Chelsio Communications

Accelerate

Chelsio T5/T4 Unified Boot for Linux & Windows

Configuration and User's Guide

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I. Unified Boot Option ROM

1. Introduction

Thank you for choosing Chelsio T5/T4 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 5 (T5) is Chelsio's next generation of highly integrated, hyper-virtualized 40/10GbE controllers. The T5 is 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 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.

The T4 adapters can fully offload TCP, UDP, iSCSI, iWARP and FCoE over a single Unified Wire. The adapters also fully support SR-IOV, EVB/VNTag, DCB, Traffic Management and Filtering.

Ideal for all data, storage and high performance clustering applications, the T5/T4 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 T5/T4 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:

- T520-BT
- T502-BT
- T580-CR

- T520-LL-CR
- T520-SO-CR*
- T520-CR
- T522-CR
- T540-CR
- T580-LP-CR
- T580-SO-CR*
- T420-CR#
- T440-CR#
- T422-CR#
- T404-BT#
- T420-BCH*
- T420-SO-CR*
- T440-LP-CR#
- T420-LL-CR#
- T420-BT#

* Only PXE

Only PXE,iSCSI

1.1.2. Supported Hardware

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

- DELL PowerEdge T710
- DELL PowerEdge 2950
- DELL PowerEdge T110
- Dell T5600
- IBM X3650 M2
- IBM X3650 M4*
- HP ProLiant DL385G2
- Supermicro X7DWE
- Supermicro X8DTE-F
- Supermicro X8STE
- Supermicro X8DT6
- Supermicro X9SRL-F
- Supermicro X9SRE-3F
- ASUS P5KPL
- ASUS P8Z68

* 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 Unified Boot onto Chelsio adapters.

1.3. 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 T5 and T4 based Converged Network Adapters (CNAs). It also contains Firmware (*t5fw-x.xx.xx.x.bin for T5; t4fw-x.xx.xx.x.bin for T4*) files.
- **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 according to 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.
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 slot as sometimes the process of securing the card causes the card to become unseated.
x. Connect a fiber cable, multi-mode for short range (SR) optics or single-mode for long range (LR) optics, to the 10Gb 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@host~]# update-pciids
%   Total   %  Received   %  Xferd  Average Speed   Time    Time     Time  Current
                                    Dload  Upload Total   Spent    Left  Speed
100 198k  100  198k     0    0     491k      0 --:--:-- --:--:-- --:--:-- 626k
Done.
```

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

```
[root@host~]# lspci |grep -i Chelsio
07:00.0 Ethernet controller: Chelsio Communications Inc T520-LL-CR Unified
Wire Ethernet Controller
07:00.1 Ethernet controller: Chelsio Communications Inc T520-LL-CR Unified
Wire Ethernet Controller
07:00.2 Ethernet controller: Chelsio Communications Inc T520-LL-CR Unified
Wire Ethernet Controller
07:00.3 Ethernet controller: Chelsio Communications Inc T520-LL-CR Unified
Wire Ethernet Controller
07:00.4 Ethernet controller: Chelsio Communications Inc T520-LL-CR Unified
Wire Ethernet Controller
```

```
07:00.5 SCSI storage controller: Chelsio Communications Inc T520-LL-CR
Unified Wire Storage Controller
07:00.6 Fibre Channel: Chelsio Communications Inc T520-LL-CR Unified Wire
Storage Controller
```

- On Windows systems, follow these steps:
    i. Open **Device Manager** in **Control Panel**.
    ii. 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 T5/T4 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 and *VBD* and *NDIS* for Windows systems.

xv. Finally, verify if the card is discovered:
    - For Linux systems, examine the output of *dmesg* and you should see a similar output:

```
eth2: Chelsio T520-LL rev 0 10GBASE-SFP RNIC PCIe 8 GT/s x8 MSI-X, Offload
capable
0000:07:00.4: S/N: RE12130097, P/N: 11011675004
```

The above outputs indicate the hardware configuration of the adapters as well as the Serial numbers. As observed by the *x8*, the card is properly installed in an x8 slot on the machine and using MSI-X interrupts.

- For Windows systems, open **Device Manager** again. Expand **Network adapters** section and now Chelsio adapter should be listed.

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 Ethernet network interface. However, for T5 40G and T420-BT adapters, the association of physical Ethernet ports and their corresponding network device names is opposite. For this adapter, the port nearest to the motherboard will appear as the first network interface.

3. 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. Both methods also provide the functionality to update/erase (T5/T4) Boot configuration, Hardware configuration and Phy Firmware files.

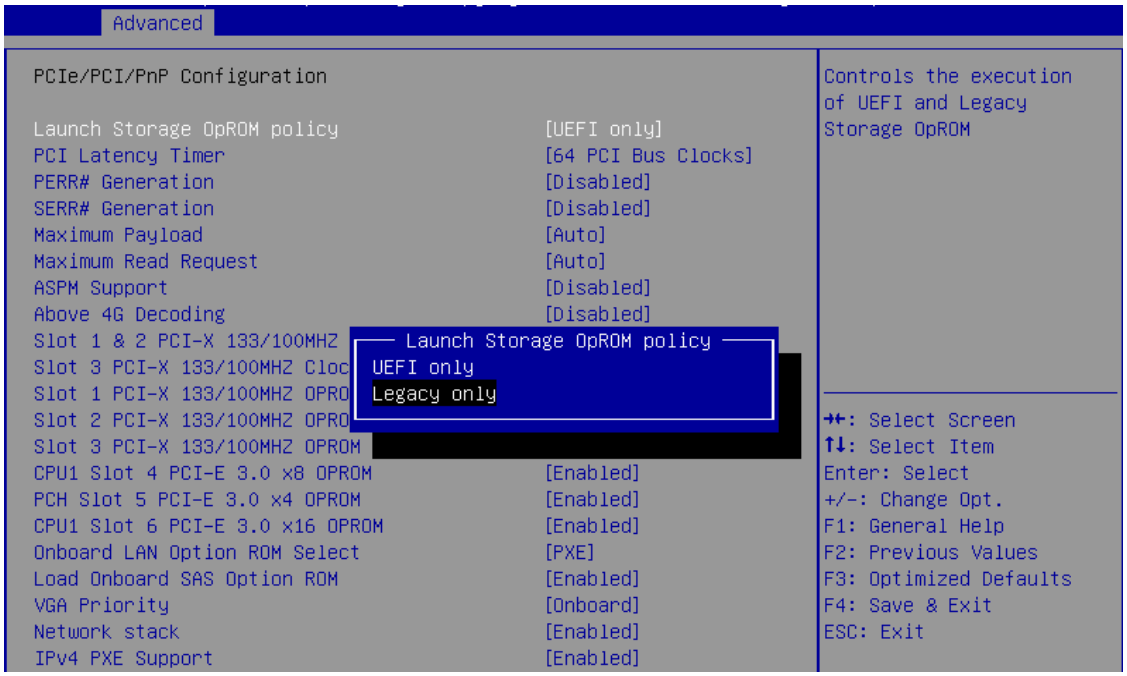
3.1. Preparing USB flash drive

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:

i. Create a DOS bootable USB flash drive. (Click here for instructions)
ii. Create a directory *CHELSIO* on the USB flash drive.
iii. If you haven't done already, download Chelsio-Uboot-x.x.x.xx.zip from Chelsio Download Center, service.chelsio.com
iv. Untar the downloaded package and change your working directory to *OptionROM* directory.
v. Copy all the files and place them in the *CHELSIO* directory created on the USB flash drive.
vi. Plug-in the USB flash drive in the system on which the Chelsio CNA is installed.
vii. Reboot the system and go into the BIOS setup.
viii. Make the USB flash drive as the primary boot device.
ix. Save the changes.

3.2. 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
```

```
C:\CHELSIO>cfut4 -l

 Chelsio T4/T5 Flash Utility v1.5


 Index  ChelsioAdaptertype   DevId
 =====  ==================   =====
  [0]   T520-LL              5011
```

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 T4/T5 Flash Utility v1.5

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

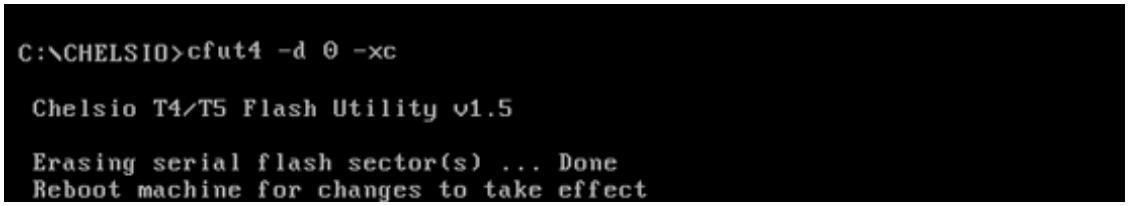
v. Delete any previous firmware using the following command:

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

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

 Chelsio T4/T5 Flash Utility v1.5

 Erasing serial flash sector(s) ... Done
 Erasing serial flash sector(s) ... Done
 Reboot machine for changes to take effect
C:\CHELSIO>_
```

vi. Delete any previous Option ROM settings:

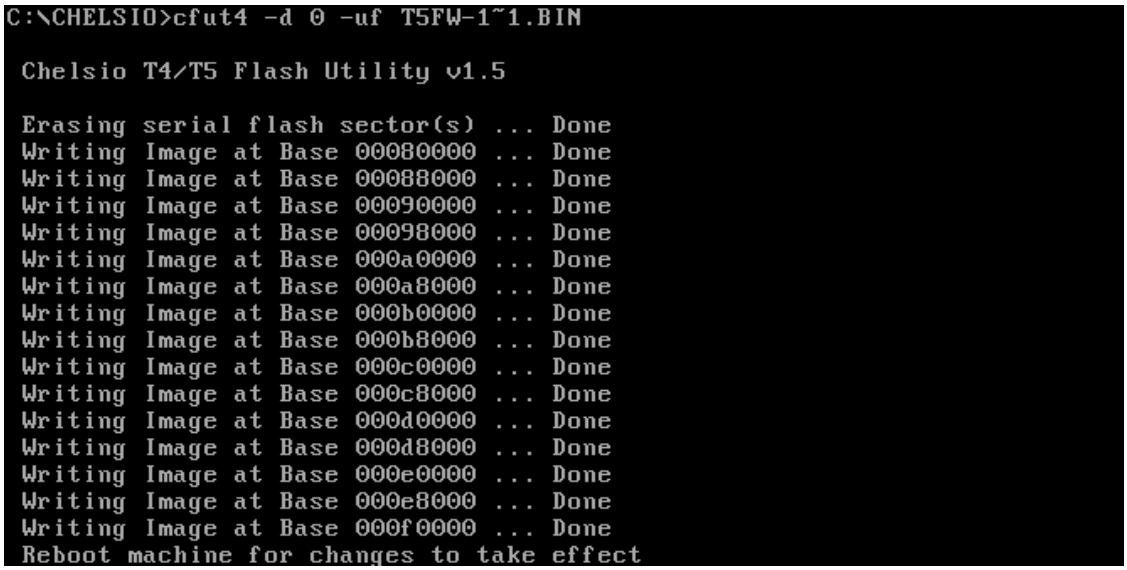
```
C:\CHELSIO>cfut4 -d <idx> -xc
```



vii. Run the following command to flash the appropriate firmware (*t5fw-x.xx.xx.x.bin* for T5 adapters; *t4fw-x.xx.xx.x.bin* for T4 adapters).

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

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



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 T4/T5 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. Flash the default boot configuration file.

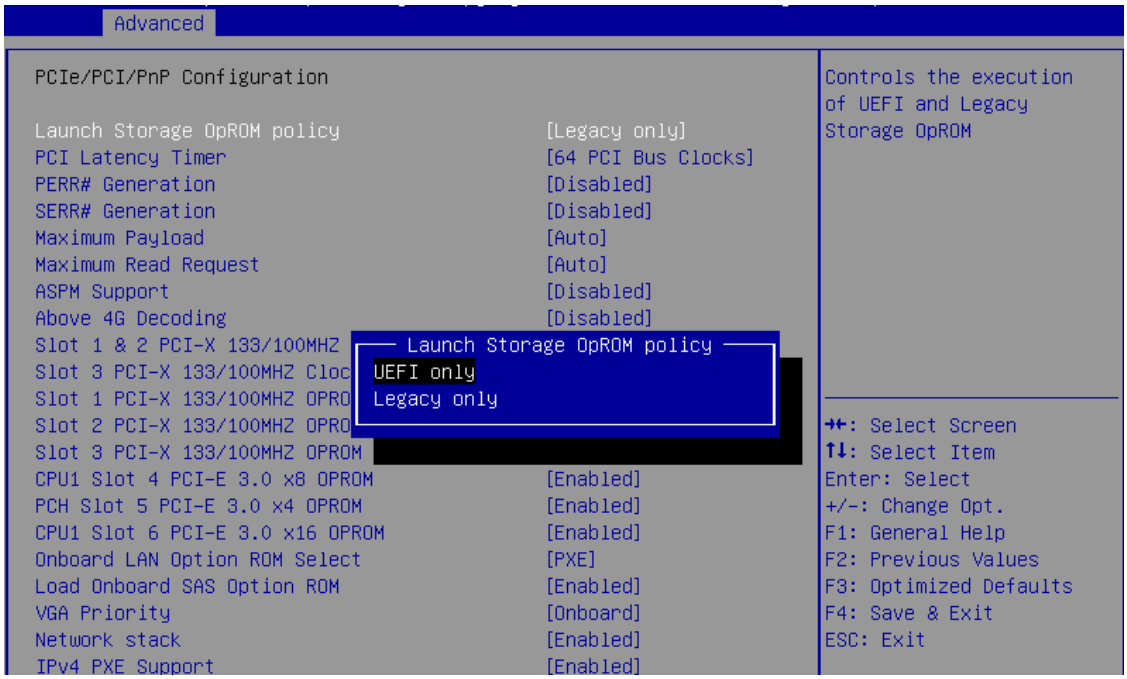
```
C:\CHELSIO>cfut4 -d <idx> -uc bootcfg
```

