

Chelsio Unified Wire for VMware ESXi 8.0

Installation and User Guide



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I. Chelsio Unified Wire

1. Introduction

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

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

Ideal for all data, storage and high-performance clustering applications, Chelsio 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 datacenters, cloud service installations, and highperformance computing environments, Chelsio adapters bring a new level of performance metrics and functional capabilities to the computer networking industry.

This document describes the installation, use and maintenance of Unified Wire software for VMware ESXi and its various components.

1.1. Features

The Chelsio Unified Wire package installs various drivers and utilities and consists of the following software:

- Native Network (NIC) driver with SR-IOV support
- iSCSI Offload Initiator Driver
- iSER Offload Initiator Driver
- NVMe-oF Offload Initiator Driver

Onte Drivers are not VMware certified.

For detailed instructions on loading, unloading, and configuring the drivers/tools, refer to their respective sections.

1.2. Hardware Requirements

The Chelsio Unified Wire software supports the Chelsio Terminator series of Unified Wire adapters. To know more about the list of adapters supported by each driver, refer to their respective sections.

1.3. Software Requirements

The Chelsio Unified Wire software has been developed to run on 64-bit ESXi based platforms.

• ESXi 8.0



The Chelsio Unified Wire driver package consists of the following files/directories:

- **cxl-*.vib**: Native Network driver VIB file.
- cheiscsi-*.vib: iSCSI, NVMe-oF Offload Initiator driver VIB file.
- cheiwarp-*.vib: iSER Offload Initiator driver VIB file.

2. Hardware Installation

Follow these steps to install the Chelsio adapter in your system:

- 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.



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

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

[root@	~]# :	lspci grep	-i Chels	sio						
06:00.0	Ethernet	controller:	Chelsio	Communications	Inc	T6225-CR	Unified	Wire	Ethernet	Controller
06:00.1	Ethernet	controller:	Chelsio	Communications	Inc	T6225-CR	Unified	Wire	Ethernet	Controller
06:00.2	Ethernet	controller:	Chelsio	Communications	Inc	T6225-CR	Unified	Wire	Ethernet	Controller
06:00.3	Ethernet	controller:	Chelsio	Communications	Inc	T6225-CR	Unified	Wire	Ethernet	Controller
06:00.4	Ethernet	controller:	Chelsio	Communications	Inc	T6225-CR	Unified	Wire	Ethernet	Controller
06:00.5	SCSI sto	rage controll	ler: Chel	lsio Communicati	ions	Inc T622	5-CR Unif	fied W	Nire Stora	ige Controller
06:00.6	Fibre Cha	annel: Chelsi	io Commur	nications Inc Te	6225	-CR Unifie	ed Wire S	Stora	ge Control	ller

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

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

Once native network driver (*cxl*) is installed and loaded, examine the output of dmesg to see if the card is discovered. You should see a similar output:

Chapter I. Chelsio Unified Wire

2017-09-26T04:09:20.207Z cpu6:66032)cx11.0: cx1_port_init:874: mbox 0 pf 0 chan 0 viid c0
2017-09-26T04:09:20.209z cpu6:66032)DMA: 646: DMA Engine 'cxl-0000:04:00.0' created using mapper 'DMANull'.
2017-09-26T04:09:20.209Z cpu6:66032)cxl1.0: cxl_config_queues:1091: max_filters 120
2017-09-26T04:09:20.209Z cpu6:66032)VMK_PCI: 765: device 0000:04:00.0 allocated 32 MSIX interrupts
2017-09-26T04:09:20.209Z cpu6:66032)cxll.0: cxl_intr_alloc_msix:2581: net q 14 rss q 16 non rss q 13 tx q 8
2017-09-26T04:09:20.211Z cpu6:66032)cxl1.0: cxl_rss_do init:5221: pool 0 rss viid c1
2017-09-26T04:09:20.212Z cpu6:66032)cx11.0: cx1_rss_init:2501: pool 0 rss mode 31
2017-09-26T04:09:20.212z cpu6:66032)Chelsio <mark>T6</mark> 225-CR rev 0 25G NIC PCIe 8 GT/s x8 MSI-X S/N: RE35160002, P/N: 11012096002

The above outputs indicate the hardware configuration of the adapter as well as serial number.

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

3. Software/Driver Installation

- i. Download the driver package from Chelsio Download Center.
- ii. Put the host in maintenance mode using the vSphere (desktop or web) Client.

10.193	3.204.79	ACTIONS V		_								
Summary	Monitor Co	Actions - 10.193.204.79	ľ	^	Resource Pools Da	tastores	Networks	Updates				
	Hypervisor:	🛅 New Virtual Machine		7					CPU	Free: 12.44 (3Hz (^
5	Model:	🎁 Deploy OVF Template							Used: 1.56 GHz	Capacity: 14 (3Hz	
	Logical Proce	🐌 New Resource Pool		V	73 @ 3.50GHZ				Memory	Free: 43.32	GB	
	NICs: Virtual Machin	🚼 New vApp							Used: 4.57 GB	Capacity: 47.89	GB	
	State:	Maintenance Mode			Enter Maintenance Mode				Storage	Free: 308.5	GB	
	Uptime:	Connection	J.	-					Used: 29 GB	Capacity: 337.5	GB	
		Device	1	-	Exit Maintenance Mode							
C ECVI Ch	all for the best bas	Power	-							Suppress Marpin		
 SSH for 	the host has been	Certificates	-							Suppress Warning	d g	
		Storage	1								2	
Hardware		🔮 Add Networking			~	Configuratio	n			~	· .	
		Host Profiles	×									
Tags		Export System Logs			^	Related Obje	ects			^	s	
Assigned Te	g	Reconfigure for vSpher		pri	n	k1						~
											*	ł
✓ Status	× 1	Settings		-	Queued For	~	Start Time 🗸	×	Completion Time	Server	~	~
	0%	Move To-		0	ALVADII 4 ms		04/16/2020,	7:47:59 PM		10.193.204.16		v
		move ro		~						More	Tasks	

iii. Install the drivers.

```
[root@host:~] cp *.zip /productLocker/
[root@host:~] cp *.zip /var/log/vmware/
[root@host:~] esxcli software component apply --depot=/productLocker/CHL-
esx-8.0.0-Chelsio-Drivers-5.3.0.33-10EM.800.1.0.20613240.zip --no-sig-check
```

```
root@KGF2:~] esxcli software component apply --depot=/productLocker/CHL-esx-8.0.0-Chelsio-Drivers-5.3.0.33-10EM.800.1.0.20613240.zip --no-sig-check
Installation Result
Components Installed: Chelsio-Drivers_5.3.0.33-10EM.800.1.0.20613240
Components Removed:
Components Skipped:
Message: The update completed successfully, but the system needs to be rebooted for the changes to be effective.
Reboot Required: true
```

- iv. Once the installation or update is successfully completed, exit from maintenance mode and reboot the host.
- v. Verify that the drivers are installed successfully.

[root@host:~] esxcli software component vib list --component=Chelsio-Drivers

[root@KGF2:~] esxcli software component vib list --component=Chelsio-Drivers Name Version Vendor Acceptance Level Install Date Platforms cheiscsi 5.3.0.33-10EM.800.1.0.20613240 CHL VMwareCertified 2025-02-25 host cheiwarp 5.3.0.33-10EM.800.1.0.20613240 CHL VMwareCertified 2025-02-25 host 5.3.0.33-10EM.800.1.0.20613240 CHL 2025-02-25 cxl VMwareCertified host

4. Software/Driver Uninstallation

() Note Before proceeding with the uninstallation, ensure that no iSCSI, iSER or NVMe-oF session or connection is active and running.

i. Use the vSphere Client (desktop or web) to place the host in maintenance mode:

10.193.204.79	ACTIONS V	~	
Summary Monitor C Hypervisor: Model: Processor Ty Logical Proc NICs: Virtual Mach	Image: Second	Resource Pools Datastores Networks Updates	Free: 12.44 GHz Capacity: 14 GHz Free: 43.32 GB Capacity: 47.89 GB Free: 308.5 GB
State: Uptime:	Maintenance Mode Connection Power	Exter Maintenance Mode Uset 29 68 Uset 29 68 Uset 29 68 Uset 29 68	Capacity: 337.5 GB
 ESXi Shell for the host ha SSH for the host has been 	S Certificates Storage		Suppress Warning Suppress Warning
Hardware	🔮 Add Networking	Configuration	~
Tags Assigned Tag	Export System Logs Reconfigure for vSpher	n Related Objects	^
V Status V	♥→ Assign License t Settings Move To	∨ Queued For ✓ Start Time ↓ ✓ Completion Time DCAL\Admi 4 ms 04/16/2020,7/47/59 PM	V Server V 10.193.204.16 V More Tasks

ii. Uninstall the drivers.

```
[root@host:~] esxcli software component remove --component=Chelsio-Drivers
[root@KGF2:~] esxcli software component remove --component=Chelsio-Drivers
Removal Result
   Components Installed:
   Components Removed: Chelsio-Drivers_5.3.0.33-10EM.800.1.0.20613240
   Components Skipped:
   Message: The update completed successfully, but the system needs to be rebooted for the changes to be effective.
   Reboot Required: true
```

iii. Reboot the host.

```
[root@host:~] reboot
```

5. Software/Driver Update

For any distribution specific problems, please check README and Release Notes included in the release for possible workaround.

For regular updates on various software/drivers, visit Chelsio Download Center. You can also subscribe to our newsletter for the latest software updates.

II. Native Network Driver with SR-IOV Support

1. Introduction

Chelsio's Unified Wire adapters provide extensive support for NIC operation. A high performance fully offloaded and fully featured TCP/IP stack meets or exceeds software implementations in RFC compliance. Chelsio's Terminator engine provides unparalleled performance through a specialized data flow processor implementation and a host of features designed for high throughput and low latency in demanding conditions and networking environments.

