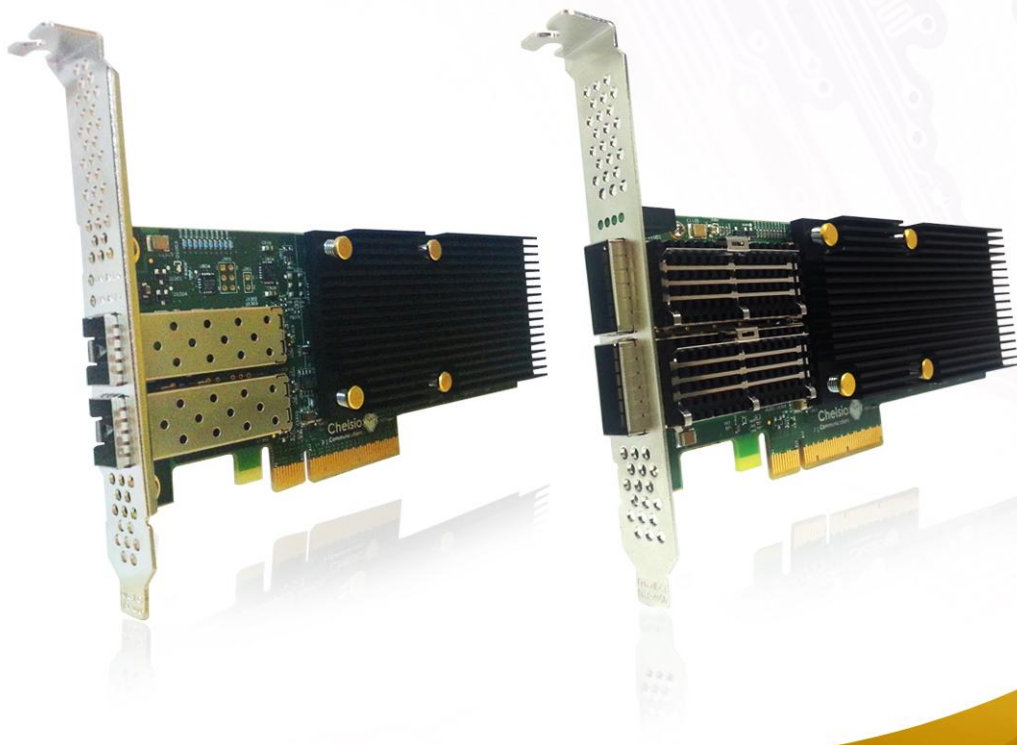




# Chelsio T5/T4 Unified Wire for Windows

## Installation and User's Guide



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**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 (India) Private Limited**

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

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

**Chelsio KK (Japan)**

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

Tel: 03-6234-4353

**Sales**

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

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

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## Version History

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## I. Chelsio Unified Wire

## 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.

### 1.1. Features

Chelsio's T5/T4 Unified Wire package contains Chelsio's NDIS function driver. The driver supports NIC and NDK functionalities.

### 1.2. Hardware Requirements

The Chelsio T5/T4 Unified Wire supports all x64 architectures supporting PCIE (x4, x8) slots.

- AMD CPUs, 64-bit (x86\_64/amd64)
- Intel CPUs, 64-bit (x86\_64)



Note

*The Chelsio Unified Wire supports 3.3v PCI bus only. Running an adapter on a PCI x4 slot is not recommended as performance will be significantly reduced by the limitations of PCI.*

### 1.3. Software Requirements

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Chelsio T5/T4 Unified Wire has been developed to run on Windows based platforms. To know more about the complete list of versions supported by each driver/software, please refer to their respective sections.

### 1.4. Package Contents

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Chelsio T5/T4 Unified Wire driver package contains driver files and support documentation (*docs* folder).

## 2. Hardware Installation

1. Shutdown/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 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. Verify if the adapter was installed successfully. To do so, open **Device Manager** in **Control Panel**.
13. Under **Other devices** section, Chelsio adapter should be listed as **Ethernet Controller**. If the adapter is not listed, right-click on the system name or click on the **Actions** menu and select **Scan for hardware changes**

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

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

14. Once the Unified Wire package is installed, open **Device Manager** again. Expand **Network adapters** section and now Chelsio adapter should be listed.



