SGI® Altix® Systems Dual-Port Gigabit Ethernet Board User's Guide

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This equipment has been tested and found compliant with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at personal expense.

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Record of Revision

Version	Description
001	February 2004 Initial release.
002	August 2004 Updated to correct connector information.
003	August 2005 Updated to support the SGI ProPack 3 Service Pack 6 and SGI ProPack 4 Service Pack 2 (or later) releases.

New Features in This Guide

This revision of the *SGI Altix Systems Dual-Port Gigabit Ethernet Board User's Guide* supports SGI ProPack 3 for Linux and SGI ProPack 4 for Linux releases.

Major Documentation Changes

Updated cabling information in "Fiber-Optic Board Cabling" on page 5.

Contents

Figures

Tables

About this book

This guide describes the two versions of the dual-port Gigabit Ethernet board, shows you how to connect the boards to an Ethernet network, and explains how to operate the boards.

You can use the dual-port Gigabit Ethernet board to replace the built-in Ethernet network adapter in your system, or use it in addition to your current adapter. The dual-port Gigabit Ethernet board operates under SGI ProPack for Linux v2.4 or later.

This guide is written for users of the dual-port Gigabit Ethernet board. It is assumed that you have general knowledge of Ethernet networks and the system in which the board is installed.

Important Information

Warning: Never look into the end of a fiber optic cable to confirm that light is being emitted (or for any other reason). Most fiber optic laser wavelengths (1300 nm and 1550 nm) are invisible to the eye and cause permanent eye damage. Shorter wavelength lasers (for example, 780 nm) are visible and can cause significant eye damage. Use only an optical power meter to verify light output.

Warning: Never look into the end of a fiber optic cable on a powered device with any type of magnifying device, such as a microscope, eye loupe, or magnifying glass. Such activity causes cause a permanent burn on the retina of the eye. Optical signal cannot be determined by looking into the fiber end.

Chapter Descriptions

This guide contains the following chapters:

- Chapter 1, “Gigabit Ethernet Board Features and Capabilities,” summarizes board features, lists the protocols and interfaces with which the board is compatible, and gives board configuration limits for various systems.
- Chapter 2, “Connecting the Gigabit Ethernet Board to a Network,” shows you how to connect the Gigabit Ethernet board to your network.
- Chapter 3, “Operating the Gigabit Ethernet Board,” explains how to verify installation of the board and software, how to reset the board, how to set parameters to improve performance, and how to set configuration parameters.
- Appendix A, “Specifications”, summarizes the physical and performance characteristics, environmental information, and operating ranges of the board.

A glossary and an index complete this guide.

Related Publications

This guide is part of a document set that fully supports the installation, operation, and service of the dual-port Gigabit Ethernet board. For more information about installing and servicing the dual-port Gigabit Ethernet board, see the user’s guide for the system in which the board is installed.

SGI Altix Hardware Documentation

The following is a list of hardware documentation available from SGI that describes SGI Altix systems.

- *SGI Altix 3000 User’s Guide*
  Provides an overview of the architecture and describes the major components of the SGI Altix 3000 family of servers and superclusters. It also describes the standard procedures for powering up and powering down the system, provides basic troubleshooting information, and includes important safety and regulatory specifications.

- *SGI Altix 330 System User's Guide*
  Provides an overview of the Altix 330 system components, and it describes how to set up and operate this system.
- *SGI Altix 350 System User's Guide*
  Provides an overview of the Altix 350 system components, and it describes how to set up and operate this system.
- *Silicon Graphics Prism Deskside Visualization System User's Guide*
  Provides an overview of the Silicon Graphics Prism Deskside system components, and it describes how to set up and operate this system.
- *Silicon Graphics Prism Visualization System User's Guide*
  Provides an overview of the Silicon Graphics Prism Visualization System components, and it describes how to set up and operate this system.

