



Chelsio Network Driver for Macintosh OS X

Installation and User's Guide



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1. Introduction

Thank you for choosing Chelsio 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 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 T4 adapters bring a new level of performance metrics and functional capabilities to the computer networking industry.

The 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.

1.1. Features

Chelsio's installer package installs T5, T4 and T3 network drivers for Macintosh OS X operating system. The network driver provides support for PCI Express Ethernet adapters based on the Chelsio Terminator (T5, T4 and T3) ASIC.

The driver supports Jumbo Frames, Transmit/Receive checksum offload, TCP segmentation offload (TSO/LSO), MSI Interrupts, Gatekeeper and Large Receive Offload (LRO).

This package contains T5/T4/T3 kernel extension installation feature, please refer section [Software/Driver Installation](#) for details.

1.2. Hardware Requirements

1.2.1. Supported Adapters

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

- **T5 Adapters**
 - T580-CR
 - T580-SO-CR
 - T580-LP-CR
 - T520-LL-CR
 - T520-SO-CR
 - T520-CR
 - T540-CR

- **T4 Adapters**
 - T420-CR
 - T440-CR
 - T404-BT
 - T422-CR
 - T420-SO-CR
 - T420-LL-CR
 - T440-LP-CR
 - T420-CX

- **T3 Adapters**
 - N310E
 - N310E-CXA
 - N320E-GEN2
 - S310E-SR
 - S310E-SR+
 - S310E-CXA
 - S310E-CR
 - N320E-CXA*
 - S320E-CR*
 - S320E-LP-CR*
 - S302E*
 - S320E-CXA*

*Only port 0 (first port) supported.

1.3. Software Requirements

The Chelsio Network driver has been developed to run on Intel based Macintosh OS X platforms in NIC mode. Currently the driver is available for following version(s):

- Macintosh OS X 10.11.x (El Capitan 64-bit)
- Macintosh OS X 10.10.x (Yosemite 64-bit)

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

1.4. Package Contents

The Chelsio Network driver package for Macintosh OS X consists of the following:

- **cxgtool.rtf** : *cxgbtool* help file
- **cxgb.mpkg**: driver package
- **firmware**: firmware binary files

2. Hardware Installation

Follow these steps to install Chelsio adapter in your system:

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 by using the following command:
 - a. For T5 adapters

```
host:root# system_profiler | less
.
.
.
Ethernet Cards:
  ethernet:
    Type: Ethernet Controller
    Bus: PCI
    Vendor ID: 0x1425
    Device ID: 0x5002
    Subsystem Vendor ID: 0x1425
    Subsystem ID: 0x0000
    Revision ID: 0x0000
    Link Width: x8
    BSD name: cxgb14
    Kext name: cxgb.kext
    Location: /Library/Extensions/cxgb.kext
    Version: 1.10.11
```


b. For T4 adapters

```
host:root# system_profiler | less
.
.
.
Ethernet Cards:
  ethernet:
    Type: Ethernet Controller
    Driver Installed: No
    MSI: No
    Bus: PCI
    Slot: Slot-2
    Vendor ID: 0x1425
    Device ID: 0x4003
    Subsystem Vendor ID: 0x1425
    Subsystem ID: 0x0000
    Revision ID: 0x0000
    Link Width: x4
    Link Speed: 5.0 GT/s
```

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

- For T5 adapters:

```
cxgb: Chelsio T522-CR rev 0 10GBASE-SFP NIC PCIe 2.5 GT/s x8 MSI
cxgb: S/N: PT43130019 P/N: 11011765002      FW version: 1.10.11
```

- For T4 adapters:

```
cxgb: Chelsio T440-CR rev 2 10GBASE-SFP NIC PCIe x8 MSI
cxgb: S/N: PT18111251 E/C: 01234567890123  FW version: 1.10.11
```

The above outputs indicate the hardware configuration and serial number of the adapter. As observed by the x8, the card is properly installed in an x8 slot on the machine and the card is using MSI interrupts.



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 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

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

1. If you haven't done already, download the installer package (*dmg file*) from Chelsio Download Center, <http://service.chelsio.com/>
2. Mount the disk image *cxgb.dmg* file by double-clicking on it. The disk image should mount as a new device and place you in the base directory of the *cxgb* device. If the disk image is downloaded using Safari browser it will mount automatically.
3. Locate the *cxgb.mpkg* installer package inside the mounted device and double-click on it to start the installer.
4. A Welcome screen will be displayed. Click "Continue" to proceed.