1.1. Hardware Requirements

1.1.1. Supported Adapters

The following are the adapters that are compatible with Chelsio native network driver:

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

1.2. Software Requirements

1.2.1. ESXi Requirements

The native network driver has been developed to run on the following 64-bit ESXi platforms:

- Host:
 - ESXi 8.0

- Virtual Machine (with VFs):
 - RHEL/Rocky Linux 9.5, 5.14.0-503.11.1.el9_5.x86_64
 - RHEL/Rocky Linux 9.4, 5.14.0-427.14.1.el9_4.x86_64
 - RHEL/Rocky Linux 8.10, 4.18.0-553.el8_10.x86_64
 - RHEL/Rocky Linux 8.9, 4.18.0-513.5.1.el8_9.x86_64
 - Kernel.org 6.12.16
 - Kernel.org 6.6.79
 - Windows Server 2025
 - Windows Server 2022

1.2.2. SR-IOV Requirements

- SR-IOV should be enabled in the BIOS.
- Intel Virtualization Technology for Directed I/O (VT-d) should be enabled in the BIOS.
- PCI Express Slot should be ARI capable.

2. Software/Driver Loading

After rebooting the ESXi Host, the driver will load automatically. However, it is possible to manually load the driver by using the command below:

```
[root@host:~] vmkload_mod cxl
```

Execute the following command, so that the device manager performs a rescan:

[root@host:~] kill -SIGHUP \$(cat /var/run/vmware/vmkdevmgr.pid)

3. Software/Driver Configuration and Fine-tuning

3.1. Multiple Adapters

By default, the cxl driver will initialize eight Chelsio ports. In case of using multiple adapters, set the *max_ports* module parameter and reboot the machine.

```
[root@host:~] esxcfg-module -s max_ports=N cxl
[root@host:~] reboot
```

10 Note This setting is persistent across reboots and need not be applied every time.

Example: To use three numbers of T540-CR (4-port) adapters, with a total of 12 Chelsio ports:

```
[root@host:~] esxcfg-module -s max_ports=12 cxl
[root@host:~] reboot
```

3.2. cxgbtool

The *cxgbtool* command queries or sets various aspects of Chelsio network interface cards. It complements standard tools used to configure network settings and provides functionality not available through such tools. Some of the commands provided can be used to query running statistics to aid in debugging. The tool will be installed by default on installing the driver.

Syntax and Usage

To use cxgbtool, use the syntax:

```
[root@host:~] /opt/chelsio/bin/cxgbtool <options>
```

() Note For information on available parameters and their usage, refer to cxgbtool help by running the /opt/chelsio/bin/cxgbtool -h command.

3.3. Adapter Configuration

The adapter's configuration should be updated for optimal performance in ESXi environment.



Run the following *cxgbtool* command and reboot the machine.

```
[root@host:~] /opt/chelsio/bin/cxgbtool -c esxcfg -set
[root@host:~] reboot
```

3.4. Firmware Update

The driver will auto-load the firmware if an update is required. The version can be verified using:

```
[root@host:~] /opt/chelsio/bin/cxgbtool -c version
```

3.5. Connecting a Virtual Machine

Follow the steps mentioned below to connect the Chelsio adapter to a virtual machine:

i. Create a new virtual switch.

[root@host:~] esxcfg-vswitch -a vSwitchN

ii. Link a Chelsio adapter to the newly created virtual switch.

[root@host:~] esxcfg-vswitch -L vmnicN vSwitchN

iii. Create a new port group on the vSwitch.

[root@host:~] esxcfg-vswitch -A <port group name> vSwitchN

iv. From the vSphere client, right-click on the virtual machine, select the virtual network adapter to be used, and attach the newly created port group.



3.6.1. Instantiate VFs

Follow the steps mentioned below to instantiate virtual functions:

i. *max_vfs* is a comma separated module parameter that specifies the maximum number of VFs per port. Load the Native Network driver (cxl) with *max_vfs* parameter and set it to a non-zero value. In case of multiple adapters, use ',,' to separate the number of VFs per adapter:

[root@host:~] esxcfg-module cxl -s max_vfs=W,X,,Y,Z

Where,

W: Number of VFs per port 0 of adapter 0.

- X: Number of VFs per port 1 of adapter 0.
- Y: Number of VFs per port 0 of adapter 1.
- Z: Number of VFs per port 1 of adapter 1.

i Note A maximum of 16 VFs can be instantiated per port.

Example: To instantiate 3 VFs for port 1 of adapter 0 & 4 VFs for port 0 of adapter 1:

[root@host:~] esxcfg-module cxl -s max vfs=0,3,,4,0

ii. Verify *max_vfs* setting using the *-g* option:

[root@host:~] esxcfg-module -g cxl

- iii. Reboot the ESXi host to apply the changes.
- iv. Check if VFs were instantiated successfully on the PCI bus by either using the shell prompt (using *lspci*) or GUI.

[root@ :~] lspci | grep Chelsio 0000:05:00.0 Network controller: Chelsio Communications Inc. T580-LP-CR Unified Wire Ethernet Controller [vmnic4] 0000:05:00.1 Network controller: Chelsio Communications Inc. T580-LP-CR Unified Wire Ethernet Controller [vmnic5] 0000:05:00.3 Network controller: Chelsio Communications Inc. T580-LP-CR Unified Wire Ethernet Controller [vmnic7] 0000:05:00.4 Network controller: Chelsio Communications Inc. T580-LP-CR Unified Wire Ethernet Controller [vmnic7] 0000:05:00.5 Mass storage controller: Chelsio Communications Inc T580-LP-CR Unified Wire Ethernet Controller 0000:05:00.5 Mass storage controller: Chelsio Communications Inc T580-LP-CR Unified Wire Storage Controller 0000:05:00.6 Network controller: Chelsio Communications Inc T580-LP-CR Unified Wire Storage Controller 0000:05:01.0 Network controller: Chelsio Communications Inc T580-LP-CR Unified Wire Ethernet Controller 0000:05:01.1 Network controller: Chelsio Communications Inc T580-LP-CR Unified Wire Ethernet Controller 0000:05:01.1 Network controller: Chelsio Communications Inc T580-LP-CR Unified Wire Ethernet Controller 0000:05:01.1 Network controller: Chelsio Communications Inc T580-LP-CR Unified Wire Ethernet Controller [PF_0.5.0_VF_0] 0000:05:01.1 Network controller: Chelsio Communications Inc T580-LP-CR Unified Wire Ethernet Controller [PF_0.5.0_VF_1] 0000:05:01.4 Network controller: Chelsio Communications Inc T580-LP-CR Unified Wire Ethernet Controller [PF_0.5.0_VF_1]

Manage Monitor PCI Devices Power Managem D Storane	at Toggle passthrough	🛛 🖉 Configure SR-IOV 🌙 Hardware label 🔹 Reboothost C	Refresh				
Monitor PCI Devices Power Managem I Storane I	at Toggle passthrough	🛛 🥒 Configure SR-IOV 🌙 Hardware label 🛛 🚯 Reboot host 🕴 🕻	Refresh				
Virtual Machines Storage	ent				Q Search	Q Search	
> El Storade	Address	✓ Description	~ SR-IOV	✓ Passthrough	 Hardware Label 	~	
Networking	0000:00:02.0	Intel Corporation Xeon E7 v2/Xeon E5 v2/Core i7 PCI Expre	ess Root Port 2a Not capable	Not capable		^	
-	0000:04:08.5	Chelsio Communications Inc T6225-CR Unified Wire Ethe	ernet Controller [VF] Not capable	Active			
	0000:04:08.4	Chelsio Communications Inc T6225-CR Unified Wire Ethe	ernet Controller [VF] Not capable	Active			
	0000:04:08.1	Chelsio Communications Inc T6225-CR Unified Wire Ethe	ernet Controller [VF] Not capable	Active			
	0000:04:08.0	Chelsio Communications Inc T6225-CR Unified Wire Ethe	ernet Controller [VF] Not capable	Active			
	0000:04:07.5	Chelsio Communications Inc T6225-CR Unified Wire Ethe	ernet Controller [VF] Not capable	Active			
	0000:04:07.4	Chelsio Communications Inc T6225-CR Unified Wire Ethe	ernet Controller [VF] Not capable	Active			
	0000:04:07.1	Chelsio Communications Inc T6225-CR Unified Wire Ethe	ernet Controller [VF] Not capable	Active			
	0000:04:07.0	Chelsio Communications Inc T6225-CR Unified Wire Ethe	ernet Controller [VF] Not capable	Active			
	0000:04:06.5	Chelsio Communications Inc T6225-CR Unified Wire Ethe	ernet Controller [VF] Not capable	Active			
	0000:04:06.4	Chelsin Communications Inc T6225-CR Unified Wire Ethe	ernet Controller IVE1 Not canable	Active		*	

3.6.2. Assigning VFs to VMs

Once the SR-IOV VFs are enabled/instantiated successfully on the host, they can be associated with Virtual Machines (VMs). The VFs can be assigned to VMs as:

- SR-IOV passthrough network adapters
- PCI Devices
- 1 Note
- Unloading host network driver (cxl) when VFs are attached to VMs is not supported by VMware.
- T5 Adapters are not supported in Windows VMs with SR-IOV.

• SR-IOV passthrough network adapters

i. Right-click on the VM and select Edit Settings. Click Add network adapter.

/irtual Hardware VM Option	s		
🕞 Add hard disk 📋 Add ne	twork adapter 📕 Add other device		
CPU 🔔	2 ~ 🚺		
> 🎟 Memory 🔔	4 GB ~		
Hard disk 1 🔔	25 GB ~		>
SCSI Controller 0	VMware Paravirtual	~	>
📼 SATA Controller 0			>
⊷ USB controller 1	USB 2.0	~	
🖻 Network Adapter 1	VM Network	✓ Connect	>
Video Card	Default settings	~	
> 🖵 Video Card	blidde Strangs		

ii. Select the required Port Group and select Adapter type as SR-IOV passthrough.