```
C:\CHELSIO>cfut4 -d 0 -uc bootcfg

 Chelsio T4/T5 Flash Utility v1.5

 Erasing serial flash sector(s) ... Done
 Updating the configuration in flash
 Writing Image at Base 00070000 ... Done
 Updating the configuration in flash succeeded
```

x. Reboot the system for changes to take effect.

3.3. uEFI

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



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

ii. Boot to EFI Shell.

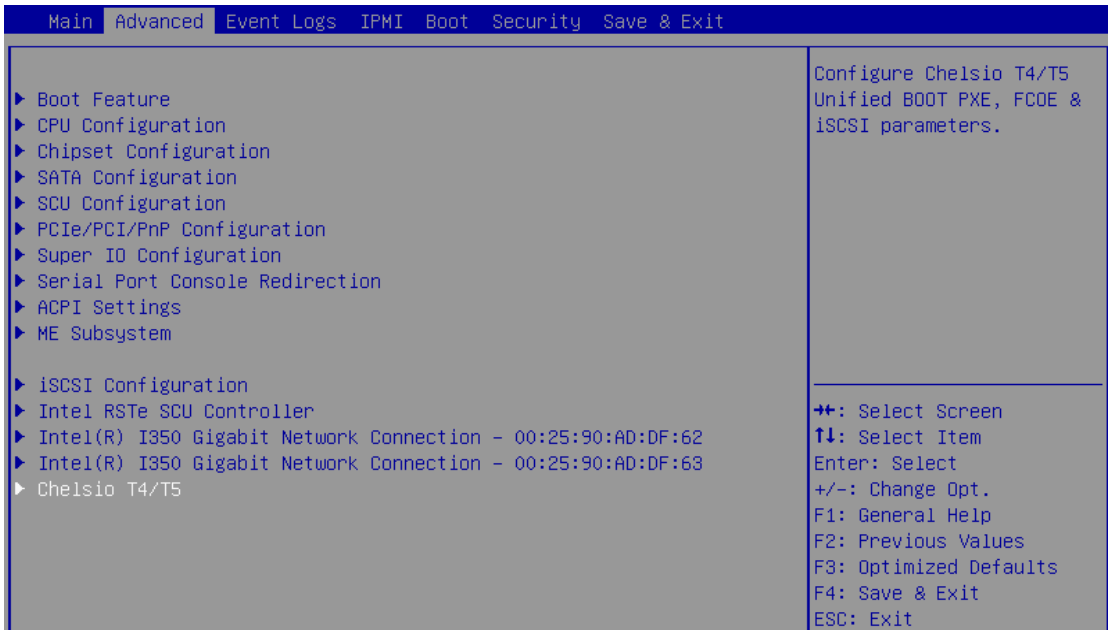
```
EFI Shell version 2.31 [4.654]
Current running mode 1.1.2
Device mapping table
  fs0  :Removable HardDisk - Alias hd83b0f0b blk0
        PciRoot(0x0)/Pci(0x1d,0x0)/USB(0x1,0x0)/USB(0x5,0x0)/HD(1,MBR,0x0fdb738d,0x800,0x78b800)
  blk0 :Removable HardDisk - Alias hd83b0f0b fs0
        PciRoot(0x0)/Pci(0x1d,0x0)/USB(0x1,0x0)/USB(0x5,0x0)/HD(1,MBR,0x0fdb738d,0x800,0x78b800)
  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> _
```

iii. 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 (iv)

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

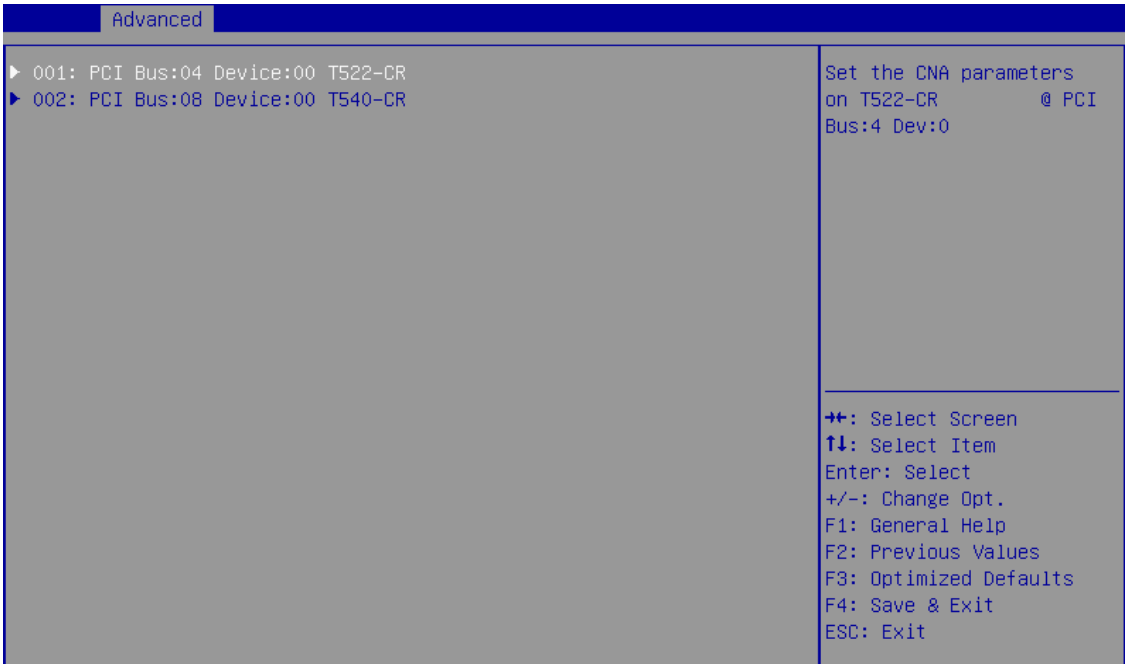
iv. Reboot the system and go into BIOS setup.

v. Chelsio HII should be listed as ***Chelsio T4/T5***. Highlight it and press [Enter].

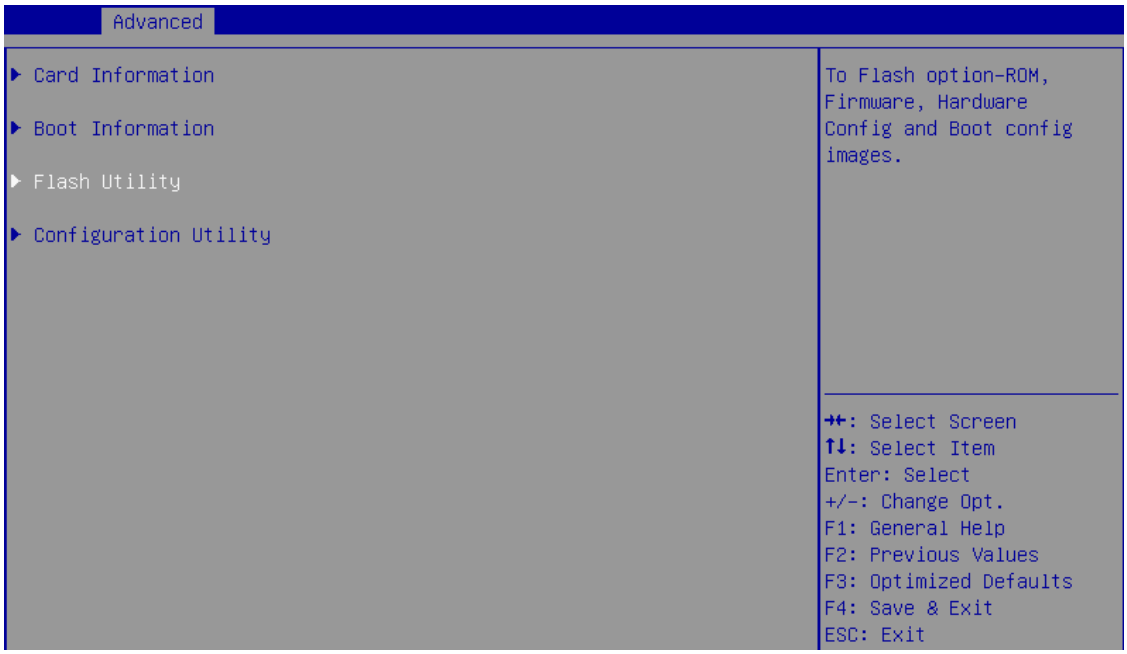


Note *If Chelsio T4/T5 is not listed, please ensure that Chelsio uEFI driver is loaded correctly as mentioned **here** in the **Flashing Firmware and Option ROM** section.*

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



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



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

- **Erase existing firmware**

a. Select *[Erase]* as *Flash Operation*

b. Select *[FW File]* as *Flash File Type*

c. Select *Update/Erase*

d. Press [Y] to confirm.

e. Reboot system.

- **Update firmware**

a. Select *[Update]* as *Flash Operation*

b. Select *[FW File]* as *Flash File Type*

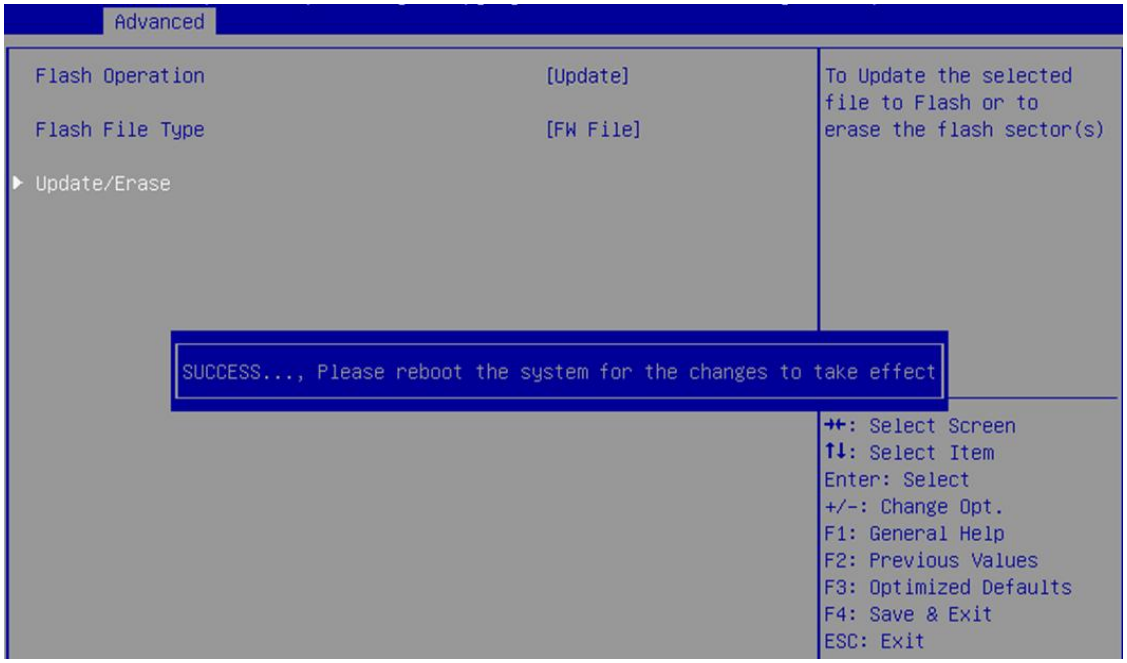
c. Enter full path to the firmware file for *Enter File Name*. For e.g.: *CHELSIO\t5fw-1.13.32.0.bin*.

d. Press [Enter]

e. Select *Update/Erase*

f. Press [Y] to confirm.

g. Reboot system



Similarly, you can use the above method to update/erase Option ROM, (T5/T4) Boot Configuration, Hardware Configuration and Phy Firmware file.

4. Configuring PXE Server

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

- DHCP Server
- TFTP Server

PXE server configuration steps for Linux can be found on following links:

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

PXE server configuration steps for Windows can be found on following links:

- 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

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

5. PXE boot process

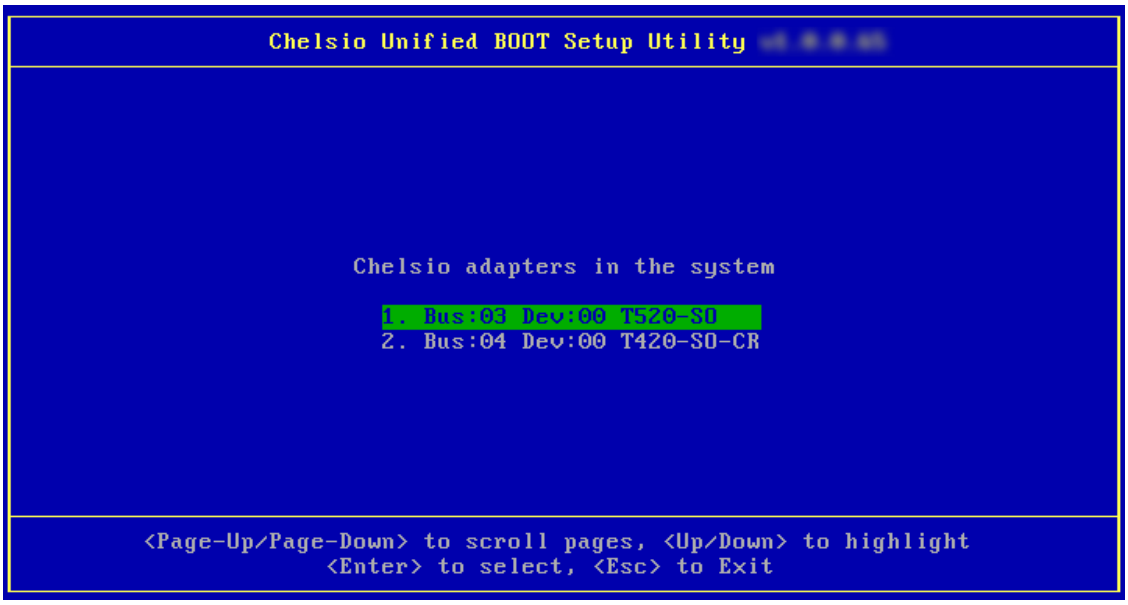
Before proceeding, please ensure that the Chelsio CNA has been flashed with the provided firmware and option ROM (See **Flashing Firmware and option ROM**).

5.1. Legacy PXE boot

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

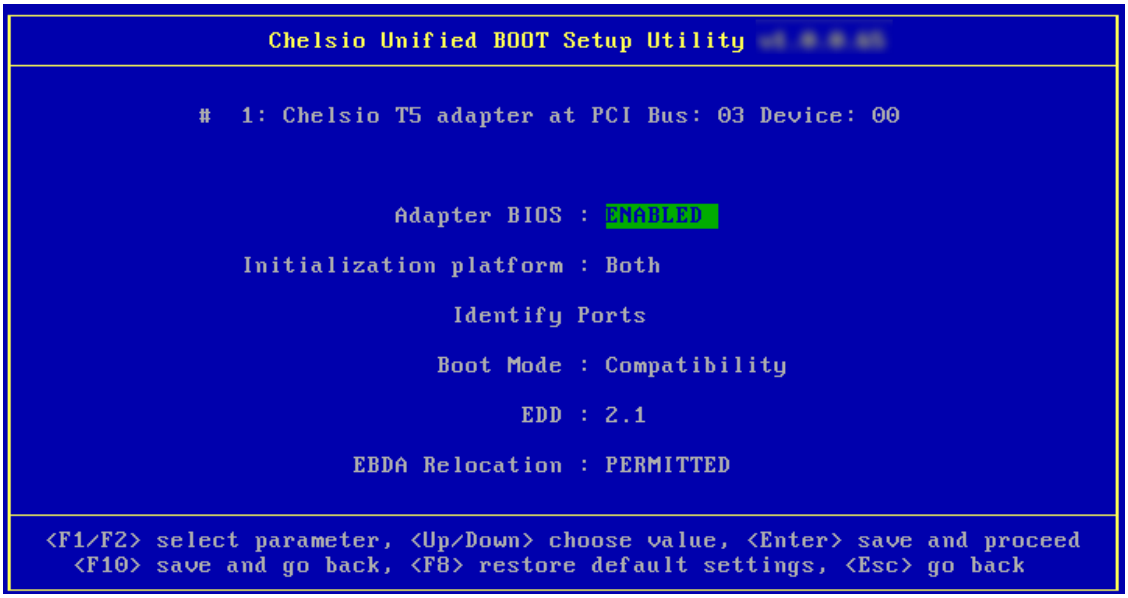
ii. Press [Alt+C] when the message *Chelsio Unified Boot BIOS vX.X.X.XX, Copyright (C) 2003-2015 Chelsio Communications Press <Alt-C> to Configure T4/T5 Card(s)*. *Press <Alt-S> to skip B*IOS appears on the screen to enter the configuration utility.

iii. The configuration utility will appear as below:



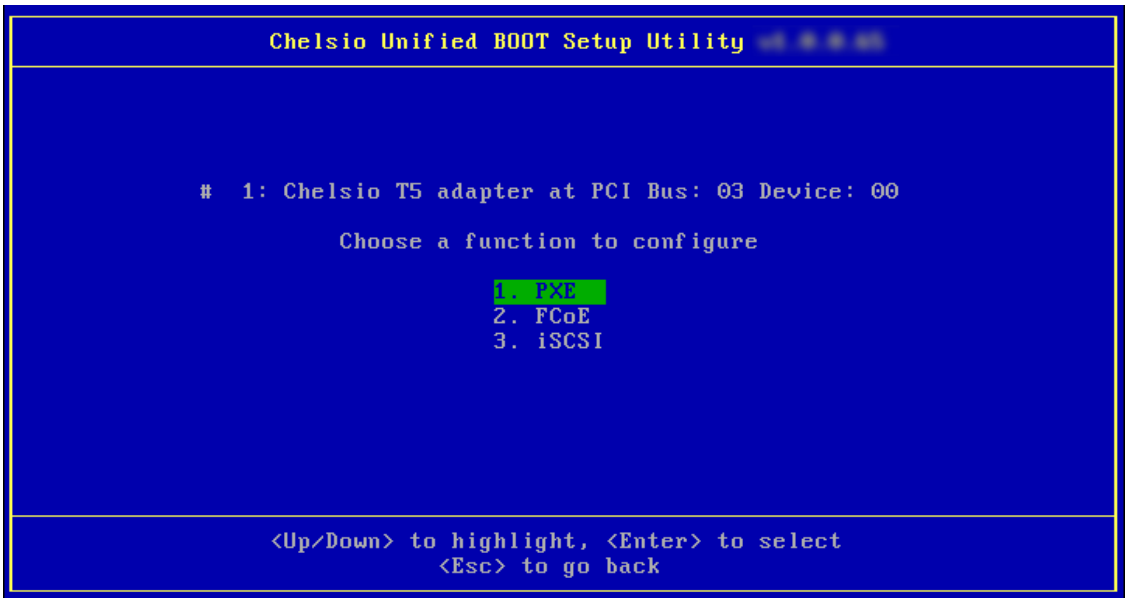
iv. Choose the CNA on which you flashed the option ROM image. Hit [Enter].

v. Enable the Adapter BIOS using arrow keys if not already enabled. Hit [ENTER].

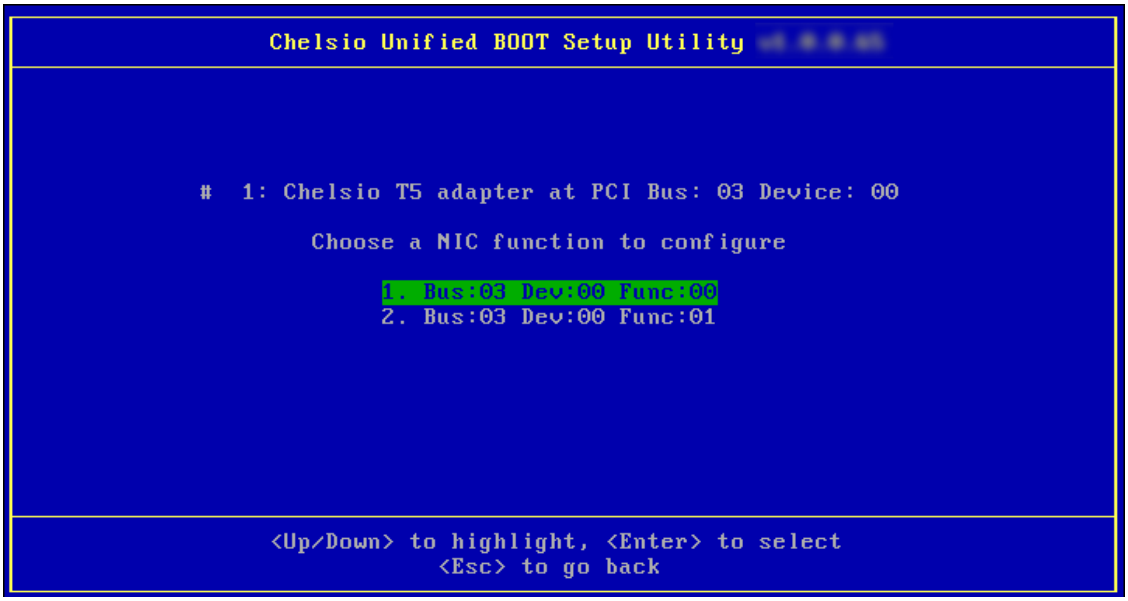


Note *Use the default values for Boot Mode, EDD and EBDA Relocation parameters, unless instructed otherwise.*

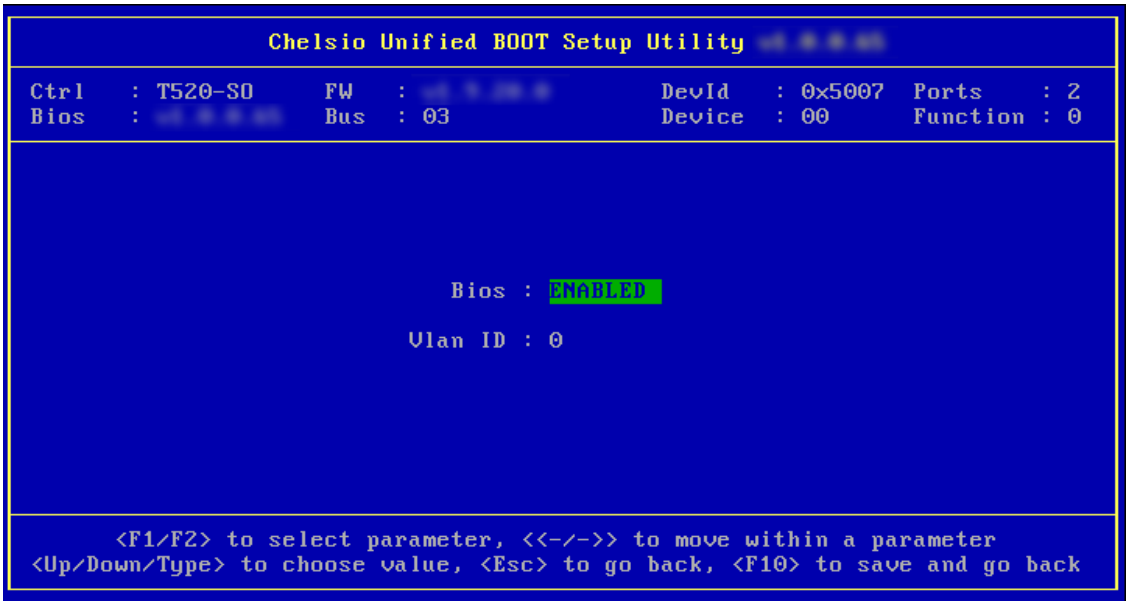
vi. Choose *PXE* from the list to configure. Hit [Enter].



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



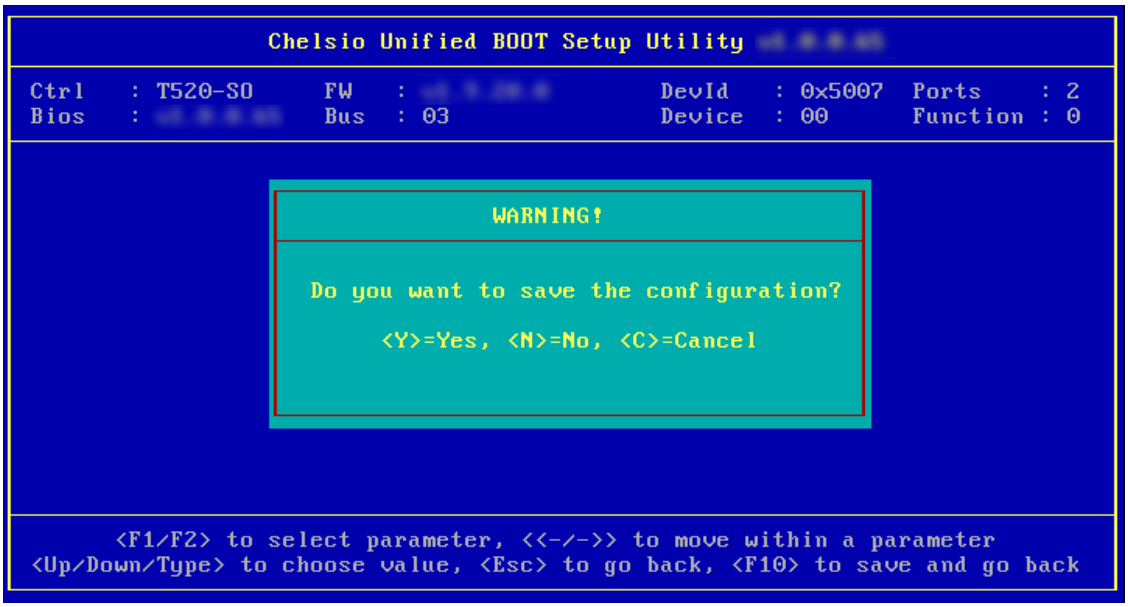
viii. Enable NIC function bios if not already enabled.



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. Please refer the table below:

NIC Function enabled	Ports enabled
NIC Func00	00
NIC Func01	01
NIC Func02	02
NIC Func03	03

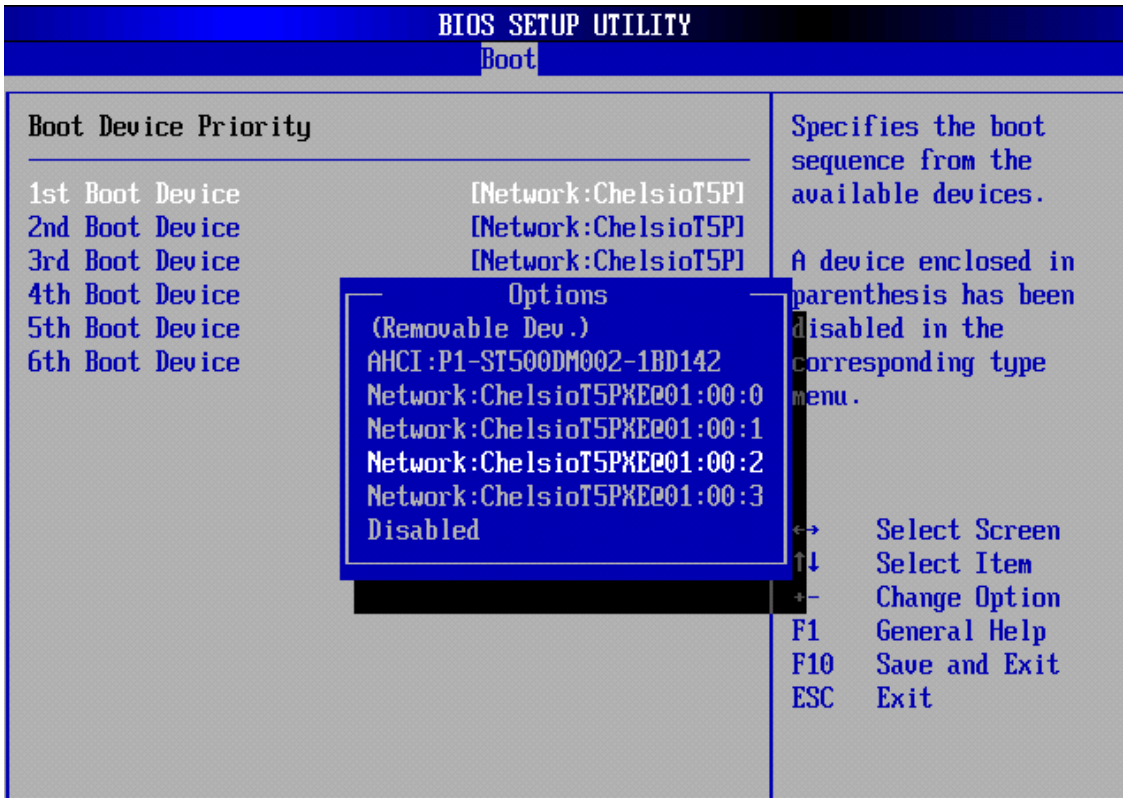
x. Hit [F10] or [Esc] and then [Y] to save configuration changes.



xi. Reboot the system.

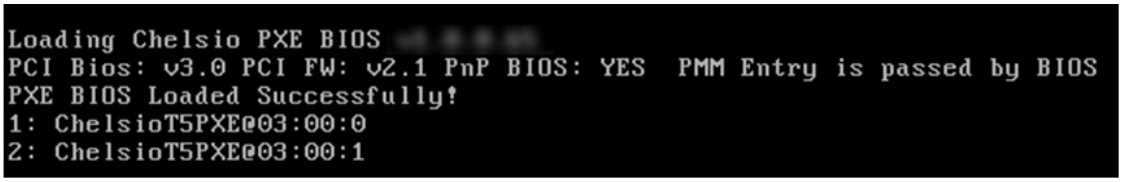
xii. Hit [F2] or [DEL] or any other key as mentioned during system startup to enter the system BIOS.

xiii. Choose any one of the Chelsio PXE devices as the first boot device.



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

xv. Chelsio option ROM will now initialize and setup PXE devices.



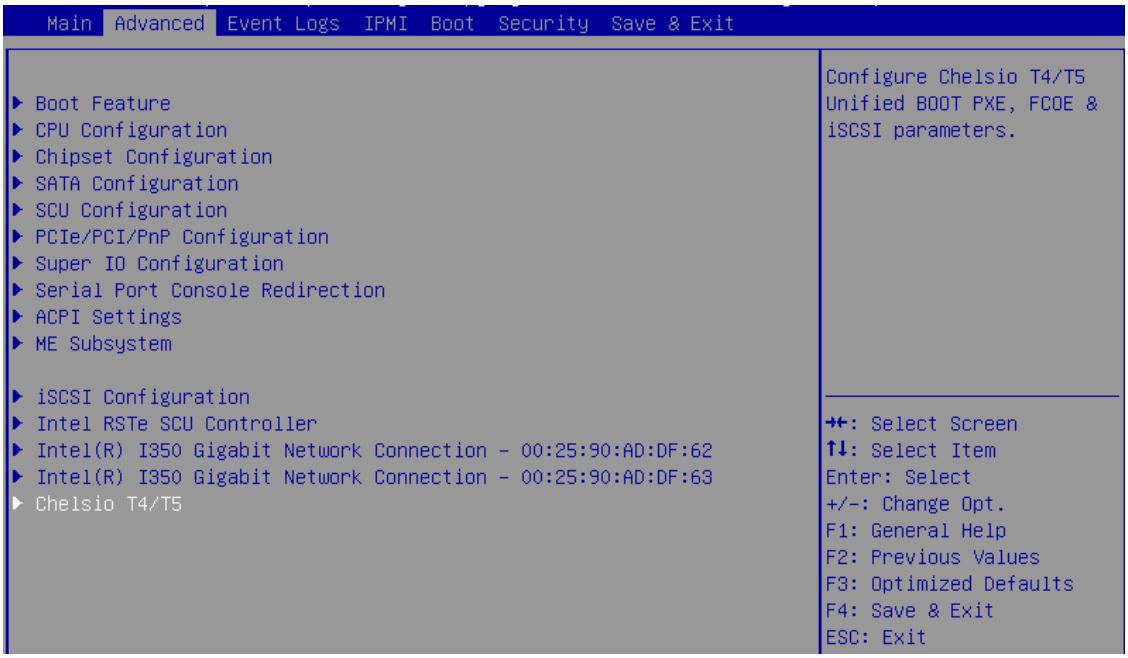
5.2. uEFI PXE Boot

Important

- *Only uEFI v2.1 and v2.3.1 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.

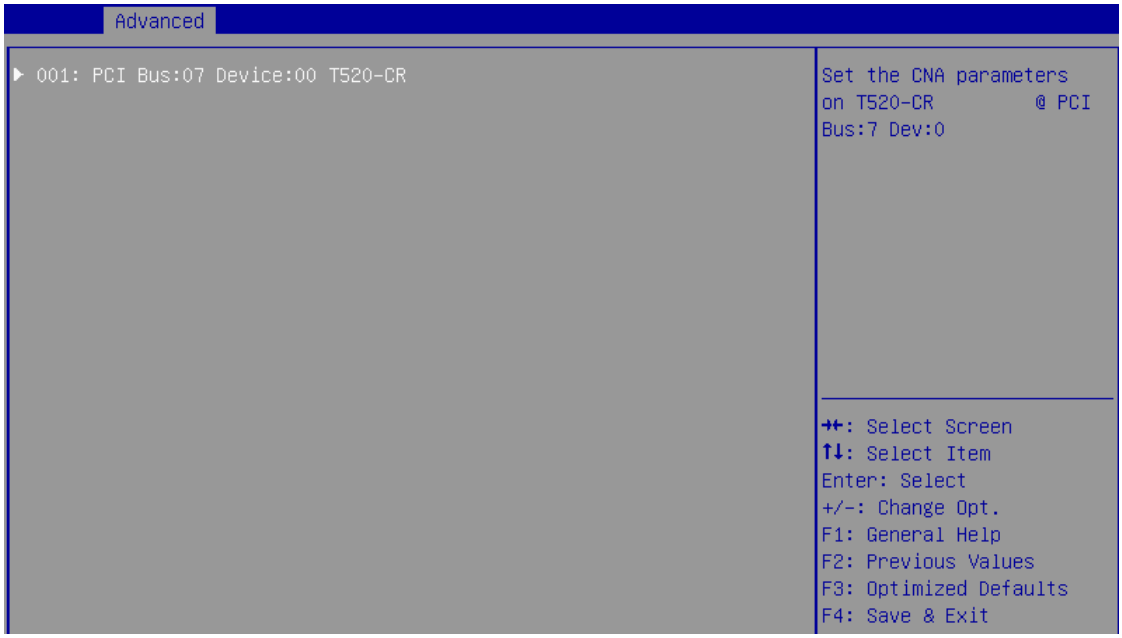
i. Reboot the system and go into the BIOS setup.
ii. Chelsio HII should be listed as **Chelsio T4/T5**. Highlight it and press [Enter].



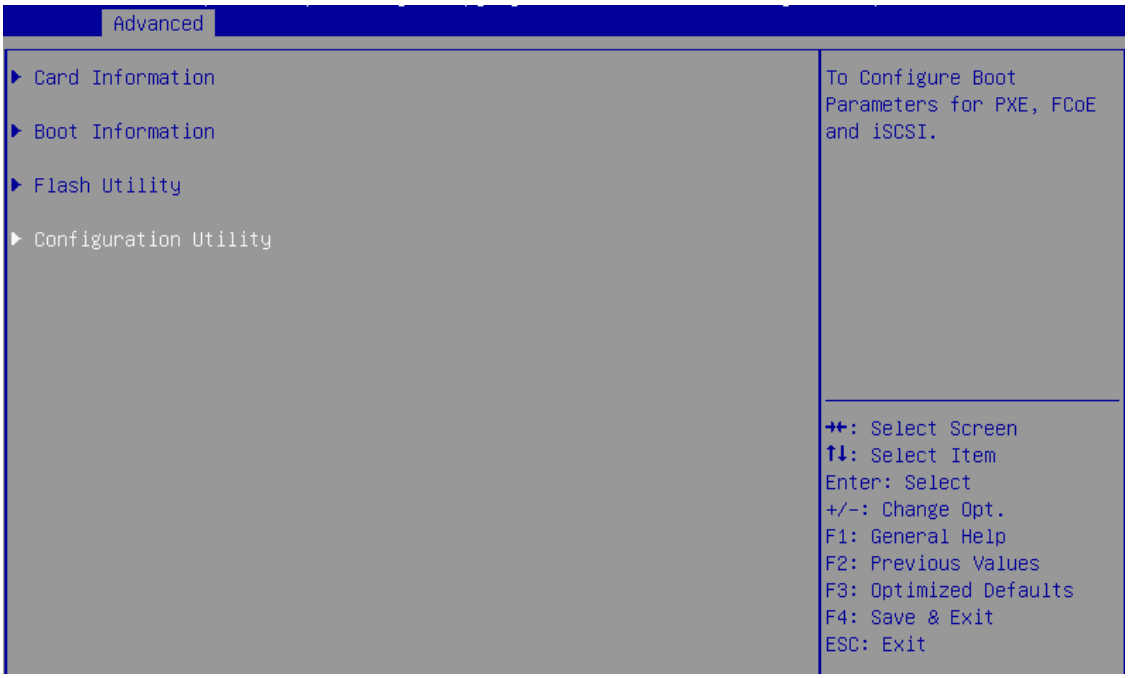
Note

*If Chelsio T4/T5 is not listed, please ensure that Chelsio uEFI driver is loaded correctly as mentioned **here** in the **Flashing Firmware and Option ROM** section.*

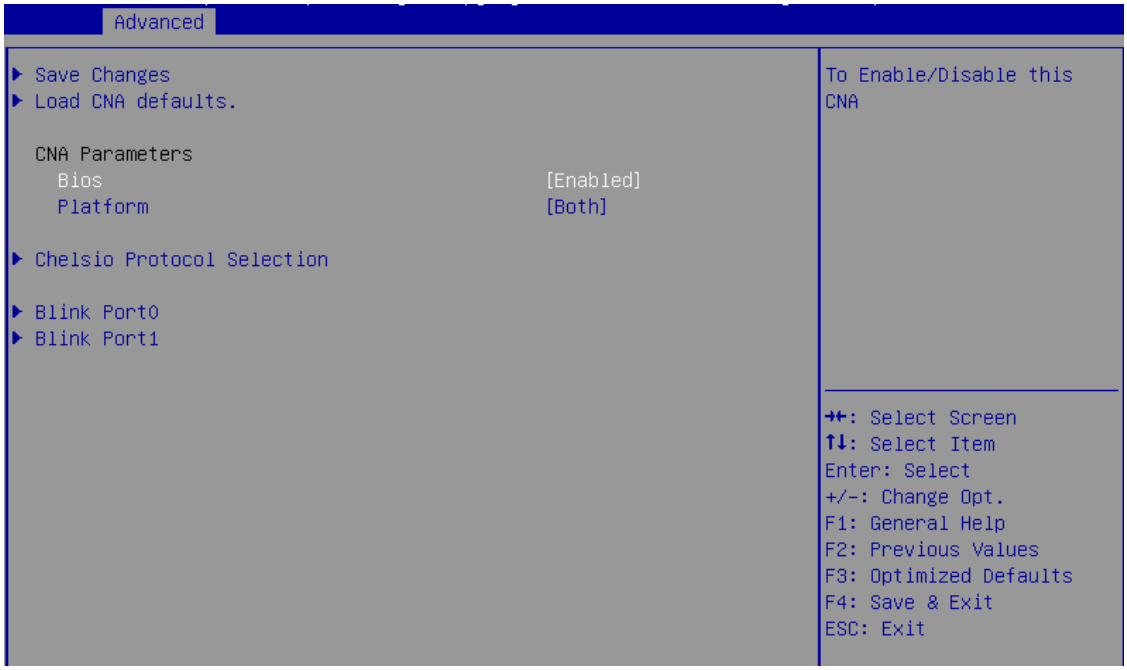
iii. Select the Chelsio adapter to be configured and press [Enter].



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

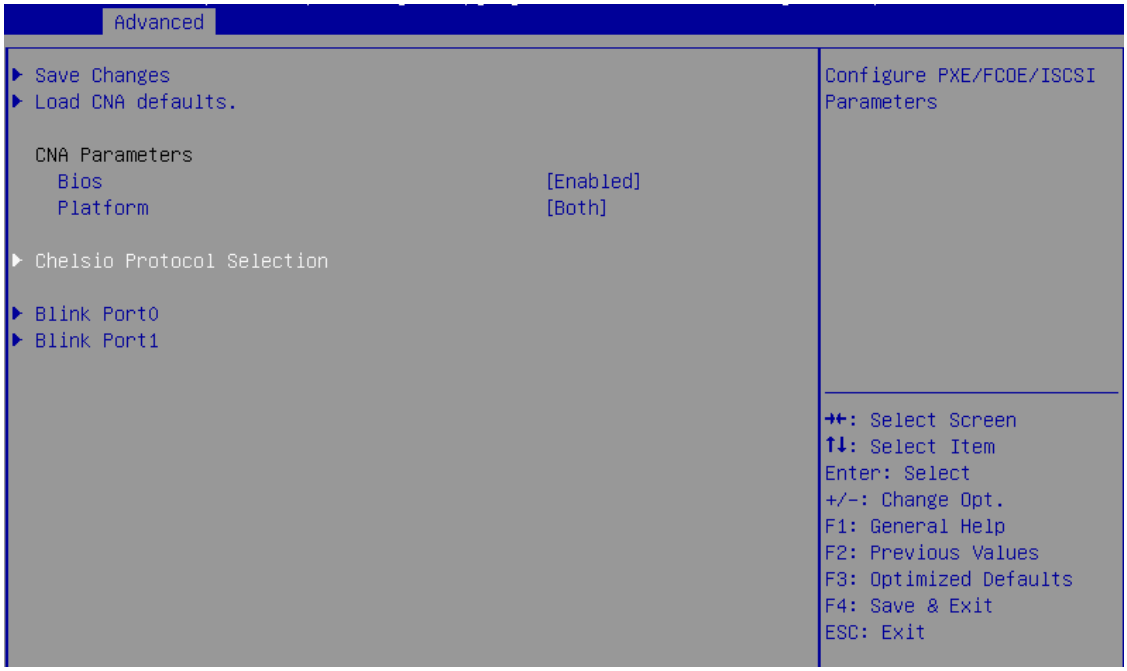


v. Enable adapter BIOS if not already enabled.

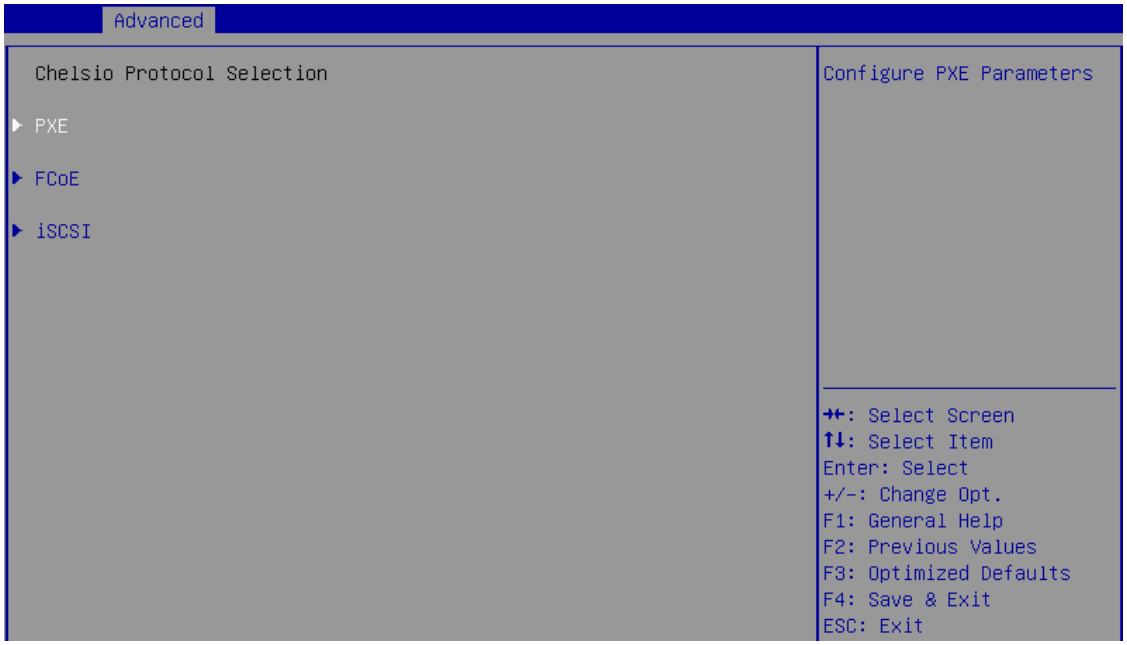


Note *It is highly recommended that you use the **Save Changes** option every time a parameter/option is changed.*

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

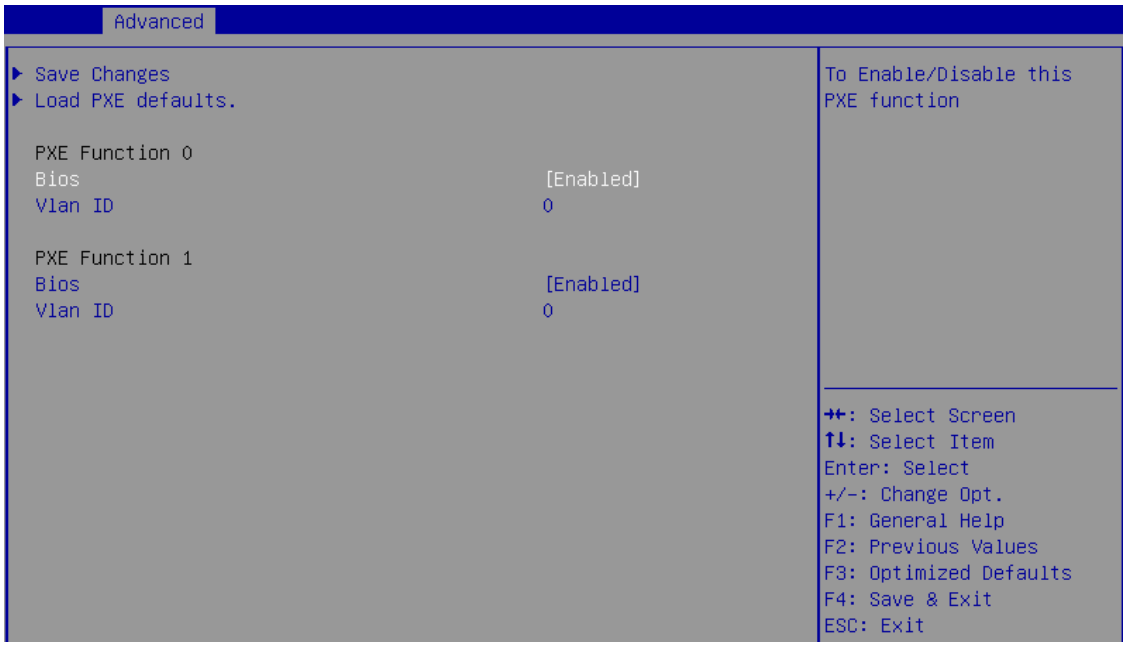


vii. Select **PXE** and press [Enter].

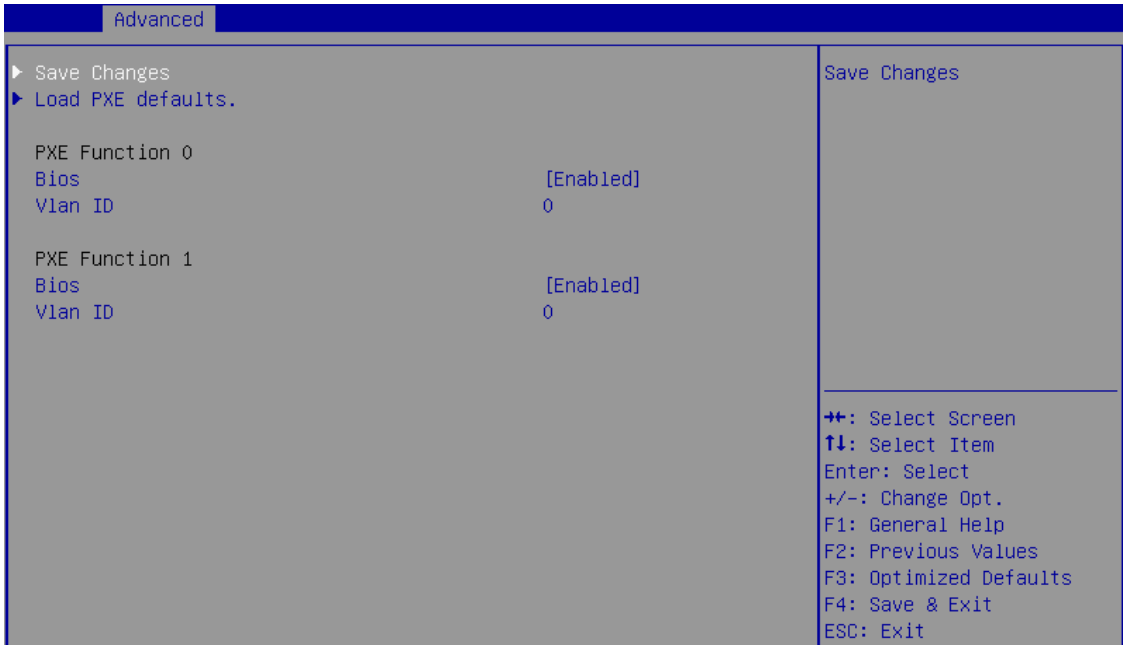


viii. Choose the boot port to try PXE boot. It is recommended to enable only those functions and ports which are going to be used. Please note that enabling PXE Function 0 will enable port 0 for PXE, enabling PXE Function 1 will enable port 1 and so on, for NIC function. Please refer the table below:

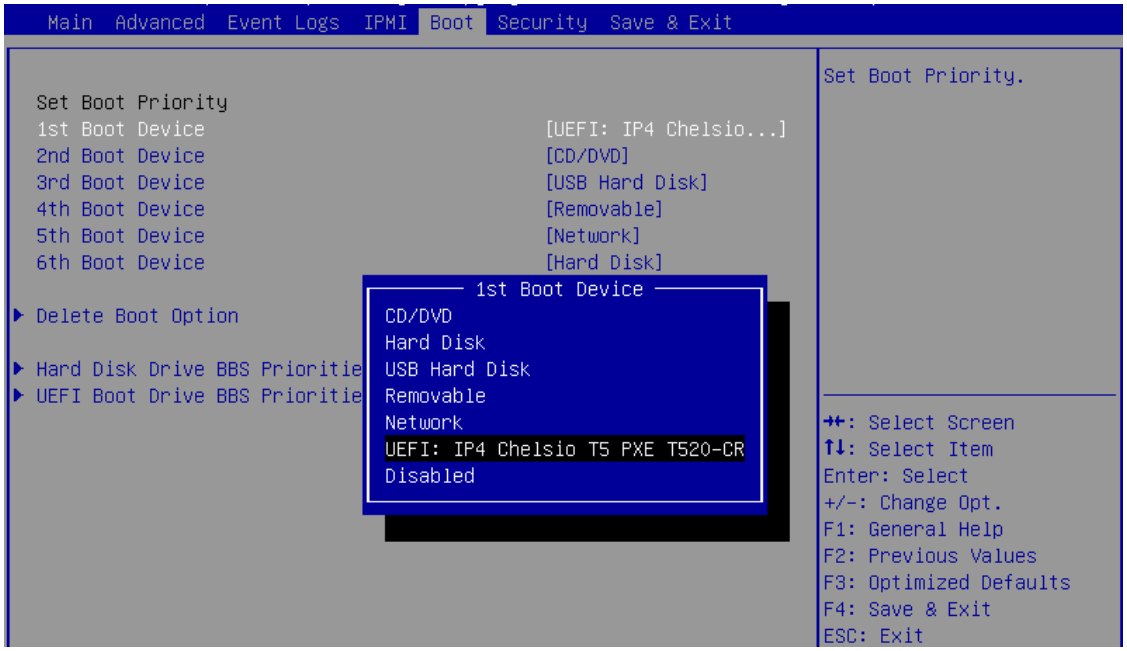
NIC Function enabled	Ports enabled
PXE Function 0	00
PXE Function 1	01
PXE Function 2	02
PXE Function 3	03



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

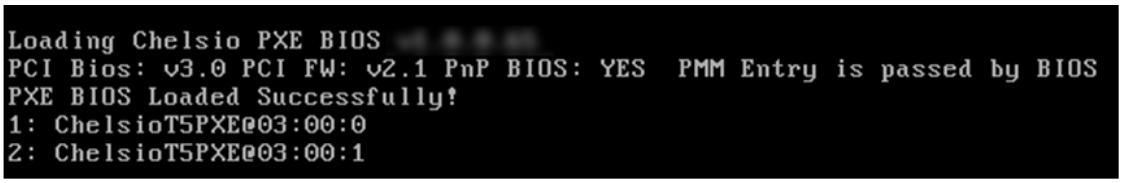


x. Reboot the system and choose any of the available Chelsio PXE devices for PXE boot.



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

xii. Chelsio option ROM will now initialize and setup PXE devices.



6. FCoE boot process

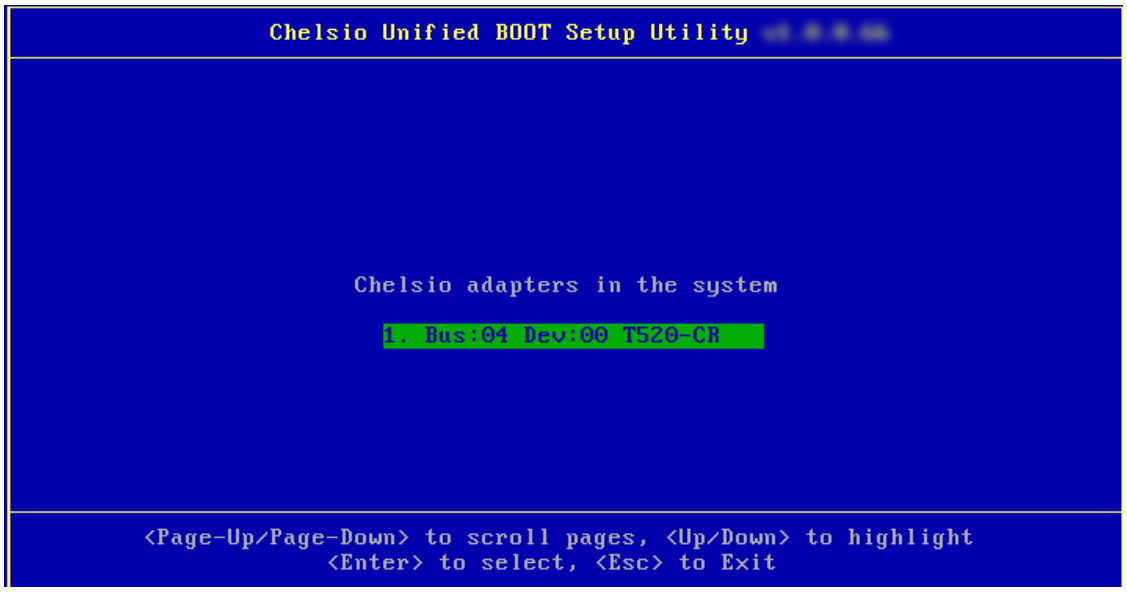
Before proceeding, please ensure that the Chelsio CNA has been flashed with the provided firmware and option ROM (See **Flashing firmware and option ROM**).