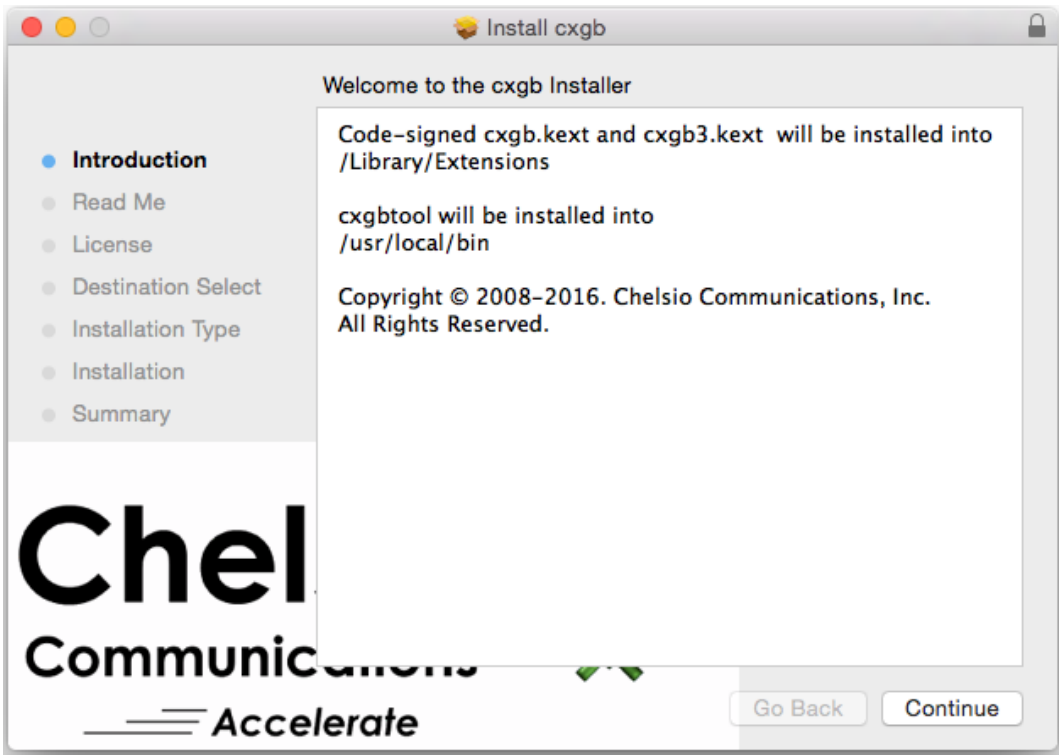


Figure 3 (a) – Installer welcome window

5. The next screen displays important information regarding the drivers for Chelsio adapters. Please read carefully and click “Continue” to proceed.