🛱 Edit settings - RHEL94-75 ((ESXi 8.0 virtual machine)							
> 🕞 Hard disk 1 🛕	25 GB ~	×						
> 🔆 SCSI Controller 0	VMware Paravirtual	×						
🖾 SATA Controller 0		×						
⊷ USB controller 1	USB 2.0 Y							
		×						
> 🔄 Network Adapter 1	VM Network VM Connect	×						
∨ 🛱 New Network Adapter	T6 VM Network	×						
Status	Connect at power on							
Adapter Type	SR-IOV passthrough							
Memory reservation	To enable PCI passthrough or SR-IOV, the VM's memory will be reserved.	To enable PCI passthrough or SR-IOV, the VM's memory will be reserved.						
Physical function	T6225-CR Unified Wire Ethernet Controller - 0000:ae:00.0	T6225-CR Unified Wire Ethernet Controller - 0000:ae:00.0						
MAC Address	T6225-CR Unified Wire Ethernet Controller - 0000:ae:00.0							
	T6225-CR Unified Wire Ethernet Controller - 0000:ae:00.1							
	CANCEL	SAVE						

iii. Select the required Physical Function (Port) to use and click **Save**.

PCI Devices

i. Right-click on the VM and select Edit Settings. Click on Virtual Hardware tab. Click ADD NEW DEVICE and select PCI Device.

🛱 Edit settings - RHEL94-75 (ES)	(i 8.0 virtua	l machine)	
Virtual Hardware VM Options			
🚍 Add hard disk 🛛 🚊 Add networ	k adapter	Add other device	
> 💭 CPU 🛕	2 ~	O CD/DVD drive	
		Floppy drive	
> 🎟 Memory 🛕	-	📼 Serial port	
> 🕞 Hard disk 1 🛕	25	🖨 Parallel port	×
	VMware Pa	↔ USB controller	×
> 🔆 SCSI Controller 0			
🖾 SATA Controller 0		Sound controller	×
++ USB controller 1		PCI device	
	USB 2.0	Dynamic PCI device	
	_	♦ SCSI controller	×
> 🖳 Network Adapter 1	VM Networ	📼 SATA controller	Connect X
> 🗆 Video Card	Default sett	D NVMe controller	,
-		 Watchdog Timer 	
		C Precision Clock	
			CANCEL

ii. Select the required Chelsio VF and click **Save**.



For more information on configuring SR-IOV, refer to VMware's official documentation.

3.6.3. Using VFs in Linux VM

To use the newly attached VFs in a virtual machine, follow the steps mentioned below:

- i. Power-on the Virtual Machine with VF attached to it.
- ii. Verify that the Chelsio VF shows up in the VM using the *lspci* command.

```
[root@host~]# lspci | grep Chelsio
00:08:0 Ethernet controller: Chelsio Communications Inc T580-LP-CR Unified
Wire Ethernet Controller [VF]
```

iii. Download the latest *Chelsio Unified Wire* driver package, from Chelsio Download Center. iv. Untar the tarball using the following command.

[root@host~]# tar zxvf ChelsioUwire-x.xx.x.tar.gz

v. Change you current working directory to *ChelsioUwire-x.xx.x.x* directory and install the VF driver using the following command.

[root@host~]# make vnic install

vi. Load the VF driver in the VM using the below command.

[root@host~]# modprobe cxgb4vf

1 Note To know more about Chelsio Virtual Function driver, refer to the Chelsio Unified Wire for Linux User Guide.

vii. Bring up the VF interface with the IP address and it will communicate with other VFs or hosts.

[root@host~]# ifconfig ethX <IPv4/IPv6 address> up

3.6.4. Using VFs in Windows VM

To use the newly attached VFs in a virtual machine, follow the steps mentioned below:

- i. Power-on the Virtual Machine with VF attached to it.
- ii. Download the latest Chelsio Unified Wire driver package, from Chelsio Download Center.
- iii. Install the Chelsio Unified Wire using the installer or zip package.

10 Note For detailed instructions, refer to the Chelsio Unified Wire for Windows User Guide.

iv. Assign the required IP addresses for the VF in Network Connections.

1 Important T5 Adapters are not supported in Windows VMs with SR-IOV.

3.6.5. VF Link State

VF link state depends on the physical port link status by default. To override this and always enable the VF link, follow the below procedure. This will enable VF to VF communication irrespective of the physical port link status.

i. Update the vfstate using the following command on the host.

```
[root@host:~] /opt/chelsio/bin/cxgbtool -c vfopt -idx <VF ID> -vfstate 2 -a
<adap> -p <port>
```

```
[root@zojila:~] /opt/chelsio/bin/cxgbtool -c vfopt -idx 2 -vfstate 2 -a 0 -p 1
Setting vf link status successful
```

ii. View the current vfstate.

```
[root@host:~] /opt/chelsio/bin/cxgbtool -c vfopt -idx <VF ID> -a <adap> -p
<port>
```

```
[root@zojila:~] /opt/chelsio/bin/cxgbtool -c vfopt -idx 2 -a 0 -p 1
vf link state: 2
```

iii. Toggle the VF interface on the VM to apply the changes.

```
[root@host~]# ifconfig ethX down
[root@host~]# ifconfig ethX up
```

vfstate can be set to 1 for default behavior.

3.6.6. Example

i. In this example, 2 VFs are instantiated per port, hence a total of 4 VFs instantiated on the host. The host is then rebooted.

```
[root@host:~] esxcfg-module cxl -s max_vfs=2,2
[root@host:~] reboot
```

- ii. 4 VMs are set up in the following combination:
 - VF0 of PF0 (VF marked with the bus-id <PCIslot.01.0>) is assigned to VM1
 - VF1 of PF0 (VF marked with the bus-id <PCIslot.01.4>) is assigned to VM2
 - VF0 of PF1 (VF marked with the bus-id <PCIslot.01.1>) is assigned to VM3
 - VF1 of PF1 (VF marked with the bus-id <PCIslot.01.5>) is assigned to VM4
- iii. VMs are powered up one after another.
- iv. VF driver (*cxgb4vf*) is installed and loaded in all the VMs.

The above configuration results in the following connectivity:

- VFs of the same port can communicate with each other. That is VM1 can communicate with VM2, and VM3 can communicate with VM4.
- VFs of port 0 (VM1 and VM2) will be able to communicate with any peer connected to port 0 of the network adapter.
- VFs of port 1 (VM3 and VM4) will be able to communicate with any peer connected to port 1 of the network adapter.

3.6.7. Configuring VLANs

If the VFs are attached as SR-IOV passthrough network adapters to the VMs, VLAN can be configured at the port group. After configuring the VLAN, the VF network driver should be reloaded on the VM to apply the changes.

```
[root@host~] # rmmod cxgb4vf
[root@host~] # modprobe cxgb4vf
```

For Windows VMs, disable and enable the **Chelsio Bus Enumerator [Virtual Function]** in System Devices of the Device Manager to apply the changes.

4. Software/Driver Unloading

Execute the following command to unload the Native Network driver:

[root@host:~] vmkload_mod -u cxl



If iSCSI, iSER or NVMe-oF Offload Initiator Driver is loaded, unload it before unloading the native network driver.

III. iSCSI Offload Initiator Driver

1. Introduction

The Chelsio Unified Wire series of adapters are Independent Hardware iSCSI adapters. They support iSCSI acceleration and iSCSI Direct Data Placement (DDP) where the hardware handles the expensive byte touching operations, such as CRC computation and verification, and direct DMA to the final host memory destination:

• iSCSI PDU digest generation and verification

On transmit -side, Chelsio hardware computes and inserts the Header and Data digest into the PDUs. On receive-side, Chelsio hardware computes and verifies the Header and Data digest of the PDUs.

• Direct Data Placement (DDP)

Chelsio hardware can directly place the iSCSI Data-In or Data-Out PDU's payload into preposted destination host-memory buffers based on the Initiator Task Tag (ITT) in Data-In or Target Task Tag (TTT) in Data-Out PDUs.

• PDU Transmit and Recovery

On transmit-side, Chelsio hardware accepts the complete PDU (header + data) from the host driver, computes and inserts the digests, decomposes the PDU into multiple TCP segments if necessary, and transmit all the TCP segments onto the wire. It handles TCP retransmission if needed. On receive-side, Chelsio hardware recovers the iSCSI PDU by reassembling TCP segments, separating the header and data, calculating and verifying the digests, then forwarding the header to the host. The payload data, if possible, will be directly placed into the pre-posted host DDP buffer. Otherwise, the data will be sent to the host too.

1.1. Hardware Requirements

1.1.1. Supported Adapters

The following are the adapters that are compatible with Chelsio iSCSI Offload Initiator driver:

- T62100-CR
- T62100-LP-CR
- T6425-CR
- T6225-CR
- T6225-LL-CR
- T6225-SO-CR (Memory Free; 256 IPv4/128 IPv6 offload connections supported)
- T580-CR
- T580-LP-CR
- T540-CR
- T540-LP-CR
- T540-BT
- T520-CR
- T520-LL-CR
- T520-BT

2. Software/Driver Loading

After rebooting the ESXi Host, the driver will load automatically. However, it is possible to manually load the driver.

```
[root@host:~] vmkload mod cheiscsi
```

Execute the following command, so that device manager performs a rescan:

```
[root@host:~] kill -SIGHUP $(cat /var/run/vmware/vmkdevmgr.pid)
```



Execute the following command to restore the Advanced Options of storage adapter after cheiscsi reload:

[root@host:~] esxcfg-rescan -A

3. Software/Driver Configuration and Fine-tuning

The following sections describe the method to configure Chelsio iSCSI Offload Initiator and connect to target.