6.1. Legacy FCoE boot

i. Reboot the system.

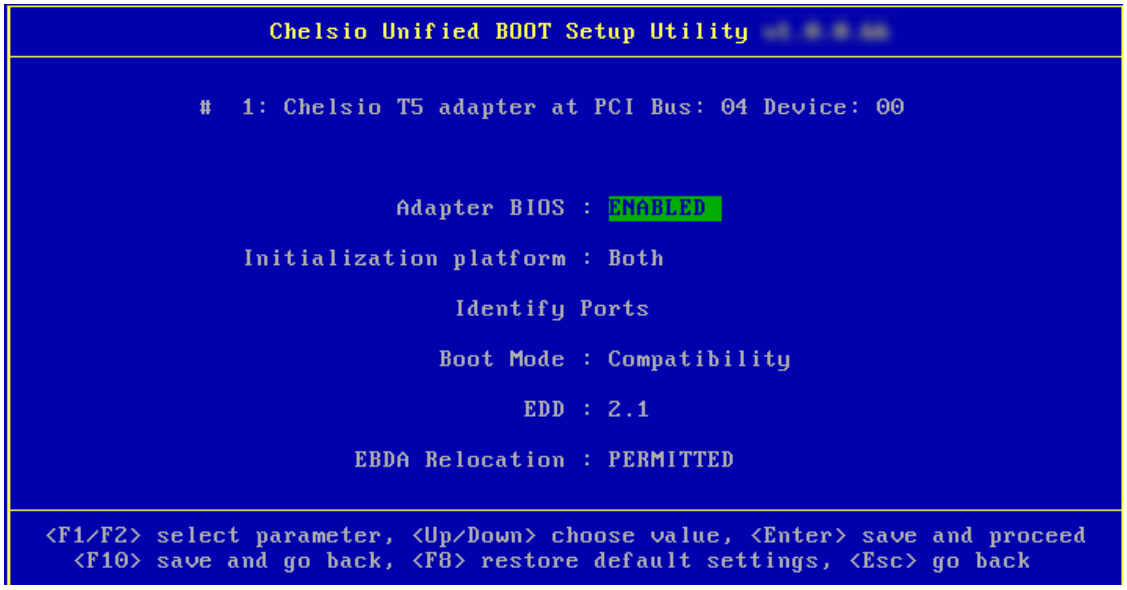
ii. Press [Alt+C] when the message "*Chelsio Unified Boot BIOS vX.X.X.XX, Copyright (C) 2003-2015 Chelsio Communications Press <Alt-C> to Configure T4/T5 Card(s). Press <Alt-S> to skip B*IOS" appears on the screen to enter the configuration utility.

iii. The configuration utility will appear as below:



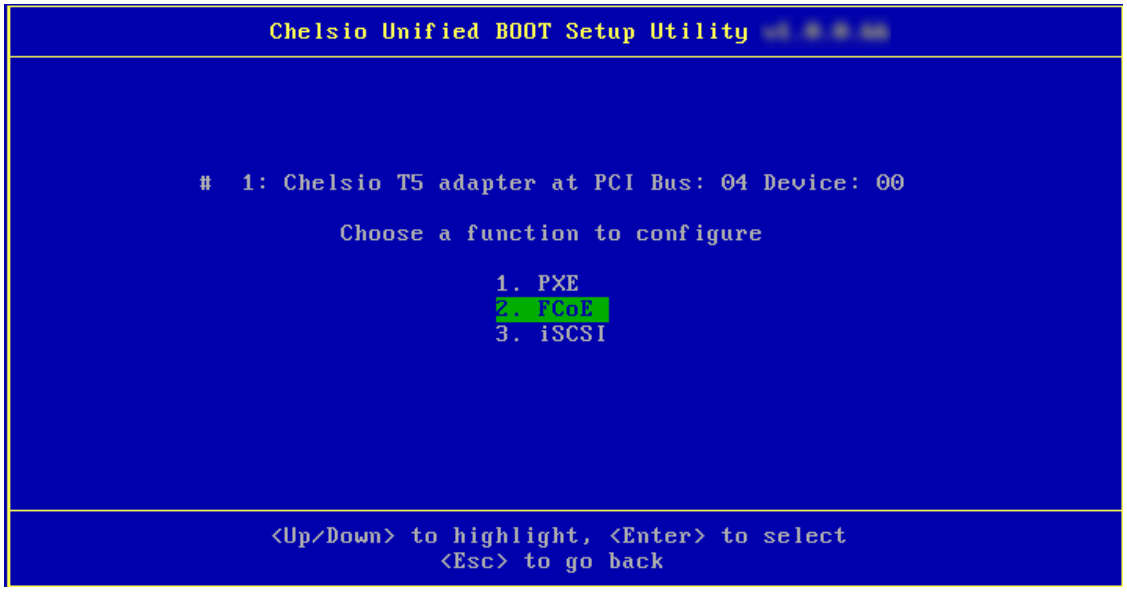
iv. Choose the CNA on which you flashed the option ROM image. Hit [Enter].

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

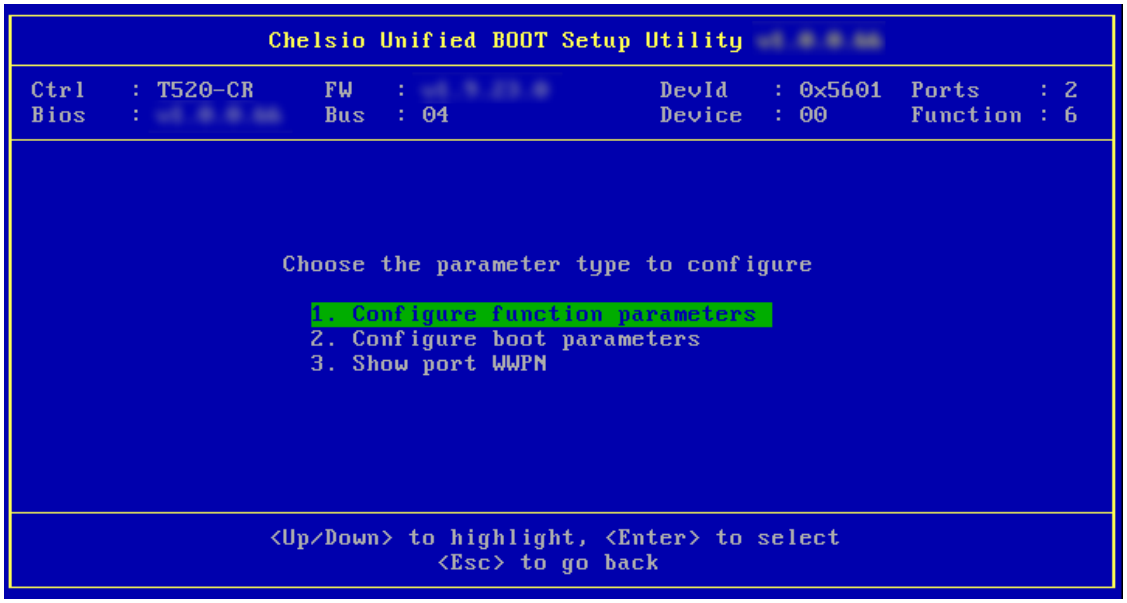


Note *Use the default values for Boot Mode, EDD and EBDA Relocation parameters, unless instructed otherwise.*

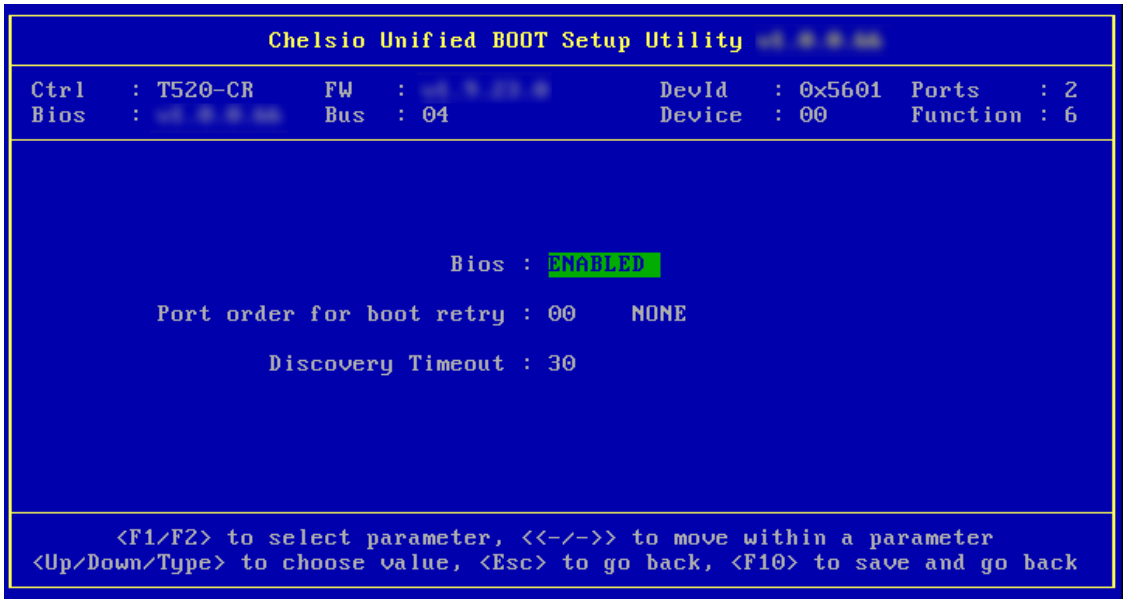
vi. Choose FCoE from the list to configure and hit [Enter].



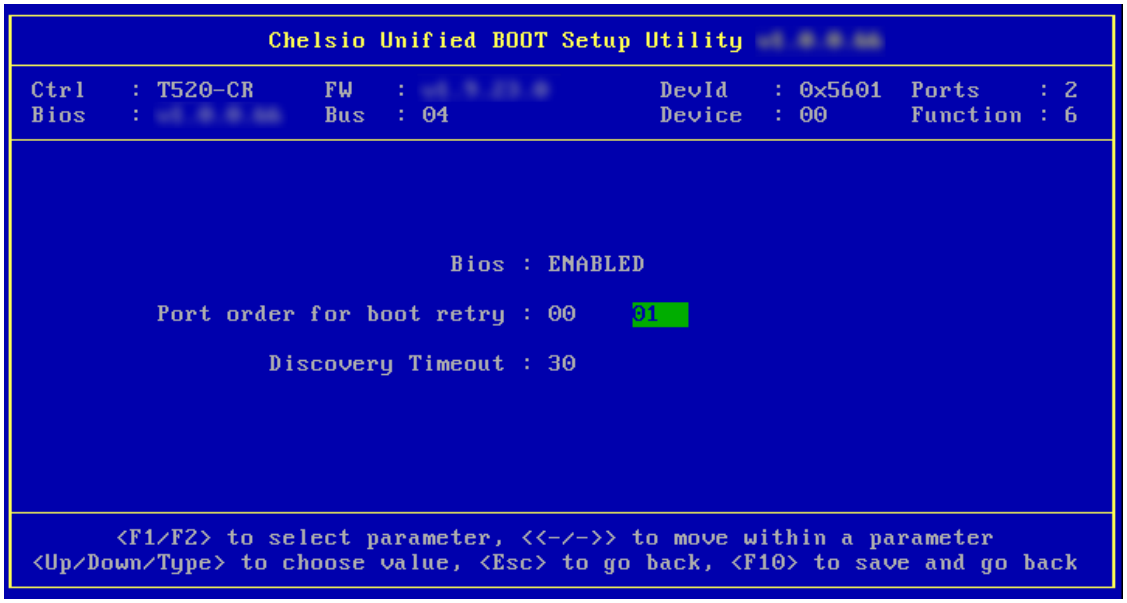
vii. Choose the first option, **Configure function parameters**, from the list of parameter type and hit [Enter].



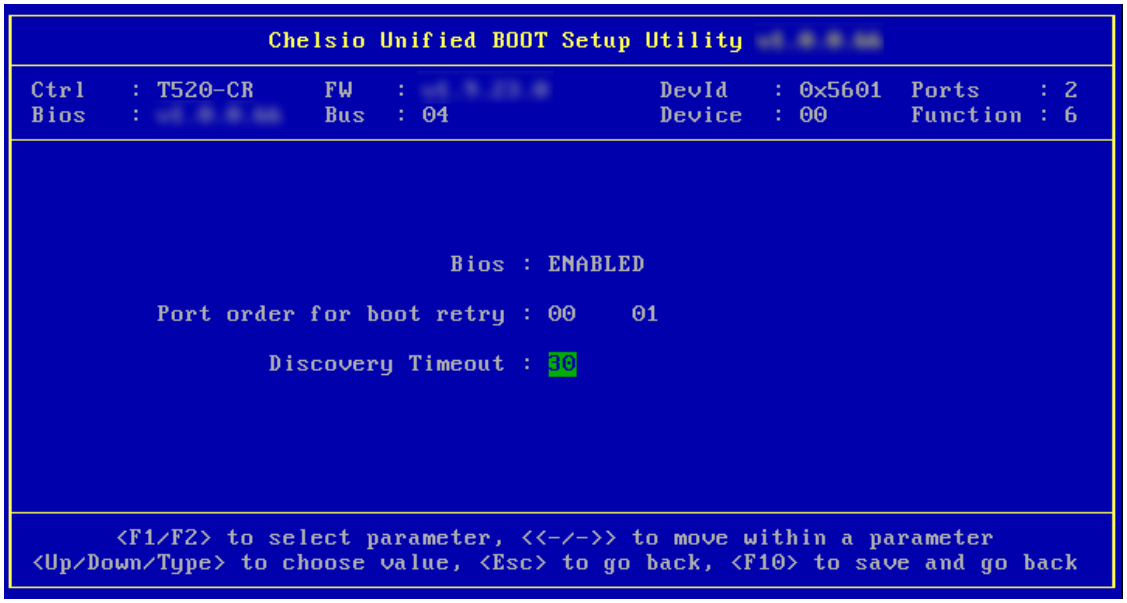
viii. Enable FCoE BIOS if not already enabled.



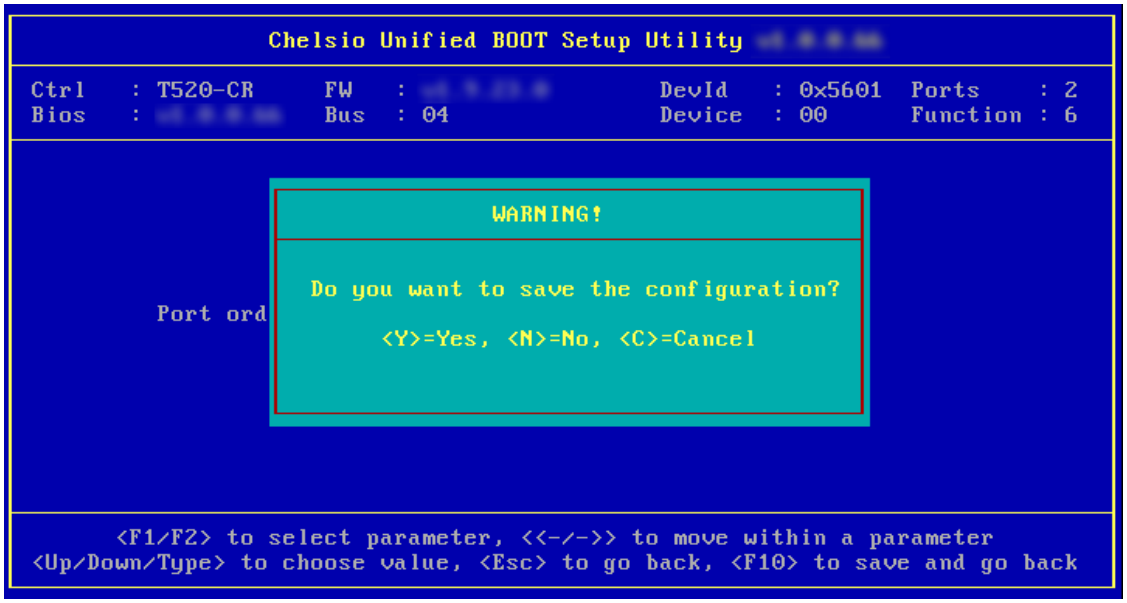
ix. Choose the order of the ports to discover FCoE targets.



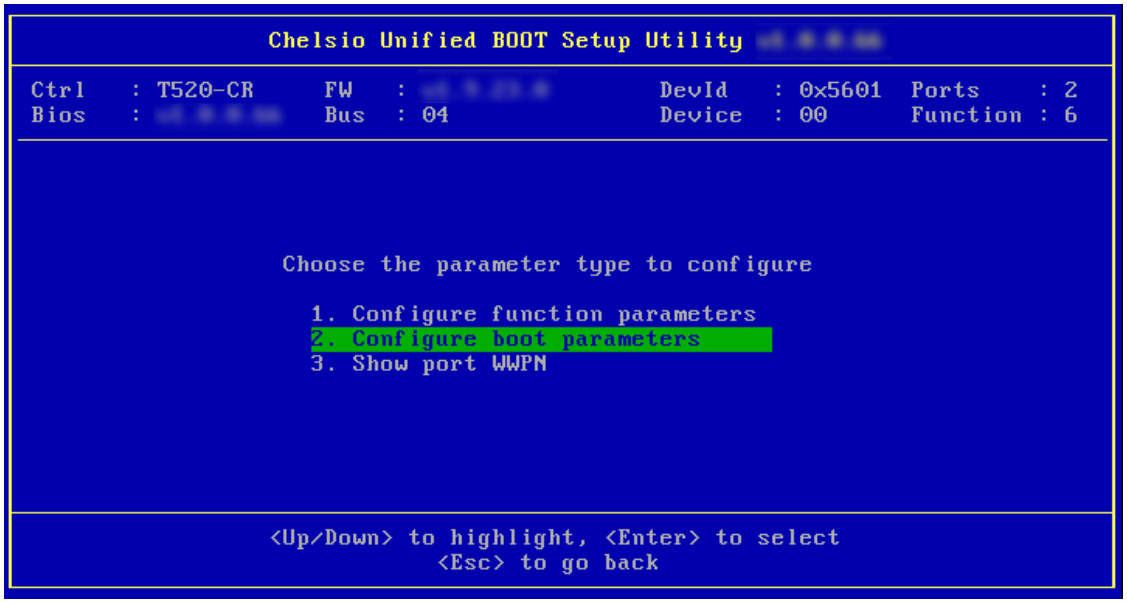
x. Set discovery timeout to a suitable value. Recommended value is >= 30.



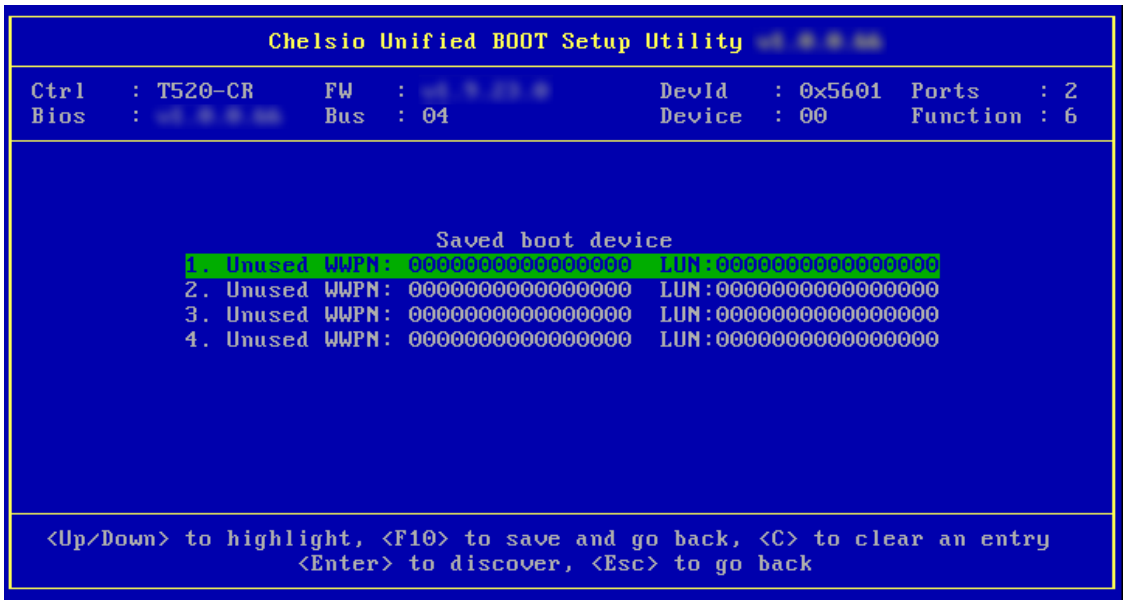
xi. Hit [F10] or [Esc] and then [Y] to save the configuration.



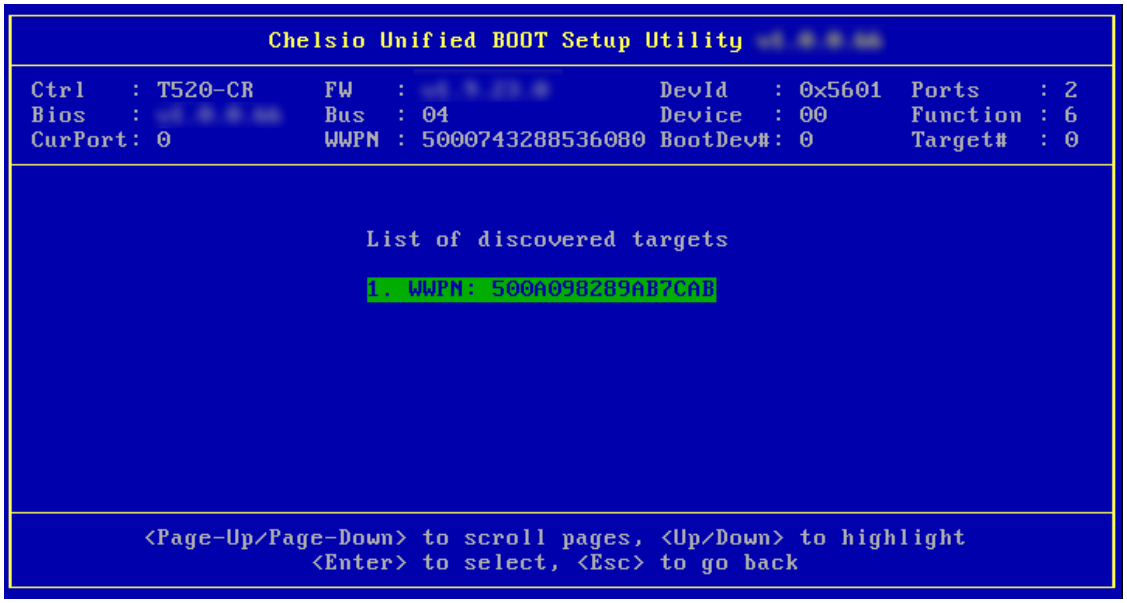
xii. Choose **Configure boot parameters**.



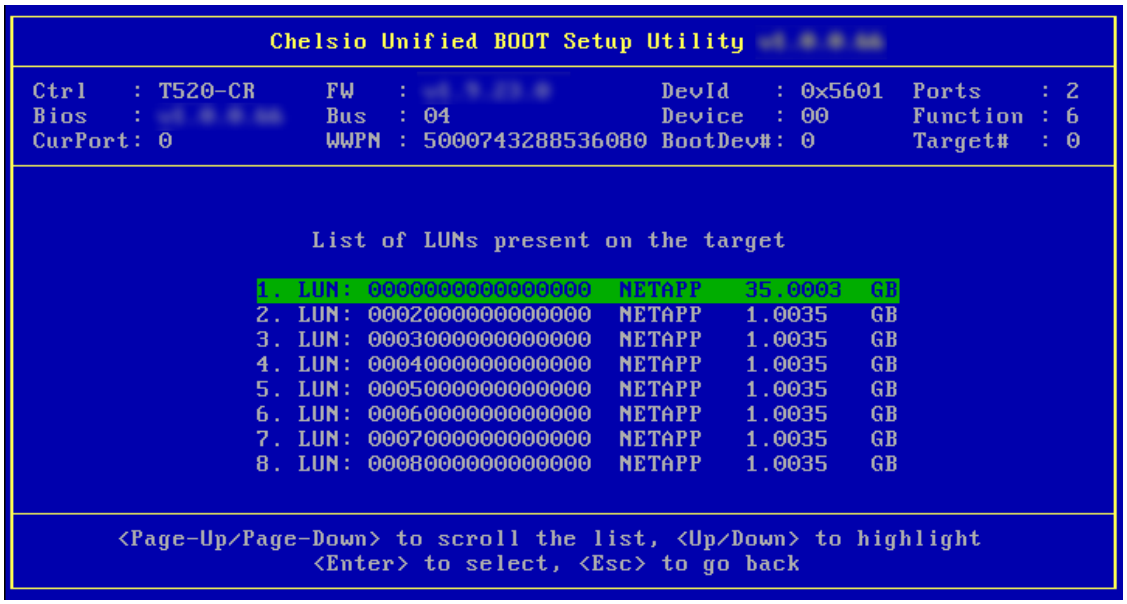
xiii. Select the first boot device and hit [Enter] to discover FC/FCoE targets connected to the switch. Wait till all reachable targets are discovered.

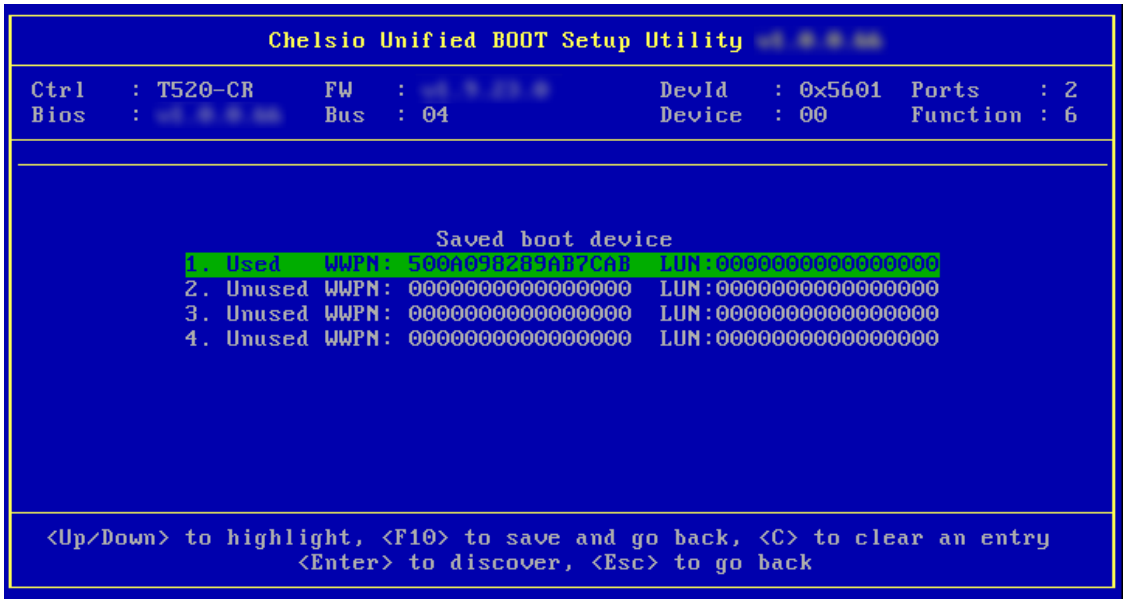


xiv. List of discovered targets will be displayed. Highlight a target using the arrow keys and hit [Enter] to select.

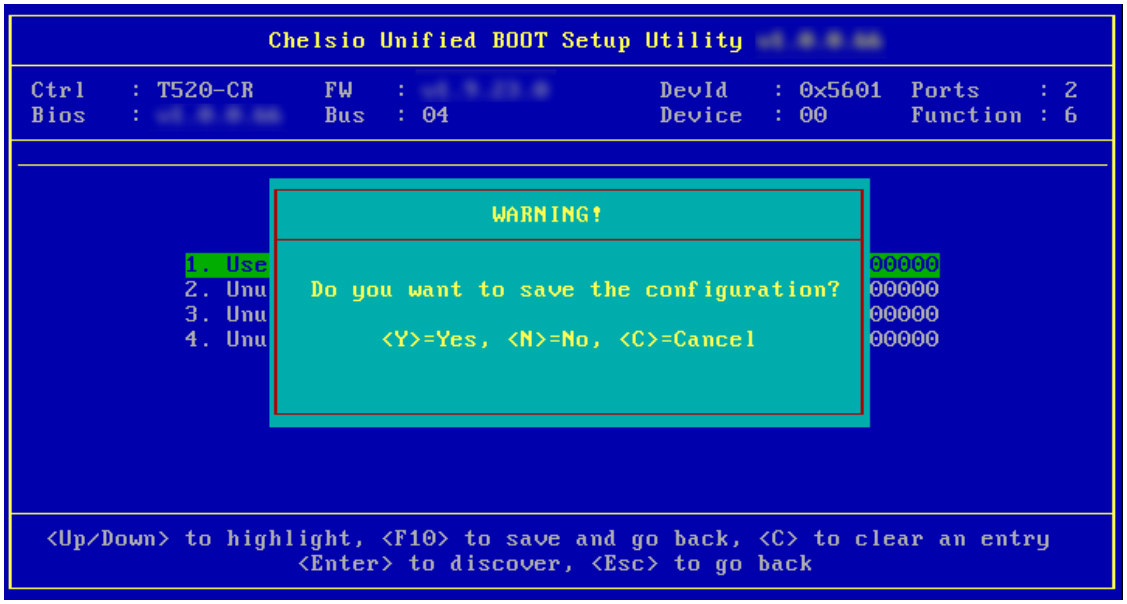


xv. From the list of LUNs displayed for the selected target, choose one on which operating system has to be installed. Hit [Enter].



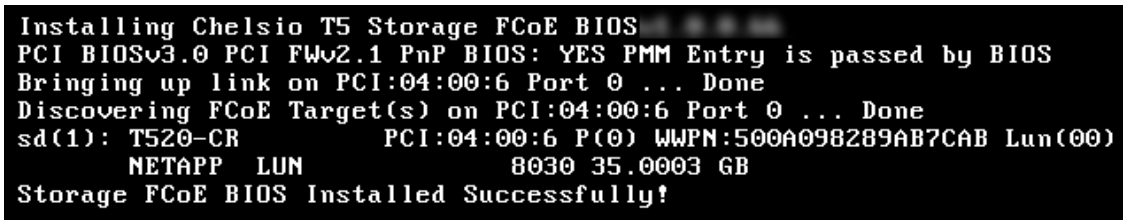


xvi. Hit [F10] or [Esc] and then [Y] to save the configuration.

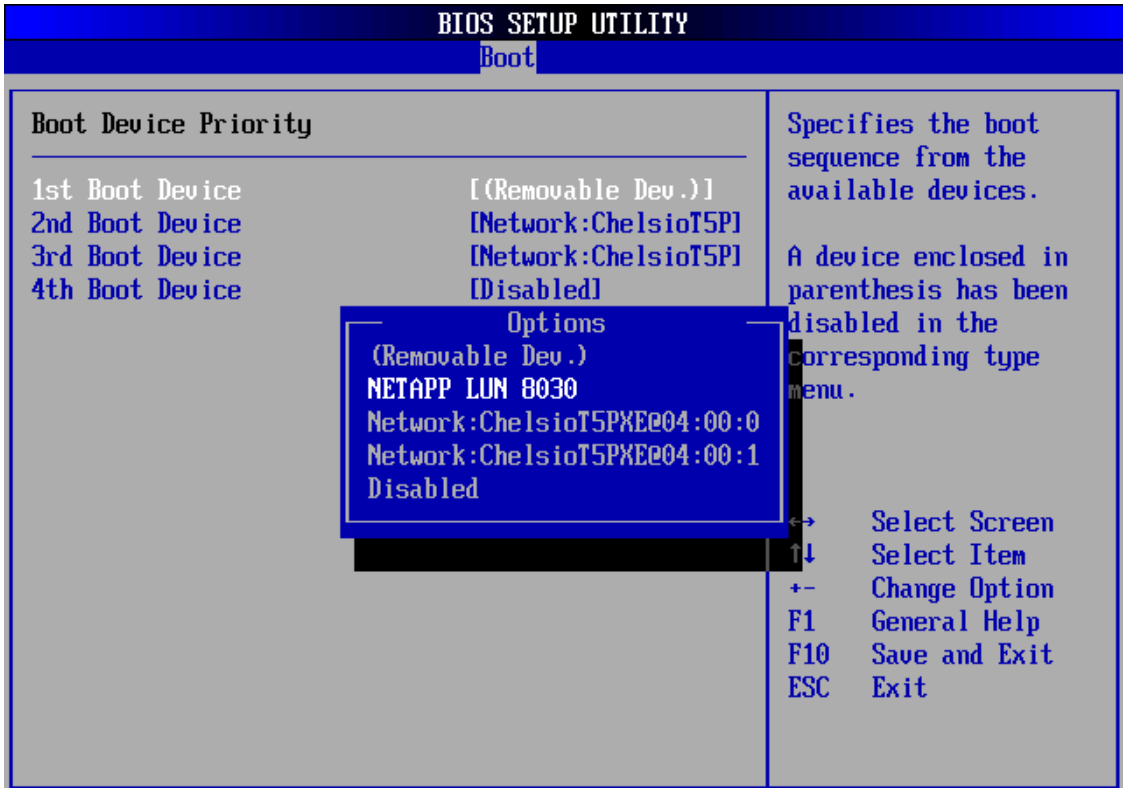


xvii. Reboot the machine.

xviii. During POST, Chelsio option ROM will discover FCoE targets.



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.

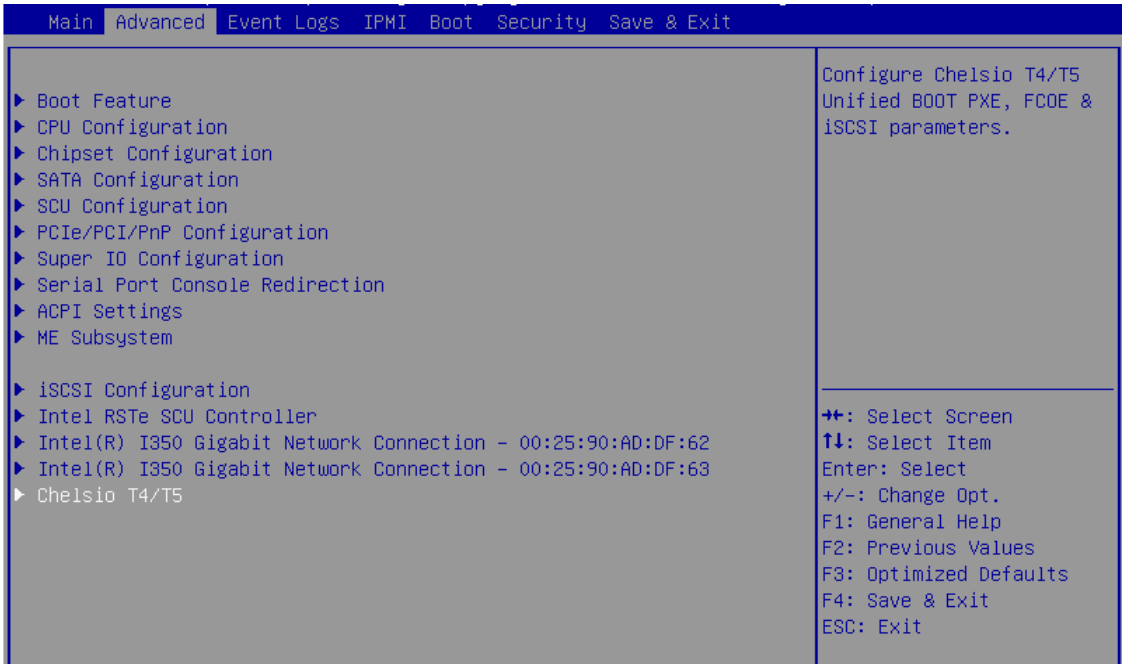
6.2. uEFI FCoE Boot

Important

- *Only uEFI v2.1 and v2.3.1 supported.*
- *Any other uEFI version is NOT SUPPORTED and may render your system unusable.*

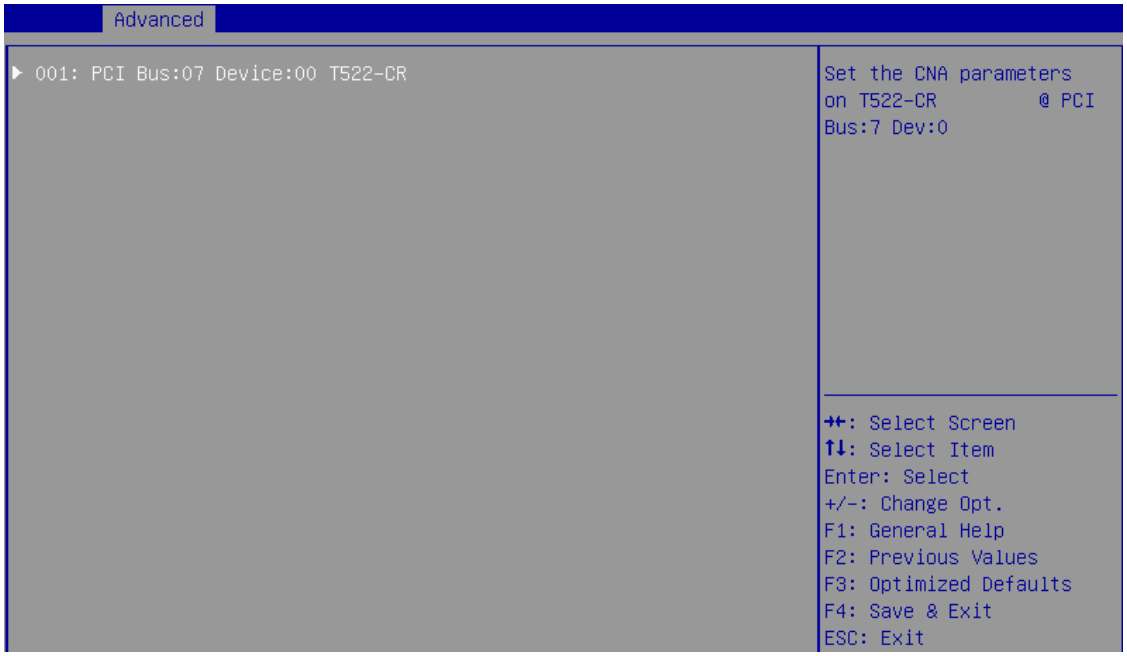
i. Reboot the system and go into BIOS setup.

ii. Select **Chelsio T4/T5** and press [Enter]

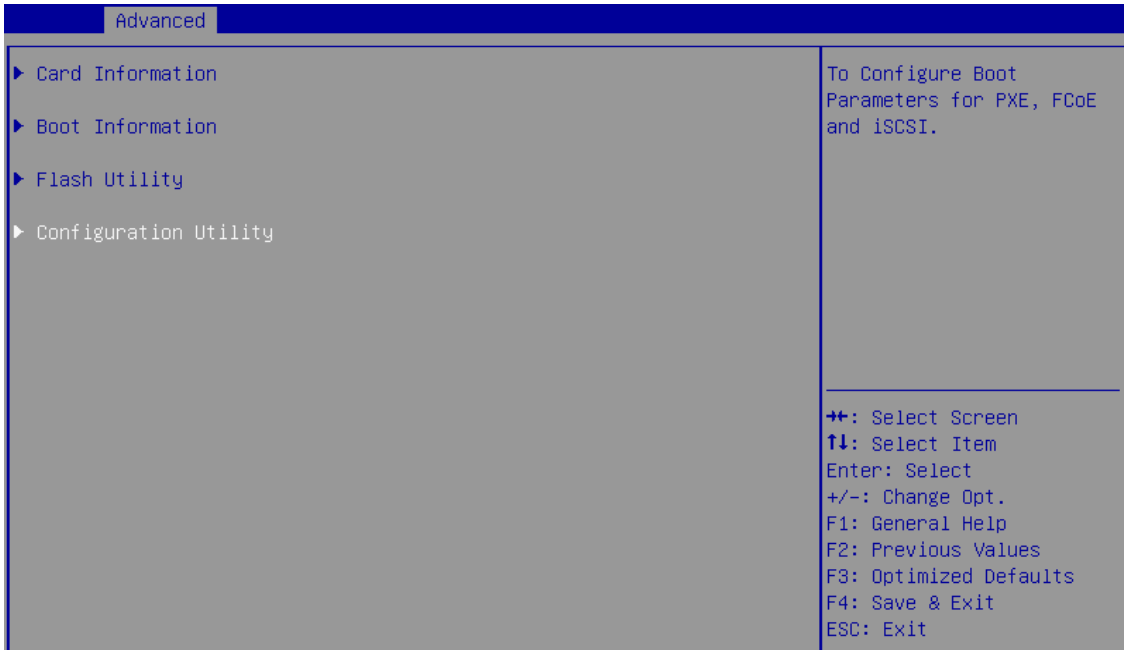


Note *If Chelsio T4/T5 is not listed, please ensure that Chelsio uEFI driver is loaded correctly as mentioned* ***here*** *in the* ***Flashing Firmware and Option ROM*** *section.*

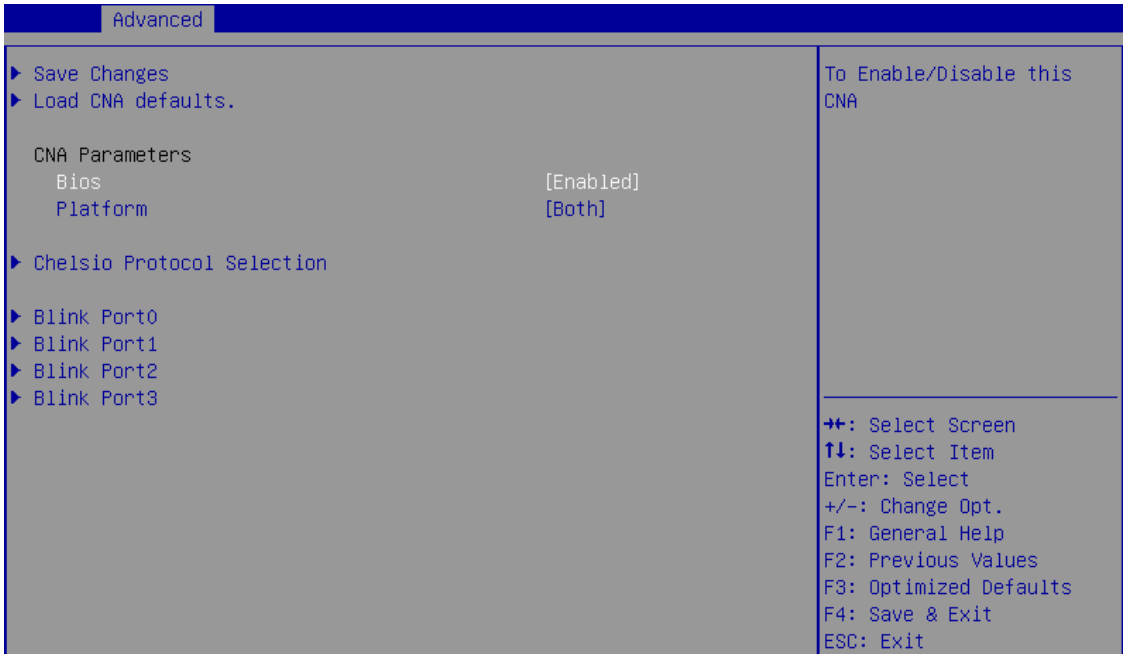
iii. Select the Chelsio adapter to be configured and press [Enter].



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

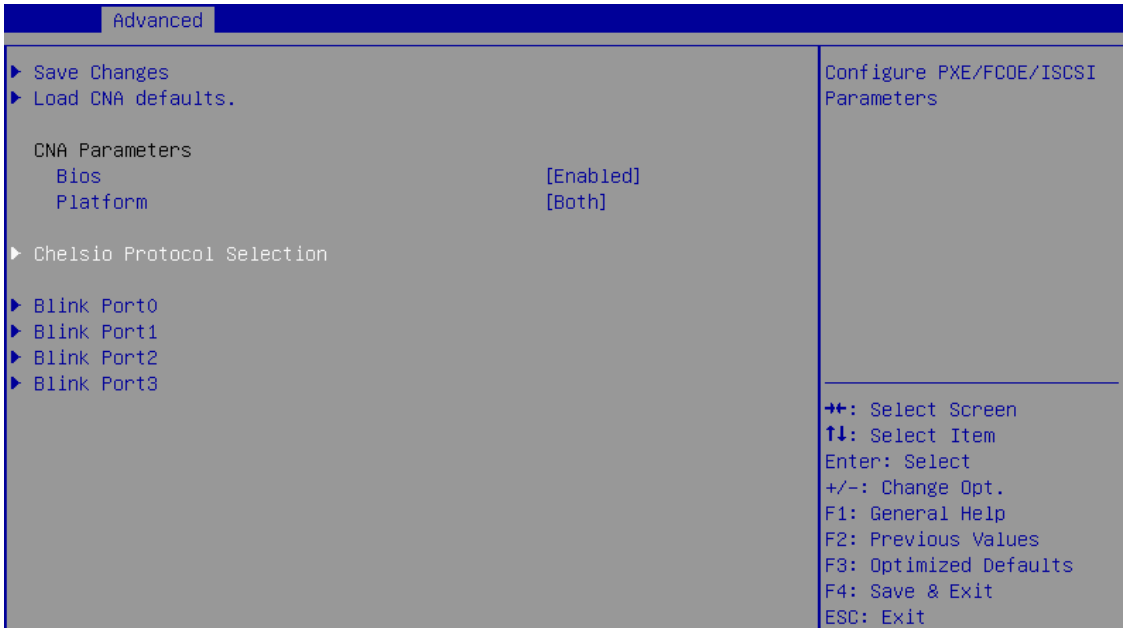


v. Enable adapter BIOS if not already enabled.

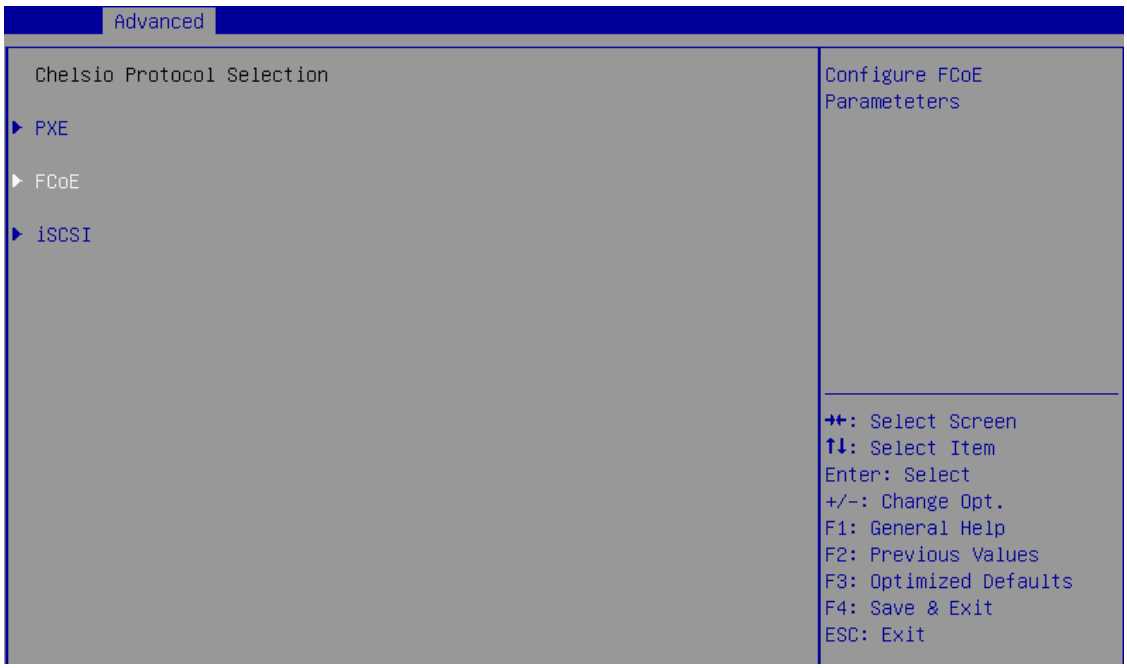


Note *It is highly recommended that you use the **Save Changes** option every time a parameter/option is changed.*

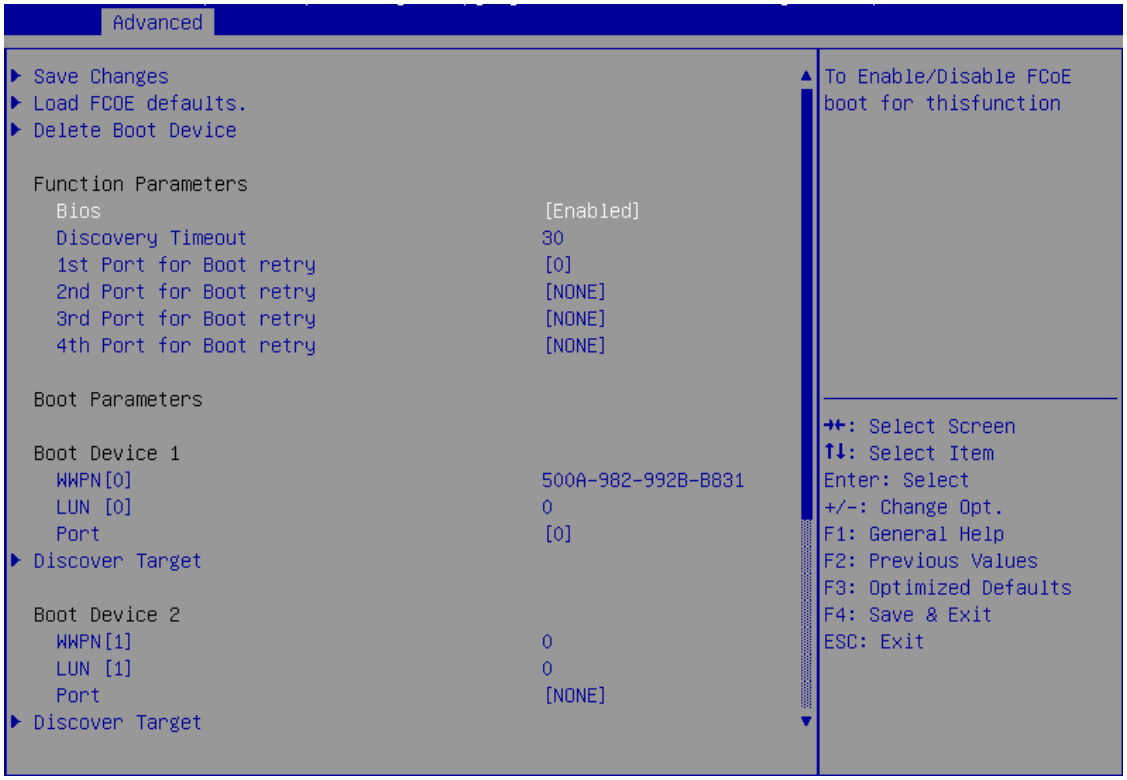
vi. Select **Chelsio Protocol Selection** and press [Enter].



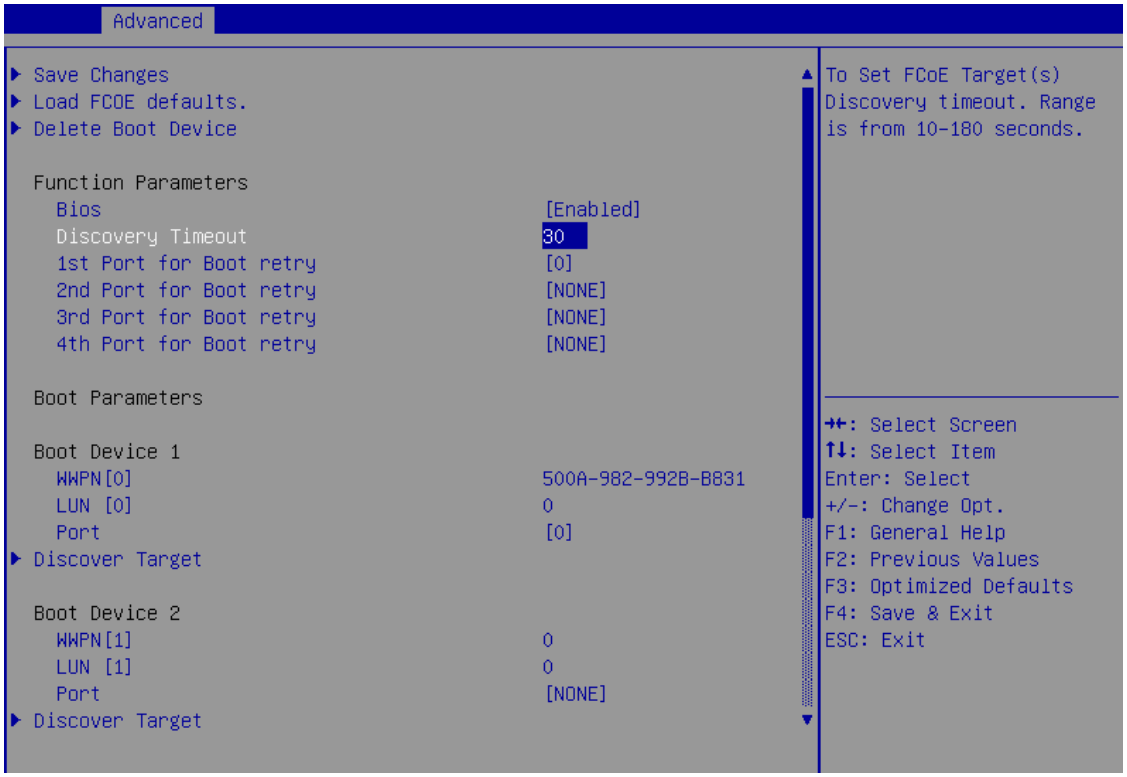
vii. Select **FCoE** and press [Enter].



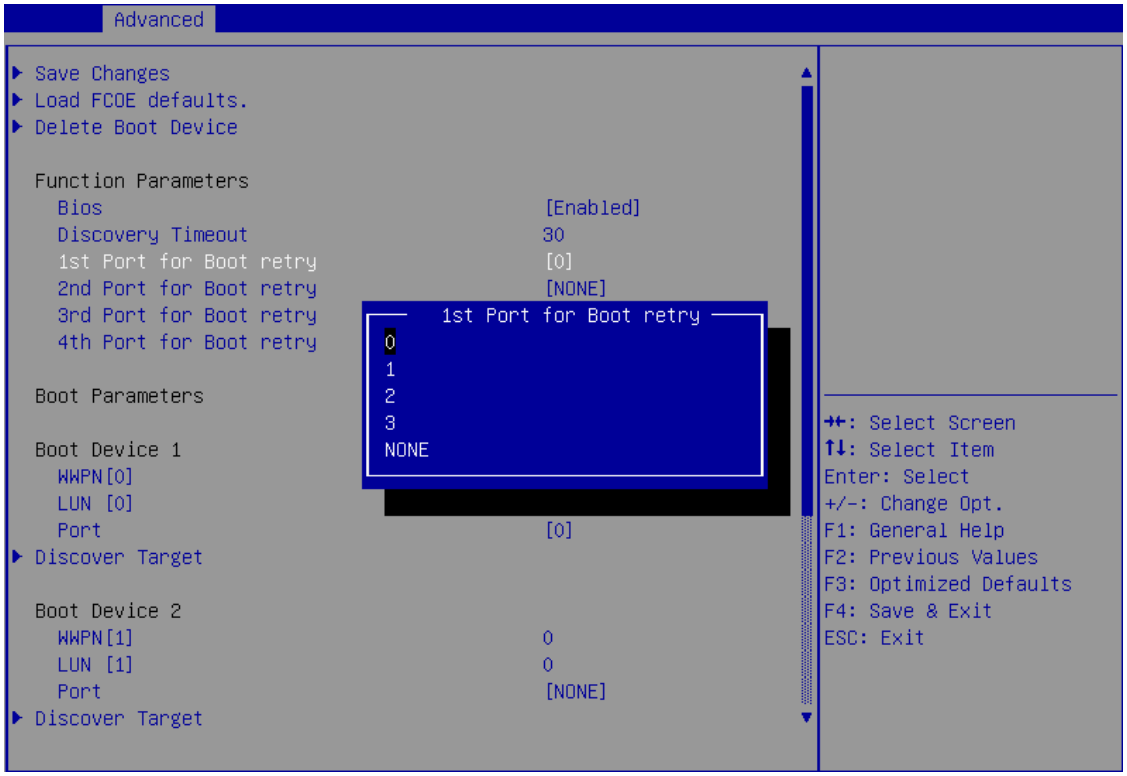
viii. Under **Function Parameters**, enable FCoE BIOS, if not already enabled.



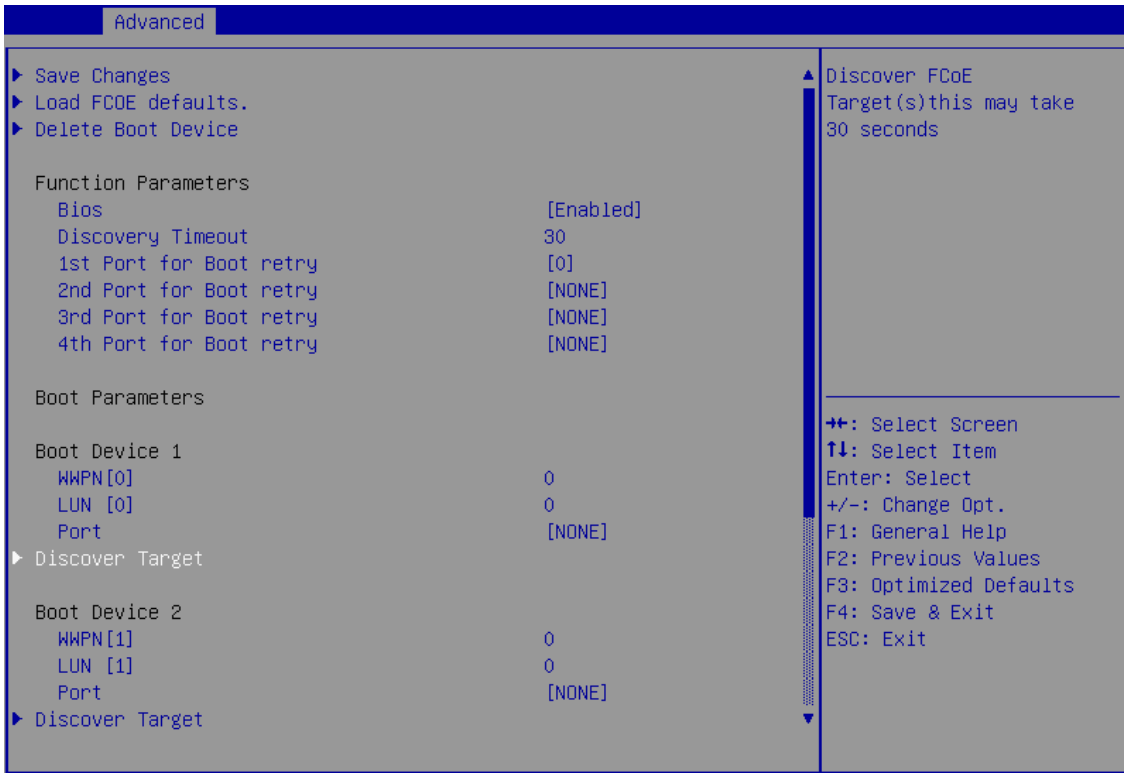
ix. Set discovery timeout to a suitable value. Recommended value is >= 30



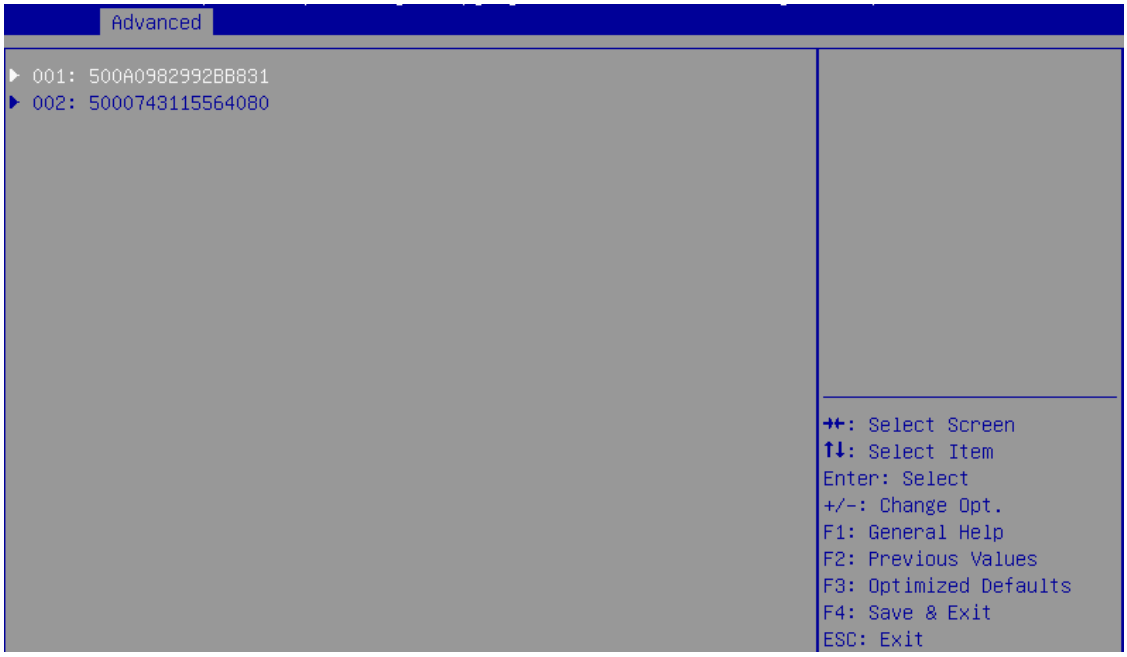
x. Choose the order of the ports to discover FCoE targets.



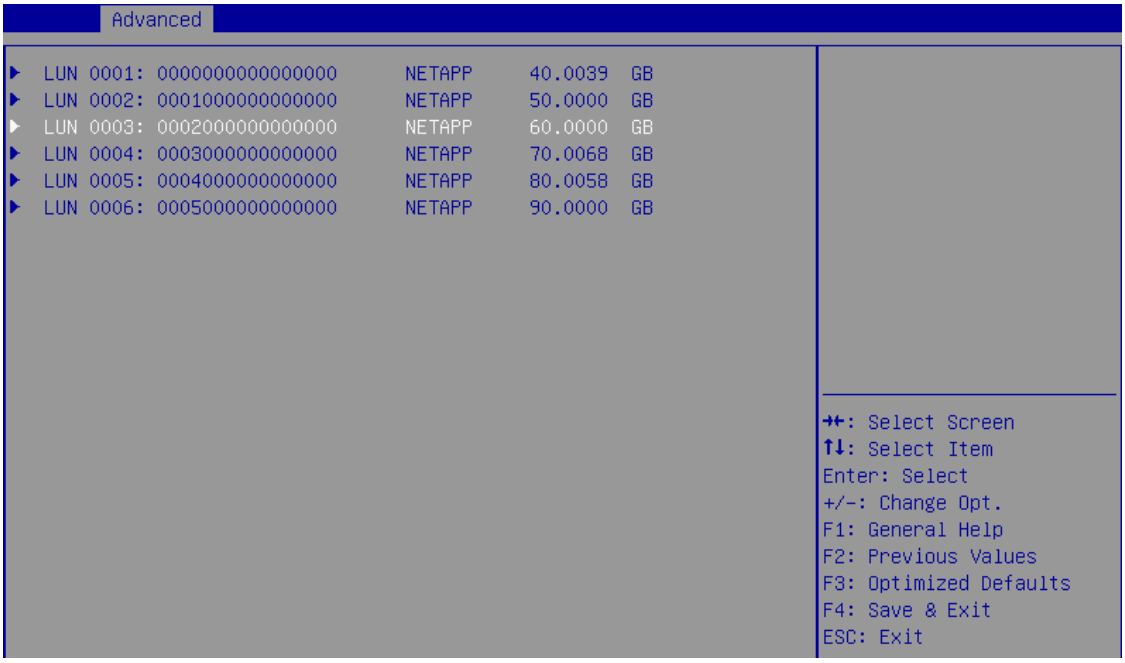
xi. Under the first boot device, select **Discover Target** and press [Enter] to discover FC/FCoE targets connected to the switch. Wait till all reachable targets are discovered.



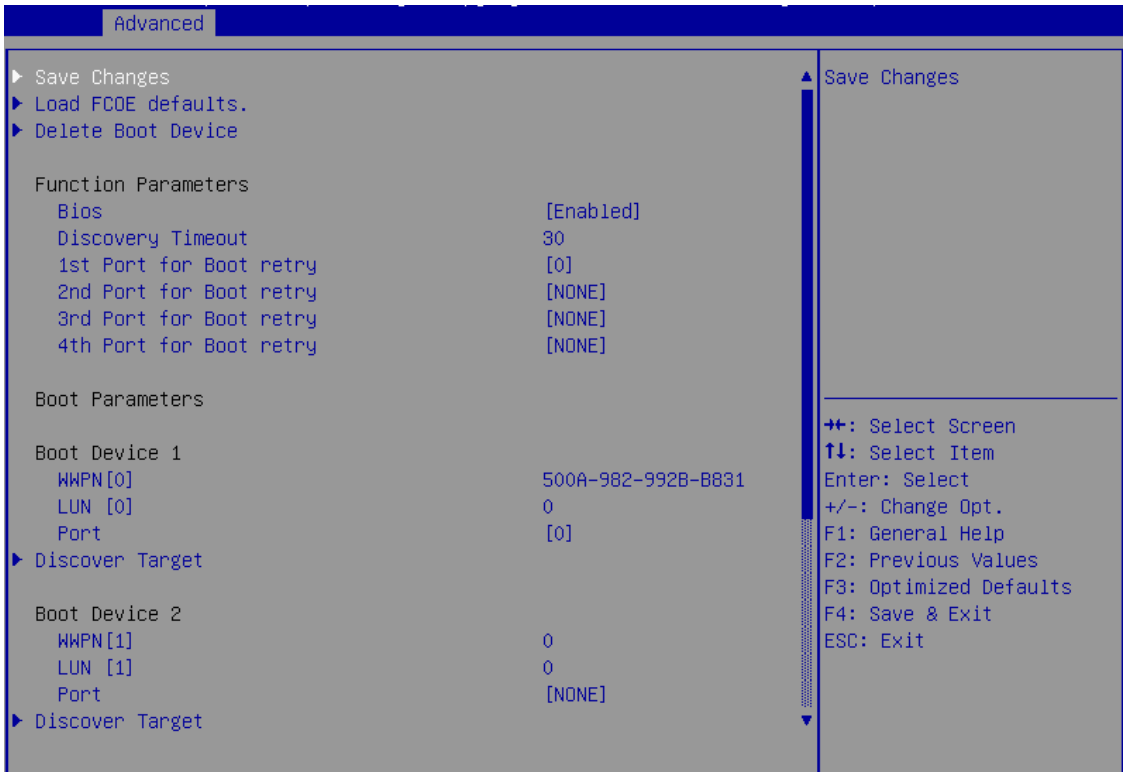
xii. List of discovered targets will be displayed. Highlight a target to select it and hit [Enter].



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

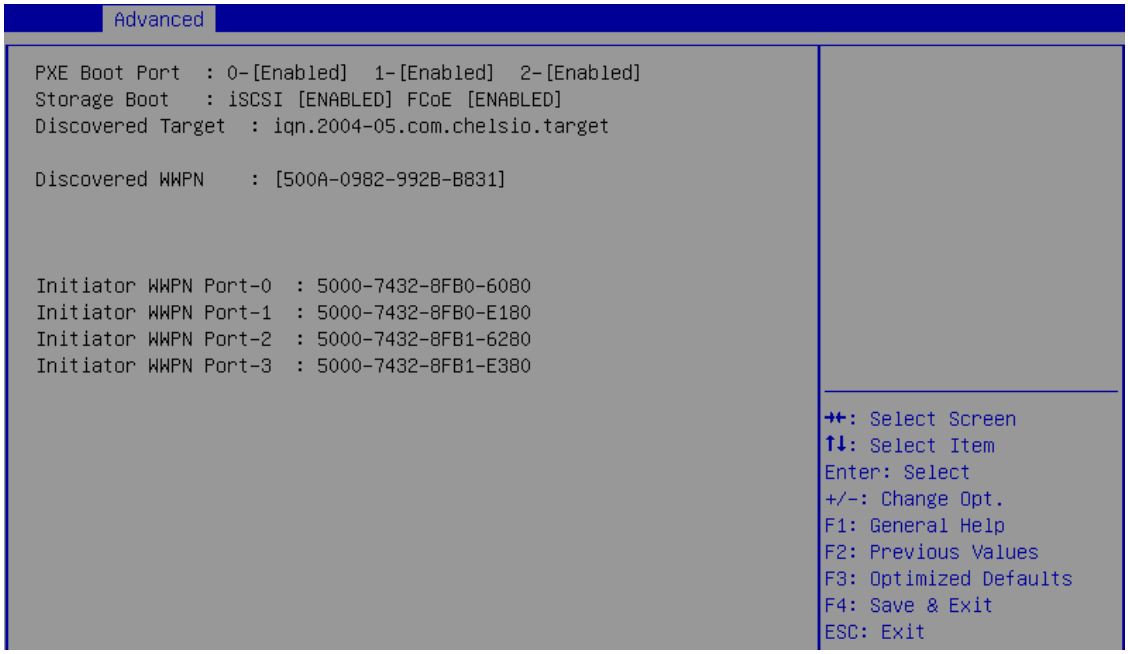


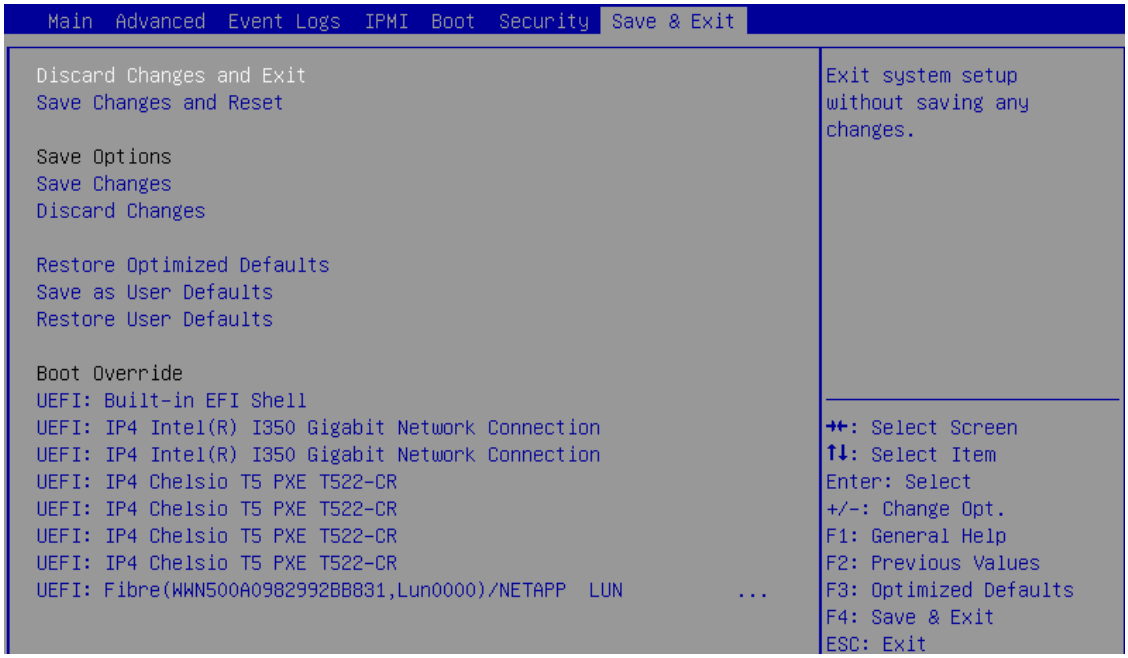
xiv. Select **Save Changes** and press [Enter].



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.

7. iSCSI boot process

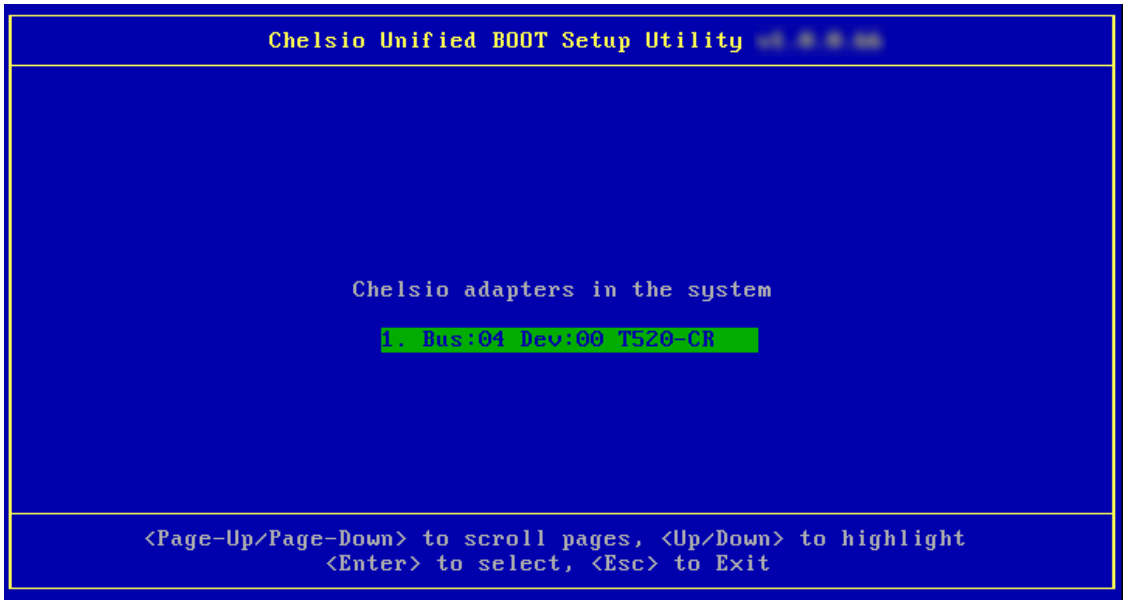
Before proceeding, please ensure that the Chelsio CNA has been flashed with the provided firmware and option ROM (See **Flashing Firmware and option ROM**).

7.1. Legacy iSCSI boot

i. Reboot the system.

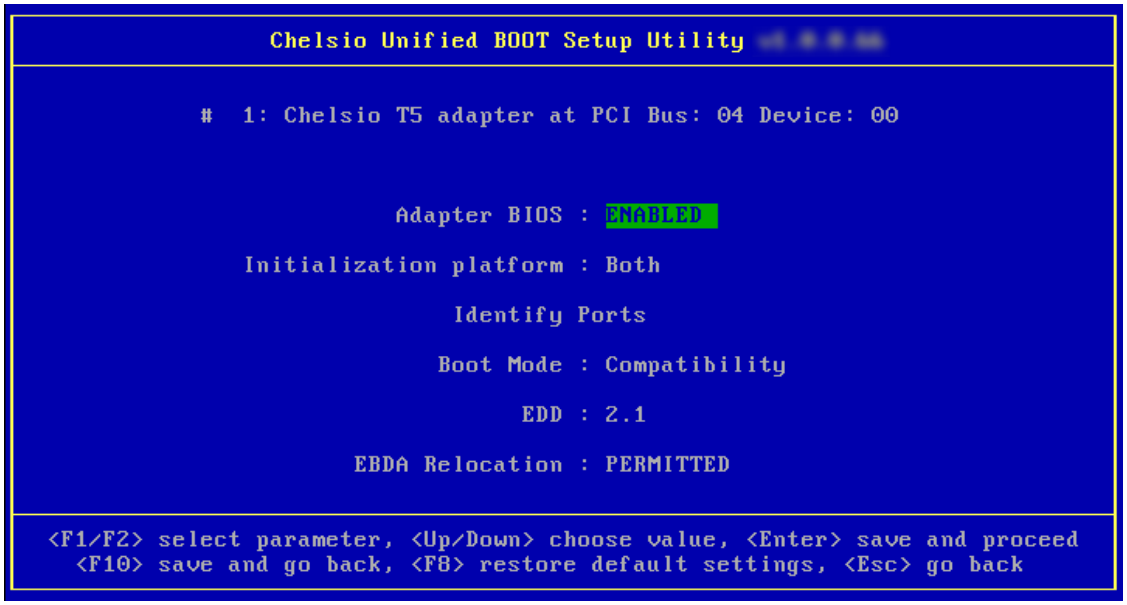
ii. Press [Alt+C] when the message "*Chelsio Unified Boot BIOS vX.X.X.XX, Copyright (C) 2003-2015 Chelsio Communications Press <Alt-C> to Configure T4/T5 Card(s). Press <Alt-S> to skip B*IOS" appears on the screen to enter the configuration utility.

iii. The configuration utility will appear as below:



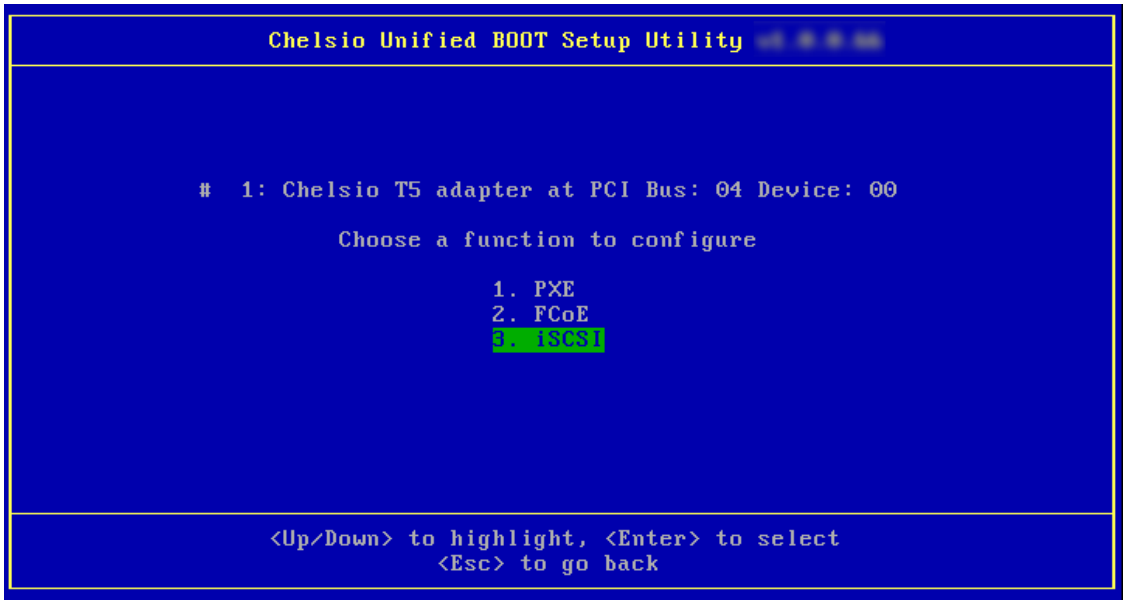
iv. Choose the CNA on which you flashed the option ROM image. Hit [Enter].

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

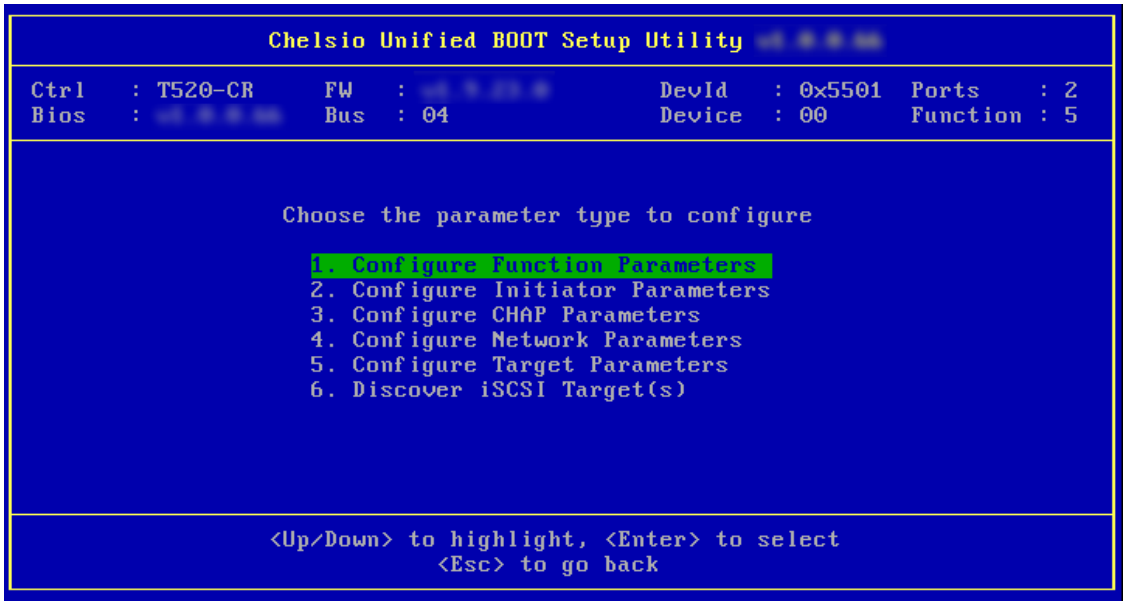


Note *Use the default values for Boot Mode, EDD and EBDA Relocation parameters, unless instructed otherwise.*

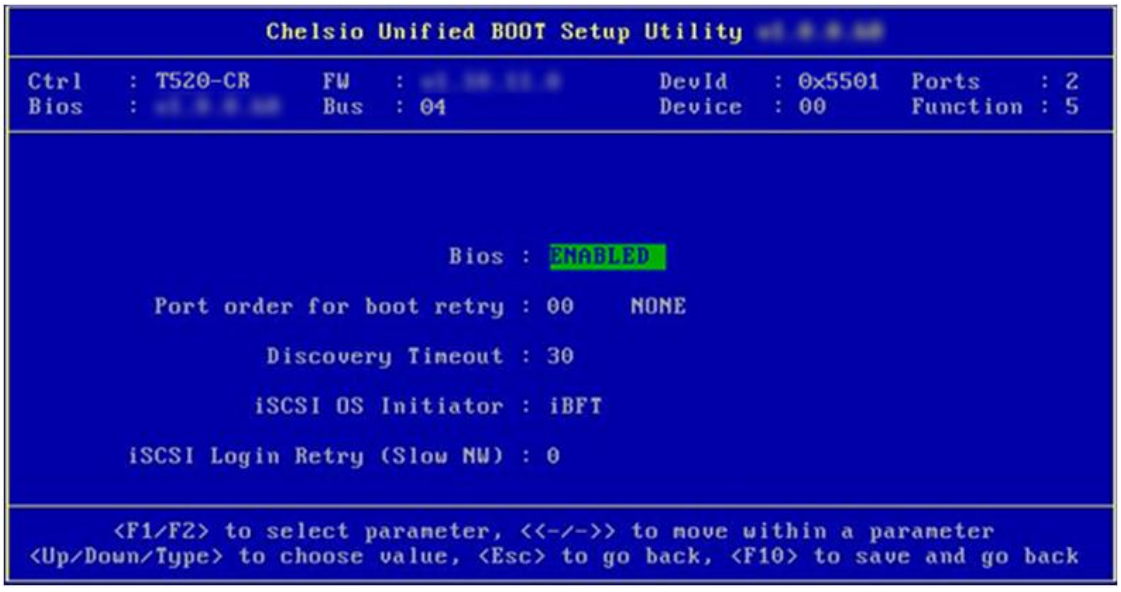
vi. Choose *iSCSI* from the list to configure and hit [Enter].



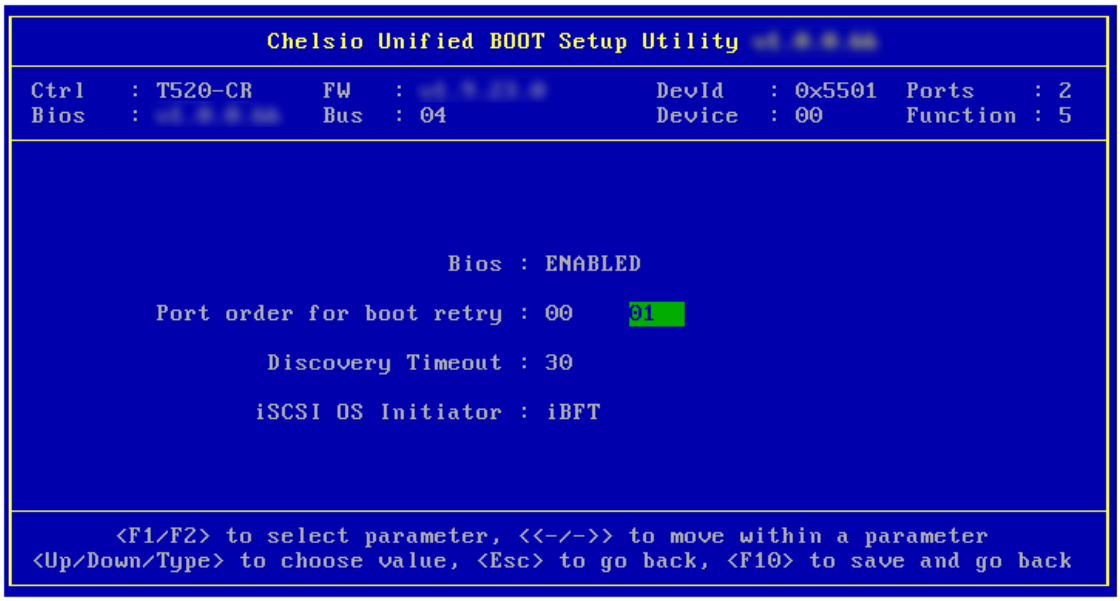
vii. Choose the first option, **Configure Function Parameters**, from the list of parameter type and hit [Enter].



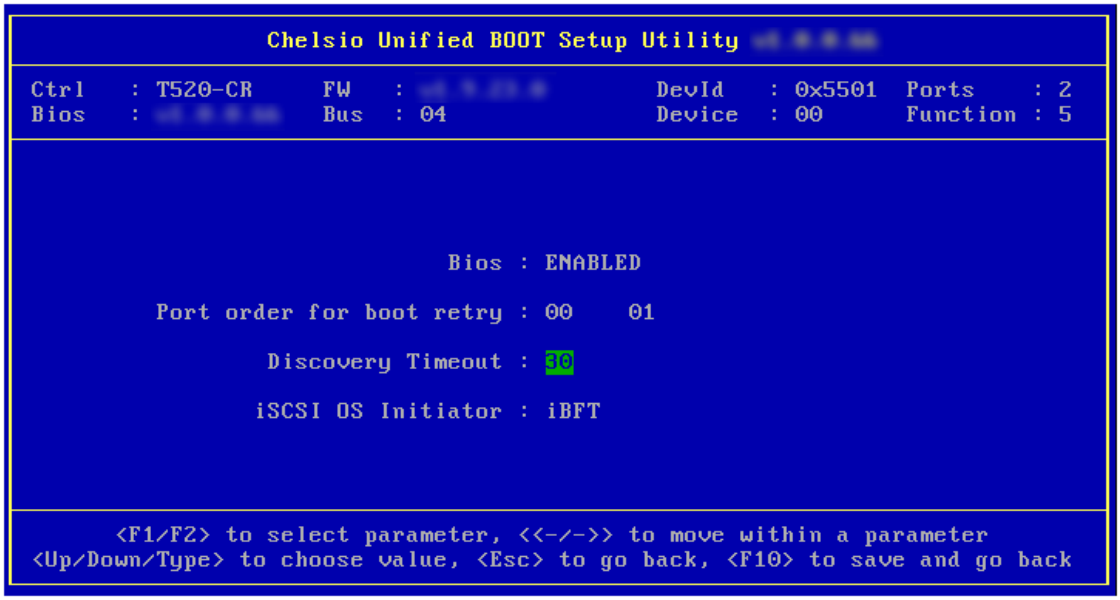
viii. Enable iSCSI BIOS if not already enabled. iBFT (iSCSI Boot Firmware Table) will be selected by default. You can also configure the number of iSCSI login attempts (retries) in case the network is unreachable or slow.



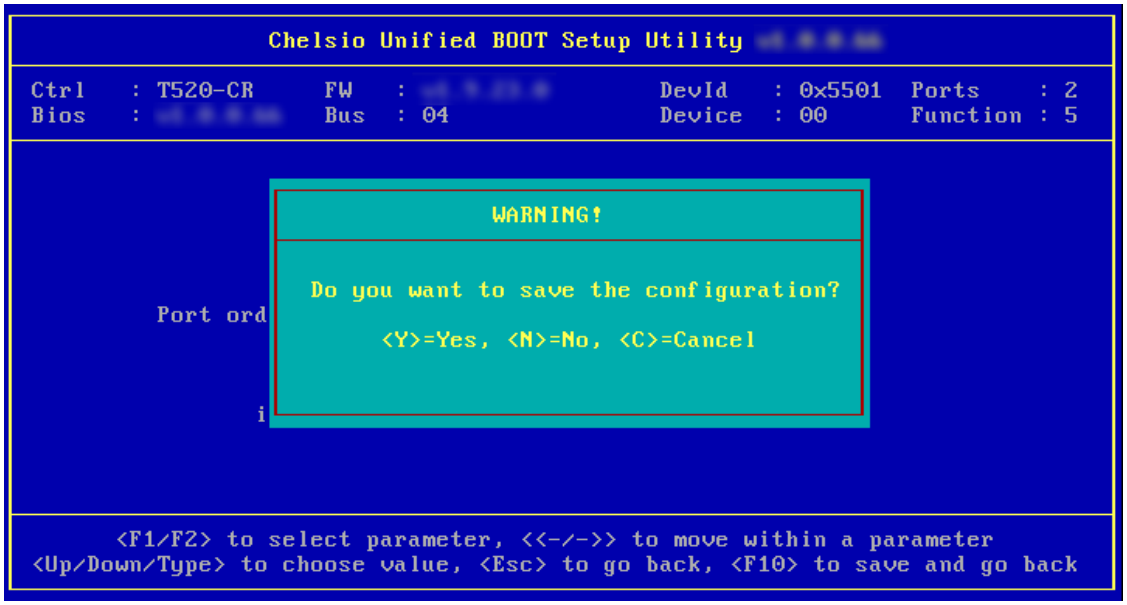
ix. Choose the order of the ports to discover iSCSI targets.



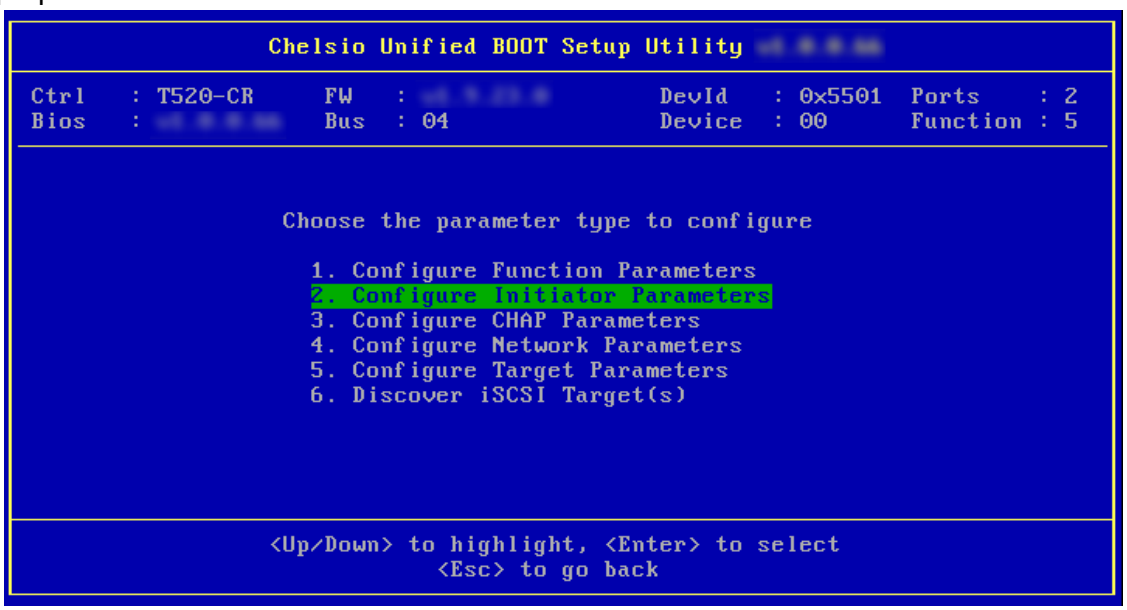
x. Set discovery timeout to a suitable value. Recommended value is >= 30.



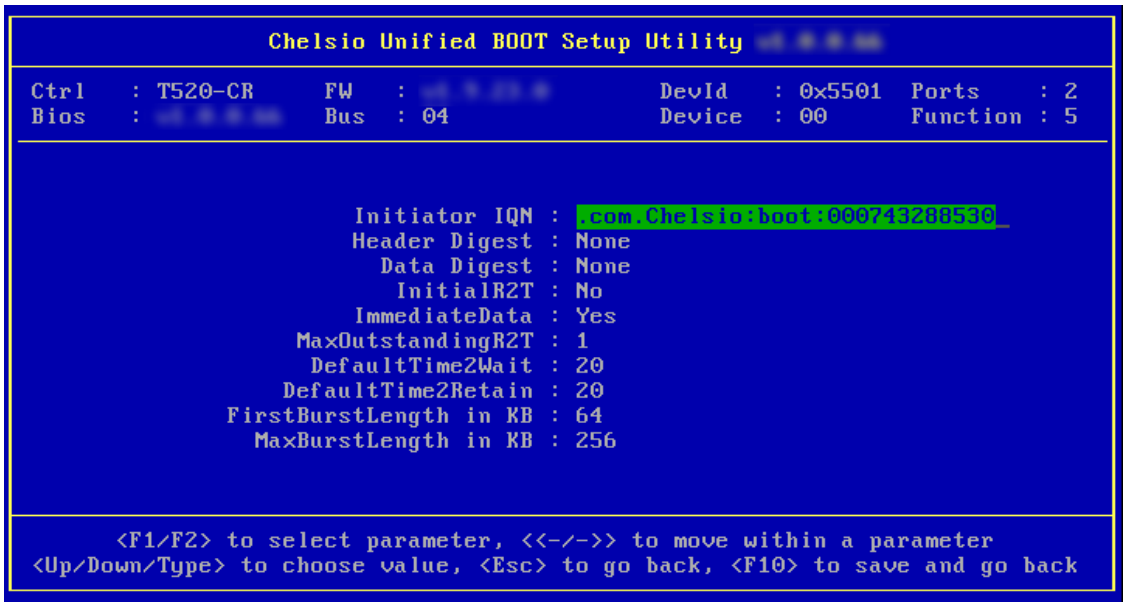
xi. Hit [Esc] and then [Y] to save the configuration.



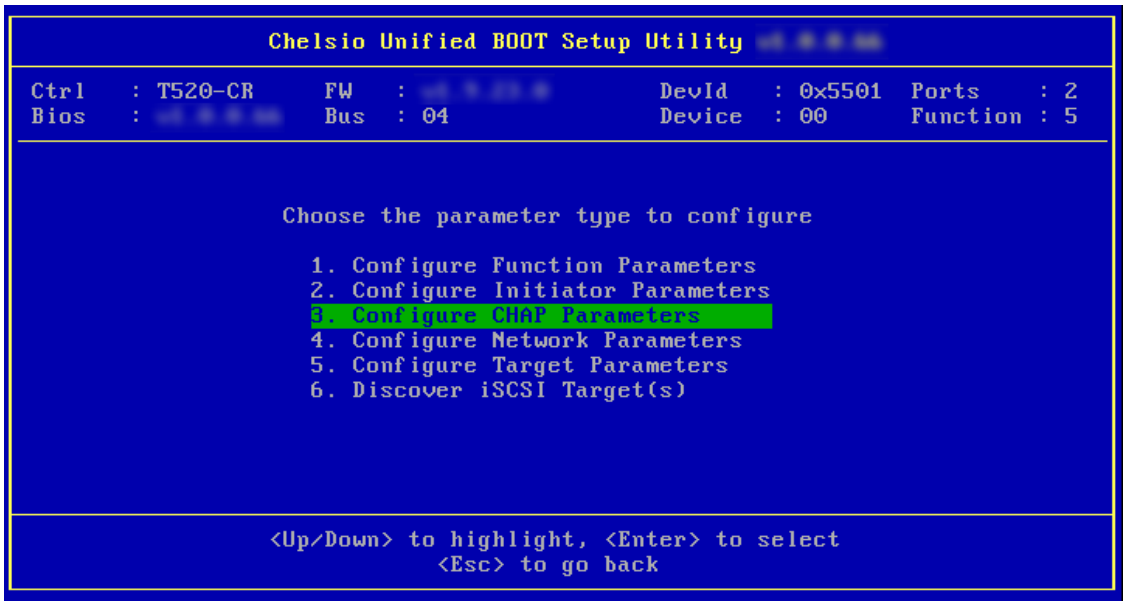
xii. Go back and choose **Configure Initiator Parameters** to configure initiator related properties.



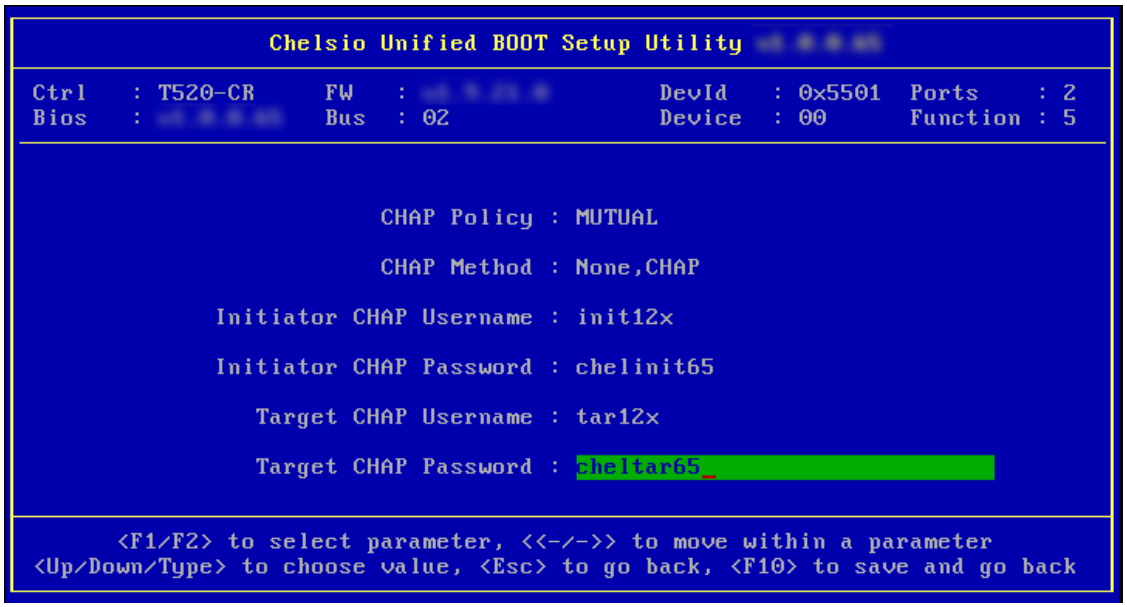
xiii. Initiator properties like IQN, Header Digest, Data Digest, etc will be displayed. Change the values appropriately or continue with the default values. Hit [F10] to save.



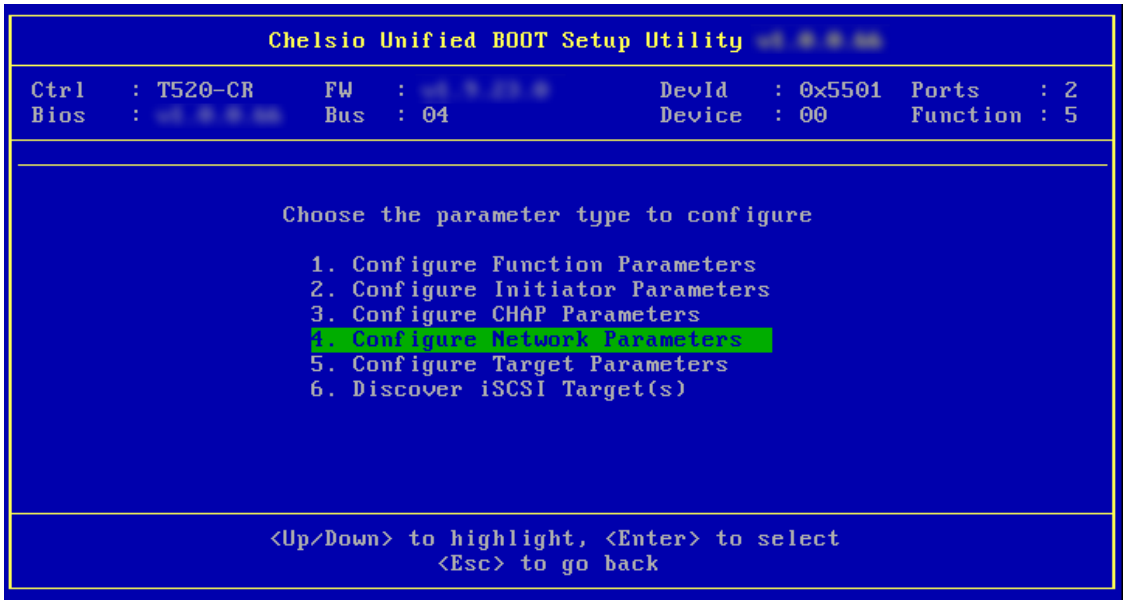
