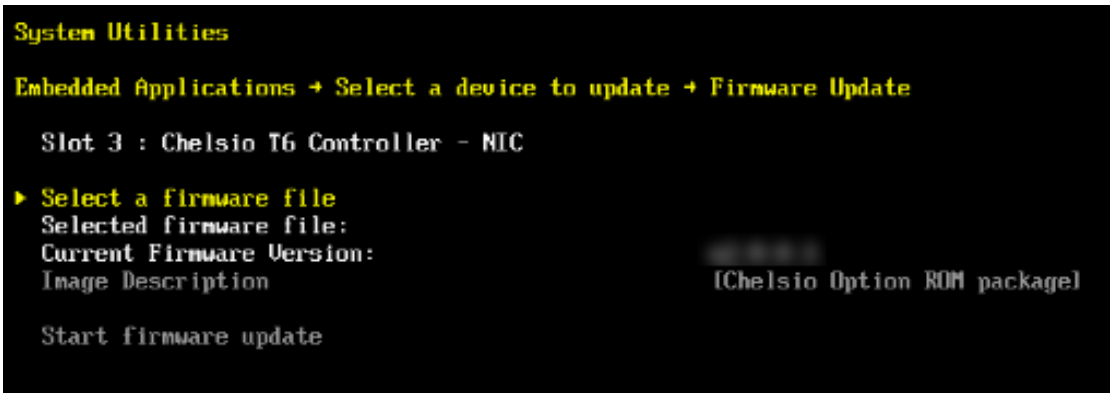
ii. Reboot machine for changes to take effect.

- **Using FMP**

- Reboot system and press F9 to access **System Utilities**



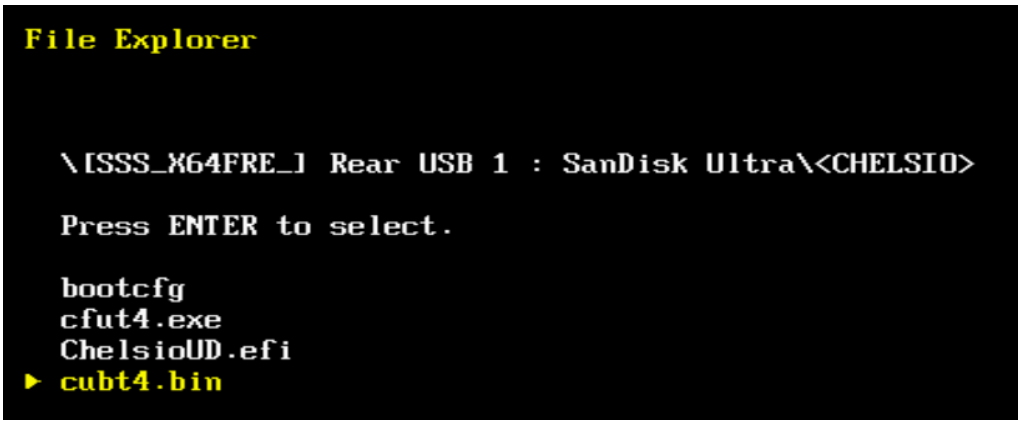
- Go to **Embedded Applications** → **Firmware Update** → **Chelsio T6 Controller**

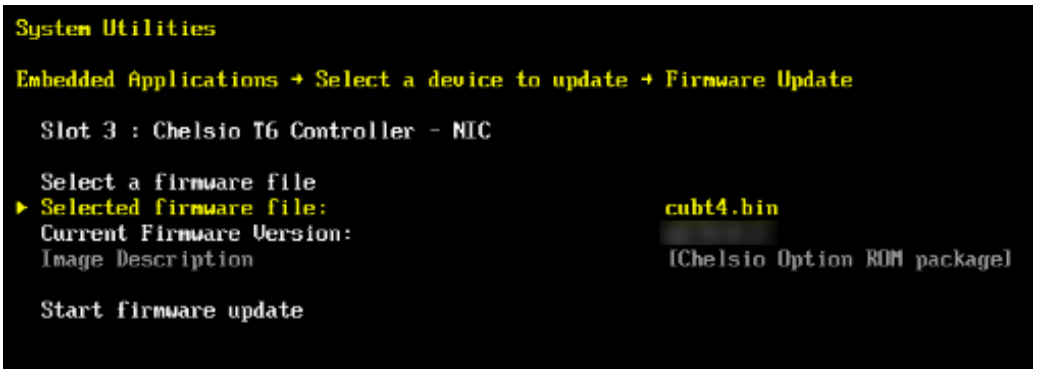


- Highlight ***Select a firmware file*** option and hit [Enter].

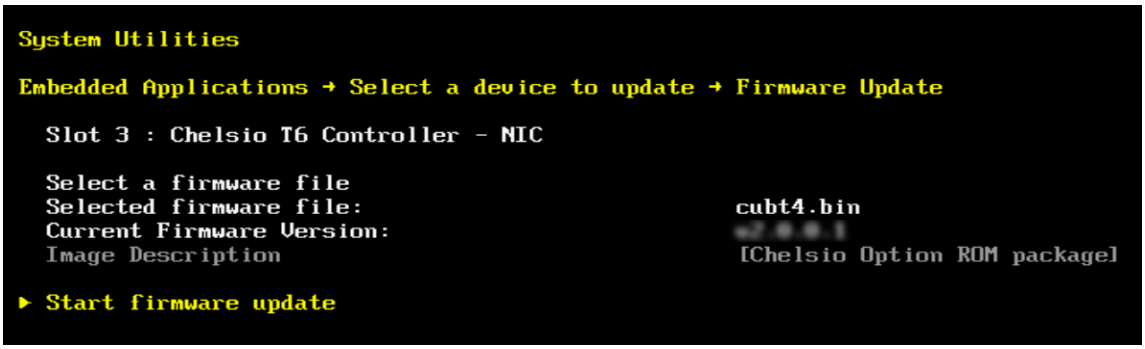
- Select the USB flash drive which contains the latest optionROM and hit [Enter].

- Select optionROM file *cubt4.bin* and hit [Enter]. The file should show up in the ***Selected firmware file*** field.

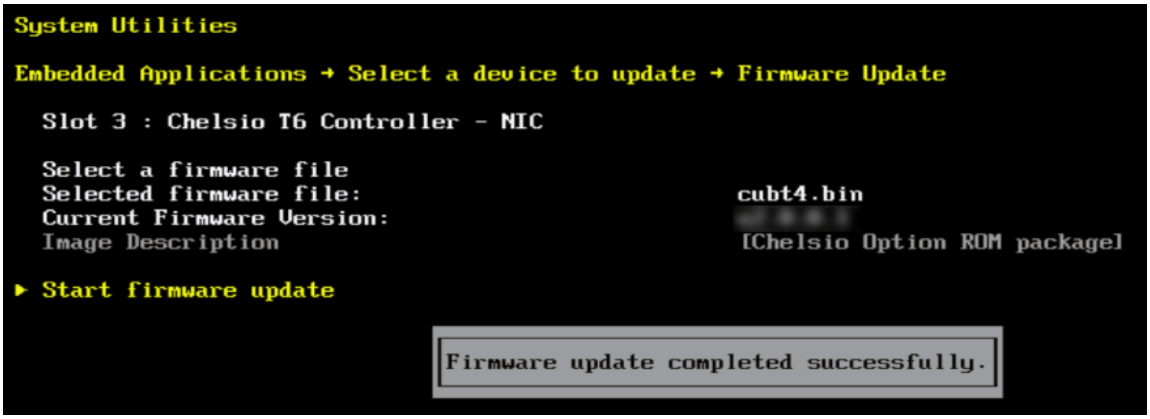




- Select ***Start firmware update*** and hit [Enter].



- After **Firmware update completed successfully** prompt appears, reboot the machine for changes to take effect.



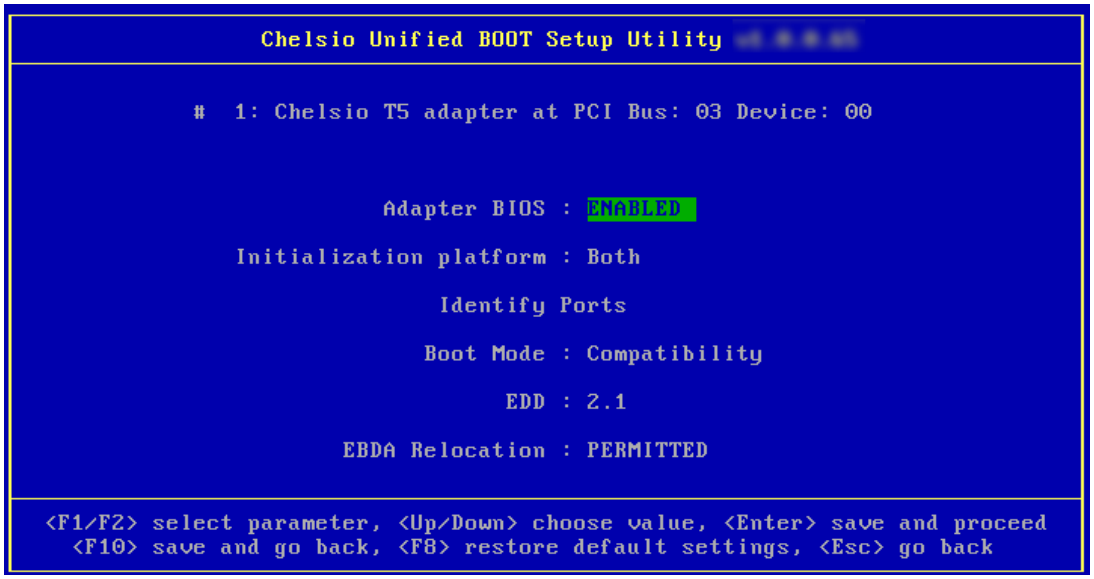
4.5. Default Option ROM Settings

If you wish to restore option ROM settings to their default values, i.e., PXE enabled, iSCSI and FCoE disabled, use any of the methods mentioned below:

4.5.1. Using Option ROM (boot level)

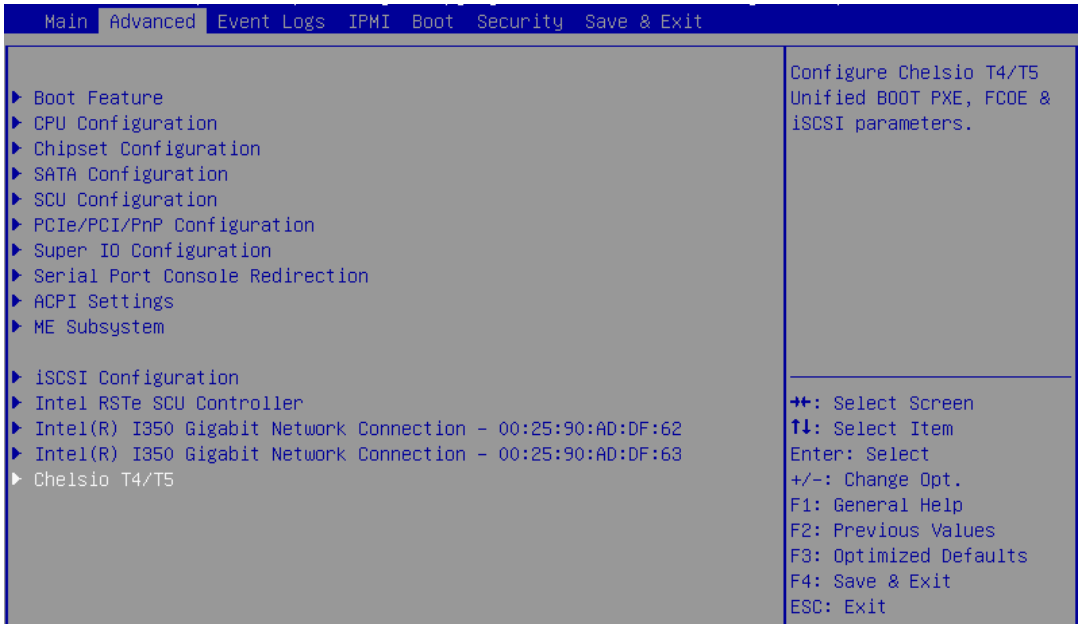
- **Legacy PXE**

Boot system into Chelsio's Unified Boot Setup utility and press F8.



- **uEFI PXE**

Boot system into uEFI mode and press F3.



5. Configuring PXE Server

The following components are required to configure a server as PXE Server:

- DHCP Server
- TFTP Server

PXE server configuration steps for different operating systems can be found in following links:

Note *Chelsio Communications does not take any responsibility regarding contents given in below mentioned links. They are given for example purposes only.*

Linux

- http://linux-sxs.org/internet_serving/pxeboot.html
- http://www.howtoforge.com/ubuntu_pxe_install_server

Windows

- http://technet.microsoft.com/en-us/library/cc771670%28WS.10%29.aspx
- http://tftpd32.jounin.net/ (Use port # 67, set PXE option and provide bootable file name in settings)
- http://unattended.sourceforge.net/pxe-win2k.html

VMware

- https://www.vcritical.com/2011/07/vmware-esxi-5-interactive-pxe-installation-improvements/
- http://www.vstellar.com/2017/07/25/automating-esxi-deployment-using-pxe-boot-and-kickstart/
- http://fdo-workspace.blogspot.in/2016/11/building-tftp-dhcp-for-pxe-esxi-65.html

6. PXE boot process

Before proceeding, please ensure that the Chelsio CNA has been flashed with the provided firmware and option ROM (See Flashing Firmware and option ROM).

6.1. Legacy PXE boot

i. After configuring the PXE server, make sure the PXE server works. Then reboot the client machine.

ii. Press [Alt+C] when the message to configure Chelsio adapters appears on the screen.

```
Chelsio Unified Boot BIOS
Copyright (C) 2003-2016 Chelsio Communications
Press <Alt-C> to Configure T5/T6 Card(s). Press <Alt-S> to skip BIOS.
```

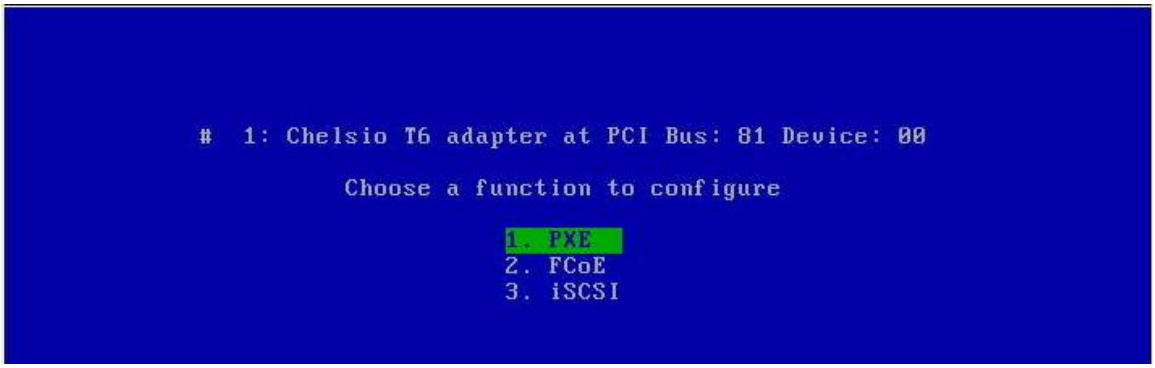
iii. The configuration utility will appear as below:

iv. Choose the CNA on which you flashed the option ROM image. Hit [Enter].

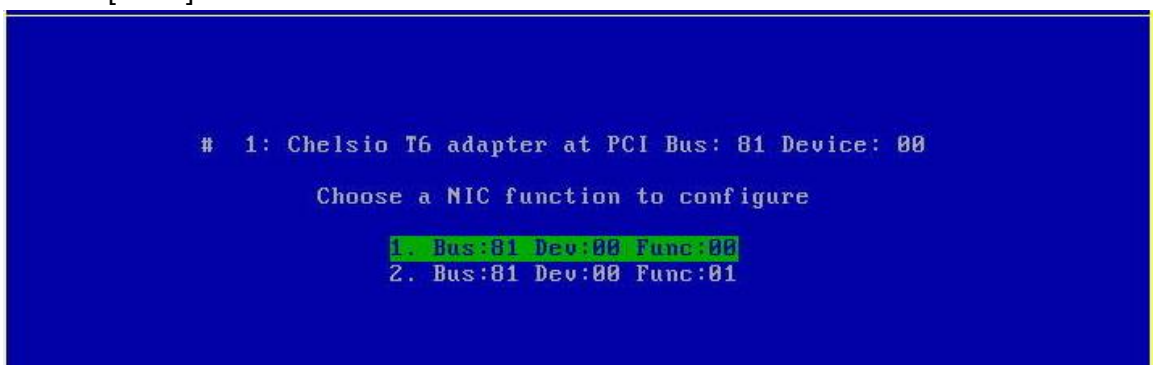
v. Enable the adapter BIOS using arrow keys if not already enabled. Hit [Enter].

Note *Use the default values for Boot Mode, EDD and EBDA Relocation parameters, unless instructed otherwise.*

vi. Choose *PXE* from the list to configure. Hit [Enter].



vii. Use the arrow keys to highlight the appropriate function among the supported NIC functions and hit [Enter] to select.



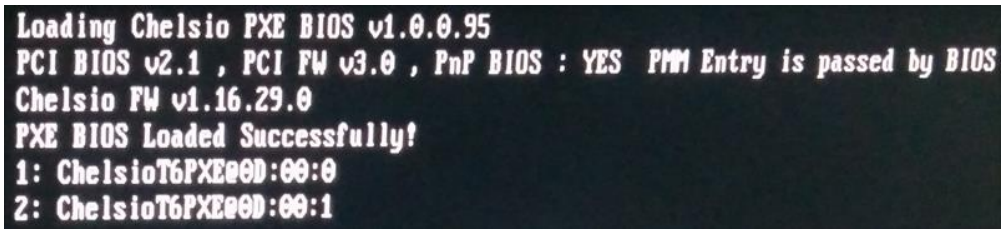
viii. Enable NIC function bios if not already enabled.

ix. Choose the boot port to try the PXE boot. It is recommended to only enable functions and ports which are going to be used. Please note that enabling NIC Func 00 will enable port 0 for PXE, enabling NIC Func 01 will enable port 1 and so on for NIC function.

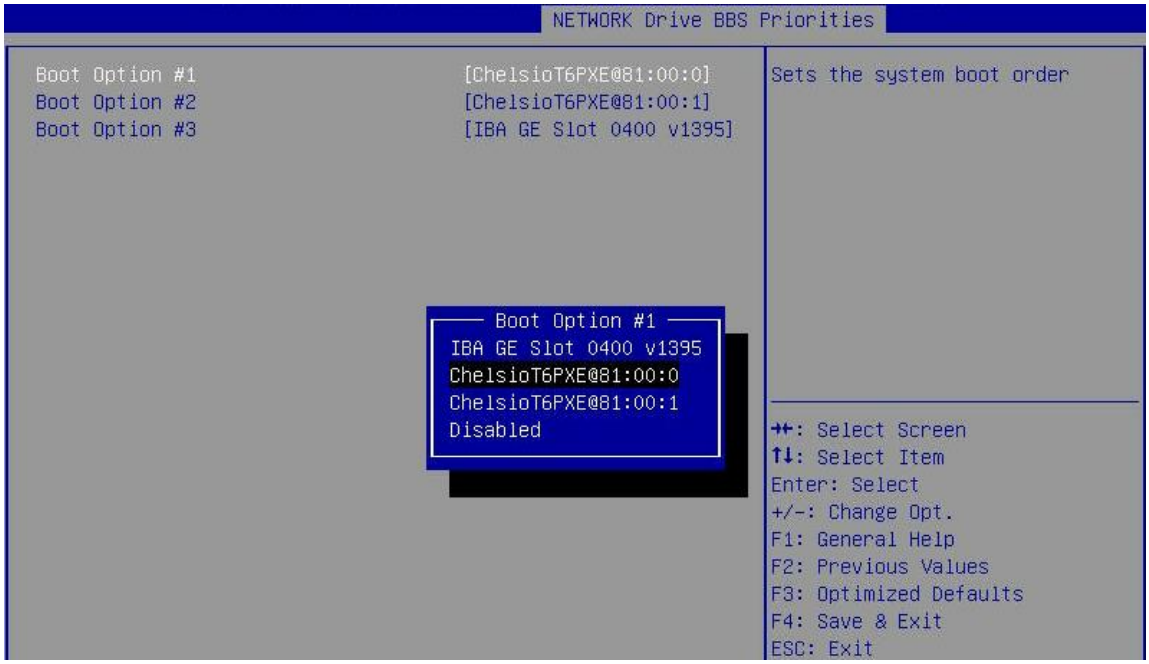
x. Hit [F10] or [Esc] and then [Y] to save configuration changes.

xi. Reboot the system.

xii. Allow the Chelsio option ROM to initialize and setup PXE devices. DO NOT PRESS ALT-S to skip Chelsio option ROM.



xiii. In the system setup, choose any of the Chelsio PXE devices as the first boot device.



xiv. Reboot. DO NOT PRESS ALT-S to skip Chelsio option ROM, during POST.

xv. Hit [F12] key when prompted to start PXE boot.

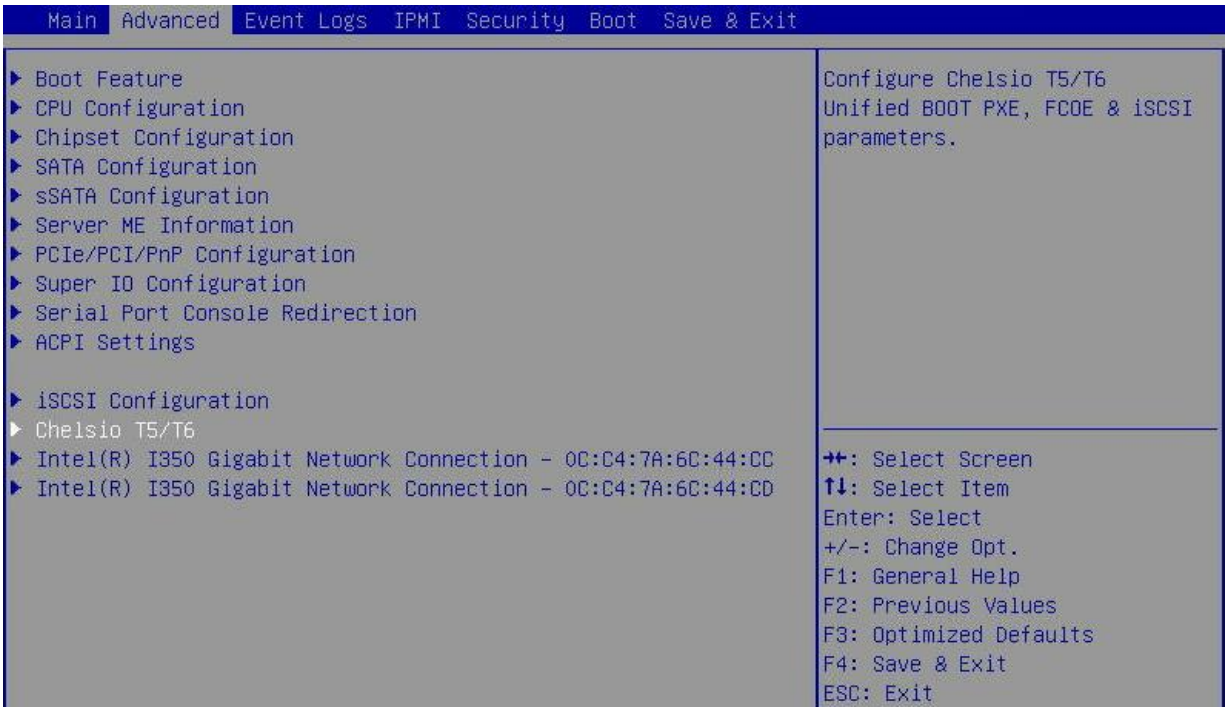
6.2. uEFI PXE Boot

Important

- *Only uEFI v2.3.1, v2.4 and v2.5 supported.*
- *Any other uEFI version is NOT SUPPORTED and may render your system unusable.*

This section describes the method to configure and use Chelsio uEFI PXE interfaces.

i. Reboot the system and go into the BIOS setup.
ii. Chelsio HII should be listed as **Chelsio T5/T6**. Highlight it and press [Enter].



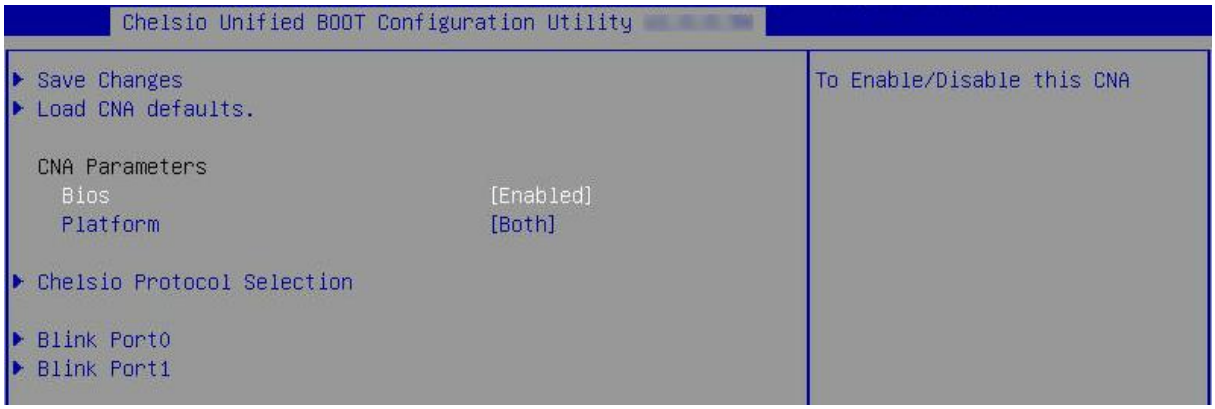
Note

*If Chelsio T5/T6 is not listed, please ensure that Chelsio uEFI driver is loaded correctly as mentioned here in the **Flashing Firmware and Option ROM** section.*

iii. Select the Chelsio adapter to be configured and press [Enter].

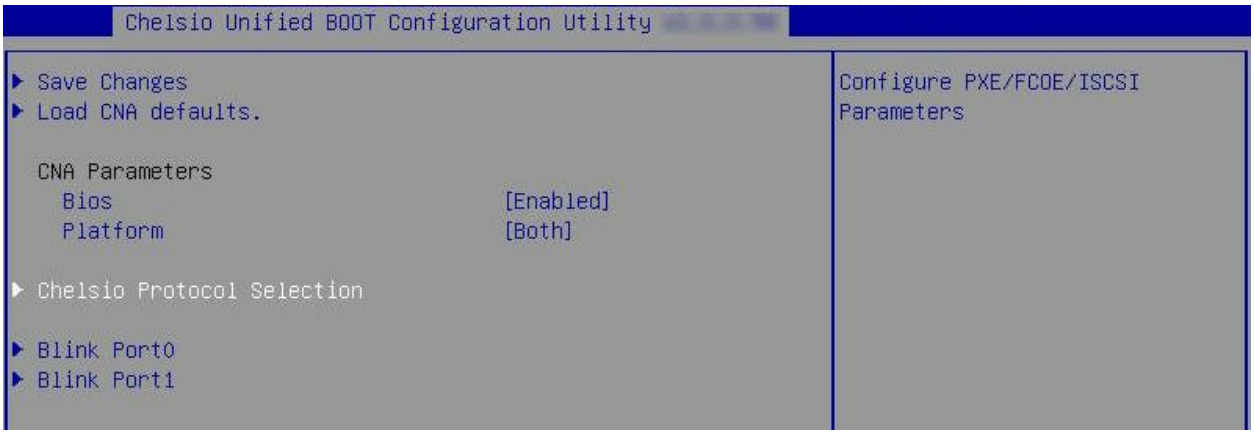
iv. Select **Configuration Utility** and press [Enter].

v. Enable adapter BIOS if not already enabled.

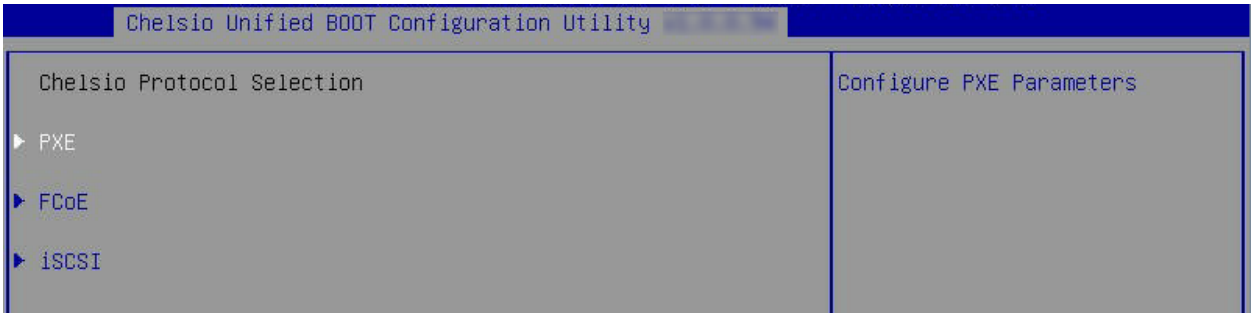


Note *It is highly recommended that you use the **Save Changes** option every time a parameter/option is changed.*

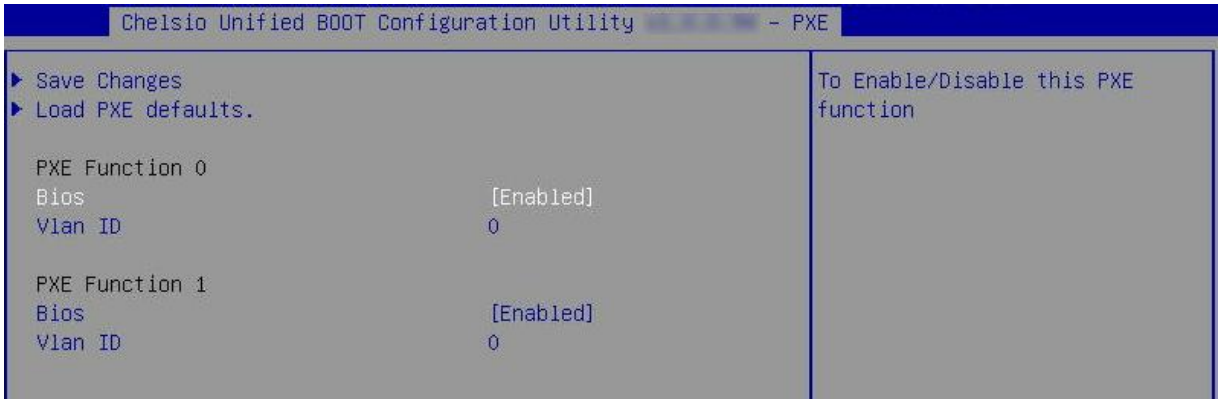
vi. Select **Chelsio Protocol Selection** and press [Enter].



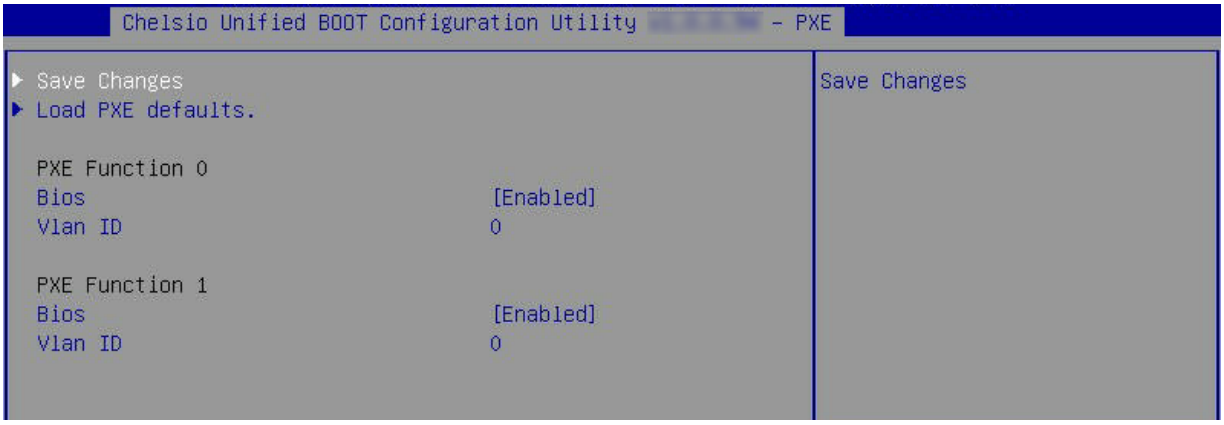
vii. Select **PXE** and press [Enter].



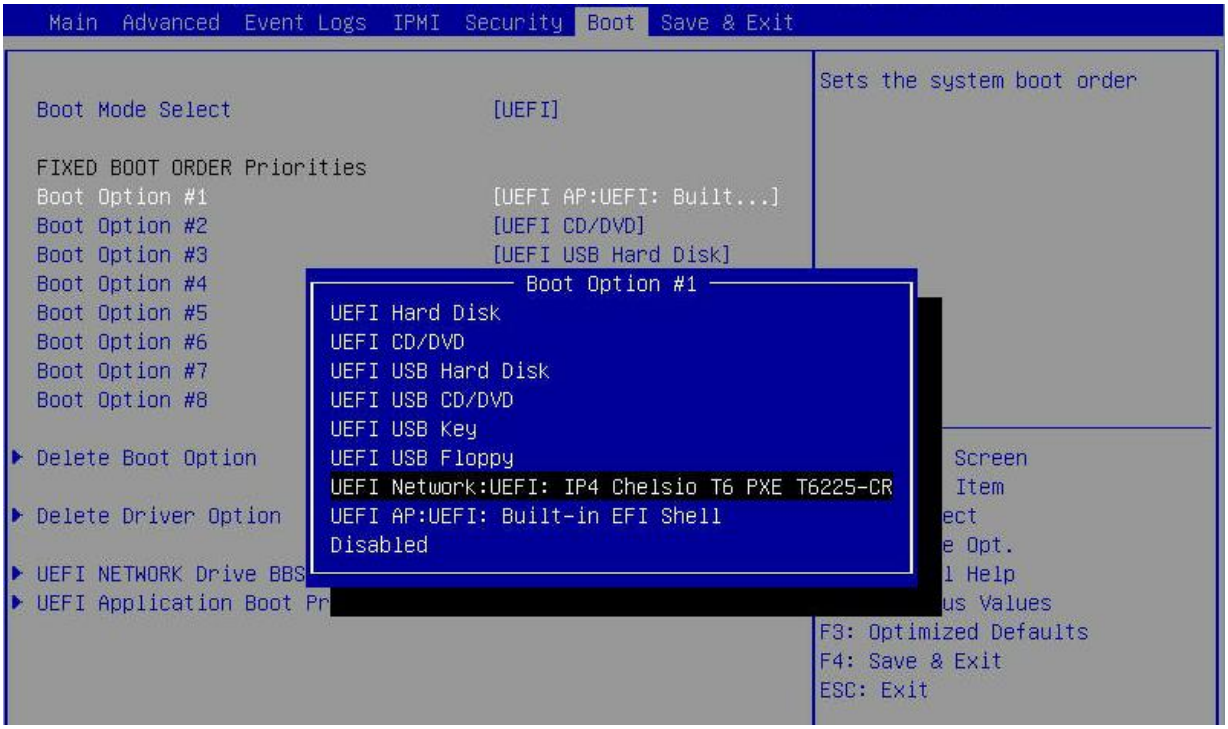
viii. Choose the boot port to try PXE boot. It is recommended to enable only those functions and ports which are going to be used. Please note that enabling PXE Function 0 will enable port 0 for PXE, enabling PXE Function 1 will enable port 1 and so on, for NIC function.



ix. Select **Save Changes** and press [Enter].



x. Reboot the system and in BIOS, choose any of the available Chelsio PXE devices for PXE boot.



xi. Reboot and hit [F12] key when prompted to start PXE boot.

7. FCoE boot process

Before proceeding, please ensure that the Chelsio CNA has been flashed with the provided firmware and option ROM (See Flashing firmware and option ROM).

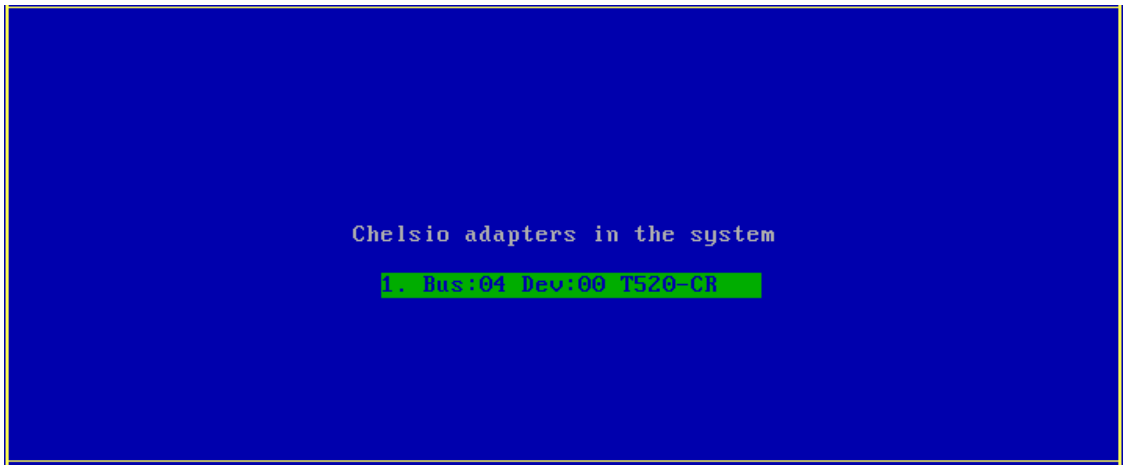
7.1. Legacy FCoE boot

i. Reboot the system.

ii. Press [Alt+C] when the message to configure Chelsio adapters appears on the screen.