*Network device names for Chelsio's physical ports are assigned using the following convention: the port farthest from the motherboard will appear as the first ethernet network interface. However, for T580-LP-CR, T580-SO-CR 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 Unified Wire can be installed using **Windows Update** or **Chelsio's Unified Wire Installer**. Alternatively, you can install or remove driver files in an offline Windows image using procedures mentioned in the following links:

- <http://technet.microsoft.com/en-us/library/hh825070.aspx>
- <http://blogs.technet.com/b/heyscriptingguy/archive/2012/09/27/use-the-powershell-dism-cmdlets-to-manage-windows-8.aspx>

## 4. Firmware Update

The driver will auto-load the T5 and T4 firmwares if an update is required. The firmware version can be verified using *cxgbtool*:

```
C:\Users\Administrator> cxgbtool nic0 version
```

## 5. 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.

## II. NDIS Function

## 1. Introduction

Chelsio's T5/T4 series of Unified Wire Adapters provide extensive support for NIC operation, including all stateless offload mechanisms for both IPv4 and IPv6 (IP, TCP and UDP checksum offload, LSO - Large Send Offload aka TSO - TCP Segmentation Offload, Network Direct and assist mechanisms for accelerating LRO - Large Receive Offload).

### 1.1. Hardware Requirements

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#### 1.1.1. Supported Adapters

The following are the currently shipping Chelsio Adapters that are compatible with Chelsio NDIS driver:

- T520-LL-CR
- T520-SO-CR\*
- T580-SO-CR \*
- T520-CR
- T540-CR
- T580-LP-CR
- T420-CR
- T440-CR
- T422-CR
- T420-SO-CR\*
- T404-BT
- T440-LP-CR
- T420-BT
- T420-LL-CR
- T420-CX

\* NDK Functionality not supported

### 1.2. Software Requirements

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#### 1.2.1. Windows Requirement

Currently Chelsio T5/T4 NDIS Function driver is available for Windows server 2012 R2.

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

### 2.1. Assigning IP address to the Chelsio Network Adapter

1. Double click on the Network Connections icon and choose the Chelsio card entry and double click it.
2. Click on the Properties button from the Local Area Connection X Status.
3. Select "Internet Protocol (TCP/IP)" from the list and click on Properties button below it.
4. From the Internet Protocol (TCP/IP) Properties window, assign an IP Address (e.g. 192.169.1.10) and subnet mask (e.g. 255.255.255.0).
5. Click on Ok and close on the other window.
6. Check to see if you can ping to some other address on this subnet.

### 2.2. Advanced Configuration

The Chelsio Network driver provides advanced configuration options under the Device Properties. In the Network Connections window, select the Chelsio Adapter's Local Area Connection interface (right-click -> properties). Click the **Configure** button.

#### 2.2.1. VBD Driver Parameters

To see all tunable VBD driver parameters, open the **Device Manager** (Start > Control Panel -> System & Security-> System -> Device Manager), click on the **System Devices**, double click on the **Chelsio T5/T4 40G/10G Bus Enumerator**, and then click the **Advanced** tab.

- **Max VMQueues:**

- *Description:* Specifies the maximum number of virtual machine queues.
- *Value:* 0-16
- *Default:* 4

- **Nic Port x:**

- *Description:* Enables/Disables the Nic port x.
- *Value:* Enabled | Disabled
- *Default:* Enabled

- **Port x Speed & Duplex:**

- *Description:* Specifies the Port x operation speed and mode.
- *Value:*
  - 100Mbps/Full Duplex
  - 1Gbps/Full Duplex
  - Auto Detect
- *Default:* Auto Detect



*This parameter is valid only for 1G port. User can specify any of the above 1G or 100M full duplex modes. If Auto-Detect is selected, the 1G port will do auto-negotiation.*

- **iScsi Port x:**

- *Description:* Enables/Disables the iScsi port x.
- *Value:* Enabled | Disabled
- *Default:* Disabled

### 2.2.2. NDIS Miniport Driver Parameters

To see all tunable NDIS Miniport Driver parameters, open the **Device Manager** (Start > Control Panel -> System & Security-> System -> Device Manager), click on the **Network adapters**, double click on any **Chelsio Network Adapter**, and then click the **Advanced** tab.