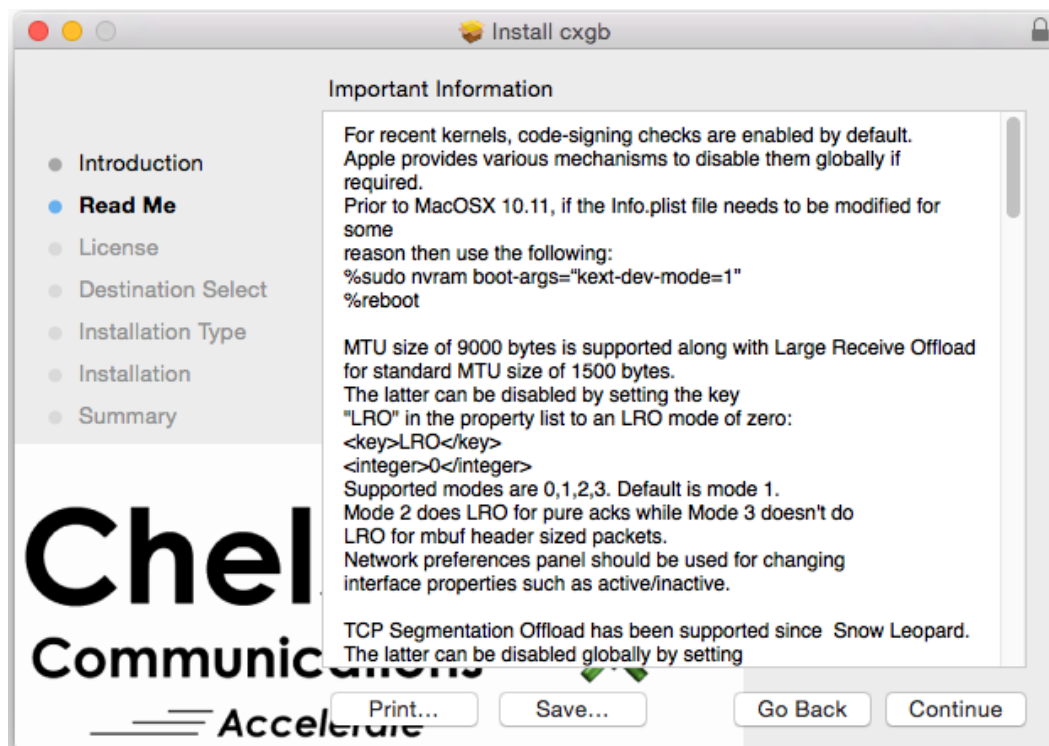


Figure 3 (b) – Readme window

- 6. Click “Continue” and then click “Read License” to read Chelsio’s End User License Agreement or “Agree” to proceed.