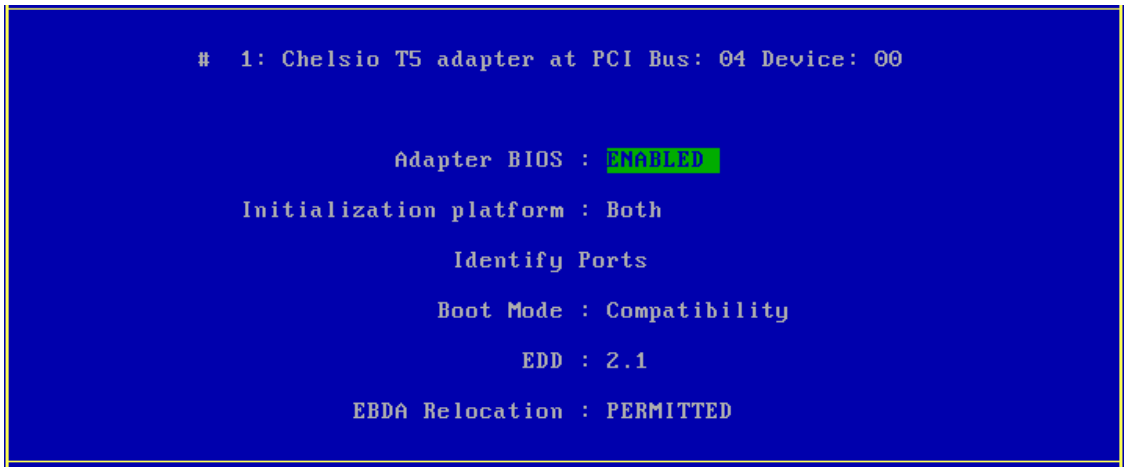
```
Chelsio Unified Boot BIOS [redacted]
Copyright (C) 2003-2016 Chelsio Communications
Press <Alt-C> to Configure T5/T6 Card(s). Press <Alt-S> to skip BIOS.
```

iii. The configuration utility will appear as below:



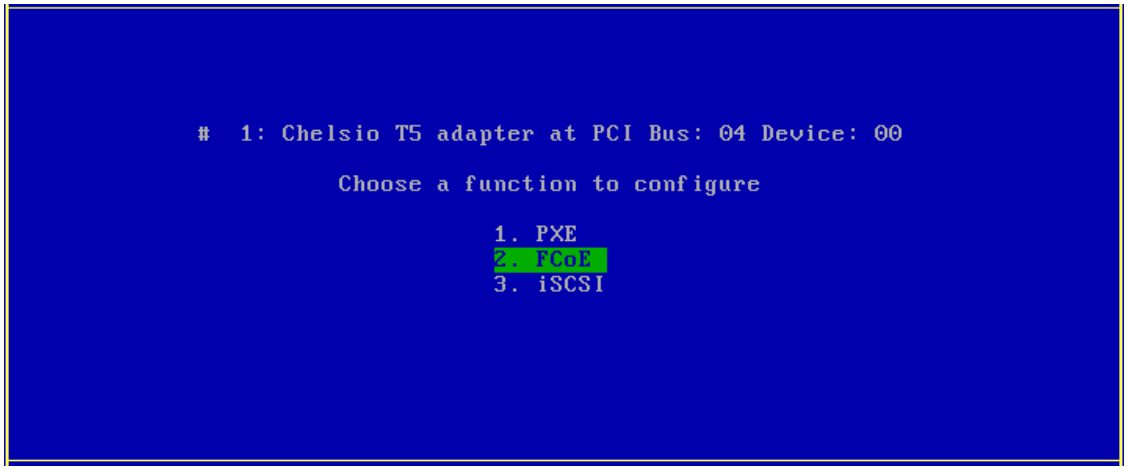
iv. Choose the CNA on which you flashed the option ROM image. Hit [Enter].

v. Enable the adapter BIOS if not already enabled. Hit [ENTER].

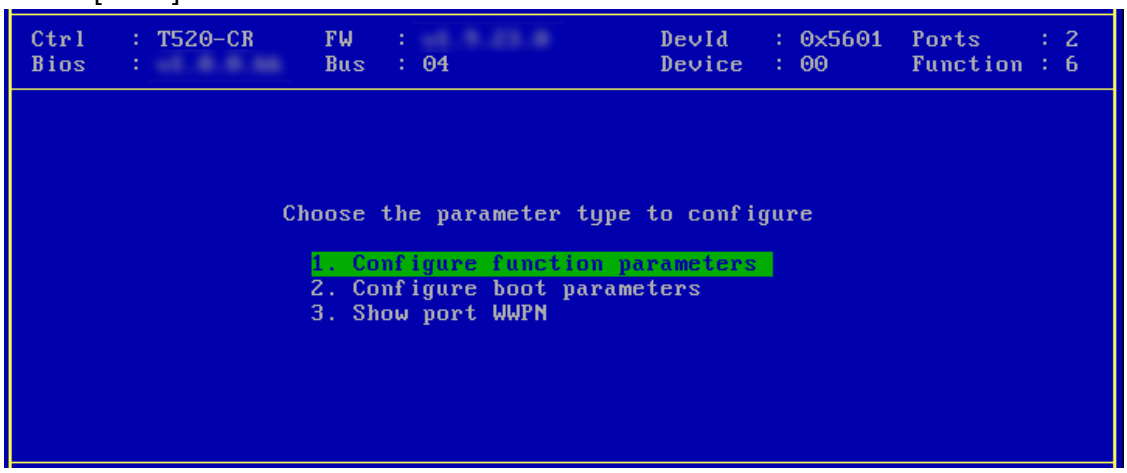


Note *Use the default values for Boot Mode, EDD and EBDA Relocation parameters, unless instructed otherwise.*

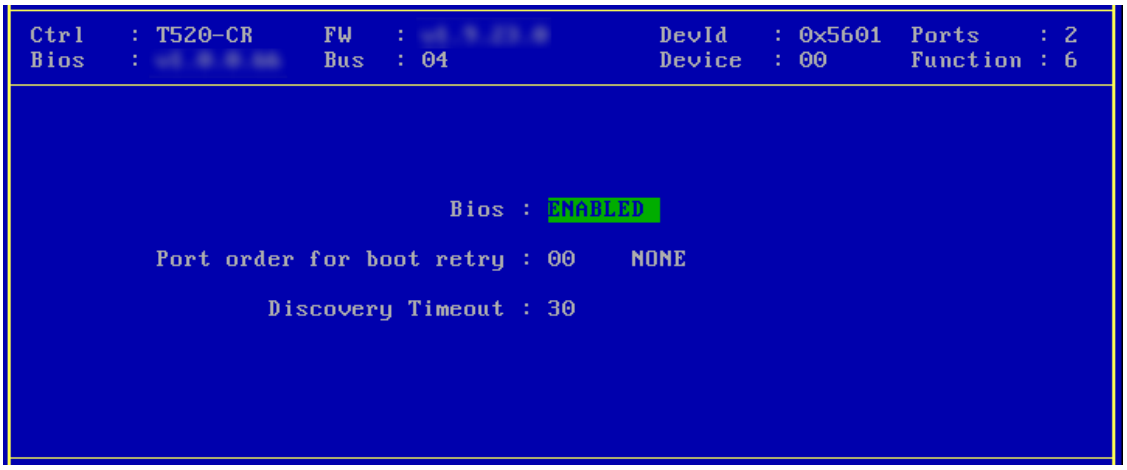
vi. Choose FCoE from the list to configure and hit [Enter].



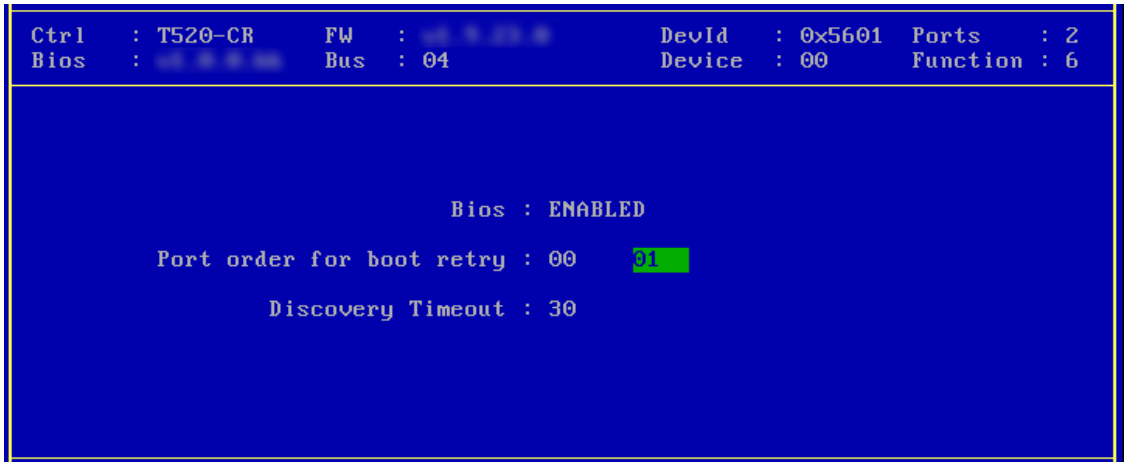
vii. Choose the first option, **Configure function parameters**, from the list of parameter type and hit [Enter].



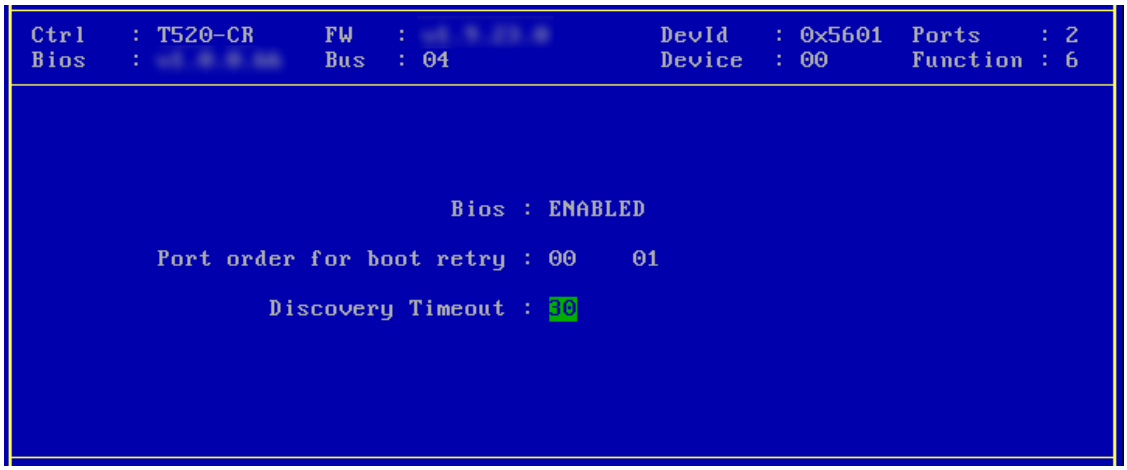
viii. Enable FCoE BIOS if not already enabled.



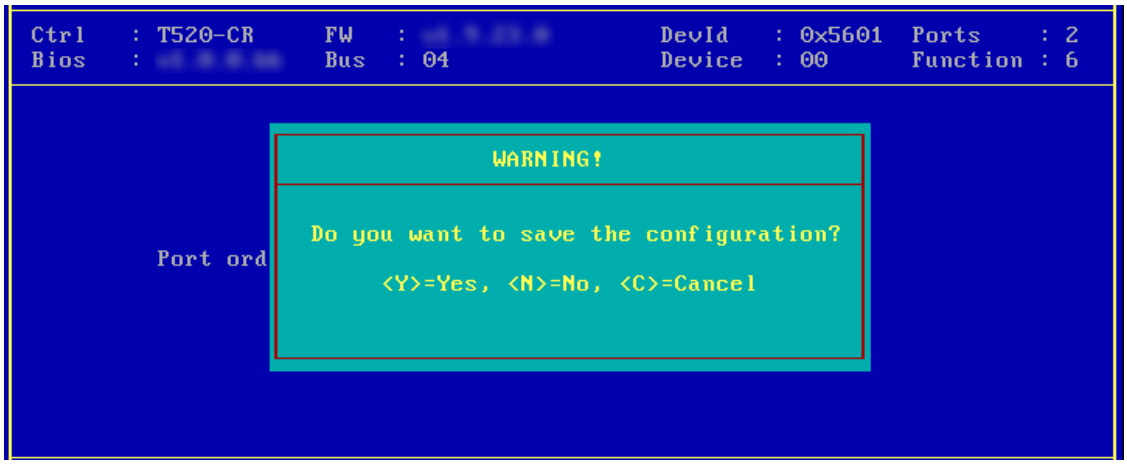
ix. Choose the order of the ports to discover FCoE targets.



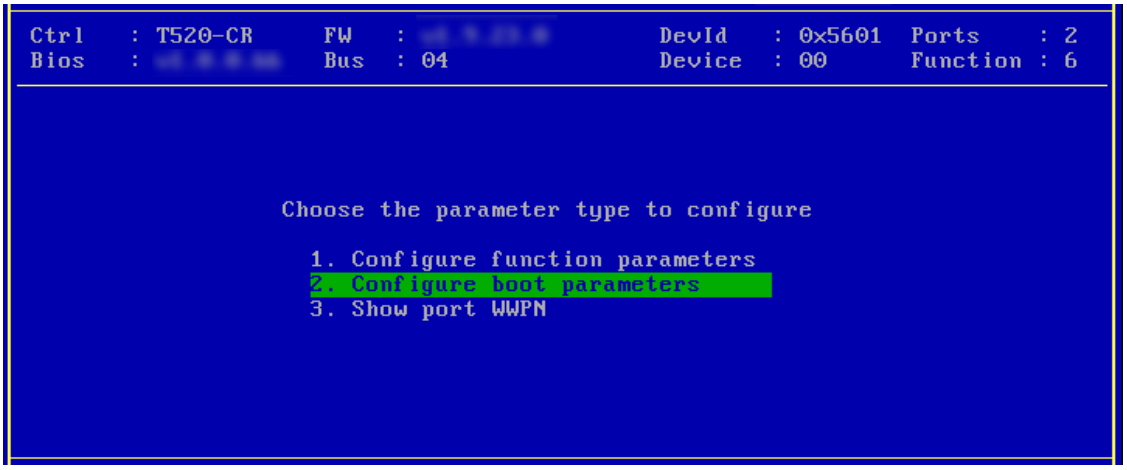
x. Set discovery timeout to a suitable value. Recommended value is >= 30.



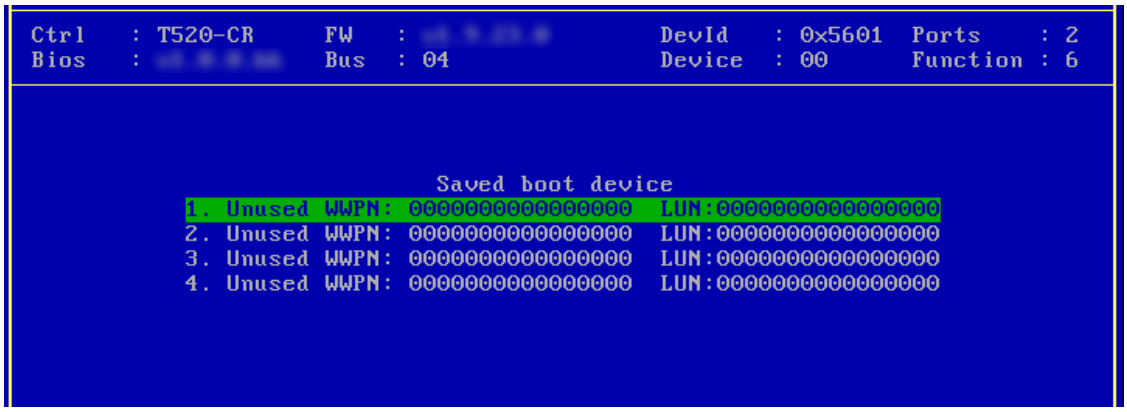
xi. Hit [F10] or [Esc] and then [Y] to save the configuration.



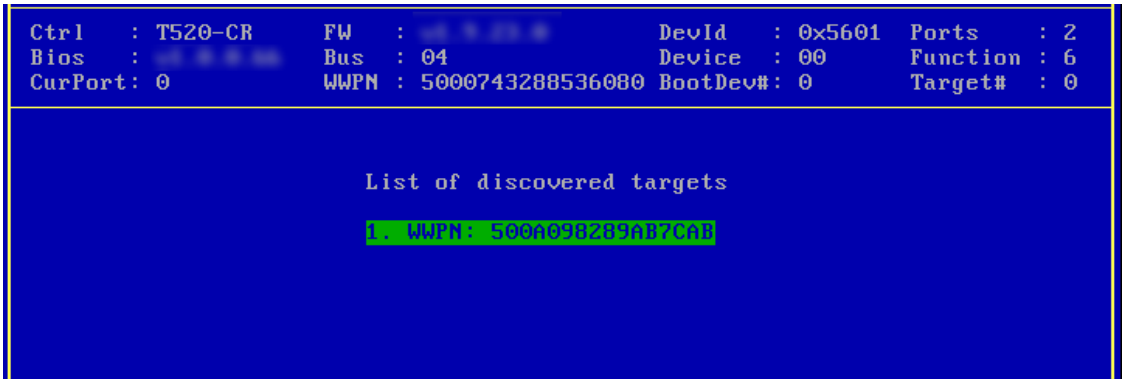
xii. Choose **Configure boot parameters**.



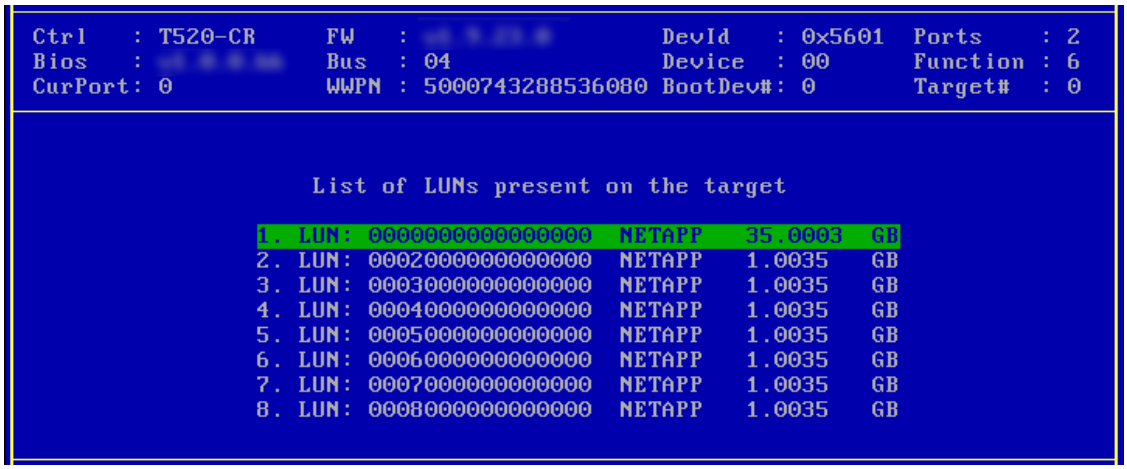
xiii. Select the first boot device and hit [Enter] to discover FC/FCoE targets connected to the switch. Wait till all reachable targets are discovered.

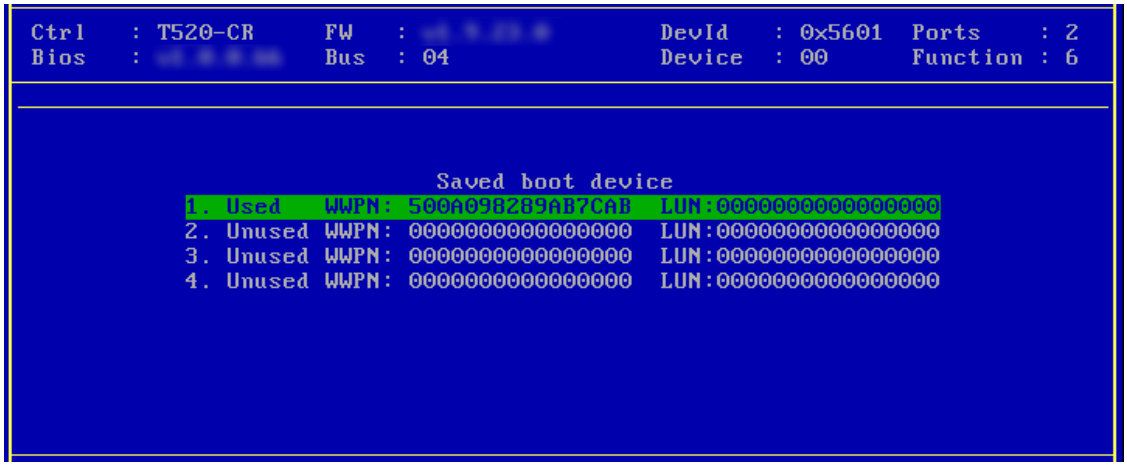


xiv. List of discovered targets will be displayed. Highlight a target using the arrow keys and hit [Enter] to select.

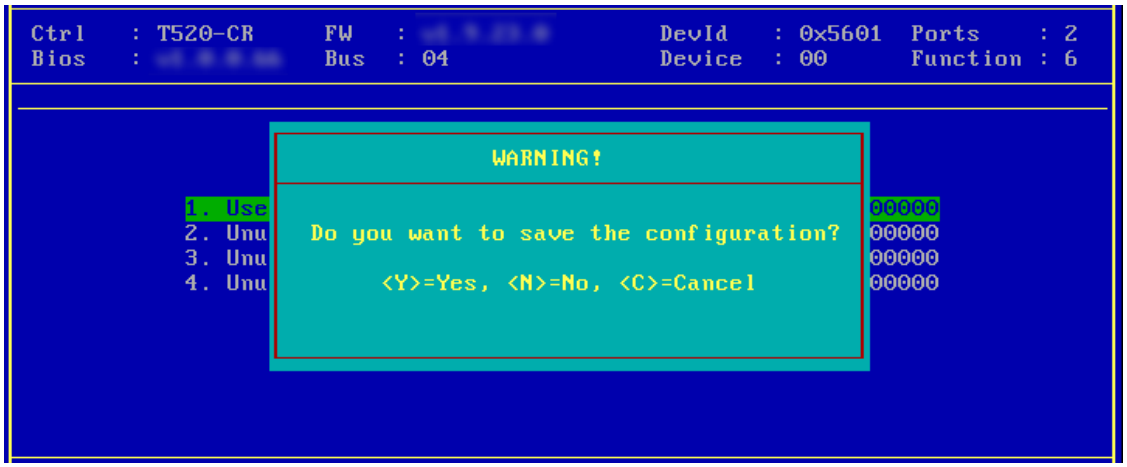


xv. From the list of LUNs displayed for the selected target, choose one on which operating system has to be installed. Hit [Enter].





xvi. Hit [F10] or [Esc] and then [Y] to save the configuration.

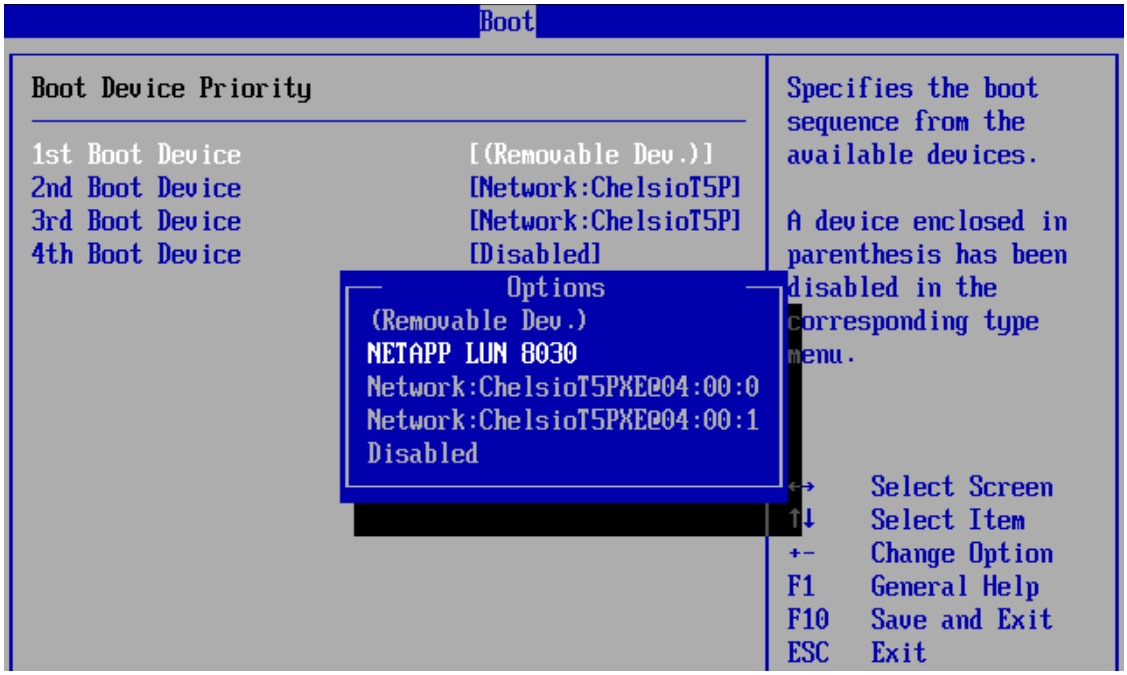


xvii. Reboot the machine.

xviii. During POST, allow the Chelsio option ROM to discover FCoE targets.

```
Installing Chelsio T5 Storage FCoE BIOS
PCI BIOSv3.0 PCI FWv2.1 PnP BIOS: YES PMM Entry is passed by BIOS
Bringing up link on PCI:04:00:6 Port 0 ... Done
Discovering FCoE Target(s) on PCI:04:00:6 Port 0 ... Done
sd(1): T520-CR         PCI:04:00:6 P(0) WWPN:500A098289AB7CAB Lun(00)
       NETAPP  LUN              8030 35.0003 GB
Storage FCoE BIOS Installed Successfully!
```

xix. Enter BIOS setup and choose FCoE disk discovered via Chelsio adapter as the first boot device.



xx. Reboot and boot from the FCoE disk or install the required OS using PXE.

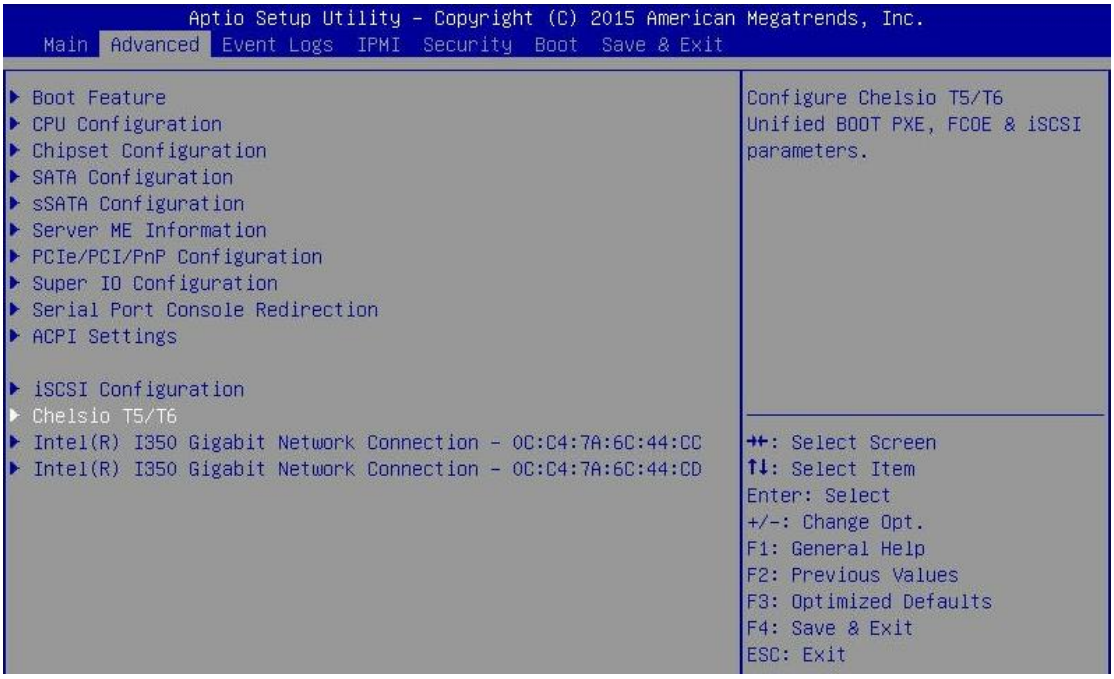
7.2. uEFI FCoE Boot

Important

- *Only uEFI v2.3.1, v2.4 and v2.5 supported.*
- *Any other uEFI version is NOT SUPPORTED and may render your system unusable.*

i. Reboot the system and go into BIOS setup.

ii. Select **Chelsio T5/T6** and press [Enter]



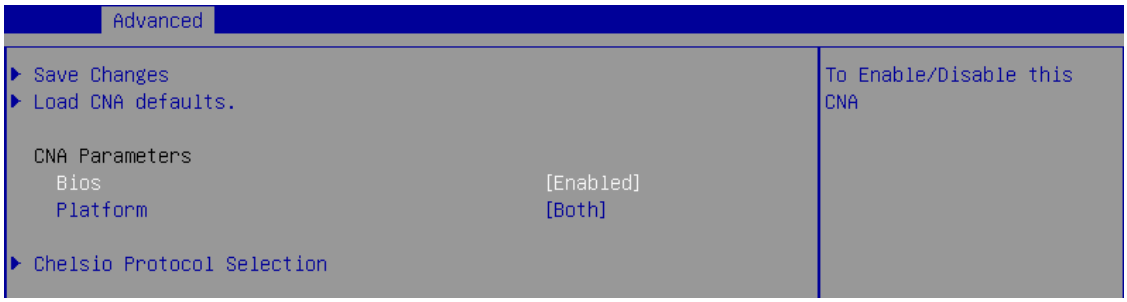
Note

If Chelsio T5/T6 is not listed, please ensure that Chelsio uEFI driver is loaded correctly as mentioned here in the ***Flashing Firmware and Option ROM*** *section.*

iii. Select the Chelsio adapter to be configured and press [Enter].

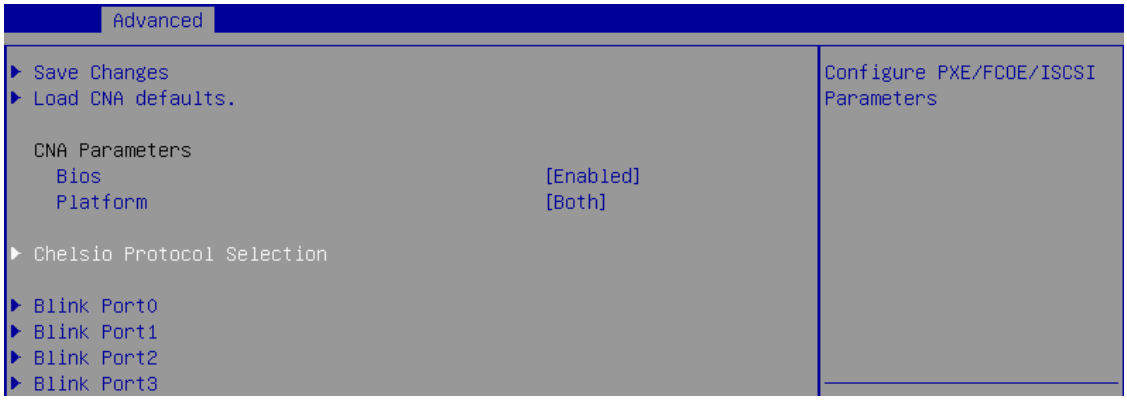
iv. Select **Configuration Utility** and press [Enter].

v. Enable adapter BIOS if not already enabled.



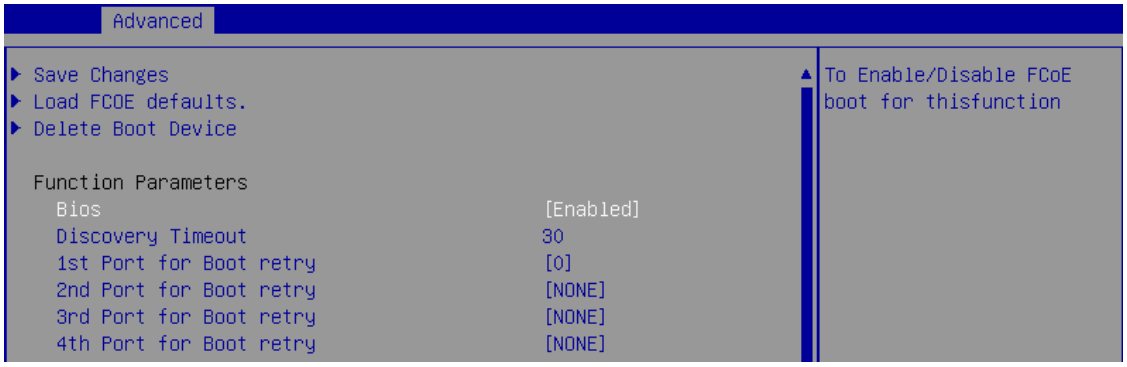
Note *It is highly recommended that you use the **Save Changes** option every time a parameter/option is changed.*

vi. Select **Chelsio Protocol Selection** and press [Enter].

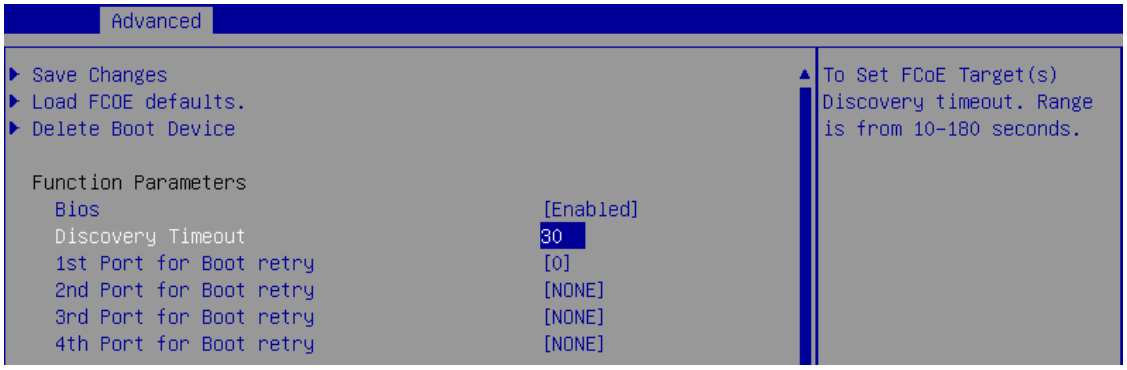


vii. Select **FCoE** and press [Enter].

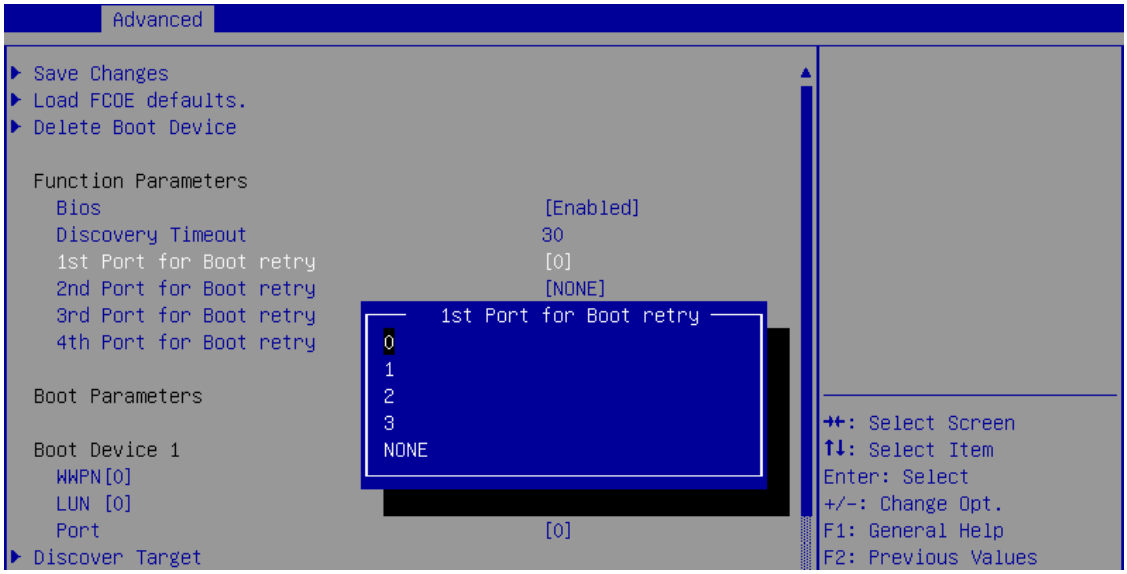
viii. Under **Function Parameters**, enable FCoE BIOS, if not already enabled.