xiv. CHAP authentication is disabled by default. To enable and configure, go back and choose **Configure CHAP Parameters**



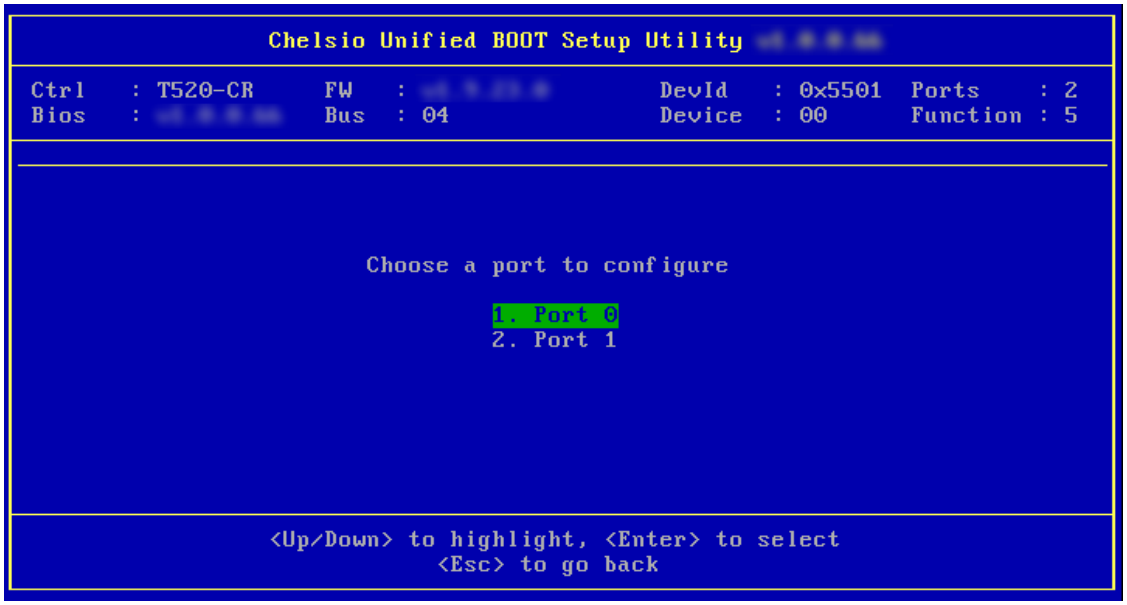
xv. Enable CHAP authentication by selecting *ENABLED* in the **CHAP Policy** field. Next, choose either *one-way* or *mutual* as the authentication method. Finally, provide Initiator and Target CHAP credentials according to the authentication method selected. Hit [F10] to save.



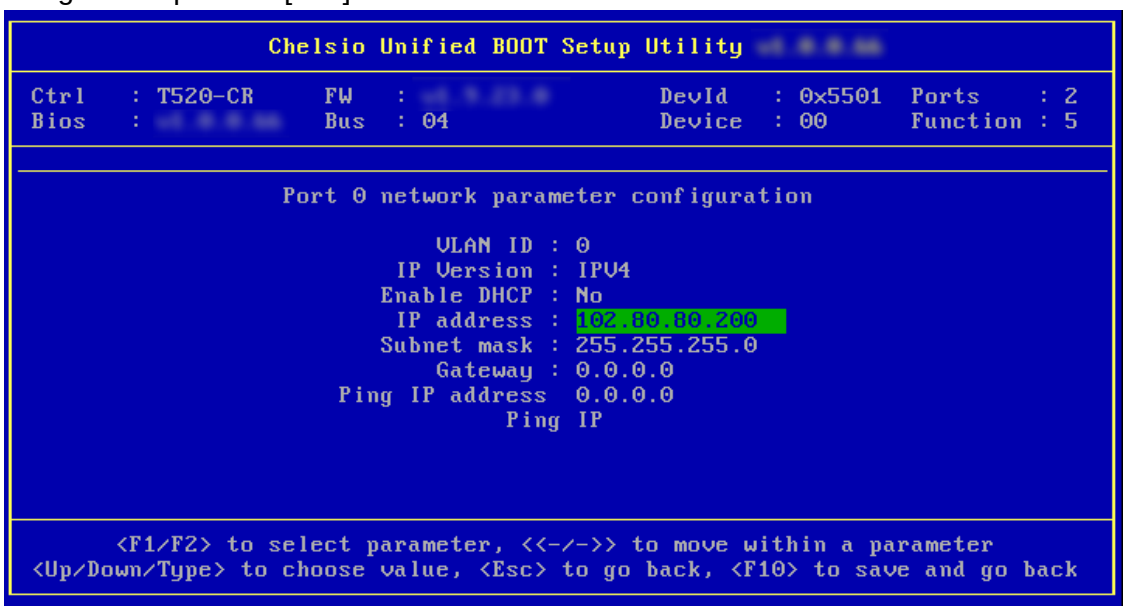
xvi. Go back and choose **Configure Network Parameters** to configure iSCSI Network related properties.



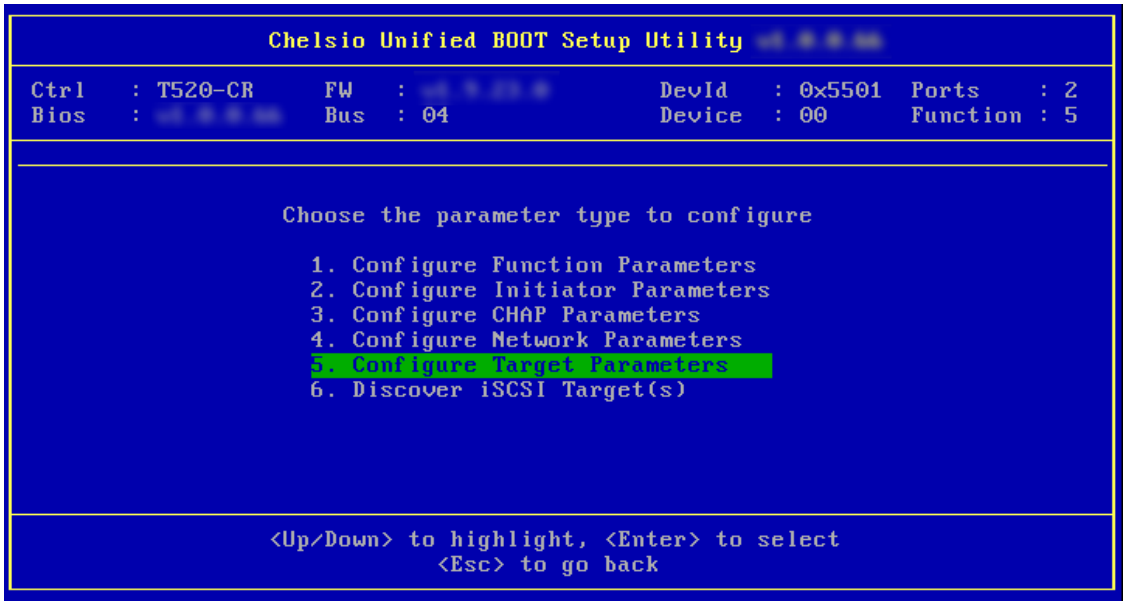
xvii. Select the port using which you want to connect to the target. Hit [Enter].



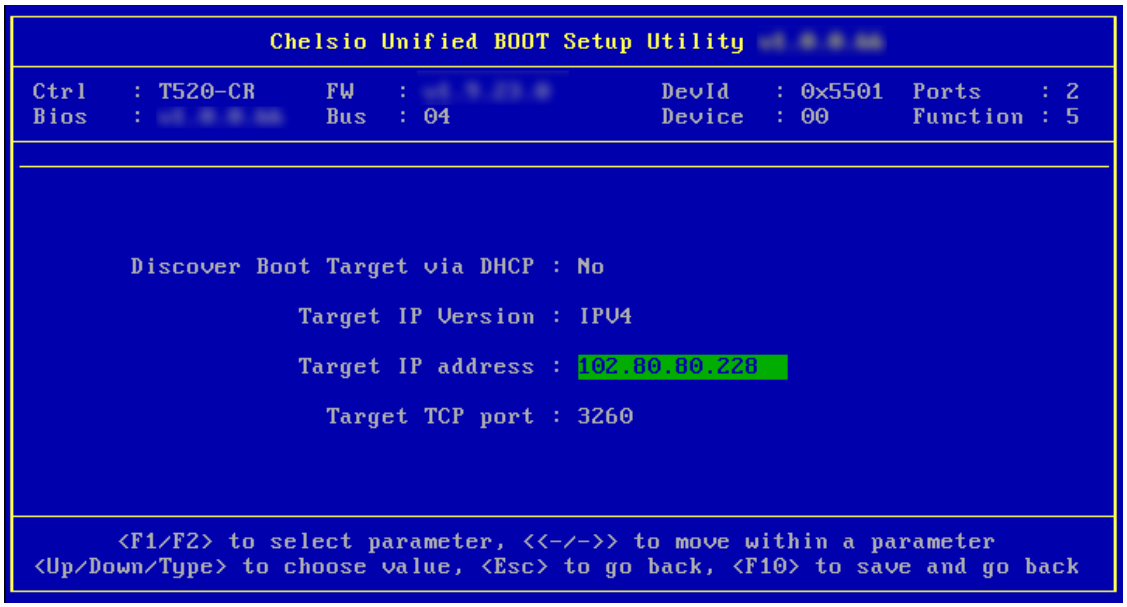
xviii. Select *Yes* in the **Enable DHCP** field to configure port using DHCP or *No* to manually configure the port. Hit [F10] to save.



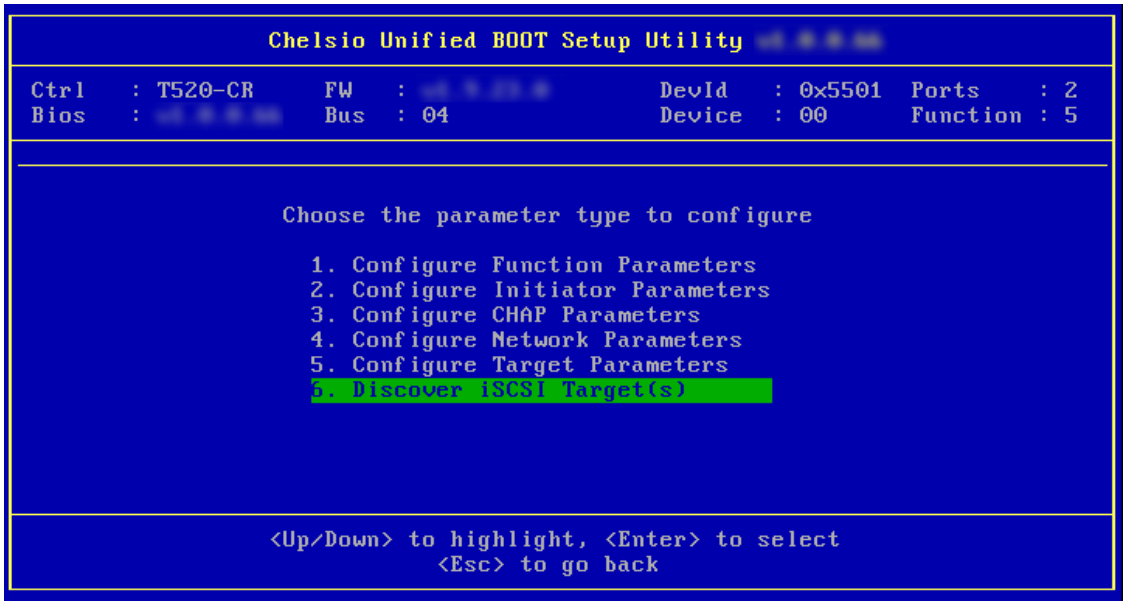
xix. Go back and choose **Configure Target Parameters** to configure iSCSI target related properties.



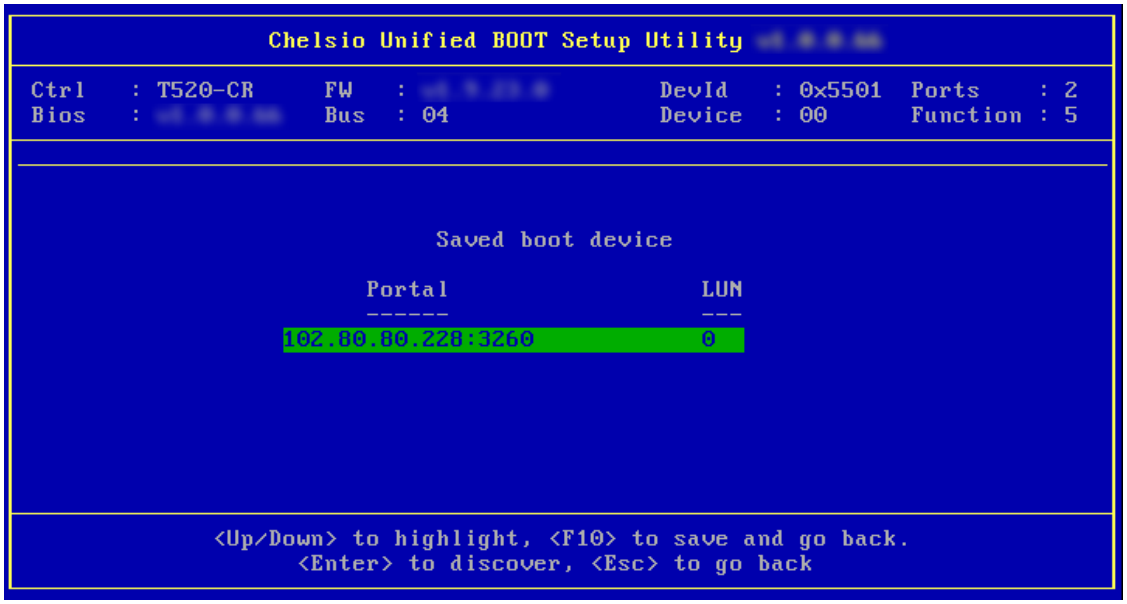
xx. If you want to discover target using DHCP, select *Yes* in the **Discover Boot Target via DHCP** field. To discover target via static IP, select *No* and provide the target IP and Hit [F10] to save. The default TCP port selected is 3260.



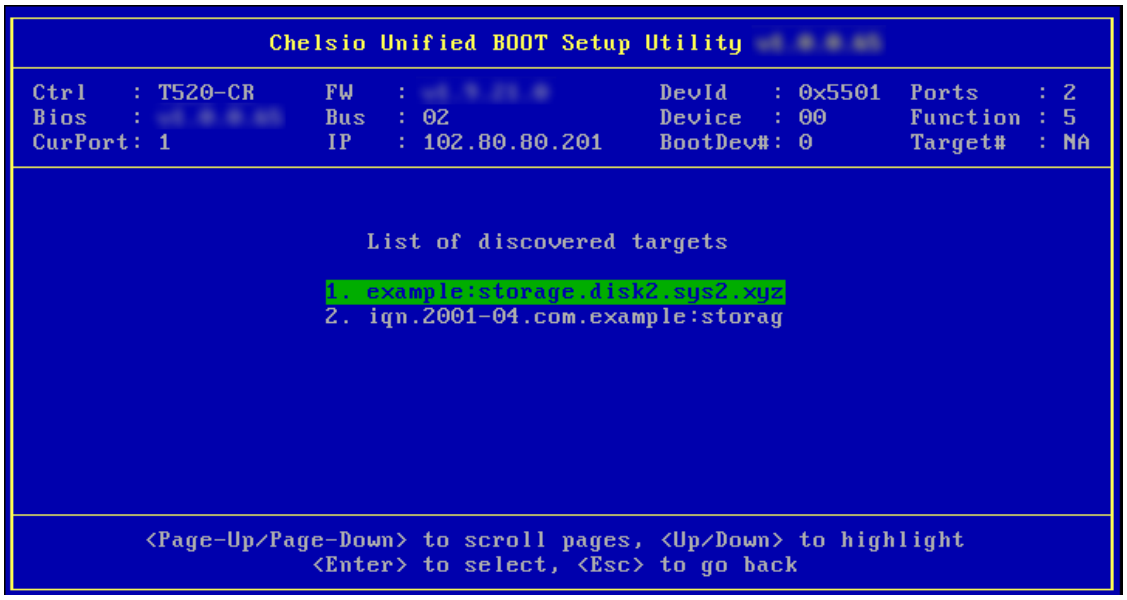
xxi. Go back and choose **Discover iSCSI Target (s)** to connect to a target.



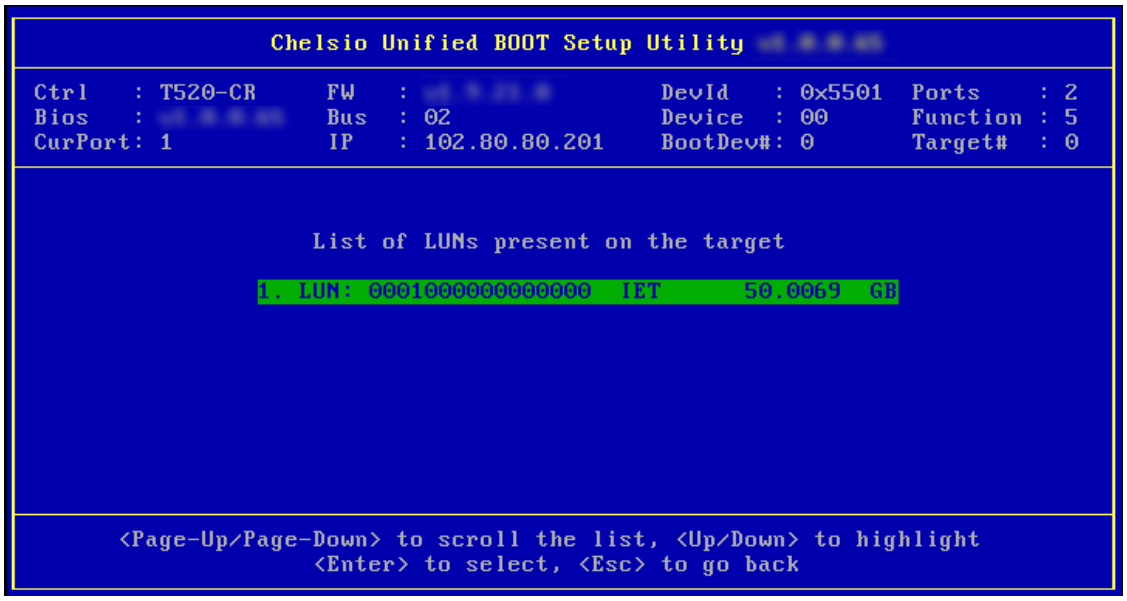
xxii. Select the portal group on which iSCSI service is provided by the target.



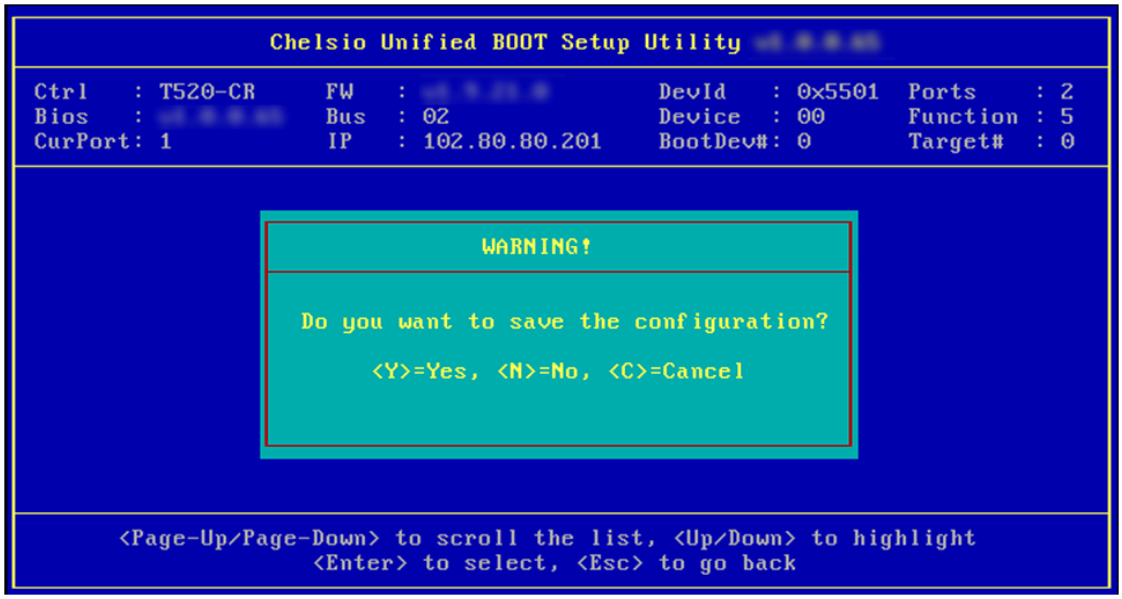
xxiii. A list of available targets will be displayed. Select the target you wish to connect to and hit [Enter].



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

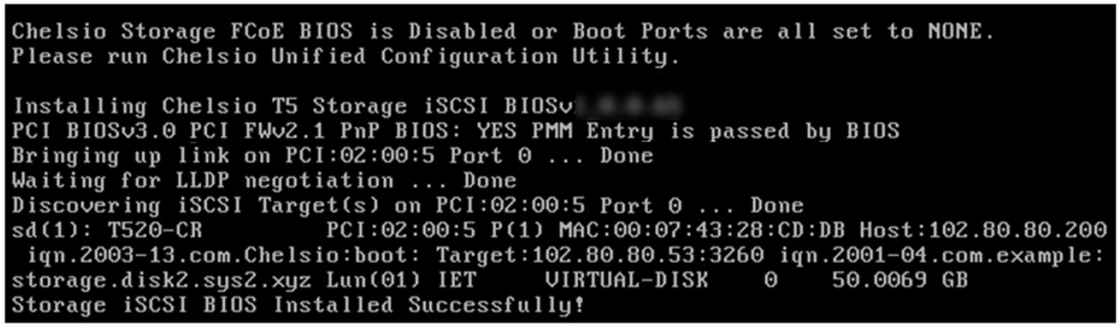


xxv. Hit [Esc] and then [Y] to save the configuration.

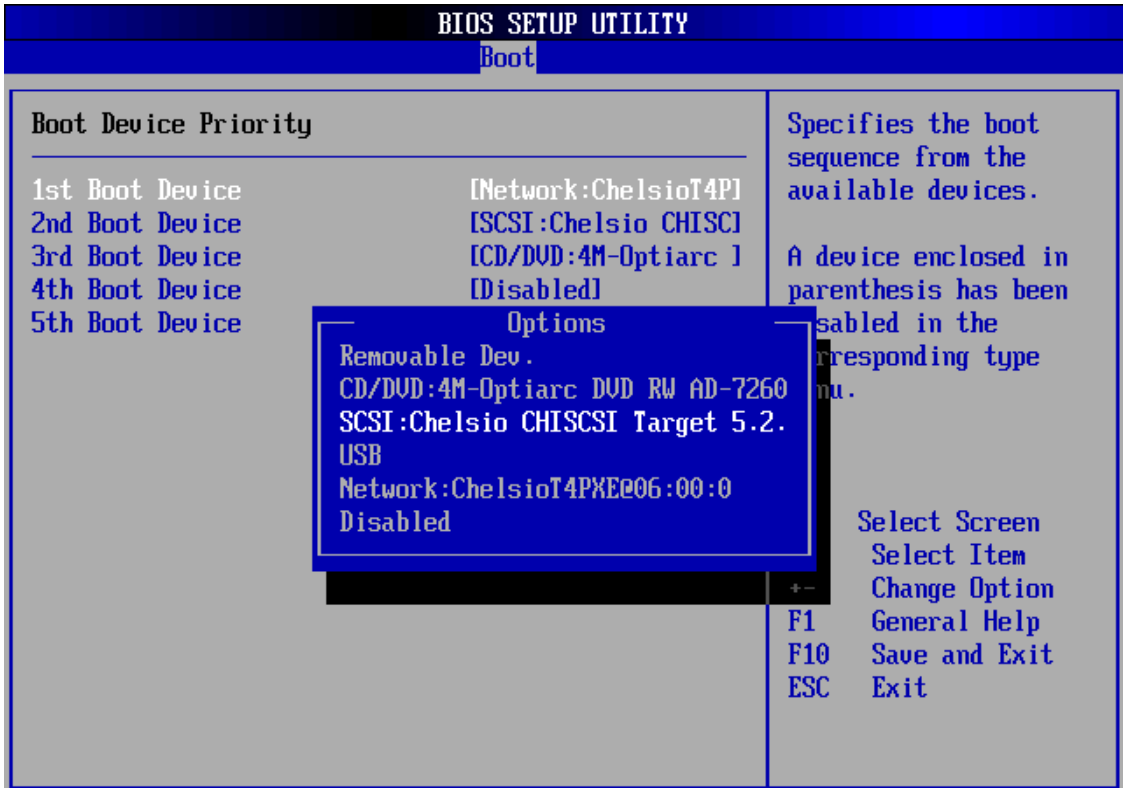


xxvi. Reboot the machine.

xxvii. During POST, Chelsio option ROM will 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.

7.2. uEFI iSCSI Boot

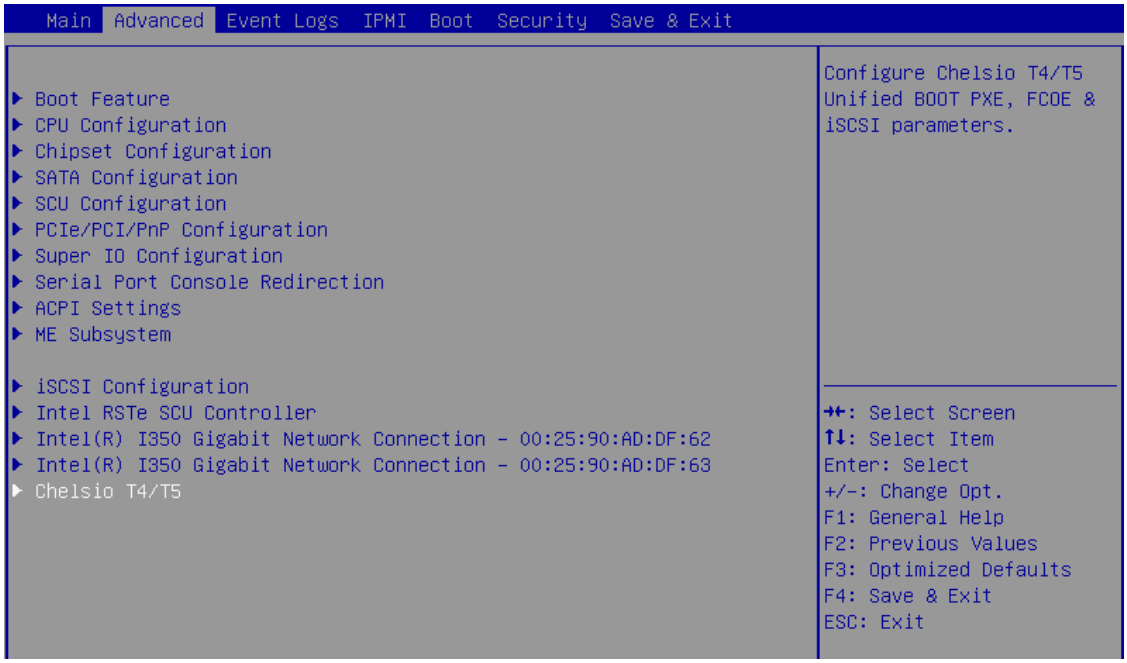
Important

- *Only uEFI v2.1 and v2.3.1 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.

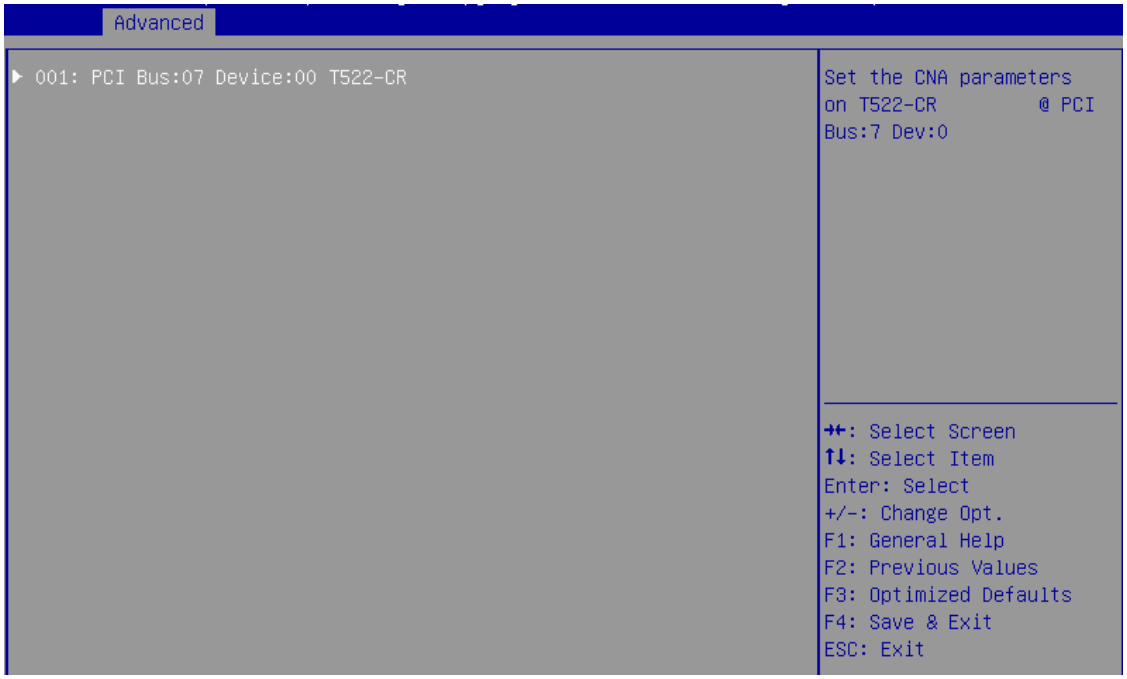
ii. Select **Chelsio T4/T5** and press [Enter]



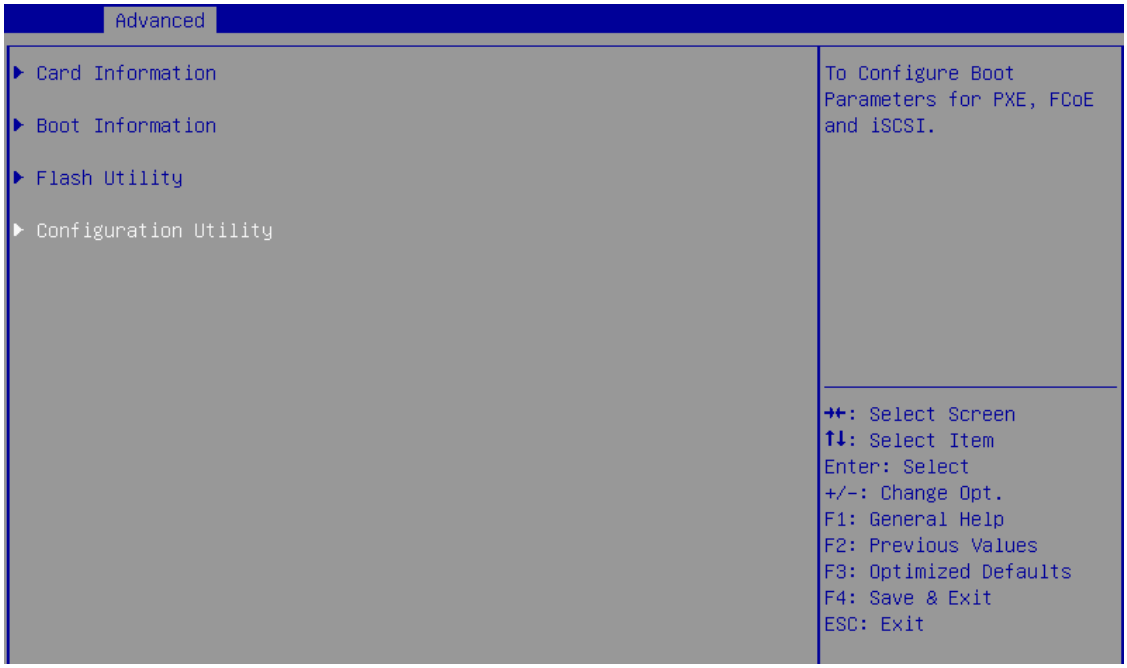
Note

*If Chelsio T4/T5 is not listed, please ensure that Chelsio uEFI driver is loaded correctly as mentioned **here** in the **Flashing Firmware and Option ROM** section.*

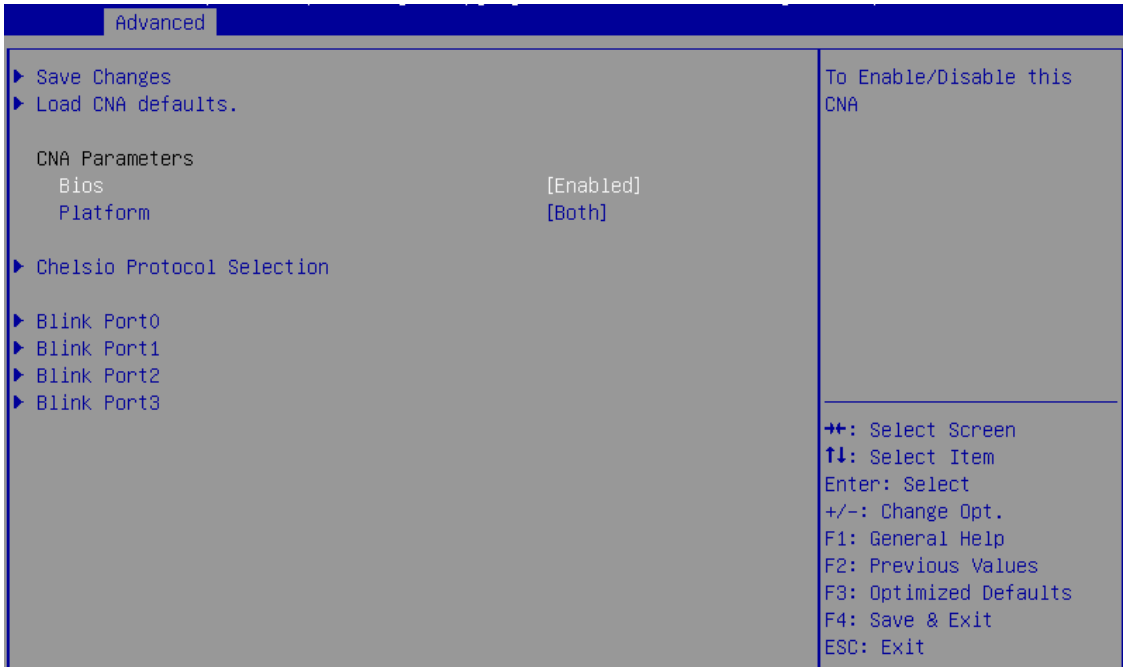
iii. Select the Chelsio adapter to be configured and press [Enter].



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

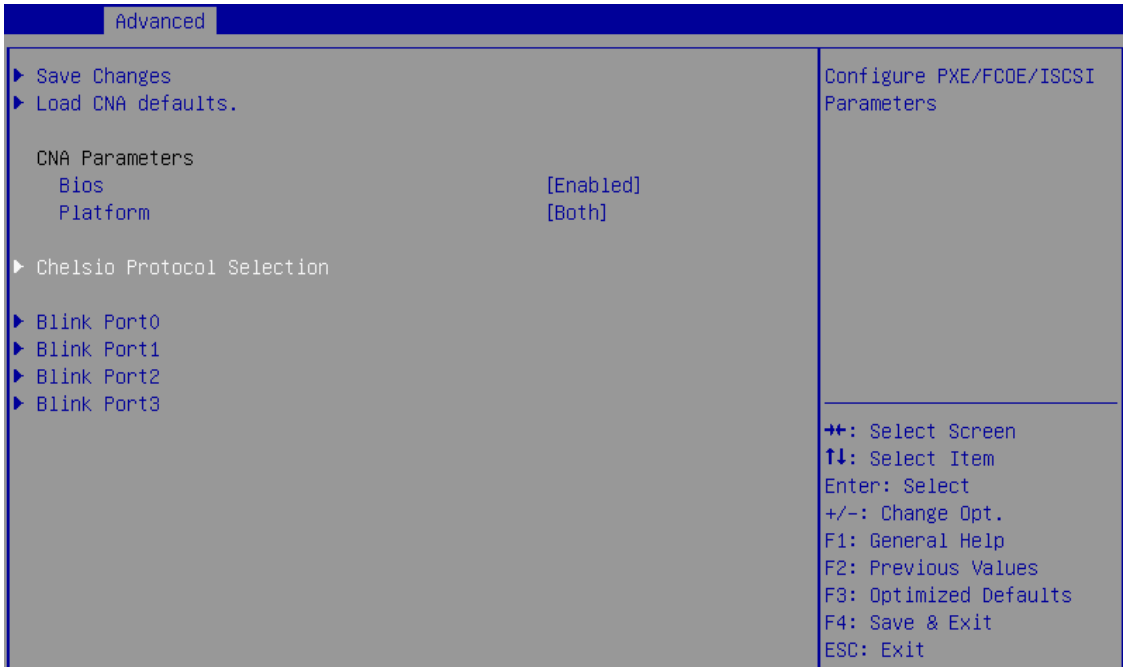


v. Enable adapter BIOS if not already enabled.

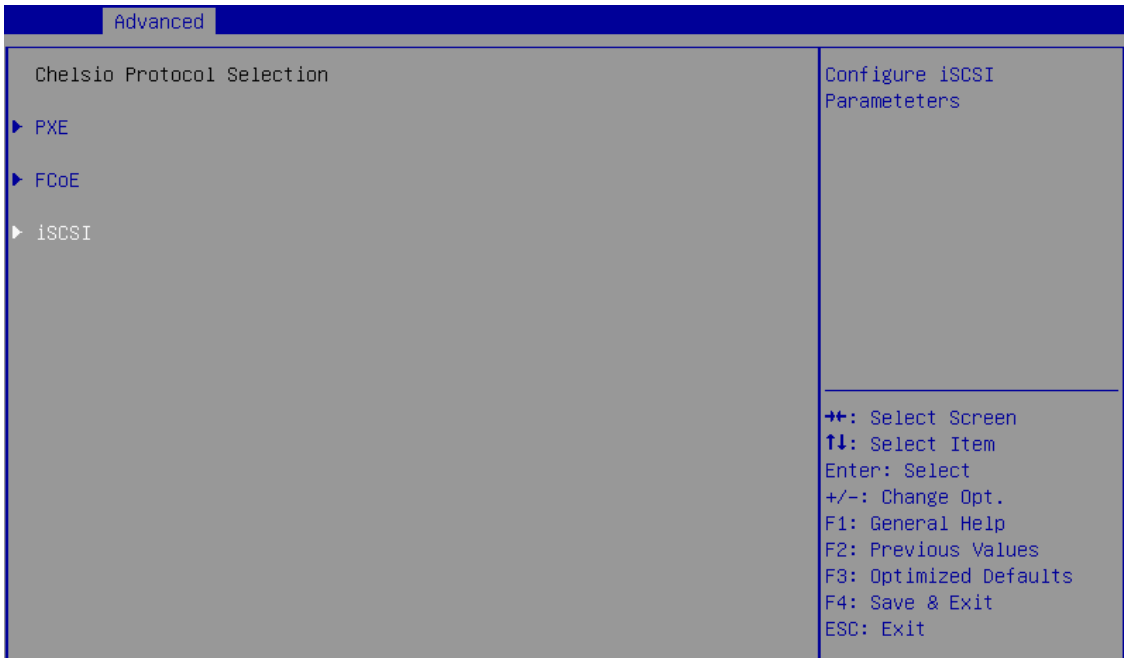


Note *It is highly recommended that you use the **Save Changes** option every time a parameter/option is changed.*

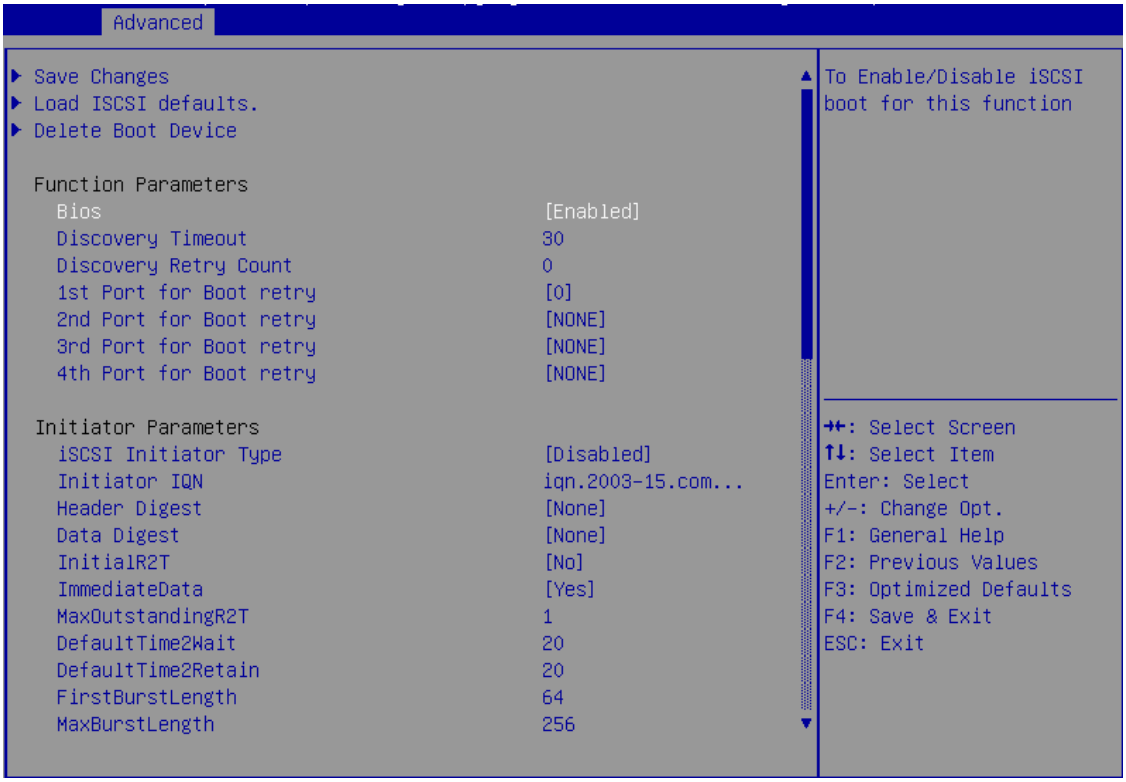
vi. Select **Chelsio Protocol Selection** and press [Enter].



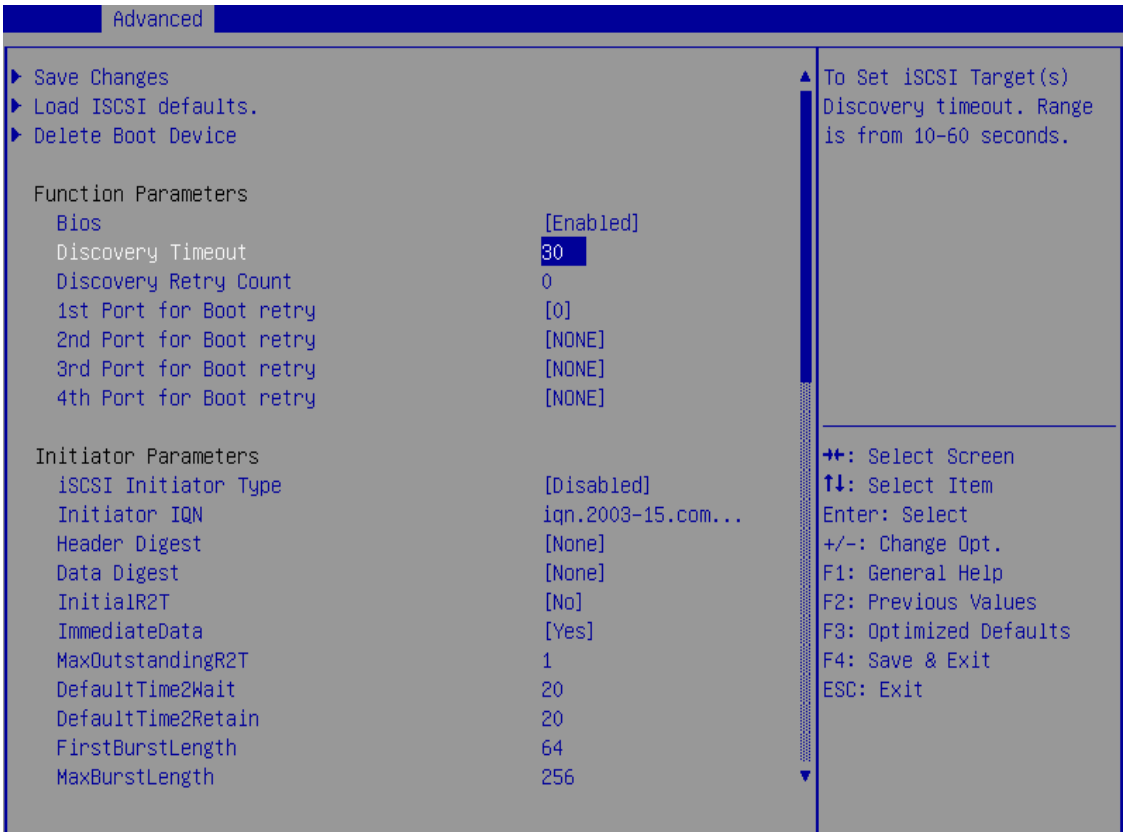
vii. Select **iSCSI** and press [Enter]



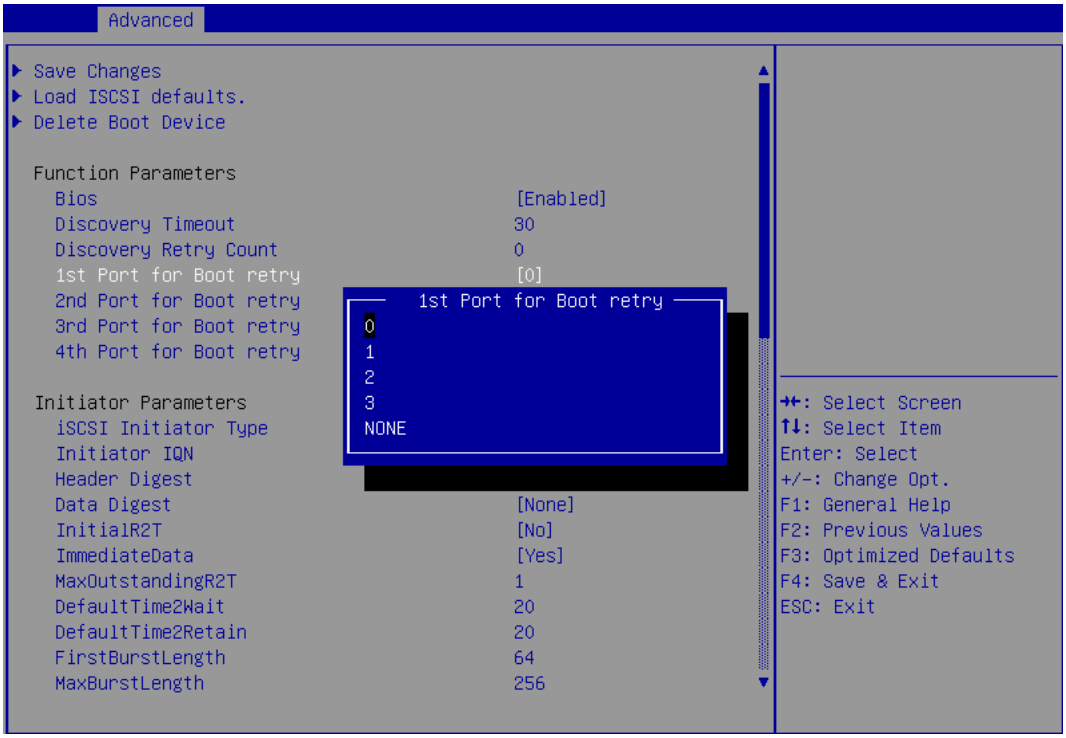
viii. Under **Function Parameters**, enable iSCSI BIOS, if not already enabled.



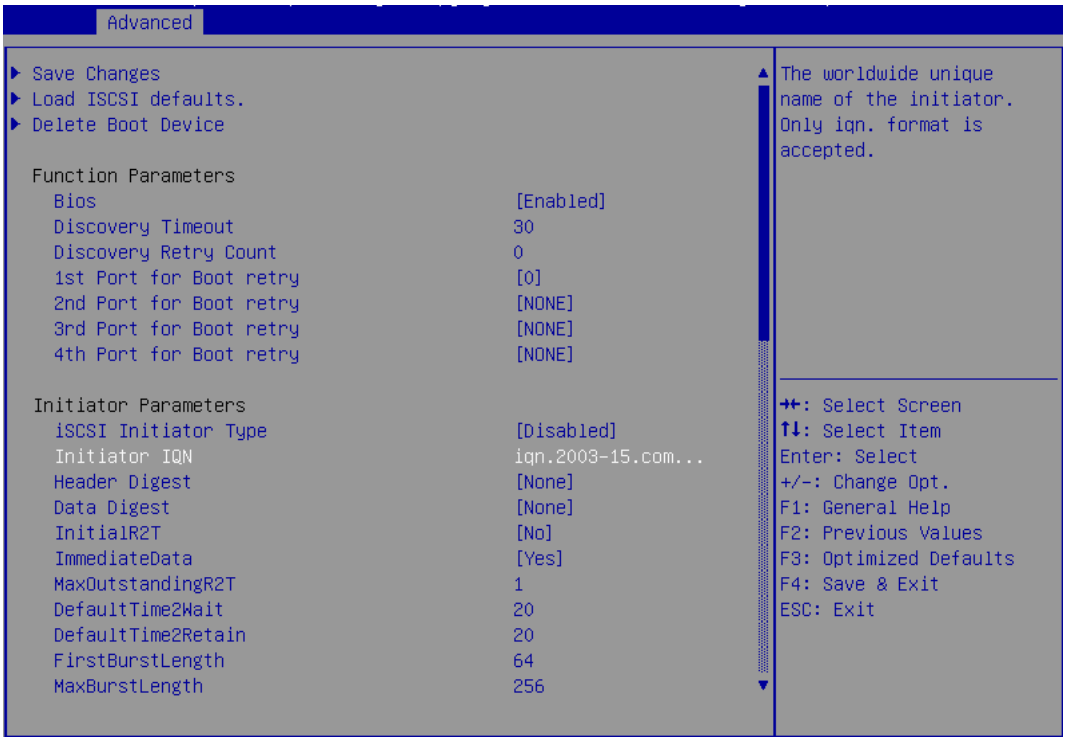
ix. Set discovery timeout to a suitable value. Recommended value is >= 30



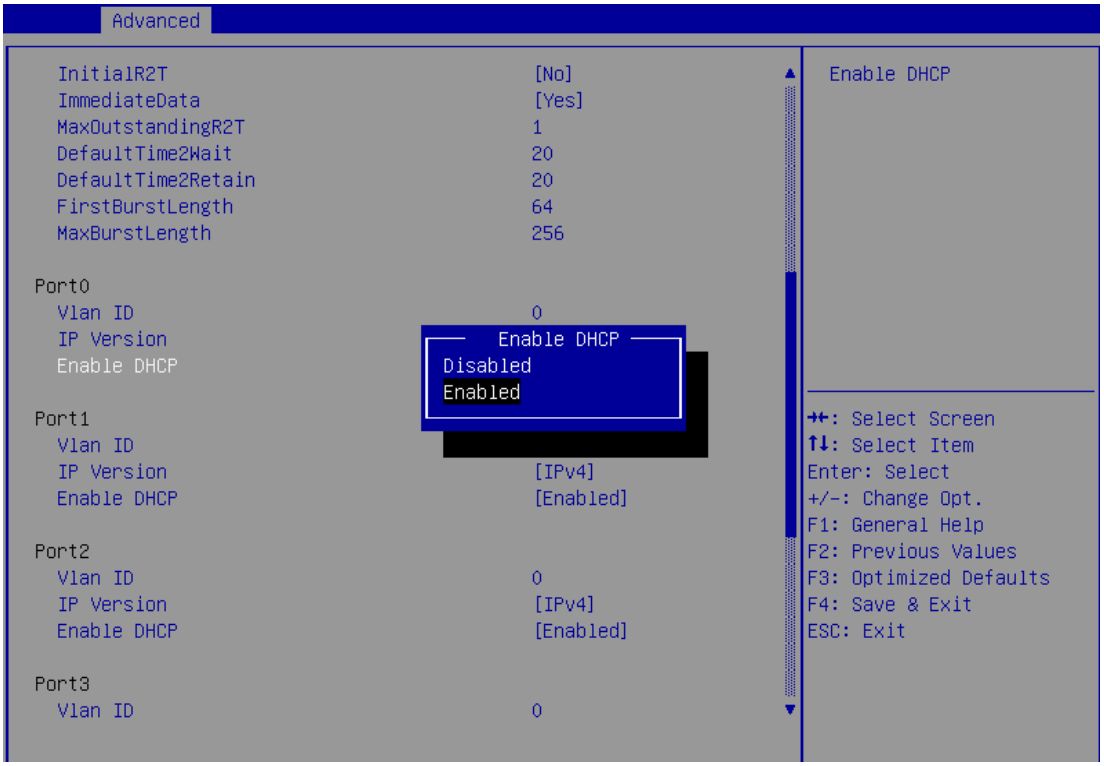
x. Choose the order of the ports to discover iSCSI targets.



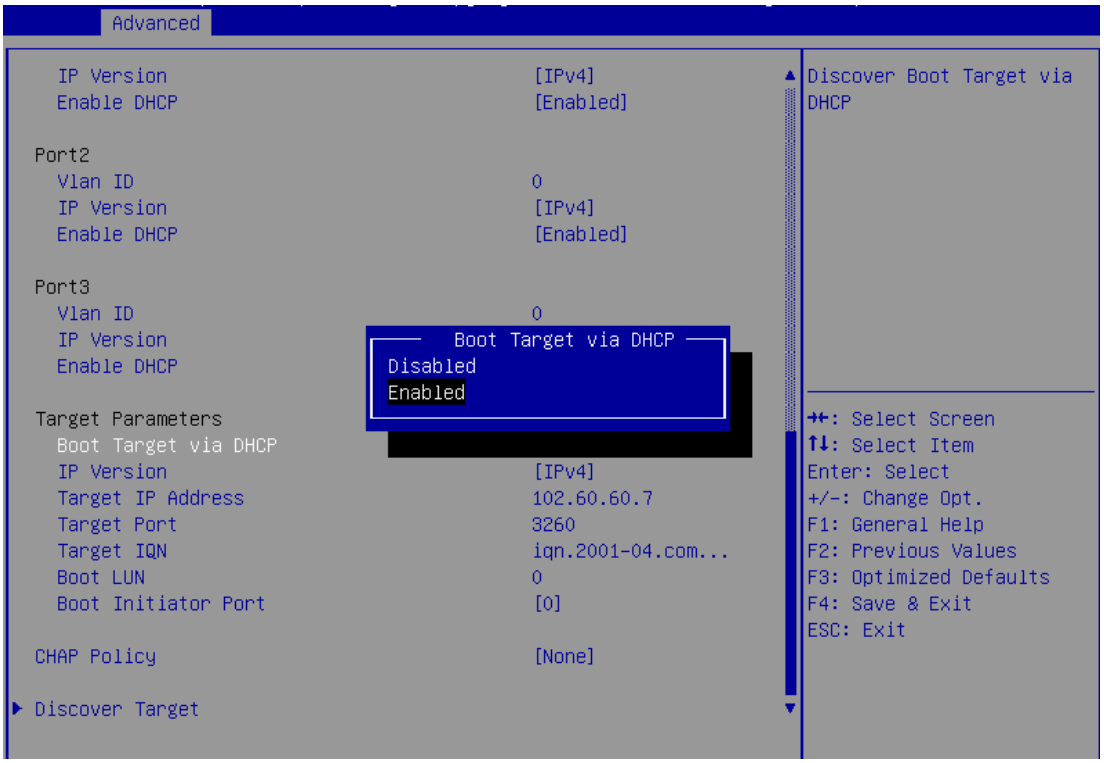
xi. Under **Initiator Parameters**, iSCSI Initiaitor properties like IQN, Header Digest, Data Digest, etc will be displayed. Change the values appropriately or continue with the default values.



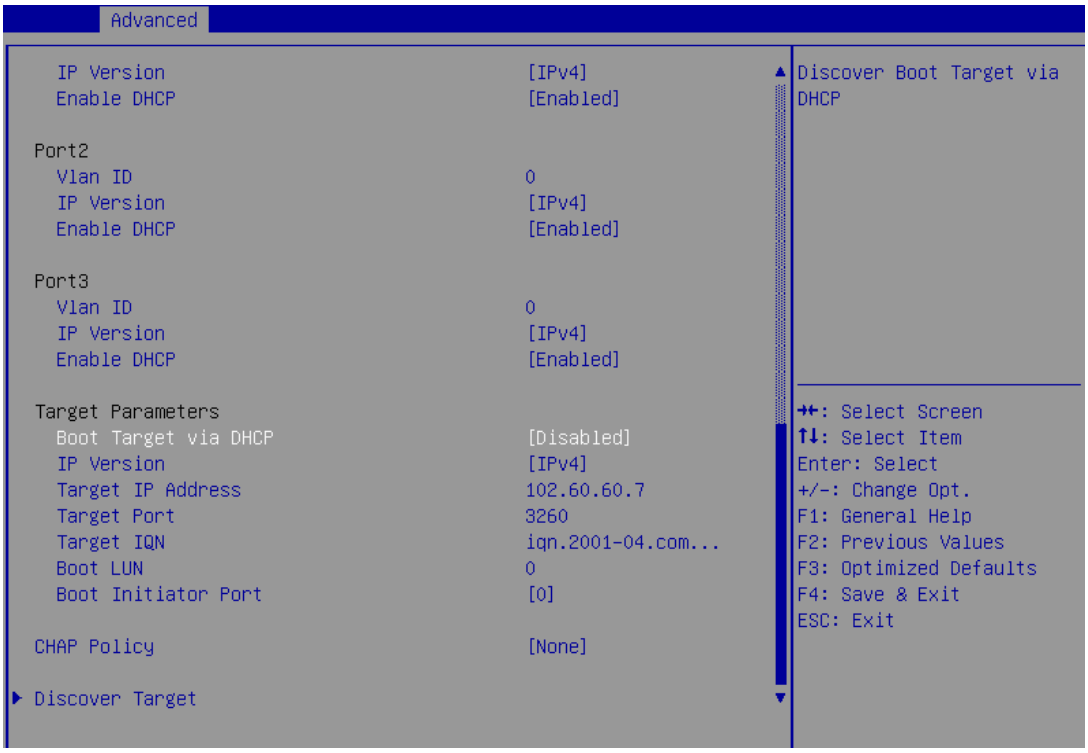
xii. Under the first port, select **Enable DHCP** field, hit [Enter] and select **Enabled**. This will configure port using DHCP. Select **Disabled** to manually configure the port.



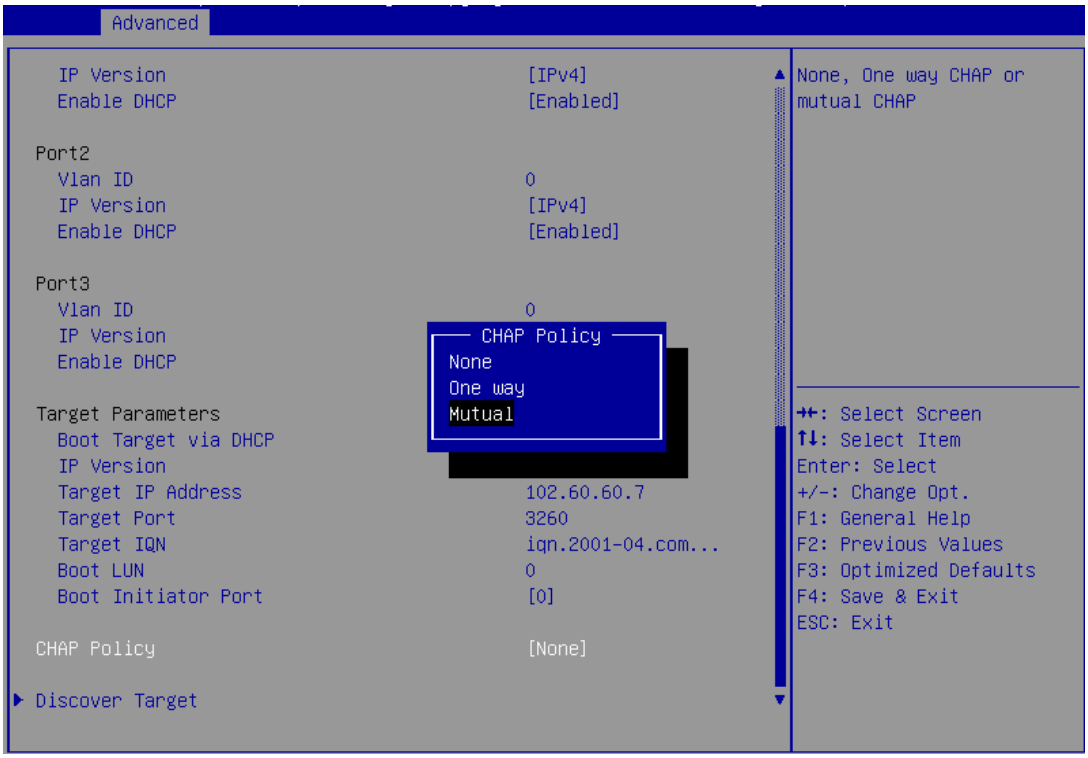
xiii. Under **Target Parameters**, select **Enabled** for the **Boot Target via DHCP** parameter to discover target using DHCP.



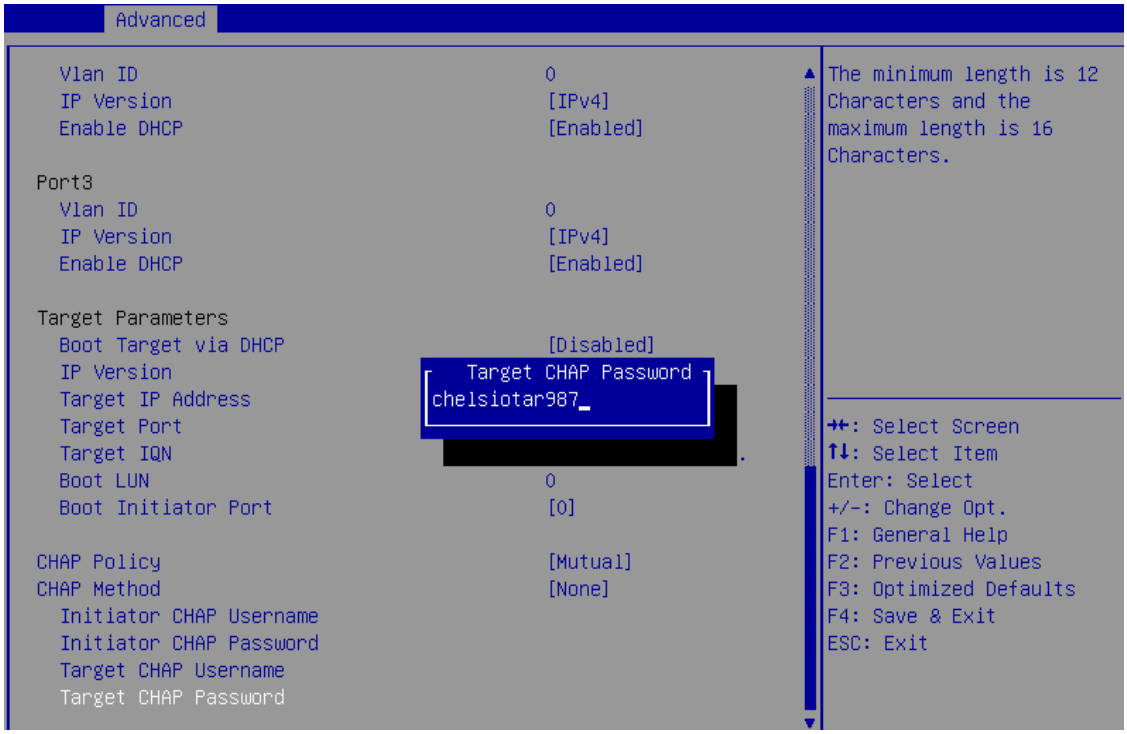
To discover target via static IP, select **Disabled** and provide the target IP.



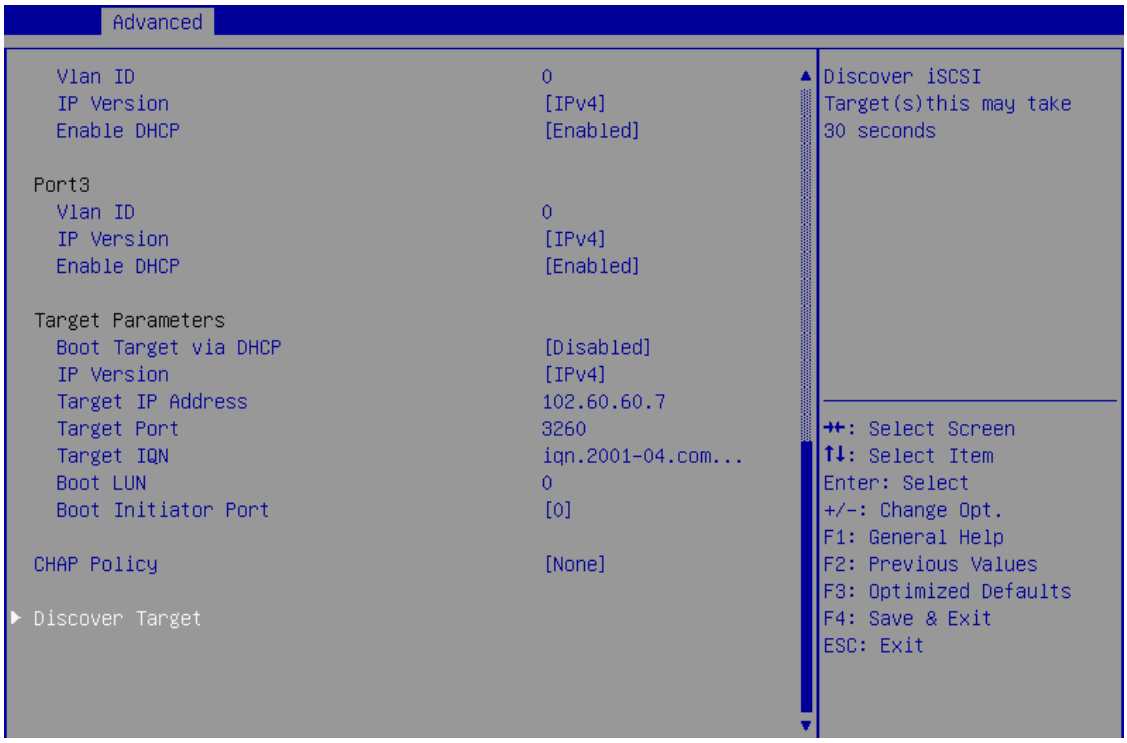
xiv. CHAP authentication is disabled by default. To enable and configure, highlight **CHAP Policy** and hit [Enter]. Select the policy type from the corresponding pop-up and hit [Enter] again.



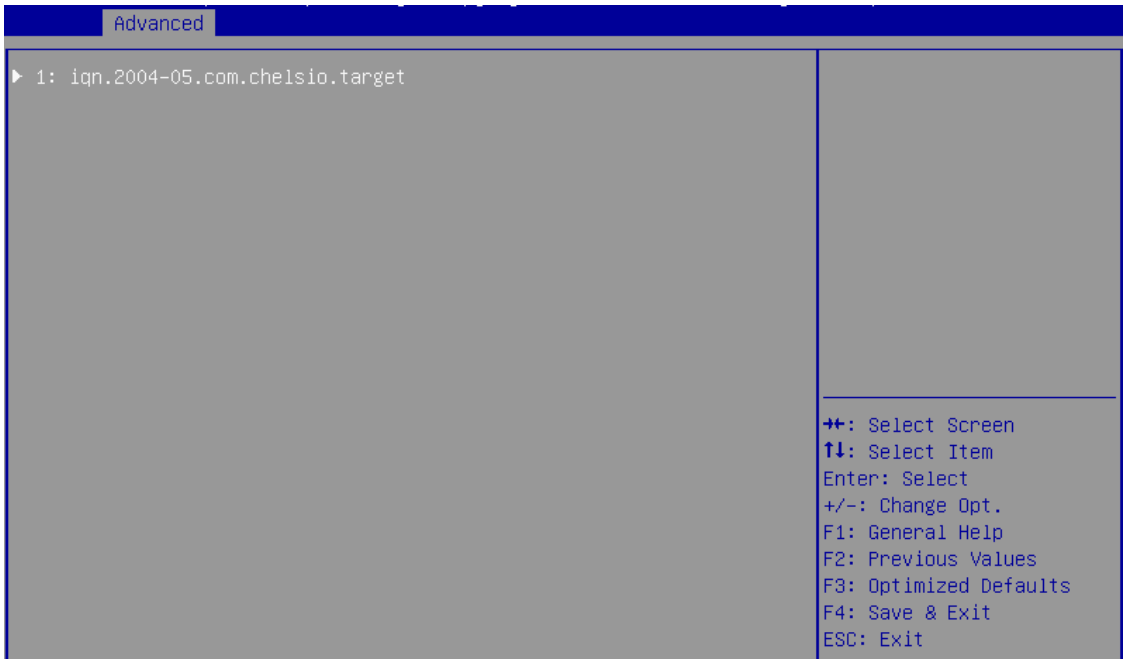
xv. Provide Initiator and Target CHAP credentials according to the CHAP policy selected.



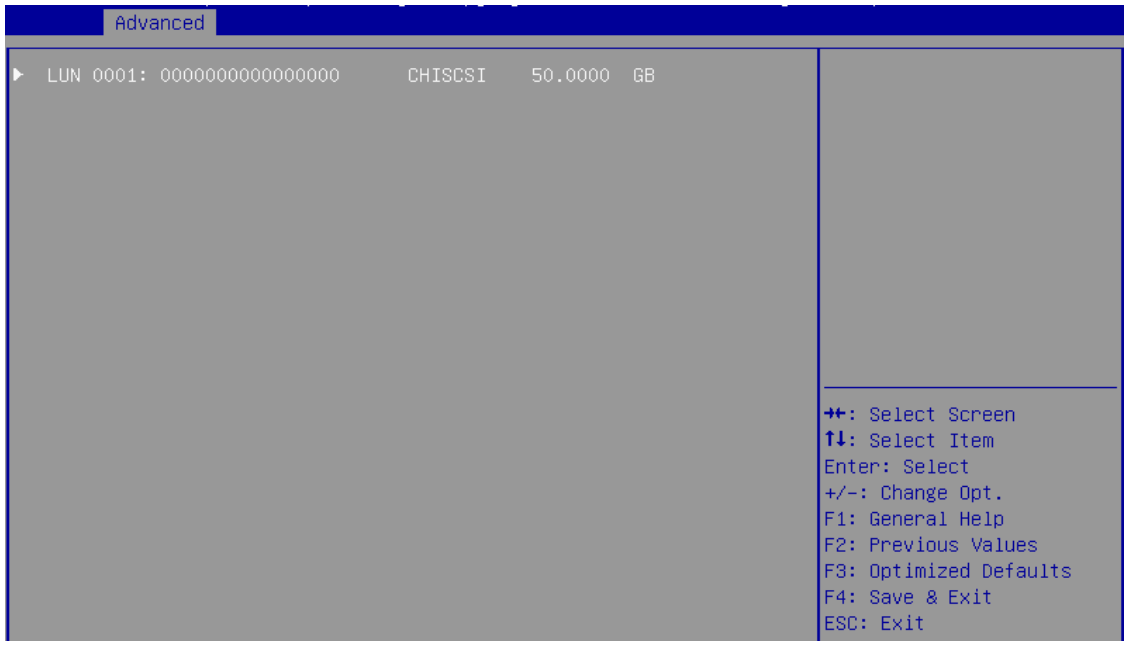
xvi. Select **Discover Target** and press [Enter] to discover iSCSI targets connected to the switch. Wait till all reachable targets are discovered.



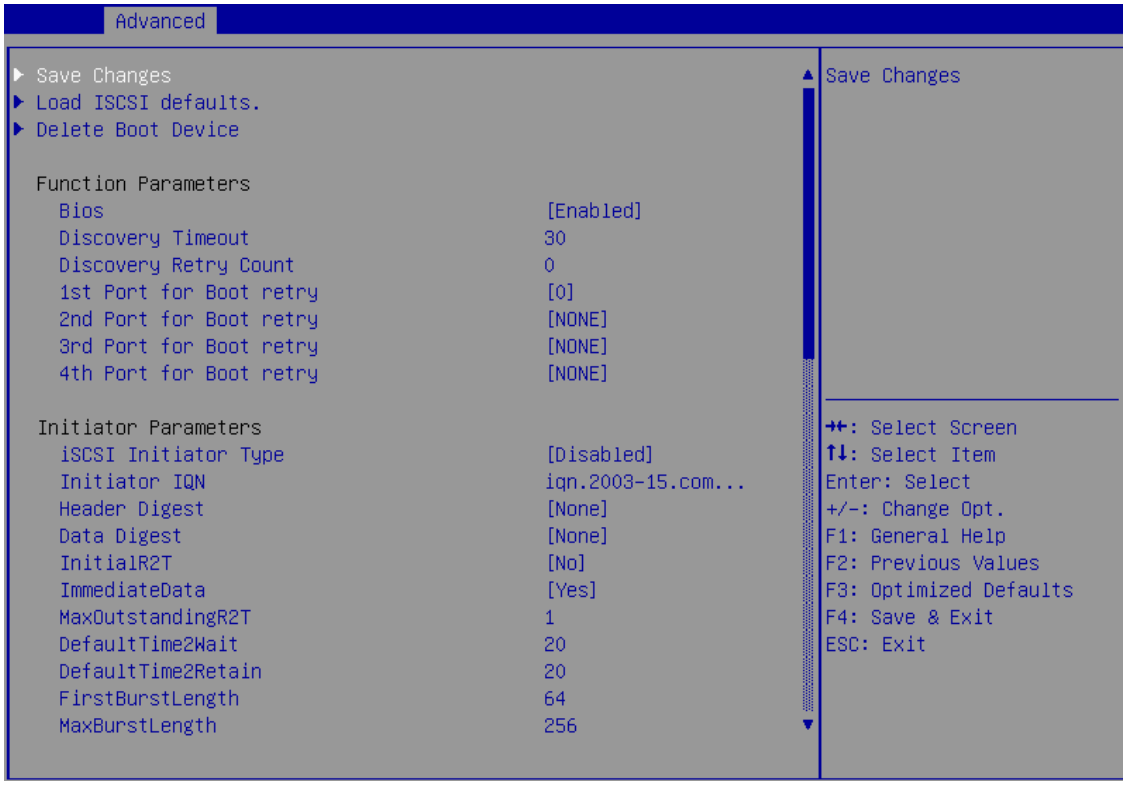
xvii. A list of available targets will be displayed. Select the target you wish to connect to and hit [Enter].



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

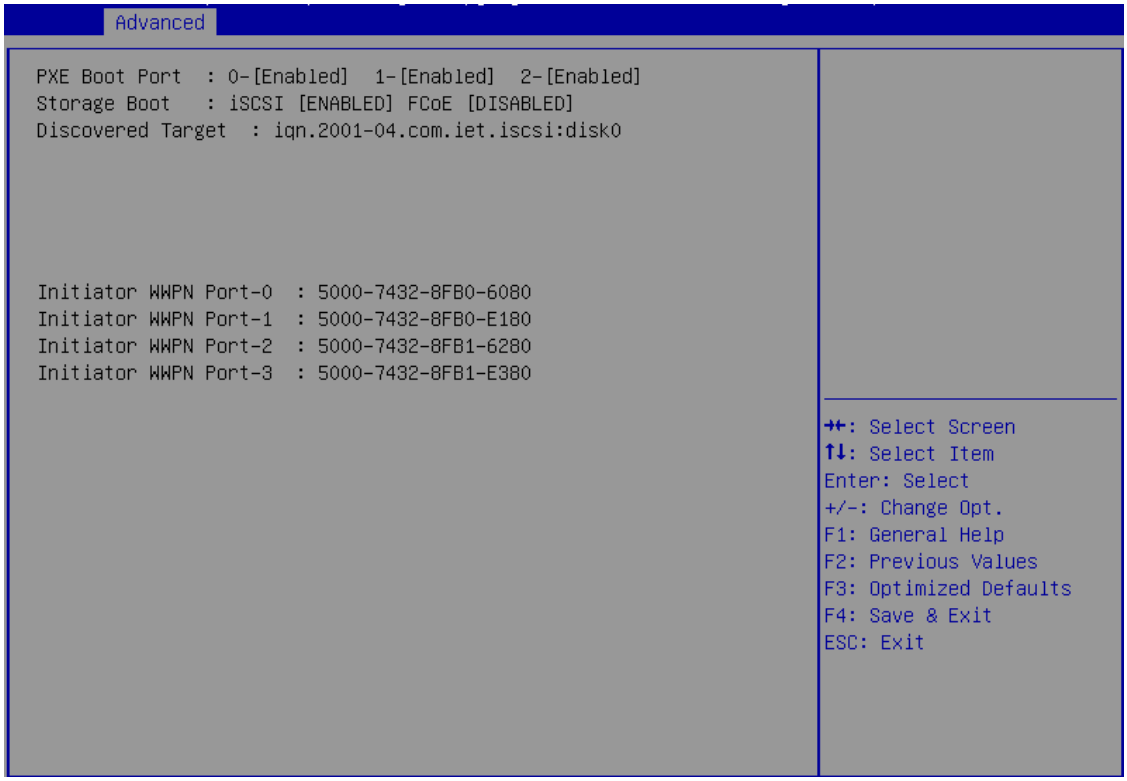


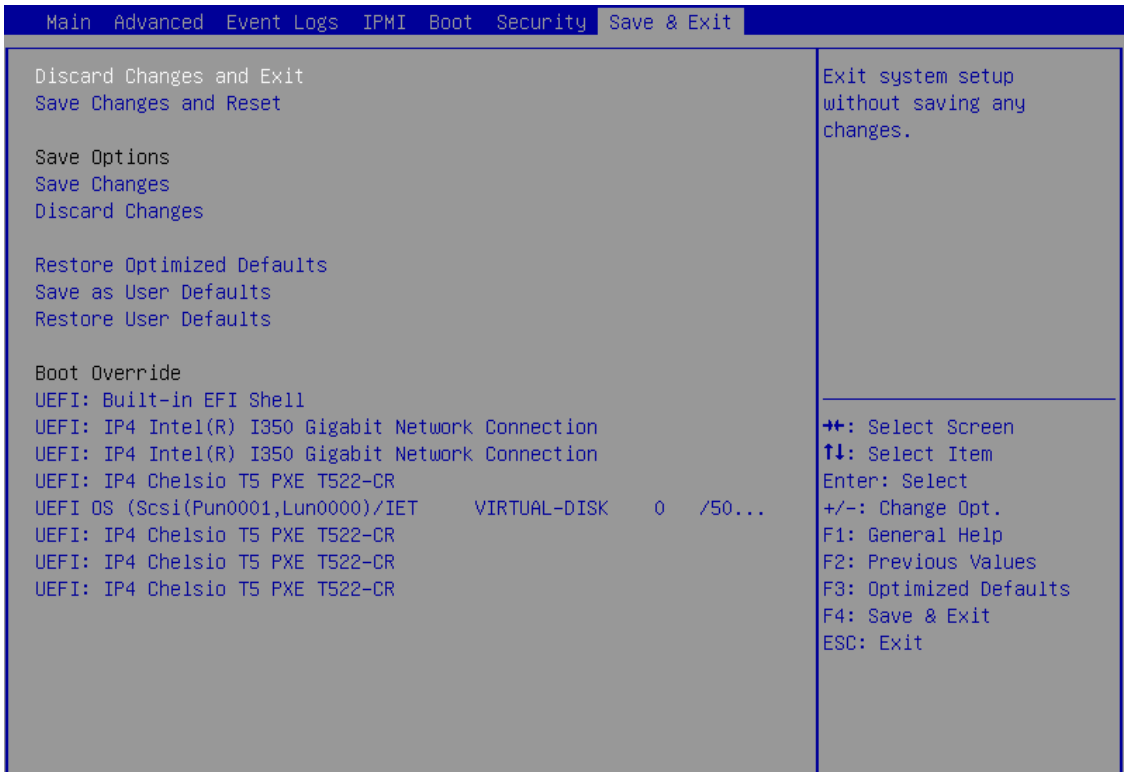
xix. Select **Save Changes** and press [Enter]



xx. Reboot the system for changes to take effect.

xxi. The discovered LUN should appear in the **Boot Configuration** 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

This section of the document describes the use and configuration of Chelsio's DUD for OS installations via PXE server on FC/FCoE LUN and iSCSI LUN. This solution can be used for installing operating systems over an Ethernet network/SAN using Chelsio's T5 and T4 based Converged Network Adapters (CNAs).

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:

- T520-BT
- T502-BT
- T580-CR
- T520-LL-CR
- T520-SO-CR*
- T520-CR
- T522-CR
- T540-CR
- T580-LP-CR
- T580-SO-CR*
- T420-CR#
- T440-CR#
- T422-CR#
- T420-BCH*
- T420-SO-CR*
- T440-LP-CR#
- T420-LL-CR#
- T420-BT#
- T404-BT#

* Only PXE

Only PXE,iSCSI

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)
RHEL7.1, 3.10.0-229.el7	PXE, FCoE, iSCSI
RHEL 7.0, 3.10.0-123.el7	PXE, FCoE, iSCSI
RHEL6.6, 2.6.32-504.el6	PXE, FCoE, iSCSI
SLES12, 3.12.28-4-default*	PXE, FCoE, iSCSI
SLES11SP3, 3.0.76-0.11	PXE, FCoE, iSCSI

*DUD required only for FCoE installation; for PXE and iSCSI, inbox drivers can be used.

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 RHEL and SLES distributions for T5 adapters. In case of T4 adapters, you can skip this step and use inbox drivers to install the operating system.

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, service.chelsio.com

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, service.chelsio.com

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 SLES11sp3.