3.1. Configuring Initiator

- i. Log in to vCenter Server through vSphere Web Client using a web browser.
- ii. If you have already created and configured the host intended to be used as initiator, skip to step (iii).
 - a. Under **Hosts and Clusters**, right-click and click **New Datacenter...** Provide a name and Click **OK**.
 - b. Right-click on the newly created datacenter and click **Add Host...** Follow the onscreen instructions and provide information to add the host. Click **Finish**.
- iii. Select the host and under the **Configure** tab, select **Storage Adapters**. This displays the list of available Chelsio iSCSI adapters.



You can also view the list in CLI using:

[root@host:~] esxcli iscsi adapter list
[root@KGF1:~] esxcli iscsi adapter list
Adapter Driver State UID Description
ymhba66 cheiscsi online iscsi.ymhba66 T6225-CR Chelsio iSCSI offload initiator (RE41160005)

iscsi.vmhba67 T6225-CR Chelsio iSCSI offload initiator (RE41160005)

iv. In the Adapter Details section, click Network Settings tab and then Edit.

online

cheiscsi

mhba67

v. Configure IPv4 address for the adapter and click OK.

	Edit IP and DNS Configuration	v	rmhba66 ×	
	IPv4 settings IPv6 settings	DNS settings		
	No IPv4 settings			
	 Obtain IPv4 settings automatic 	cally		
	 Use static IPv4 settings 			
	IPv4 address	120.1.1.100		
	Subnet mask for IPv4	255.255.255.0		
	Default gateway for IPv4	120.1.1.1		
		[CANCEL	
				ı
Properties Devices	Paths Dynamic Discovery	Static Discovery	Network Settings	Advanced Options
✓ IP Address and DNS C	Configuration ACTIONS ~			
IPv4 address	120.1.1.100 (static)			
Subnet mask for IPv4	255.255.255.0			
Default gateway for IPv4	120.1.1.1			
IPv6 address	Not enabled			
Preferred DNS server	::			
Alternate DNS server				

vi. To use IPv6 address, use the following command:

```
[root@host:~] /opt/chelsio/bin/cxgbtool -c chnet -set -6 -ipaddr <IPv6
address> -gw <IPv6 gateway> -plen <subnet mask> -p <port>
```

```
[root@localhost:~] /opt/chelsio/bin/cxgbtool -c chnet -set -6 -ipaddr 2000::79 -gw 2000::1 -plen 64 -p 0
Setting chnet Configuration:
    Adapter name : vmhba64
    Node id : 0
    Operation : Setting Ipv6
    IP : 2000::79
    prefix len : 64
    Gateway : 2000::1
    Status : Success
```

vii. To apply the changes, click **RESCAN ADAPTER**.

Summary	Monitor	Configu	ire Pe	rmission	s VMs	Datastores	Networks	Updates							
Storage		~	Stor	age A	dapter	S									
Storage	Adapters		ADD 9	SOFTWAR	E ADAPTER	 REFRESH 	RESCAN STORAG	E RESCAN ADAPT	REMOVE						
Storage Host Ca	Devices che Configura	ition		Adapte	er y	r Model			т Туре	▼ Status	T Identif	ier T	Targets	T Devices	T Paths
Protoco	I Endpoints		•		mhba66	T6225-CF 0005)	R Chelsio iSCSI off	fload initiator (RE41	16 iscsi	Online	Port0 elsio:)(iqn.2017-07.com.ch 00-07-43-04-b4-54)		15	15
I/O Filter	rs	~	0	⇔ v	mhba67	T6225-CF 0005)	R Chelsio iSCSI off	fload initiator (RE41	16 iSCSI	Online	Port1 sio:00	(iqn.2017-07.com.chel 0-07-43-04-b4-5c)	0	17	17
Virtual s	witches		0	⇔ v	mhba69	VMware	NVME over RDM	A Storage Adapter	RDMA	Online			0	0	0
VMkerne	el adapters		Man	age Colun	nns Expe	ort ~									5 items

3.2. Connecting to Target

There are two methods to discover and connect to targets:

- **Dynamic Discovery:** Discovers all the available targets for a given target server.
- Static Discovery: Discovers a specific target by manually entering target information.

3.2.1. Dynamic Discovery

- Adding Target Server
- i. Select the iSCSI adapter to connect to the target and select Dynamic Discovery.

Summary Monitor	Configure	e Permissions VMs	Datastores Networks	Updates						
Storage	~	Storage Adapters								
Storage Adapters		ADD SOFTWARE ADAPTER ~	REFRESH RESCAN STORAGE	RESCAN ADAPTER	REMOVE					
Storage Devices Host Cache Configura	tion	Adapter T	Model	Ŧ	Туре ү	Status T	Identifier T	Targets 🔻	Devices	T Paths
Protocol Endpoints		💿 🔆 vmhba66	T6225-CR Chelsio iSCSI offic 0005)	ad initiator (RE4116	iscsi	Online	Port0(iqn.2017-07.com.ch elsio:00-07-43-04-b4-54)	0	15	15
I/O Filters		◯	T6225-CR Chelsio iSCSI offic	ad initiator (RE4116	iSCSI	Online	Port1(iqn.2017-07.com.chel	0	17	17
Virtual switches	Ť	◯	VMware NVME over RDMA	Storage Adapter	RDMA	Online		0	0	0
VMkernel adapters	- 1	Manage Columns Export ~	7							5 items
Physical adapters	- 1			1						
TCP/IP configuration	- 1	Properties Devices Pr	Dynamic Discovery	Static Discovery	Network Sett	ings Advan	ced Options			
Virtual Machines	~	ADD REMOVE AUTHE	NTICATION ADVANCED							
VM Startup/Shutdow	n	ISCSI server								Ŧ
Agent VM Settings	- 1									
Default VM Compatib	ility				Y					
Swap File Location										

ii. Click Add and provide the target server IP. Click OK.

Add Send Targ	et Server vmhba66	×
iSCSI Server	120.1.1.178	
Port	3260	
	CANCEL	ок

- iii. To apply the changes, rescan the iSCSI adapter.
- iv. All the available LUNs discovered on the given target server will be displayed in the **Devices** tab. You can perform various tasks like detach, rename, erase partitions, etc.

Summary Monitor Configu	ure Permissions VMs Datastores Ne	tworks Update	is.						
Storage 🗸 🗸	Storage Adapters								
Storage Adapters	ADD SOFTWARE ADAPTER ~ REFRESH RESCA	N STORAGE RESC	AN ADAPTER	REMOVE					
Storage Devices					alation and a standard		Transfe	Devices	Dette
Host Cache Configuration	Adapter Y Model		Ť	Туре ү	Status Y Identifie	۲ ۲	r largets y	Devices	Paths
Protocol Endpoints	I C vmhba66 T6225-CR Chelsic 0005)	iSCSI offload initia	tor (RE4116	iSCSI	Online Port0(i	qn.2017-07.com.ch	10	10	10
I/O Filters	C C vmhba67 T6225-CR Chelsic	SCSL offload initia	tor (RE4116	iSCSI	Online Port1(ic	in 2017-07 com che	el O	0	0
Networking 🗸 🗸	0005)				sio:00-	07-43-04-b4-5c)		-	_
Virtual switches	Manage Columns Export ~								5 items
VMkernel adapters									
Physical adapters	Properties Devices Paths Dynamic	iscovery Stati	c Discovery	Network Settin	igs Advanced Opti	ons			
RDMA adapters									
TCP/IP configuration	REFRESH ATTACH DETACH RENAME TU	RN ON LED TURN	OFF LED E	RASE PARTITIONS	MARK AS FLASH DISK	MARK AS LOCAL	MARK AS PEREN	NIALLY RESERVE	D
Virtual Machines 🛛 🗸	Name T	LUN 🕆 🔻	Туре ү	Capacity Y	Datastore T	Operational State	Hardware Acceleration	Drive Type Y	Transport
VM Startup/Shutdown	LIO-ORG iSCSI Disk (naa.600140589c29	0	disk	3.72 GB	Not Consumed	Attached	Supported	HDD	iSCSI
Agent VM Settings	48a35974td398d2ba664)								
Default VM Compatibility	4b3b74e769c3498857)	5 1	disk	3.72 GB	Not Consumed	Attached	Supported	HDD	ISCSI
Swap File Location	LIO-ORG iSCSI Disk (naa.6001405037efe 32182a461ca68016ade)	1 2	disk	3.73 GB	Not Consumed	Attached	Supported	HDD	ISCSI
Licensing	LIO-ORG ISCSI Disk (naa.600140540201 a571e87437a992b85564)	3	disk	3.73 GB	Not Consumed	Attached	Supported	HDD	iscsi
Host Profile	LIO-ORG iSCSI Disk (naa.6001405d211c8	4	disk	3.72 GB	Not Consumed	Attached	Supported	HDD	iSCSI
Time Configuration	7549934f6584d41f9cc)								
Authentication Services	LIO-ORG iSCSI Disk (naa.600140509198 d194ae4e848c825f9b5)	5	disk	3.73 GB	Not Consumed	Attached	Supported	HDD	iSCSI
Certificate									
Power Management	1 Manage Columns Export - Deselect A	ai							10 items

The Paths tab displays LUN status and allows you to enable or disable them.

Propertie	es Devices	Paths	Dynamic Discovery	Static Discovery	Network Settings	Advanced Options		
ENABLE	DISABLE							
	Runtime Name		Ŧ	Target	T LUN		ŤΨ	Status
	vmhba66:CO:TO:	L O		l.	0			Active (I/O)
DI	vmhba66:CO:T1:L	1			1			Active (I/O)
DI	vmhba66:C0:T2:1	2			2			Active (I/O)
C	vmhba66:C0:T3:L	.3			3			Active (I/O)

These LUNs can now be attached to VMs or can be used to store VMs.

