Chelsio T3 Network Driver for Linux

Installation and User's Guide

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Document History

Version	Revision Date
1.0.0	08/10/2012
1.0.1	08/23/2012

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1. Introduction

Chelsio's T3 adapters have pioneered the industry with the Unified Wire technology, enabling tremendous cost savings and performance increases for HPC, data centers and storage networks. Chelsio's unique patented hardware architecture increases bandwidth, reduces latency, and dramatically lowers host-system CPU utilization.

Chelsio's T3 adapters are one of the most widely-deployed brands in the world, with in excess of 150,000 ports installed and more than 100 OEM design wins.

Chelsio's T3 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, and assist mechanisms for accelerating LRO - Large Receive Offload).

TCP offload is fully implemented in the hardware, thus freeing the CPU from TCP/IP overhead. The freed CPU can be used for any computing needs. The TCP offload in turn removes network bottlenecks and enables applications to take full advantage of the networking capabilities.

This document describes how to install and configure Network driver (NIC/TOE) for Chelsio's T3 10/1G series of adapters.

1.1. Features

Chelsio T3 Network driver package installs network (NIC/TOE) driver, Offload bonding driver and various utility tools (cop, cxgbtool, perftune.sh) for Chelsio's T3 10/1G adapters.

1.2. Hardware Requirements

1.2.1. Supported Adapters

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

- S302E
- S302E-C
- S310E-CR
- S310E-CR-C
- S310E-CXA
- S310E-SR+
- S310E-SR
- S310E-BT
- S320E-CR

- S320E-LP-CR
- S320E-CXA
- S320EM-BS
- S320EM-BCH
- N320E-G2-CR
- N320E
- N320E-CXA
- N320E-BT
- N310E
- N310E-CXA

1.3.   Software Requirements

1.3.1.   Linux Requirements

The Chelsio T3 Network driver has been developed to run on 64-bit Linux based platforms. Following is the list of supported distributions.

- Redhat Enterprise Linux 4 update 3 kernel   (RHEL4.3)   2.6.9-34.EL
- Redhat Enterprise Linux 4 update 4 kernel   (RHEL4.4)   2.6.9-42.EL
- Redhat Enterprise Linux 4 update 5 kernel   (RHEL4.5)   2.6.9-55.EL
- Redhat Enterprise Linux 4 update 6 kernel   (RHEL4.6)   2.6.9-67.EL
- Redhat Enterprise Linux 4 update 7 kernel   (RHEL4.7)   2.6.9-78.EL
- Redhat Enterprise Linux 4 update 8 kernel   (RHEL4.8)   2.6.9-89.EL
- Redhat Enterprise Linux 5 base kernel   (RHEL5)   2.6.18-8.el5
- Redhat Enterprise Linux 5 update 1 kernel   (RHEL5.1)   2.6.18-53.el5
- Redhat Enterprise Linux 5 update 2 kernel   (RHEL5.2)   2.6.18-92.el5
- Redhat Enterprise Linux 5 update 3 kernel   (RHEL5.3)   2.6.18-128.el5
- Redhat Enterprise Linux 5 update 4 kernel   (RHEL5.4)   2.6.18-164.el5
- Redhat Enterprise Linux 5 update 5 kernel   (RHEL5.5)   2.6.18-194.el5
- Redhat Enterprise Linux 5 update 6 kernel   (RHEL5.6)   2.6.18-238.el5
- Redhat Enterprise Linux 5 update 7 kernel   (RHEL5.7)   2.6.18-274.el5
- Redhat Enterprise Linux 5 update 8 kernel   (RHEL5.8)   2.6.18-308.el5
- Redhat Enterprise Linux 6 base kernel   (RHEL6)   2.6.32-71.el6
- Redhat Enterprise Linux 6 update 1 kernel   (RHEL6.1)   2.6.32-131.0.15.el6
- Redhat Enterprise Linux 6 update 2 kernel   (RHEL6.2)   2.6.32-220.el6
- Redhat Enterprise Linux 6 update 3 kernel   (RHEL6.3)   2.6.32-279.el6
- Suse Linux Enterprise Server 10 SP2 kernel (SLES10.2)   2.6.16.60-0.21
- Suse Linux Enterprise Server 10 SP3 kernel (SLES10.3)   2.6.16.60-0.54.5
- Suse Linux Enterprise Server 11 base kernel (SLES11)   2.6.27.19-5
- Suse Linux Enterprise Server 11 SP1 kernel (SLES11.1)   2.6.32.12-0.7
- Kernel.org linux-2.6.19 - linux-2.6.36

Offload (TOE) support is available on x86_64, i386, and ia64 architectures.