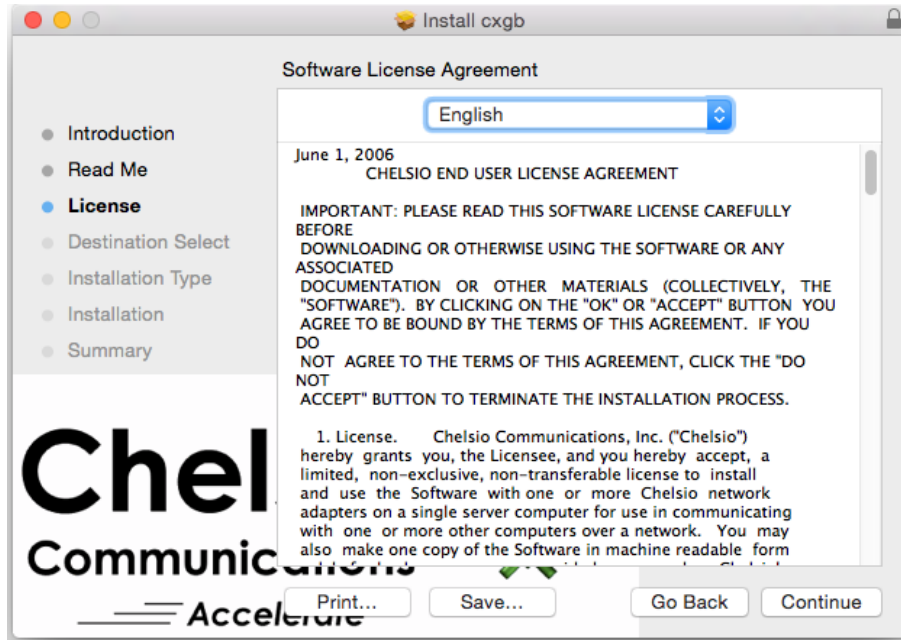


Figure 3 (c) – Chelsio EULA window

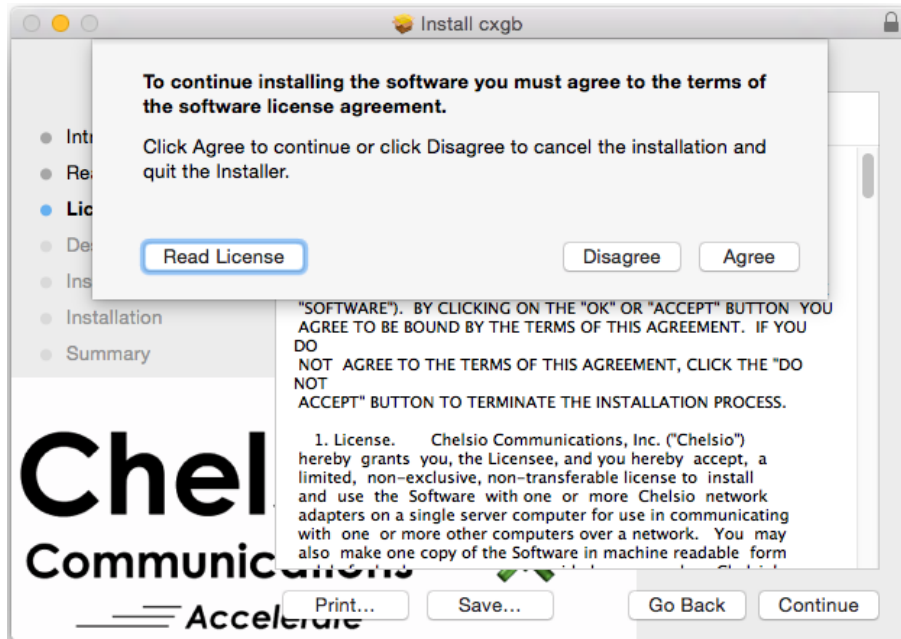


Figure 3 (d) – EULA acceptance prompt

7. Now, either click “Install” to proceed with complete package installation or “Customize” to select the components to be installed.

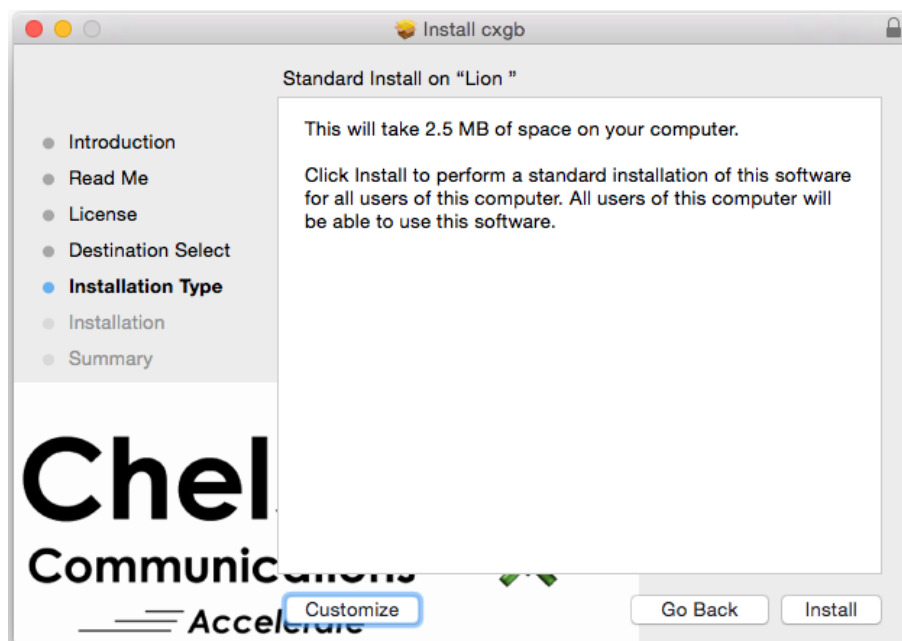


Figure 3 (e) – Customize installation

Note In custom installation, user can choose between *cxgb* (T5/T4 kernel extension), *cxgb3* (T3 kernel extension) or *cxgbtool* (command line utility). In standard installation all three components will be selected & installed.