```
[root@host~]# dd if=/root/Chelsio-Uboot-x.x.x.xx/LinuxDUD/Chelsio-
DriverUpdateDisk-SLES11sp3-x86_64-x.x.x.x.img of=/dev/sda1
```

3. OS Installation

3.1. Installation using Chelsio DUD (PXE boot)

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.

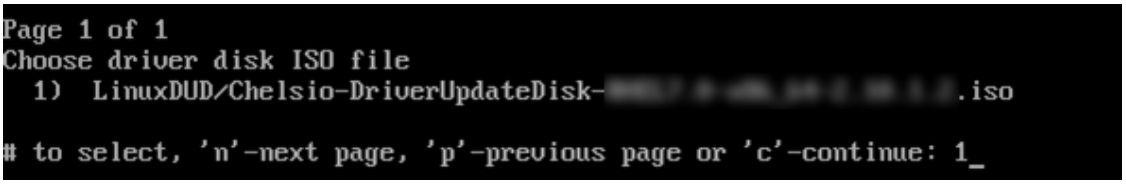
The DUD supports installation of Linux distributions using Chelsio adapters over Network. There may be built-in Chelsio driver in these distributions. The driver may or may not work with Chelsio adapters, depending on the adapter in use, and the version of the driver that shipped in that particular distribution.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

3.1.1. RHEL 7.X installation

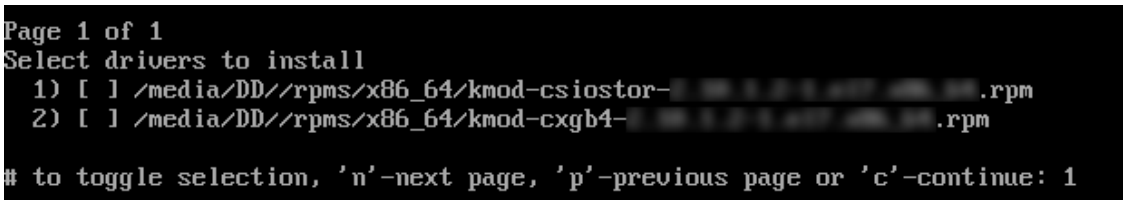
i. Please make sure that the USB drive with DUD image is inserted. Type *e* and then *dd* at the boot prompt for the installation media. The *dd* option specifies that you will be providing a Driver Update Disk during the installation.

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].

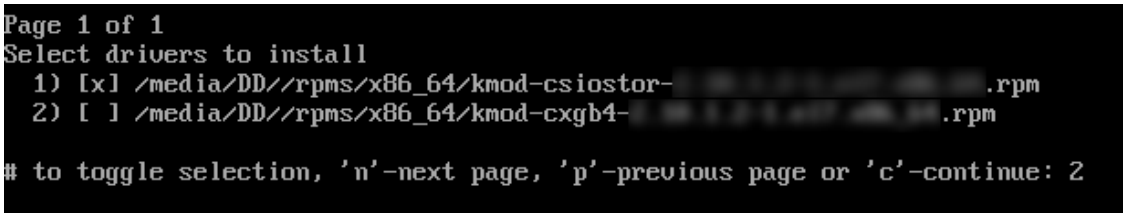
iii. The installer will search and display DUD image files found in the selected device. Enter the index number of the file to be used and hit [Enter].



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]



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.



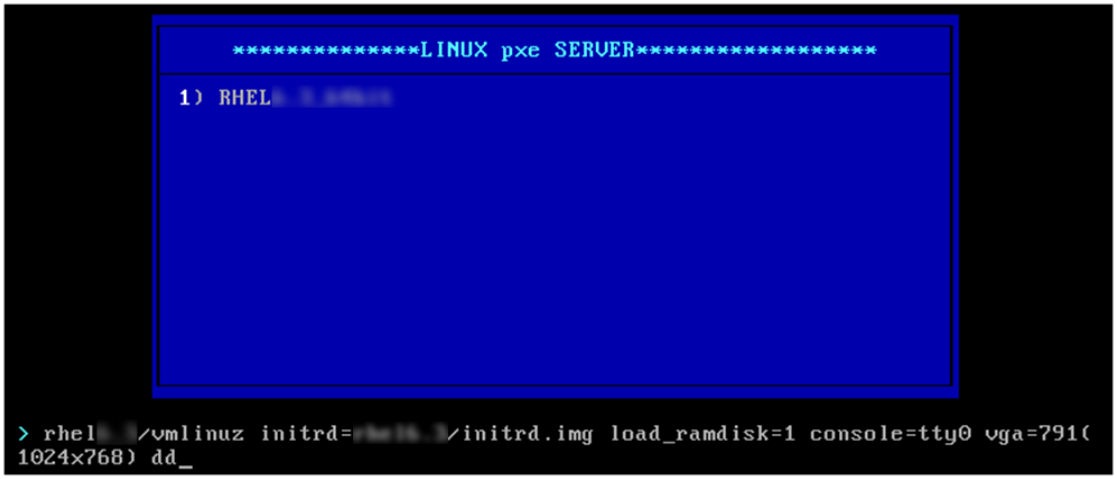
Note *To deselect a driver, enter the index of the selected driver and hit [Enter]*

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.

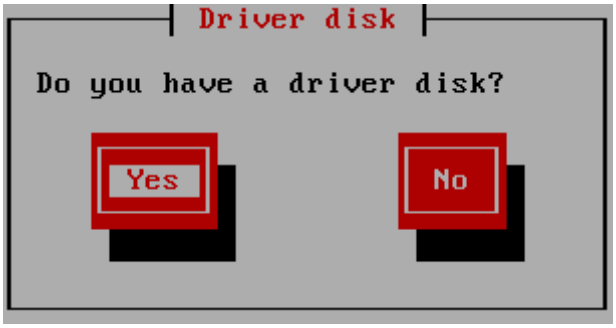
vii. After the drivers are successfully loaded, OS installation will commence. Proceed as usual.

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.



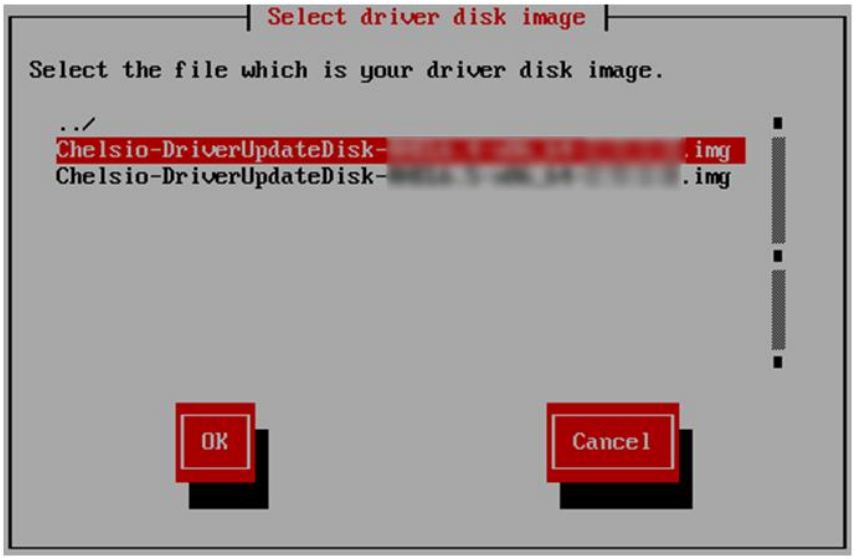
ii. The installer will load and prompt you for the driver update disk. Select “Yes” and hit [Enter] to proceed.



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”.

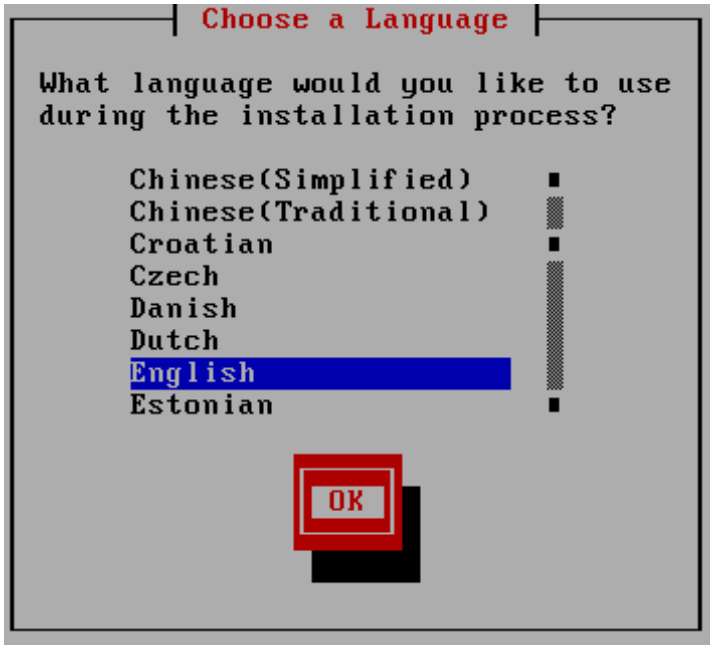
You can view the messages from the Linux kernel and drivers to determine the name of the USB drive, by pressing [Alt] + [F3] or [Alt] + [F4]. Press [Alt] + [F1] to get back to the list.

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.

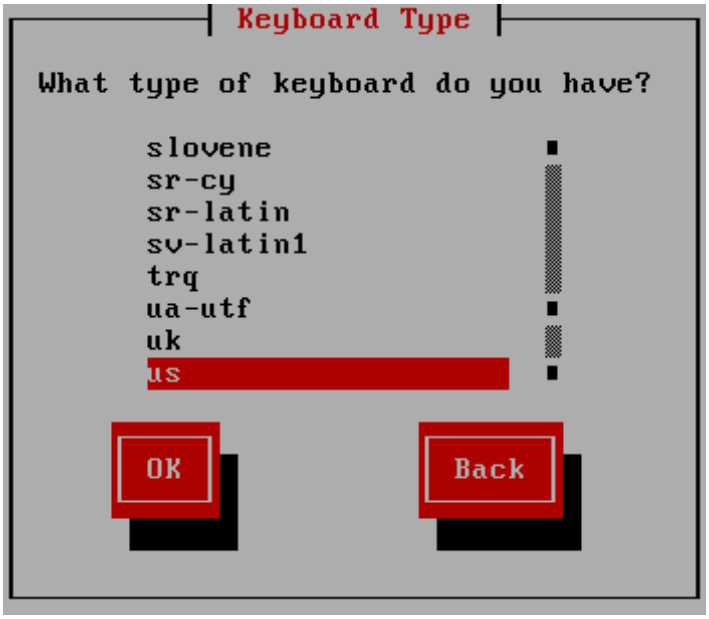


v. The installer will ask if you wish to load more drivers. Choose “Yes” to load if you have any other drivers to load. Otherwise choose “No”.

vi. Select the required language from the list.

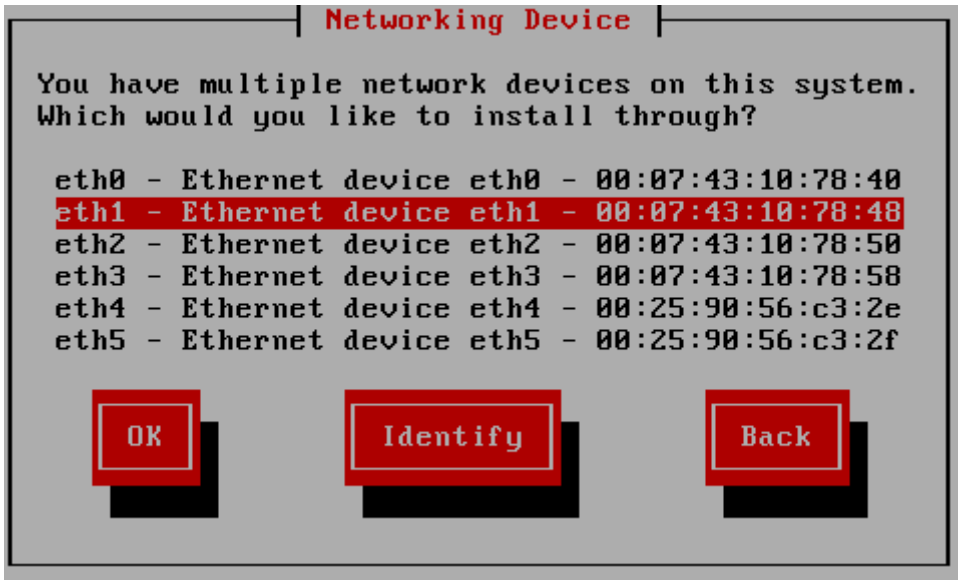


vii. Select the type of keyboard you have from the list.

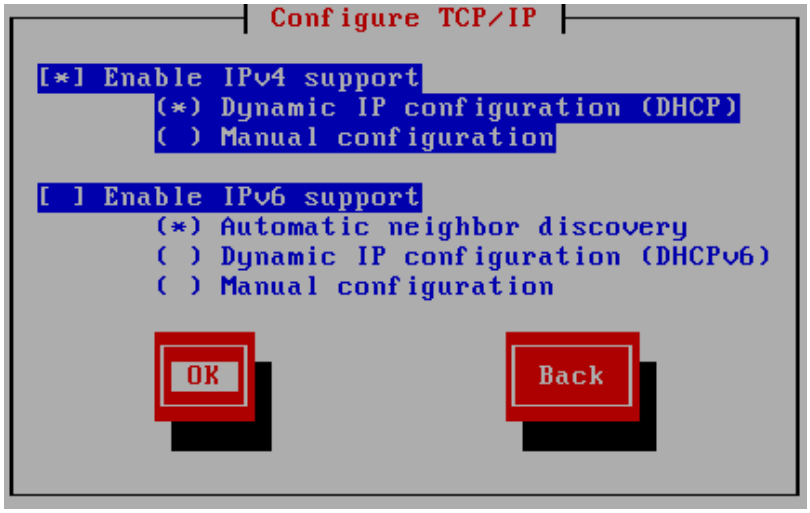


viii. In this step, you can choose the source which contains the OS installation ISO image. In this case, select “NFS directory”.

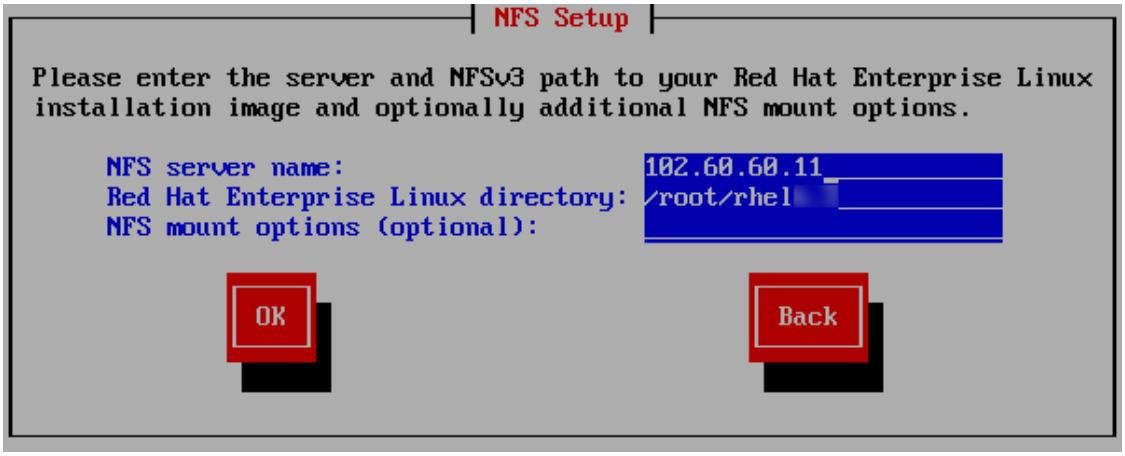
ix. The Chelsio network devices will be displayed. Select the appropriate Chelsio NIC interface to proceed with installation.



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.

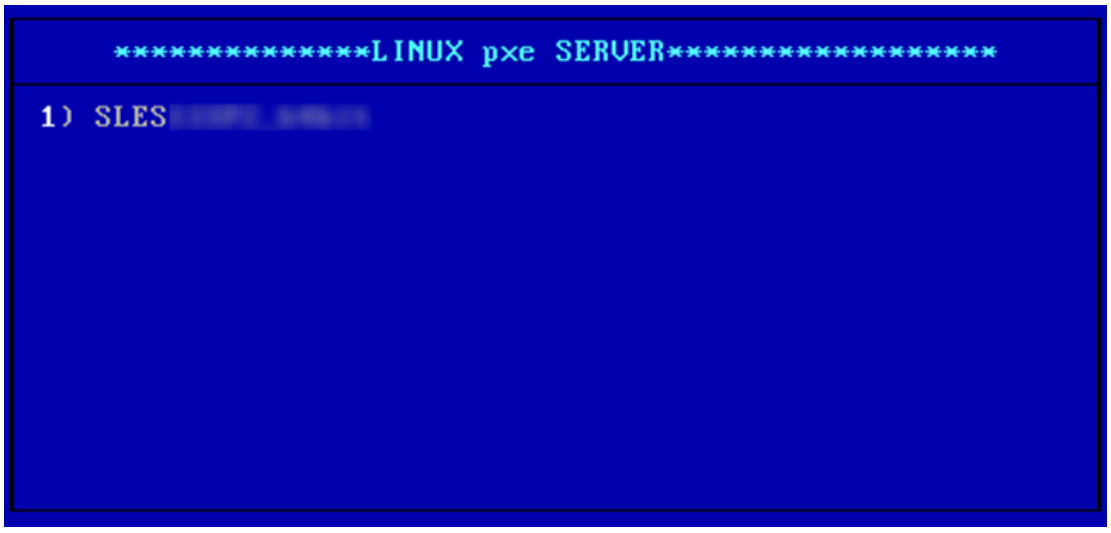


3.1.3. SLES11 SPx/SLES12 installation

i. In case of SLES11 SPx PXE, FCoE and iSCSI, and SLES12 FCoE, please make sure that the USB drive with DUD image is inserted.

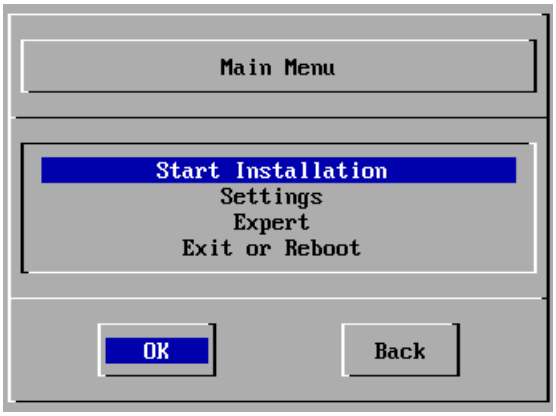
Note *No DUD required for SLES12 PXE and iSCSI, as inbox drivers can be used.*

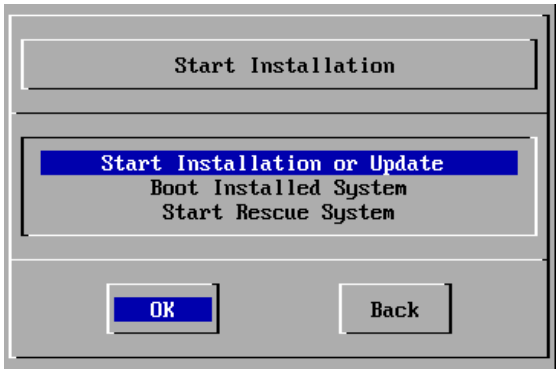
ii. Select the appropriate entry from the PXE menu and press [Enter].



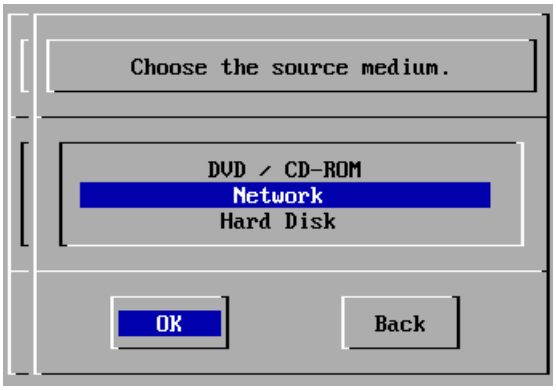
```
[    2.227429] hp_sw: device handler registered
[    2.252145] rdac: device handler registered