- Removing Target Server
- i. Under Dynamic Discovery tab, select target server, click Remove and then OK to confirm.

Properties	Devices Paths	Dynamic Discovery	Static Discovery	Network Settings	Advanced Options
ADD	REMOVE AUTHENTICAT	ION ADVANCED			
isc:	SI server				
120	0.1.1.178:3260				

ii. To apply the changes, rescan the iSCSI adapter.

3.2.2. Static Discoverys

- Adding Target Server
- i. Select the iSCSI interface to connect to the target and select Static Discovery tab.

Summary Monitor	Configu	re Permissions VMs	Datastores Networks	Updates						
Storage	~	Storage Adapters								
Storage Adapters		ADD SOFTWARE ADAPTER ~	REFRESH RESCAN STORAG	E RESCAN ADAPTER	REMOVE					
Storage Devices	ation	Adapter T	Model	Ŧ	Туре 🔻	Status 🔻	Identifier T	Targets T	Devices T	Paths
Protocol Endpoints	ation	●	T6225-CR Chelsio iSCSI of 0005)	fload initiator (RE4116	iSCSI	Online	Port0(iqn.2017-07.com.ch elsio:00-07-43-04-b4-54)	0	0	0
I/O Filters	~	◯	T6225-CR Chelsio iSCSI of 0005)	fload initiator (RE4116	iSCSI	Online	Port1(iqn.2017-07.com.chel sio:00-07-43-04-b4-5c)	0	0	0
Virtual switches		Manage Columns Expor	· *							5 items
VMkernel adapters					1					
Physical adapters		Properties Devices	Paths Dynamic Discovery	Static Discovery	Network Set	ttings Advar	nced Options			
RDMA adapters										
TCP/IP configuration		ADD REMOVE AU	ADVANCED							
Virtual Machines	~	iSCSI server			▼ Target N	ame				Ŧ

ii. Click Add and provide the target server IP and target IQN. Click OK.

Add Static Tar	get Server vmhba66	×
iSCSI Server	120.1.1.178	
Port	3260	
iSCSI Target Name	iqn.2015-12.org.linux-iscsi.chelsio.1-target	
Inherit authentication :	settings from parent	
	CANCEL	к

- iii. To apply the changes, rescan the iSCSI adapter.
- iv. All the available LUNs discovered on the given target server will be displayed in the **Devices** tab. You can perform various tasks like detach, rename, erase partitions, etc.

Summary N	Monitor	Configu	Permissions	VMs	Datastores	Networks	Updates	5						
Storage		~	Storage Ad	apters										
Storage Ad	dapters		ADD SOFTWARE A	DAPTER ~	REFRESH	RESCAN STORAG	E RESCA	N ADAPTER	REMOVE					
Storage De Host Cache	evices e Configura	tion	Adapter	т	Model			Ŧ	Туре т	Status T	dentifier	Targets	T Devices	T Paths
Protocol En	ndpoints		💿 🔆 vmt	nba66	T6225-CR (0005)	Chelsio iSCSI off	load initiat	or (RE4116	iSCSI	Online F	Port0(iqn.2017-07.com. elsio:00-07-43-04-b4-5	ch 1 i4)	1	1
I/O Filters			⊖	nba67	T6225-CR (Chelsio iSCSI off	load initiat	or (RE4116	iSCSI	Online F	Port1(iqn.2017-07.com.c sio:00-07-43-04-b4-5c)	thel O	0	0
Virtual swite	tches	Ť	Manage Columns	Export	~] ~]							,		5 items
VMkernel a	adapters													
Physical ad	lapters oters		Properties De	evices	Paths Dyn	amic Discovery	Static	Discovery	Network Set	tings Advance	d Options			
TCP/IP cont	ifiguration		REFRESH ATTA	CH DET	ACH RENAME	TURN ON LE	D TURN	OFF LED E	RASE PARTITIONS	MARK AS FLASH	DISK MARK AS LOCAL	MARK AS PEREN	NIALLY RESERVE	D
Virtual Machi	ines	~	Name			T LUN	Υ τ	Туре т	Capacity T	Datastore	T Operational T State	Hardware Acceleration	Drive Type T	Transport T
VM Startup	Shutdowr		LIO-ORG 48a3597	iSCSI Disk 4fd398d2	(naa.6001405 0a664)	89c29 0		disk	3.72 GB	Not Consume	d Attached	Supported	HDD	iSCSI
Default VM	l Compatibi	lity												

The Paths tab displays LUN status and allows you to enable or disable them.

Properties	Devices	Paths	Dynamic Discovery	Static Discovery	Network Settings	Advanced Options			
ENABLE	DISABLE								
Run	time Name		т	Target	T LUN		Υ Τ	Status	т
💿 vm	hba66:C0:T0:L	.0			0			Active (I/O)	

These LUNs can now be attached to VMs or can be used to store VMs.

- Removing Target Server
- i. Under Static Discovery tab, select the target server, click Remove and then OK to confirm.

Properties	Devices Paths	Dynamic Discovery	Static Discovery	Network Settings	Advanced Options
ADD	REMOVE AUTHENTICAT	ION ADVANCED			
iscs	SI server			▼ Target Name	۲
120	0.1.1.178:3260		linux-iscsi.chelsio.1-target		

ii. To apply the changes, rescan the iSCSI adapter.

3.3. Configurable Options

The option to edit general initiator properties like alias and name is available under the **Properties** tab.

Edit Genera	1 vmhba66	×
iSCSI Name	iqn.2017-07.com.chelsio:00-07-43-04-b4-54	_
iSCSI Alias	Port0	_
	CANCEL	

Advanced parameters like Digest, MTU, etc., can be changed in the Advanced Options tab.

Option	٣	Description T	Value		
leader Digest		iSCSI adapter option : Header Digest	Prohibited	\sim	
Data Digest		iSCSI adapter option : Data Digest	Prohibited	\sim	
ErrorRecoveryLevel		iSCSI option : iSCSI Error Recovery Level (ERL) value that the ESX initia tor would negotiate during login.	0		
oginRetryMax		iSCSI option : Maximum number of times ESX initiator would retry login to a target, before giving up.	4		
MaxOutstandingR2T		iSCSI option : Maximum number of R2T (Ready To Transfer) PDUs, that can be outstanding for a task.	1		
FirstBurstLength		iSCSI option : Maximum unsolicited data in bytes initiator can send duri ng the execution of a single SCSI command. It must be <= MaxBurstLe ngth.	262144		
MaxBurstLength		iSCSI option : Maximum SCSI data payload in bytes in a Data-In or a sol icited Data-Out iSCSI sequence.	262144		
MaxRecvDataSegLen		iSCSI option : Maximum data segment length in bytes that can be recei ved in an iSCSI PDU. It is recommended to keep it <= MaxBurstLength.	131072		
MaxCommands		iSCSI option : Maximum SCSI commands that can be queued on the isc si adpater.	128		
DefaultTimeToWait		iSCSI option : Minimum seconds to wait before attempting a logout or an active task reassignment after an unexpected connection terminati on or reset.	2		
DefaultTimeToRetain		iSCSI option : Maximum seconds that a connection and task allegiance reinstatement is still possible following a connection termination or res et.	0		
oginTimeout		iSCSI option : Time in seconds initiator will wait for the Login response	5		

4. Software/Driver Unloading

Logout all the existing iSCSI sessions. Execute the command below to unload the iSCSI Offload Initiator driver:

```
[root@host:~] vmkload_mod -u cheiscsi
```

[root@KGF2:~] vmkload_mod -u cheiscsi Module cheiscsi successfully unloaded

IV. iSER Offload Initiator Driver

1. Introduction

The iSCSI Extensions for RDMA (iSER) protocol is a translation layer for operating iSCSI over RDMA transports, such as iWARP RDMA. Chelsio Unified Wire adapters supporting iWARP provide the higher bandwidth and lower latency required for block storage transfers. iSER is stable and provides benefits of the iSCSI protocol like security and high availability.

1.1. Hardware Requirements

1.1.1. Supported Adapters

The following are the adapters that are compatible with Chelsio iSER Offload Initiator driver:

- T62100-CR
- T62100-LP-CR
- T6425-CR
- T6225-CR
- T6225-LL-CR
- T6225-SO-CR (Memory Free; 256 IPv4/128 IPv6 offload connections supported)
- T580-CR
- T580-LP-CR
- T540-CR
- T540-LP-CR
- T540-BT
- T520-CR
- T520-LL-CR
- T520-BT

2. Software/Driver Loading

After rebooting the ESXi Host, the driver loads automatically. However, it is possible to manually load the driver.

```
[root@host:~] vmkload_mod cheiwarp
```

Execute the following command, so that the device manager performs a rescan:

[root@host:~] kill -SIGHUP \$(cat /var/run/vmware/vmkdevmgr.pid)

3. Software/Driver Configuration and Fine-tuning

The following sections describe the method to configure Chelsio iSER Offload Initiator and connect to target.

3.1. Configuring Initiator

i. Enable the iSER adapter.

[root@host:~] esxcli rdma iser add

ONOTE This is not persistent across reboots. To make it persistent, add the above command to /etc/rc.local.d/local.sh file.

- ii. Log in to vCenter Server through vSphere Web Client using a web browser.
- iii. If you have already created and configured the host intended to be used as initiator, skip to step (iv).
 - a. Under **Hosts and Clusters**, right-click and click **New Datacenter...** Provide a name and Click **OK**.
 - b. Right-click on the newly created datacenter and click **Add Host...** Follow the onscreen instructions and provide information to add the host. Click **Finish**.
- iv. Select the host and under the **Configure** tab, select **Storage Adapters**. This displays the list of available iSER adapters.

