



# Chelsio T5/T4 Network Driver for XenServer

## Installation and User's Guide



---

This document and related products are distributed under licenses restricting their use, copying, distribution, and reverse-engineering.

No part of this document may be reproduced in any form or by any means without prior written permission by Chelsio Communications.

All third party trademarks are copyright of their respective owners.

THIS DOCUMENTATION IS PROVIDED “AS IS” AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

THE USE OF THE SOFTWARE AND ANY ASSOCIATED MATERIALS (COLLECTIVELY THE “SOFTWARE”) IS SUBJECT TO THE SOFTWARE LICENSE TERMS OF CHELSIO COMMUNICATIONS, INC.



**Chelsio Communications (Headquarters)**

370 San Aleso Ave.  
Suite 100  
Sunnyvale, CA 94085  
U.S.A

[www.chelsio.com](http://www.chelsio.com)

Tel: 408.962.3600  
Fax: 408.962.3661

**Chelsio KK (Japan)**

SHIMA Akasaka Bldg.  
Minato-ku, Tokyo  
Japan 107-0052

Tel: 03-6234-4353

**Chelsio (India) Private Limited**

Subramanya Arcade, Floor 3, Tower B  
No. 12, Bannerghatta Road,  
Bangalore-560029  
Karnataka,  
India

Tel: +91-80-4039-6800  
Fax: +91-80-4039-6807

**Sales**

For all sales inquiries please send email to [sales@chelsio.com](mailto:sales@chelsio.com)

**Support**

For all support related questions please send email to [support@chelsio.com](mailto:support@chelsio.com)

Copyright © 2015.Chelsio Communications. All Rights Reserved.

Chelsio ® is a registered trademark of Chelsio Communications.

All other marks and names mentioned herein may be trademarks of their respective companies.

---

## Document History

Version	Revision Date
1.0.0	05/18/2012
1.0.1	04/24/2015

---

## **TABLE OF CONTENTS**

<b>1. Introduction</b>	<b>5</b>
1.1. Features	5
1.2. Hardware Requirements	5
1.3. Software Requirements	6
1.4. Package Contents	7
<b>2. Hardware Installation</b>	<b>8</b>
<b>3. Software/Driver Installation</b>	<b>11</b>
3.1. During OS installation	11
3.2. Runtime Installation	12
3.3. Firmware Update	13
<b>4. Software/Driver Loading</b>	<b>14</b>
<b>5. Software/Driver Configuration and Fine-tuning</b>	<b>15</b>
5.1. Instantiate Virtual Functions (SR-IOV)	15
<b>6. Software/Driver Unloading</b>	<b>16</b>
<b>7. Software/Driver Uninstallation</b>	<b>17</b>
<b>8. Software/Driver Update</b>	<b>18</b>
<b>9. Appendix</b>	<b>19</b>
9.1. Chelsio End-User License Agreement (EULA)	19

## 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.

This document describes the installation, use and maintenance of Network driver for XenServer and its various components.

### 1.1. Features

Chelsio's Network driver package for XenServer is an ISO image which installs drivers for Chelsio's T5/T4 Unified Wire adapters on XenServer.

### 1.2. Hardware Requirements

#### 1.2.1. Supported Adapters

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

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

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

## 1.3. Software Requirements

---

### 1.3.1. XenServer Requirements

Chelsio's Network driver has been developed to run on XenServer platforms. Currently the software is available for the following version:

- Citrix XenServer Host 6.5.0  
Kernel version: 3.10.0+2

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

### 1.3.2. Resource Requirements

- **Control Domain (Dom0) memory:** Based on the number of 40/10/1G ports, driver allocates memory enough to run at the desired rate. It is suggested to increase the control domain memory to 2GB using the procedure explained in <http://support.citrix.com/article/CTX134951>
- **SW-IOMMU Size:** Increasing SW-IOMMU size by appending `swiotlb=128` to `/boot/extlinux.conf` avoids PCI-DMA: Out of SW-IOMMU space for <size> bytes at device <BDF> messages.

## 1.4. Package Contents

---

The software supplied is an ISO image. It consists of the following:

- RPM packages containing drivers and associated tools, firmware, etc.
- Shell script to install the driver package.