8. The selected components will now be installed.

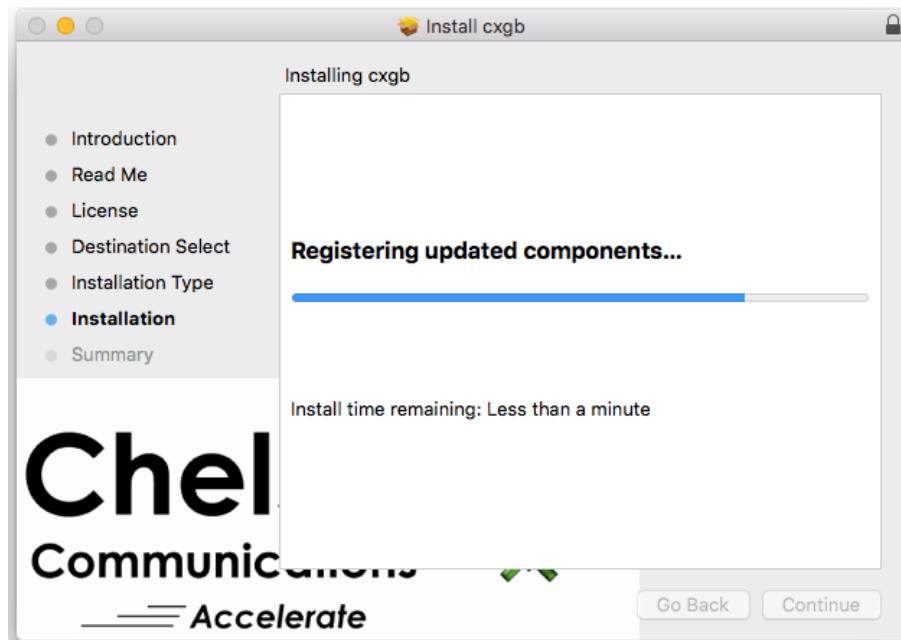


Figure 3 (f) – Installation in progress

9. Click “Close” to exit the installer.

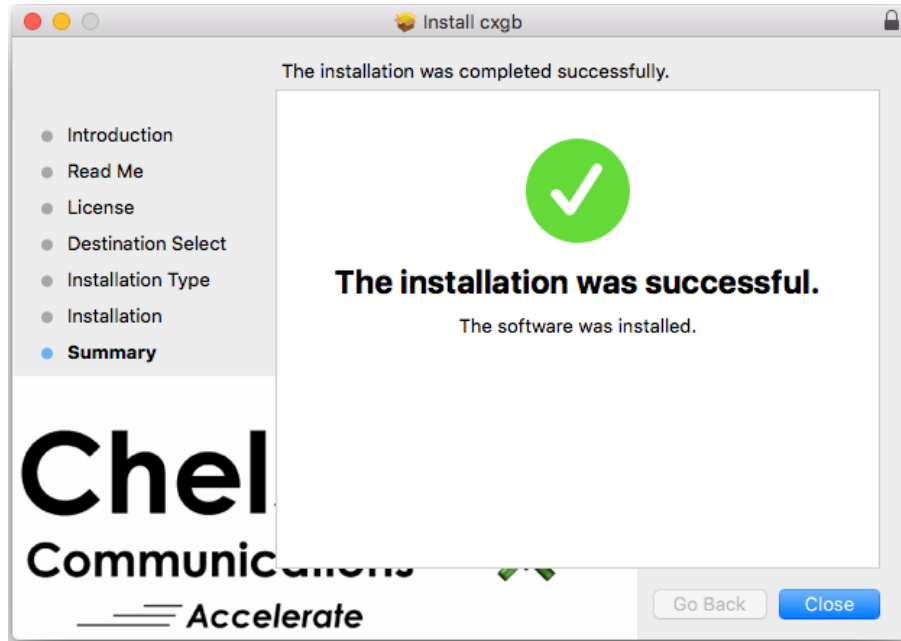


Figure 3 (g) – Installation complete

4. Software/Driver Loading

The installer will copy the signed KEXT into `/Library/Extensions/` directory.

- To load the T5/T4 network driver, run the following command:

```
host:root# sudo kextload /Library/Extensions/cxgb.kext
```

- To load the T3 network driver, run the following command:

```
host:root# sudo kextload /Library/Extensions/cxgb3.kext
```


5. Software/Driver Configuration and Fine-tuning

For recent kernels, code-signing checks are enabled by default. Apple provides various mechanisms to disable them globally if required. Prior to MacOSX 10.11, if the *Info.plist* file needs to be modified for some reason then use the following commands:

```
host:root# sudo nvram boot-args="kext-dev-mode=1"  
host:root# reboot
```

5.1. Important configurable parameters

Based on the adapter installed in the system (T5 or T4), please add the following parameters under the appropriate section in *Info.plist* file (The installer will copy the *Info.plist* file to `/Library/Extensions/cxgb.kext/Contents/` directory).

E.g., for T5, add the `<key></key>` and `<string></string>` elements in the *Terminator5* element section.