- **Flow Control:**

- *Description:* Enable or disable the receipt or transmission of PAUSE frames. If Rx is enabled, all incoming PAUSE frames will be honored. If Tx is enabled, the HW will send PAUSE frames when its MAC Rx FIFO usage is beyond a high-watermark. If Disabled option is selected, no PAUSE will be sent. When Rx MAC FIFO gets full, further ingress packets will be dropped. If Rx & Tx Enabled is selected, both Rx and Tx options will be enabled.
- *Value:*
  - Disabled
  - Rx & Tx Enabled
  - Rx Enabled
  - Tx Enabled
- *Default:* Rx & Tx Enabled

- **IPv4 Checksum Offload:**

- *Description:* Allows the checksum to be computed by the adapter for IPV4 packets.
- *Value:*
  - Disabled
  - Rx & Tx Enabled
  - Rx Enabled
  - Tx Enabled
- *Default:* Rx & Tx Enabled

- **Jumbo Packet (Maximum Transmission Unit):**

- *Description:* Specifies the Maximum Transmission Unit (MTU) value.
- *Value:* 1500-9000
- *Default:* 1500

- **Large Send Offload V2 (IPv4):**

- *Description:* Allows for configuring Large Send Offload (LSO) using version 2 for the IPv4 traffic.
- *Value:* Enabled | Disabled
- *Default:* Enabled

- **Large Send Offload V2 (IPv6):**

- *Description:* Allows for configuring Large Send Offload (LSO) using version 2 for the IPv6 traffic.
- *Value:* Enabled | Disabled
- *Default:* Enabled

- **Locally Administered Address:**

- *Description:* Specifies a new MAC address for the port. If Not Present, the default MAC from EEPROM is used. If specified, the new MAC overwrites the default MAC. This specified MAC is persistent across machine reboot.
- *Value:* Not Present | Any legal 6-byte MAC address
- *Default:* Not Present

- **Maximum Number of RSS Queues:**

- *Description:* For changing the number of RSS Queues.
- *Value:* 1-8
- *Default:* 4

- **NetworkDirect Functionality:**

- *Description:* For enabling or disabling Network Direct Functionality.
- *Value:* Enabled | Disabled
- *Default:* Enabled

- **NetworkDirect Interrupt Moderation:**

- *Description:* This parameter controls the interrupts generated during NDK traffic.
- *Value:* Enabled | Disabled
- *Default:* Enabled

For more information, refer <http://msdn.microsoft.com/en-us/library/windows/hardware/ff556017%28v=vs.85%29.aspx>

- **Receive Side Scaling (RSS):**

- *Description:* This parameter controls the RSS functions. If on, the Microsoft RSS function is enabled. If off, the Chelsio RSS function is enabled.
- *Value:* Enabled | Disabled
- *Default:* Enabled



- **Recv Segment Coalescing (IPv4):**

- *Description:* Enables or Disables the Receive Segment Coalescing feature for IPv4 traffic. This is a receiver packets aggregating feature which helps reduce the receive host CPU load and improve throughput in a 10Gb network environment where CPU can be the bottleneck.
- *Value:* Enabled | Disabled
- *Default:* Enabled

- **Recv Segment Coalescing (IPv6):**

- *Description:* Enables or Disables the Receive Segment Coalescing feature for IPv6 traffic. This is a receiver packets aggregating feature which helps reduce the receive host CPU load and improve throughput in a 10Gb network environment where CPU can be the bottleneck.
- *Value:* Enabled | Disabled
- *Default:* Enabled

- **RSS load balancing profile:**

- *Description:* This parameter controls the RSS load balancing profile.
- *Value:* Closest Processor | Closest Processor Static | Conservative Scaling | NUMA Scaling | NUMA Scaling Static
- *Default:* Closest Processor

For more information, refer <http://technet.microsoft.com/en-us/library/hh997036.aspx>

- **Rx Ethernet Queue Size:**

- *Description:* This parameter is used to set different Rx Queue sizes. Driver ships with reasonable defaults.
- *Value:* 512-4096
- *Default:* 3072

- **Rx Offload Queue Size:**

- *Description:* This parameter is used to set different Offload Rx Queue sizes. Driver ships with reasonable defaults.
- *Value:* 256-2048
- *Default:* 512



Note

*This feature is not fully tested and available for experimental usage only.*

- **TCP Checksum Offload (IPv4):**


- *Description:* This parameter enables or disables computation of TCP checksum by the adapter for IPv4 packets.
- *Value:*
  - Disabled
  - Rx & Tx Enabled
  - Rx Enabled
  - Tx Enabled
- *Default:* Rx & Tx Enabled