Summary I	Monitor	Configure	e Permissions VMs	Datastores Networks	Updates						
Storage		~	Storage Adapters								
Storage Ac	dapters		ADD SOFTWARE ADAPTER ~	REFRESH RESCAN STORAG	E RESCAN ADAPTER	REMOVE					
Storage De	evices	- 1	Adapter	Model	-	Type -	Status 👻	Identifier	Targets -	Devices -	Paths
Host Cache	e Configurat	ion	• C vmbba64	VMware iSCSLover PDMA	(ISER) Adapter	iscsi	Unbound	iser-ympic9/ian 1998-01 co		0	0
Protocol Er	ndpoints	- 1		Vinitare ises over RomA		10001	Chocana	m.vmware:kgf1.asicdesign ers.com:1161313288:64)		0	, in the second s
Networking		~	🔘 🔆 vmhba65	VMware iSCSI over RDMA	(iSER) Adapter	iSCSI	Unbound	iser-vmnic10(iqn.1998-01.c om.vmware:kgf1.asicdesig	0	0	0
Virtual swit	tches	- 1						ners.com.1940944980.65)			
VMkernel a	adapters	- 1	Manage Columns Export	<u>~</u>]							7 items
Physical ac	dapters	- 1									
RDMA ada	pters	- 1	Properties Devices	Paths Dynamic Discovery	Static Discovery	Network Po	rt Binding A	dvanced Options			
TCP/IP con	nfiguration	- 1									
Virtual Mach	nines	~	Name	vmhba64							
VM Startup	p/Shutdown	- 1	Model	VMware iSCSI over RDMA	(iSER) Adapter						
Agent VM	Settings	- 1	iSCSI Name	ign.1998-01.com.vmware:kg	gf1.asicdesigners.com:	1161313288:64					
Default VM	4 Compatibil	ity	iSCSI Alias	iser-vmnic9							
Swap File I	Location	- 1	Target Discovery	Send Targets, Static Targe	ts						
System		~	✓ Authentication ACTIC	NS ~							
Licensing			Method	None							

v. Create a VMkernel adapter connected to Chelsio uplink by following the screenshots below.

Networking	~	VMkernel adapters									
Virtual switches	Virtual switches ADD NETWORKING REFRESH										
VMkernel adapters											
Physical adapters	_	Device T	Network Label	Ŧ	Switch	Ŧ	IP Address	TCP/IP Stack	Ŧ	Enabled Services	Ŧ
RDMA adapters		: » 📼 vmk0	Ø Management Network		② vSwitch0		10.193.204.114	Default		Management	
TCP/IP configuration		: » 📼 vmk1	Ø VMkernel		② vSwitch1		120.1.1.114	Default			

Add Networking	Select connection type	×
1 Select connection type	Select a connection type to create.	
2 Select target device	VMkernel Network Adapter The VMkernel TCP/IP stack handles traffic for ESXi services such as vSphere vMotion, iSCSI, NFS, FCoE, Fault The VMkernel TCP/IP stack handles traffic for ESXi services such as vSphere vMotion, iSCSI, NFS, FCoE, Fault	
3 Port properties	Virtual Machine Port Group for a Standard Switch	
4 IPv4 settings	A port group handles the virtual machine traffic on standard switch.	
5 Ready to complete	 Physical Network Adapter A physical network adapter handles the network traffic to other hosts on the network. 	
	CANCEL	хт

Add Networking	Select target device						
 Select connection type Select target device 	Select a target device for the new connection. Select an existing network Select an existing standard switch New standard switch						
3 Create a Standard Switch	MTU (Bytes) 1500						
4 Port properties							
5 IPv4 settings							
6 Ready to complete							



vi. Move the Chelsio ports to be used in the vSwitch to the Active Adapters section.

Add Networking	Create a Standard S	vitch	×
1 Select connection type	Assign free physical network a Select unclaimed (free) adapte	dapters to the new switch. rs on the host and move them to the Active/Standby/Unused adapters of the switch	1.
2 Select target device	MOVE UP MOVE DOWN	All Properties CDP LLDP RDMA	
3 Create a Standard Switch	Unclaimed adapters	Properties Adapter Chelsio Communications Inc. T6225-CR Unified Wire Ethernet Controller	L
4 Port properties	vmnic2 vmnic3	Name vmnic10 Location PCI 0000:ae:00.1	L
5 IPv4 settings	vmnic9	✓ Status	L
6 Ready to complete	Active adapters (New) vmnic10	Status Connected Actual speed, Duplex 10 Gbit/s, Full Duplex Configured speed, 10 Gbit/s, Full Duplex Duplex	L
	Unused adapters	Networks No networks	L
		Status Allowed	
		Status Disabled	
		(\widehat{I}) Cisco Discovery Protocol is not available on this physical network adapter	
		CANCEL BACK NEX	кт

Networking ~	,	VMker	rnel	l adapters											
Virtual switches		ADD NETWORKING REFRESH													
VMkernel adapters															
Physical adapters				Device	Ŧ	Network Label	Ŧ	Switch	Ŧ	IP Address	τ	TCP/IP Stack	τ	Enabled Services	Ŧ
RDMA adapters		: :	>>	🕮 vmk0		Ø Management Network		vSwitch0		10.193.204.114		Default		Management	
TCP/IP configuration		: ;	»	🕮 vmk1		🛛 VMkernel		🗊 vSwitch1		120.1.1.114		Default			

vii. Bind the VMkernel adapter to the VMware iSER Adapter.

Summary Monitor	Configu	re Permissions VMs	Datastores Networks	Updates						
Storage	~	Storage Adapters	;							
Storage Adapters		ADD SOFTWARE ADAPTER ~	REFRESH RESCAN STORAG	SE RESCAN ADAPTER	REMOVE					
Storage Devices Host Cache Configura	ation	Adapter T	Model	т	Туре т	Status T	Identifier T	Targets	▼ Devices	T Paths
Protocol Endpoints		💿 🔶 vmhba64	VMware iSCSI over RDMA	(iSER) Adapter	iSCSI	Unbound	iser-vmnic9(iqn.1998-01.co m.vmware:kgf1.asicdesign ers.com:1161313288:64)	0	0	0
Networking Virtual switches	~	○	VMware iSCSI over RDMA	(iSER) Adapter	iSCSI	Unbound	iser-vmnic10(iqn.1998-01.c om.vmware:kgf1.asicdesig ners.com:1940944980:65)	0	0	0
VMkernel adapters Physical adapters		Manage Columns Expo	t×							7 items
RDMA adapters TCP/IP configuration		Properties Devices	Paths Dynamic Discovery	/ Static Discovery	Network Po	ort Binding A	dvanced Options			
Virtual Machines	~	ADD REMOVE VIE	W DETAILS							
VM Startup/Shutdowr	n	Port Group	Y VMkernel Adapter	T Po	t Group Policy	Ŧ	Path Status T	Physical Ne	twork Adapter	٣

Bind vmhba65 with VMkernel Adapter							
Port Group	T VMkernel Adapter	Physical Network Adapter	Ŧ				
🔽 🖉 VMkernel (vSwitch1)	vmk1	vmnic10 (10 Gbit/s, Full)					

viii. To apply the changes, click **RESCAN ADAPTER**. The status should show **Online**.

Contraction Contra		
Summary Monitor Config	gure Permissions VMs Datastores Networks Updates	
Storage 🗸 🗸	Storage Adapters	
Storage Adapters	A Due to recent configuration changes, a rescan of "vmhba65" is recommended.	
Host Cache Configuration	ADD SOFTWARE ADAPTER Y REFRESH RESCAN STORAGE RESCAN ADAPTER REMOVE	
Protocol Endpoints I/O Filters	Adapter v Model v Type v Status v Identifier v Targets v Devices v Pat	hs
Networking ~	○ ◇ ∨Mware iSCSI over RDMA (ISER) Adapter iSCSI Unbound iser-vmnic9(ign.1999-01.co 0 0 m.vmware/kgf1.asicdesign ers.com/116131228.864)	
Virtual switches VMkernel adapters	I wmhba65 VMware ISCSI over RDMA (ISER) Adapter ISCSI Online iser-vmnic10(iqn.1998-01.c 0 0 on.vmware.igf1.asicdesig ners.com/940944998065)	
RDMA adapters TCP/IP configuration	Manage Columns) Export > 7 Ite	ms
Virtual Machines 🗸 🗸	Properties Devices Paths Dynamic Discovery Static Discovery Network Port Binding Advanced Options	
VM Startup/Shutdown Agent VM Settings	ADD REMOVE VIEW DETAILS	
Default VM Compatibility	Port Group Y VMkernel Adapter Y Port Group Policy Y Path Status Y Physical Network Adapter	т
Swap File Location	Compliant Not used vmnic10 (10 Gbit/s, Full)	

(i) Note Ensure that the VMkernel NIC is associated with a vSwitch containing only a single physical vmnic, as each physical vmnic maps to a distinct iSER vmhba adapter in ESXi.

3.2. Connecting to Target

Configure the iSER target machine with the IP Address, Target name, disks etc. For information on how to configure the iSER Target, refer to the *Chelsio Unified Wire for Linux User Guide*.

Important

Enable iwpmd service on the target machine. On RHEL7.X machines, use the following command:

[root@host~]# systemctl start iwpmd

There are two methods to discover and connect to targets:

- Dynamic Discovery: Discovers all the available targets for a given target server.
- Static Discovery: Discovers a specific target by manually entering target information.

3.2.1. Dynamic Discovery

- Adding Target Server
- i. Select the iSER adapter to connect to the target and select Dynamic Discovery.