The offloaded bonding driver is supported on the following kernels:

- Redhat Enterprise Linux 4 update 4 kernel   (RHEL4.4)   2.6.9-42.EL
- Redhat Enterprise Linux 4 update 5 kernel   (RHEL4.5)   2.6.9-55.EL
- Redhat Enterprise Linux 4 update 6 kernel   (RHEL4.6)   2.6.9-67.EL
- Redhat Enterprise Linux 4 update 7 kernel   (RHEL4.7)   2.6.9-78.EL
- Redhat Enterprise Linux 4 update 8 kernel   (RHEL4.8)   2.6.9-89.EL
- Redhat Enterprise Linux 5 base kernel   (RHEL5)   2.6.18-8.el5
- Redhat Enterprise Linux 5 update 1 kernel   (RHEL5.1)   2.6.18-53.el5
- Redhat Enterprise Linux 5 update 2 kernel   (RHEL5.2)   2.6.18-92.el5
- Redhat Enterprise Linux 5 update 3 kernel   (RHEL5.3)   2.6.18-128.el5
- Redhat Enterprise Linux 5 update 4 kernel   (RHEL5.4)   2.6.18-164.el5
- Redhat Enterprise Linux 5 update 5 kernel   (RHEL5.5)   2.6.18-194.el5
- Redhat Enterprise Linux 5 update 6 kernel   (RHEL5.6)   2.6.18-238.el5
- Redhat Enterprise Linux 5 update 7 kernel   (RHEL5.7)   2.6.18-274.el5
- Redhat Enterprise Linux 5 update 8 kernel   (RHEL5.8)   2.6.18-308.el5
- Redhat Enterprise Linux 6 base kernel   (RHEL6)   2.6.32-71.el6
- Redhat Enterprise Linux 6 update 1 kernel   (RHEL6.1)   2.6.32-131.0.15.el6
- Redhat Enterprise Linux 6 update 2 kernel   (RHEL6.2)   2.6.32-220.el6
- Suse Linux Enterprise Server 10 SP2 kernel (SLES10.2)   2.6.16.60-0.21
- Suse Linux Enterprise Server 10 SP3 kernel (SLES10.3)   2.6.16.60-0.54.5
- Suse Linux Enterprise Server 11 base kernel (SLES11)   2.6.27.19-5
- Suse Linux Enterprise Server 11 SP1 kernel (SLES11.1)   2.6.32.12-0.7
- Kernel.org linux-2.6.19 - linux-2.6.36

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

1.4. Package Contents

The Chelsio T3 Network driver package contains the following:

- **src:** The *src* directory contains source files used for compiling and installing the driver.
- **tools:** The *tools* directory contains various user-space applications and scripts like *cop*, *cxgbtool, perftune.sh*
- **docs:** The *docs* directory contains support documents - README, Release Notes and User's Guide (this document) for the software package.

2. Hardware Installation

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 10Gb 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 10Gb Ethernet adapter or regular Ethernet cable for the 1Gb Ethernet adapter.
11. Power on your system.
12. Verify if the T3 adapter was installed successfully by using the following command:

```
[root@host]# lspci | grep –i Chelsio
03:00.0 Ethernet controller: Chelsio Communications Inc T320 10GbE Dual Port
Adapter
```

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

```
eth4: Chelsio T320 10GBASE-R RNIC (rev 4) PCI Express x8 MSI-X
eth4: 128MB CM, 256MB PMTX, 256MB PMRX
eth4: S/N: PT23090349      E/C: 110108230A0
```

This output indicates the hardware configuration of the card as well as the Serial number of the card. As observed by the x8, the card is properly installed in an x8 slot on the machine and the card is using MSI-X interrupts.

3. Software/Driver Installation

3.1. Installing using source

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

If building the driver for a kernel other than the current running kernel, it is necessary to pass in `KSRC=<kernelsource>` to make. Furthermore, if your build tree is in a different location than the source tree, you will need to pass in `KOBJ=<kernelobj>` to make as well.

The *src* directory contains the driver source files for building kernel modules. To build the TOE driver, change to *src/* directory and run:

```
[root@host]# make
[root@hosr]# make install
```

To build the NIC driver (without offload support), change to src/ directory and run:

```
[root@host]# make nic
[root@host]# make nic install
```

Only one type of driver needs to be compiled, NIC or TOE, not both. The TOE driver is built by default without passing any arguments to make. Building the TOE driver also provides NIC only support if the *t3_tom* driver is not loaded. Once the *t3_tom* module is loaded, all new TCP connections will be offloaded. If there are any TCP listening servers started before *t3_tom* has been loaded, it will be necessary to restart those servers for TCP to be offloaded.
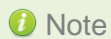
3.2. Installing using RPM

The driver may be built as an RPM for the current running kernel. To build the driver RPM, change to the *src/* directory and run:

```
[root@host]# make rpm
```

OR

```
[root@host]# make nic rpm
```

The rpm binary will be located in the *src/* directory.