>>> 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”.

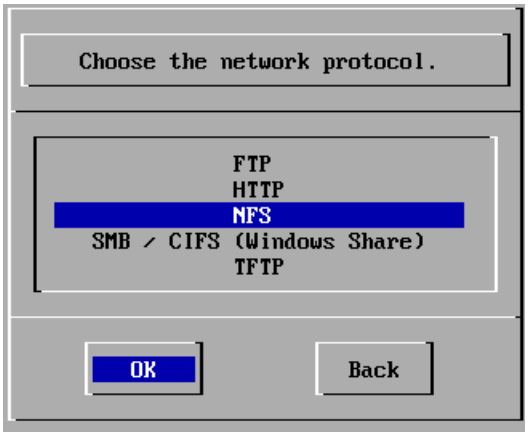




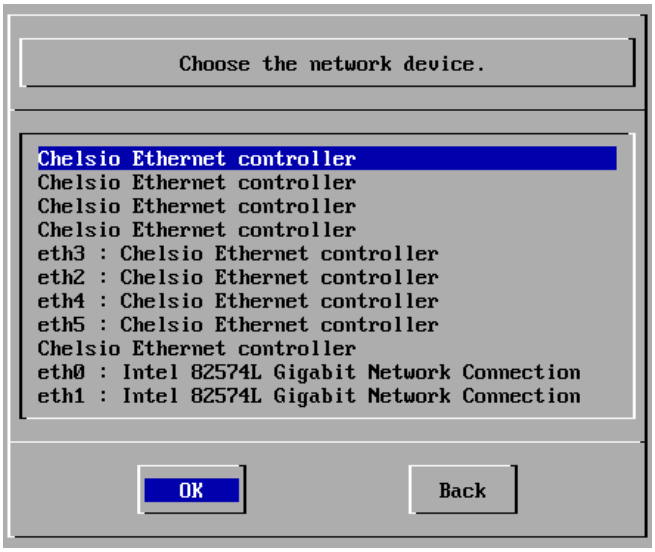
iv. Select “Network” as the source of medium to install the SLES Operating System.



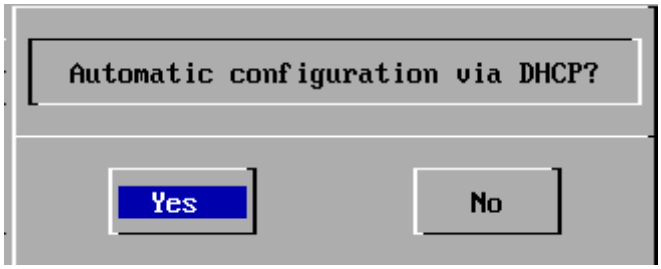
v. Select the desired Network protocol from the list presented.



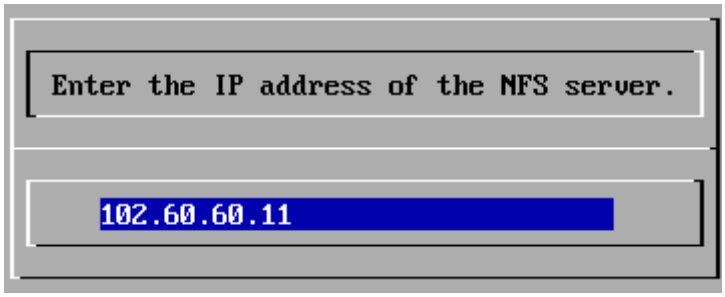
vi. Select the appropriate Chelsio interface from the list to proceed with installation. You can view the messages from the Linux kernel and drivers to determine the name of NIC interface by pressing [Alt] + [F3] or [Alt] + [F4]. Press [Alt] + [F1] to get back to the list.



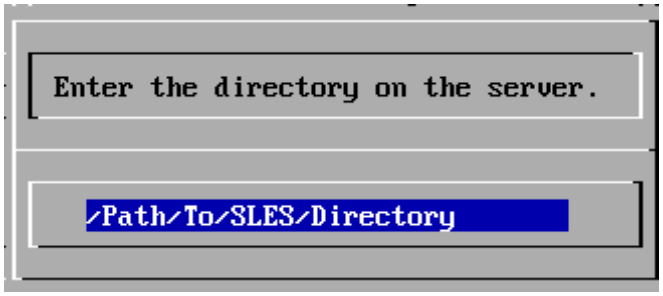
vii. Select “Yes” to configure the network interface selected in the previous step using DHCP.



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. For RHEL 6 and SLES distributions, press *Tab* and then *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 SLES11 SPx/SLES12).

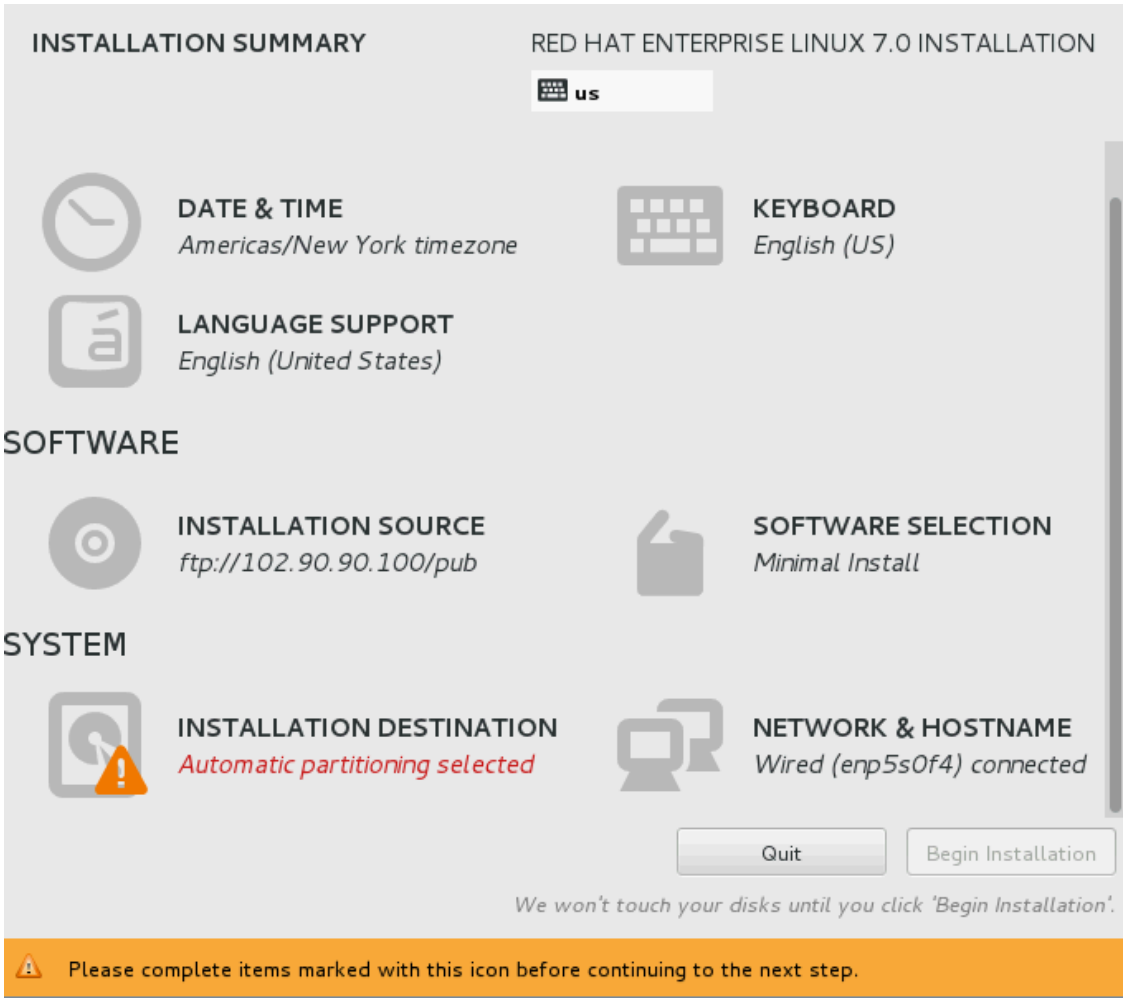
- If you are installing from a PXE server, please refer **3.1. Installation using Chelsio DUD (PXE boot)** (**Click here** for RHEL 7.x; **Click here** for RHEL6.x; **Click here** for SLES11 SPx/ SLES12) section to load Chelsio Driver Update Disk.

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

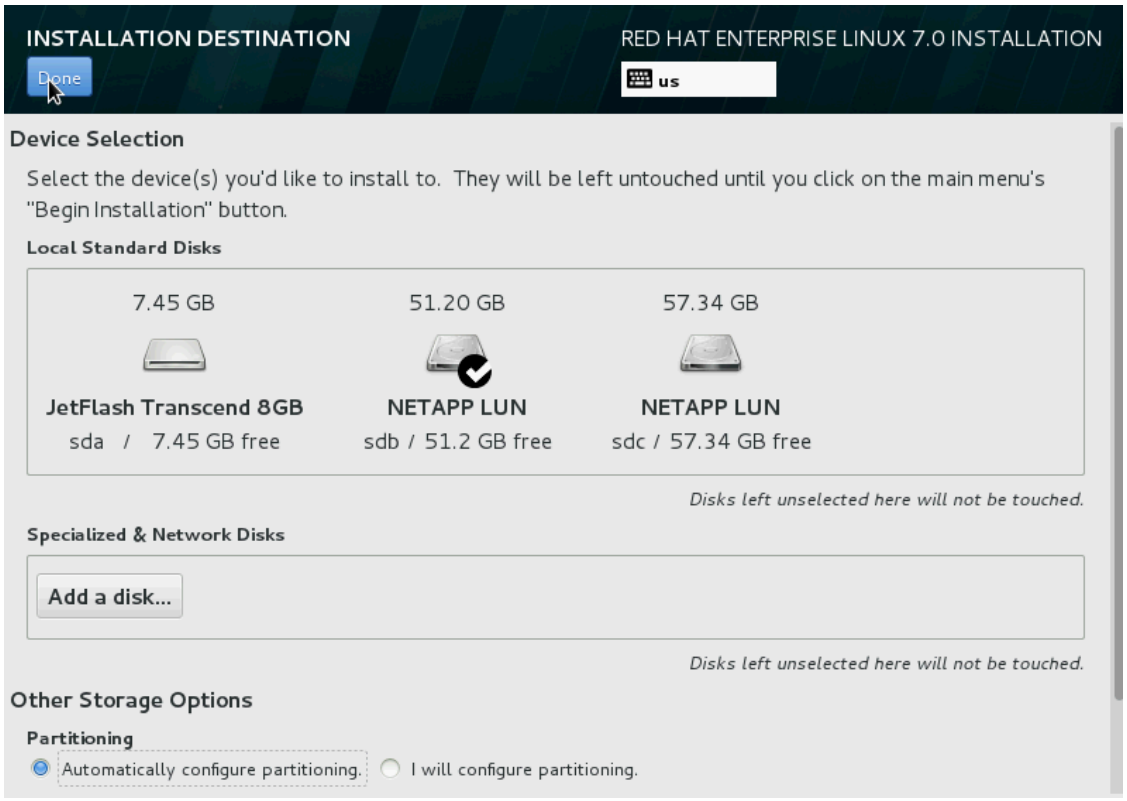
3.2.1. RHEL 7.x

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

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

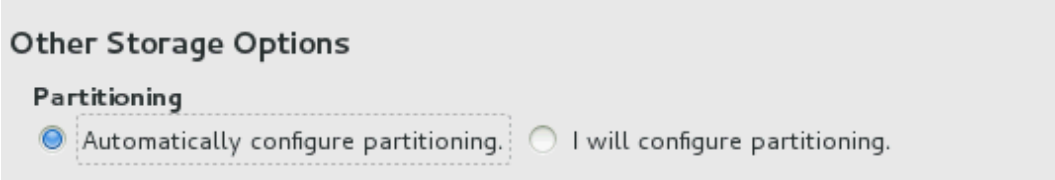


iii. The discovered FC/FCoE LUNs will appear as local storage in the **Local Standard Disks** section**.** Select the LUN which was saved as boot device in system BIOS.



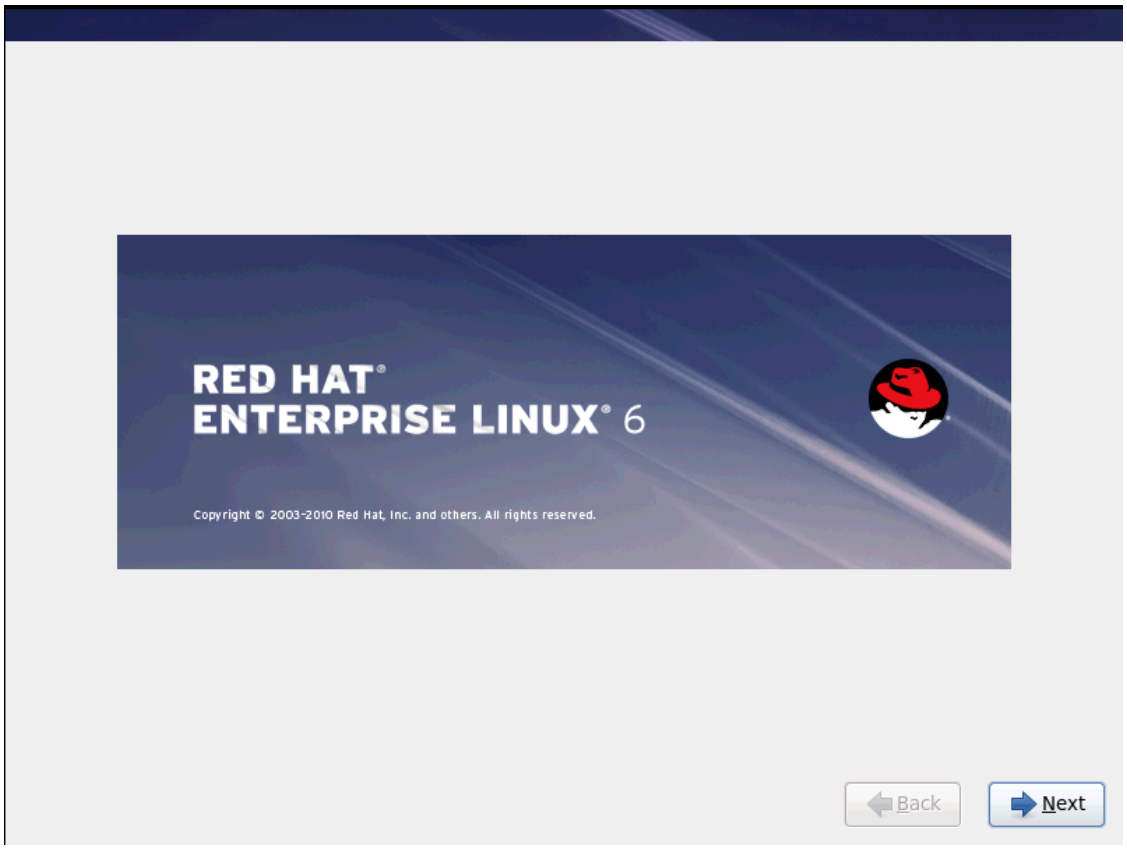
Note *Make sure the same LUN discovered at the Option ROM stage is selected for OS installation.*

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.

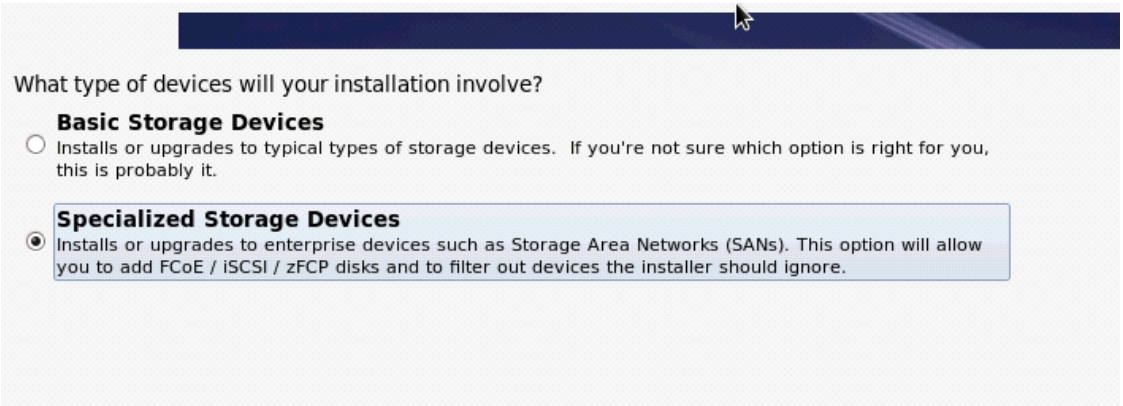


3.2.2. RHEL 6.x Installation

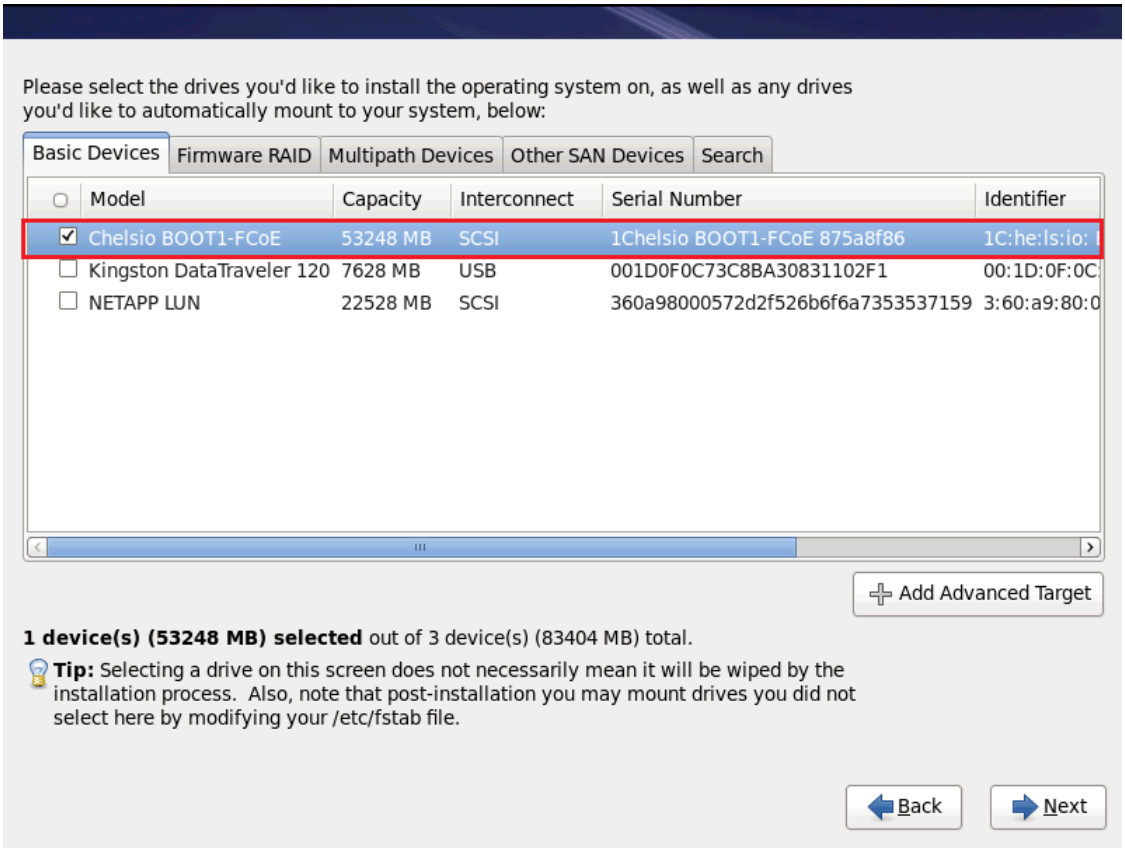
i. Click **Next** when the graphical installer screen appears.



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



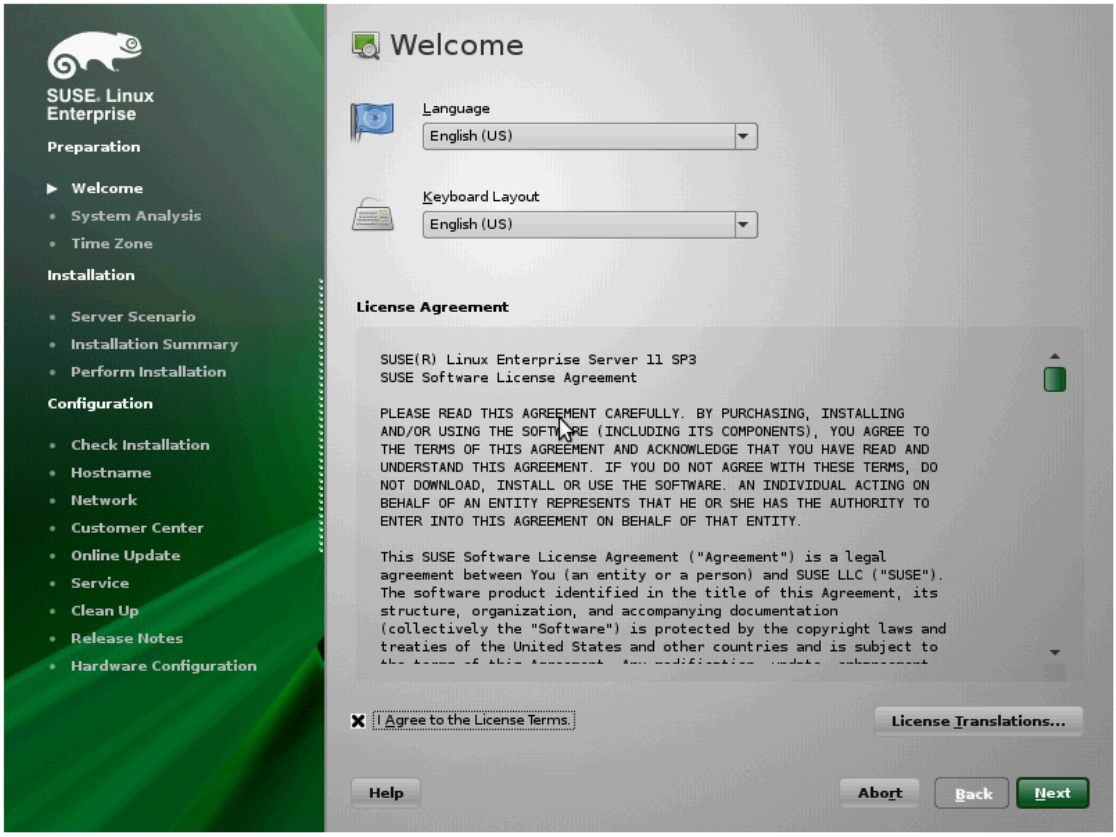
iii. Select the FC/FCoE LUN which was saved as boot device in system BIOS and click **Next**. Then proceed with the installation as usual.



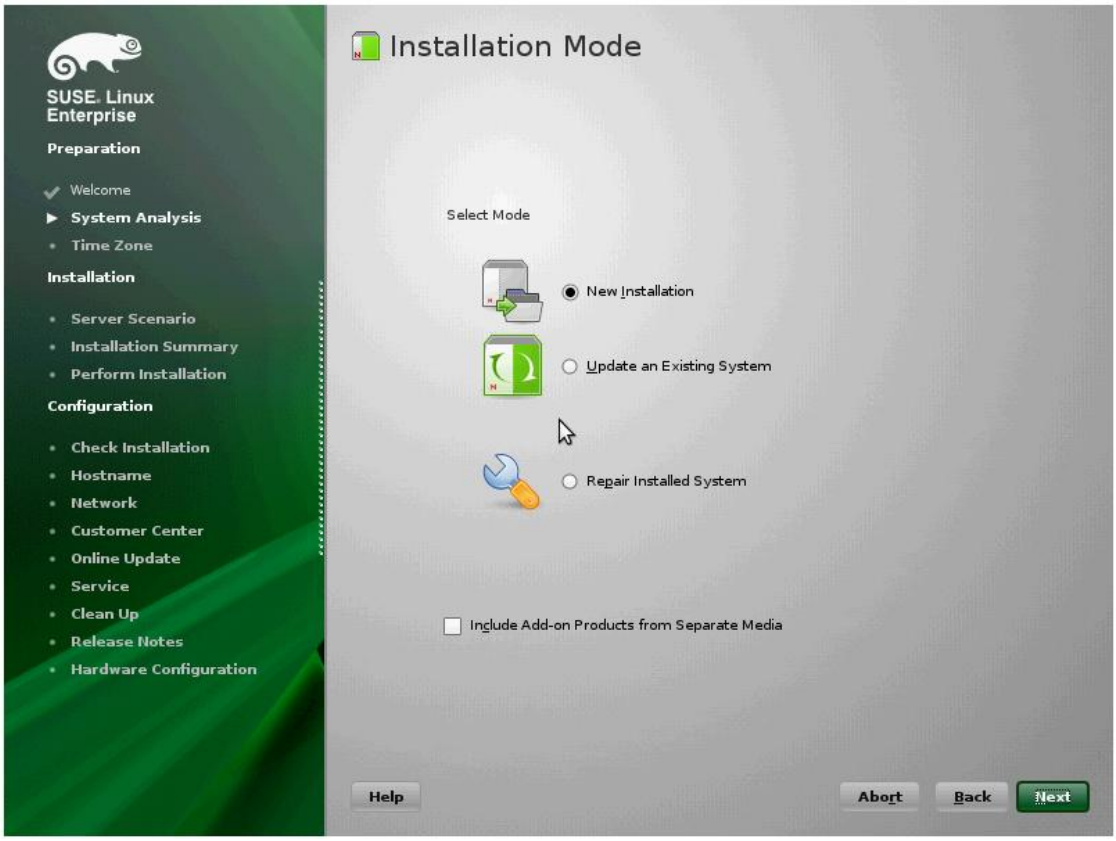
Note *Make sure the same LUN discovered at the Option ROM stage is selected for OS installation.*

3.2.3. SLES11 SPx Installation

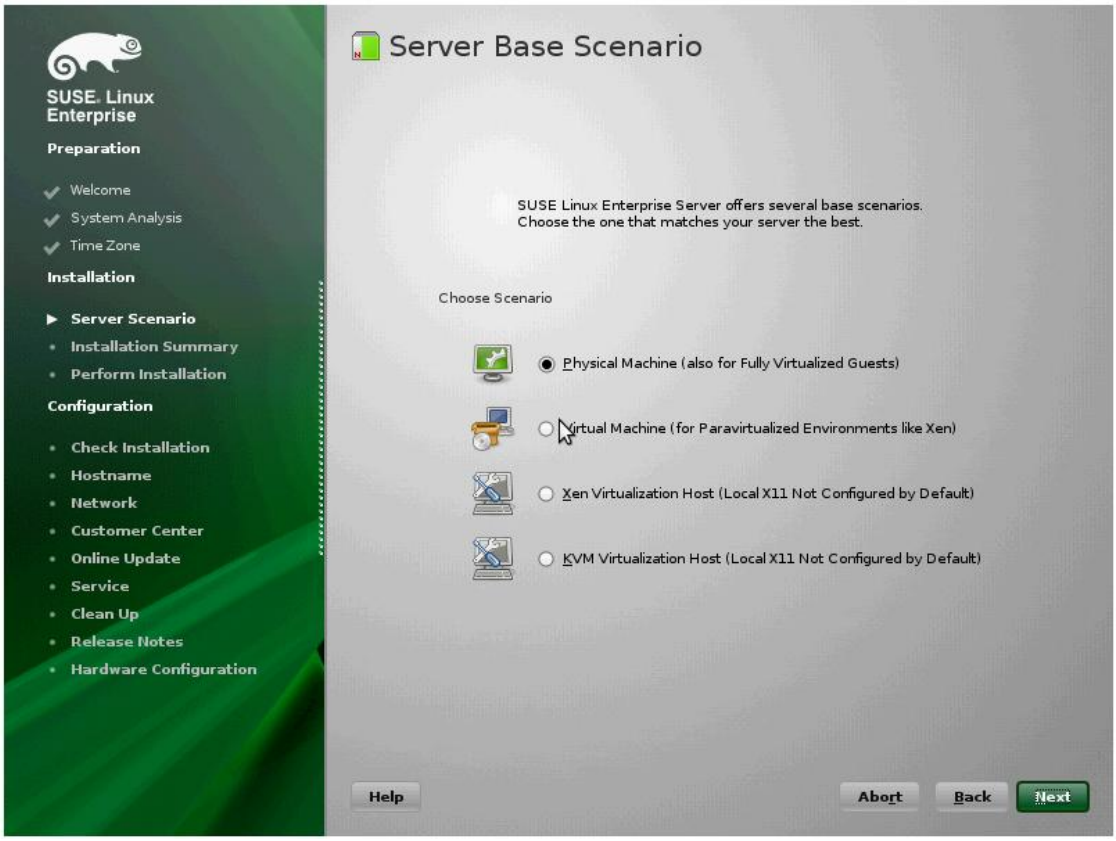
i. Choose installation language and Keyboard layout type. Select the checkbox **I Agree to the License terms** and click **Next**.



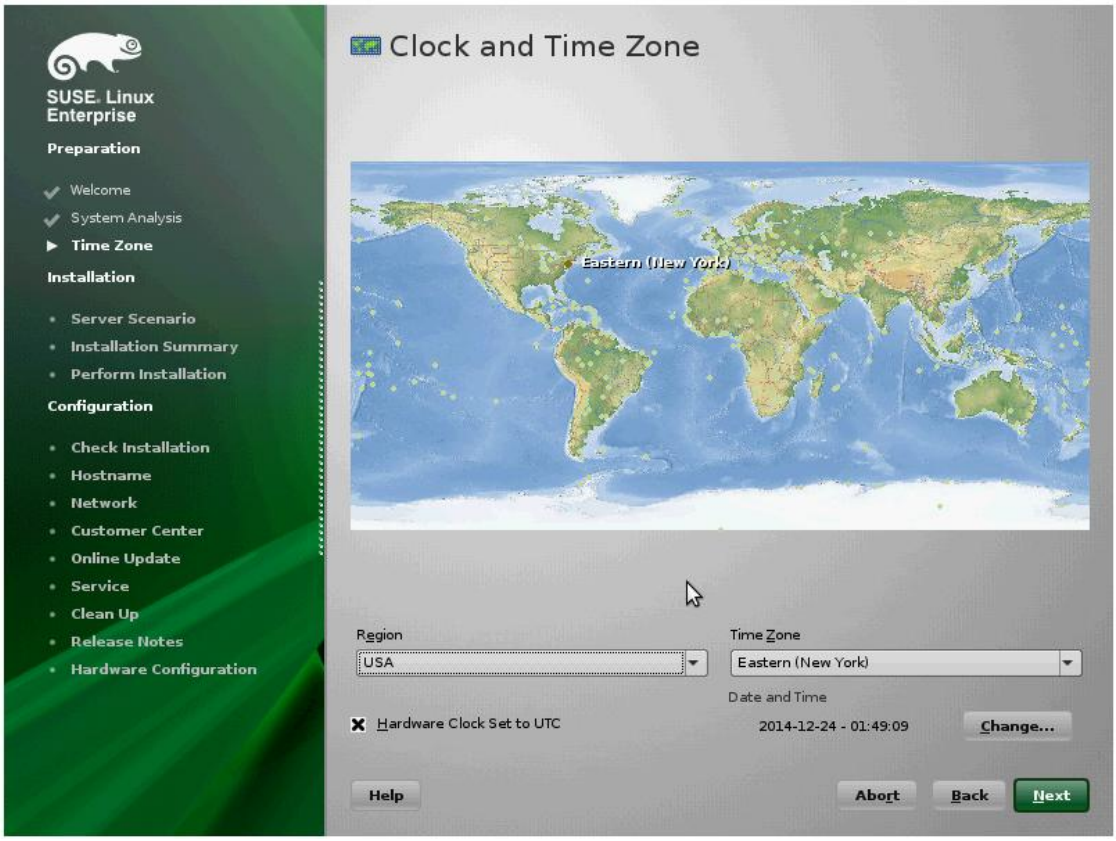
ii. Select **New Installation** to perform a fresh installation and click **Next**.



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



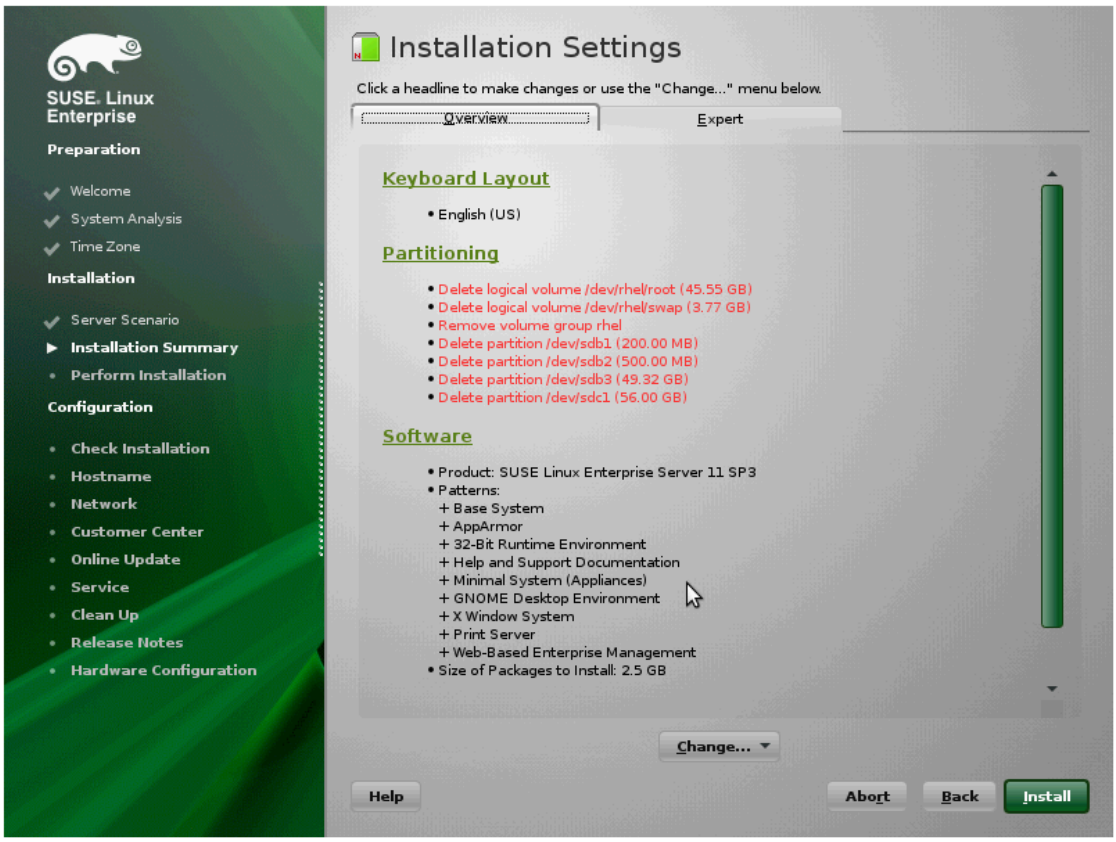
iv. Configure Clock and Time Zone settings. Click **Next**.



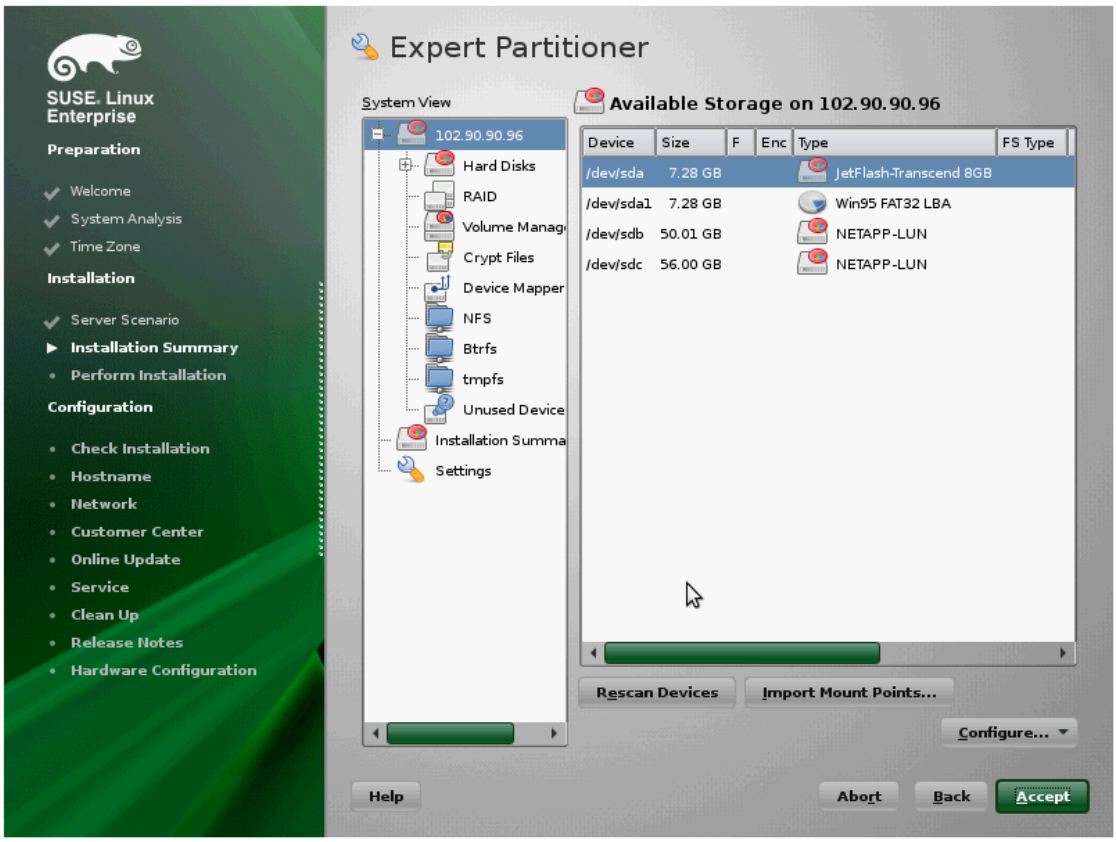
v. The discovered FC/FCoE LUNs will appear in the **Preparing Hard Disk** screen**.** Select the LUN which was saved as boot device in system BIOS. Click **Next**.

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

vi. 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**.



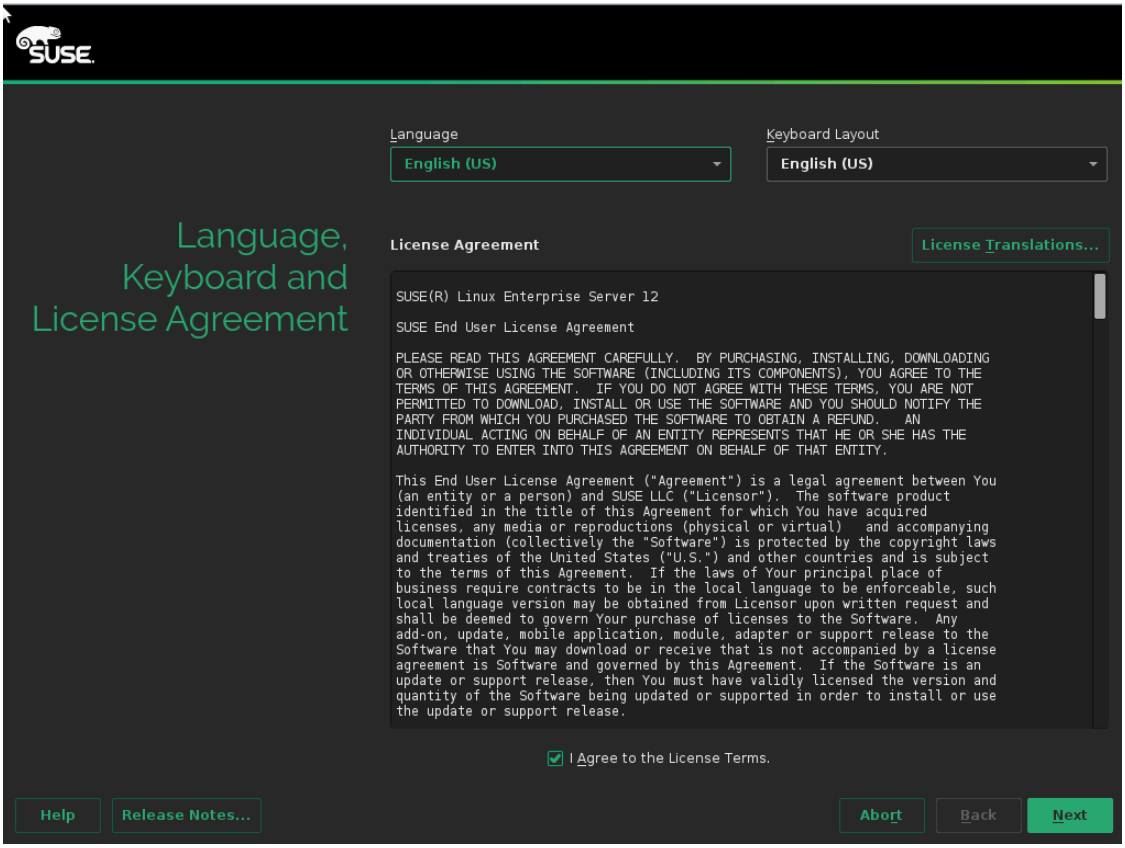
vii. The **Expert Partitioner** screen displays the partition setup suggested by the installer. Click on the device selected in step (v) and click **Accept**.



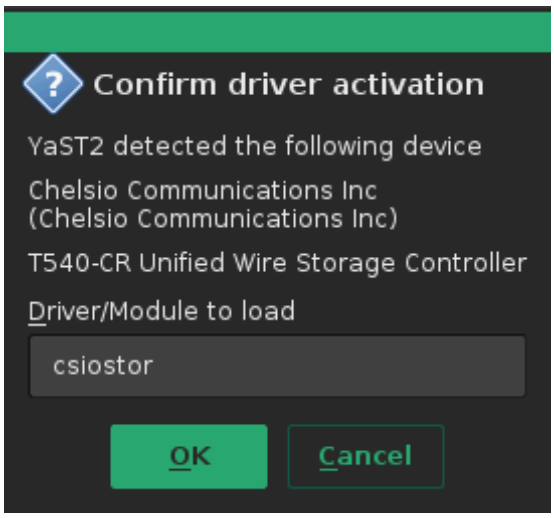
viii. Proceed with installation as usual.

3.2.4. SLES12 Installation

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

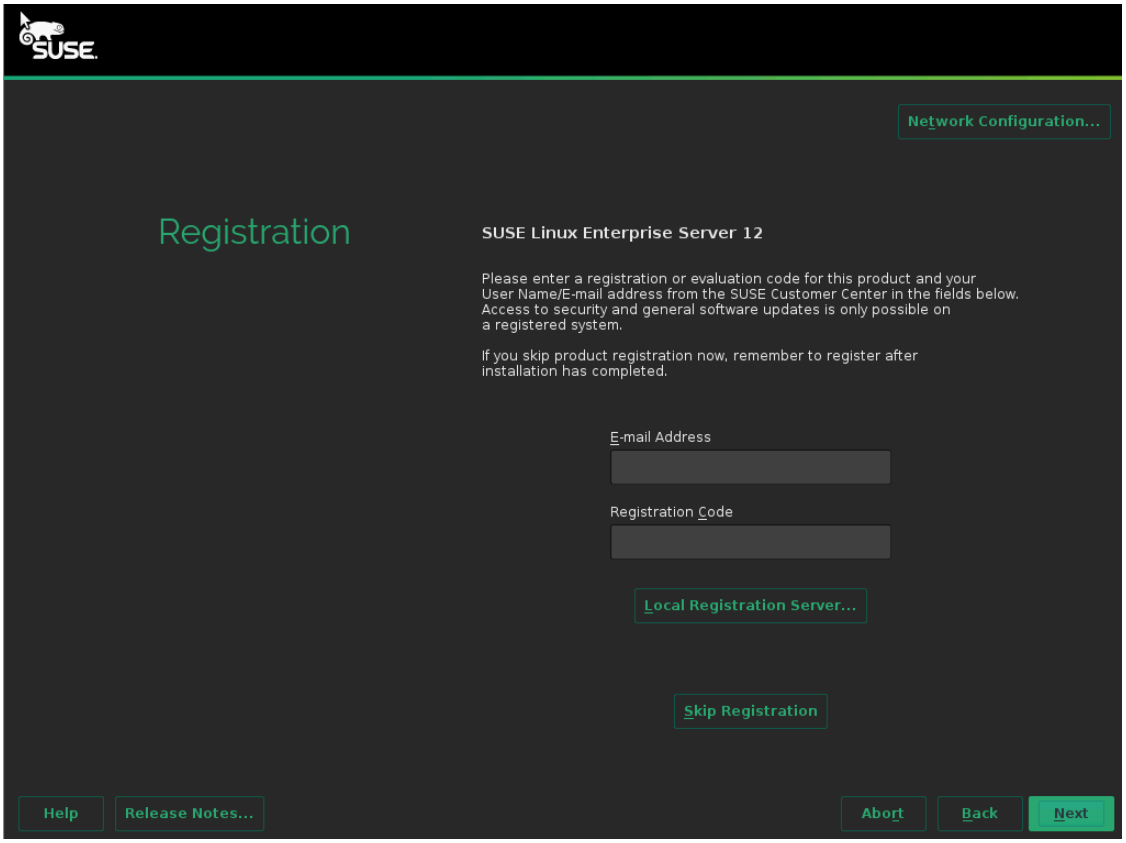


ii. During system probe, the YaST installer will detect Chelsio FCoE driver *csiostor* present in the DUD and prompt for confirmation to load/activate. Press [OK].

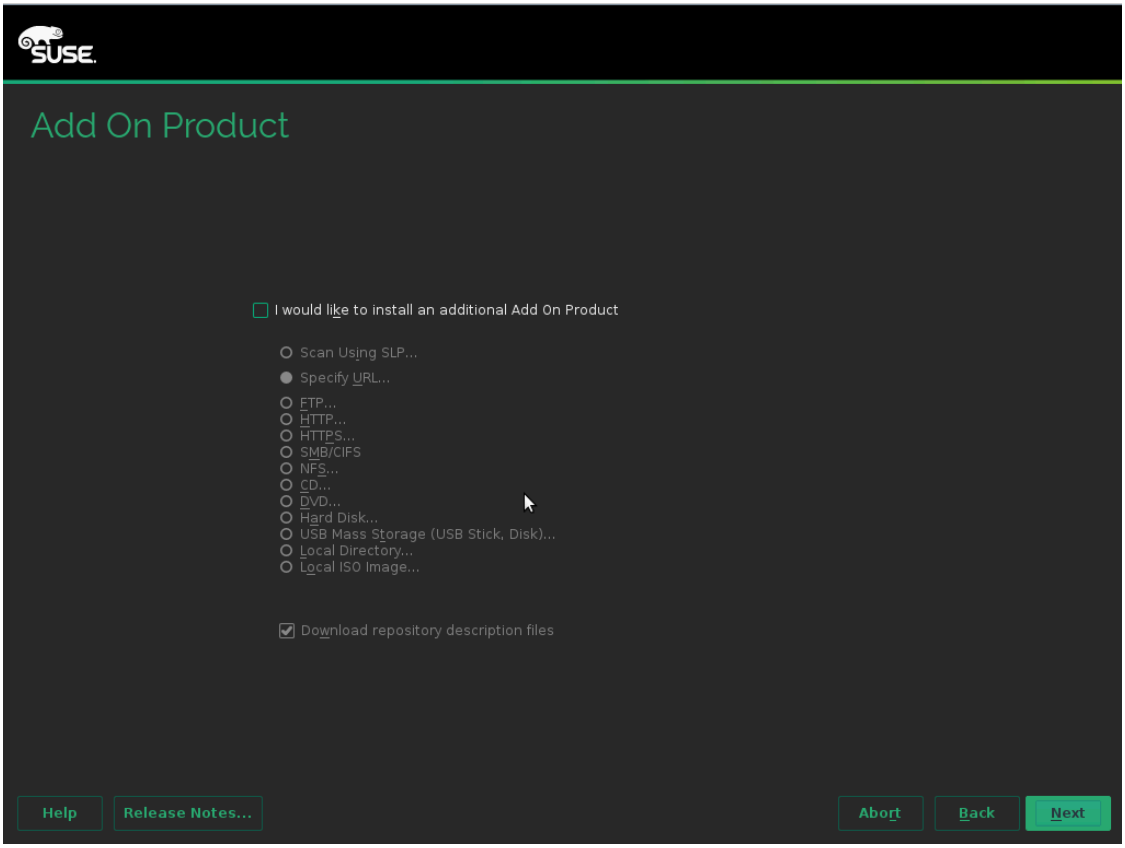


iii. To receive the latest updates for your operating system and technical support, you will need to register your system. Enter the registration or evaluation code for your copy of SLES12 and email id associated with your Suse Customer Care (SCC) account and click **Next**.

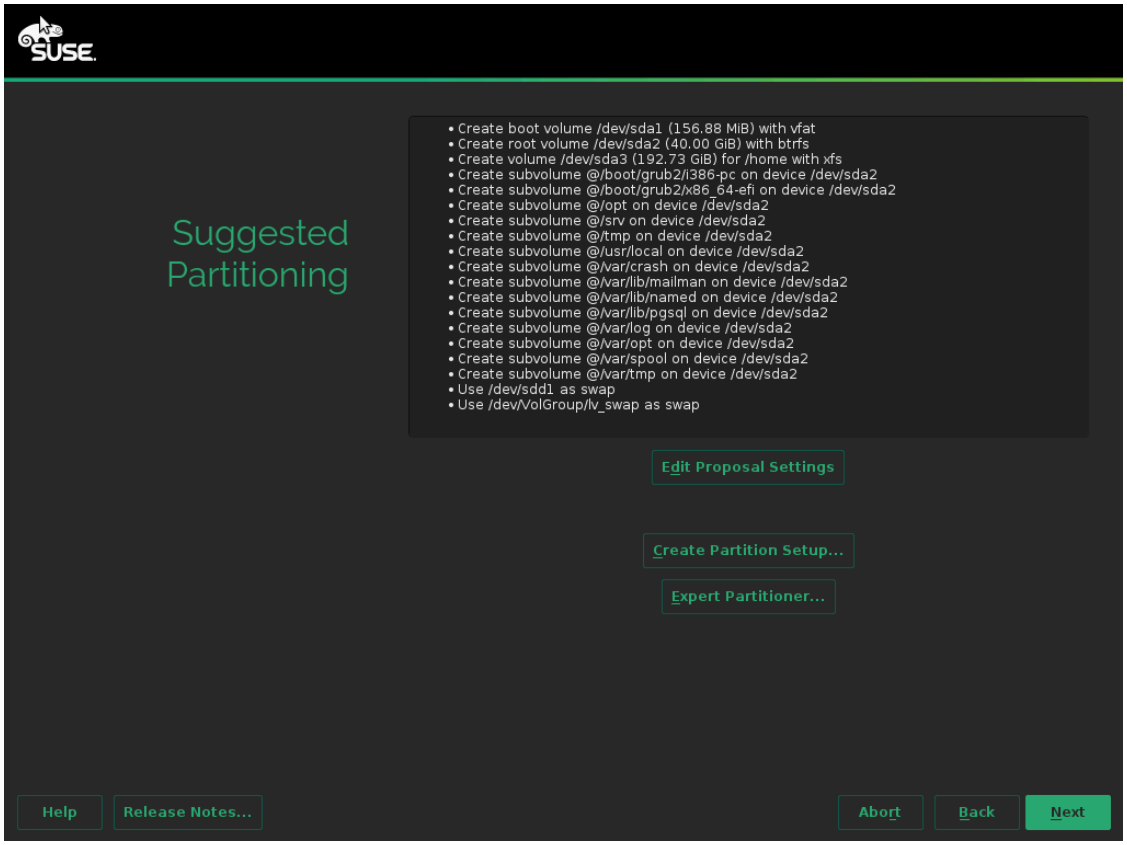
To bypass registration, click **Skip Registration** and then **Yes** on the pop-up window that appears.