Summary Monitor	Configure	Permissions VM	Datastores Networks	Updates						
Storage	~	Storage Adapte	rs							
Storage Adapters		ADD SOFTWARE ADAPTER	· REFRESH RESCAN STORAGE	RESCAN ADAPTER	REMOVE					
Storage Devices	tion	Adapter	¥ Model	т	Туре 🔻	Status 🔻	ldentifier T	Targets	T Devices	▼ Paths
Protocol Endpoints		○	VMware iSCSI over RDMA (iS	ER) Adapter	iSCSI	Unbound	iser-vmnic9(iqn.1998-01.co m.vmware:kgf1.asicdesign ers.com:1161313288:64)	0	0	0
Networking	~	 ● 	VMware iSCSI over RDMA (iS	ER) Adapter	iscsi	Online	iser-vmnic10(iqn.1998-01.c om.vmware:kgf1.asicdesig ners.com:1940944980:65)	0	0	0
VMkernel adapters	- 1	Manage Columns Exp	ort ~							7 items
Physical adapters RDMA adapters	- 1	Properties Devices	Paths Dynamic Discovery	Static Discovery	Network F	ort Binding Ac	dvanced Options			
TCP/IP configuration Virtual Machines	~	ADD REMOVE A	UTHENTICATION ADVANCED							
VM Startup/Shutdowr	n -	iSCSI server								т
Agent VM Settings					_					
Default VM Compatib	ility					1				
Swap File Location					5					

ii. Click Add and provide the target server IP. Click OK.

Add Send Targ	et Server vmhba65	×
iSCSI Server	120.1.1.178	
Port	3260	
Inherit authentication s	CANCEL	ок

iii. To apply the changes, click **RESCAN ADAPTER**.

iv. All the available LUNs discovered on the given target server will be displayed in the **Devices** tab. You can perform various tasks like detach, rename, erase partitions, etc.



The **Paths** tab displays LUN status and allows you to enable or disable them.

Properties	Devices	Paths	Dynamic Discovery	Static Discovery	Network Port B	inding	Advanced Options		
ENABLE	DISABLE								
R	untime Name	τ	Target		Ŧ	LUN	т	Status	т
💿 vi	mhba65:C0:T3:L	.3	iqn.2015-12.org.linux-	iser.chelsio.4-target :	120.1.1.178:3260	3		Active (I/O)	
0 vi	mhba65:C0:T8:L	.8	iqn.2015-12.org.linux-	iser.chelsio.9-target :	120.1.1.178:3260	8		Active (I/O)	
	mhba65:C0:T2:L	.2	iqn.2015-12.org.linux-	iser.chelsio.3-target :	120.1.1.178:3260	2		Active (I/O)	
0 vi	mhba65:C0:T7:L	.7	iqn.2015-12.org.linux	iser.chelsio.8-target :	120.1.1.178:3260	7		Active (I/O)	
	mhba65:C0:T1:L	1	iqn.2015-12.org.linux-	iser.chelsio.2-target :	120.1.1.178:3260	1		Active (I/O)	

These LUNs can now be attached to VMs or can be used to store VMs.

Removing Target Server

During **Dynamic Discovery**, iSER targets also appear as static targets and need to be removed from the **Static** list.

- i. Go to the Static Discovery tab, and select all the target iSCSI servers.
- ii. Click **Remove** and then **OK** to confirm.

Properties	Devices	Paths	Dynamic Discovery	Static Discovery	Network Port Binding	Advanced Options	
ADD	REMOVE	THENTICATI	ON ADVANCED				
iso	CSI server			т	Target Name		т
12	0.1.1.178:3260				iqn.2015-12.org.linux-	iser.chelsio.1-target	
2 12	0.1.1.178:3260				iqn.2015-12.org.linux-	iser.chelsio.2-target	
12	0.1.1.178:3260				iqn.2015-12.org.linux-	iser.chelsio.3-target	

- iii. Go to the **Dynamic Discovery** tab, and select all the target iSCSI servers.
- iv. Click Remove and then OK to confirm.



v. To apply the changes, rescan the iSER adapter.

3.2.2. Static Discovery

- Adding Target Server
- i. Select the iSER interface to connect to the target and select Static Discovery tab.

Summary Monitor Configu	re Permissions VMs Datastores Networks Updates
Storage 🗸 🗸	Storage Adapters
Storage Adapters	ADD SOFTWARE ADAPTER V REFRESH RESCAN STORAGE RESCAN ADAPTER REMOVE
Storage Devices	Adapter y Model y Type y Status y Identifier y Targets y Devices y Pathr
Protocol Endpoints	¢ vmhba64 VMware iSCSI over RDMA (ISER) Adapter iSCSI Unbound iser-vmnic9(ign.1998-01.co 0 0 0 m.v.mware.kgft.asicdesign ers.com/101312328:64)
Networking ~	I Cryptop vmhba65 VMware iSCSI over RDMA (ISER) Adapter ISCSI Online iser-vmnic10(ign.1998-01.c 0 0 0 om.vmware.kgf1asicdesig ners.com/s409449405.65)
VMkernel adapters	Manage Columns) Export > 7 item
Physical adapters RDMA adapters	Properties Devices Paths Dynamic Discovery Static Discovery Network Port Binding Advanced Options
Virtual Machines V	ADD REMOVE AUTHENTICATION ADVANCED
VM Startup/Shutdown	iSCSI server Target Name T
Agent VM Settings	
Default VM Compatibility	

ii. Click Add and provide the target server IP and target IQN. Click OK.

Add Static Tar	get Server vmhba65	×
iSCSI Server	120.1.1.178	
Port	3260	
iSCSI Target Name	iqn.2015-12.org.linux-iser.chelsio.1-target	
Inherit authentication s	settings from parent	
	CANCEL	¢

- iii. To apply the changes, rescan the iSER adapter.
- iv. All the available LUNs discovered on the given target server will be displayed in the **Devices** tab. You can perform various tasks like detach, rename, erase partitions, etc.

Propert	ties Devices	Paths	Dynam	ic Discover	y Static Disco	overy Netwo	ork Port Binding	Advanced Op	tions		
REFRE	SH ATTACH	DETACH	RENAME	TURN ON LE	D TURN OFF LE	D ERASE PART	TITIONS MARK AS F	LASH DISK	MARK AS LOCAL MARK AS PERE	NNIALLY RESERVED	
	Name		т	LUN T	Туре 🔻	Capacity T	Datastore T	Operational State	Hardware Acceleration	T Drive Type	Ŧ
	LIO-ORG iSCSI 85856e8cdac7	Disk (naa.6 46cd84585	001405 ib310)	0	disk	3.72 GB	Not Consume d	Attached	Supported	HDD	

The **Paths** tab displays LUN status and allows you to enable or disable them.

Properties	Devices	Paths	Dynamic Discovery	Static Discovery	Network Port Binding	Advanced Options			
ENABLE	DISABLE								
Run	time Name	Ŧ	Target		Y LUN		Ŧ	Status	Ŧ
💿 vm	hba65:C0:T0:L	_0	iqn.2015-12.org.linux	iser.chelsio.1-target :1	20.1.1.178:3260 0			Active (I/O)	

These LUNs can now be attached to VMs or can be used to store VMs.

- Removing Target Server
- i. Select the target server in Static Discovery tab.
- ii. Click Remove and then Yes to confirm.

Properties	Devices Paths	Dynamic Discovery	Static Discovery	Network Port Binding	Advanced Options	
ADD	REMOVE AUTHENTICATION	N ADVANCED				
isc 🖌	CSI server		▼ Target Na	me		T
120	0.1.1.178:3260		iqn.2015	-12.org.linux-iser.chelsio.1-ta	arget	

iii. To apply the changes, rescan the iSER adapter.

3.3. Configurable Options

The option to edit general initiator properties like alias and name is available under the **Properties** tab.

Edit Genera	vmhba65	×
iSCSI Name	iqn.1998-01.com.vmware:kgf1.asicdesigners.com:194094	-
iSCSI Alias	iser-vmnic10	_
	CANCEL	

Advanced parameters like Digest, MTU, etc., can be changed in the **Advanced Options** tab.

ption	Ŧ	Description T	Value		
leader Digest		iSCSI adapter option : Header Digest	Prohibited	\sim	
Data Digest		iSCSI adapter option : Data Digest	Prohibited	\sim	
rrorRecoveryLevel		iSCSI option : iSCSI Error Recovery Level (ERL) value that the ESX initia tor would negotiate during login.	0		
oginRetryMax		iSCSI option : Maximum number of times ESX initiator would retry login to a target, before giving up.	4		
1axOutstandingR2T		iSCSI option : Maximum number of R2T (Ready To Transfer) PDUs, that can be outstanding for a task.	1		
;irstBurstLength		iSCSI option : Maximum unsolicited data in bytes initiator can send duri ng the execution of a single SCSI command. It must be <= MaxBurstLe ngth.	262144		
1axBurstLength		iSCSI option : Maximum SCSI data payload in bytes in a Data-In or a sol icited Data-Out iSCSI sequence.	262144		
1axRecvDataSegLen		iSCSI option : Maximum data segment length in bytes that can be recei ved in an iSCSI PDU. It is recommended to keep it <= MaxBurstLength.	131072		
laxCommands		iSCSI option : Maximum SCSI commands that can be queued on the isc si adpater.	128		
DefaultTimeToWait		iSCSI option : Minimum seconds to wait before attempting a logout or an active task reassignment after an unexpected connection terminati on or reset.	2		
DefaultTimeToRetain		iSCSI option : Maximum seconds that a connection and task allegiance reinstatement is still possible following a connection termination or res et.	0		
oginTimeout		iSCSI option : Time in seconds initiator will wait for the Login response	5		

4. Software/Driver Unloading

Logout all the existing iSER sessions. Execute the following command to unload the iSER Offload Initiator driver:

```
[root@host:~] vmkload_mod -u cheiwarp
```

V. NVMe-oF Offload Initiator Driver

1. Introduction

NVMe over Fabrics specification extends the benefits of NVMe to large fabrics, beyond the reach and scalability of PCIe. NVMe enables deployments with hundreds or thousands of SSDs using a network interconnect, such as RDMA over Ethernet. Thanks to an optimized protocol stack, an end-to-end NVMe solution is expected to reduce access latency and improve performance, particularly when paired with a low latency, high efficiency transport such as RDMA. This allows applications to achieve fast storage response times, irrespective of whether the NVMe SSDs are attached locally or accessed remotely across enterprise or datacenter networks. Chelsio Unified Wire adapters with iWARP RDMA offload provide the high bandwidth and low latency fabric needed for NVMe-oF.