> ⓘ Note   *If OFED package is already installed, installing cxgb3toe-<x.x.x.x> rpm will cause conflicts with kernel-ib rpm. Workaround for this is either install cxgb3toe-<x.x.x.x> using "make && make install" or delete kernel-ib rpm first and then install cxgb3toe-<x.x.x.x> rpm.*

3.3.   Tools

The *tools/* directory contains user-space apps and/or scripts. To compile the tools, change to the desired subdirectory and run:

```
[root@host]# make
[root@host]# make install
```

Scripts provided may be copied to their desired location.

3.4.   Firmware update

The T3 firmware is installed on the system, typically in `/lib/firmware/cxgb3`, and the driver will auto-load the firmware if an update is required. The kernel must be configured to enable userspace firmware loading support:

Device Drivers -> Generic Driver Options -> Userspace firmware loading support

The firmware image is located in src/firmware. In the event that the firmware is not installed, or the driver does not locate the firmware directory, manual update may be necessary.

To manually update the firmware, use cxgbtool:

```
[root@host]# cxgbtool <iface> loadfw <t3fw-x.x.x.bin>
```

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.

4.1. Loading in NIC mode (without full offload support)

To load the Network driver without full offload support, run the following command:

```
[root@host]# modprobe cxgb3
```

4.2. Loading in TOE mode (with full offload support)

To enable full offload support, run the following command:

```
[root@host]# modprobe t3_tom
```

ⓘ Note   *Offload support needs to be enabled upon each reboot of the system. This can be done manually as shown above.*

5. Software/Driver Configuration and Fine-tuning

5.1. Driver and Firmware Watchdog

Users of Chelsio T3 10/1Gb adapters and *cxgb3toe* drivers can make use of the driver and firmware watchdog feature present in the driver to take appropriate action when either the driver or the firmware is not in a state to respond. In order to enable the driver watchdog, use

```
[root@host]# modprobe cxgb3 drv_wd_en=1
```

The user can also specify the action to take for the driver watchdog by specifying the `drv_wd_ac` module param value. To enable the firmware watchdog use

```
[root@host]# modprobe cxgb3 fw_wd_en=1
```

See `modinfo cxgb3` for a list of module parameters and their possible values

There is also a notifier put into the cxgb3 driver that helps the driver to detect system hang and kernel panics. This notifier though is not present in kernels older than 2.6.18. The watchdogs should be used in this case as they are a Chelsio feature and not dependent on the kernel.
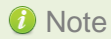
5.2. Makefile Help

Use the `make help` command for a list of options and targets related to the driver build.

5.3. Automatic module loading

An *ifup-local* script has been provided to automatically invoke *perftune.sh* if the interface is enabled using the `ifup` command. Copy both the *ifup-local* and *perftune.sh* scripts to the `/sbin` directory and *perftune.sh* will be run each time the interface is enabled. The script uses various option arguments (see `perftune.sh -h`). By default, the *ifup-local* script will invoke *perftune.sh* with *-I* (this should always be used to prevent *perftune.sh* from temporarily enabling the interface), *-x* (prevents the use of terminal colors), *-qq* (provides silent operation). It may be of interest to see when certain *perftune.sh* operations fail. If this is the case, remove the *-qq* and replace with *-q* (quiet operation, only failures and warnings are printed).

5.4. Network Device Configuration

Please refer to the operating system documentation for administration and configuration of network devices.

Note   *Some operating systems may attempt to auto-configure the detected hardware and some may not detect all ports on a multi-port adapter. If this happens, please refer to the operating system documentation for manually configuring the network device.*

5.5. Performance Tuning

In order to auto-tune the system and TOE for best performance, it is recommended to use the shell script *perftune.sh* located in the tools directory.

The *perftune.sh* has many options for tuning. Use `perftune.sh -h` to view the help. It is required to at least have the LLD module installed and loaded. For tuning of TOE devices, it is recommended that the TOE modules be loaded as well. The *perftune.sh* can auto-load the drivers before tuning by using the *-n* or *-o* (NIC or TOE) options.

6. Software/Driver Unloading

6.1. Unloading the NIC driver

To unload the NIC driver, run the following command:

```
[root@host]# rmmod cxgb3
```

6.2. Unloading the TOE driver

Please reboot the system to unload the TOE driver.

7. Software/Driver Uninstallation

To uninstall the driver , change to *src/* directory and run the following command:

```
[root@host]# make uninstall
```

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.

I. Appendix

1. Chelsio End-User License Agreement (EULA)

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