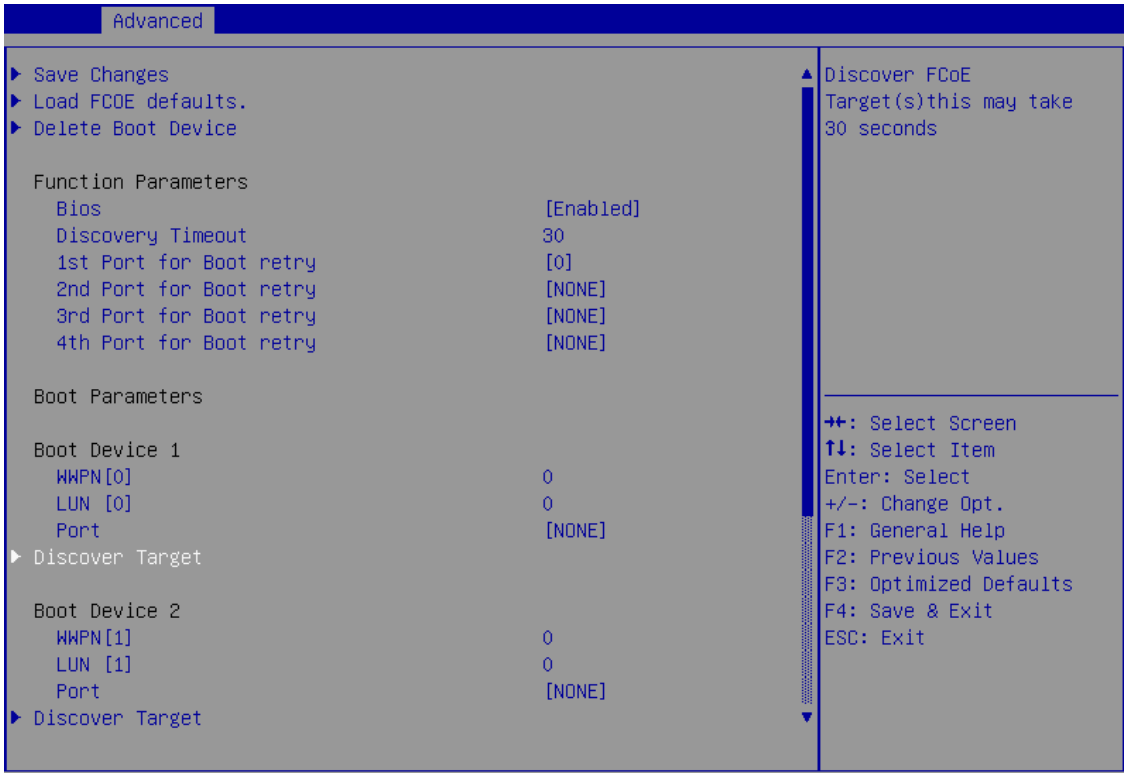
ix. Set discovery timeout to a suitable value. Recommended value is >= 30



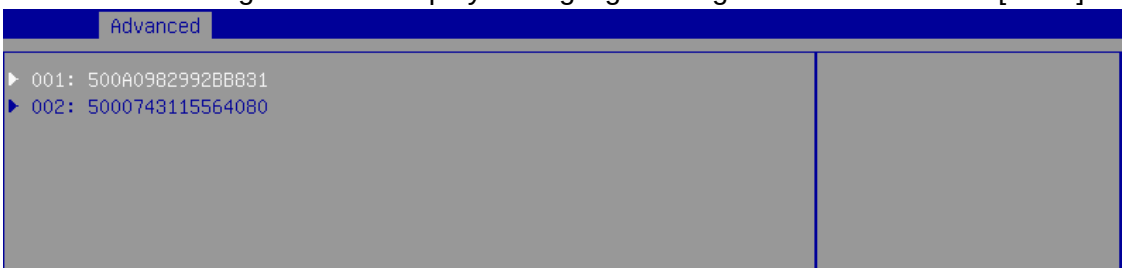
x. Choose the order of the ports to discover FCoE targets.



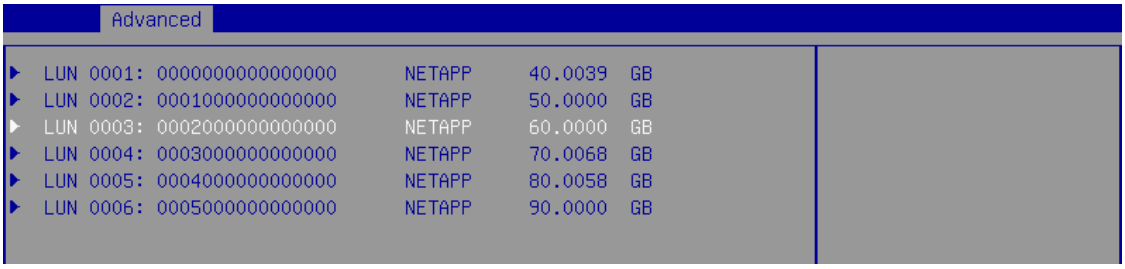
xi. Under the first boot device, select **Discover Target** and press [Enter] to discover FC/FCoE targets connected to the switch. Wait till all reachable targets are discovered.



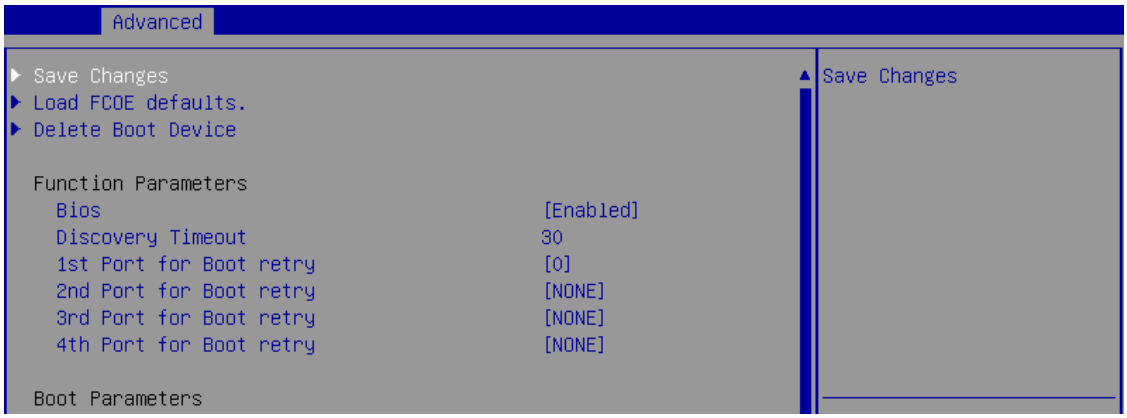
xii. List of discovered targets will be displayed. Highlight a target to select it and hit [Enter].



xiii. List of LUNs for the selected target will be displayed. Highlight a LUN to select it and hit [Enter].

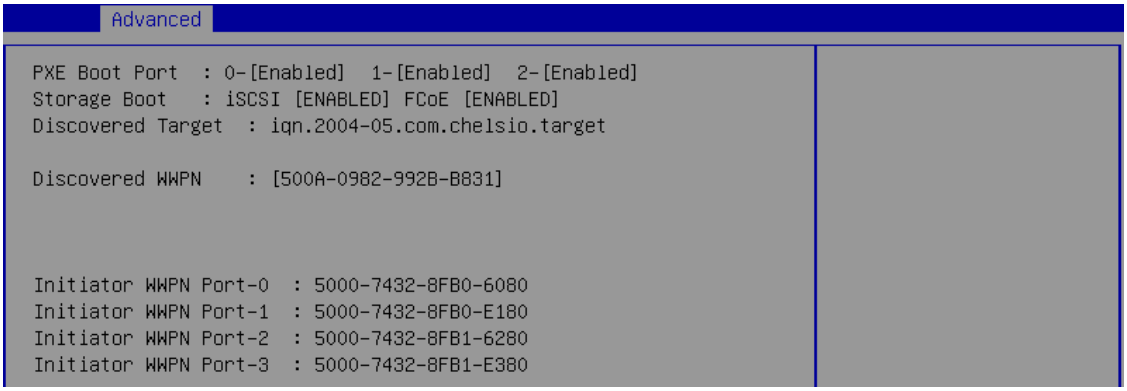


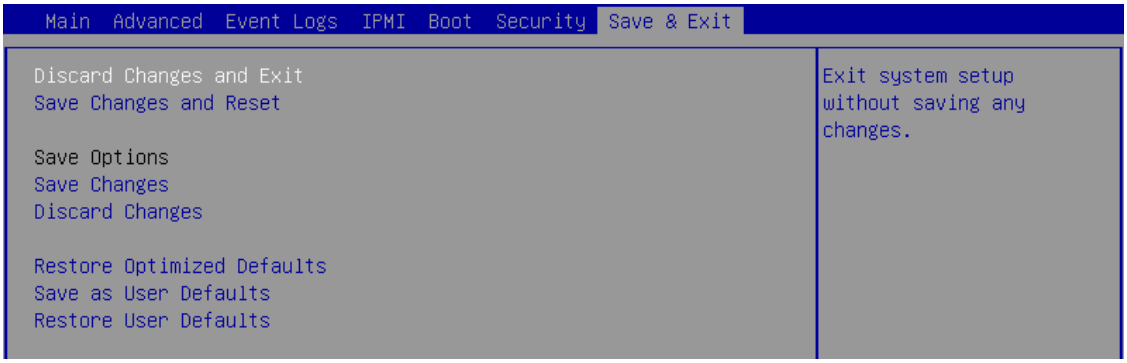
xiv. Select **Save Changes** and press [Enter].



xv. Reboot the system for changes to take effect.

xvi. The discovered LUN should appear in the **Boot Configuration** section and system BIOS section.





xvii. Select the LUN as the first boot device and exit from BIOS.

xviii. Either boot from the LUN or install the required OS.

8. iSCSI boot process

Before proceeding, please ensure that the Chelsio CNA has been flashed with the provided firmware and option ROM (See Flashing Firmware and option ROM).

8.1. Legacy iSCSI boot

i. Reboot the system.

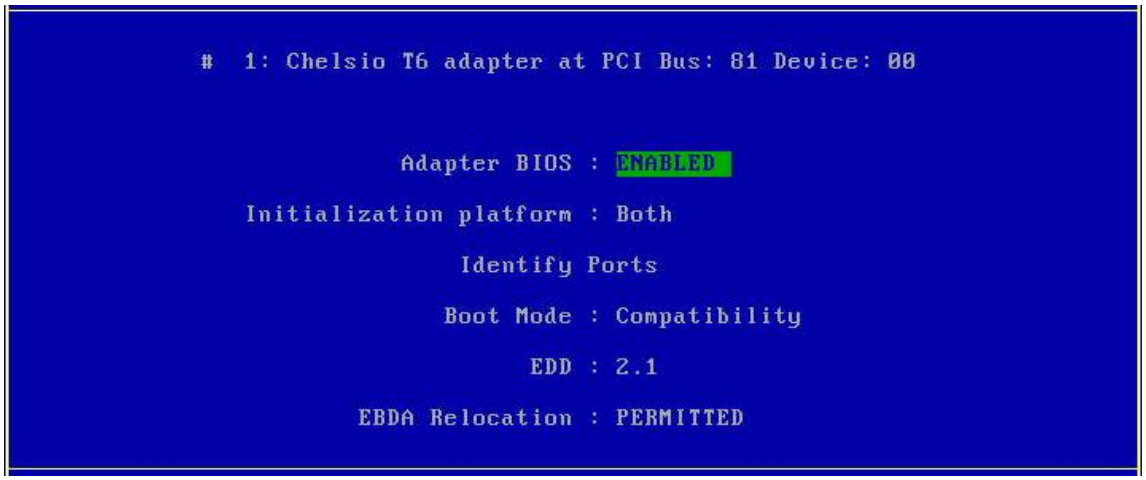
ii. Press [Alt+C] when the message to configure Chelsio adapters appears on the screen.

```
Chelsio Unified Boot BIOS
Copyright (C) 2003-2016 Chelsio Communications
Press <Alt-C> to Configure T5/T6 Card(s). Press <Alt-S> to skip BIOS.
```

iii. The configuration utility will appear as below:

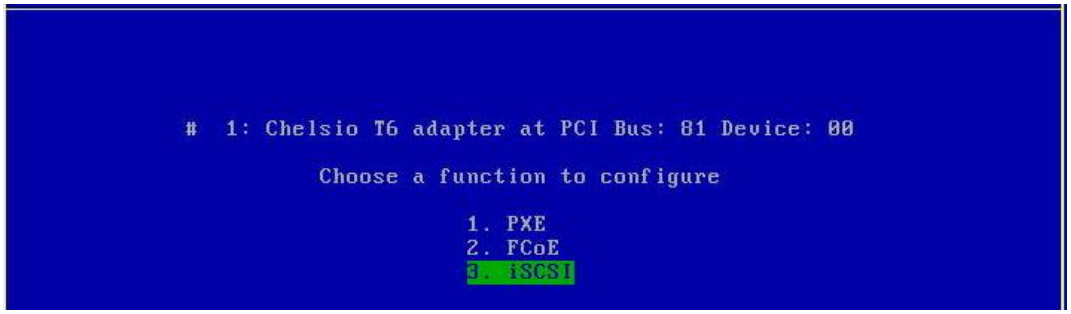
iv. Choose the CNA on which you flashed the option ROM image. Hit [Enter].

v. Enable the adapter BIOS if not already enabled. Hit [Enter].

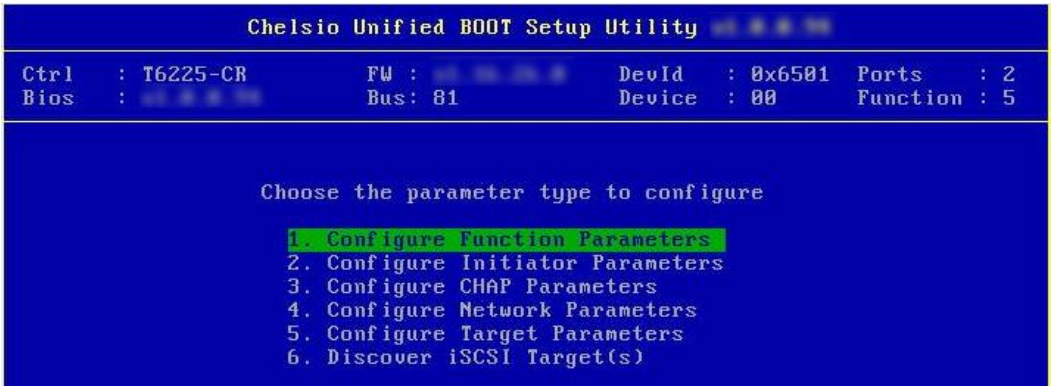


Note *Use the default values for Boot Mode, EDD and EBDA Relocation parameters, unless instructed otherwise.*

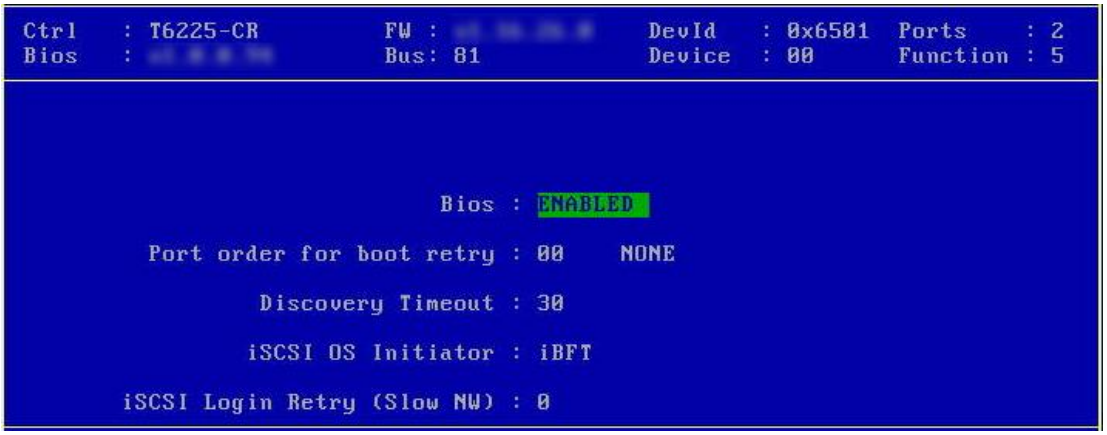
vi. Choose *iSCSI* from the list to configure and hit [Enter].



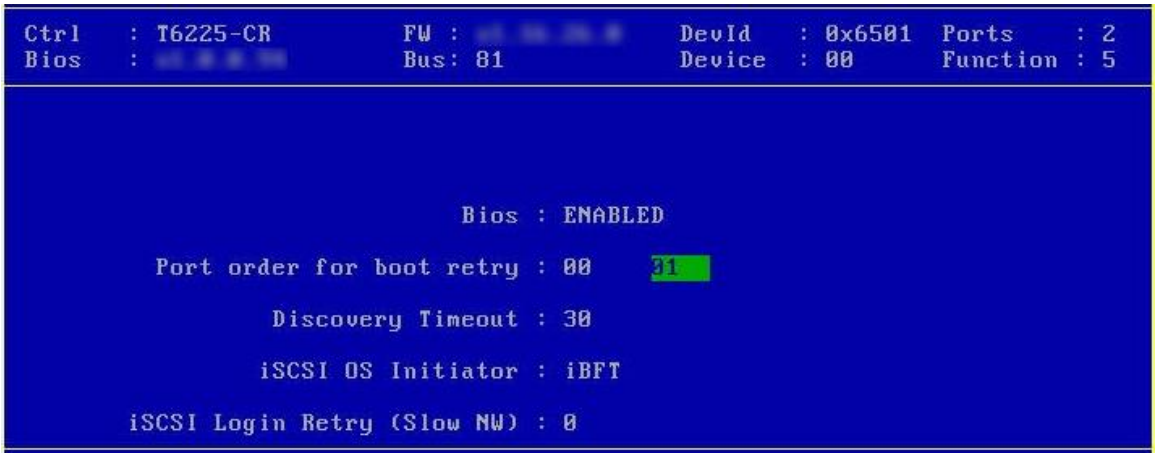
vii. Choose the first option, **Configure Function Parameters**, from the list of parameter type and hit [Enter].



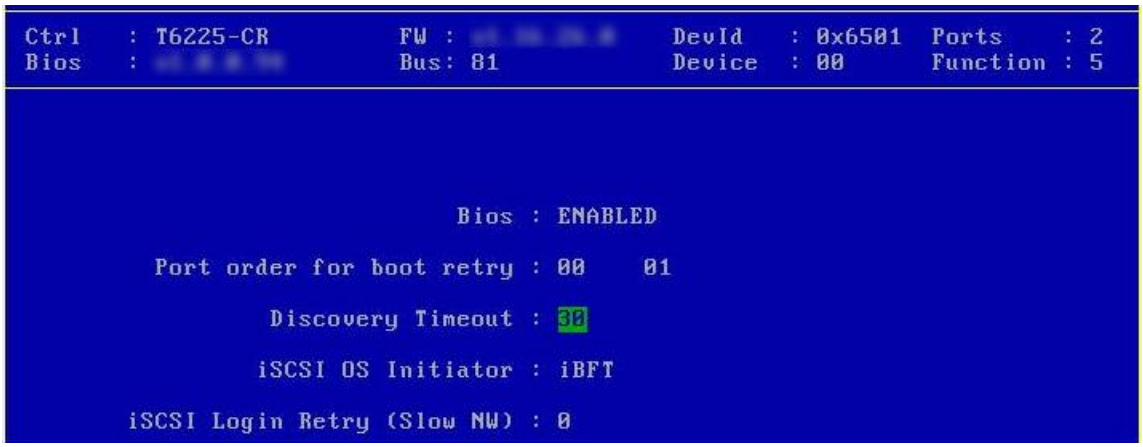
viii. Enable iSCSI BIOS if not already enabled. iBFT (iSCSI Boot Firmware Table) will be selected by default. You can also configure the number of iSCSI login attempts (retries) in case the network is unreachable or slow.



ix. Choose the order of the ports to discover iSCSI targets.



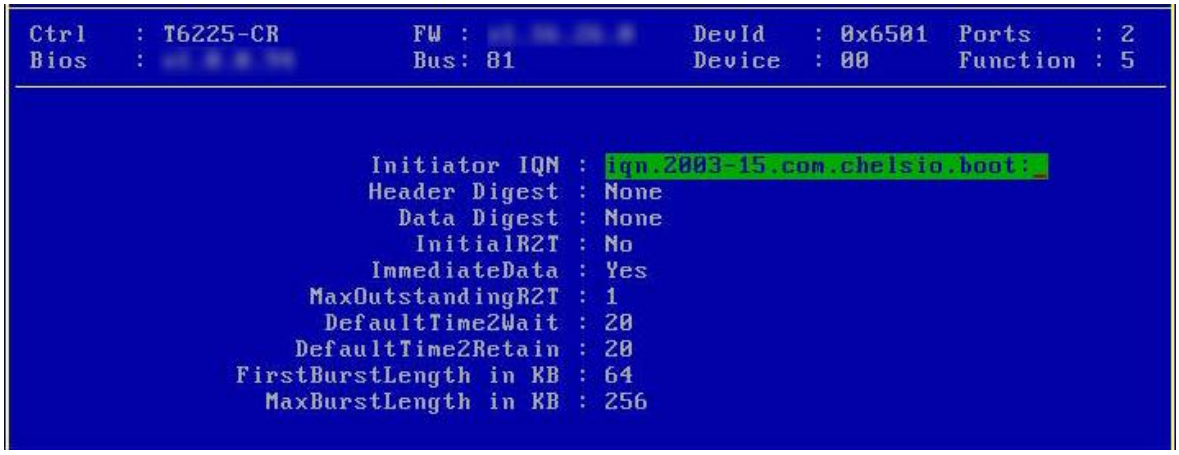
x. Set discovery timeout to a suitable value. Recommended value is >= 30.



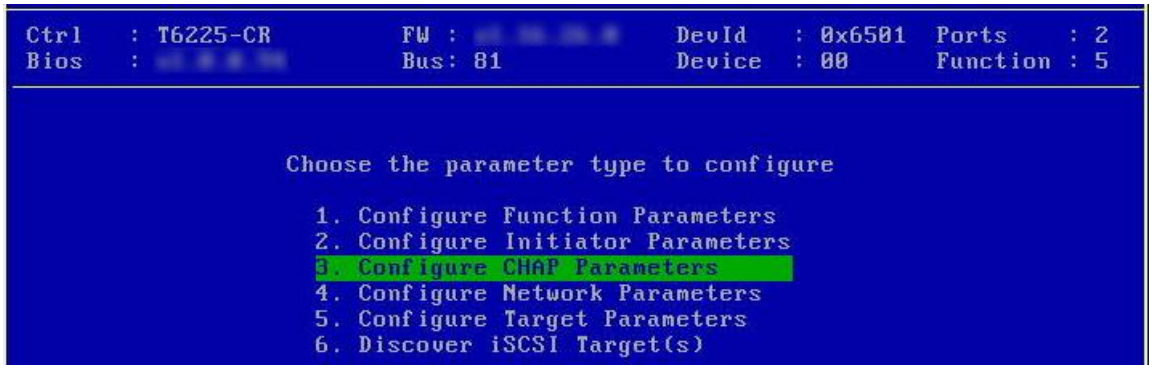
xi. Hit [Esc] and then [Y] to save the configuration.

xii. Go back and choose **Configure Initiator Parameters** to configure initiator related properties.

xiii. Initiator properties like IQN, Header Digest, Data Digest, etc. will be displayed. Change the values appropriately or continue with the default values. Hit [F10] to save.



xiv. CHAP authentication is disabled by default. To enable and configure, go back and choose **Configure CHAP Parameters**

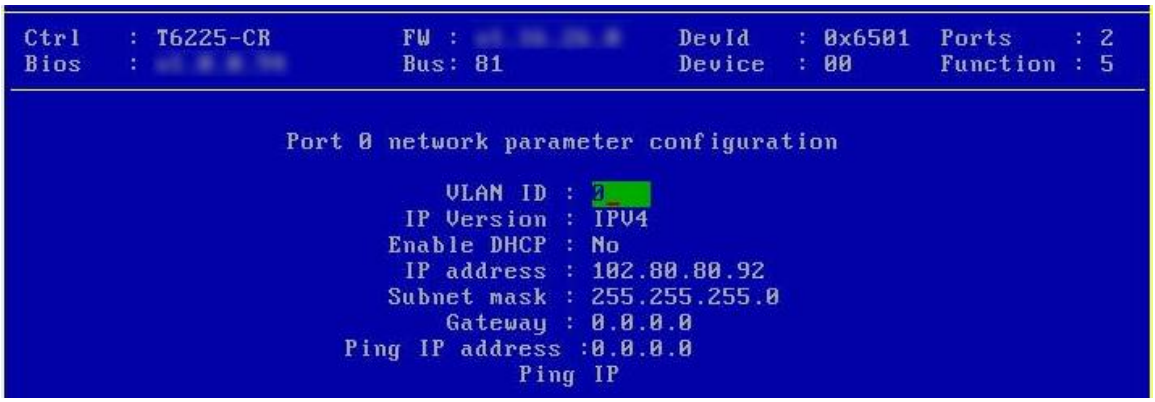


xv. Enable CHAP authentication by selecting ONE-WAY or MUTUAL in the **CHAP Policy** field. Next, choose the CHAP method. Finally, provide Initiator and Target CHAP credentials as per the authentication method selected. Hit [F10] to save.

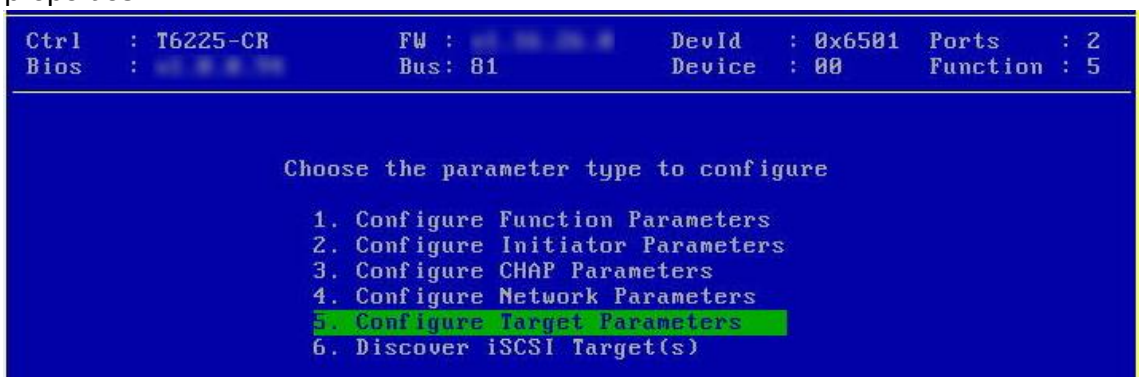
xvi. Go back and choose **Configure Network Parameters** to configure iSCSI Network related properties.

xvii. Select the port using which you want to connect to the target. Hit [Enter].

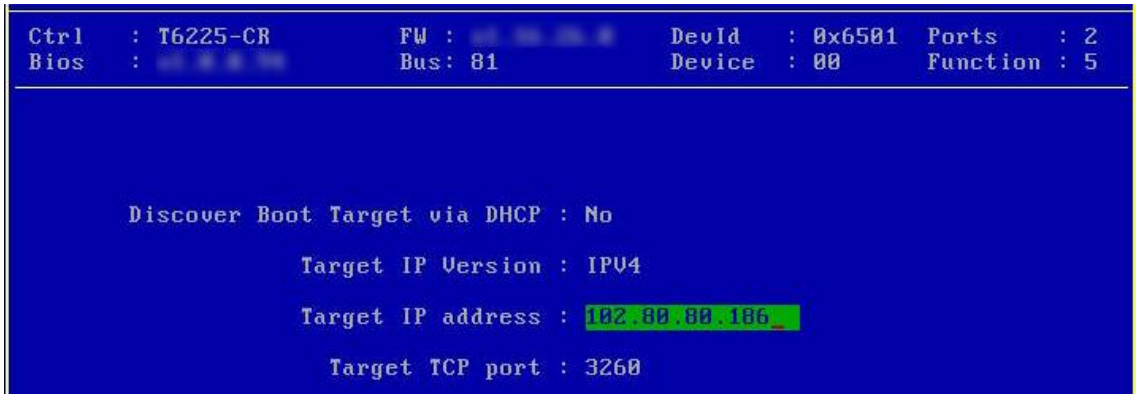
xviii. Select *Yes* in the **Enable DHCP** field to configure port using DHCP or *No* to manually configure the port. Hit [F10] to save.



xix. Go back and choose **Configure Target Parameters** to configure iSCSI target related properties.



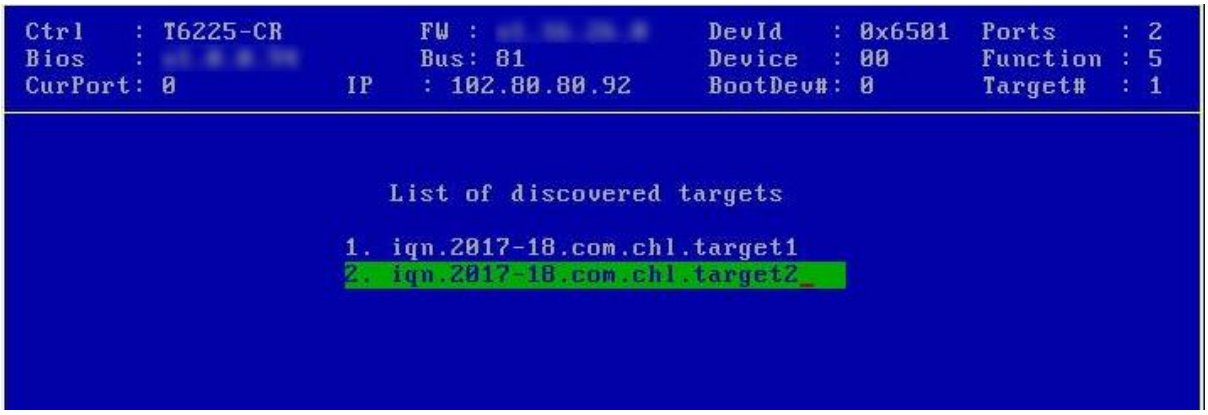
xx. If you want to discover target using DHCP, select *Yes* in the **Discover Boot Target via DHCP** field. To discover target via static IP, select *No* and provide the target IP and Hit [F10] to save. The default TCP port selected is 3260.



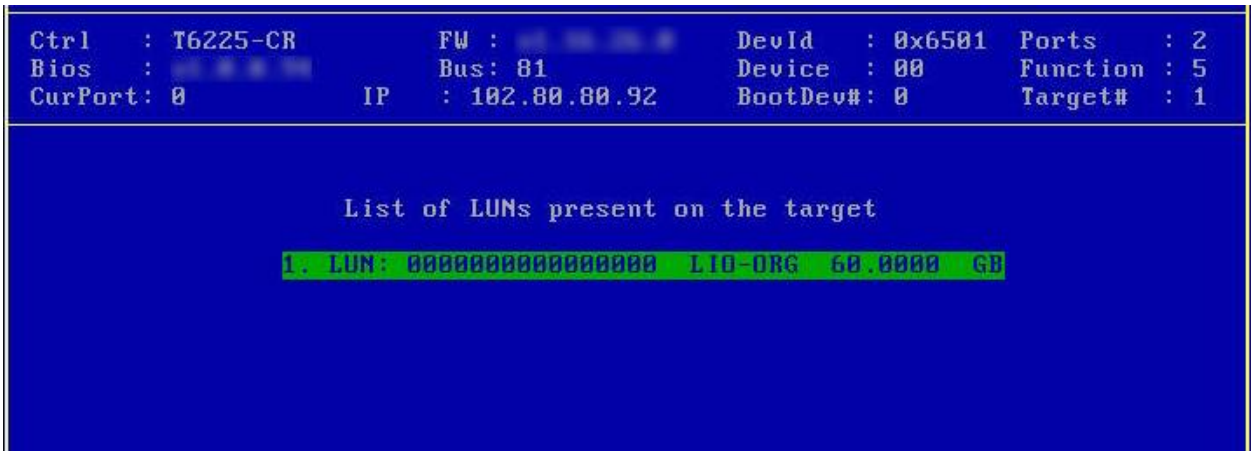
xxi. Go back and choose **Discover iSCSI Target (s)** to connect to a target.

xxii. Select the portal group on which iSCSI service is provided by the target.

xxiii. A list of available targets will be displayed. Select the target you wish to connect to and hit [Enter].



xxiv. A list of LUNs configured on the selected target will be displayed. Select the LUN you wish to connect to and hit [Enter].

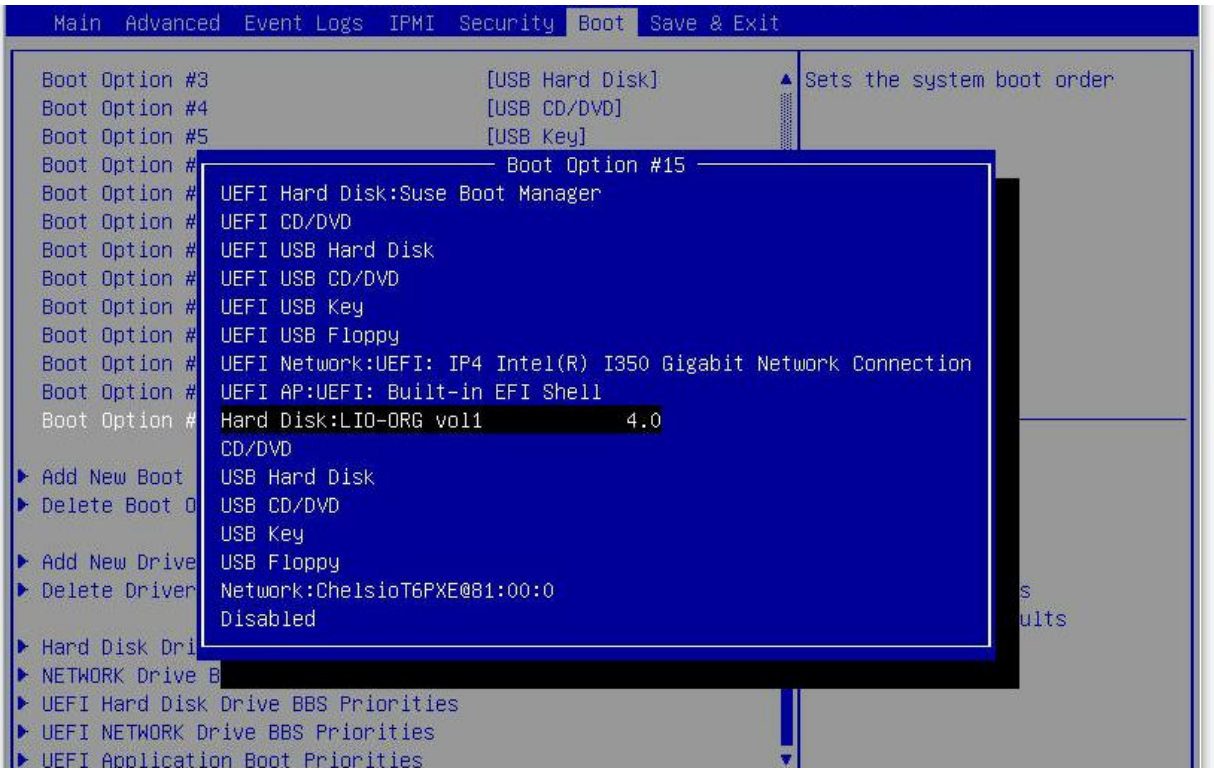


xxv. Hit [Esc] and then [Y] to save the configuration.

xxvi. Reboot the machine.

xxvii. During POST, allow the Chelsio option ROM to discover iSCSI targets.

xxviii. Enter BIOS setup and choose iSCSI target LUN discovered via Chelsio adapter as the first boot device.



xxix. Reboot and boot from the iSCSI Target LUN or install the required OS using PXE.