## 2. Hardware Installation

Follow the steps to install Chelsio Adapter in your system:

1. Shutdown and power off your system.
2. Power off all remaining peripherals attached to your system.
3. Unpack the Chelsio adapter and place it on an anti-static surface.
4. Remove the system case cover according to the system manufacturer's instructions.
5. Remove the PCI filler plate from the slot where you will install the Ethernet adapter.
6. For maximum performance, it is highly recommended to install the adapter into a PCIE x8/x16 slot.
7. 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.
8. Secure the Chelsio adapter with a screw, or other securing mechanism, as described by the system manufacturer's instructions. Replace the case cover.
9. 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.
10. Connect a fiber cable, multi-mode for short range (SR) optics or single-mode for long range (LR) optics, to the 40/10Gb Ethernet adapter or regular Ethernet cable for the 1Gb Ethernet adapter.
11. Power on your system.
12. 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.
```

13. Verify if the adapter was installed successfully by using the *lspci* command
  - a. For T5 adapters :

```
[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
```

**b. And for T4 adapters :**

```
[root@host~]# lspci | grep -i Chelsio
03:00.0 Ethernet controller: Chelsio Communications Inc T420-CR Unified Wire
Ethernet Controller
03:00.1 Ethernet controller: Chelsio Communications Inc T420-CR Unified Wire
Ethernet Controller
03:00.2 Ethernet controller: Chelsio Communications Inc T420-CR Unified Wire
Ethernet Controller
03:00.3 Ethernet controller: Chelsio Communications Inc T420-CR Unified Wire
Ethernet Controller
03:00.4 Ethernet controller: Chelsio Communications Inc T420-CR Unified Wire
Ethernet Controller
03:00.5 SCSI storage controller: Chelsio Communications Inc T420-CR Unified
Wire Storage Controller
03:00.6 Fibre Channel: Chelsio Communications Inc T420-CR Unified Wire
Storage Controller
03:00.7 Ethernet controller: Chelsio Communications Inc Device 0000
```

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

Once driver is installed and loaded, examine the output of `dmesg` to see if the card is discovered.

- For T5 adapters:

```
eth4: Chelsio T520-LL rev 0 10GBASE-SFP RNIC PCIe 5 GT/s x8 MSI-X, Offload
capable
0000:07:00.4: S/N: PT03140177, P/N: 110116750C0
```

- And, for T4 adapters:

```
eth0: Chelsio T420-CR rev 2 10GBASE-SFP RNIC PCIe x8 MSI-X  
0000:04:00.4: S/N: PT18111226, P/N: 110112140D0
```

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.



### Note

*Network device names for Chelsio's physical ports are assigned using the following convention: the port farthest from the motherboard will appear as the first network interface. However, for T5 40G and T420-BT adapters, the association of physical Ethernet ports and their corresponding network device names is opposite. For these adapters, the port nearest to the motherboard will appear as the first network interface.*

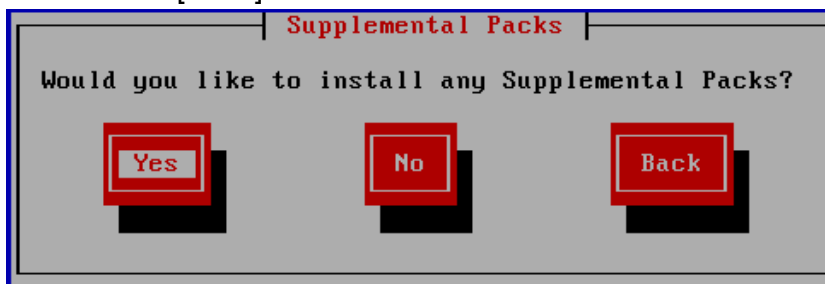
## 3. Software/Driver Installation

Chelsio Network driver must be installed by the root user. Any attempt to install the software as a regular user will fail.

There are two methods of installation: During operating system installation and Runtime.

### 3.1. During OS installation

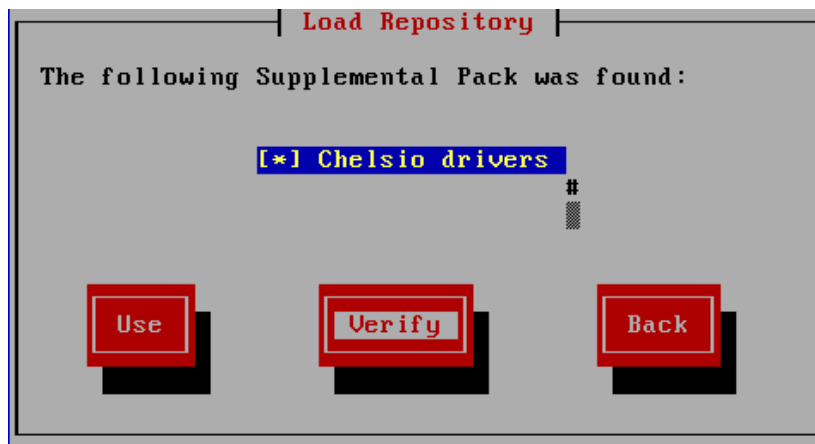
1. If you haven't done so already, download the Network driver(ISO image) from Chelsio Download Center, <http://service.chelsio.com>
2. Burn the image to a CD/DVD.
3. Start an interactive install of XenServer.
4. When the installer prompts, opt for installing drivers through Supplemental Packs. Choose "Yes" and hit [Enter].



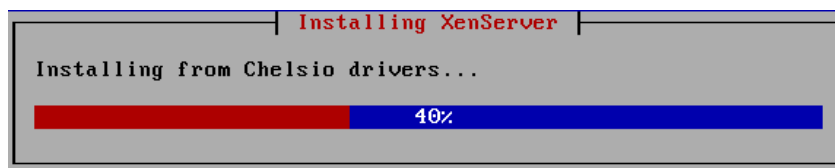
5. Insert the disc into disc drive. Choose "Ok" and hit [Enter].



- The installer will now search and display the drivers. Choose “Use” and hit [Enter].



- The selected drivers will now be installed.



- To install any additional drivers follow the same procedure mentioned above. Or choose “Skip” and hit [Enter] to complete the driver installation.

## 3.2. Runtime Installation

---

- If you haven't done so already, download the Network driver (ISO image) from Chelsio Download Center, <http://service.chelsio.com>
- Copy the ISO image on to a host running XenServer.
- Mount the image onto a directory by running the following commands:

```
[root@host~]# mkdir /tmp/iso
[root@host~]# mount -o loop <driver.iso> /tmp/iso
[root@host~]# cd /tmp/iso
```

- Run the `install.sh` script to install the drivers and tools:

```
[root@host~]# ./install.sh
```

5. Finally, unmount the ISO image:

```
[root@host~]# cd  
[root@host~]# umount /tmp/iso
```

### 3.3. Firmware Update

The T5 and T4 firmwares are installed on the system, typically in `/lib/firmware/cxgb4`, and the driver will auto-load them if an update is required.

The firmware version can be verified using *ethtool*:

```
[root@host~]# ethtool -i <iface>
```

## 4. Software/Driver Loading

The driver must be loaded by the root user. Any attempt to load the driver as a regular user will fail.

To load the driver, execute the following:

```
[root@host~]# modprobe cxgb4
```


## 5. Software/Driver Configuration and Fine-tuning

### 5.1. Instantiate Virtual Functions (SR-IOV)

To instantiate the Virtual functions, load the cxgb4 driver with `num_vf` parameter with a non-zero value. For example:

```
[root@host~]# modprobe cxgb4 num_vf=1,0,0,0
```

The number(s) provided for `num_vf` parameter specifies the number of Virtual Functions to be instantiated per Physical Function. The Virtual Functions can be assigned to Virtual Machines (Guests). A maximum of 64 Virtual Functions can be instantiated with 16 Virtual Functions per Physical Function.

 **Note** *To get familiar with physical and virtual function terminologies, please refer the PCI Express specification.*

## 6. Software/Driver Unloading

To unload the driver, execute the following:

```
[root@host~]# rmmod cxgb4
```

## 7. Software/Driver Uninstallation

1. Use the following query commands to determine the RPMs installed:

```
[root@host~]# rpm -qa | grep -i cxgb4  
[root@host~]# rpm -qa | grep -i chelsio
```

2. Now, with the results from the above queries, execute the following command to uninstall all related packages:

```
[root@host~]# rpm -e <package_name>
```

## 8. Software/Driver Update

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

Please visit Chelsio support web site <http://service.chelsio.com/> for regular updates on various software/drivers. You can also subscribe to our newsletter for the latest software updates.

## 9. Appendix

### 9.1. Chelsio End-User License Agreement (EULA)

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

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

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

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

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

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

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

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

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

any termination, including termination by you, you must destroy the Software (including the related documentation), together with all copies or modifications in any form.

6. Limited Warranty. If Chelsio furnishes the Software to you on media, Chelsio warrants only that the media upon which the Software is furnished will be free from defects in material or workmanship under normal use and service for a period of thirty (30) days from the date of delivery to you.

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

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

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

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

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

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

11. Government Restricted Rights. The Software is subject to restricted rights as follows. If the Software is acquired under the terms of a GSA contract: use, reproduction or disclosure is subject to the restrictions set forth in the applicable ADP Schedule contract. If the Software is acquired under the terms of a DoD or civilian agency contract, use, duplication or disclosure by the Government is subject to the restrictions of this Agreement in accordance with 48 C.F.R. 12.212 of the Federal Acquisition Regulations and its successors and 49 C.F.R. 227.7202-1 of the DoD FAR Supplement and its successors.

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

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

Chelsio Communications, Inc.  
370 San Aleso Ave.  
Sunnyvale, CA 94085