- **TCP Checksum Offload (IPv6):**

- *Description:* This parameter enables or disables computation of TCP checksum by the adapter for IPv6 packets.
- *Value:*
  - Disabled
  - Rx & Tx Enabled
  - Rx Enabled
  - Tx Enabled
  - *Default:* Rx & Tx Enabled

- **TCP Offload:**

- *Description:* Controls the enable or disable of TCP Offload.
- *Range:* Enabled | Disabled
- *Default:* Disabled


 **Note** *This feature is not fully tested. This feature is available for experimental usage only.*

- **Tx Ethernet Queue Size:**

- *Description:* This parameter is used to set different Tx Queue sizes. Driver ships with reasonable defaults.
- *Value:* 512-4096
- *Default:* 1024

- **Tx Offload Queue Size:**

- *Description:* This parameter is used to set different Offload Tx Queue sizes. Driver ships with reasonable defaults.
- *Value:* 256-4096
- *Default:* 512

 **Note** *This feature is not fully tested and available for experimental usage only.*

- **UDP Checksum Offload (IPv4):**

- *Description:* This parameter enables or disables computation of UDP checksum by the adapter for IPv4 packets.
- *Value:*
  - Disabled
  - Rx & Tx Enabled
  - Rx Enabled
  - Tx Enabled
- *Default:* Rx & Tx Enabled

- **UDP Checksum Offload (IPv6):**

- *Description:* This parameter enables or disables computation of UDP checksum by the adapter for IPv6 packets.
- *Value:*
  - Disabled
  - Rx & Tx Enabled
  - Rx Enabled
  - Tx Enabled
- *Default:* Rx & Tx Enabled

- **Virtual Machine Queues:**

- *Description:* Enable or disable the virtual machine queue feature on the interface.
- *Value:* Enabled | Disabled
- *Default:* Enabled

- **VLAN Identifier:**

- *Description:* Specifies the VLAN ID to be inserted.
- *Value:* 0-4094
- *Default:* 0

- **VMQ LookAhead Split:**

- *Description:* Enable or disable the ability to split receive buffers into lookahead and post-lookahead buffers.
- *Value:* Enabled | Disabled
- *Default:* Enabled


- **VMQ VLAN ID Filtering:**

- *Description:* Enable or disable the ability to filter network packets by using the VLAN identifier in the media access control (MAC) header.
- *Value:* Enabled | Disabled
- *Default:* Enabled

## 2.3. Enabling SMB Direct

SMB Direct is installed and enabled by default on Windows Server 2012 R2 systems. RDMA functionality on Chelsio adapters will be enabled after installing the driver from the package.

You can use the following PowerShell command `Get-NetAdapterRdma` to get a list of RDMA capable interfaces in your system.

 **Note** *At least one adapter should indicate “RDMA Capable” true to take advantage of SMB RDMA capability.*

The next step is to configure your network so that SMB server and client machines can communicate with each other. Disable firewall for Chelsio adapters when using SMB.

## 2.4. Verifying RDMA

There are number of ways to verify if RDMA is working:

### 2.4.1. Verify active connections using PowerShell

Open PowerShell window and execute the command `Get-SmbConnection`

### 2.4.2. Use Event Viewer

You can use Event Viewer to view SMB connection events. To do this:

- i. Open Event Viewer
- ii. In the console tree, expand **Event Viewer**.
- iii. Navigate to **Application and Service Logs-> Microsoft->Windows->SMBClient ->Operational**

## 2.5. Troubleshooting

If RDMA is not working in your system, please check for the following:

- Operating system version should be Windows Server 2012 R2.
- Verify network interface configurations on both sides.
- Please ensure that the interfaces are reachable using *ping* command.
- In the Event Viewer (on the client side), please ensure that the traffic running is not over TCP.

- Verify that SMB driver is loaded and working. Open PowerShell window and execute the following command :

```
C:\Users\Administrator> driverquery.exe | findstr /I smb
```

- Verify that Chelsio driver is loaded and working. Open PowerShell window and execute the following command :

```
C:\Users\Administrator> driverquery.exe | findstr /I chel
```

- Confirm that traffic is running over Chelsio adapter.
- Look for potential errors in Event Log.



Note

*Please configure the Microsoft firewall to allow traffic between the SMB clients and server.*

## III. Appendix

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