8.2. uEFI iSCSI Boot

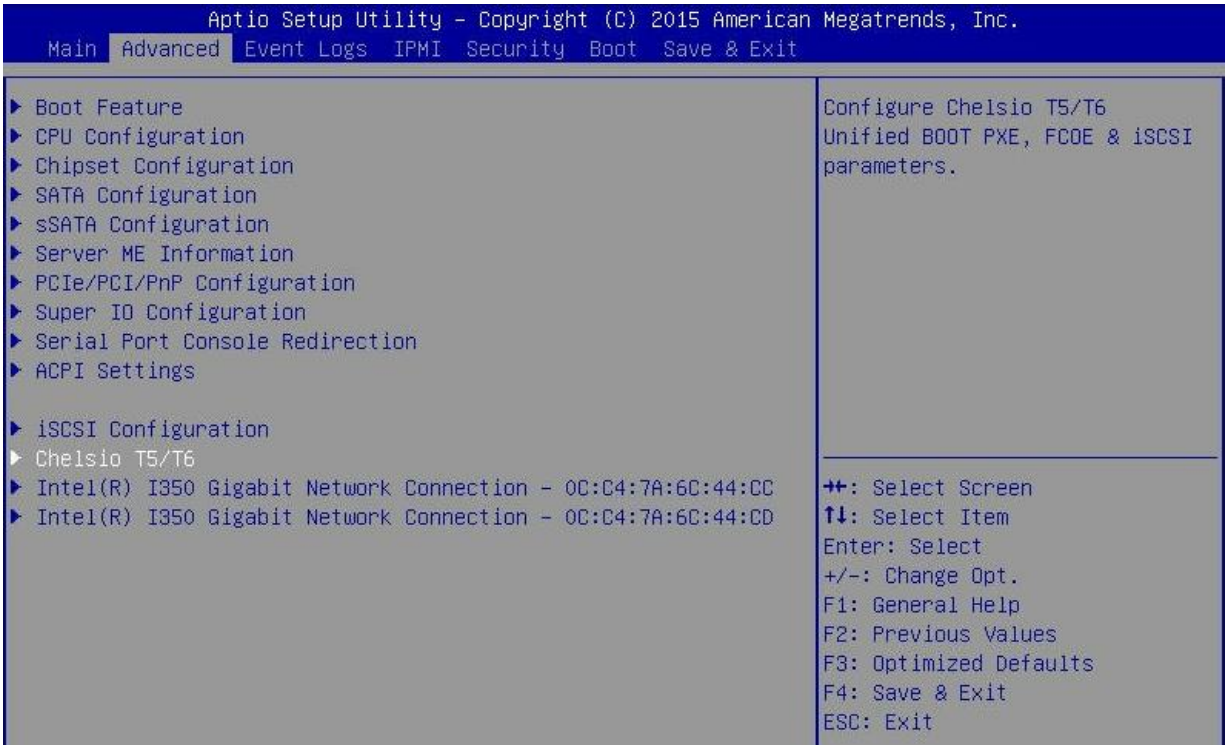
Important

- *Only uEFI v2.3.1, v2.4 and v2.5 supported.*
- *Any other uEFI version is NOT SUPPORTED and may render your system unusable.*

This section describes the method to perform iSCSI boot on uEFI platforms.

i. Reboot the system and go into BIOS setup.

ii. Select **Chelsio T5/T6** and press [Enter]

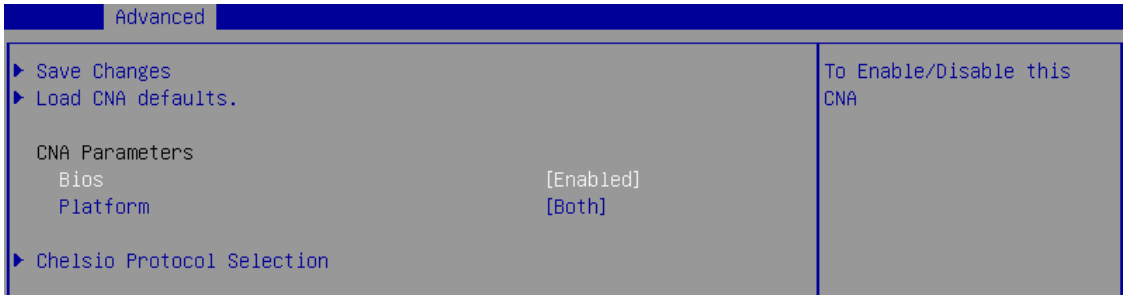


Note *If Chelsio T5/T6 is not listed, please ensure that Chelsio uEFI driver is loaded correctly as mentioned here in the* ***Flashing Firmware and Option ROM*** *section.*

iii. Select the Chelsio adapter to be configured and press [Enter].

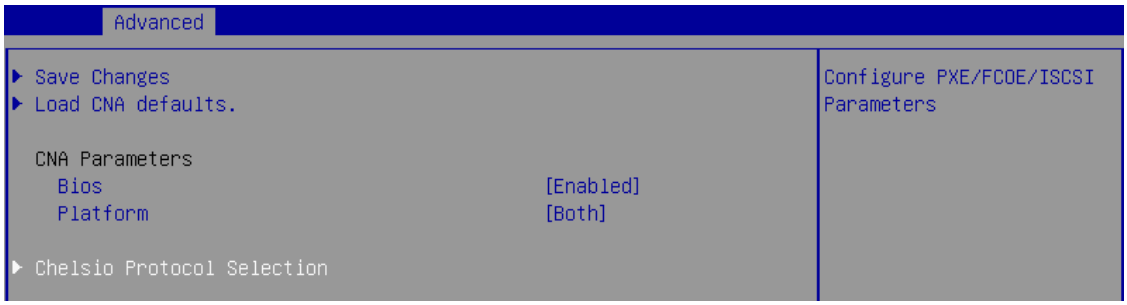
iv. Select **Configuration Utility** and press [Enter].

v. Enable adapter BIOS if not already enabled.

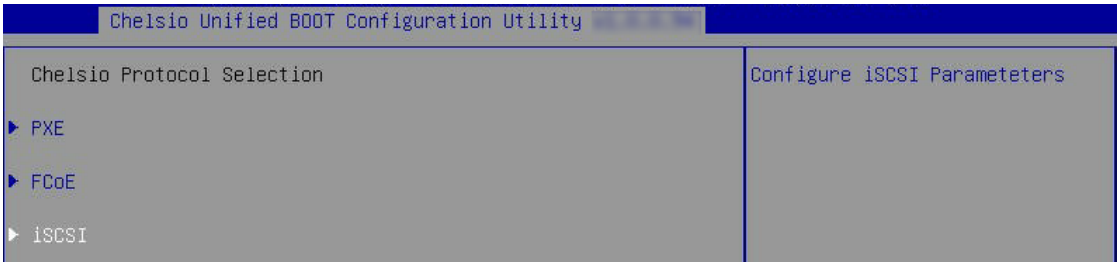


Note *It is highly recommended that you use the **Save Changes** option every time a parameter/option is changed.*

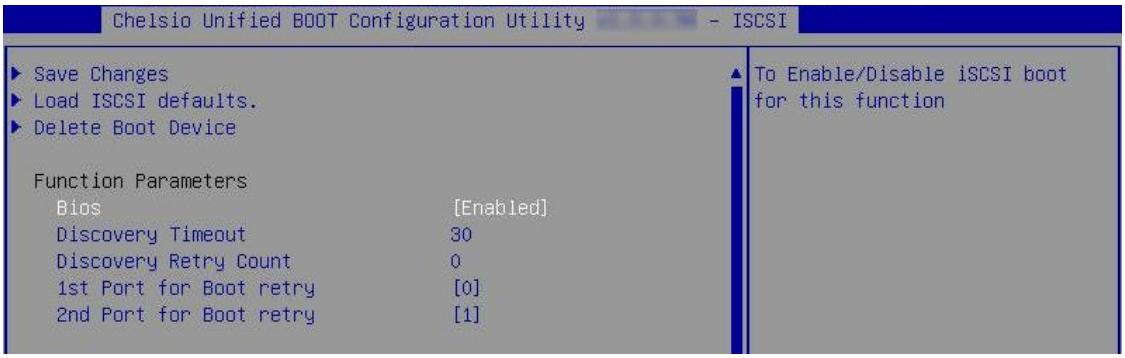
vi. Select **Chelsio Protocol Selection** and press [Enter].



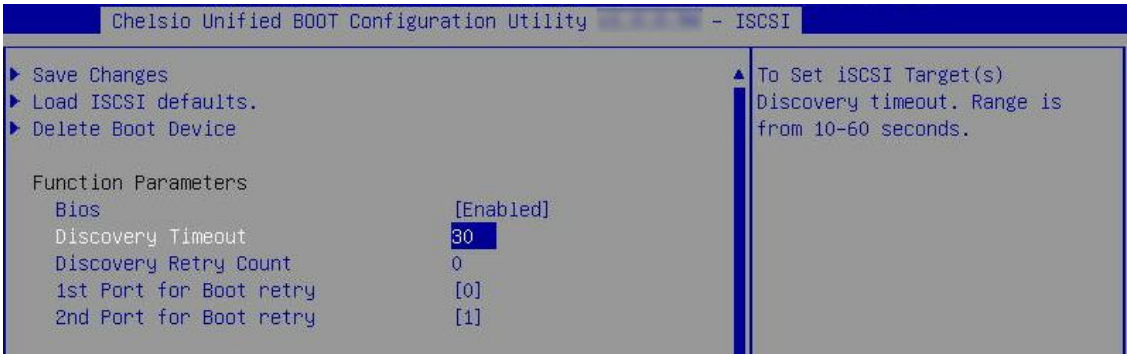
vii. Select **iSCSI** and press [Enter].



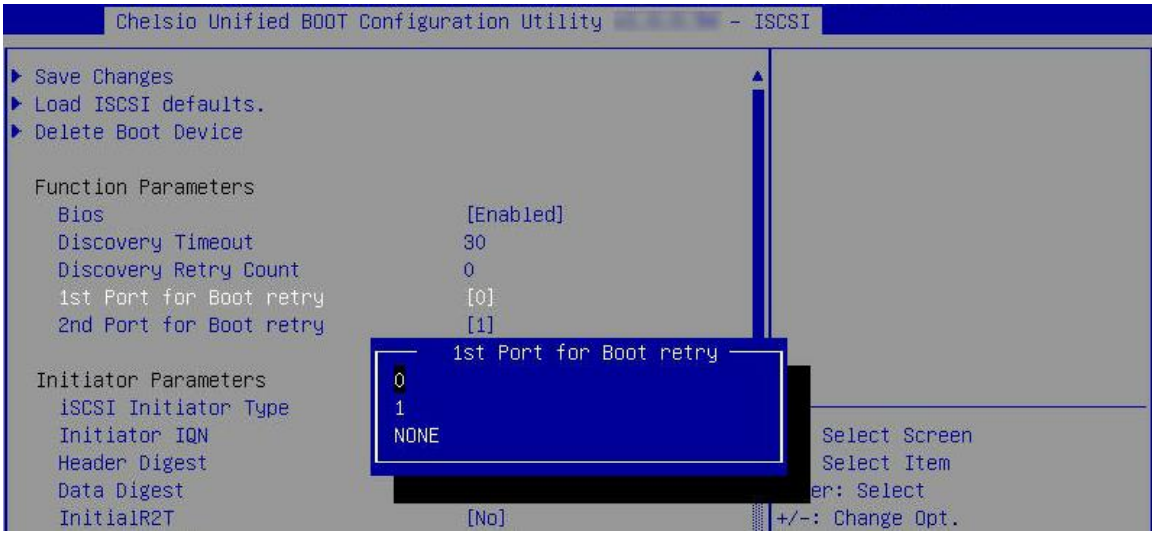
viii. Under **Function Parameters**, enable iSCSI BIOS, if not already enabled.



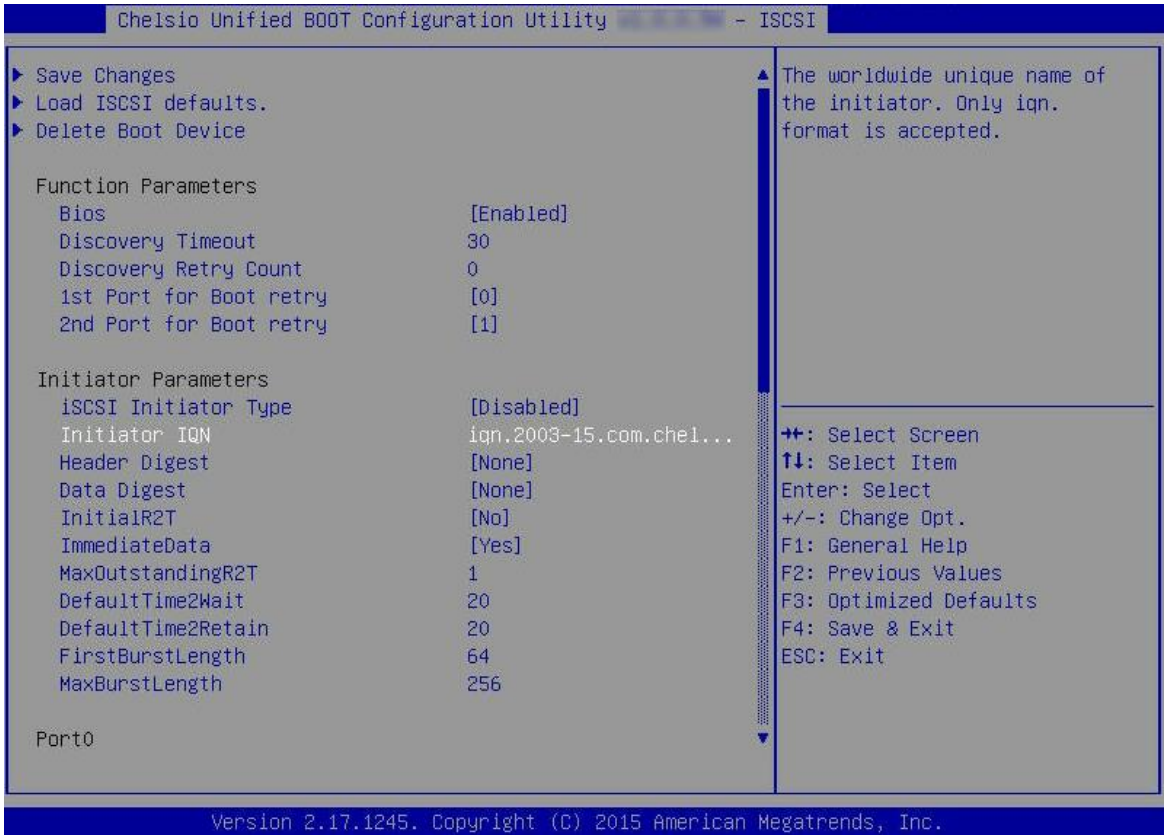
ix. Set discovery timeout to a suitable value. Recommended value is >= 30



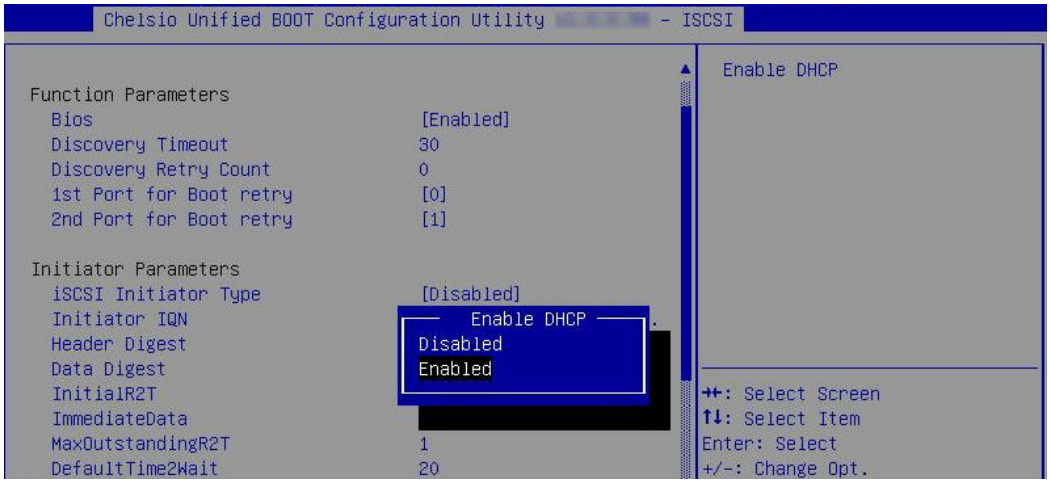
x. Choose the order of the ports to discover iSCSI targets.



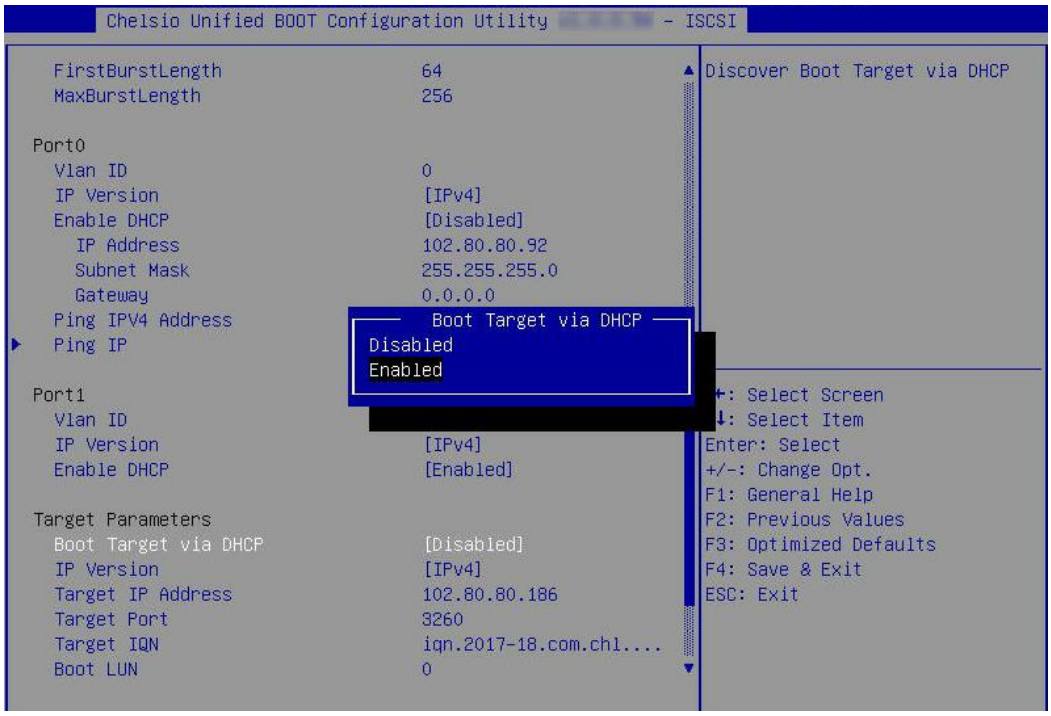
xi. Under **Initiator Parameters**, iSCSI Initiaitor properties like IQN, Header Digest, Data Digest, etc will be displayed. Change the values appropriately or continue with the default values.



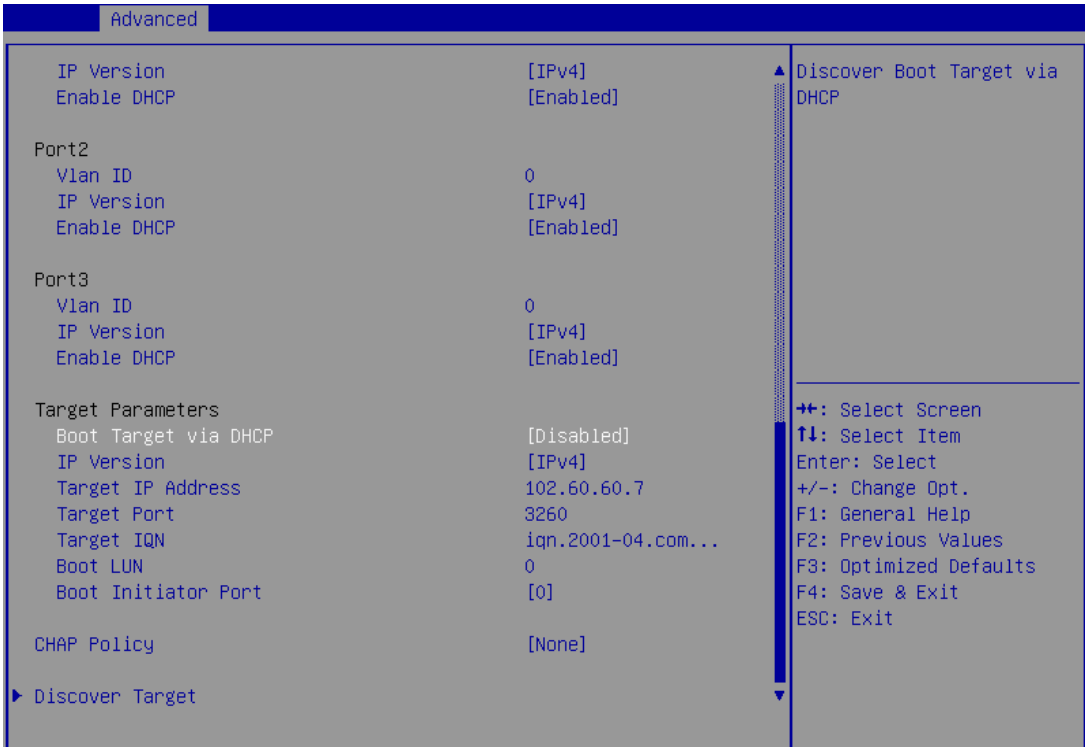
xii. Under the first port, select **Enable DHCP** field, hit [Enter] and select **Enabled**. This will configure port using DHCP. Select **Disabled** to manually configure the port.



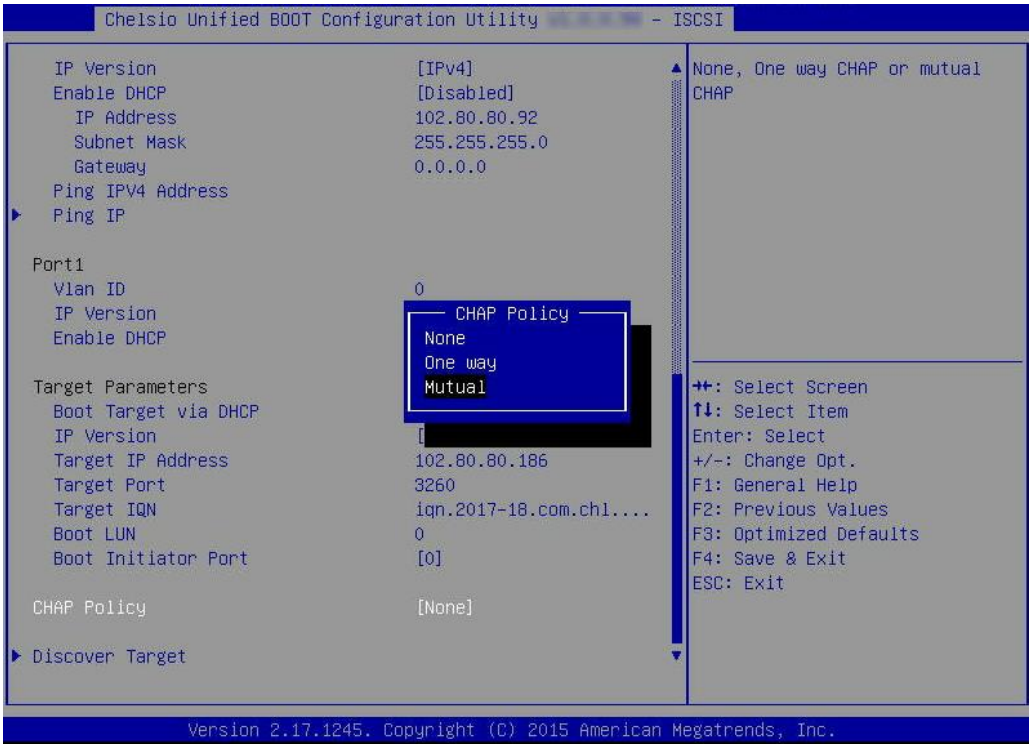
xiii. Under **Target Parameters**, select **Enabled** for the **Boot Target via DHCP** parameter to discover target using DHCP.



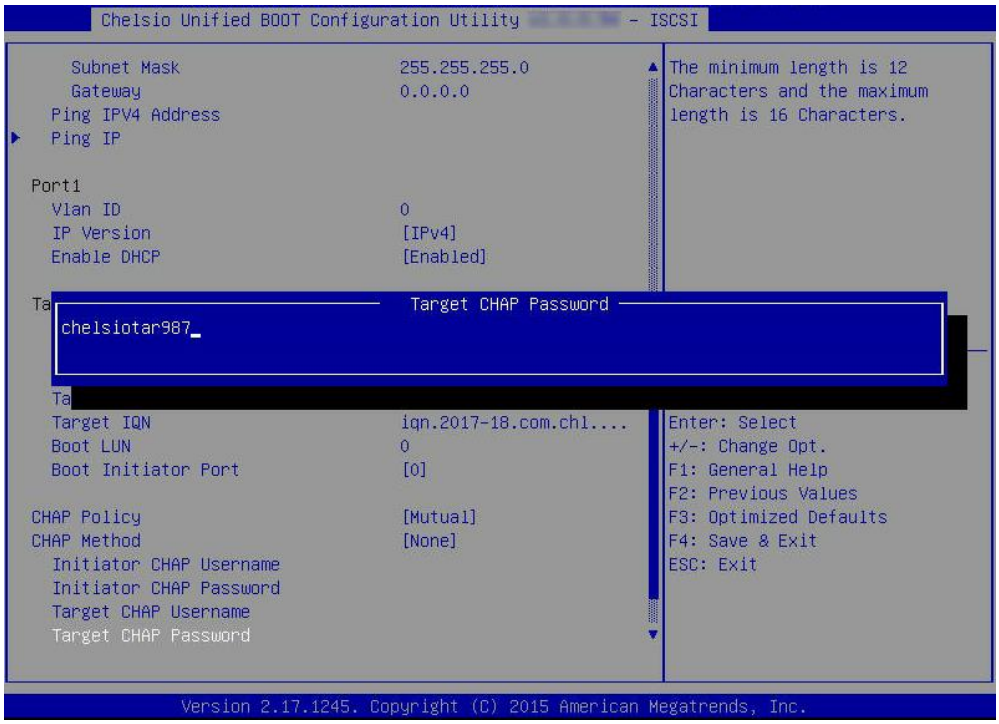
To discover target via static IP, select **Disabled** and provide the target IP.



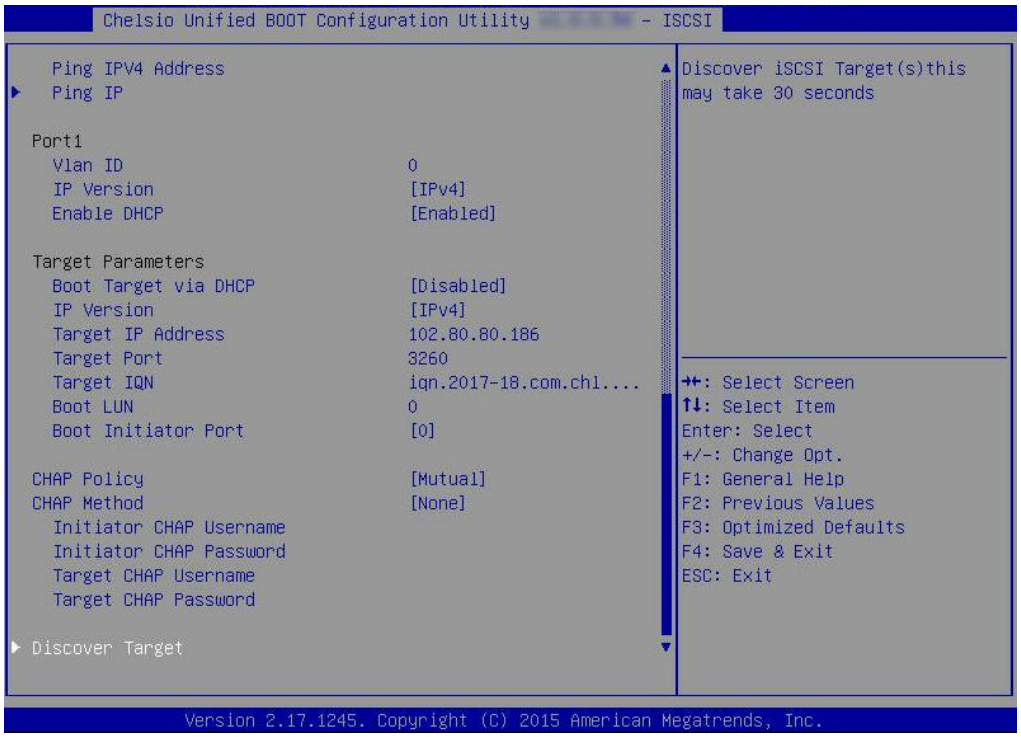
xiv. CHAP authentication is disabled by default. To enable and configure, highlight **CHAP Policy** and hit [Enter]. Select the policy type from the corresponding pop-up and hit [Enter] again.



xv. Provide Initiator and Target CHAP credentials as per the CHAP policy selected.



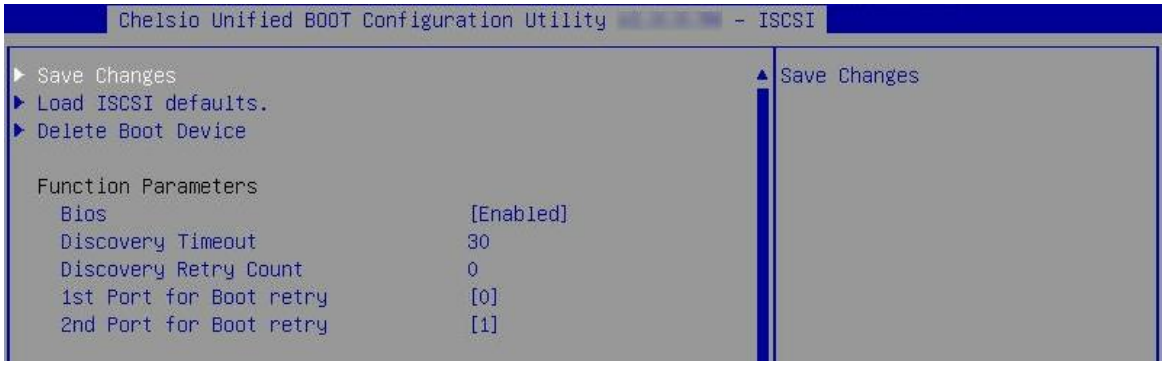
xvi. Select **Discover Target** and press [Enter] to discover iSCSI targets connected to the switch. Wait till all reachable targets are discovered.



xvii. A list of available targets will be displayed. Select the target you wish to connect to and hit [Enter].

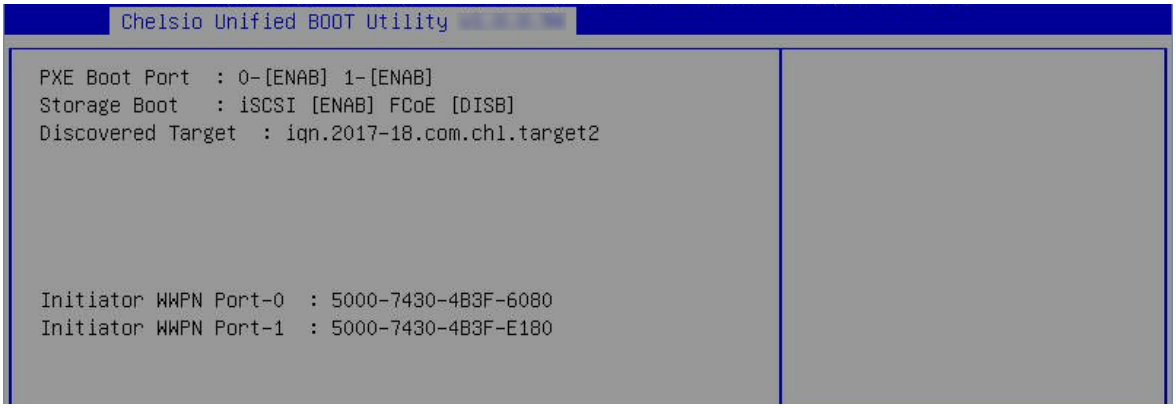
xviii. A list of LUNs configured on the selected target will be displayed. Select the LUN you wish to connect to and hit [Enter].

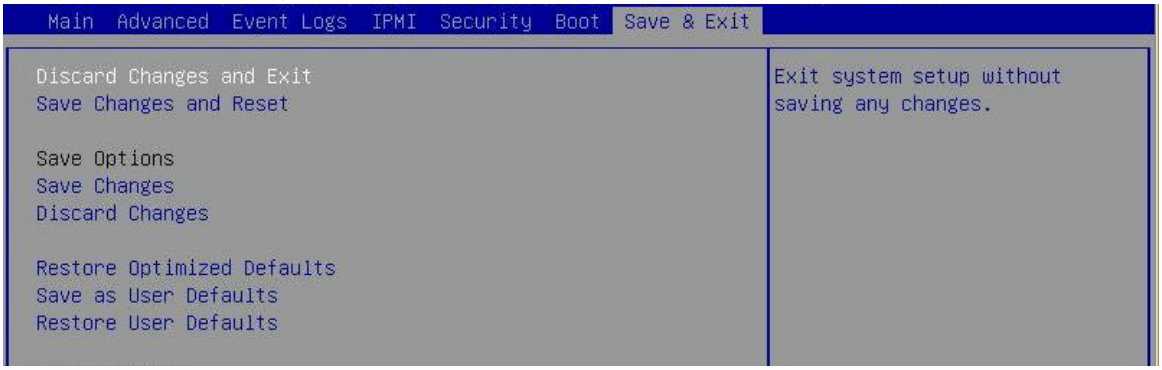
xix. Select **Save Changes** and press [Enter]



xx. Reboot the system for changes to take effect.

xxi. The discovered LUN should appear in the **Boot Configuration/ Boot Information** section and system BIOS.





xxii. Select the LUN as the first boot device and exit from BIOS.

xxiii. Either boot from the LUN or install the required OS.

II. Driver Update Disk for Linux

1. Introduction

The following section describes the procedure to create Driver Update Disks for RHEL and SLES distributions for Unified Wire adapters.

1.1. Hardware Requirements

1.1.1. Supported Adapters

The following are the currently shipping Chelsio adapters that are compatible with Chelsio Driver Update Disk software:

- T62100-CR
- T62100-LP-CR
- T62100-SO-CR*
- T6425-CR
- T6225-CR
- T6225-LL-CR
- T6225-SO-CR*
- T580-OCP-SO*
- T520-OCP-SO*
- T520-BT
- T580-CR
- T520-LL-CR
- T520-SO-CR*
- T520-CR
- T540-CR
- T580-LP-CR
- T580-SO-CR*

** Only PXE supported*

1.2. Software Requirements

1.2.1. Linux Requirements

The Chelsio Driver Update Disk driver has been developed to run on 64-bit Linux platforms. Following is the list of Drivers/Software and supported Linux distributions:

Linux Distribution	Driver/Software (DUDs)
RHEL 7.3, 3.10.0-514.el7	PXE, FCoE, iSCSI

RHEL 7.2, 3.10.0-327.el7	PXE, iSCSI
RHEL 6.9, 2.6.32-696.el6	
SLES 12 SP2, 4.4.21-69-default	
SLES 12 SP1, 3.12.49-11-default	
SLES 11 SP4, 3.0.101-63-default	

Note *Other kernel versions have not been tested and are not guaranteed to work.*

2. Creating Driver Update Disk (DUD)

The following section describes the procedure to create Driver Update Disks for Linux and Customized ISO for ESXi.

2.1. Creating DUD for RedHat Enterprise Linux

i. If you haven't done already, download Chelsio-Uboot-x.x.x.xx.zip from Chelsio Download Center.

ii. Unzip the package,

```
[root@host~]# unzip Chelsio-Uboot-x.x.x.xx.zip
```

iii. Change your current working directory to *LinuxDUD* directory,

```
[root@host~]# cd Chelsio-Uboot-x.x.x.xx/LinuxDUD
```

iv. Insert a blank, formatted USB flash drive.

v. Depending on the distribution to be installed, copy the corresponding image file to the USB drive. For example, execute the following command for RHEL 6.6:

```
[root@host~]# cp Chelsio-DriverUpdateDisk-RHEL6.6-x86_64-x.xx.x.x.img <path
to USB drive>
```

Note *For RHEL 7.X, use Chelsio-DriverUpdateDisk-RHEL7.X-x86_64-x.xx.x.x.iso*

2.2. Creating DUD for Suse Enterprise Linux

i. If you haven't done already, download Chelsio-Uboot-x.x.x.xx.zip from Chelsio Download Center.

ii. Unzip the package,

```
[root@host~]# unzip Chelsio-Uboot-x.x.x.xx.zip
```

iii. Insert a blank USB flash drive.

iv. Format the USB drive

```
[root@host~]# mkfs.vfat /dev/sda1
```

v. Depending on the distribution to be installed, copy the corresponding image file to the USB stick. For example, execute the following command for SLES11sp4.

```
[root@host~]# dd if=/root/Chelsio-Uboot-x.x.x.xx/LinuxDUD/Chelsio-
DriverUpdateDisk-SLES11sp4-x86_64-x.x.x.x.img of=/dev/sda1
```

3. OS Installation

3.1. Installation using Chelsio DUD

This is the recommended method for installing Linux OS using Chelsio PXE boot. The Chelsio Driver Update Disk (DUD) has support for all the new adapters. Use Network Boot (PXE Boot) media to install the OS, and provide the Driver Update Disk as per the detailed instructions for each OS.