1.1. Hardware Requirements

1.1.1. Supported Adapters

The following are the currently shipping Chelsio adapters that are supported:

- T62100-CR
- T62100-LP-CR
- T6425-CR
- T6225-CR
- T6225-LL-CR
- T6225-SO-CR (Memory Free; 256 IPv4/128 IPv6 offload connections supported)
- T580-CR
- T580-LP-CR
- T540-CR
- T540-LP-CR
- T540-BT
- T520-CR
- T520-LL-CR
- T520-BT

2. Software/Driver Loading

After rebooting the ESXi Host, the driver loads automatically. However, it is possible to manually load the driver by using the command below:

```
[root@host:~] vmkload_mod cheiscsi
```

Execute the following command, so that the device manager performs a rescan:

[root@host:~] kill -SIGHUP \$(cat /var/run/vmware/vmkdevmgr.pid)

3. Software/Driver Configuration and Fine-tuning

3.1. Connecting to NVMe target

Configure the NVMe target machine with the IP Address, Target name, disks etc. For information on how to configure the NVMe Target, refer to the *Chelsio Unified Wire for Linux User Guide*.

Important Disable iwpmd service on the target machine. On RHEL7.X machines, use the following command:

```
[root@host~]# systemctl stop iwpmd
```

Follow the below procedure on NVMe Initiator machine to connect to the target:

- i. Log in to vCenter Server through vSphere Web Client using a web browser.
- ii. If you have already created and configured the host intended to be used as initiator, skip to step (iii).
 - a. Under **Hosts and Clusters**, right-click and click **New Datacenter...** Provide a name and Click **OK**.
 - b. Right-click on the newly created datacenter and click **Add Host...** Follow onscreen instructions and provide information to add the host. Click **Finish**.
- iii. Select the host and under the **Configure** tab, select **Storage Adapters**. This displays the list of available Chelsio storage adapters.

Summary Monitor Config	ure Permissions VMs	Datastores Networks Updates					
Storage 🗸 🗸	Storage Adapters						
Storage Adapters	ADD SOFTWARE ADAPTER ~	REFRESH RESCAN STORAGE RESCAN ADAPTER	REMOVE				
Storage Devices	Adapter T	Model T	Type 🝸 Status 🍸	Identifier T	Targets T	Devices T	Paths
Protocol Endpoints	◯	PERC H755 Front	SAS Unknown		2	2	2
I/O Filters	🔿 🔶 vmhba66	T6225-CR Chelsio iSCSI offload initiator (RE4116 0005)	iSCSI Online	Port0(iqn.2017-07.com.ch elsio:00-07-43-04-b4-54)	0	0	0
Networking \checkmark	 ● 	T6225-CR Chelsio iSCSI offload initiator (RE4116 0005)	iSCSI Online	Port1(iqn.2017-07.com.chel sio:00-07-43-04-b4-5c)	0	0	0
Virtual switches							
VMkernel adapters	Manage Columns Export	tv					7 items
Physical adapters							
RDMA adapters	Properties Devices	Paths Dynamic Discovery Static Discovery	Network Settings Adva	nced Options			
TCP/IP configuration	✓ General ACTIONS ✓						
Virtual Machines 🗸 🗸	Name	vmhba67					
VM Startup/Shutdown	Model	T6225-CR Chelsio iSCSI offload initiator (RE411600	005)				
Agent VM Settings	iSCSI Name	iqn.2017-07.com.chelsio:00-07-43-04-b4-5c					
Default VM Compatibility	iSCSI Alias	Port1					- 1
Swap File Location	Target Discovery	Send Targets, Static Targets					- 1

- iv. In the Adapter Details section, click Network Settings tab and then Edit.
- v. Configure IPv4 address for the adapter and click OK.

				Edit IP an Configura	d DNS tion		vmhba67	×
				IPv4 settings	IPv6 settings	DNS settings		
				○ No IPv4 setti	ngs			
				Obtain IPv4	ettings automatica	ally		
				 Use static IP 	/4 settings			
				IPv4 address		120.1.1.150		
				Subnet mask for	IPv4	255.255.255.0		
				Default gateway	for IPv4	120.1.1.1		
				contain gatering				l
							CANCEL	ок
Properties	Devices	Paths	Dynamic Discovery	Static Disco	very Net	twork Setting	s Advan	ced Optior
✓ IP Addre	ss and DNS C	onfigurati	on ACTIONS ~					
IPv4 add	ress	120.	1.1.150 (static)					
Subnet m	nask for IPv4	255	.255.255.0					
Default g IPv4	ateway for	120.	1.1.1					
IPv6 add	ress	Not	enabled					
Preferred	DNS server	::						

vi. Use the following command to configure the IPv6 address:

```
[root@host:~] /opt/chelsio/bin/cxgbtool -c chnet -set -6 -ipaddr <IPv6
address> -gw <IPv6 gateway> -plen <subnet mask> -p <port>
```

```
[root@localhost:~] /opt/chelsio/bin/cxgbtool -c chnet -set -6 -ipaddr 2000::79 -gw 2000::1 -plen 64 -p 0
Setting chnet Configuration:
    Adapter name : vmhba64
    Node id : 0
    Operation : Setting Ipv6
    IP : 2000::79
    prefix len : 64
    Gateway : 2000::1
    Status : Success
```

vii. Discover the target.

Alternate DNS server

```
[root@host:~] /opt/chelsio/bin/cxgbtool -c nvmf -tport <target_port> -
ipaddr <target ip address> -p <Chelsio Port #> -D
```

```
[root@localhost:~] /opt/chelsio/bin/cxgbtool -c nvmf -tport 4420 -ipaddr 10.200.200.5 -p 0 -D
process_nvmf_resp status 0x0 nrec 0x10
0) nvm subsys nvme-ram0 ctrl id 0xffff addr 10.200.200.5
1) nvm subsys nvme-ram1 ctrl id 0xffff addr 10.200.200.5
```

If -p is not specified, by default Port 0 will be used.

While using IPv6, specify the target IPv6 address within [].

[root@localhost:~] /opt/chelsio/bin/cxgbtool -c nvmf -tport 4420 -ipaddr [1000::146] -p 0 -D

Login to the target by specifying the target name.

```
[root@host:~] /opt/chelsio/bin/cxgbtool -c nvmf -tport <target_port> -
ipaddr <target ip address> -p <Chelsio Port #> -L -subnqn <target name>
```

[root@localhost:~] /opt/chelsio/bin/cxgbtool -c nvmf -tport 4420 -ipaddr 10.200.200.5 -p 0 -L -subnqn nvme-ram0 login status 0 target id 0

viii. Rescan the storage adapter and the target LUNs will be visible.

[root@host:~] esxcfg-rescan -A

ix. List the logged in targets.

```
[root@host:~] /opt/chelsio/bin/cxgbtool -c nvmf -tlist -p <Chelsio Port #>
```

If -p is not specified, by default Port 0 will be used.

```
[root@localhost:~] /opt/chelsio/bin/cxgbtool -c nvmf -tlist
0) tgt_id: 0, state: 5, IP: 10.200.200.5, Port: 4420, sub_nqn: nvme-ram0
s
```

x. All the available LUNs will be displayed in the **Devices** tab. These LUNs can now be attached to VMs or can be used to store VMs.

Properties	Devices Paths Dynamic Discovery		Static Discov	Network Settings			Advanced Options							
REFRESH	ATTACH	DETACH	RENAME	TURN ON LED	TURN OFF LED	ERA	SE PAR	TITIONS	MAR	K AS HDD DISK	MARK AS LOCAL	MARK AS PEREN	NIALLY RESERVED	
Na	me				т	LUN	٣	Туре	т	Capacity T	Datastore T	Operational State T	Hardware Acceleration	Drive Type
✓ N\	/Me iSCSI Di	sk (t10.NVN 73f0df9	/leLin 7f7c685c5	ux)	0		disk		3.72 GB	Not Consume d	Attached	Unknown	Flash

3.2. Disconnecting from NVMe target

To logout or disconnect from the NVMe target:

```
[root@host:~] /opt/chelsio/bin/cxgbtool -c nvmf -tport <target_port> -
ipaddr <target ip address> -p <Chelsio Port #> -LT -all
```

If -p is not specified, by default Port 0 will be used.

[root@localhost:~] /opt/chelsio/bin/cxgbtool -c nvmf -tport 4420 -ipaddr 10.200.200.5 -p 0 -LT -all Log out: tgt id 0 Logout status 0

4. Software/Driver Unloading

Logout of all the existing NVMe-oF sessions. Execute the following command to unload the driver:

```
[root@host:~] vmkload_mod -u cheiscsi
```

VI. Appendix

1. Troubleshooting

Logs collection

In case of any issues, collect the below logs:

- /var/log/vmkernel.log
- Adapter logs (*dump_file*) using the below command:

```
[root@host:~]/opt/chelsio/bin/cxgbtool -c cudbg -d all -f <dump_file> -a
<adap>
```

[root@localhost:~] /opt/chelsio/bin/cxgbtool -c cudbg -d all -f /productLocker/cudbg.dmp -a 0 Writing 51347516 bytes to /productLocker/cudbg.dmp

In case of a PSOD, additionally provide the vmkernel zdump from /var/core/ directory.

Please contact Chelsio support at support@chelsio.com with all relevant logs for any issues.

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