You can obtain SGI documentation, release notes, or man pages in the following ways:

- See the SGI Technical Publications Library at http://docs.sgi.com. Various formats are available. This library contains the most recent and most comprehensive set of online books, release notes, man pages, and other information.
- SGI ProPack for Linux documentation, and all other documentation included in the RPMs on the distribution CDs, can be found on the CD titled "SGI ProPack V.2.4 for Linux - Documentation CD." To access the information on the documentation CD, open the index.html file with a web browser. Because this online file can be updated later inthe release cycle than this document, you should check it for the latest information. After installation, all SGI ProPack for Linux documentation (including README.SGI) is in the /usr/share/doc/sgi-propack-2.4 directory.
- You can also view man pages by typing `man` <*title*> on a command line.

For example, to display the man page for the `apropos` command, type the following on a command line:

```
man apropos
```

Important system configuration files and commands are documented on man pages. References in the documentation to these pages include the name of the command and the section number in which the command is found. For example, “apropos(1)” refers to the `apropos` command and indicates that it is found in section 1 of Linux man pages.

For additional information about displaying reference pages using the `man` command, see `man`(1).

Conventions

The following conventions are used throughout this document:

Convention	Meaning
`Command`	This fixed-space font denotes literal items such as commands, files, routines, path names, signals, messages, and programming language structures.
variable	The italic typeface denotes variable entries and words or concepts being defined. Italic typeface also is used for book titles.
`user input`	This fixed-space font denotes literal items that the user enters in interactive sessions. Output is shown in nonbold, fixed-space font.
[ ]	Brackets enclose optional portions of a command or directive line.
...	Ellipses indicate that a preceding element can be repeated.
`man page`(*x*)	Man page section identifiers appear in parentheses after man page names.
GUI element	This font denotes the names of graphical user interface (GUI) elements such as windows, screens, dialog boxes, menus, toolbars, icons, buttons, boxes, fields, and lists.

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  Mountain View, California 94043-1351

SGI values your comments and will respond to them promptly.

Gigabit Ethernet Board Features and Capabilities

Gigabit Ethernet is an extension of existing Ethernet technology that allows computer systems to communicate at speeds up to 1 gigabit per second (Gbps), which is theoretically ten times the rate of existing Fast Ethernet (100-Base-T) technology.

Gigabit Ethernet is targeted at backbone networks and interserver connectivity. It provides an upgrade path for high-end workstations that require more bandwidth than Fast Ethernet can provide. This board is supported in the following systems:

- SGI Altix 330
- SGI Altix 350
- SGI Altix 3000
- Silicon Graphics Prism Deskside Visualization System
- Silicon Graphics Prism Visualization System

This chapter includes the following sections:

Board Features

The Gigabit Ethernet board is available in two formats: the dual-port Fiber-Optic Gigabit Ethernet board and the dual-port Copper Gigabit Ethernet board.

These boards are described in the following sections:

Fiber-Optic Gigabit Ethernet is defined in the IEEE standard P802.3z. The Fiber-Optic Gigabit Ethernet board is compatible with this approved standard. Copper Gigabit Ethernet is defined in the IEEE standard P802.3ab. The Copper Gigabit Ethernet board is compatible with this approved standard.

Each board has a support bracket as shown in Figure 1-1.

Figure 1-1 Gigabit Ethernet Board Support Bracket

This bracket is only required in the PCI-carrier environment (IX-PX bricks) and is not required in any other configuration. For information on how to find installation instructions for this bracket, see "Installing the Board" on page 9.

Fiber-Optic Board Features

The Fiber-Optic Gigabit Ethernet board includes these features:

- Dual Ethernet ports
- Full-duplex Gigabit Ethernet interface as defined in the IEEE P802.3z approved standard
- Support for Ethernet frame sizes up to 9000 bytes
- Dual DMA channels
- ASIC with on-chip MAC and RISC processors (two)
- Duplex LC fiber connector
- 32-/64-bit, 33-/66-MHz PCI bus interface
- 32-/64-bit, 66-/133-MHz PCI-X bus interface

- Universal dual-voltage signaling (3.3 V and 5 V)
- Compliance with PCI Local Bus revision 2.2 and PCI-X Local Bus revision 1.0 standards

For full technical specifications of the board, see Appendix A, “Specifications”.

Figure 1-2 shows the dual-port Fiber-Optic Gigabit Ethernet board.