The DUD supports installation of Linux distributions using Chelsio adapters over Network. There may be built-in Chelsio driver in these distributions. The driver may or may not work with Chelsio adapters, depending on the adapter in use, and the version of the driver that shipped in that particular distribution. Please flash the firmware provided in the package.

3.1.1. RHEL 7.X installation

i. Please make sure that the USB drive with DUD image is inserted. Type *e* and then *dd* at the boot prompt for the installation media. The *dd* option specifies that you will be providing a Driver Update Disk during the installation.

Note

- *In case of iSCSI boot, type* ***dd ip=ibft***
- *In case of T5 adapters with RHEL 7.2, use inbox drivers for installation. No DUDs required.*

ii. You will be asked to select the Driver Update Disk device from a list. USB drives usually show up as SCSI disks in Linux. Enter the index number of the device to be used and hit [Enter].

```
Page 1 of 1
Driver disk device selection
      DEVICE     TYPE                LABEL          UUID
  1)  sda1       vfat                7_8GB          C6A6-09F1

# to select, 'r'-refresh, 'n'-next page, 'p'-previous page or 'c'-continue: 1
```

iii. The installer will search and display DUD image files found in the selected device. Enter the index number of the file to be used and hit [Enter].

```
Page 1 of 1
Choose driver disk ISO file
  1)  LinuxDUD/Chelsio-DriverUpdateDisk-[illegible].iso

# to select, 'n'-next page, 'p'-previous page or 'c'-continue: 1_
```

iv. Drivers provided in the DUD will be listed. Enter 1 to select FCoE driver (*csiostor*), or 2 to select Network driver (*cxgb4*). Hit [Enter]

```
Page 1 of 1
Select drivers to install
  1) [ ] /media/DD//rpms/x86_64/kmod-csiostor-[illegible].rpm
  2) [ ] /media/DD//rpms/x86_64/kmod-cxgb4-[illegible].rpm

# to toggle selection, 'n'-next page, 'p'-previous page or 'c'-continue: 1
```

v. To select the next driver, enter the driver index or enter “c” to start the loading process. Hit [Enter]. The selected driver(s) will now be loaded.

```
Page 1 of 1
Select drivers to install
  1) [x] /media/DD//rpms/x86_64/kmod-csiostor-[illegible].rpm
  2) [ ] /media/DD//rpms/x86_64/kmod-cxgb4-[illegible].rpm

# to toggle selection, 'n'-next page, 'p'-previous page or 'c'-continue: 2
```

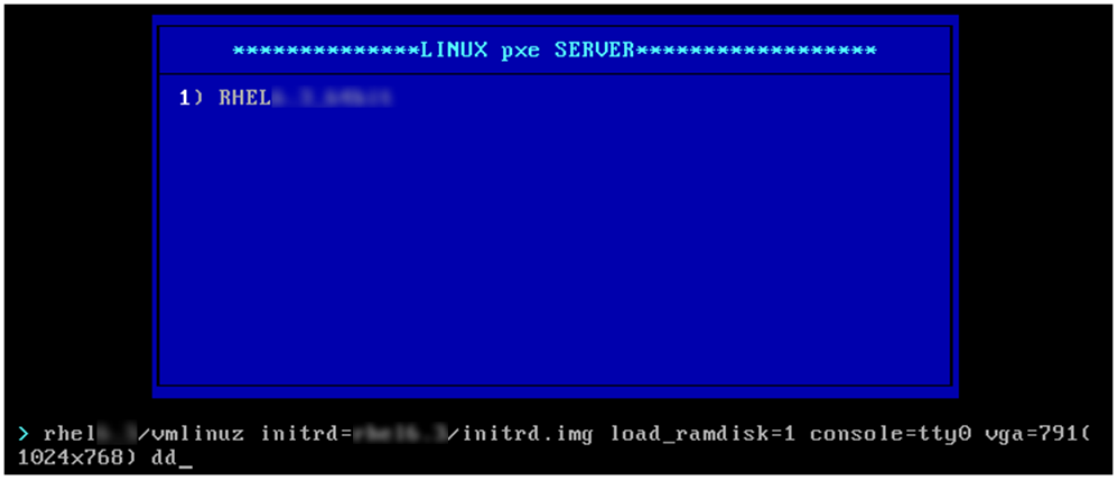
Note *To deselect a driver, enter the index of the selected driver and hit [Enter]*

vi. The **Driver disk prompt** will be displayed again. Follow the same procedure mentioned above to select any other drivers you wish to load or press “C” to skip and start the loading process.

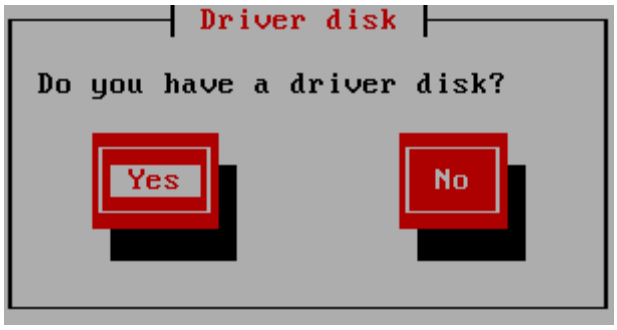
vii. After the drivers are successfully loaded, OS installation will commence. Proceed as usual.

3.1.2. RHEL 6.X installation

i. Please make sure that the USB drive with DUD image is inserted. Press *Tab* and then type *dd* at the boot prompt for the installation media. The *dd* option specifies that you will be providing a Driver Update Disk during the installation.



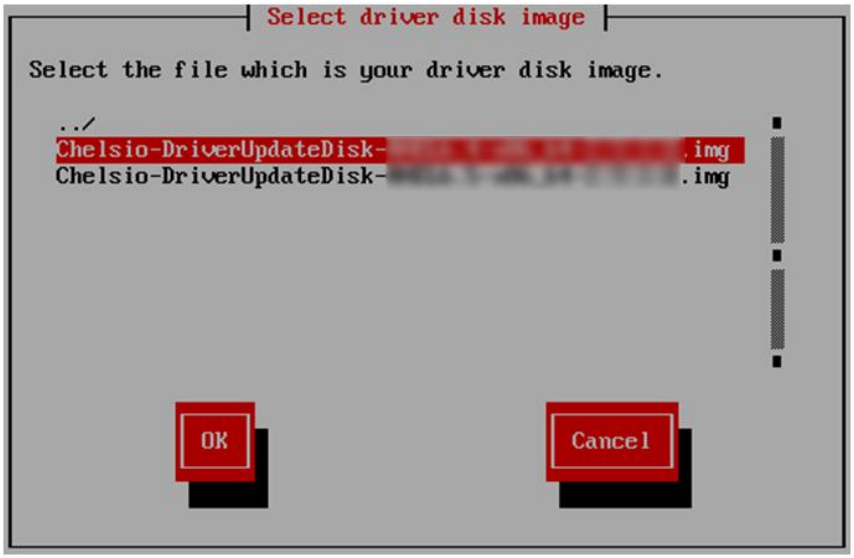
ii. The installer will load and prompt you for the driver update disk. Select “Yes” and hit [Enter] to proceed.



iii. You will be asked to select the Driver Update Disk device from a list. USB drives usually show up as SCSI disks in Linux. So, if there are no other SCSI disks connected to the system, the USB drive would assume the first drive letter “a”. Hence the drive name would be “sda”.

You can view the messages from the Linux kernel and drivers to determine the name of the USB drive, by pressing [Alt] + [F3] or [Alt] + [F4]. Press [Alt] + [F1] to get back to the list.

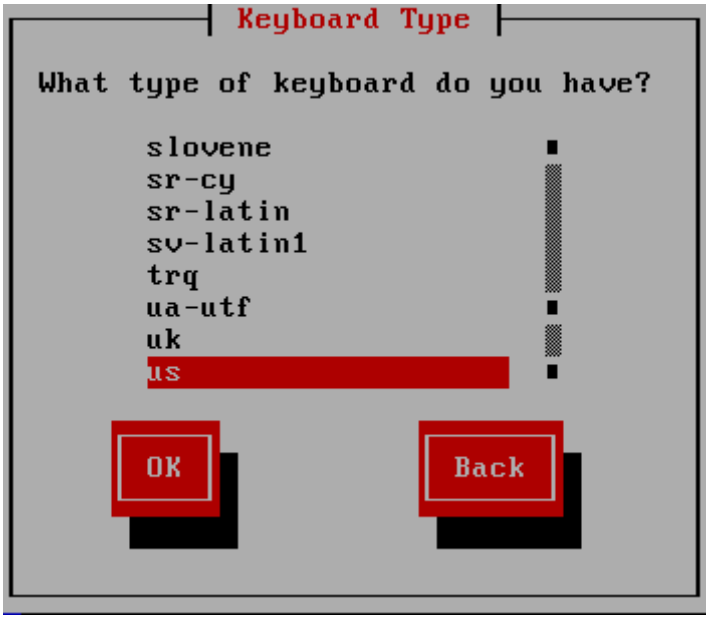
iv. Select the Appropriate image file and Choose “OK”. Now the installer will search for the appropriate drivers from the driver disk and load them. This step may take some time. Check on the [Alt] + [F3] or [Alt] + [F4] screens for log messages.



v. The installer will ask if you wish to load more drivers. Choose “Yes” to load if you have any other drivers to load. Otherwise choose “No”.

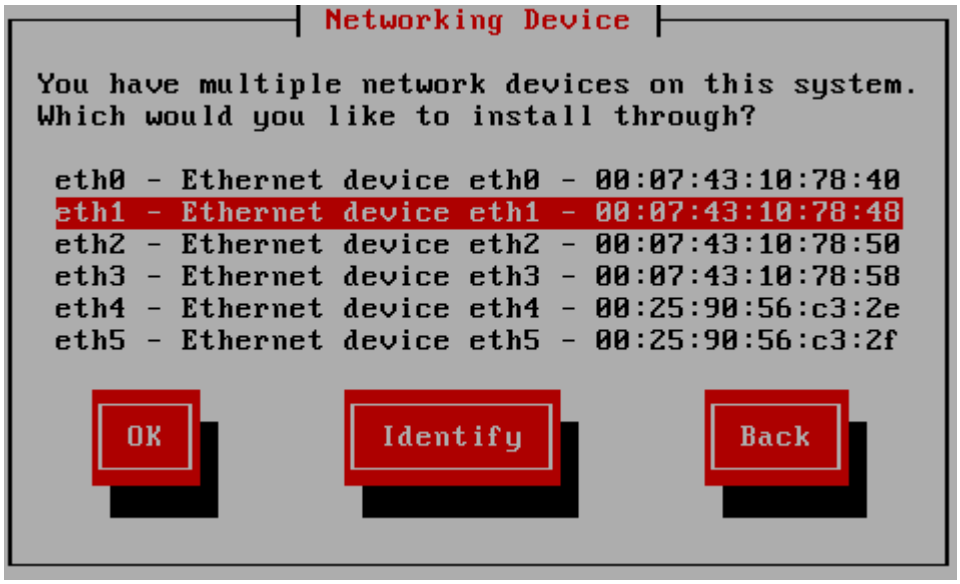
vi. Select the required language from the list.

vii. Select the type of keyboard you have from the list.

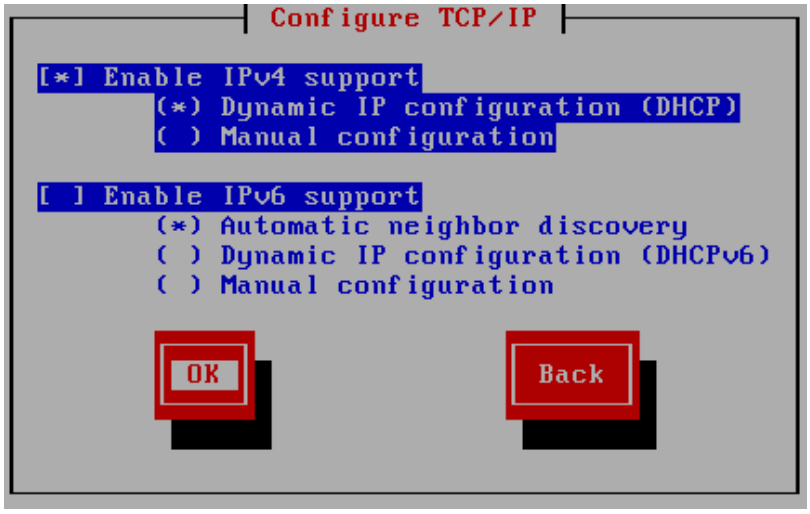


viii. In this step, you can choose the source which contains the OS installation ISO image. In this case, select “NFS directory”.

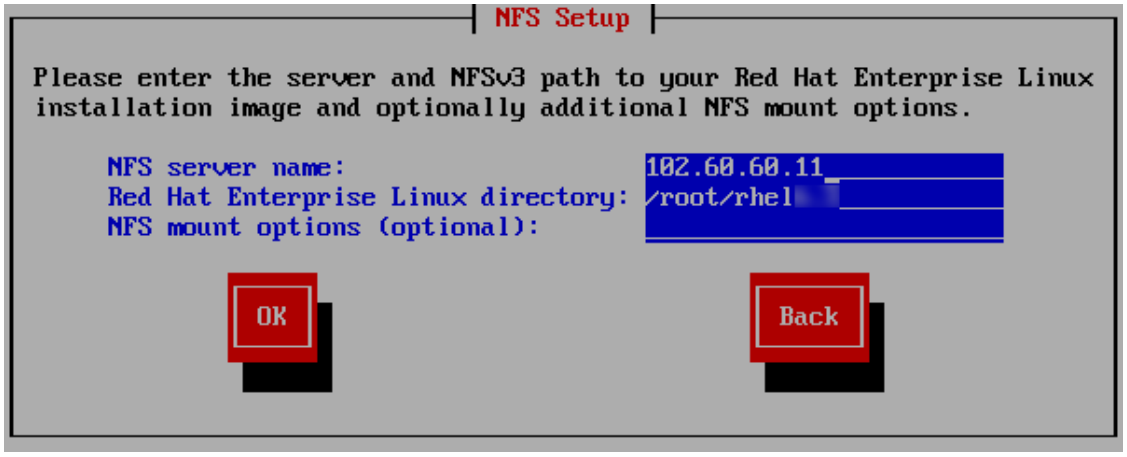
ix. The Chelsio network devices will be displayed. Select the appropriate Chelsio NIC interface to proceed with installation.



x. Here you can specify if you want to configure your network interfaces using DHCP or manually using IPv4. IPv6 is currently not supported. Hence disable IPv6 before proceeding.

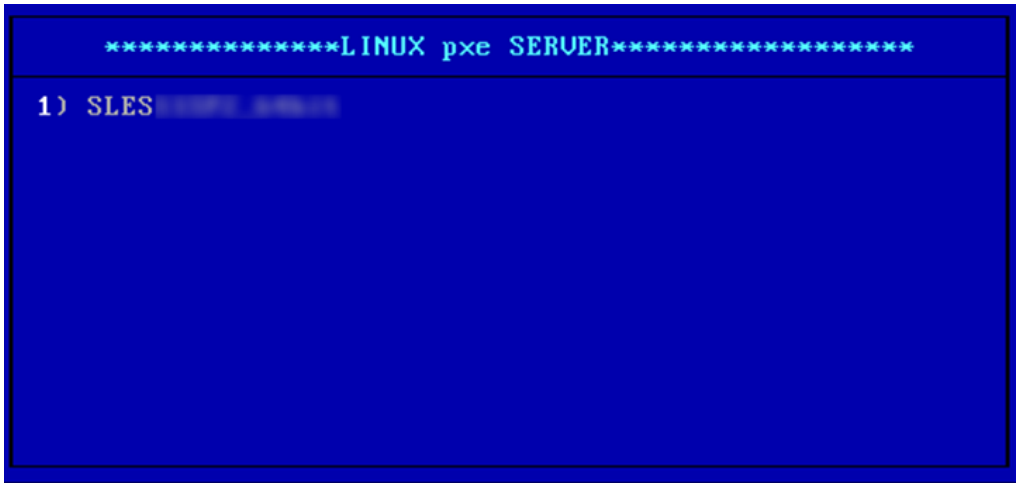


xi. Proceeding with the installation will get NFS/FTP/HTTP setup page. Here, provide NFS server details to proceed with the installation. Then the graphical Installation screens for RHEL will appear. Proceed with the installation as usual.



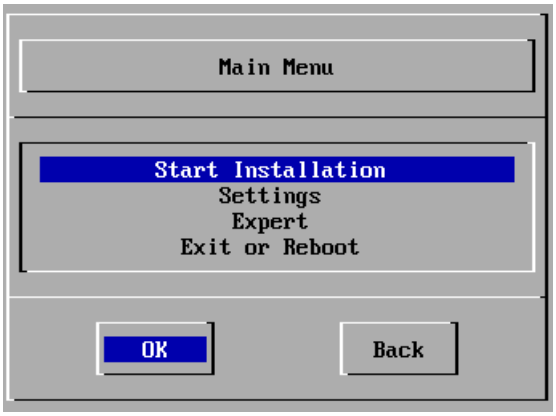
3.1.3. SLES 11 SPx/SLES 12/SLES 12 SPx installation

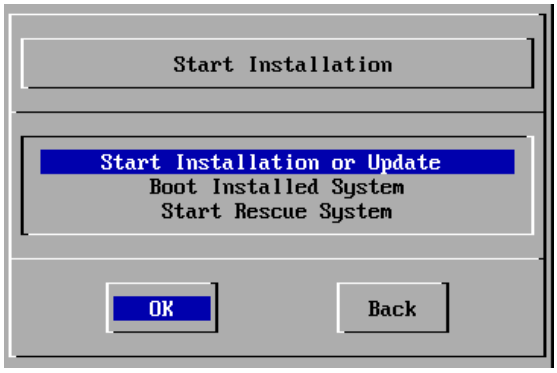
i. Please make sure that the USB drive with DUD image is inserted.
ii. Select the appropriate entry from the PXE menu and press [Enter].



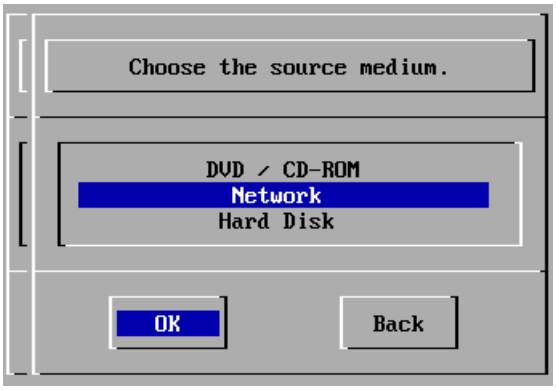
```
[    2.227429] hp_sw: device handler registered
[    2.252145] rdac: device handler registered

>>> SUSE Linux Enterprise Server 11 installation program v3.3.81 (c) 1996-2010 SUSE Linux Products GmbH <<<
Starting udev... ok
Loading basic drivers... ok
Starting hardware detection... ok
(If a driver is not working for you, try booting with brokenmodules=driver_name.)

Activating usb devices... ok
AMI Virtual CDROM
  drivers: usb_storage*
JetFlash Transcend 2GB
  drivers: usb_storage*
Logitech USB Multimedia Keyboard
  drivers: usbhid*
Chelsio Ethernet controller
  drivers: cxgb4*
Chelsio Ethernet controller
  drivers: cxgb4*
Chelsio Ethernet controller
  drivers: cxgb4*
Chelsio Ethernet controller
  drivers: cxgb4*
Chelsio Ethernet controller
  drivers: cxgb4*
Intel 82574L Gigabit Network Connection
  drivers: e1000e*
Intel 82574L Gigabit Network Connection
  drivers: e1000e*
Driver Update: Chelsio Network driver update Disk
Driver Update: Chelsio FCoE Initiator Driver Update Disk
Driver Updates added:
  Chelsio Network driver update Disk
  Chelsio FCoE Initiator Driver Update Disk
```

iii. Select “Start Installation” and then “Start Installation or Update”.

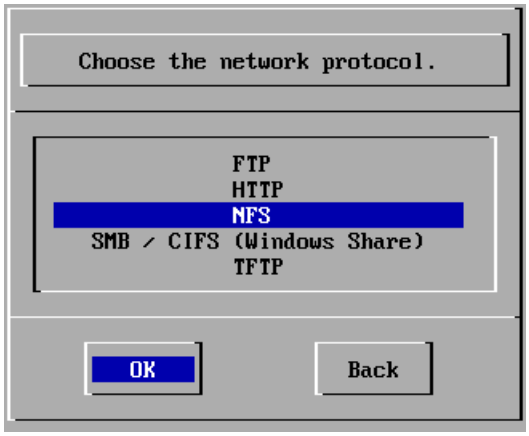




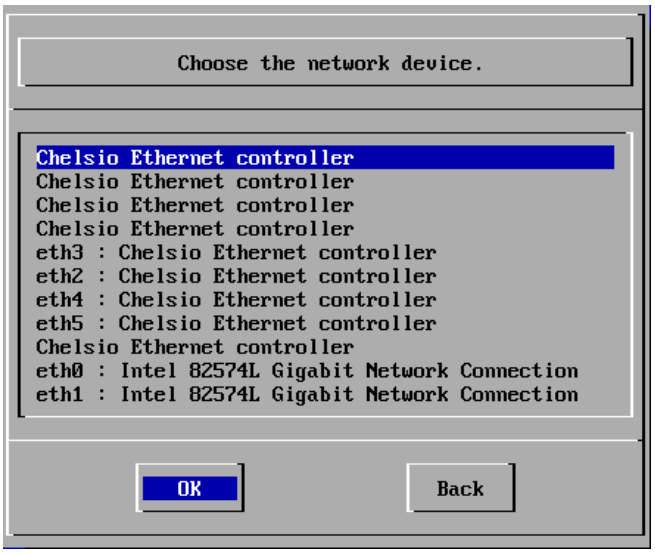
iv. Select “Network” as the source of medium to install the SLES Operating System.



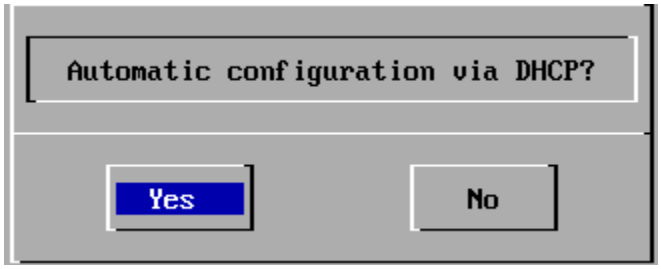
v. Select the desired Network protocol from the list presented.



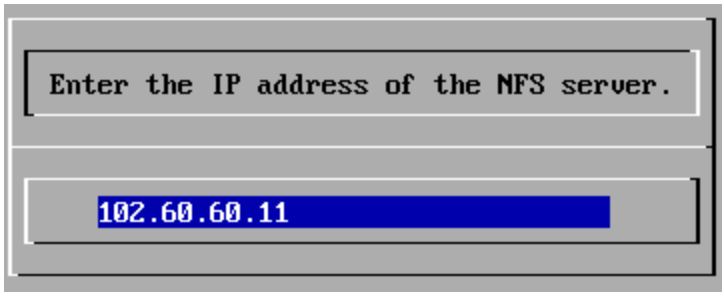
vi. Select the appropriate Chelsio interface from the list to proceed with installation. You can view the messages from the Linux kernel and drivers to determine the name of NIC interface by pressing [Alt] + [F3] or [Alt] + [F4]. Press [Alt] + [F1] to get back to the list.



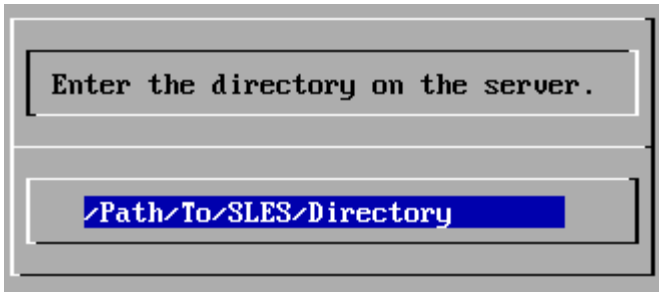
vii. Select “Yes” to configure the network interface selected in the previous step using DHCP.



viii. Provide a valid NFS/FTP/HTTP/TFTP Server IP address to proceed.



ix. Provide a valid directory path to the operating system to be installed.



x. Proceed with the installation as usual.

3.2. Installation on FCoE LUN

- If you are installing using CD/DVD, please make sure that the USB drive with DUD image is inserted. Also, change the boot priority to boot from CD/DVD in the BIOS setup.
    i. Insert the OS installation disc into your CD/DVD ROM.
    ii. On the Grub menu, choose *Install or upgrade an existing system* option if not already selected.
    iii. Type *e* and then *dd* at the boot prompt for RHEL 7.
    iv. Load Chelsio Driver Update Disk depending on the Linux distribution (Click here for RHEL 7.3).

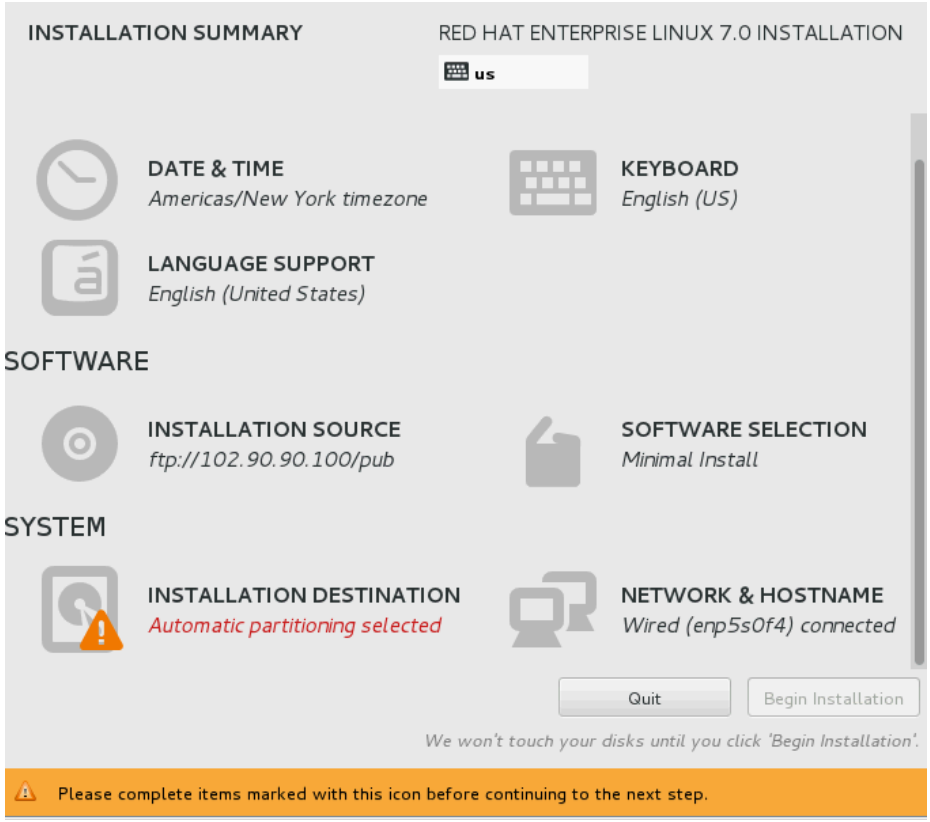
- If you are installing from a PXE server, please refer **3.1. Installation using Chelsio DUD** (Click here for RHEL 7.3) section to load Chelsio Driver Update Disk.

After successfully loading Chelsio DUD, follow the procedure mentioned below to continue installation, based on the distribution.

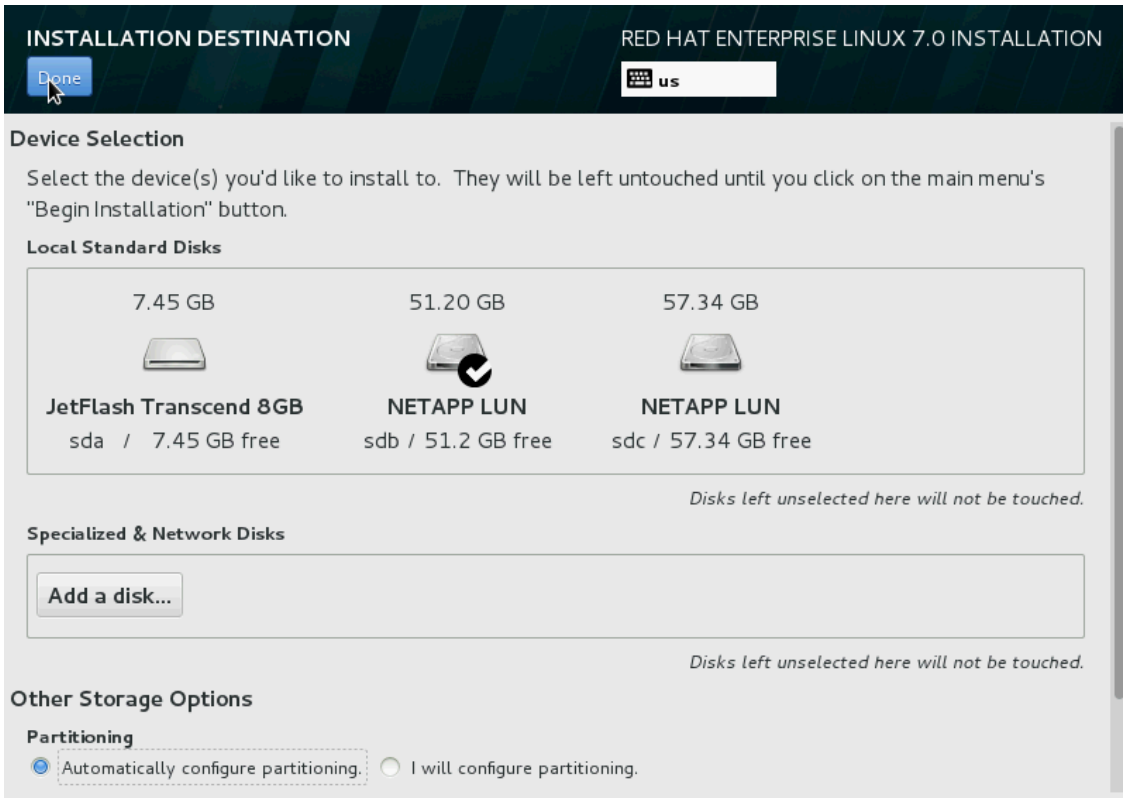
3.2.1. RHEL 7.x

i. Choose your installation language and click **Continue**

ii. Click **INSTALLATION DESTINATION** under **SYSTEM.**

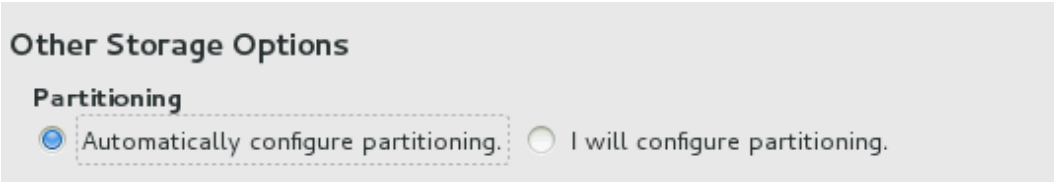


iii. The discovered FC/FCoE LUNs will appear as local storage in the **Local Standard Disks** section**.** Select the LUN which was saved as boot device in system BIOS.



Note *Make sure the same LUN discovered at the Option ROM stage is selected for OS installation.*

iv. Under **Other Storage Options**, you can either chose to configure partition automatically or manually. Select the appropriate option and click **Done**. Then proceed with the installation as usual.



3.3. Installation on iSCSI LUN

- If you are installing using CD/DVD, please make sure that the USB drive with DUD image is inserted. Also, change the boot priority to boot from CD/DVD in the BIOS setup.
    i. Insert the OS installation disc into your CD/DVD ROM.
    ii. On the Grub menu, choose *Install or upgrade an existing system* option if not already selected.
    iii. For RHEL 6 press *Tab* and then type *dd.* For RHEL 7, type *e* and then *dd ip=ibft*. This will ensure that Chelsio iSCSI Initiator driver is used as SCSI transport medium. For SLES distributions, press *Tab* and then type *dd.*
    iv. Load Chelsio Driver Update Disk depending on the Linux distribution (Click here for RHEL 7.x; Click here for RHEL6.x; Click here for SLES 11 SPx/SLES 12/SLES 12 SPx.

- If you are installing from a PXE server, please refer **3.1. Installation using Chelsio DUD** (Click here for RHEL 7.x; Click here for RHEL6.x; Click here for SLES 11 SPx/SLES 12/SLES 12 SPx) section to load Chelsio Driver Update Disk.

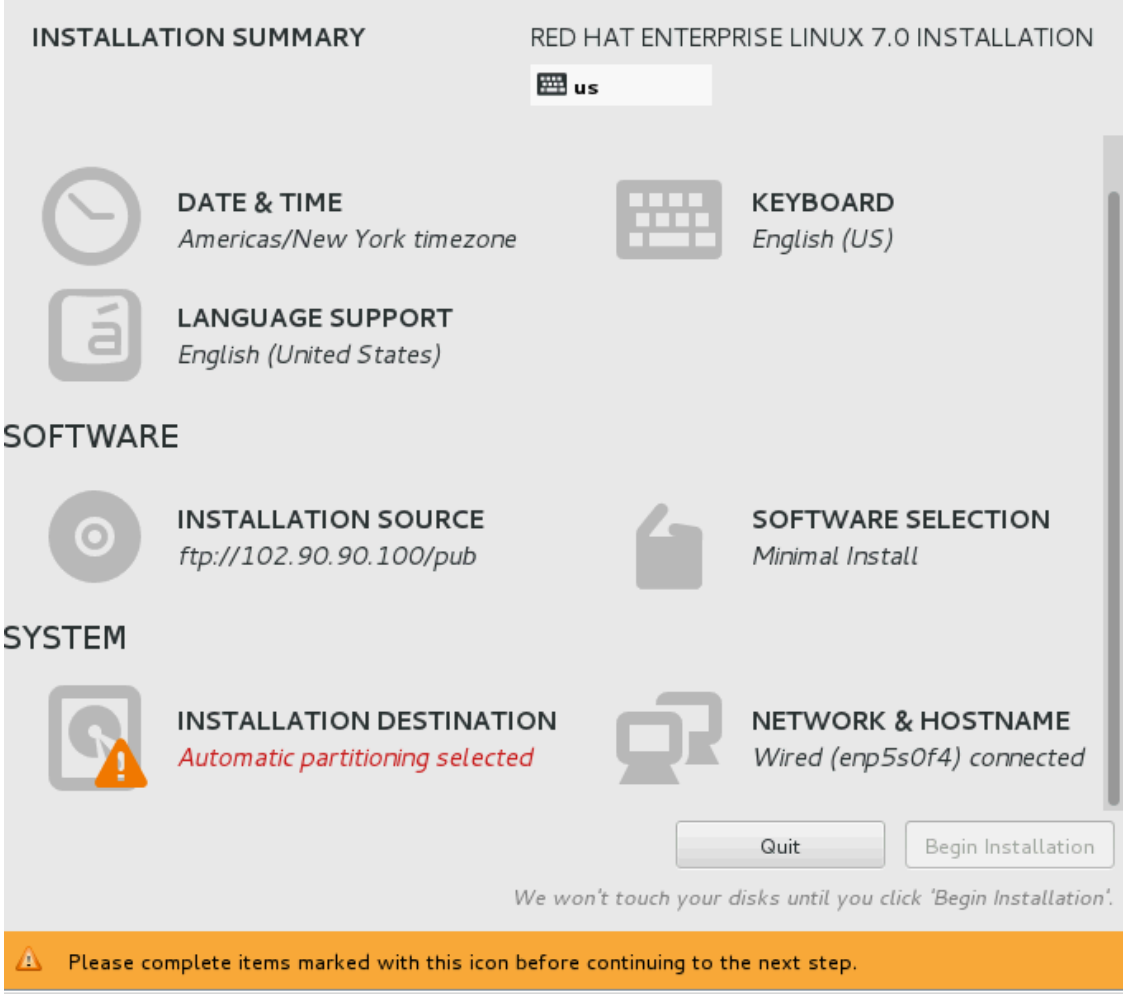
After successfully loading Chelsio DUD, follow the procedure mentioned below to continue installation, based on the distribution.