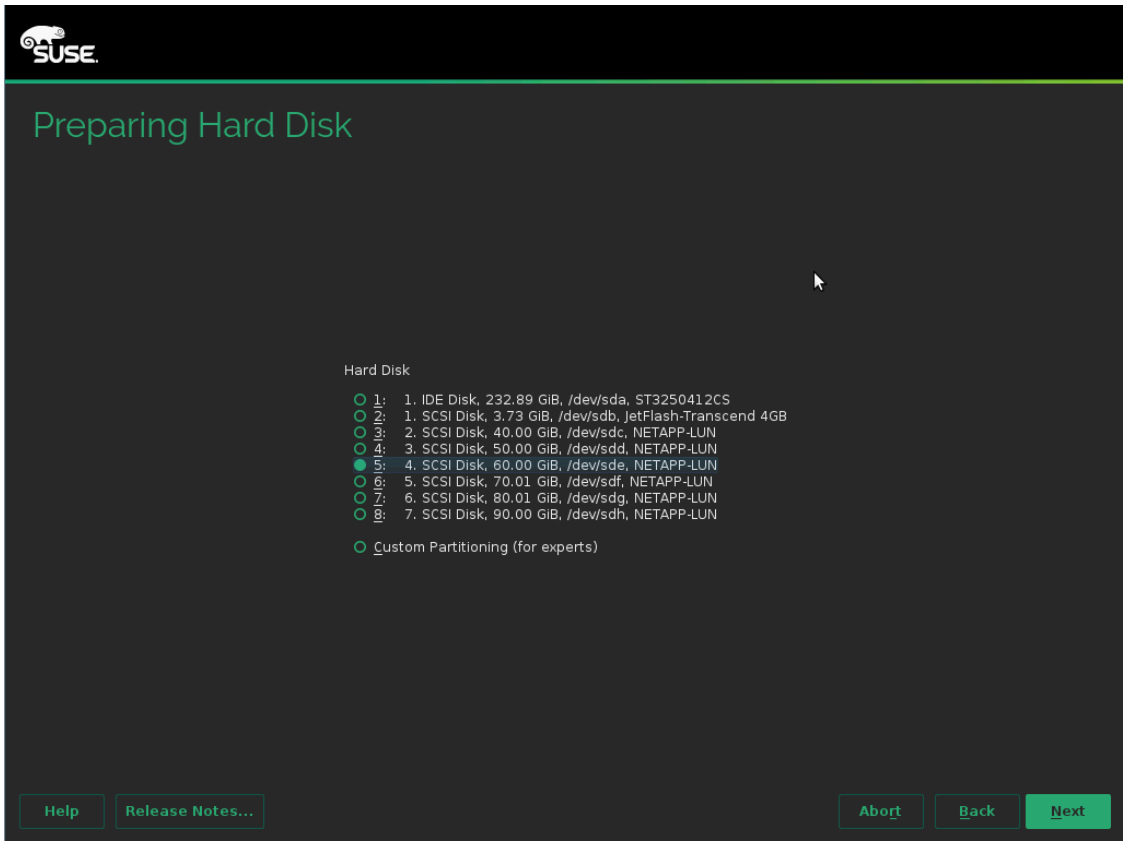
iv. The next screen will display a list of add-ons and extensions available for SLES12. To install, select the checkbox *I would like to install an additional Add On Product*, then select the radio button for the add-on/extension you wish to install, and click **Next**.



v. On the *Suggested Partitioning* screen, YaST generated partition setup will be displayed. To change the suggested settings click **Edit Proposal** Settings. To select the disk on which to apply the proposed settings, click **Create Partition Setup**. To change the partition setup click **Expert Partitioner**.

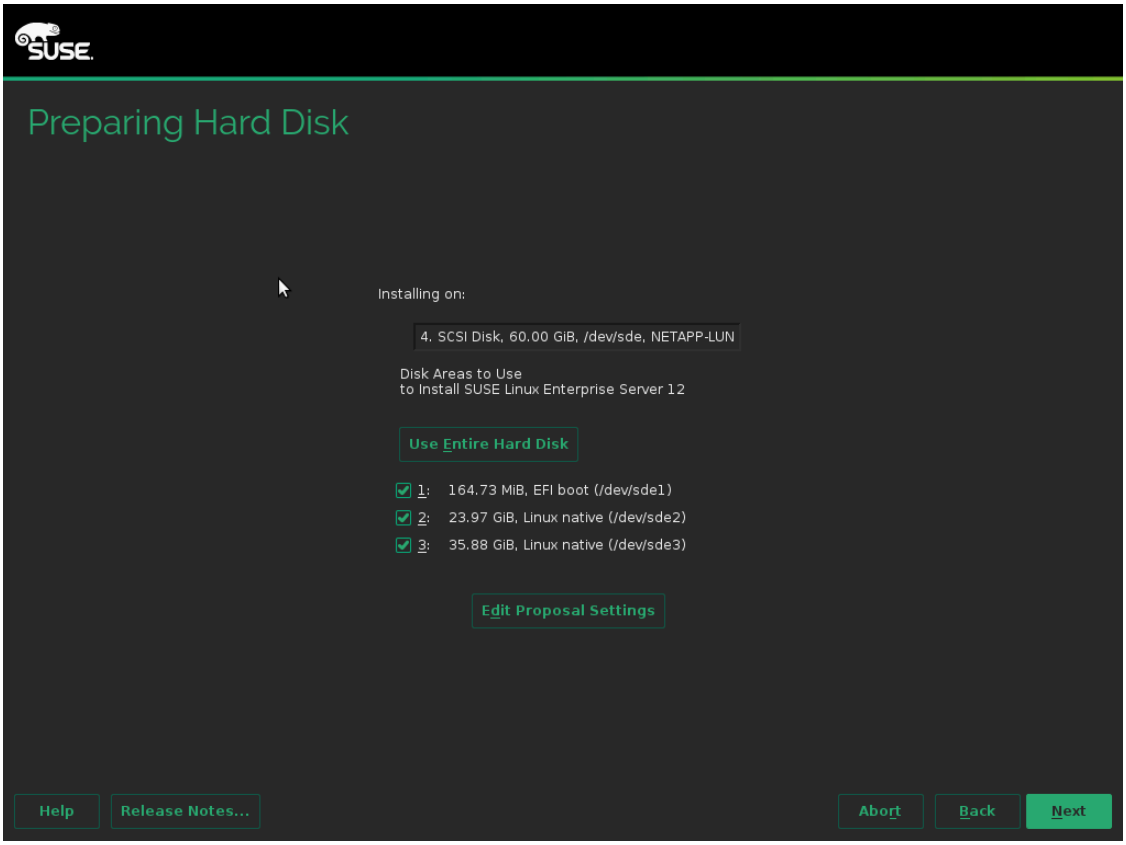


vi. Click **Create Partition Setup** and select the LUN which was saved as boot device in system BIOS. Click **Next**.

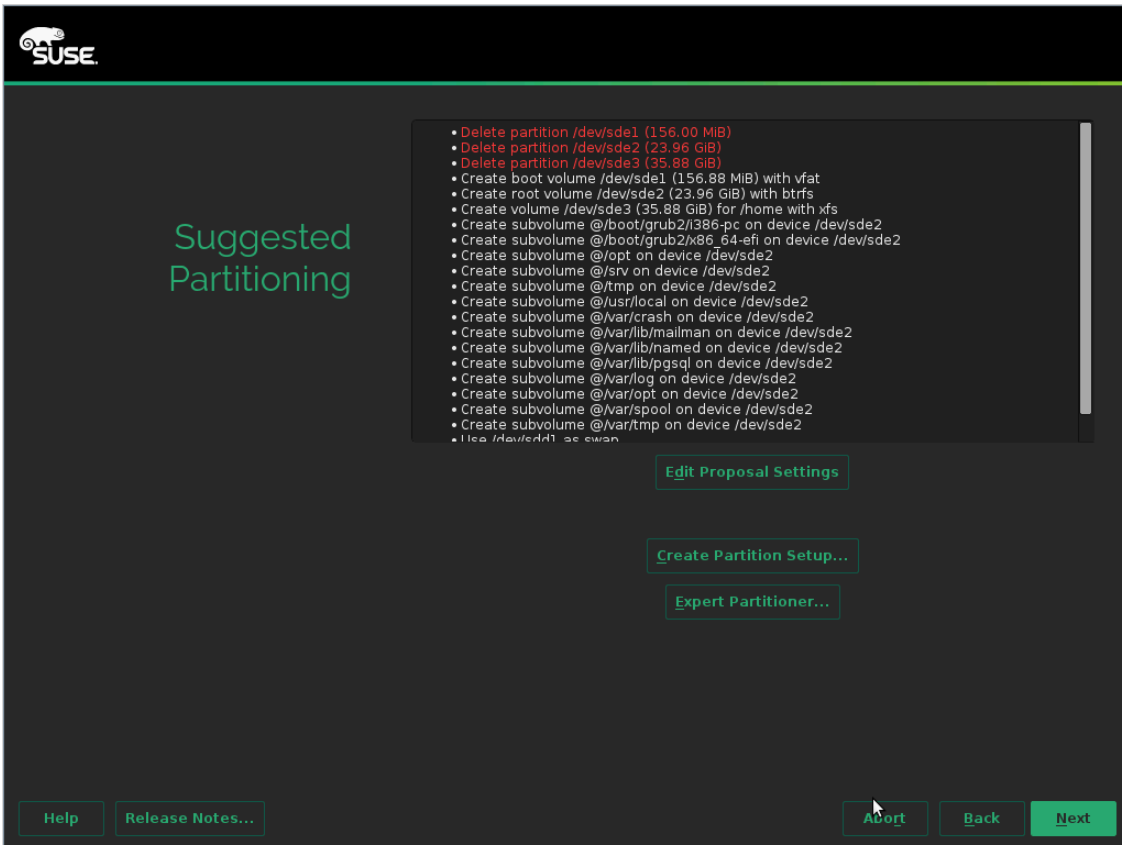


Note *Make sure the same LUN discovered at the Option ROM stage is selected for OS installation.*

vii. To use the entire LUN for installation, click **User Entire Hard Disk**. Please note that this will delete all the existing partitions. To install operating system on an existing partition, select the partition from the list displayed. Click **Next**.



viii. The selected LUN should now appear in the *Suggested Partitioning* screen. Click **Next**.



ix. Proceed with 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. Type *e* and then *dd* at the boot prompt for RHEL 7. For RHEL 6 and SLES distributions, press *Tab* and then *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 SLES11 SPx).

- If you are installing from a PXE server, please refer **3.1. Installation using Chelsio DUD (PXE boot)** (**Click here** for RHEL 7.x; **Click here** for RHEL6.x; **Click here** for SLES11 SPx) section to load Chelsio Driver Update Disk.

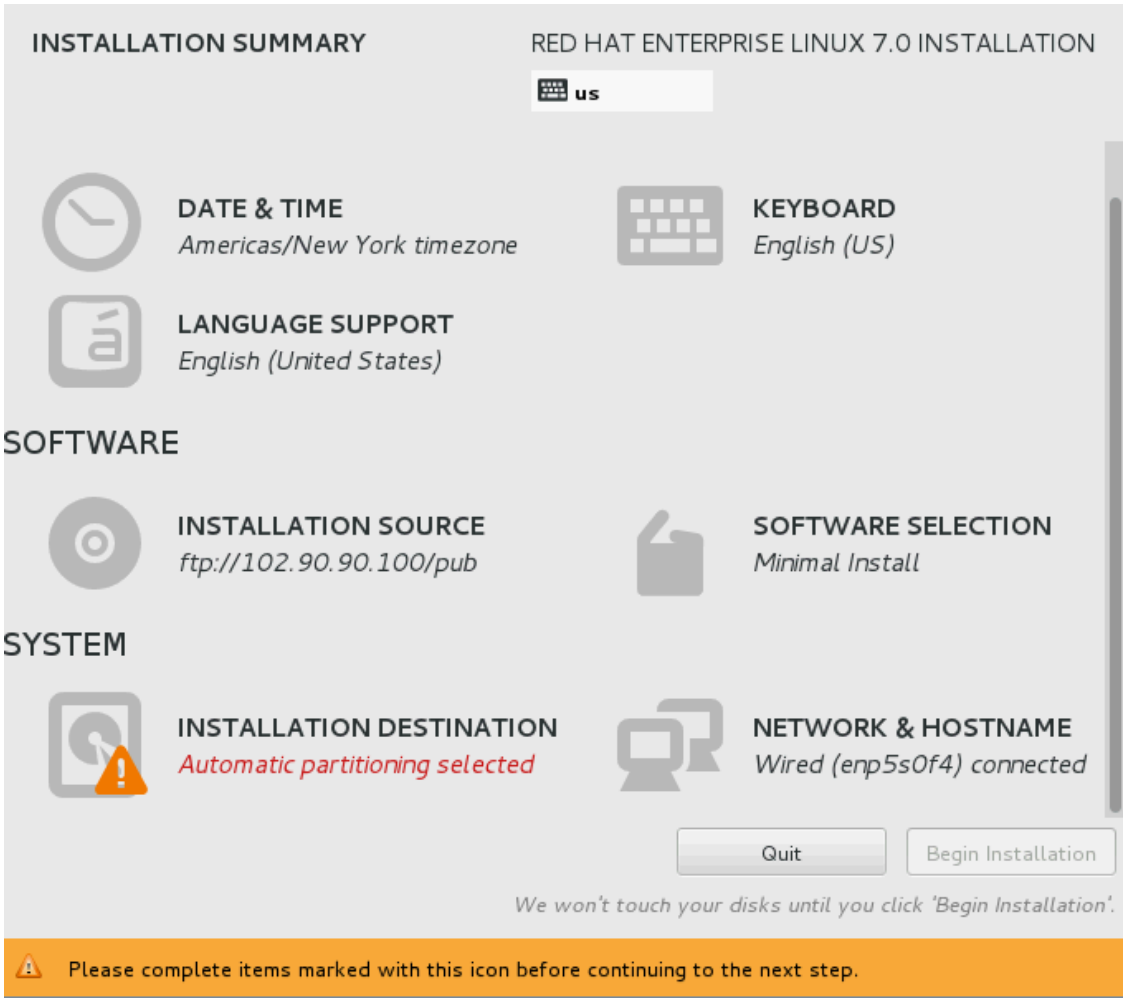
Note *No separate DUD required for SLES 12 OS installation, as inbox drivers can be used.*

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

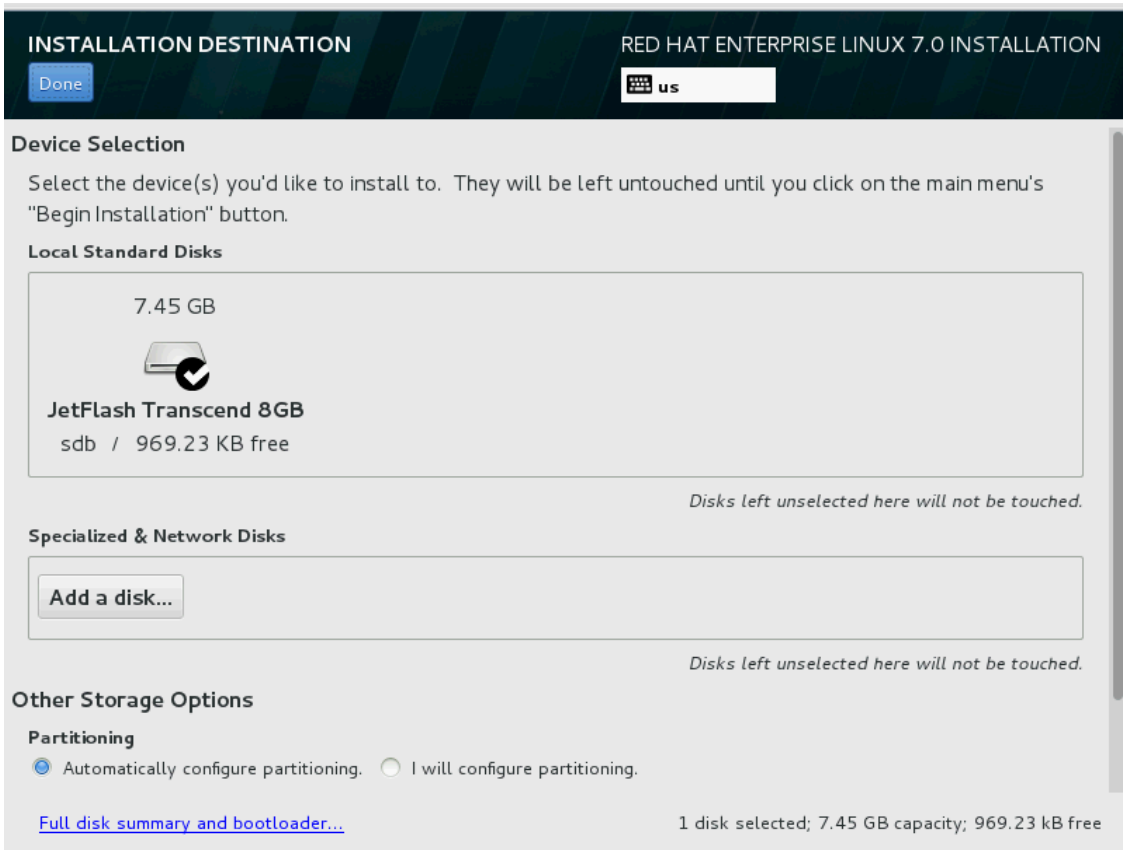
3.3.1. RHEL 7.x

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

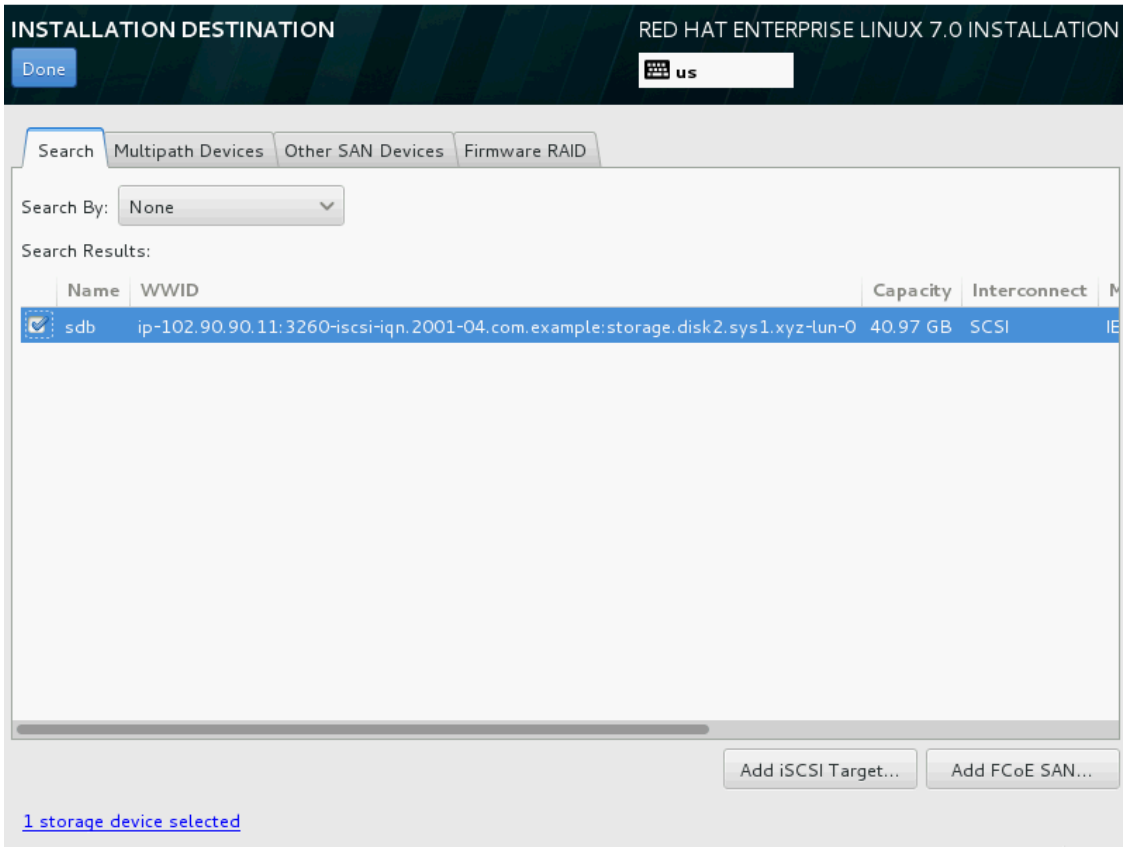
ii. Click **Installation Destination** under **SYSTEM.**



iii. Click **Add a disk**

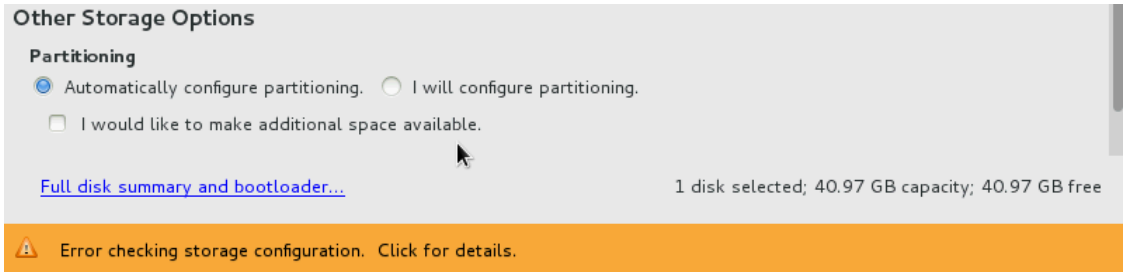


iv. The discovered iSCSI LUNs will appear in the **Search** tab. Select it and click **Done**.



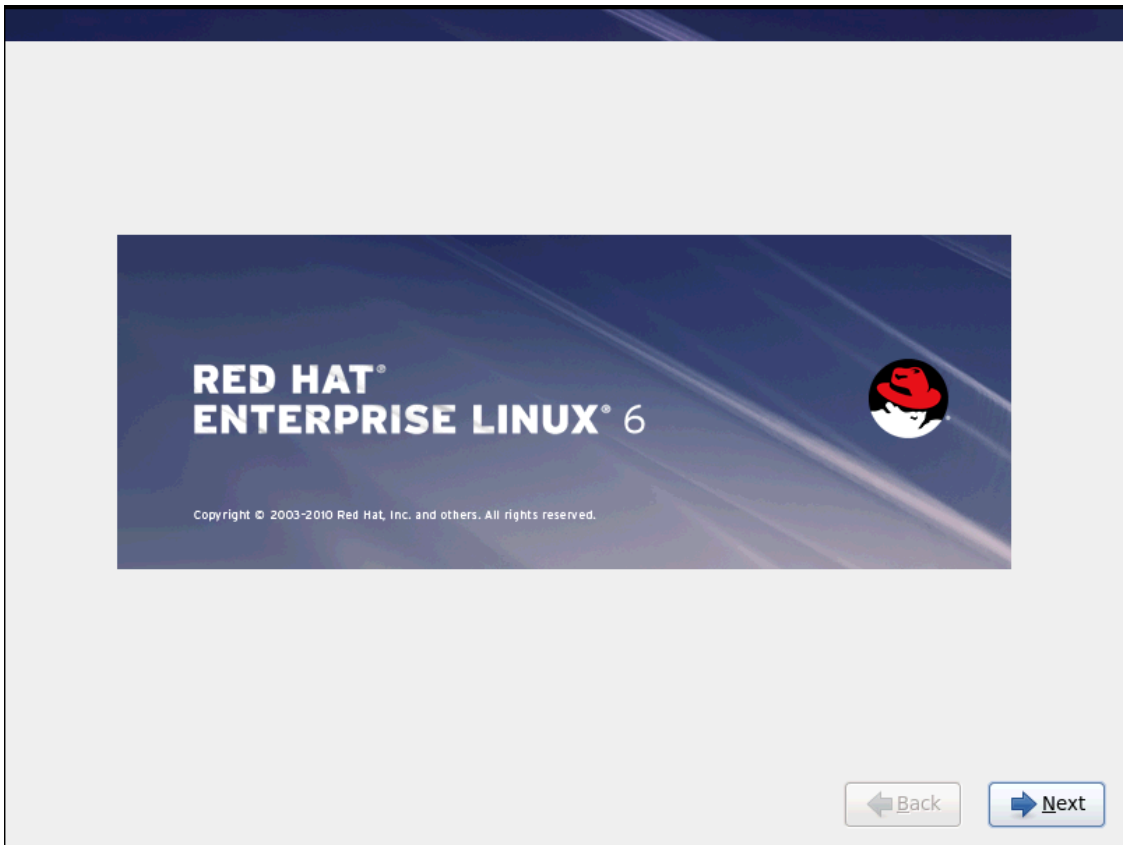
Note *Make sure the same LUN discovered at the Option ROM stage is selected for OS installation.*

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.

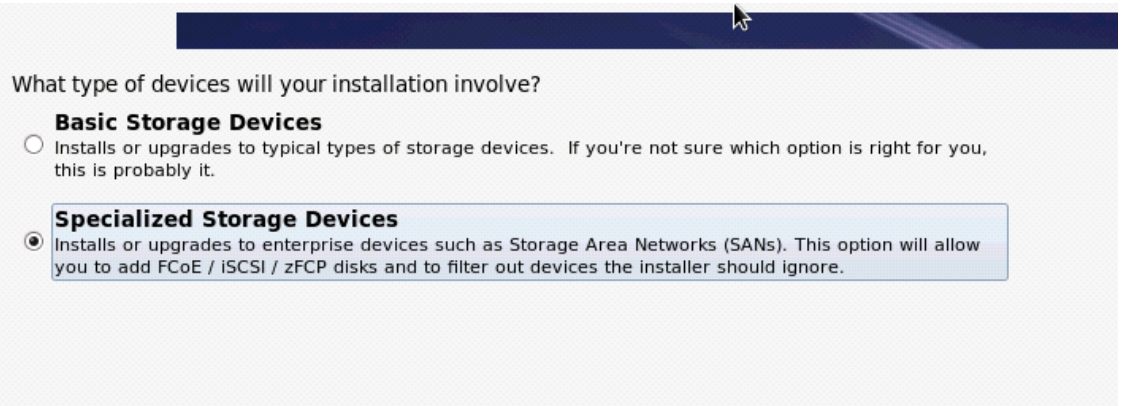


3.3.2. RHEL 6.x

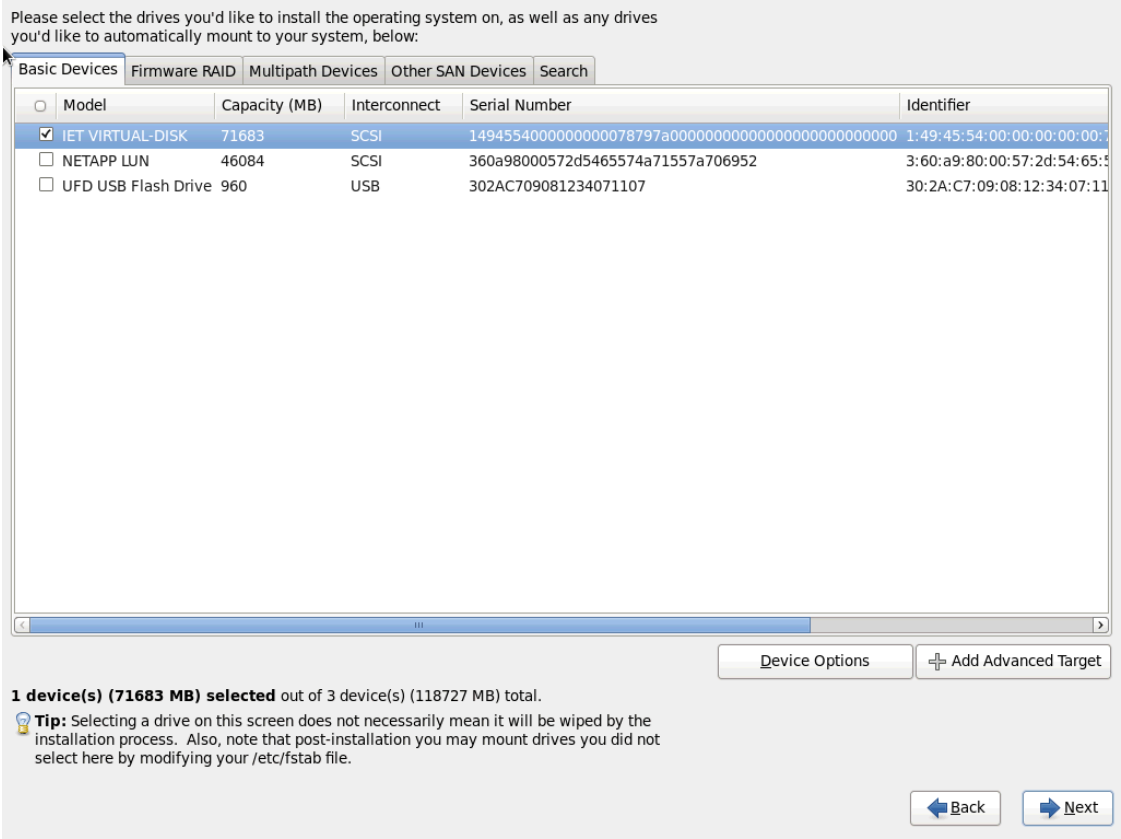
i. Click **Next** when the graphical installer screen appears.



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**.

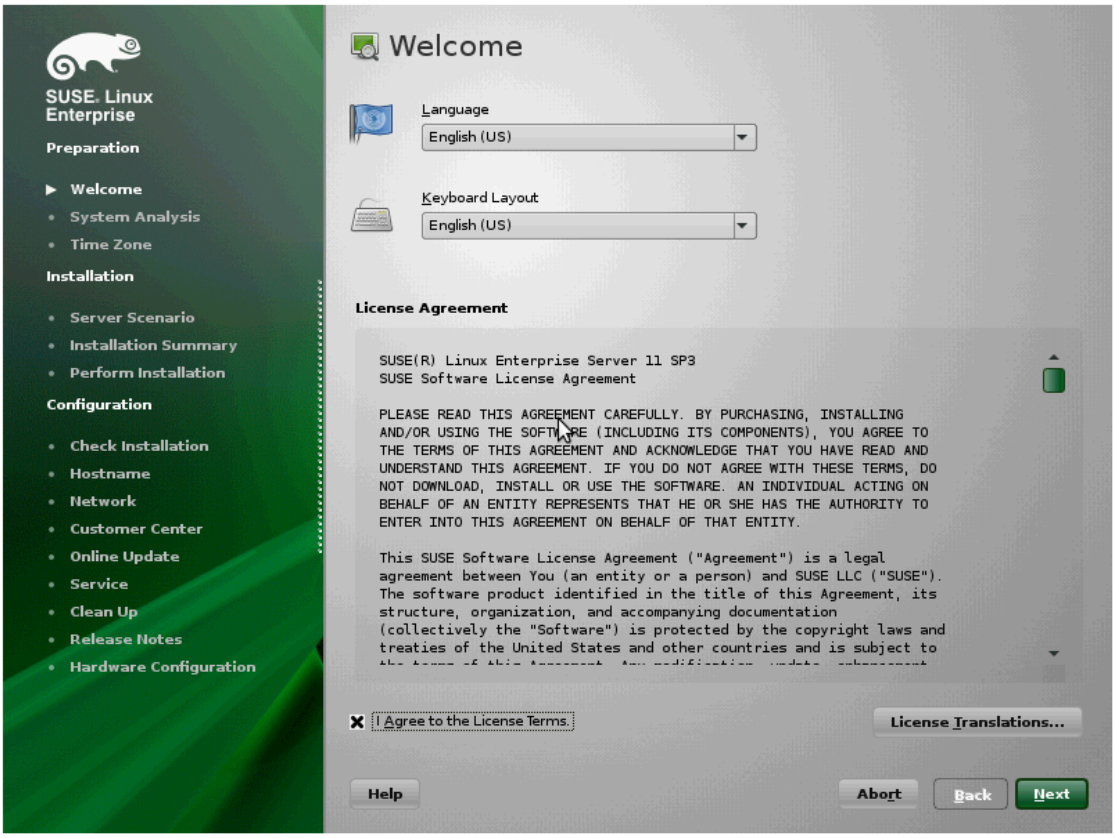


Note *Make sure the same LUN discovered at the Option ROM stage is selected for OS installation.*

iv. Proceed with the installation as usual.

3.3.3. SLES11 SPx installation

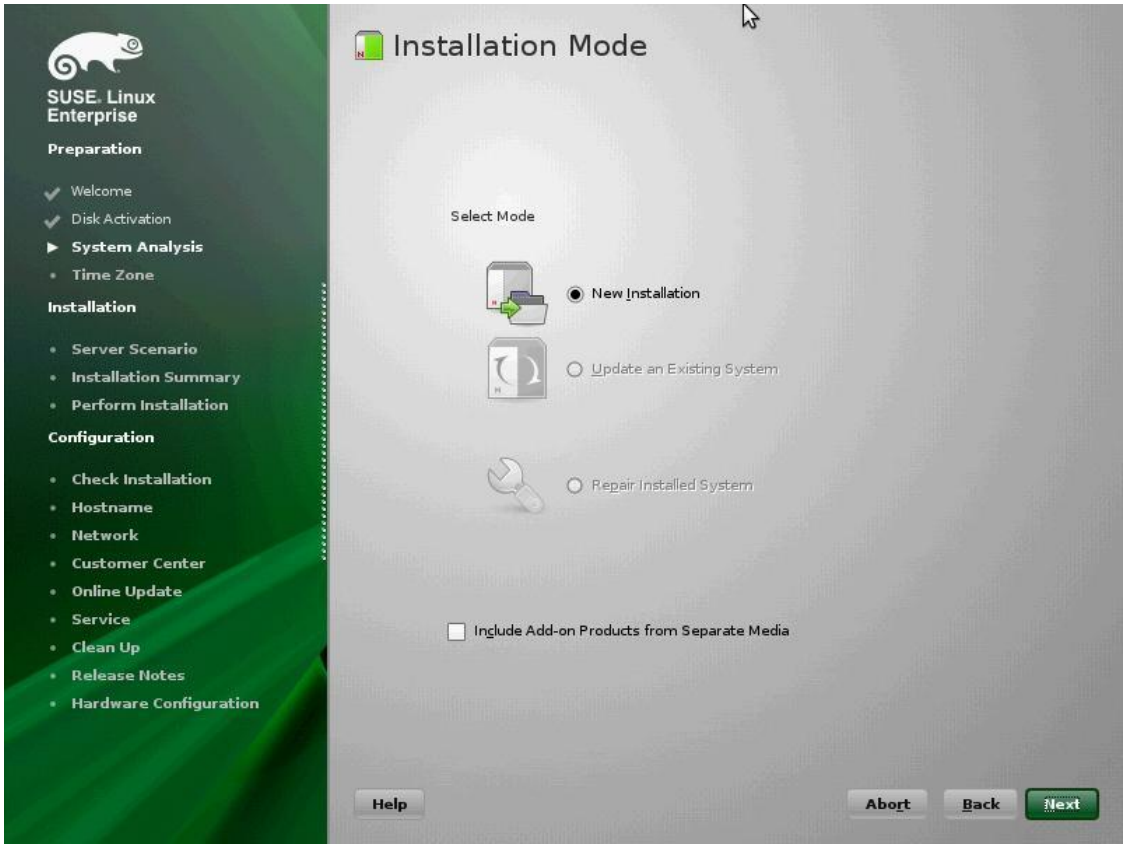
i. Choose installation language and Keyboard layout type. Select the checkbox **I Agree to the License terms** and click **Next**.



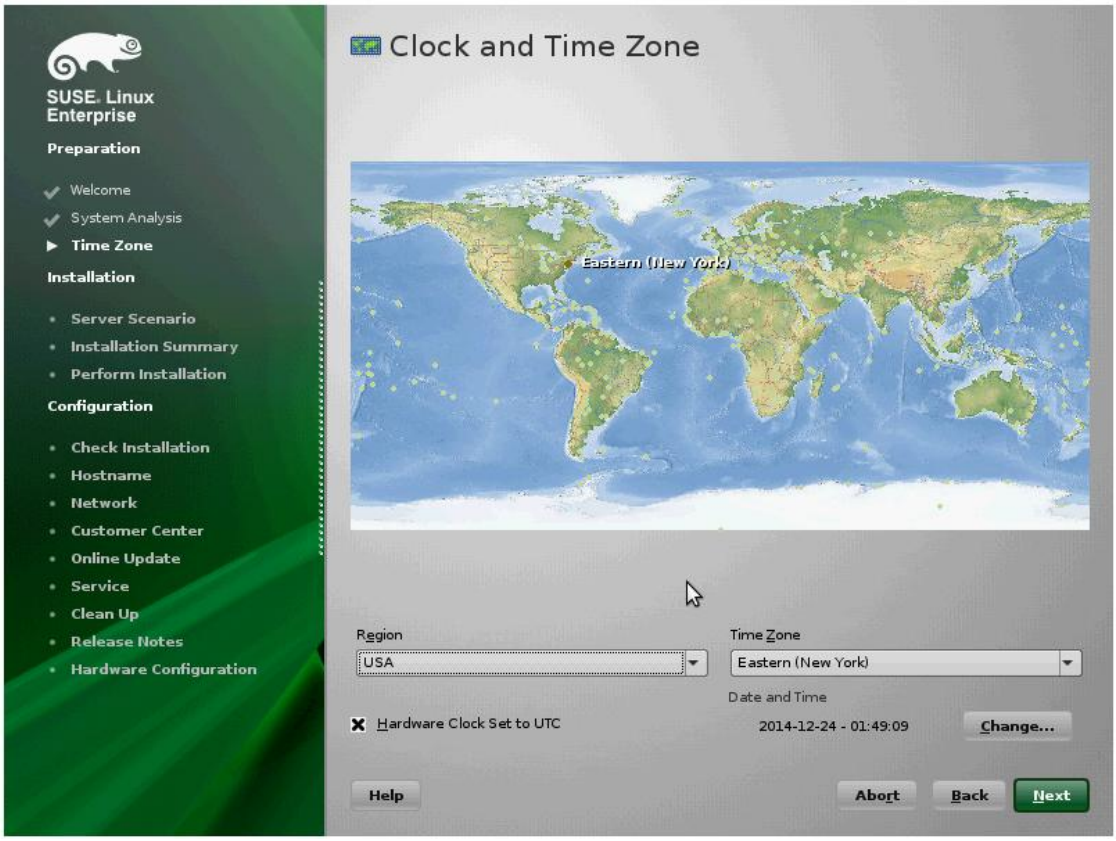
ii. Click **Configure iSCSI Disks** in the **Disk Activation** screen.

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**.

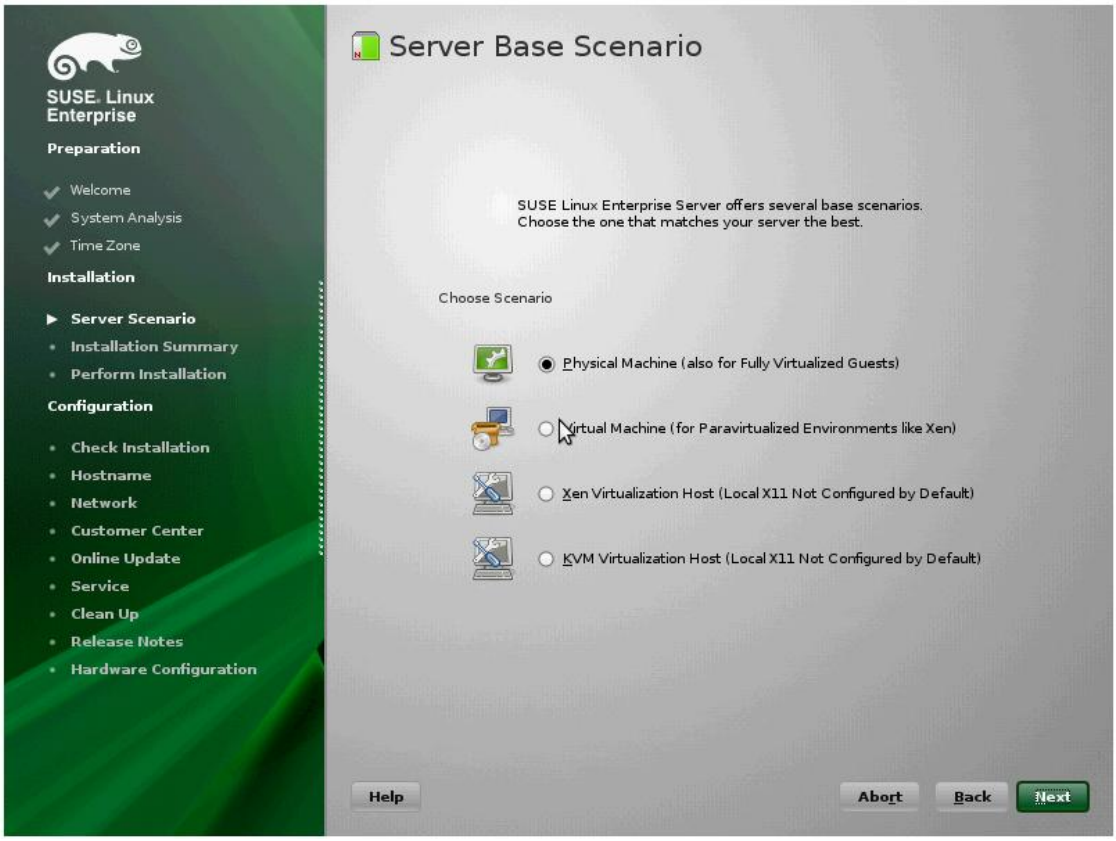
iv. Select **New Installation** to perform a fresh installation and click **Next**.



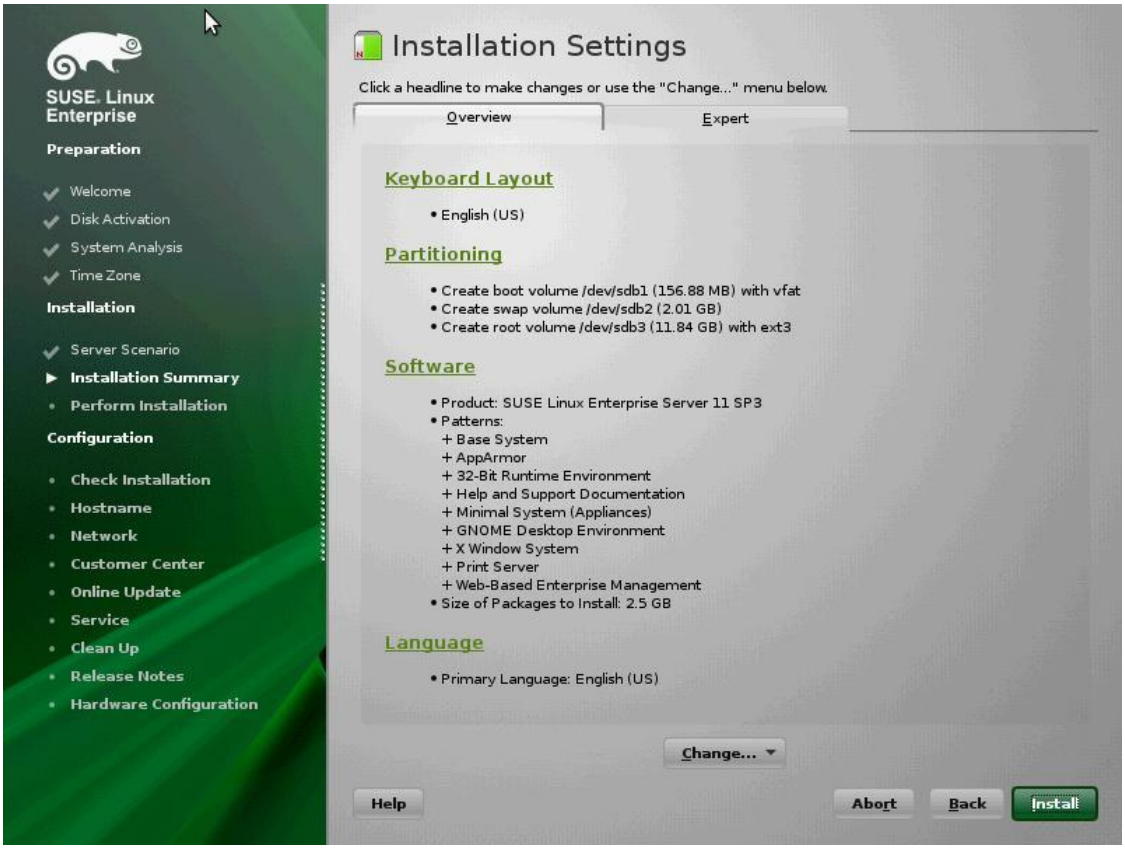
v. Configure Clock and Time Zone settings. Click **Next**.



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



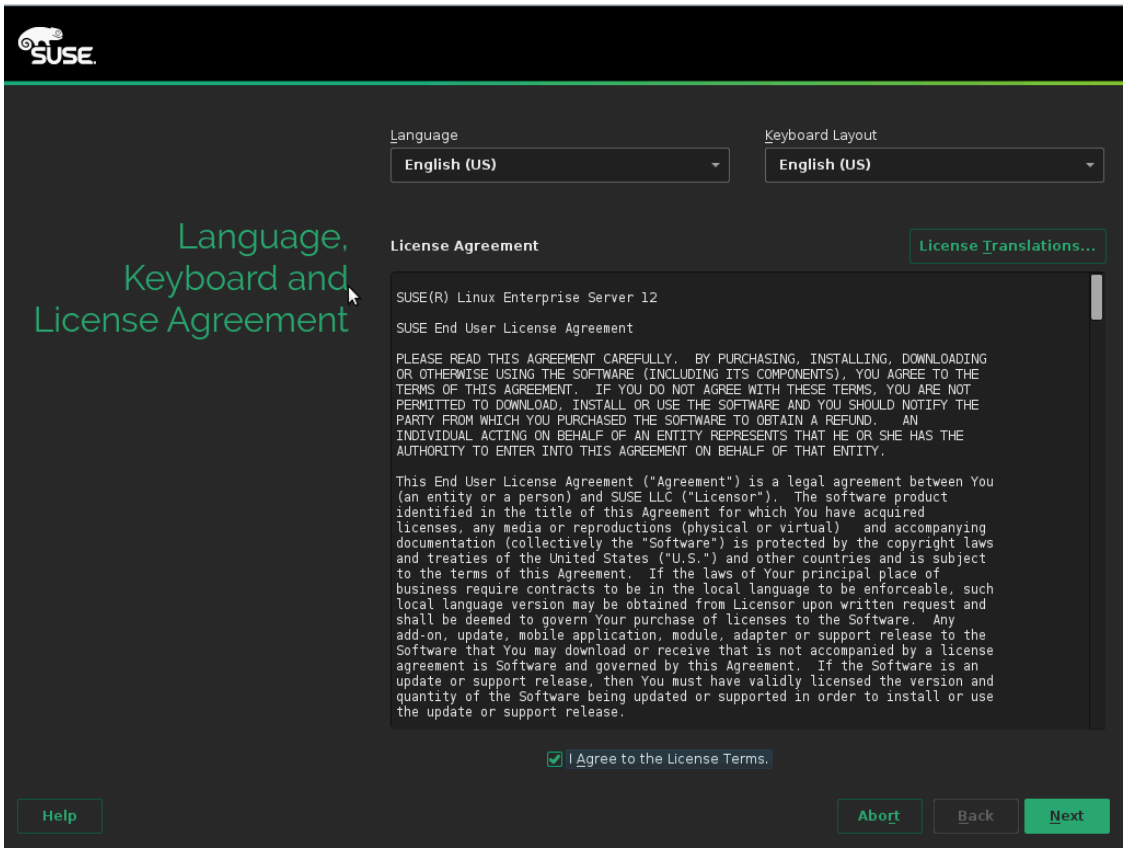
vii. The **Installation Settings** screen displays the summary of user-selected and YaST-suggested options for the installation. You can review and modify them if required. Basic settings can be changed in the **Overview** tab and advanced settings can be changed in the **Expert** tab. To change, click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



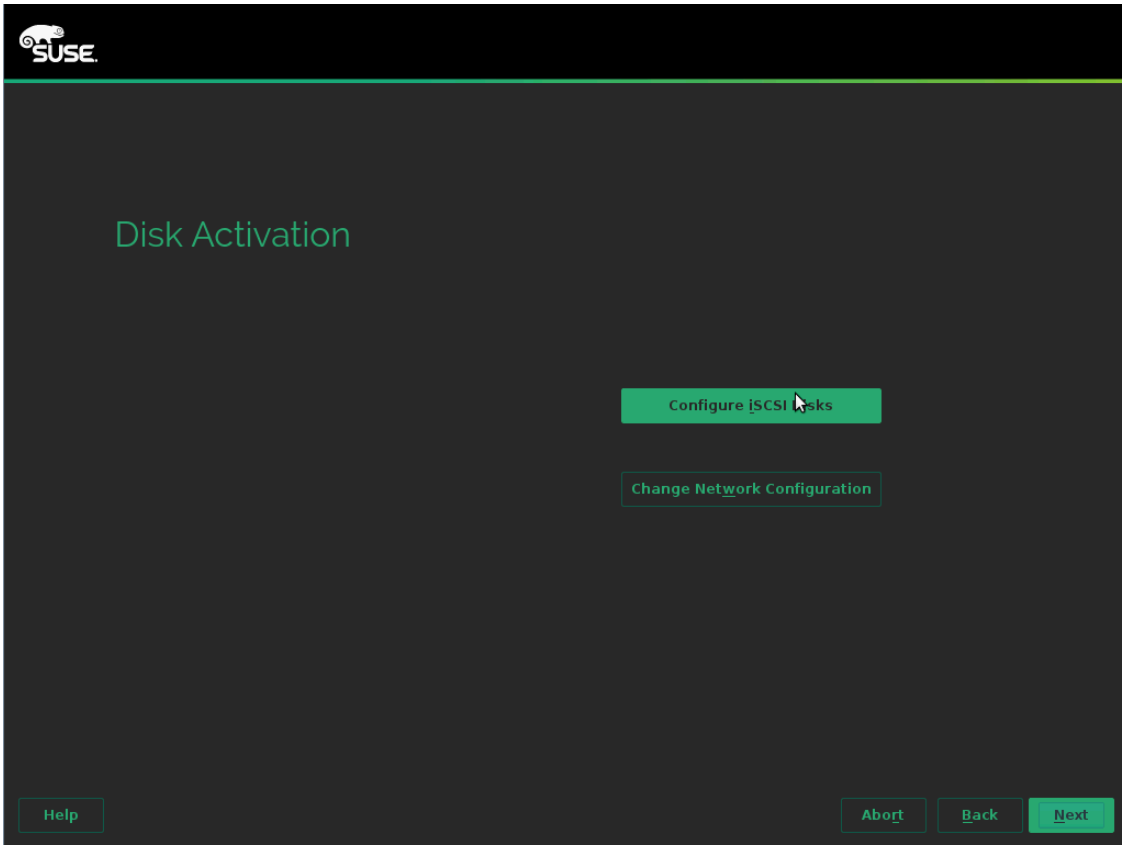
viii. Proceed with installation as usual.

3.3.4. SLES12 Installation

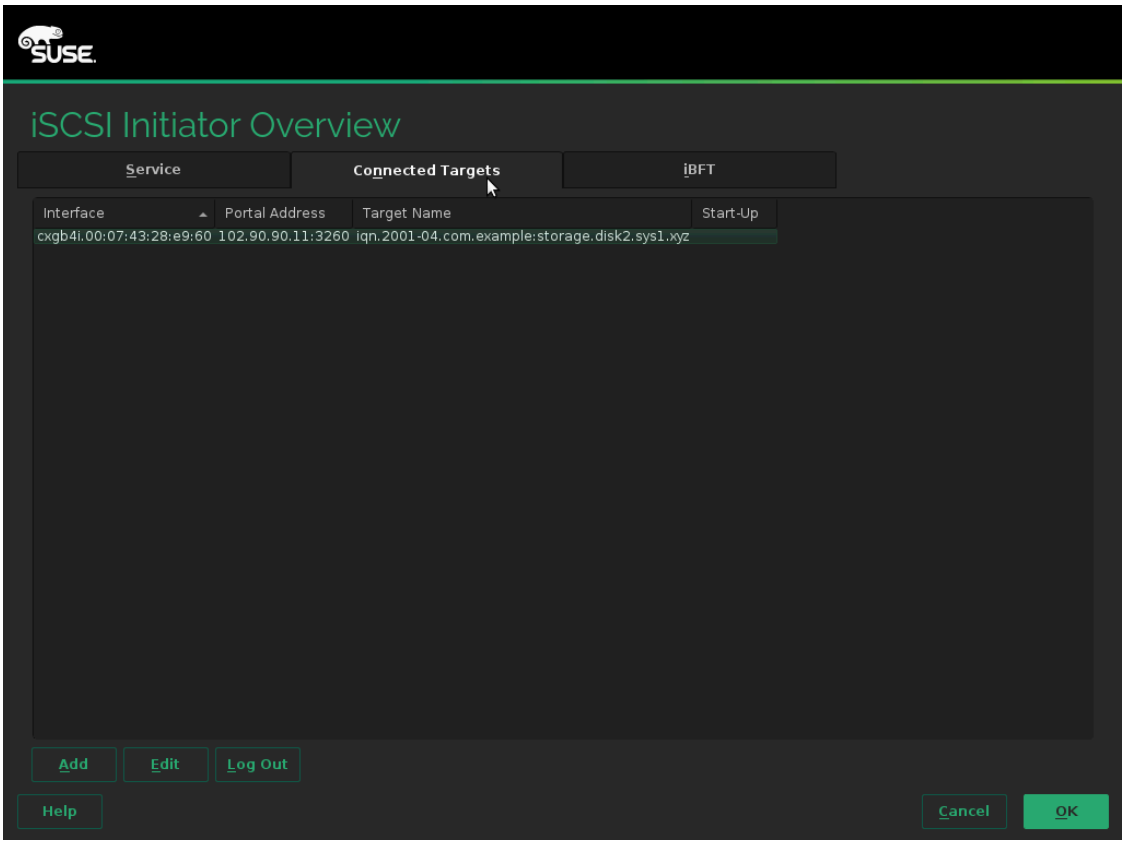
i. Choose installation language and Keyboard layout type. Select the checkbox **I Agree to the License terms** and click **Next**.