5.1.1. LRO

Large Receive Offload support is enabled by default. It can be disabled by setting the key *LRO* in the property list to an LRO mode of zero:

```
<key>LRO</key>  
<string>0</string>
```

Supported modes are 0,1,2,3. Default is mode 1. Mode 2 does LRO for pure acks while Mode 3 doesn't do LRO for mbuf header sized packets.

5.1.2. TCP Segmentation Offload support

TCP Segmentation Offload support is enabled by default. It can be disabled globally by using the following command:

```
host:root# sysctl net.inet.tcp.tso=0
```

TSO can also be disabled in the driver by setting the key "TSO" in the property list to any string:

```
<key>TSO</key>  
<string></string>
```

5.1.3. MSI Interrupts

MSI interrupts are available and enabled by default. They can be disabled by adding the entry with key "MSI" in the property list:

```
<key>MSI</key>  
<string>disable</string>
```

Currently, the driver initializes one qset per port. The driver supports multiple MSI vectors if available.

5.2. Kernel tuning

5.2.1. Increasing default parameter values

To increase default parameter values on Mac OS X client, edit the `/etc/sysctl.conf` configuration file. For example, if the default value for `kern.ipc.maxsockbuf < 2097152` then set it in `/etc/sysctl.conf` to be 2097152.


5.2.2. Increasing mbuf cluster


If dmesg output contains "outputPacket() zero segments", it means in order to support the workload the number of mbuf clusters available should be increased as packet drops are occurring. This can be achieved by increasing the number of mbuf clusters using boot-args parameter `ncl`.

See <http://support.apple.com/kb/HT3512> for more information.

5.3. Network Device Configuration

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

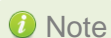
 **Note** *Some operating systems may attempt to auto-configure the detected hardware and some may not detect all ports on a multi-port adapter. If this happens, please refer the operating system documentation for manually configuring the network device.*

 **Note** *Network preferences panel should be used for changing interface properties such as active/inactive or MTU size.*

5.4. cxgbtool

The app `cxgbtool` is used to display or change Chelsio network card settings. For more help, use `cxgbtool help` command at command prompt as follows:

```
host:root# cxgbtool -h
```



cxgbtool supports filtering settings on the Chelsio T3 based adapters only.

5.5. Firmware Update

The minimum firmware version matching the driver must be loaded before the new driver installed can load, and the loading is initiated by the post-install phase of the installer.

The current driver can load the new firmware using the `loadfw` command of `cxgbtool` that came with the currently installed driver. Follow the steps mentioned below:

1. If not done already, mount the new disk image `cxgb.dmg` file by double-clicking on it. The `cxgb` disk image should mount as a new device and place you in the base directory of the `cxgb` device.
2. Browse to the `firmware` directory. For example, if the disk image was mounted to `/Volumes`, run the following commands to load the appropriate firmware based on Chelsio adapter family:

```
host:root# cd /Volumes/cxgb-x.y.z/firmware
host:root# cxgbtool cxgbX loadfw <firmware-file>.bin
```

In the event that firmware needs to be loaded but the driver issues timeout messages then disable the master PF's BSD interface and then add the entry with key `fwattach` in the property list before loading the firmware:

```
<key>fwattach</key>
<string>disable</string>
```

Loading firmware and setting hardware registers can only be done using the master physical function which restricts the BSD interface name that can be used as a parameter to `cxgbtool` for those commands. By default, the master physical function is associated with Port 0.


6. Software/Driver Unloading

- To unload the T5/T4 Network driver, run the following command:

```
host:root# sudo kextunload /Library/Extensions/cxgb.kext
```

- To unload the T3 Network driver, run the following command:

```
host:root# sudo kextunload /Library/Extensions/cxgb3.kext
```

 **Note** *Unloading the driver while traffic is running is not recommended.*

7. Software/Driver Uninstallation

Refer [Software/Diver Unloading](#) chapter and unload the driver depending on the driver type.

- To uninstall the T5/T4 driver, run the following command:

```
host:root# rm -rf /Library/Extensions/cxgb.kext
```

- To uninstall the T3 driver, run the following command:

```
host:root# rm -rf /Library/Extensions/cxgb3.kext
```

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)

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