3.3.1. RHEL 7.x

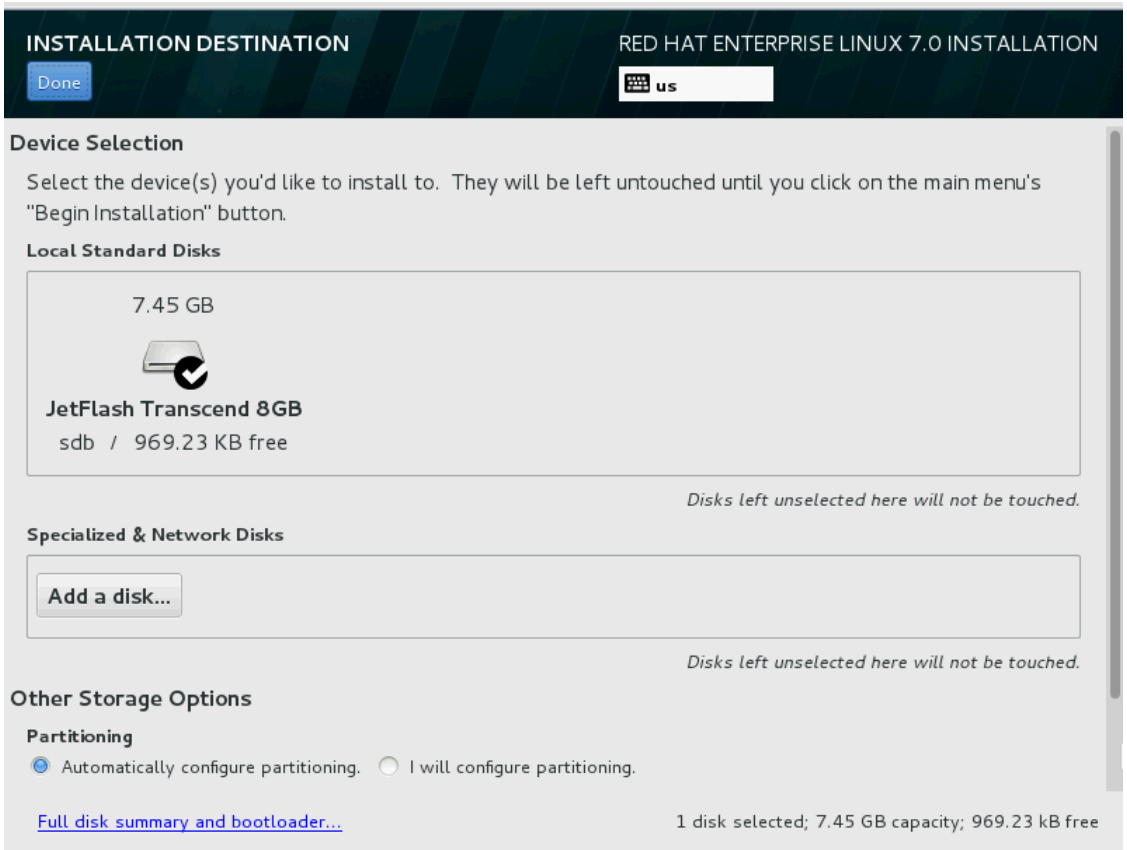
i. On the installer welcome screen, choose your installation language and click **Continue**


RED HAT ENTERPRISE LINUX 7.0 INSTALLATION
us
WELCOME TO RED HAT ENTERPRISE LINUX 7.0.
What language would you like to use during the installation process?
English English
Afrikaans Afrikaans
አማርኛ Amharic
العربية Arabic
অসমীয়া Assamese
Asturianu Asturian
Беларуская Belarusian
Български Bulgarian
বাংলা Bengali
English (United States)
English (United Kingdom)
English (India)
English (Australia)
English (Canada)
English (Denmark)
English (Ireland)
English (New Zealand)
English (Nigeria)
English (Hong Kong SAR China)
Type here to search.
Quit
Continue

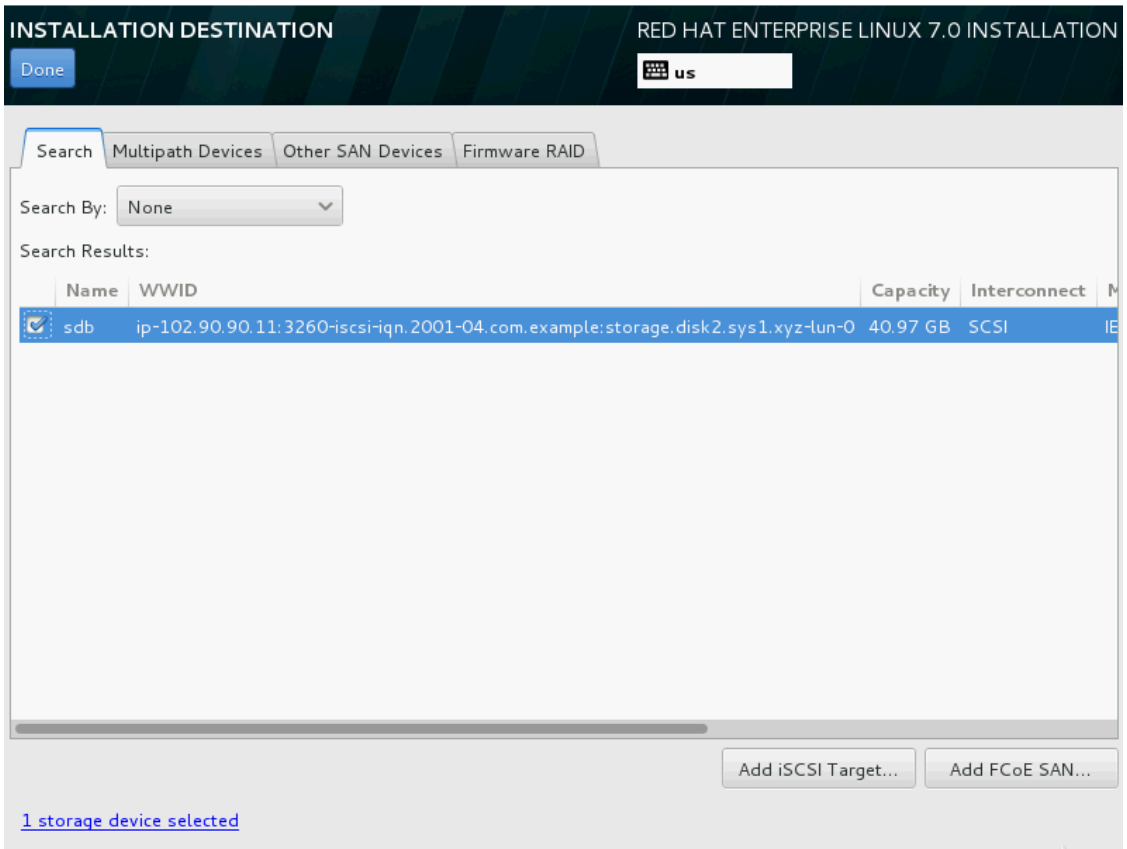
ii. Click **Installation Destination** under **SYSTEM.**



iii. Click **Add a disk**

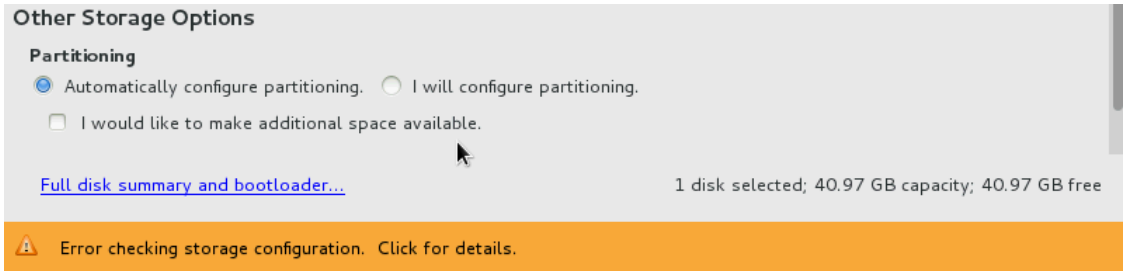


iv. The discovered iSCSI LUNs will appear in the **Search** Tab. Select it and click **Done**.



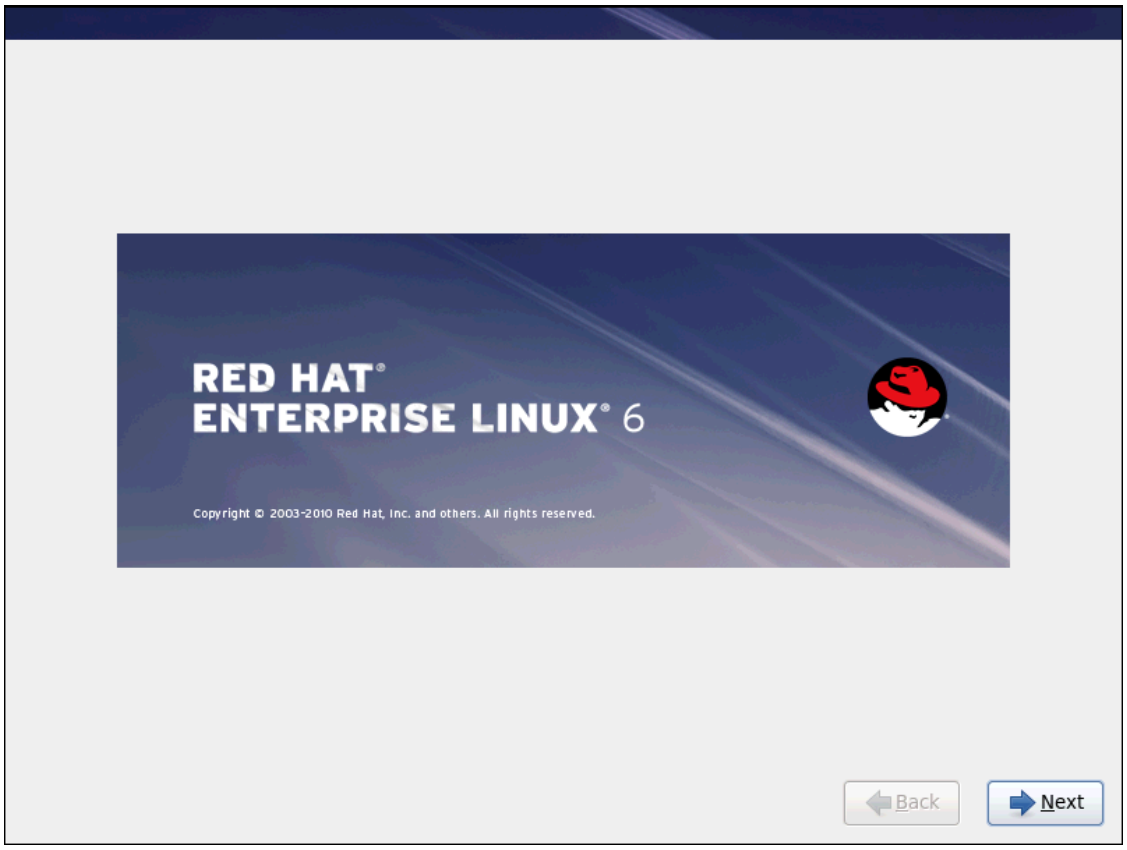
Note *Make sure the same LUN discovered at the Option ROM stage is selected for OS installation.*

v. Under **Other Storage Options**, you can either chose to configure partition automatically or manually. Select the appropriate option and click **Done**. Then proceed with the installation as usual.

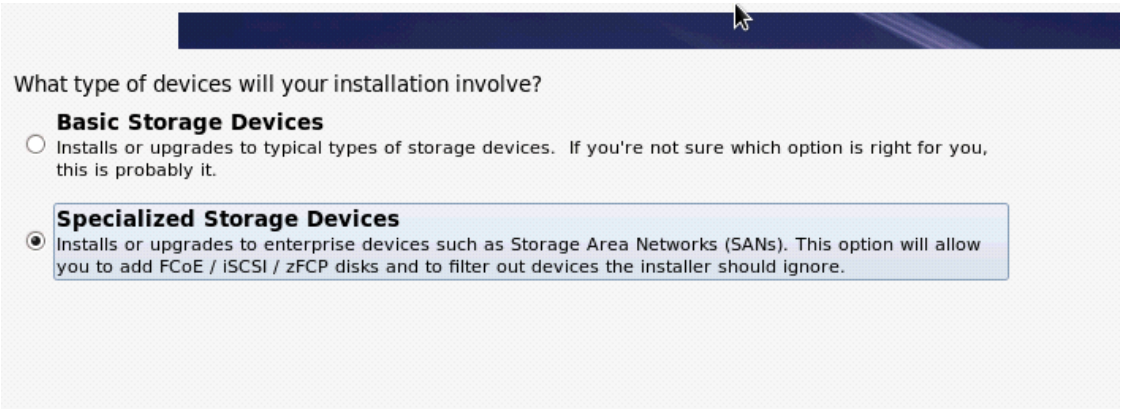


3.3.2. RHEL 6.x

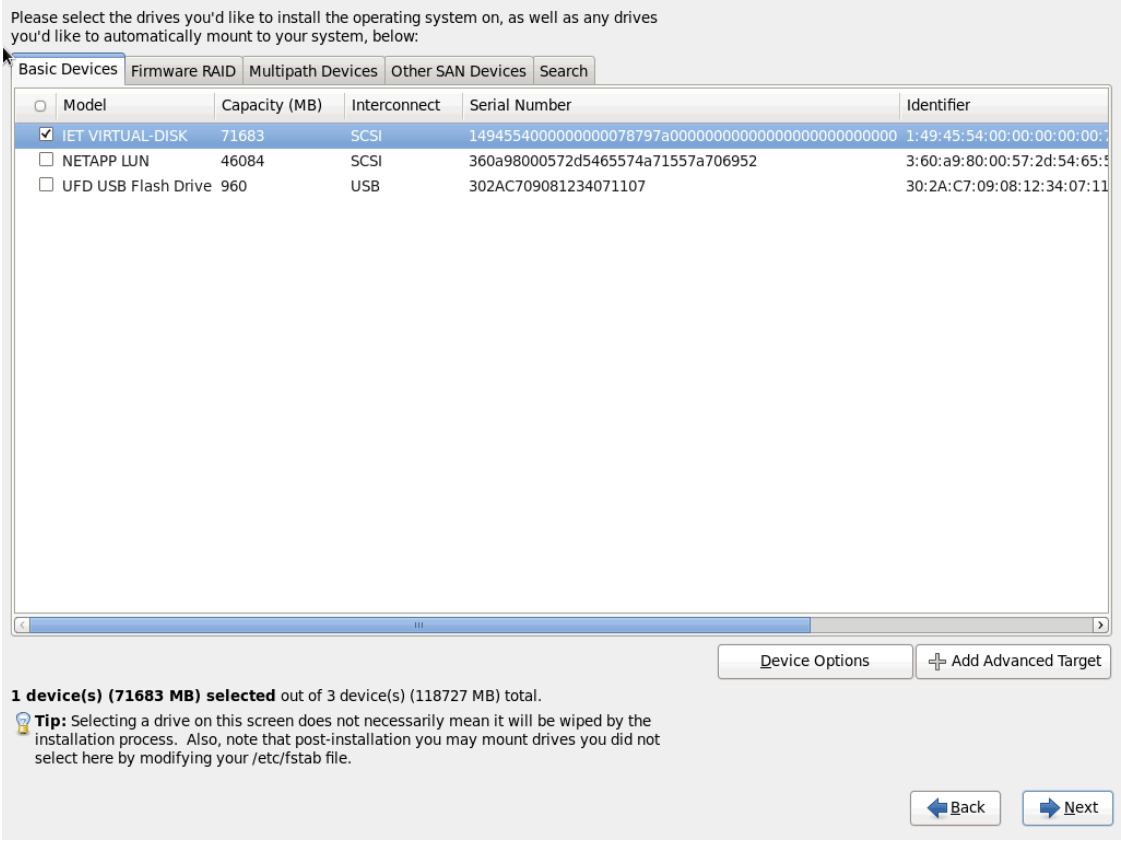
i. Click **Next** when the graphical installer screen appears.



ii. Select **Specialized Storage Devices** radio button and click **Next**.



iii. The discovered LUNs will appear in the **Basic Devices** Tab. Select the LUN which was saved as boot device in system BIOS and click **Next**.

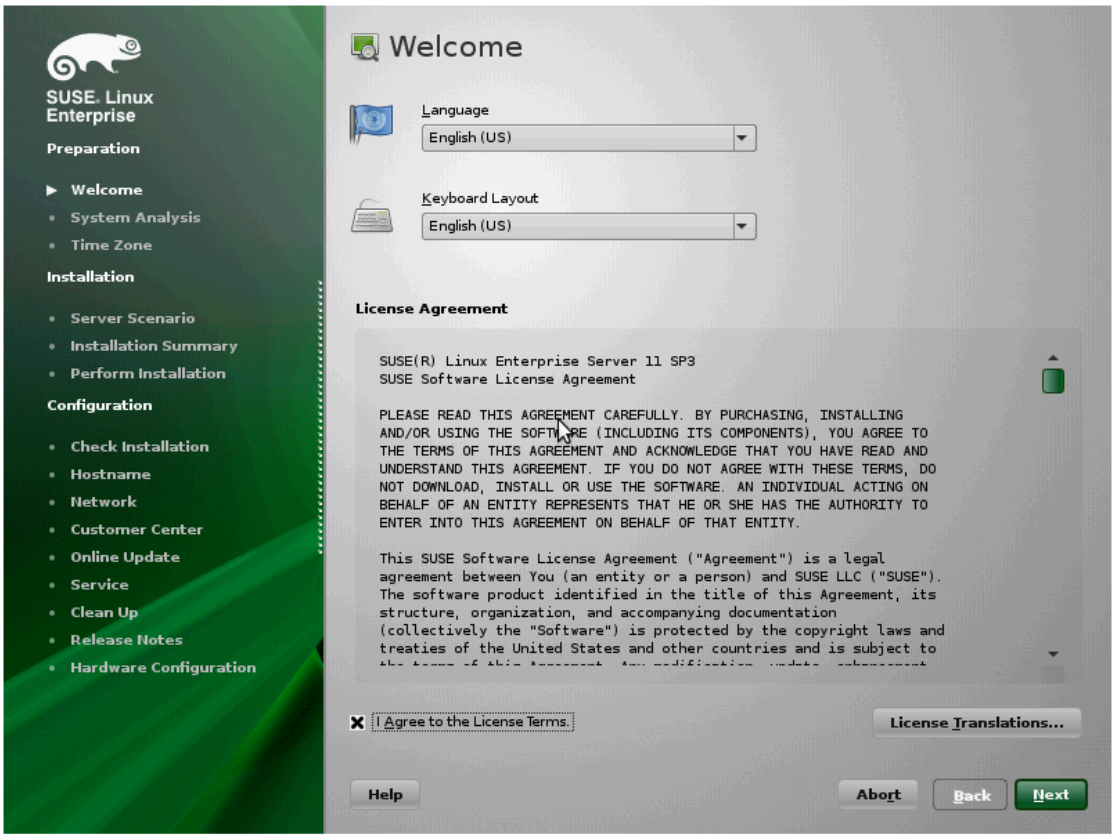


Note *Make sure the same LUN discovered at the Option ROM stage is selected for OS installation.*

iv. Proceed with the installation as usual.

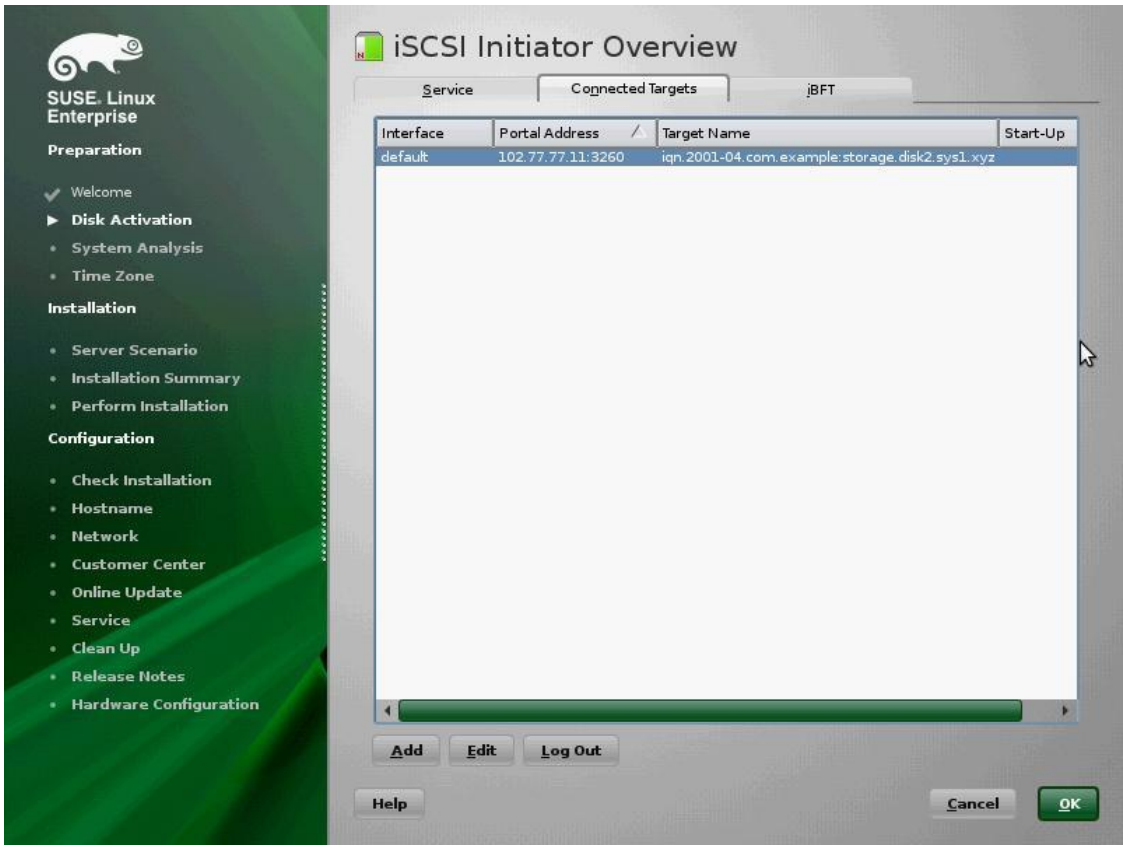
3.3.3. SLES11 SPx installation

i. Choose installation language and Keyboard layout type. Select the checkbox **I Agree to the License terms** and click **Next**.

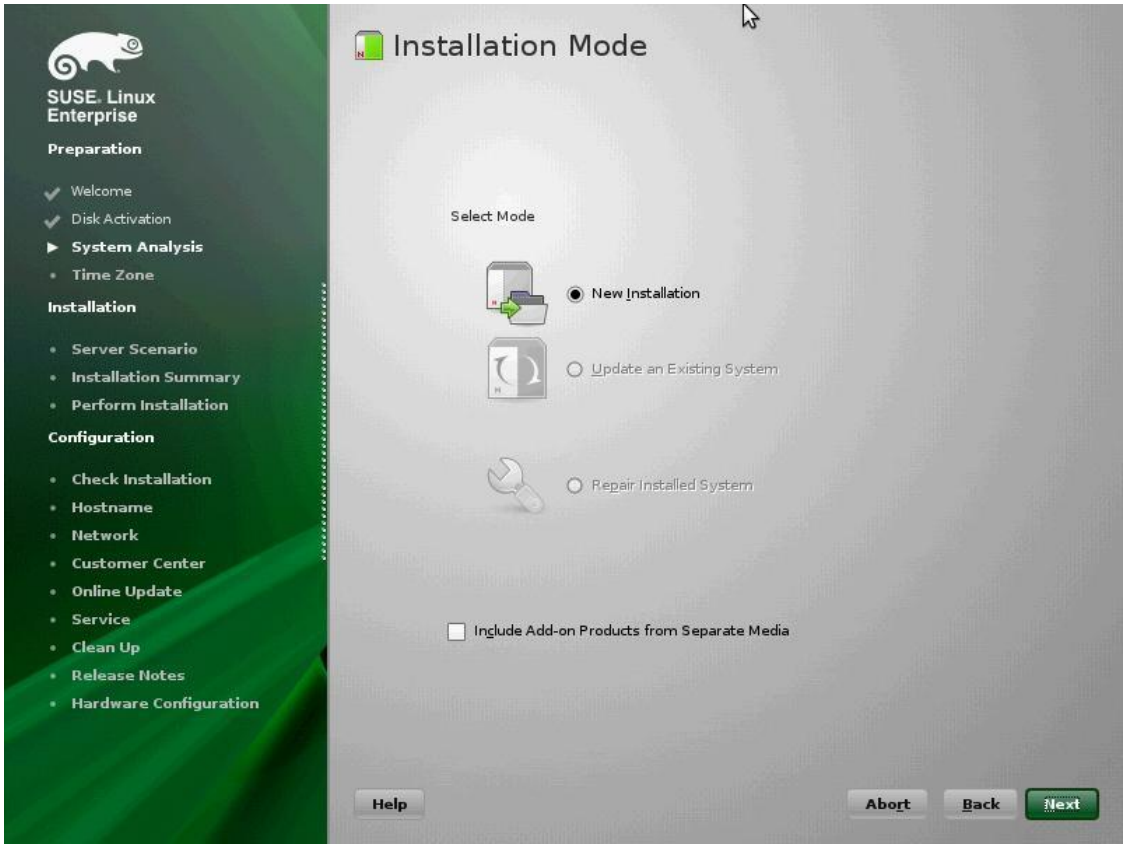


ii. Click **Configure iSCSI Disks** in the **Disk Activation** screen.

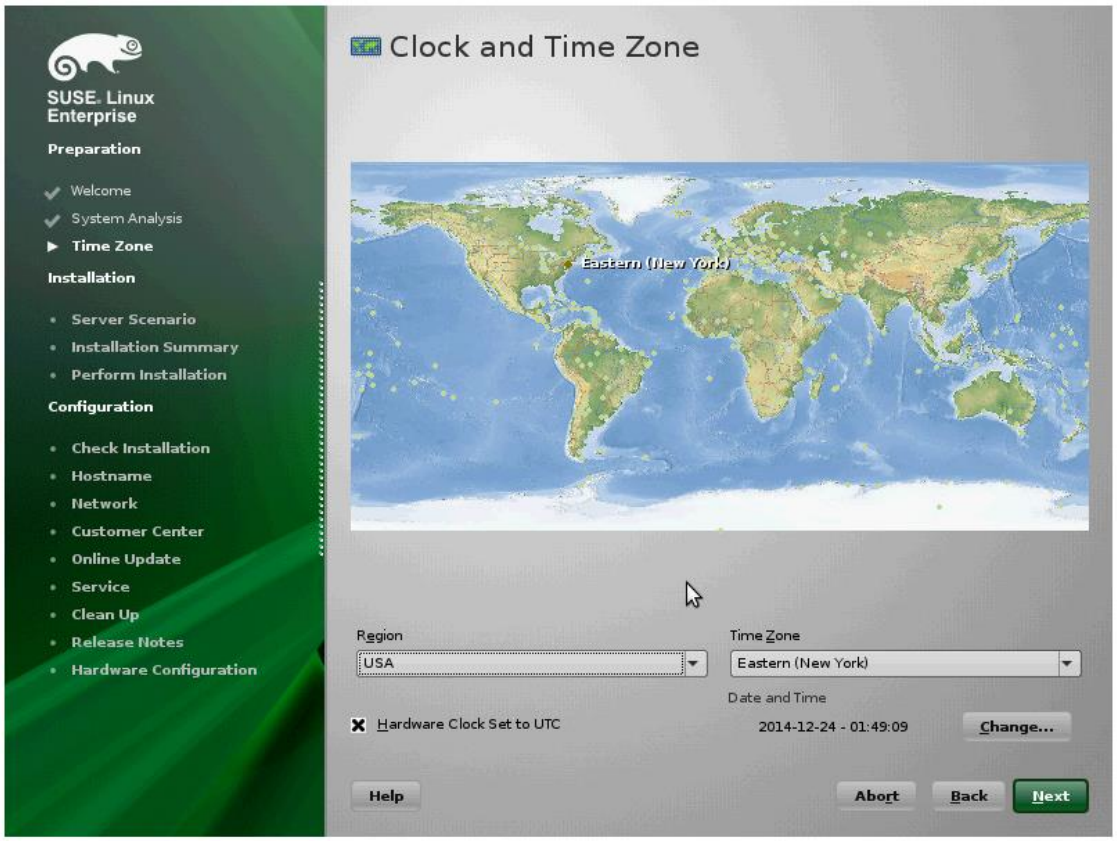
iii. The discovered LUNs will appear in the **Connected Targets** Tab. Select the LUN which was saved as boot device in system BIOS and click **OK**.



iv. Select **New Installation** to perform a fresh installation and click **Next**.

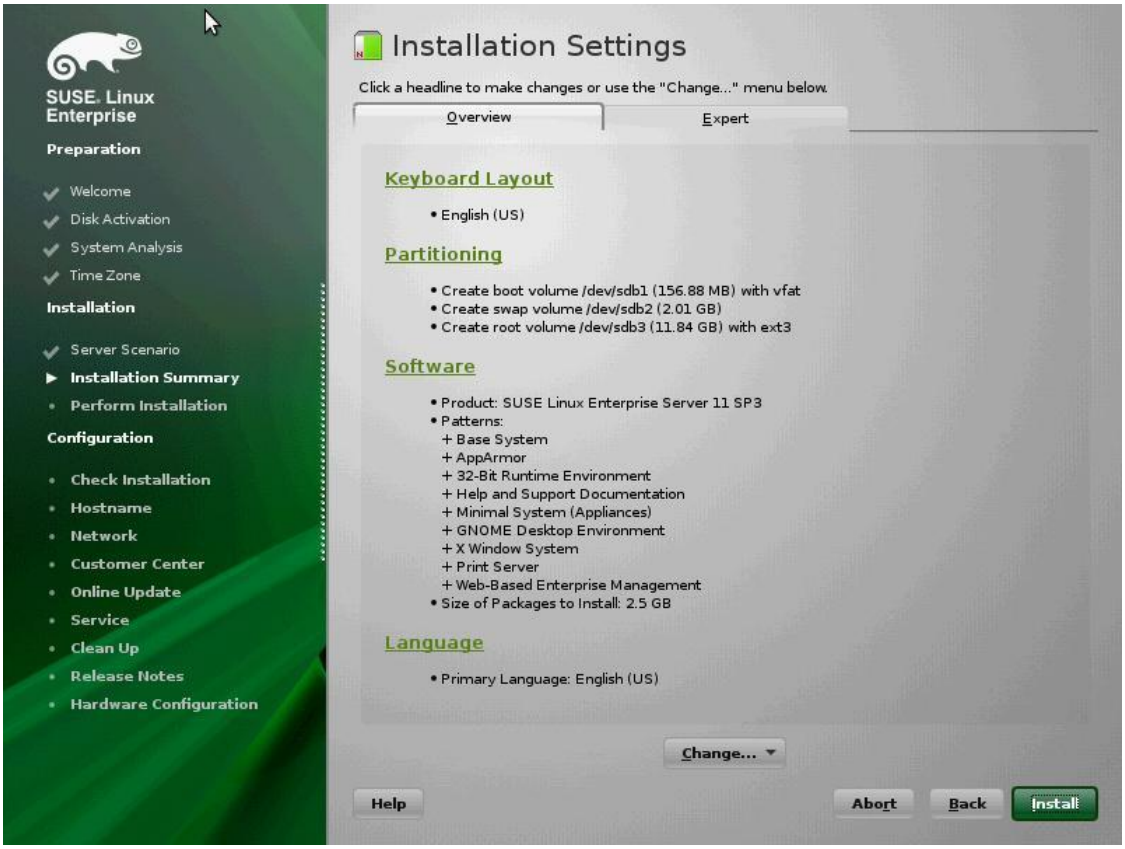


v. Configure Clock and Time Zone settings. Click **Next**.



vi. Choose from the available server base scenarios and click **Next**.

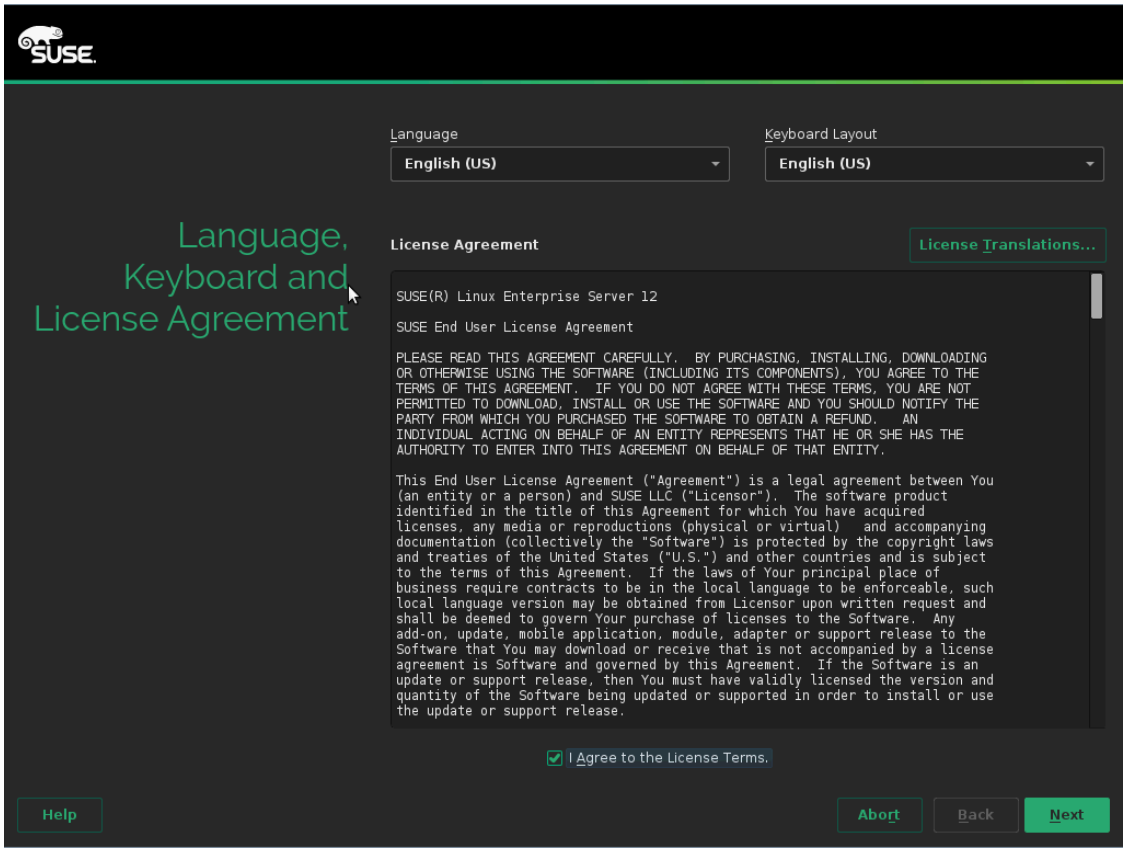
vii. The **Installation Settings** screen displays the summary of user-selected and YaST-suggested options for the installation. You can review and modify them if required. Basic settings can be changed in the **Overview** tab and advanced settings can be changed in the **Expert** tab. To change, click on one of the headlines or click **Change** and select the category. Finally, click **Next**.



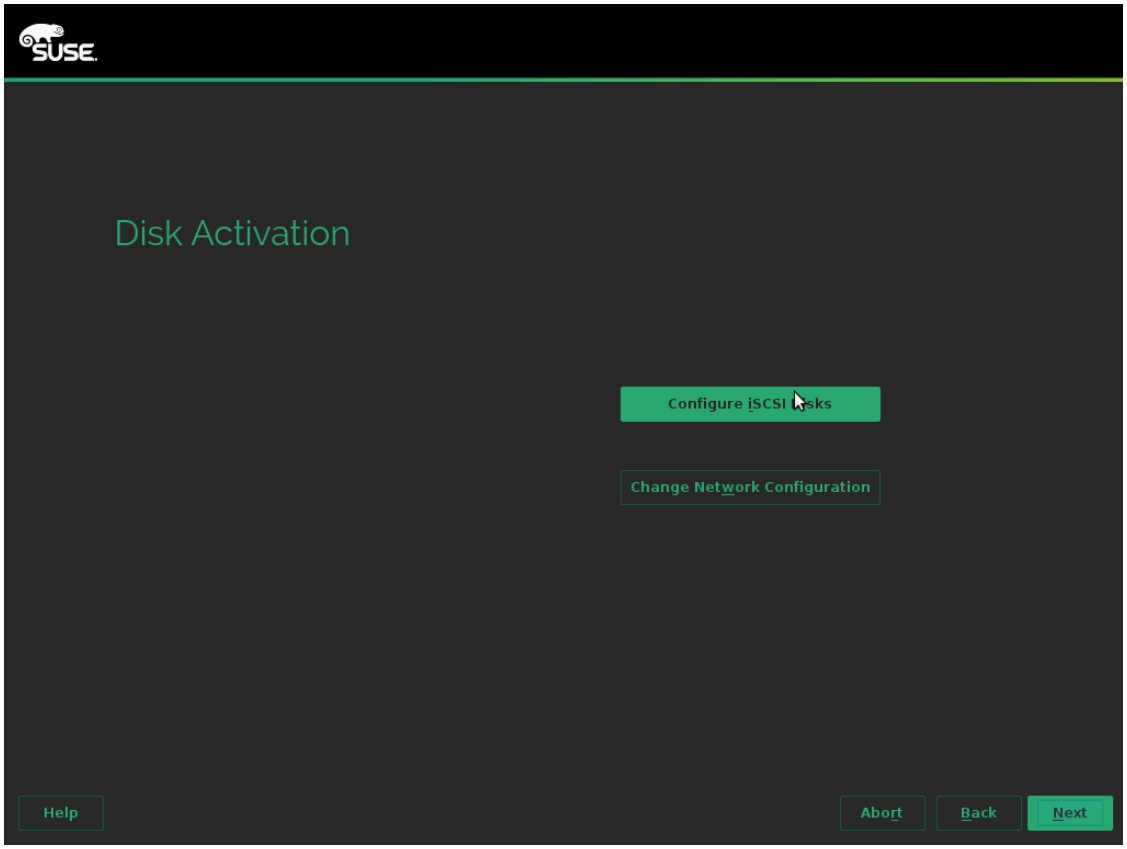
viii. Proceed with installation as usual.