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 T5 and T4 adapters. The driver package consists of Network driver needed to install Windows operating system on iSCSI LUN 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:

- T520-BT
- T580-CR
- T520-LL-CR
- T520-SO-CR*
- T520-CR
- T522-CR
- T540-CR
- T580-LP-CR
- T580-SO-CR*
- T420-CR
- T440-CR
- T422-CR
- T420-SO-CR*
- T420-BCH*
- T420-BT
- T404-BT

* Only PXE

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 version:

- Windows Server 2012 R2

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 operating system 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 at **Windows Deployment Services Getting Started Guide**.

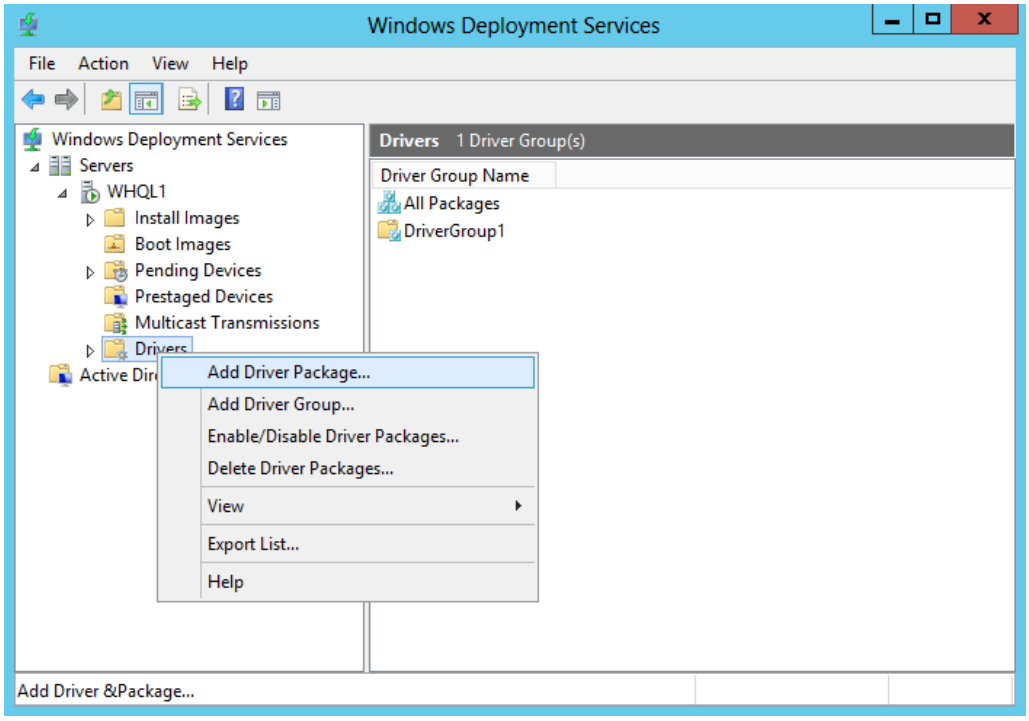
2.2. Adding Driver Packages to WDS Server

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

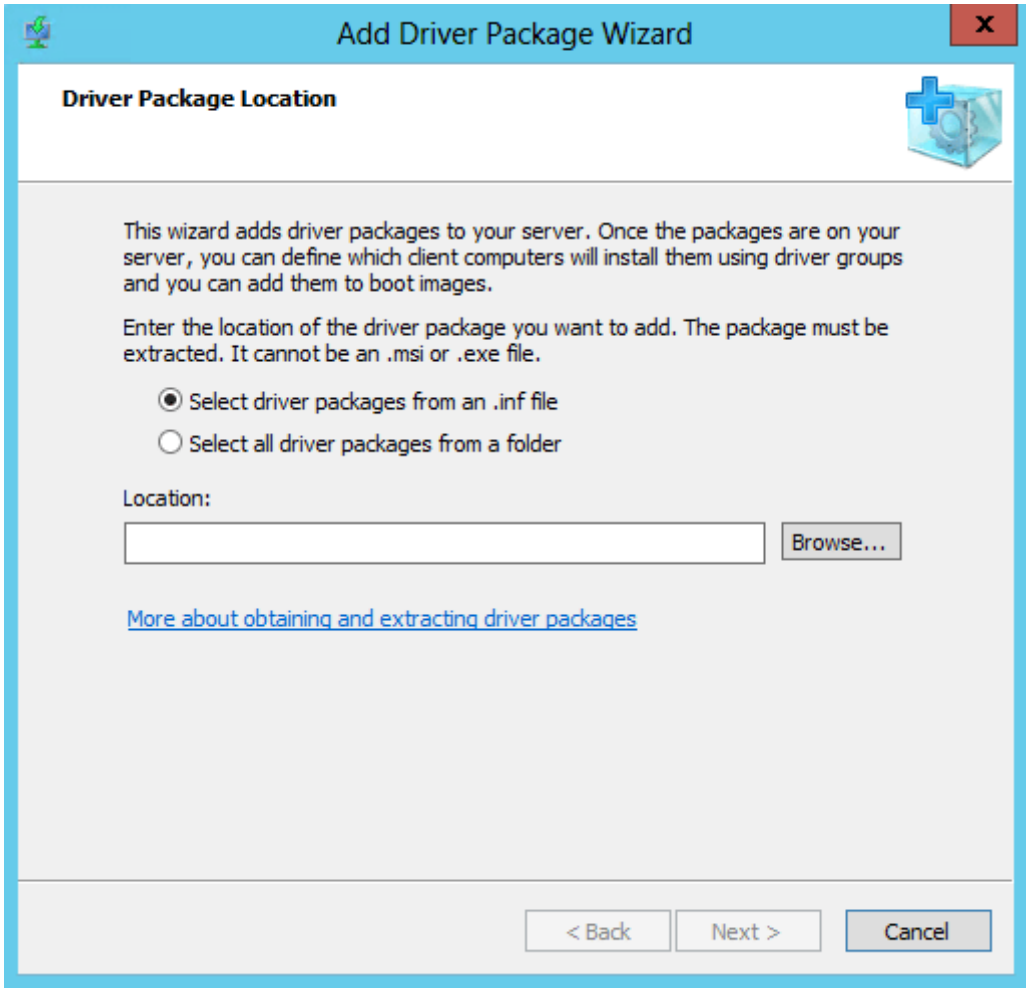
Before proceeding, download *Chelsio-Uboot-x.x.x.xx.zip* from Chelsio Download Center, **service.chelsio.com** and unzip the contents of the package to a desired location.

2.2.1. Adding VBD

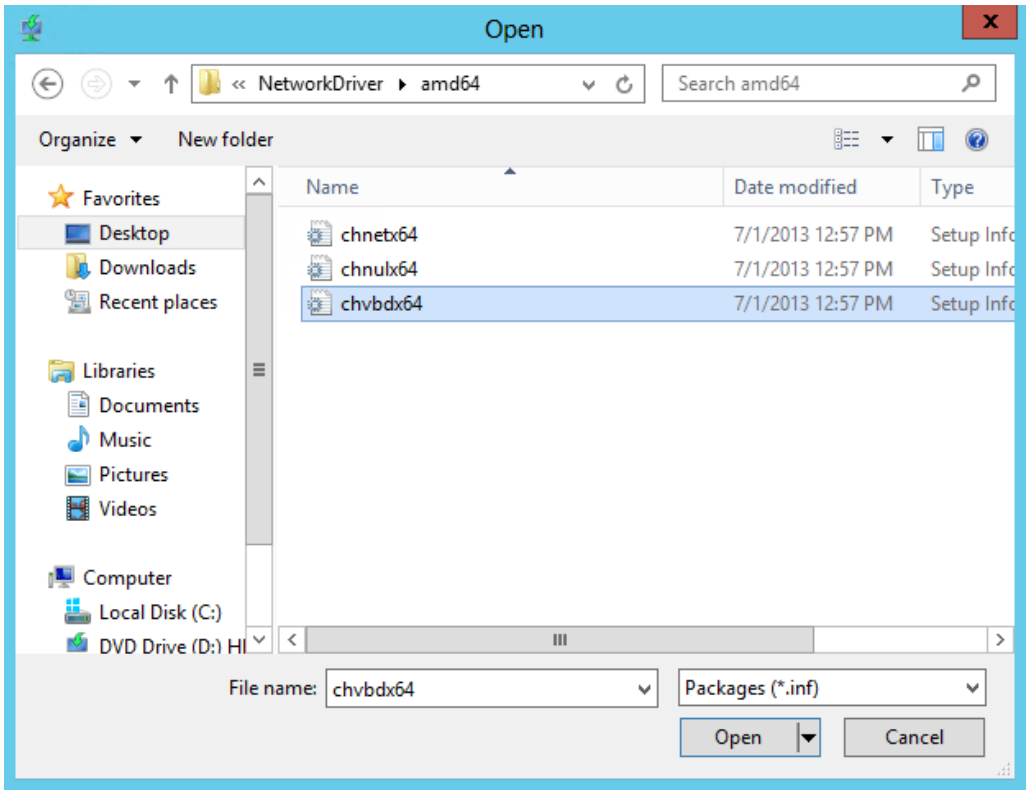
i. Open the **Windows Deployment Services** MMC snap-in. Expand the **Servers** node and the node for your Windows Deployment Services server. Right-click the **Drivers** node and select **Add Driver Package**.



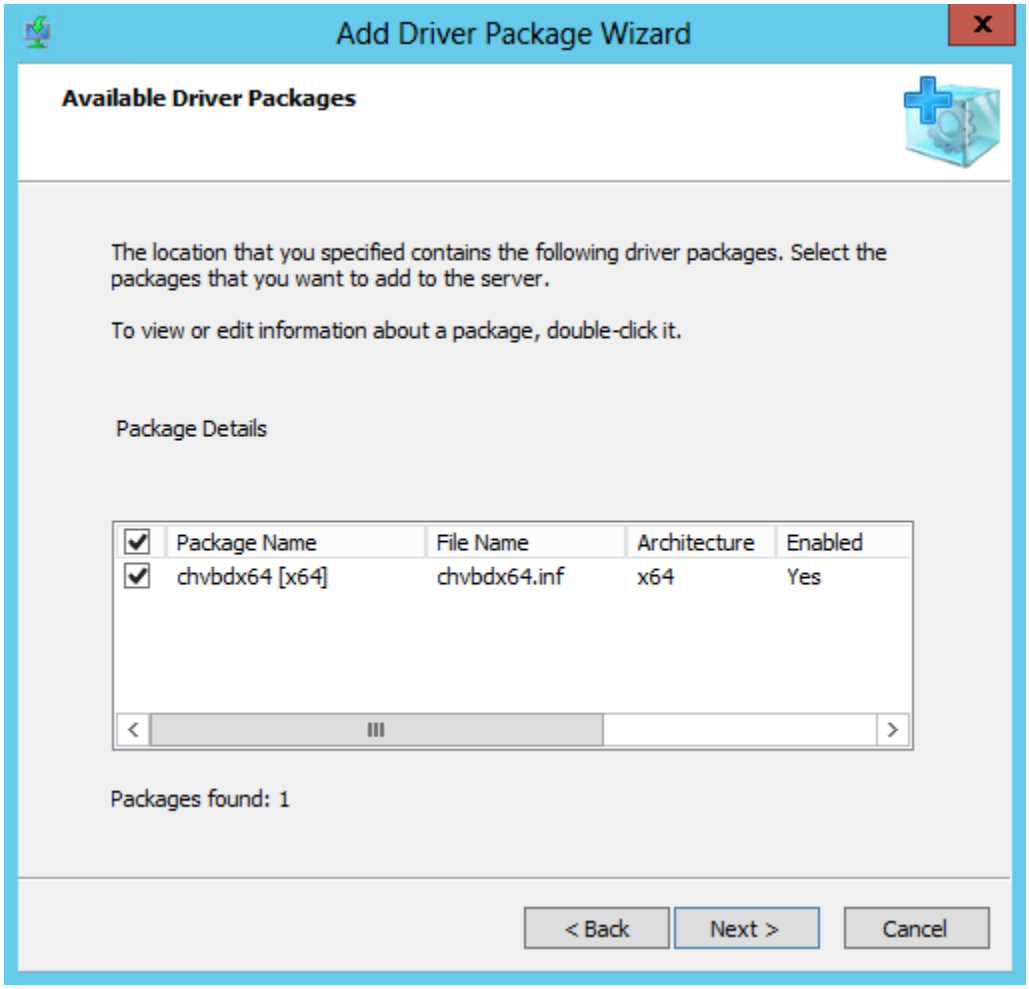
ii. Select the *Select driver package from an .inf file* option and click **Browse**.



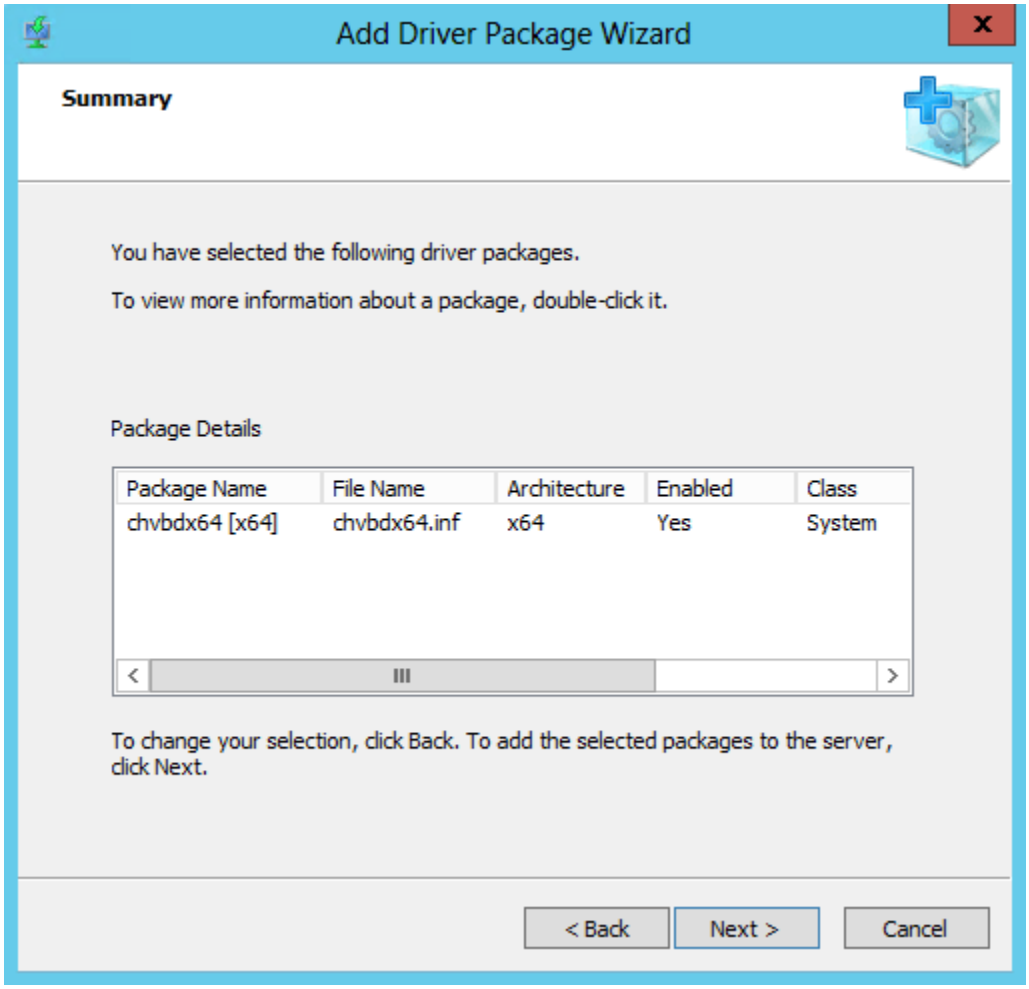
iii. Locate the VBD driver (*chvbdx64.inf)* in *Chelsio-Uboot-x.x.x.xx/WindowsDrivers/NetworkDriver/amd64* and click **Open**.



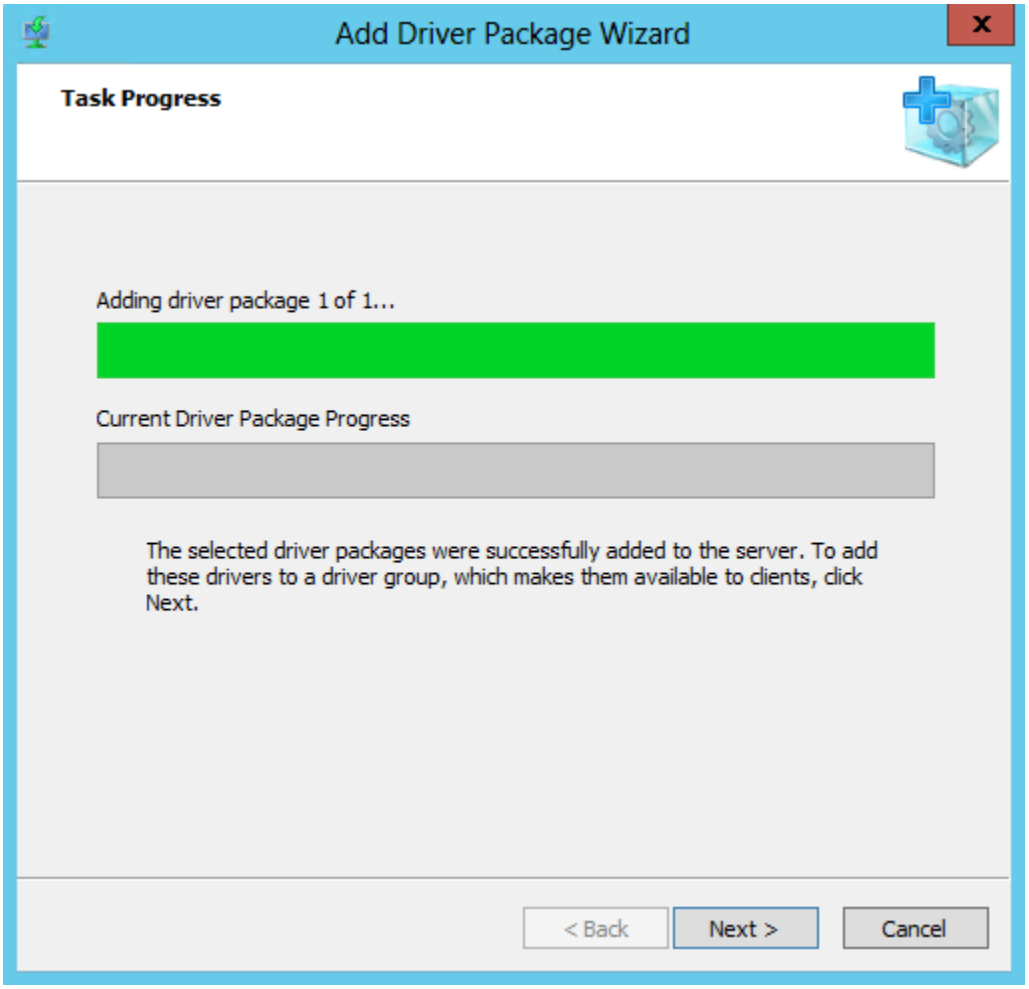
iv. Please ensure that the checkbox for *chvbdx64[x64]* is selected and click **Next**.



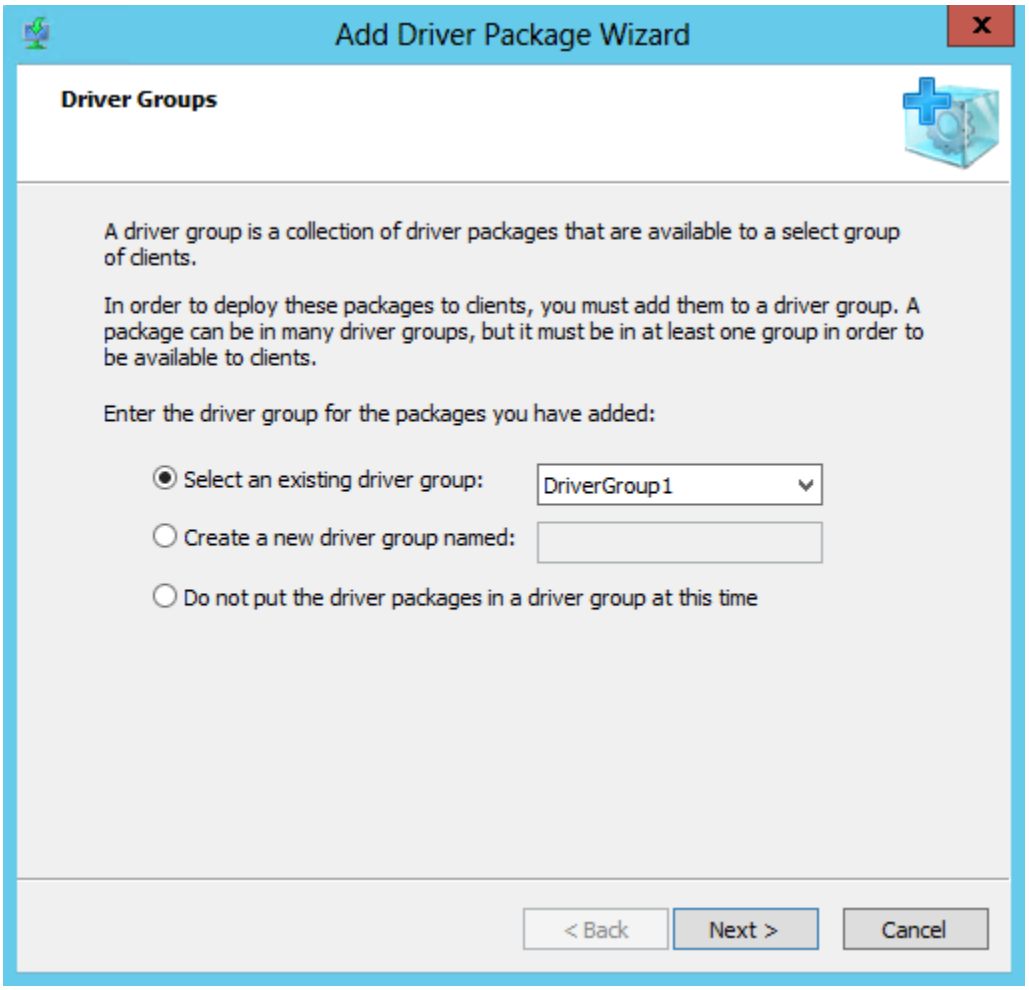
v. To add the selected VBD driver, click **Next** or to change click **Back**.



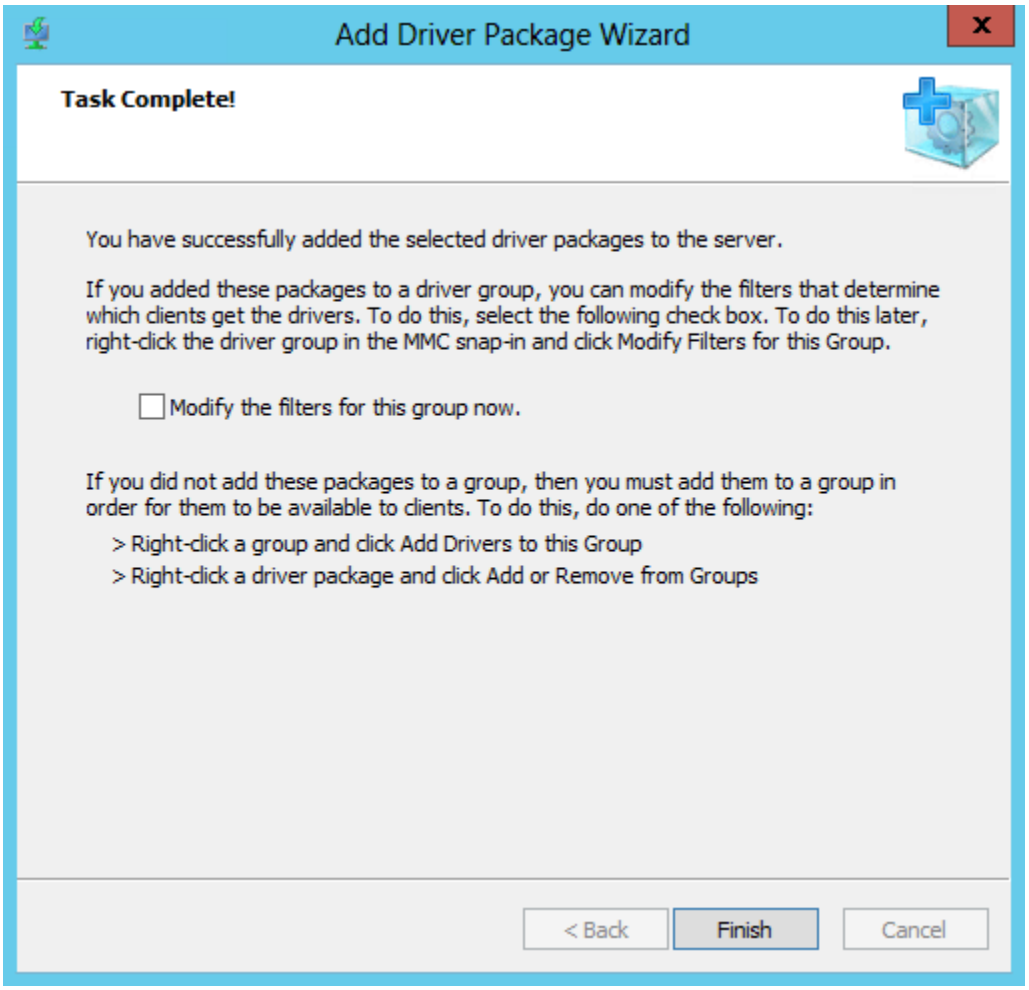
vi. The selected driver will now be added to the server. After the task is complete, click **Next**.



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.

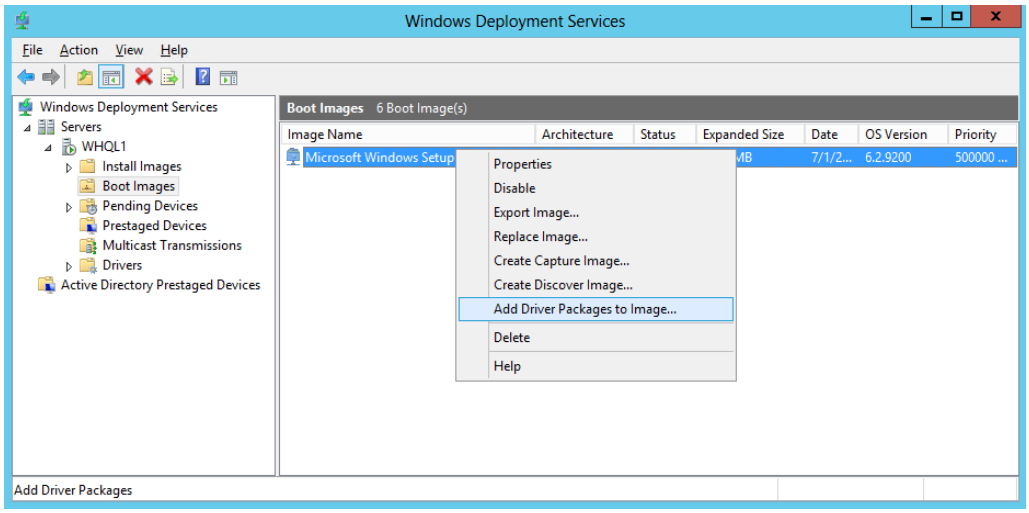
2.3. Adding Driver Packages to Boot Images

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**.

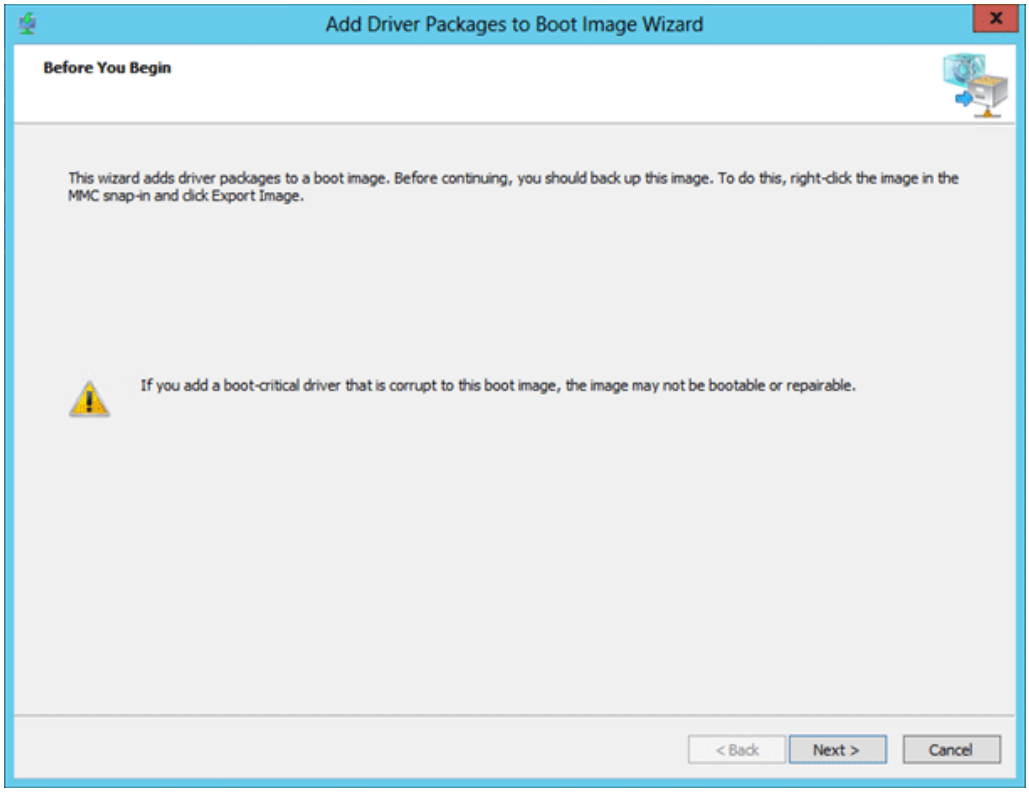
2.3.1. Adding VBD driver

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

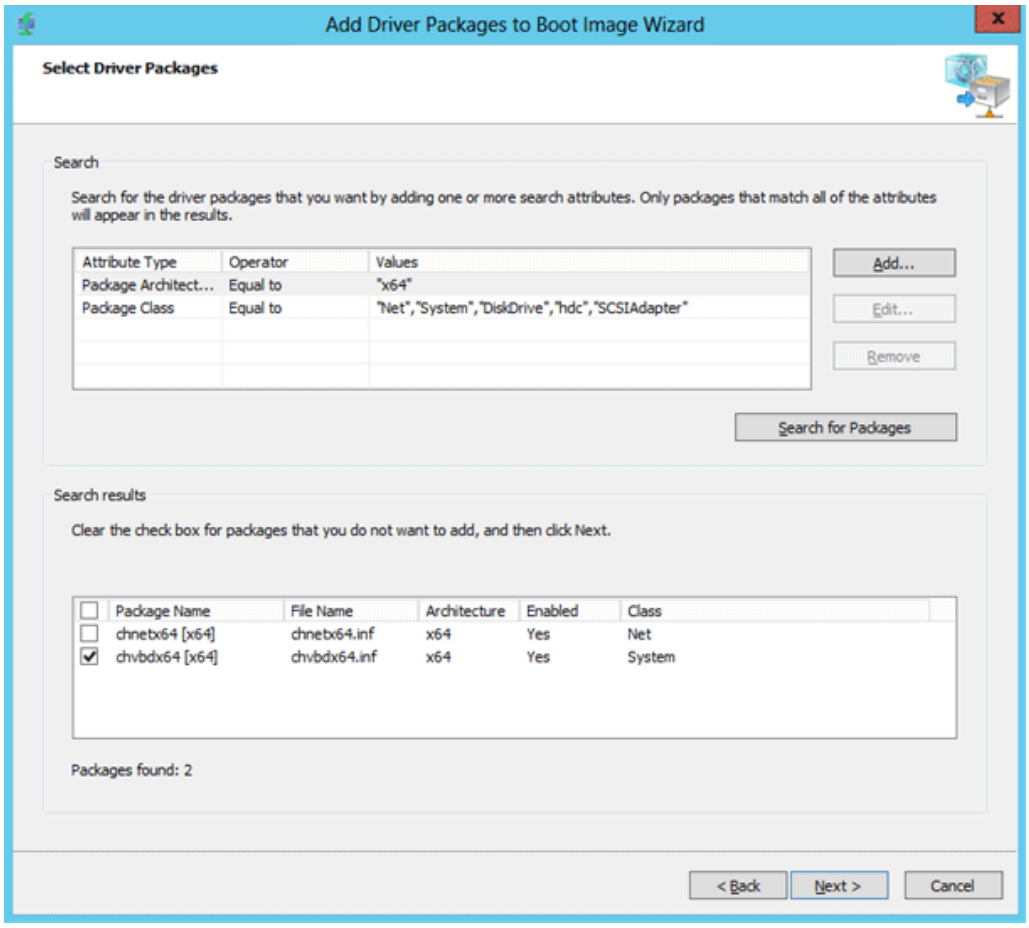
ii. Right-click on the boot image that you want to add the driver to, and select **Add Driver Packages to Image**.



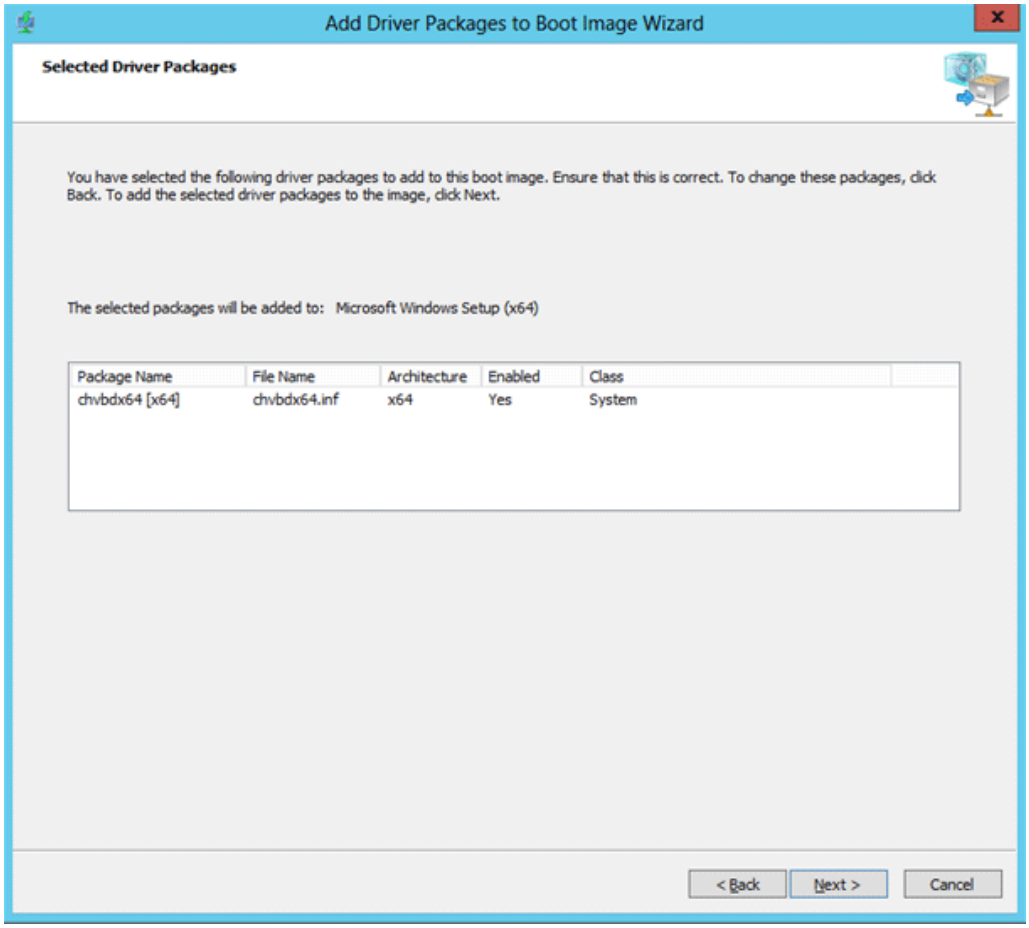
iii. If required, back up the boot image by following the instruction on the screen or click **Next** to continue.



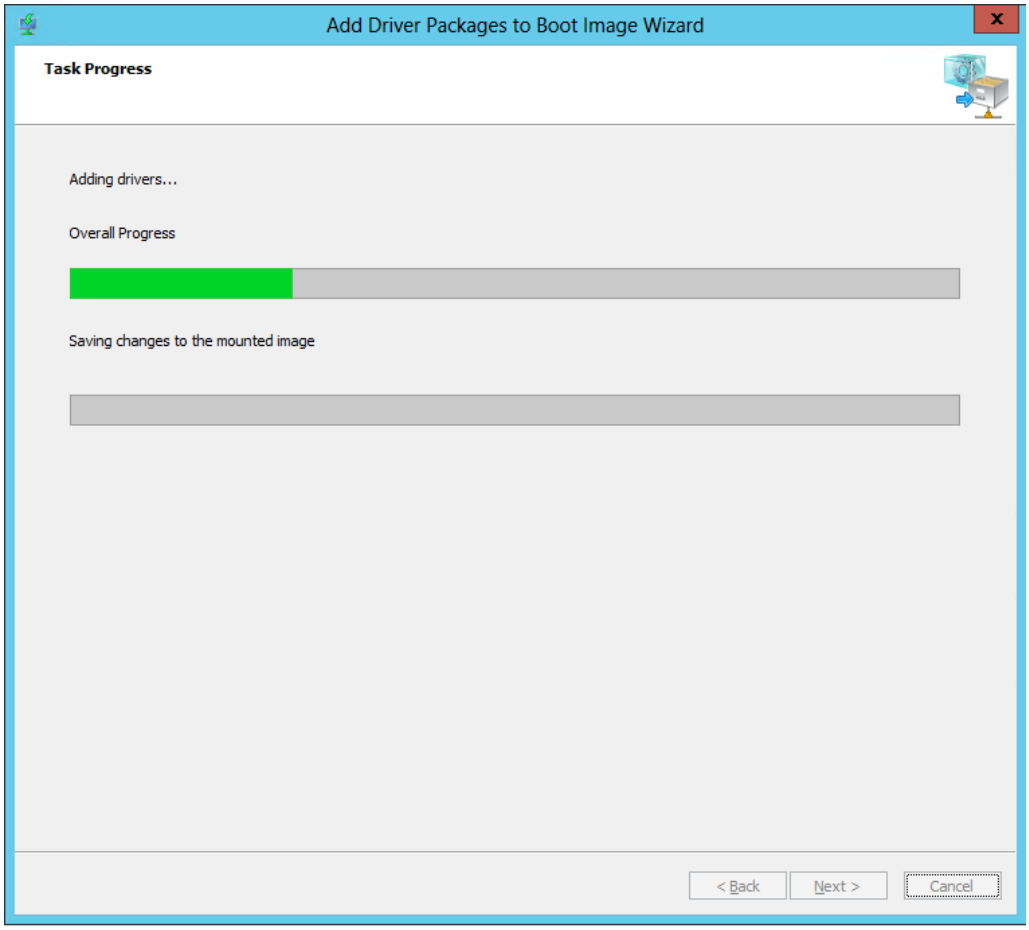
iv. Click **Search for Packages**. Then in the **Search results** section, select the checkbox for *chvbdx64[x64] o*nly and click **Next**.



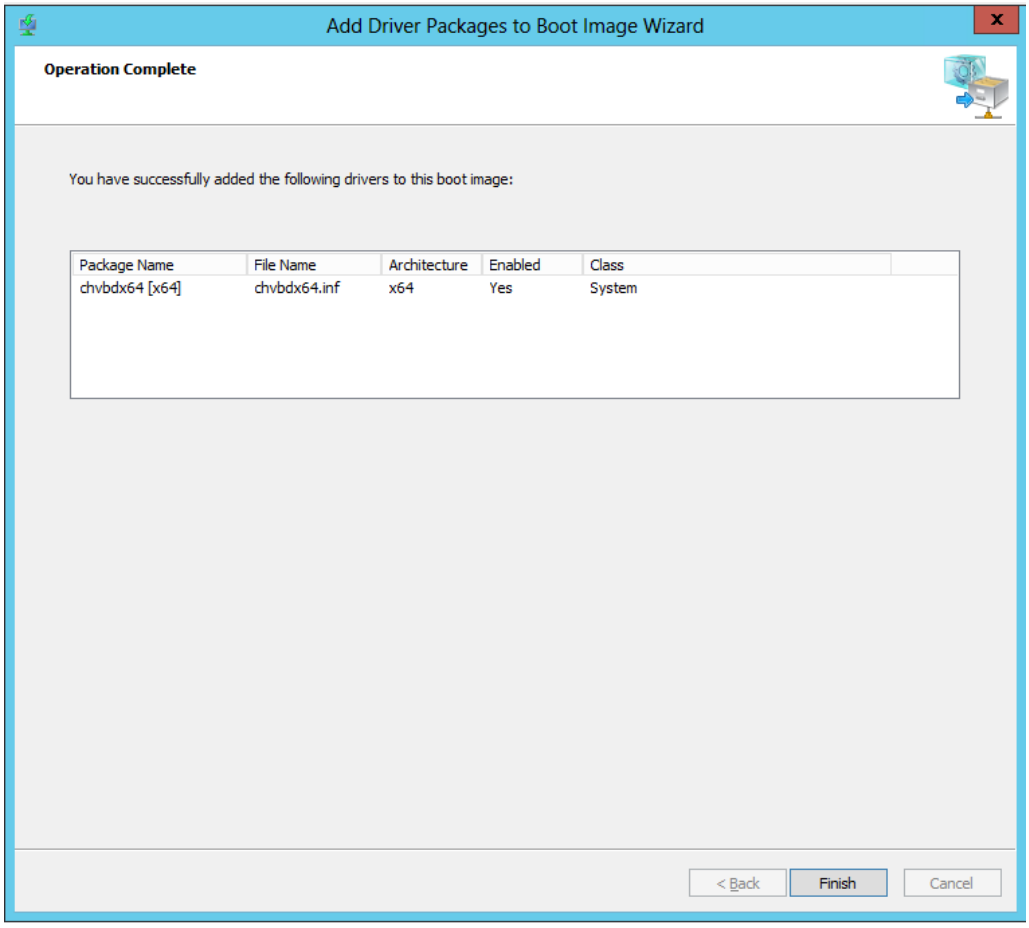
v. To add the selected VBD driver, click **Next** or to change click **Back**.



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.*

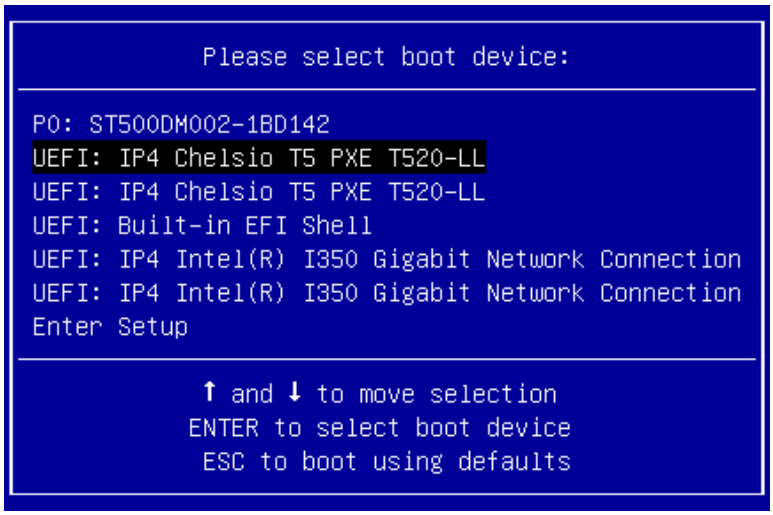
3. OS Installation

This is the recommended method for installing Windows OS on iSCSI LUN 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. Installation on iSCSI LUN

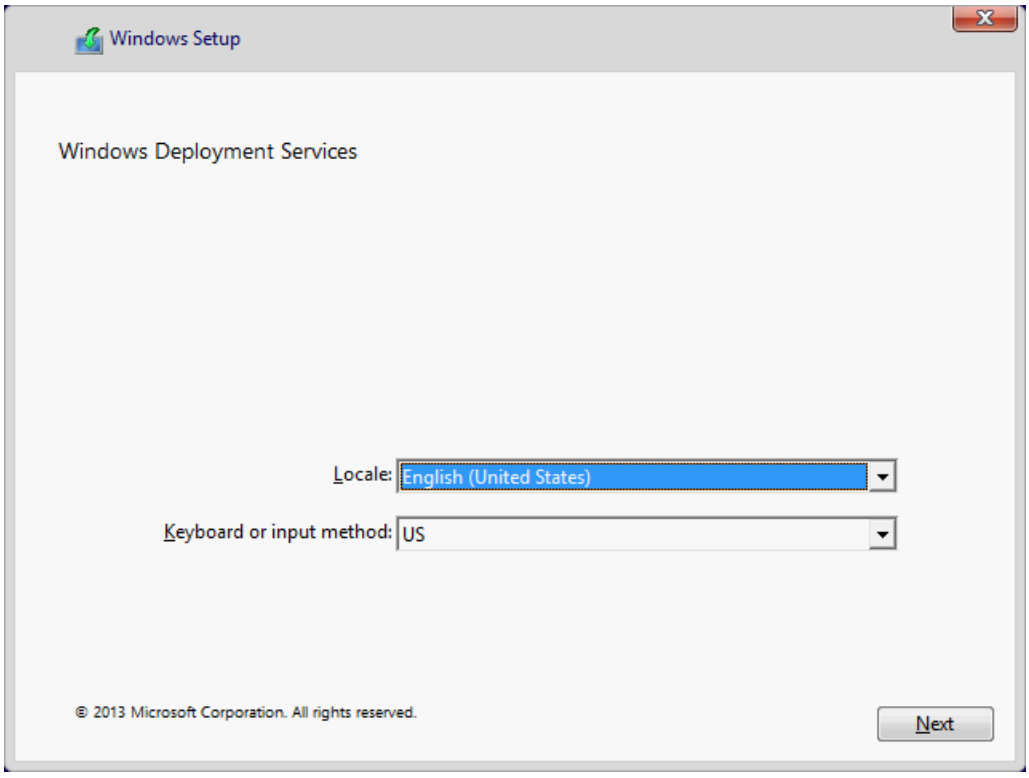
3.1.1. Using PXE-WDS Server

i. Reboot the machine. In the boot menu, choose the port which was used to connect to the Target LUN during iSCSI boot.

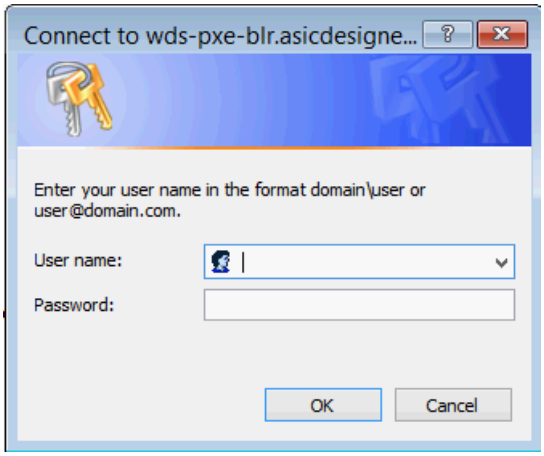


ii. On successful connection, Windows boot image will load from the PXE-WDS server.

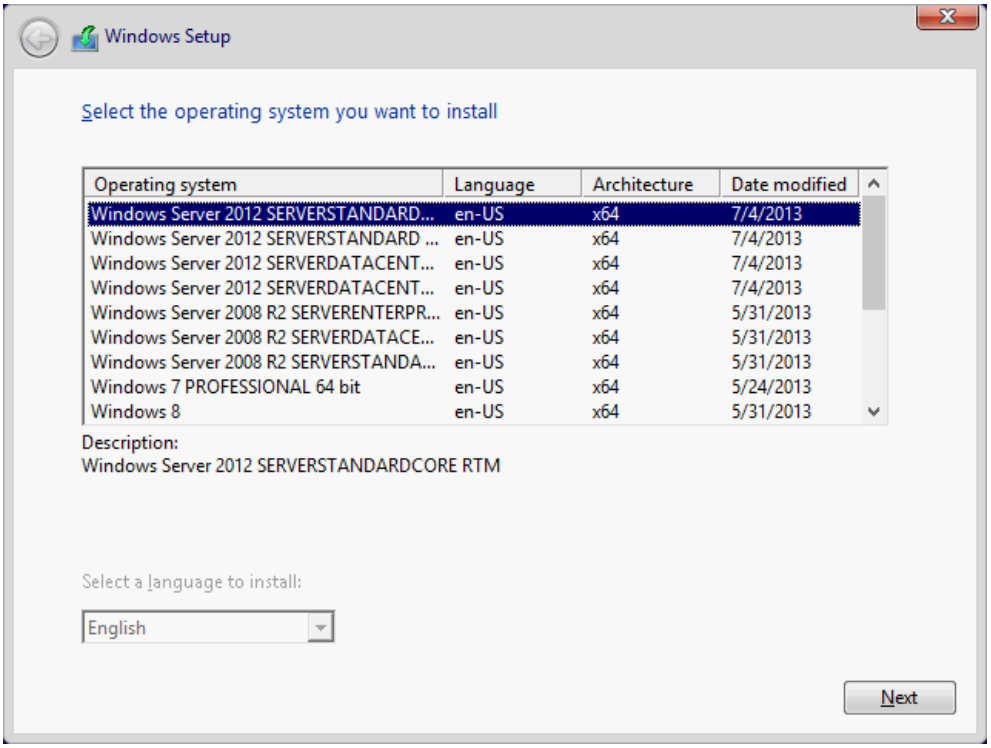
iii. Next, the Windows Setup window will appear. Select the System Locale (language) and Keyboard/input method. Click **Next**.



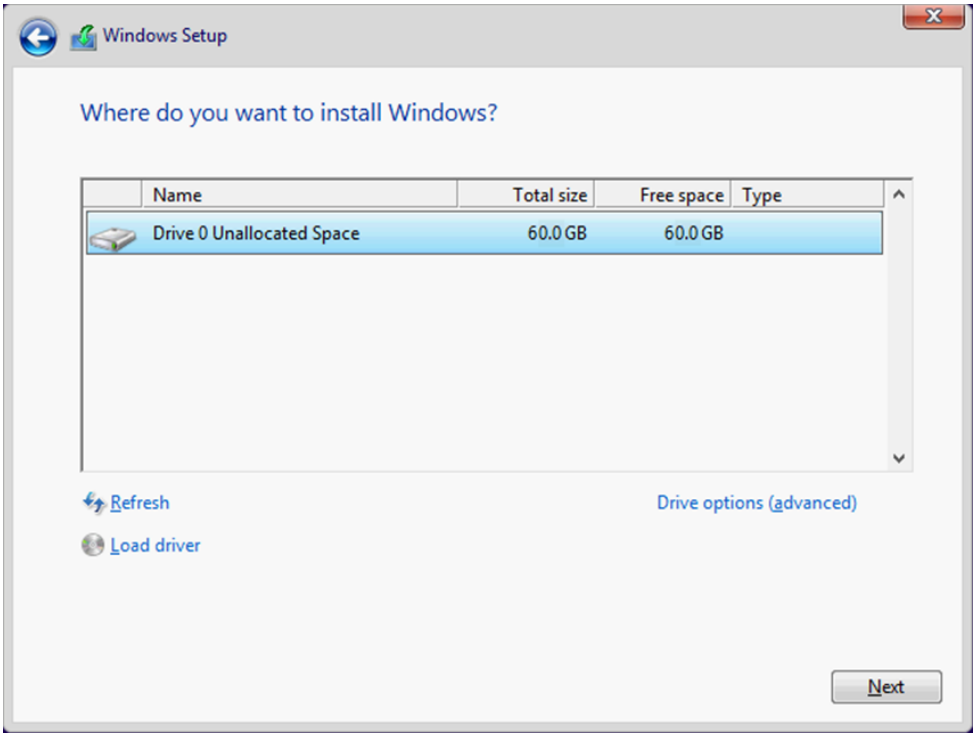
iv. Enter server credentials and click **OK**.



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



vi. Select the Target LUN discovered using MS iSCSI Initiator and click **Next**.



vii. Proceed with installation as usual.

IV. 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).

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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:

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Sunnyvale, CA 94085