3.3.4. SLES 12/SLES 12 SPx Installation

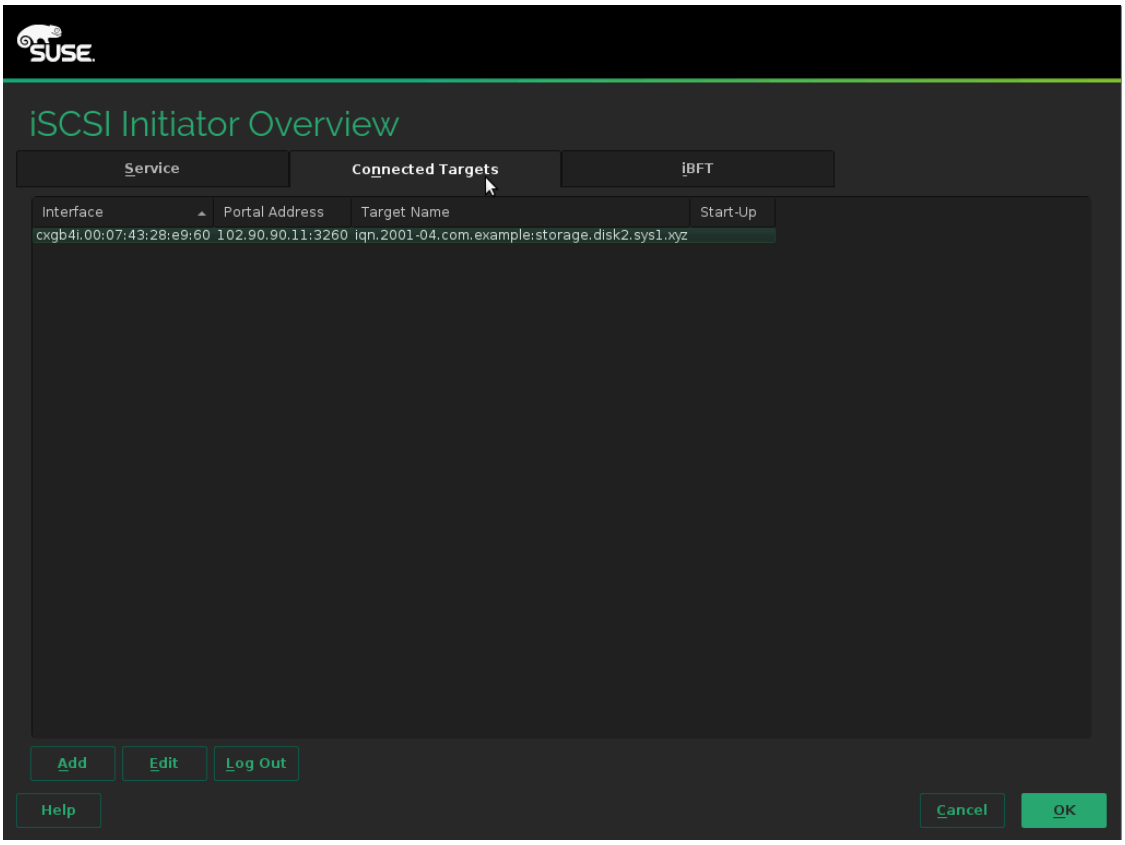
i. Choose installation language and Keyboard layout type. Select the checkbox **I Agree to the License terms** and click **Next**.



ii. Click **Configure iSCSI Disks** in the **Disk Activation** screen.



iii. The discovered LUNs will appear in the **Connected Targets** Tab. Select the LUN which was saved as boot device in system BIOS and click **OK**.



Note *Make sure the same LUN discovered at the Option ROM stage is selected for OS installation.*

iv. Proceed with the installation as usual.

III. PXE-WDS Driver For Windows

1. Introduction

This section describes the use and configuration of Chelsio's PXE-WDS driver package for Chelsio's adapters. The driver package consists of Network driver needed to install Windows operating system using WDS server for Chelsio CNAs.

Windows Deployment Services can be used to add driver packages to boot image on the server and configure them to be deployed to client computers along with the install image. This can be used to PXE boot to the supported operating systems.

Chelsio is providing Network driver to be used during the PXE installation process from WDS server.

1.1. Hardware Requirements

1.1.1. Supported Adapters

The following are the currently shipping Chelsio adapters that are compatible with Chelsio PXE-WDS driver:

- T62100-CR
- T62100-LP-CR
- T62100-SO-CR
- T6425-CR
- T6225-CR
- T6225-LL-CR
- T6225-SO-CR
- T580-CR
- T580-LP-CR
- T580-SO-CR
- T540-CR
- T520-CR
- T520-LL-CR
- T520-SO-CR
- T520-BT

1.2. Software Requirements

1.2.1. Windows Requirements

The Chelsio PXE-WDS driver package has been developed to run on Windows platform. Currently the driver is available for following versions:

- Server 2016 (only PXE)
- 10 AU Client (only PXE)

- Server 2012 R2 (only PXE)

Other versions have not been tested and are not guaranteed to work.

Note *Boot image from above mentioned operating systems is supported. You can find the image (boot.wim) in \Sources folder in the installation CD/DVD.*

2. PXE- WDS driver configuration

You can use Windows Deployment Services to add driver packages (such as network adapter drivers, mass storage drivers, and bus drivers) to Windows boot images. This means that you do not have to export the image, use the tools in the Windows Automated Installation Kit to add driver packages manually- and then add the updated boot image.

2.1. Windows Deployment Services

Please refer to Microsoft documentation to setup WDS server. Additional information is available in the Windows Deployment Services Getting Started Guide.

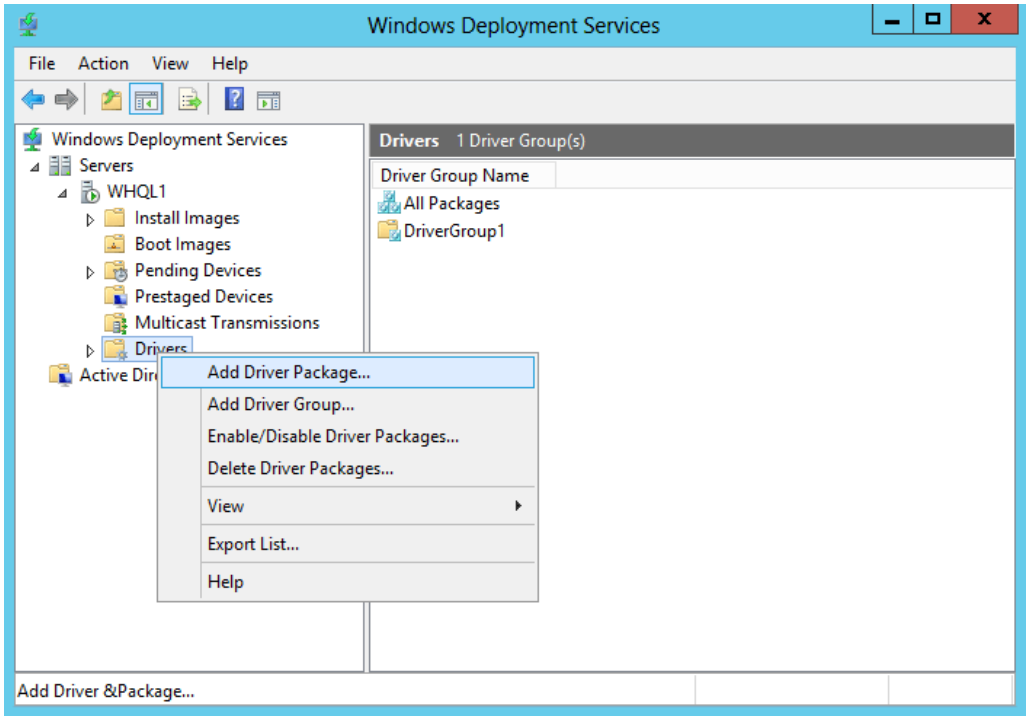
2.2. Adding Driver Packages to WDS Server

First add VBD driver and then followed by NDIS. For more information, see Managing and Deploying Driver Packages.

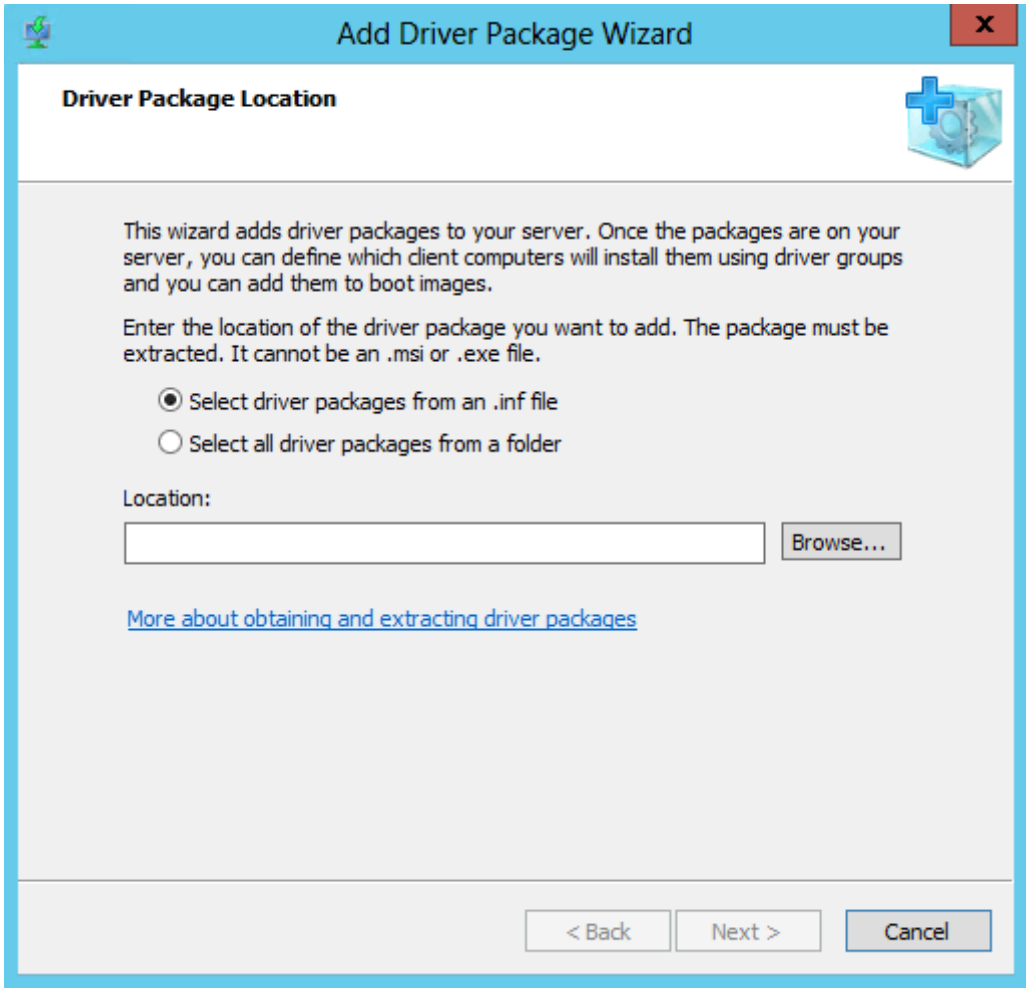
Before proceeding, download *Chelsio-Uboot-x.x.x.xx.zip* from Chelsio Download Center, and unzip the contents of the package to a desired location.

2.2.1. Adding VBD

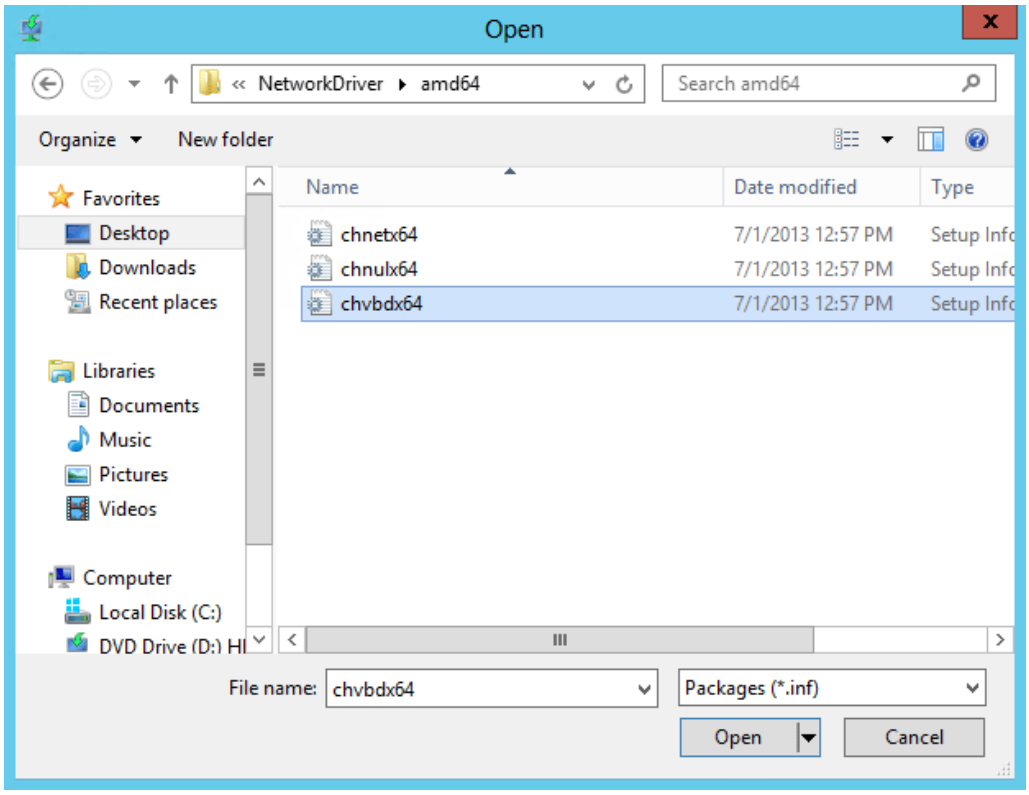
i. Open the **Windows Deployment Services** MMC snap-in. Expand the **Servers** node and the node for your Windows Deployment Services server. Right-click the **Drivers** node and select **Add Driver Package**.



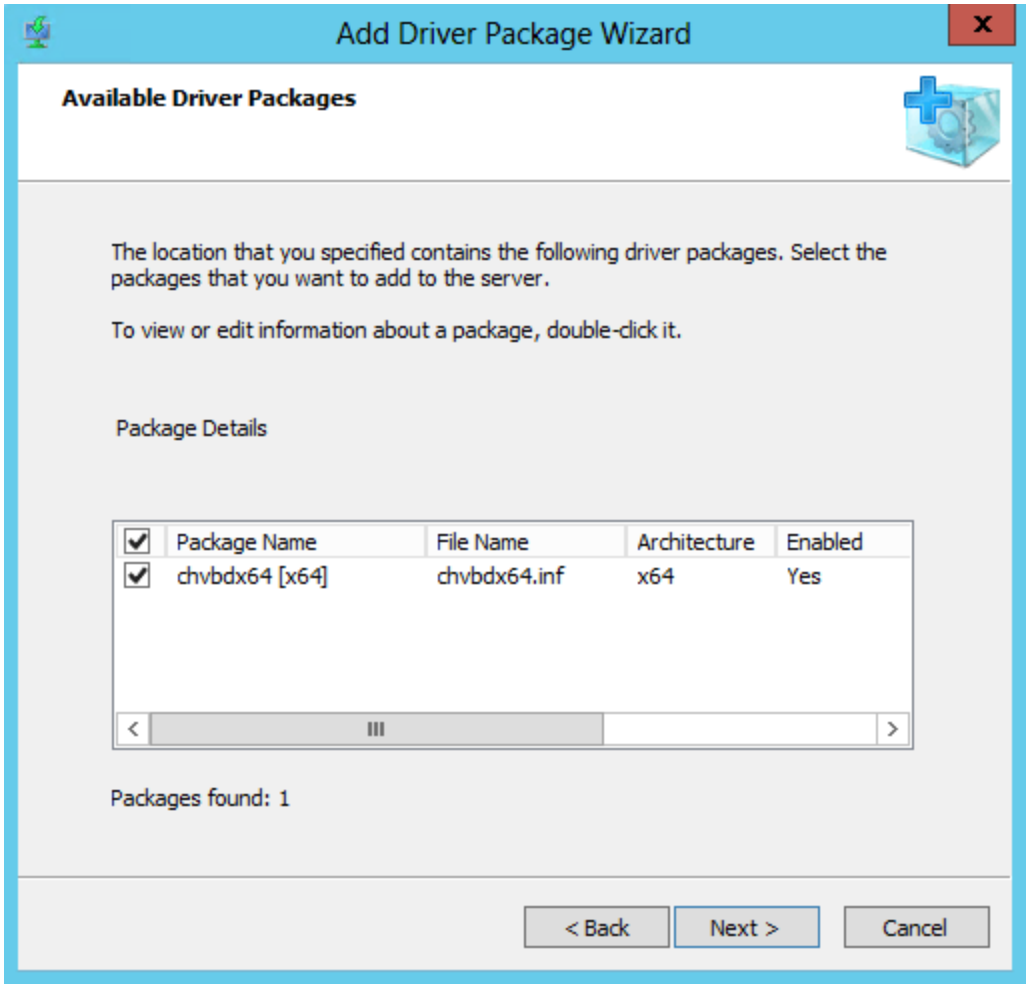
ii. Select the *Select driver package from an .inf file* option and click **Browse**.



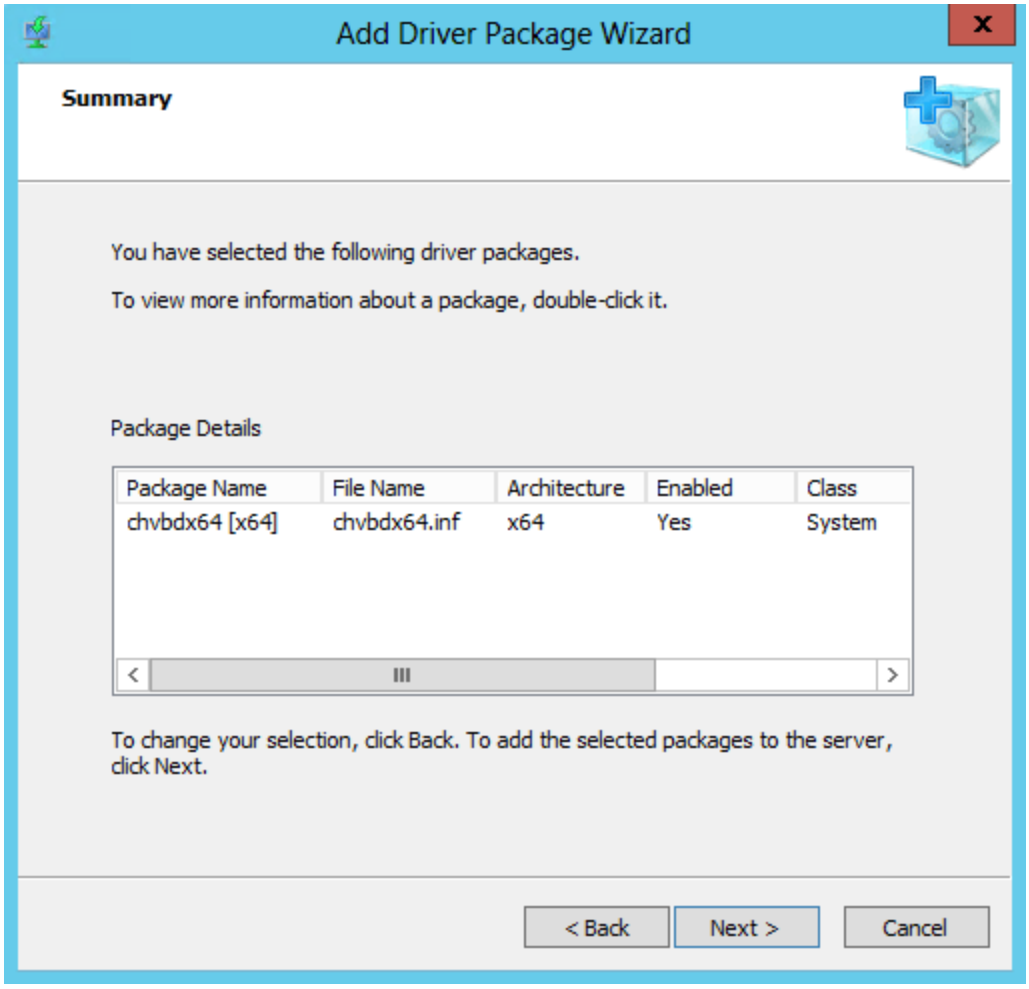
iii. Locate the VBD driver (*chvbdx64.inf)* in *Chelsio-Uboot-x.x.x.xx/WindowsDrivers/NetworkDriver/amd64* and click **Open**.



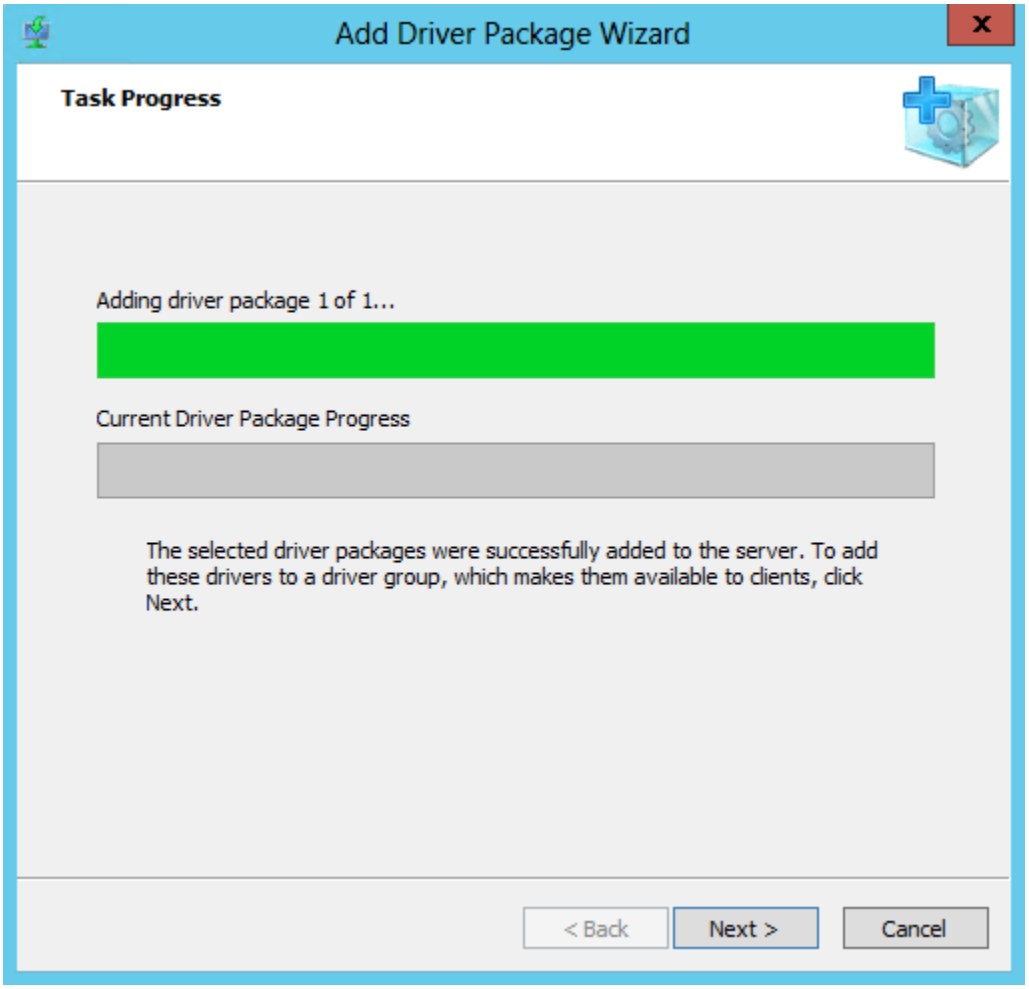
iv. Please ensure that the checkbox for *chvbdx64[x64]* is selected and click **Next**.



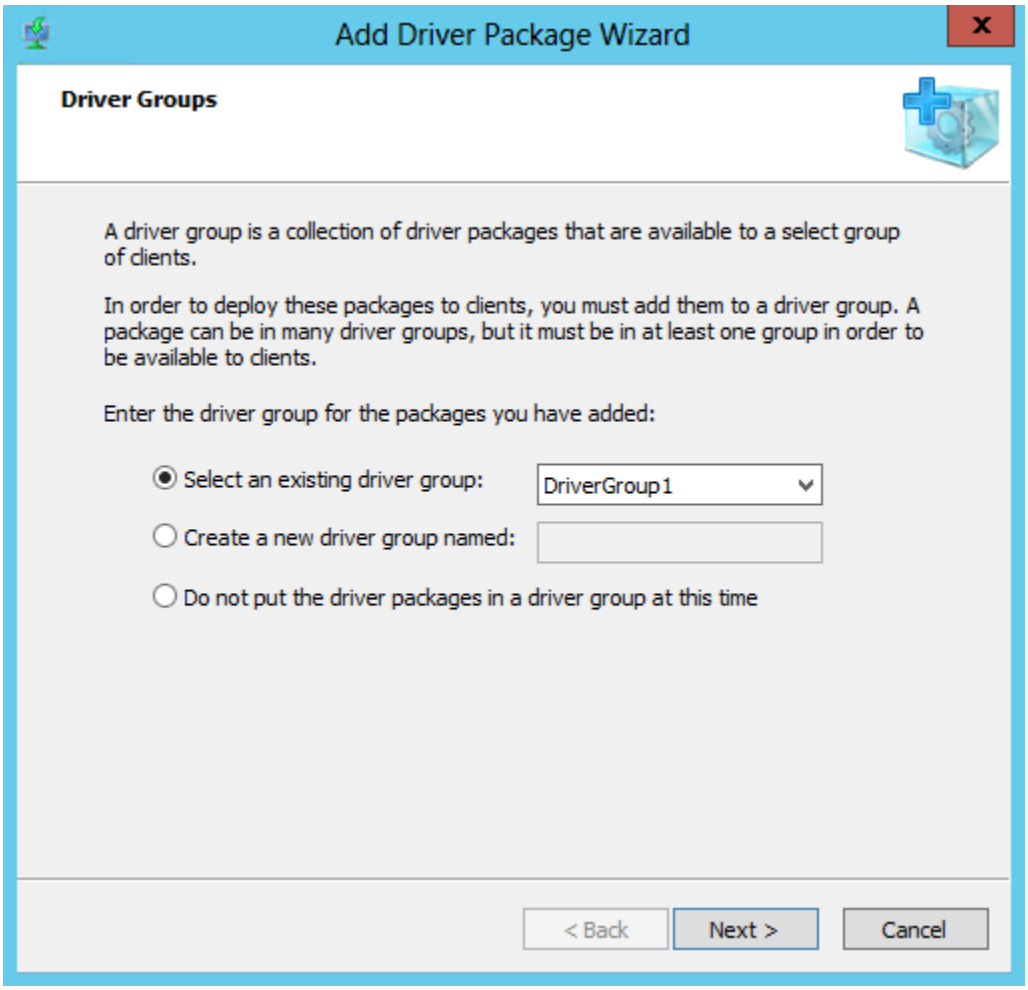
v. To add the selected VBD driver, click **Next** or to change click **Back**.



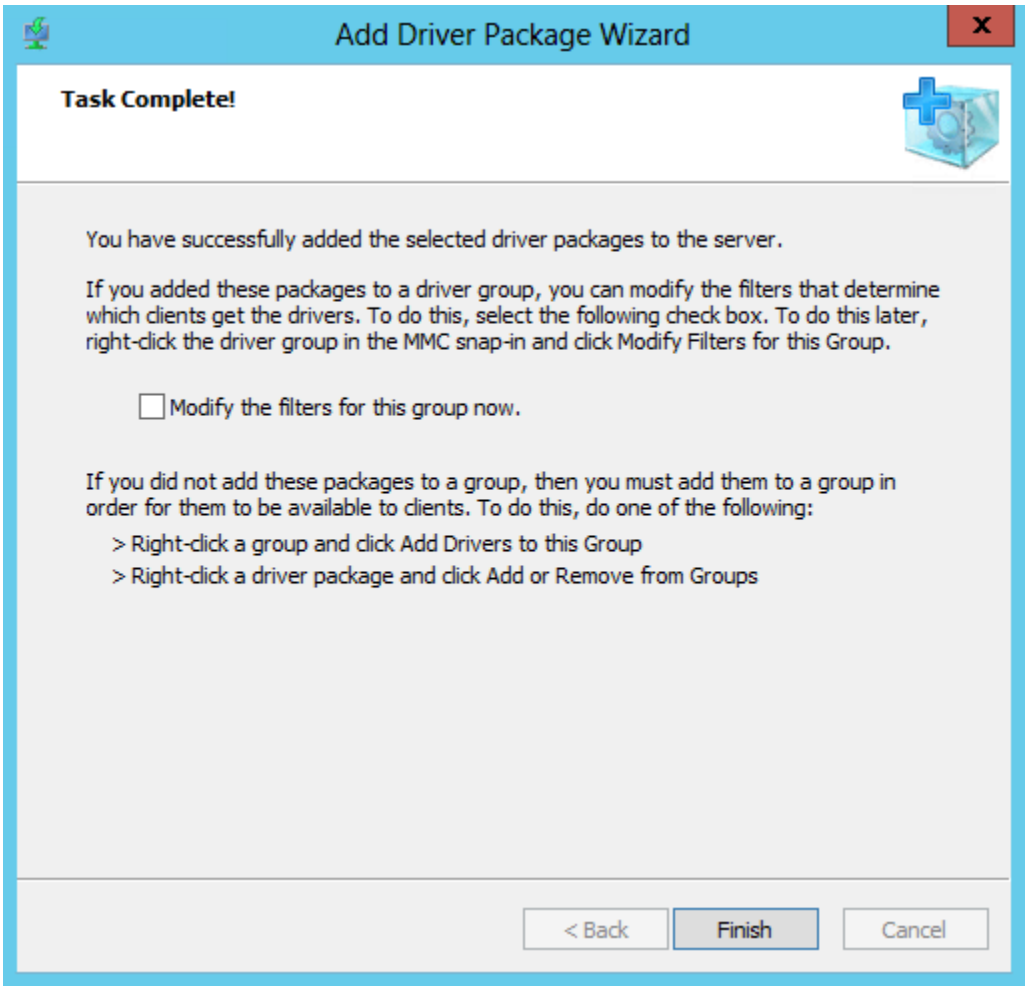
vi. The selected driver will now be added to the server. After the task is complete, click **Next**.



vii. When asked which driver group to add the packages to, select *Select an existing driver group*, and ensure that *DriverGroup1* is selected. This driver group (by default) is configured as follows:
   a) It has no filters so all clients will have access to the packages in this group, and
   b) Only packages that match the client's hardware will be installed.



viii. On the last page of the wizard, make sure that the check box for *Modify the filters for the group now* is unselected, and click **Finish**.



2.2.2. Adding NDIS (chnetx64.inf)

The procedure for adding NDIS driver to the WDS server is similar to VBD as explained in the previous section. In step (iii), locate and use the file *chnetx64.inf* and in step (iv), ensure that only *chnetx64[x64]* is selected.

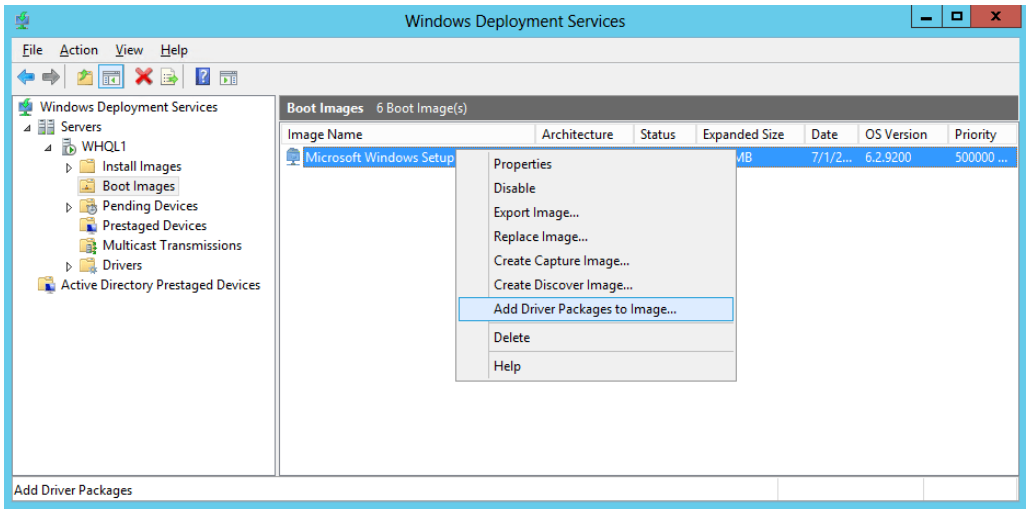
2.3. Adding Driver Packages to Boot Images

Please ensure that the VBD and NDIS drivers are added to the WDS server before proceeding (See Adding Driver Packages to WDS Server). Also, add VBD driver first and then followed by NDIS to the boot image. For more information, see Managing and Deploying Driver Packages.

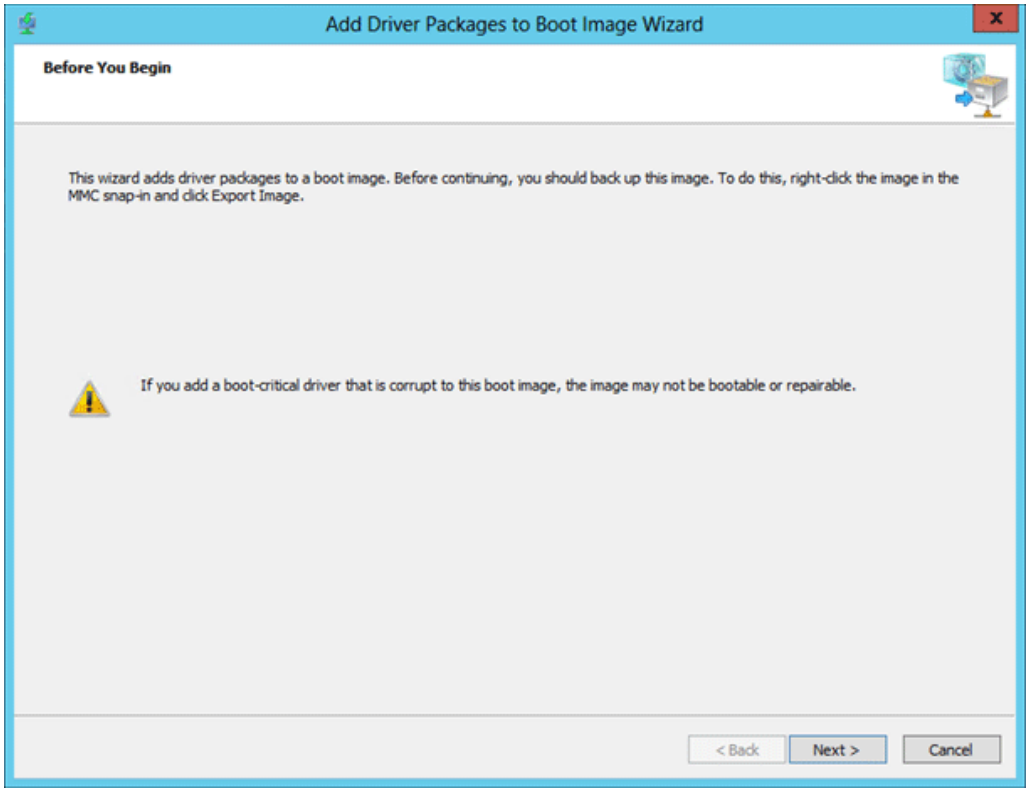
2.3.1. Adding VBD driver

i. Open the **Windows Deployment Services** MMC snap-in. Expand the **Servers** node and then **Boot Images** node.

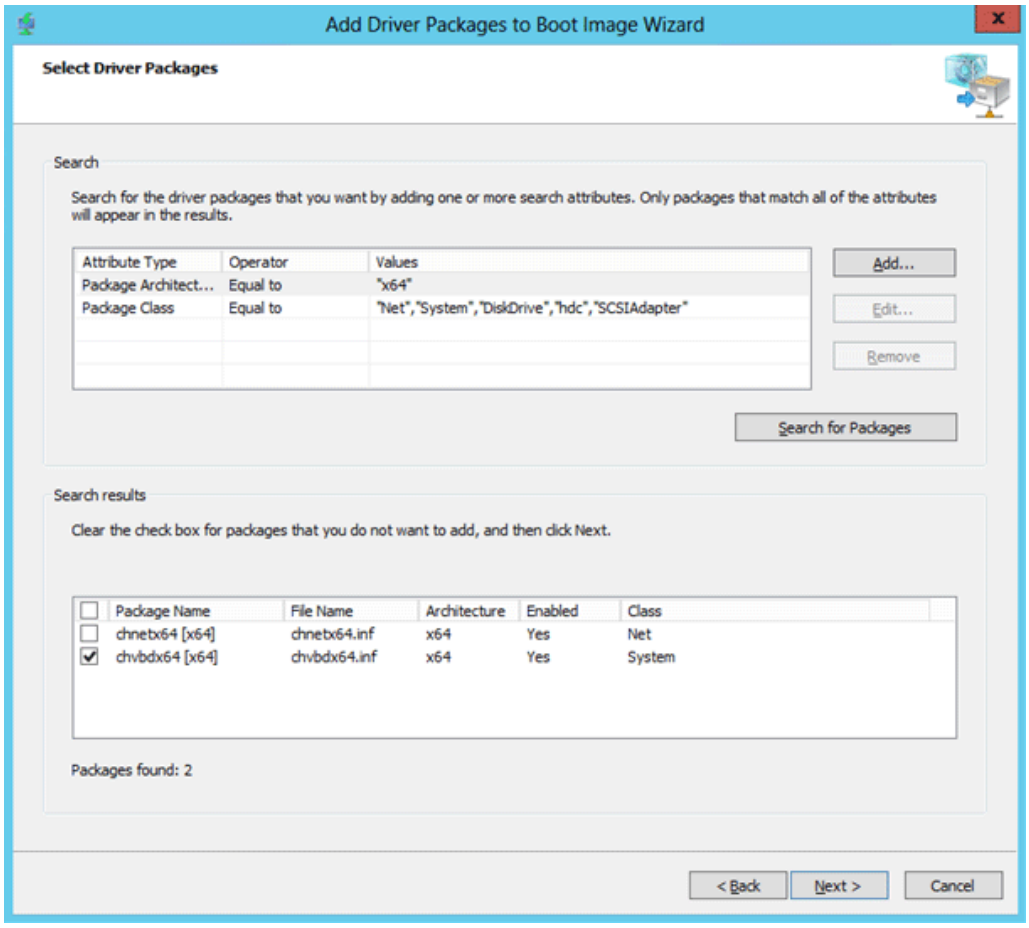
ii. Right-click on the boot image that you want to add the driver to, and select **Add Driver Packages to Image**.



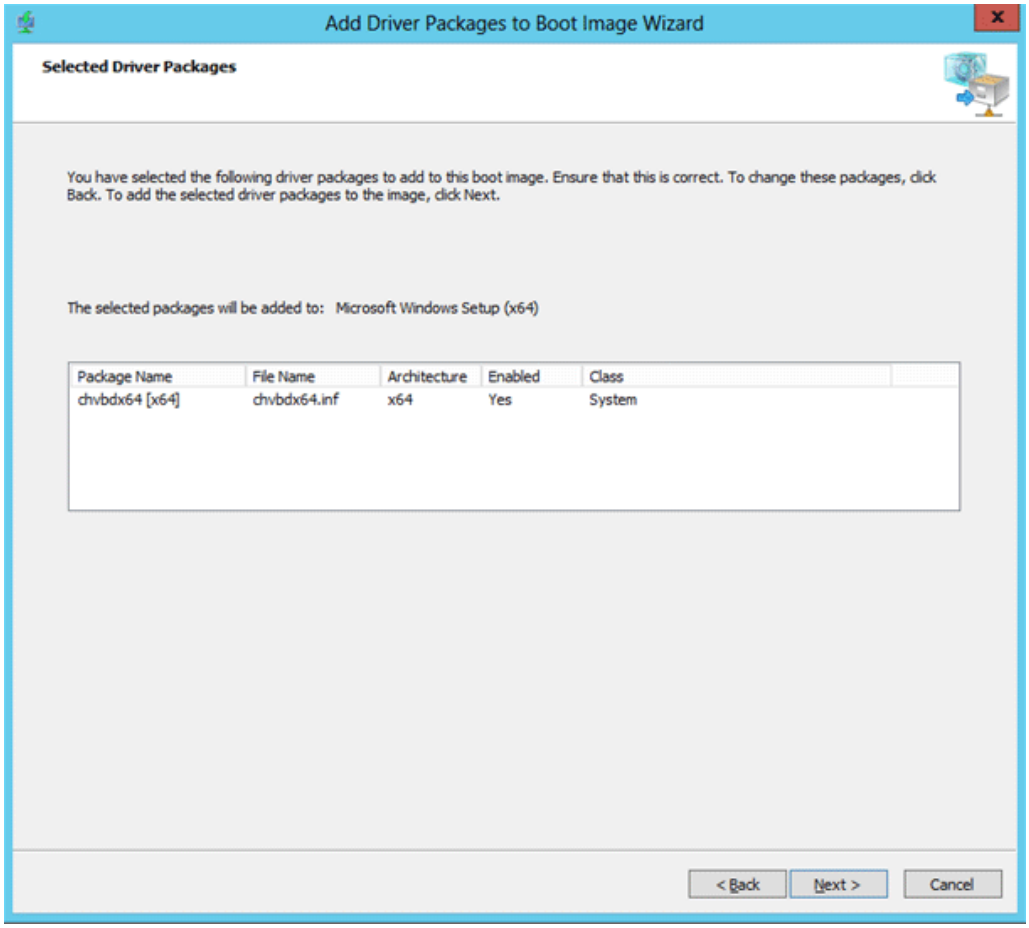
iii. If required, back up the boot image by following the instruction on the screen or click **Next** to continue.



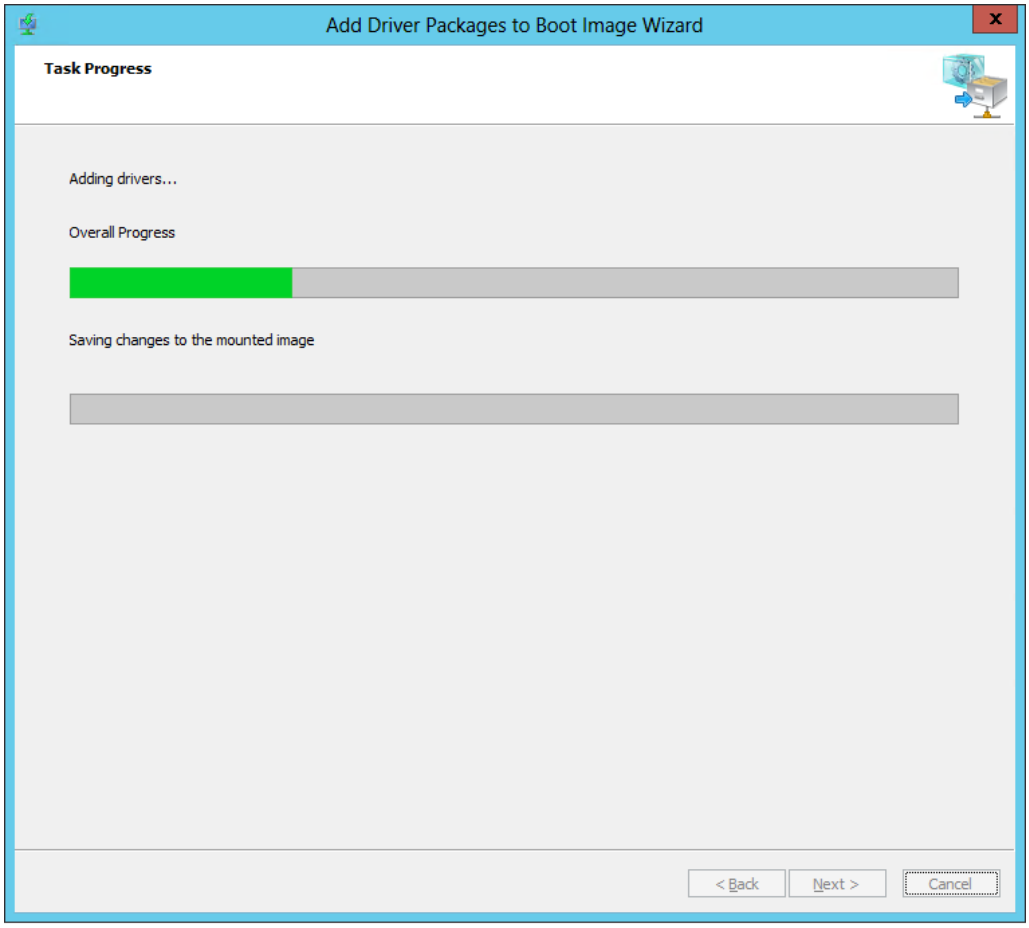
iv. Click **Search for Packages**. Then in the **Search results** section, select the checkbox for *chvbdx64[x64]* only and click **Next**.



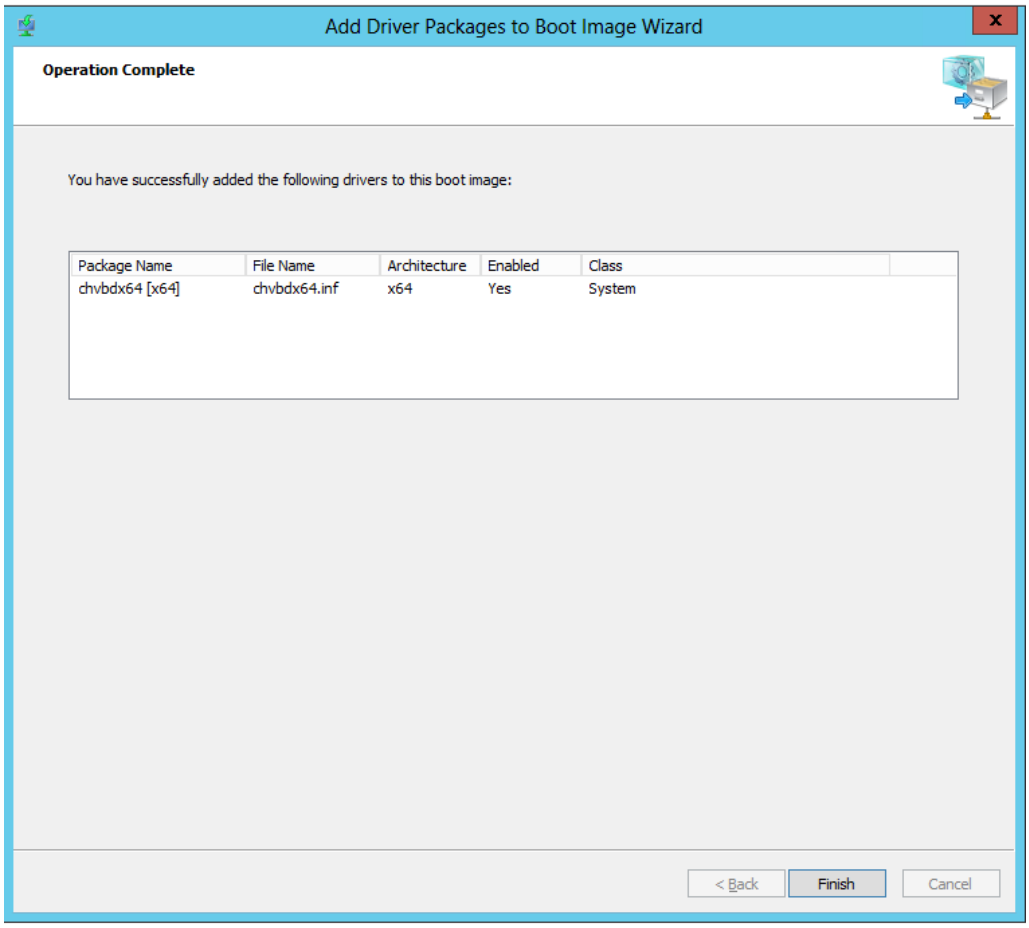
v. To add the selected VBD driver, click **Next** or to change click **Back**.



vi. The VBD driver will now be added to the boot image.



vii. Once the task is completed, click **Finish** to close the wizard.



2.3.2. Adding NDIS driver (chnetx64.inf) to Windows boot image

The procedure for adding NDIS driver to Windows boot image is similar to VBD as explained in the previous section. In step (iv), select the checkbox for *chnetx64[x64]* only and click **Next**.

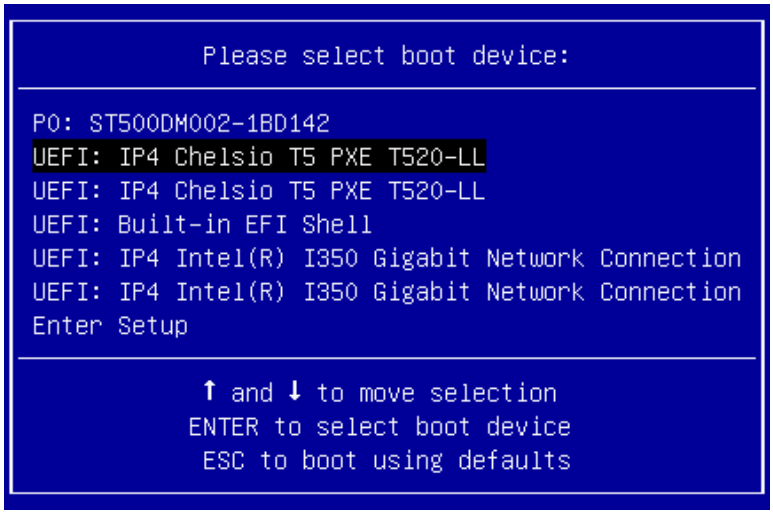
Note *If the image you are updating is currently being downloaded to a client when you perform this procedure, Windows Deployment Services will ensure that the client receives a consistent copy of the file.*

3. OS Installation

This is the recommended method for installing Windows OS using Chelsio PXE boot. Please ensure that the necessary driver packages have been added to Windows boot image (*boot.wim*) as mentioned in the previous section before proceeding.

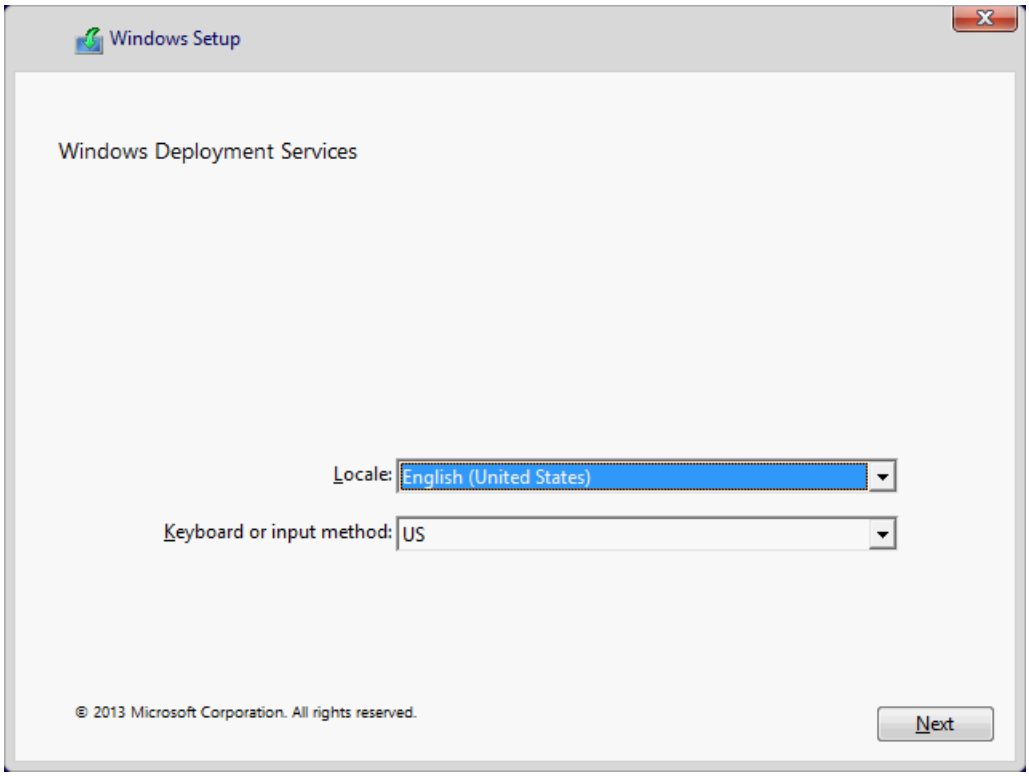
3.1. PXE Installation

i. Reboot the machine. In the boot menu, choose the port which was used to connect to the PXE-WDS Server.

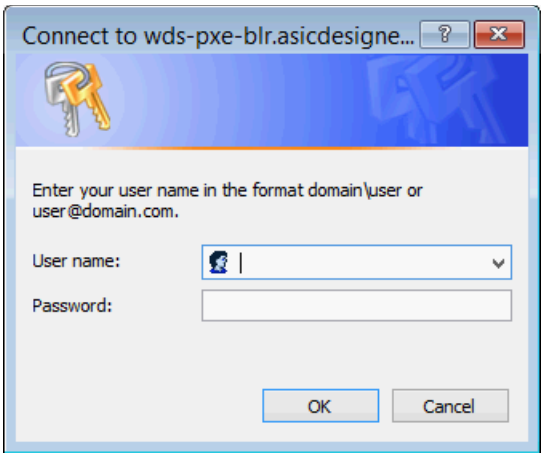


ii. On successful connection, Windows boot image will load from the PXE-WDS server.

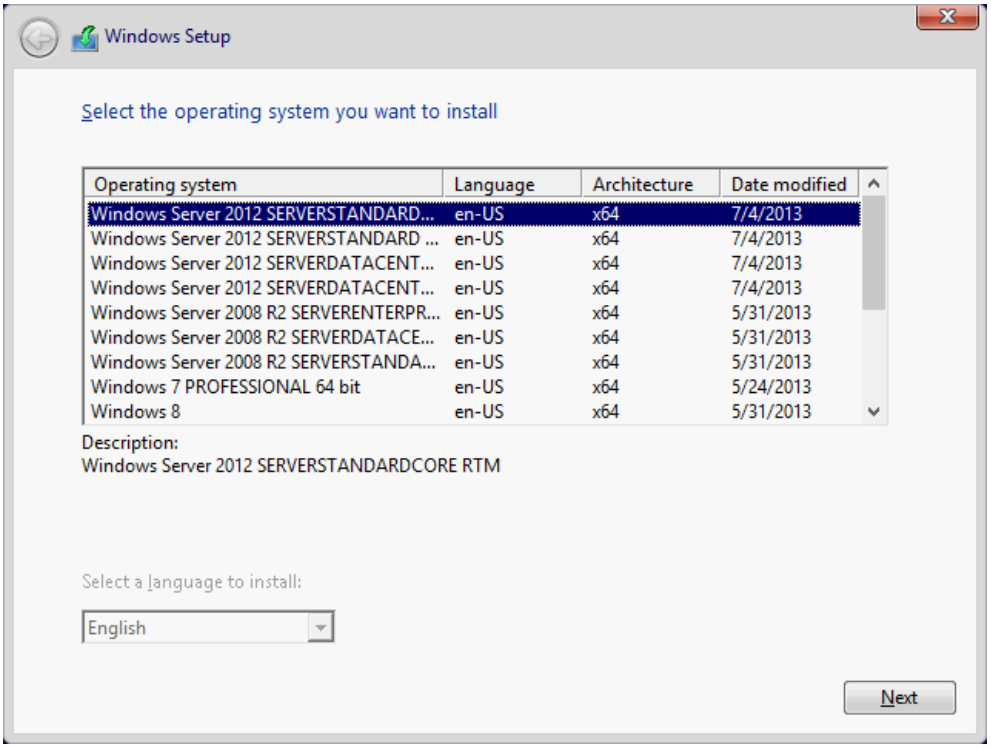
iii. Next, the Windows Setup window will appear. Select the System Locale (language) and Keyboard/input method. Click **Next**.



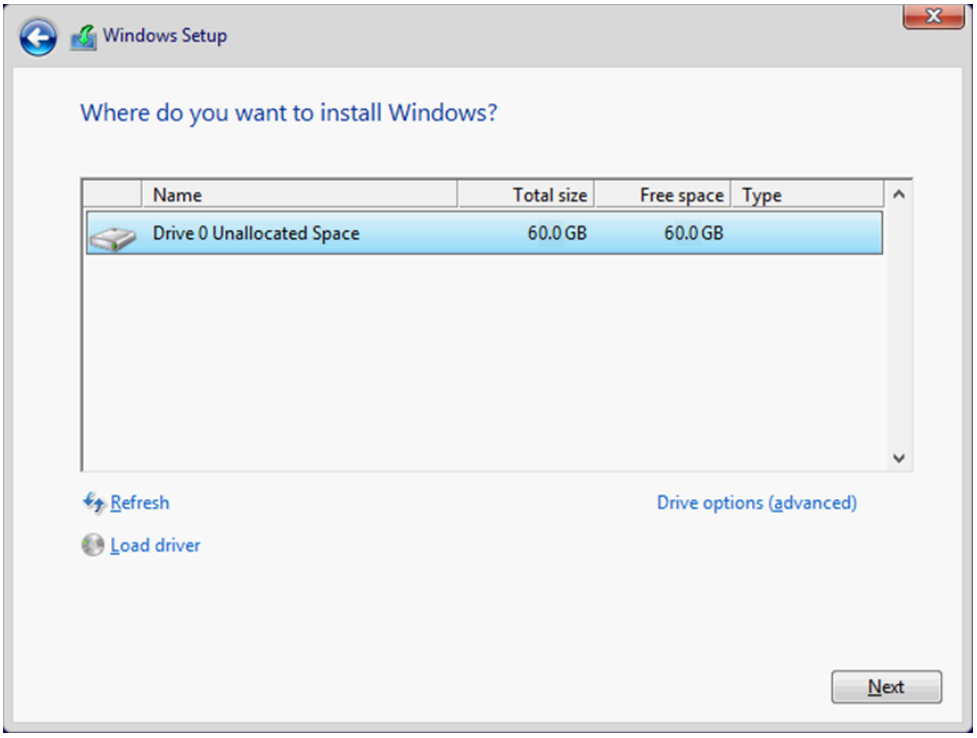
iv. Enter server credentials and click **OK**.



v. Select the operating system to be installed and click **Next**.



vi. Select the hard drive and click **Next** to continue with the installation.



vii. Proceed with installation as usual.

IV. ESXi

1. Introduction

The following section describes the procedure to PXE boot ESXi OS using Chelsio Unified Wire adapters.

1.1. Hardware Requirements

1.1.1. Supported Adapters

The following are the currently shipping Chelsio adapters that are compatible with Chelsio ESXi driver:

- T62100-CR
- T62100-LP-CR
- T62100-SO-CR*
- T6425-CR
- T6225-CR
- T6225-LL-CR
- T6225-SO-CR*
- T520-BT
- T580-CR
- T520-LL-CR
- T520-SO-CR*
- T520-CR
- T540-CR
- T580-LP-CR
- T580-SO-CR*

** Only PXE supported*

1.2. Software Requirements

1.2.1. ESXi Requirements

The Chelsio Native Network driver has been developed to run on ESXi platforms. Currently the driver is available for the following versions:

- ESXi 6.5 U1
- ESXi 6.5a
- ESXi 6.5

Note *Other versions have not been tested and are not guaranteed to work.*

2. Customized ISO

2.1. Adding Chelsio Drivers

Follow the steps mentioned below to add Chelsio offline driver bundle to ESXi installation ISO image.

Pre-requisites

- Install Windows 2012 R2 on the system used to create the ISO image.
- Download and install the latest vCenter Server and PowerCLI from VMware website.
- Download the required ESXi standard software depot from VMware website.

i. Copy Chelsio driver bundle from *Chelsio-Uboot-x.x.x.xx/ESXi/*, and the ESXi software depot to a desired location.

ii. Launch PowerCLI and add both the ESXi depot and driver bundle as software depots:

```
PowerCLI C:\> Add-EsxSoftwareDepot -DepotUrl <esxi_offline_bundle>.zip,
<driver_offline_bundle>.zip
```

```
PowerCLI C:\> Add-EsxSoftwareDepot C:\VMware-ESXi-6.5.0-4011740-depot.zip, C:\offline-bundle.zip

Depot Url
---------
zip:C:\VMware-ESXi-6.5.0-4011740-depot.zip?index.xml
zip:C:\offline-bundle.zip?index.xml
```

iii. Verify that the driver is now available as a software package:

```
PowerCLI C:\> Get-EsxSoftwarePackage
```

```
PowerCLI C:\> Get-EsxSoftwarePackage

Name                      Version                          Vendor     Creation Date
----                      -------                          ------     -------------
vmkplexer-vmkplexer       6.5.0-0.0.4564106                VMW        10/27/2016 4:...
sata-ata-piix             2.12-10vmw.650.0.0.4564106       VMW        10/27/2016 4:...
net-usbnet                1.0-3vmw.650.0.0.4564106         VMW        10/27/2016 4:...
sata-sata-sil             2.3-4vmw.650.0.0.4564106         VMW        10/27/2016 4:...
lsi-msgpt2                20.00.01.00-3vmw.650.0.0.45...   VMW        10/27/2016 4:...
scsi-megaraid2            2.00.4-9vmw.650.0.0.4564106      VMW        10/27/2016 4:...
scsi-iscsi-linux-92       1.0.0.2-3vmw.650.0.0.4564106     VMW        10/27/2016 4:...
ata-pata-hpt3x2n          0.3.4-3vmw.650.0.0.4564106       VMW        10/27/2016 4:...
shim-libata-9-2-1-0       6.5.0-0.0.4564106                VMW        10/27/2016 4:...
net-forcedeth             0.61-2vmw.650.0.0.4564106        VMW        10/27/2016 4:...
scsi-mpt2sas              19.00.00.00-1vmw.650.0.0.45...   VMW        10/27/2016 4:...
ata-pata-pdc2027x         1.0-3vmw.650.0.0.4564106         VMW        10/27/2016 4:...
scsi-megaraid-mbox        2.20.5.1-6vmw.650.0.0.4564106    VMW        10/27/2016 4:...
qflge                     1.1.0.3-1vmw.650.0.0.4564106     VMW        10/27/2016 4:...
cxl                       1.1.0.64-10EM.650.0.0.4240417    CHL        9/20/2017 2:1...
lsu-hp-hpsa-plugin        2.0.0-3vmw.650.0.0.4564106       VMware     10/27/2016 4:...
lightwaveesx              6.5.0-0.0.4564106                VMware     10/27/2016 4:...
lpfc                      11.1.0.6-1vmw.650.0.0.4564106    VMW        10/27/2016 4:...
scsi-aic79xx              3.1-5vmw.650.0.0.4564106         VMW        10/27/2016 4:...
ata-pata-cmd64x           0.2.5-3vmw.650.0.0.4564106       VMW        10/27/2016 4:...
ata-pata-serverworks      0.4.3-3vmw.650.0.0.4564106       VMW        10/27/2016 4:...
lsu-lsi-mpt2sas-plugin    2.0.0-5vmw.650.0.0.4564106       VMware     10/27/2016 4:...
misc-drivers              6.5.0-0.0.4564106                VMW        10/27/2016 4:...
native-misc-drivers       6.5.0-0.0.4564106                VMware     10/27/2016 4:...
```

iv. List all the image profiles available and note the name of ESXi image.

```
PowerCLI C:\> Get-EsxImageProfile
```

```
PowerCLI C:\> Get-EsxImageProfile

Name                          Vendor          Last Modified   Acceptance Level
----                          ------          -------------   ----------------
ESXi-6.5.0-4011740-standard   VMware, Inc.    6/15/2016 11... PartnerSupported
ESXi-6.5.0-4011740-no-tools   VMware, Inc.    6/15/2016 11... PartnerSupported
```

v. By default, the ESXi image is read-only. Hence, using the profile name obtained in the previous step, clone the image:

```
PowerCLI C:\> New-EsxImageProfile -CloneProfile "<image_profile_name>" -name
"<new_profile_name>" -Vendor "<vendor_name>"
```

```
PowerCLI C:\> New-EsxImageProfile -CloneProfile "ESXi-6.5.0-4011740-standard" -name "ISO Profile" -Vendor "MyCorp"

Name                          Vendor          Last Modified   Acceptance Level
----                          ------          -------------   ----------------
ISO Profile                   MyCorp          6/15/2016 11... PartnerSupported
```

vi. Add the Chelsio driver to the new image profile, specifying the package name obtained in step (iii)

```
PowerCLI C:\> Add-EsxSoftwarePackage -ImageProfile "<new_profile_name>" -
SoftwarePackage "<driver_package_name>"
```

```
PowerCLI C:\> Add-EsxSoftwarePackage -ImageProfile "ISO Profile" -SoftwarePackage "cxl"
Name                           Vendor          Last Modified   Acceptance Level
----                           ------          -------------   ----------------
ISO Profile                    MyCorp          9/27/2017 11... PartnerSupported
```

vii. Finally, export the new image profile as an ISO:

```
PowerCLI C:\> Export-EsxImageProfile -ImageProfile "<new_profile_name>" -
ExportToISO -filepath <path>.iso
```

```
PowerCLI C:\> Export-EsxImageProfile -ImageProfile "ISO Profile" -ExportToISO -filepath C:\ISO-with-cxl.iso
PowerCLI C:\> _
```

In case the Chelsio driver is unsigned, use the above command with *-NoSignatureCheck* option i.e.,

```
PowerCLI C:\> Export-EsxImageProfile -ImageProfile "ISO Profile" -ExportToISO -filepath C:\ISO-with-cxl.iso -NoSignatureCheck
PowerCLI C:\> _
```

2.2. PXE Server Configuration

The customized ISO with Chelsio offline driver bundle can be deployed in the PXE Server.

2.3. OS Installation

The client machine can now connect to the PXE Server over Chelsio network. ESXi 6.5 image (with Chelsio offline bundle) will start loading on the client machine. Proceed with ESXi installation as usual.

V. Appendix

Chelsio End-User License Agreement (EULA)

Installation and use of the driver/software implies acceptance of the terms in the Chelsio End-User License Agreement (EULA).

IMPORTANT: PLEASE READ THIS SOFTWARE LICENSE CAREFULLY BEFORE DOWNLOADING OR OTHERWISE USING THE SOFTWARE OR ANY ASSOCIATED DOCUMENTATION OR OTHER MATERIALS (COLLECTIVELY, THE "SOFTWARE"). BY CLICKING ON THE "OK" OR "ACCEPT" BUTTON YOU AGREE TO BE BOUND BY THE TERMS OF THIS AGREEMENT. IF YOU DO NOT AGREE TO THE TERMS OF THIS AGREEMENT, CLICK THE "DO NOT ACCEPT" BUTTON TO TERMINATE THE INSTALLATION PROCESS.

1. License. Chelsio Communications, Inc. ("Chelsio") hereby grants you, the Licensee, and you hereby accept, a limited, non-exclusive, non-transferable license to install and use the Software with one or more Chelsio network adapters on a single server computer for use in communicating with one or more other computers over a network. You may also make one copy of the Software in machine readable form solely for back-up purposes, provided you reproduce Chelsio's copyright notice and any proprietary legends included with the Software or as otherwise required by Chelsio.

2. Restrictions. This license granted hereunder does not constitute a sale of the Software or any copy thereof. Except as expressly permitted under this Agreement, you may not:

(i) reproduce, modify, adapt, translate, rent, lease, loan, resell, distribute, or create derivative works of or based upon, the Software or any part thereof; or

(ii) make available the Software, or any portion thereof, in any form, on the Internet. The Software contains trade secrets and, in order to protect them, you may not decompile, reverse engineer, disassemble, or otherwise reduce the Software to a human-perceivable form. You assume full responsibility for the use of the Software and agree to use the Software legally and responsibly.

3. Ownership of Software. As Licensee, you own only the media upon which the Software is recorded or fixed, but Chelsio retains all right, title and interest in and to the Software and all subsequent copies of the Software, regardless of the form or media in or on which the Software may be embedded.

4. Confidentiality. You agree to maintain the Software in confidence and not to disclose the Software, or any information or materials related thereto, to any third party without the express written consent of Chelsio. You further agree to take all reasonable precautions to limit access of the Software only to those of your employees who reasonably require such access to perform their employment obligations and who are bound by confidentiality agreements with you.

5. Term. This license is effective in perpetuity, unless terminated earlier. You may terminate the license at any time by destroying the Software (including the related documentation), together with all copies or modifications in any form. Chelsio may terminate this license, and this license shall be deemed to have automatically terminated, if you fail to comply with any term or condition of this Agreement. Upon any termination, including termination by you, you must destroy the Software (including the related documentation), together with all copies or modifications in any form.

6. Limited Warranty. If Chelsio furnishes the Software to you on media, Chelsio warrants only that the media upon which the Software is furnished will be free from

defects in material or workmanship under normal use and service for a period of thirty (30) days from the date of delivery to you.

CHELSIO DOES NOT AND CANNOT WARRANT THE PERFORMANCE OR RESULTS YOU MAY OBTAIN BY USING THE SOFTWARE OR ANY PART THEREOF. EXCEPT FOR THE FOREGOING LIMITED WARRANTY, CHELSIO MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, AND HEREBY DISCLAIMS ALL OTHER WARRANTIES, INCLUDING, BUT NOT LIMITED TO, NON-INFRINGEMENT OF THIRD PARTY RIGHTS, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow the exclusion of implied warranties or limitations on how long an implied warranty may last, so the above limitations may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

7. Remedy for Breach of Warranty. The sole and exclusive liability of Chelsio and its distributors, and your sole and exclusive remedy, for a breach of the above warranty, shall be the replacement of any media furnished by Chelsio not meeting the above limited warranty and which is returned to Chelsio. If Chelsio or its distributor is unable to deliver replacement media which is free from defects in materials or workmanship, you may terminate this Agreement by returning the Software.

8. Limitation of Liability. IN NO EVENT SHALL CHELSIO HAVE ANY LIABILITY TO YOU OR ANY THIRD PARTY FOR ANY INDIRECT, INCIDENTAL, SPECIAL, CONSEQUENTIAL OR PUNITIVE DAMAGES, HOWEVER CAUSED, AND ON ANY THEORY OF LIABILITY, ARISING OUT OF OR RELATED TO THE LICENSE OR USE OF THE SOFTWARE, INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR LOSS OF ANTICIPATED PROFITS, EVEN IF CHELSIO HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT SHALL CHELSIO'S LIABILITY ARISING OUT OF OR RELATED TO THE LICENSE OR USE OF THE SOFTWARE EXCEED THE AMOUNTS PAID BY YOU FOR THE LICENSE GRANTED HEREUNDER. THESE LIMITATIONS SHALL APPLY NOTWITHSTANDING ANY FAILURE OF ESSENTIAL PURPOSE OF ANY LIMITED REMEDY.

9. High Risk Activities. The Software is not fault-tolerant and is not designed, manufactured or intended for use or resale as online equipment control equipment in hazardous environments requiring fail-safe performance, such as in the operation of nuclear facilities, aircraft navigation or communication systems, air traffic control, direct life support machines, or weapons systems, in which the failure of the Software could lead directly to death, personal injury, or severe physical or environmental damage. Chelsio specifically disclaims any express or implied warranty of fitness for any high risk uses listed above.

10. Export. You acknowledge that the Software is of U.S. origin and subject to U.S. export jurisdiction. You acknowledge that the laws and regulations of the United States and other countries may restrict the export and re-export of the Software. You agree that you will not export or re-export the Software or documentation in any form in violation of applicable United States and foreign law. You agree to comply with all applicable international and national laws that apply to the Software, including the U.S.

Export Administration Regulations, as well as end-user, end-use, and destination restrictions issued by U.S. and other governments.

11. Government Restricted Rights. The Software is subject to restricted rights as follows. If the Software is acquired under the terms of a GSA contract: use, reproduction or disclosure is subject to the restrictions set forth in the applicable ADP Schedule contract. If the Software is acquired under the terms of a DoD or civilian agency contract, use, duplication or disclosure by the Government is subject to the restrictions of this Agreement in accordance with 48 C.F.R. 12.212 of the

Federal Acquisition Regulations and its successors and 49 C.F.R. 227.7202-1 of the DoD FAR Supplement and its successors.

12. General. You acknowledge that you have read this Agreement, understand it, and that by using the Software you agree to be bound by its terms and conditions. You further agree that it is the complete and exclusive statement of the agreement between Chelsio and you, and supersedes any proposal or prior agreement, oral or written, and any other communication between Chelsio and you relating to the subject matter of this Agreement. No additional or any different terms will be enforceable against Chelsio unless Chelsio gives its express consent, including an express waiver of the terms of this Agreement, in writing signed by an officer of Chelsio. This Agreement shall be governed by California law, except as to copyright matters, which are covered by Federal law. You hereby irrevocably submit to the personal jurisdiction of, and irrevocably waive objection to the laying of venue (including a waiver of any argument of forum non conveniens or other principles of like effect) in, the state and federal courts located in Santa Clara County, California, for the purposes of any litigation undertaken in connection with this Agreement. Should any provision of this Agreement be declared unenforceable in any jurisdiction, then such provision shall be deemed severable from this Agreement and shall not affect the remainder hereof. All rights in the Software not specifically granted in this Agreement are reserved by Chelsio. You may not assign or transfer this Agreement (by merger, operation of law or in any other manner) without the prior written consent of Chelsio and any attempt to do so without such consent shall be void and shall constitute a material breach of this Agreement.

Should you have any questions concerning this Agreement, you may contact Chelsio by writing to:

Chelsio Communications, Inc.
209 North Fair Oaks Avenue,
Sunnyvale, CA 94085
U.S.A