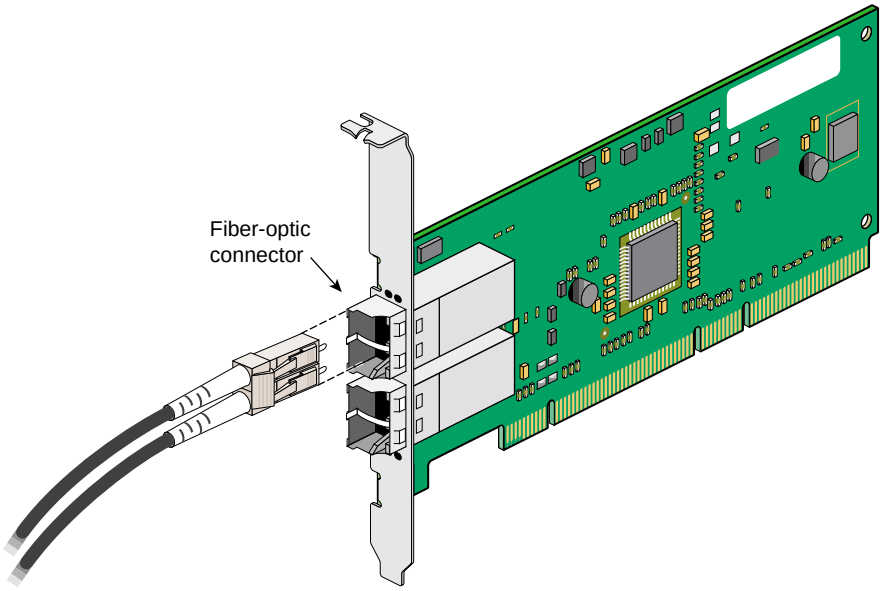

Figure 1-2 Fiber-Optic Gigabit Ethernet Board

Copper Board Features

The Copper Gigabit Ethernet board includes these features:

- Dual Ethernet ports
- Full-duplex Gigabit Ethernet interface as defined in the IEEE P802.3ab approved standard
- Support for Ethernet frame sizes up to 9000 bytes
- Dual DMA channels
- ASIC with on-chip MAC and RISC processors (two)
- RJ45 UTP connector for Category-5 copper cabling
- 32-/64-bit, 33-/66-MHz PCI bus interface
- 32-/64-bit, 66-/133-MHz PCI-X bus interface
- Universal dual-voltage signaling (3.3 V and 5 V)
- Compliance with PCI Local Bus revision 2.2 and PCI-X Local Bus revision 1.0 standards

For full technical specifications of the board, see Appendix A, “Specifications”.

Figure 1-3 shows the dual-port Copper Gigabit Ethernet board.

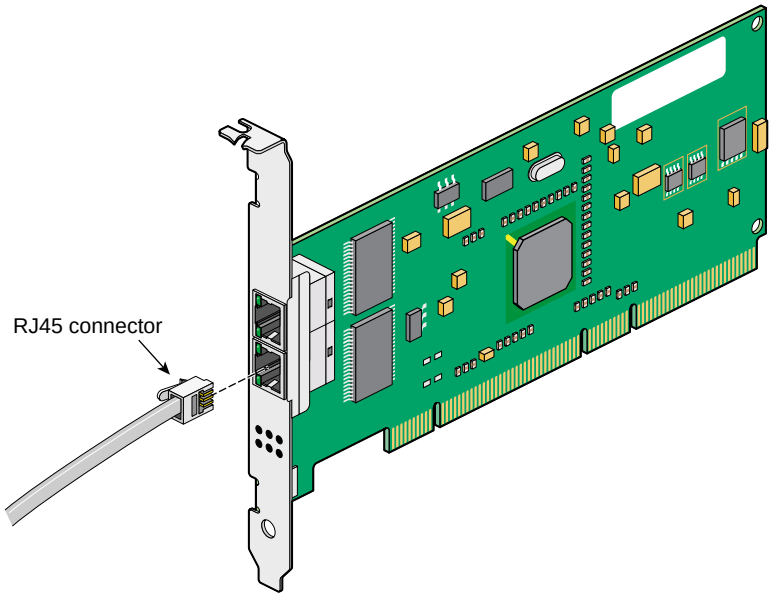

Figure 1-3 Copper Gigabit Ethernet Board

Cabling

The cabling for the Gigabit Ethernet board is described in the following sections:

- "Fiber-Optic Board Cabling" on page 5
- "Copper Board Cabling" on page 7

Fiber-Optic Board Cabling

The Fiber-Optic Gigabit Ethernet board is connected to the network using fiber-optic cable. The cable, which is not included in the shipment, must be a 50-micron or 62.5-micron multimode duplex cable with an LC connector.

Note: Most optical Ethernet switches and cards have SC connectors, but this dual-port card has LC connectors. In order to connect this card to a switch, you need an SC to LC cable. See the X-F21-xxx marketing codes in Table 1-1.

Table 1-1 lists SGI fiber-optic cables.

Table 1-1 SGI 62.5-Micron Cable Options for Fiber-Optic Gigabit Ethernet

Length	Marketing Code
3 m (9.8 ft)	X-F21-3M
10 m (39.3 ft)	X-F21-10M
25 m (82 ft)	X-F21-25M
100 m (328 ft)	X-F21-100M

Table 1-2 lists operating ranges for 50-micron and 62.5-micron cables for a 1000-BASE-SX port. Fiber type is MM.

Table 1-2 Fiber-Optic Operating Range, 1000-BASE-SX Standard

Diameter (Microns)	Modal Bandwidth (MHz * km)	Range (Meters)
62.5	160	2 to 220[a]
62.5	200	2 to 275[b]
50	400	2 to 500
5	500	2 to 550[c]

a. The TIA 568 building wiring standard specifies 160/500 MHz * km multimode fiber.

b. The international ISO/IEC 11801 building wiring standard specifies 200/500 MHz * km multimode fiber.

c. The ANSI Fibre Channel specification specifies 500/500 MHz * km 50 micron multimode fiber, and 500/500 MHz * km fiber has been proposed for addition to ISO/IEC 11801.

To achieve the longer distances available with 1000-Base-LX, use a switch with 1000-Base-LX ports. Figure 1-4 diagrams an example configuration.

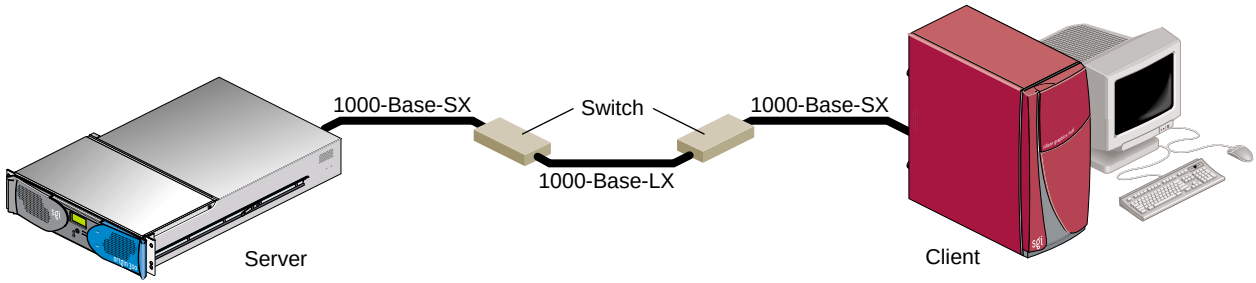

Figure 1-4 Example of 1000-Base-LX Configuration

Copper Board Cabling

The Copper Gigabit Ethernet board is implemented using twisted pair cable. The cable, which is not included in the shipment, must be Category-5 cable plant (4-pair) with an RJ45 UTP connector at each end. Table 1-3 lists the SGI twisted pair cables. The operating range for 1000-Base-T is up to 100 m (328 ft).

Table 1-3 SGI Twisted Pair Cable

Length	Marketing Code
10 feet	X-TP-JUMP-10FT

To achieve the longer distances available with 1000-Base-T, use a switch with 1000-Base-T ports. Figure 1-5 diagrams an example configuration.

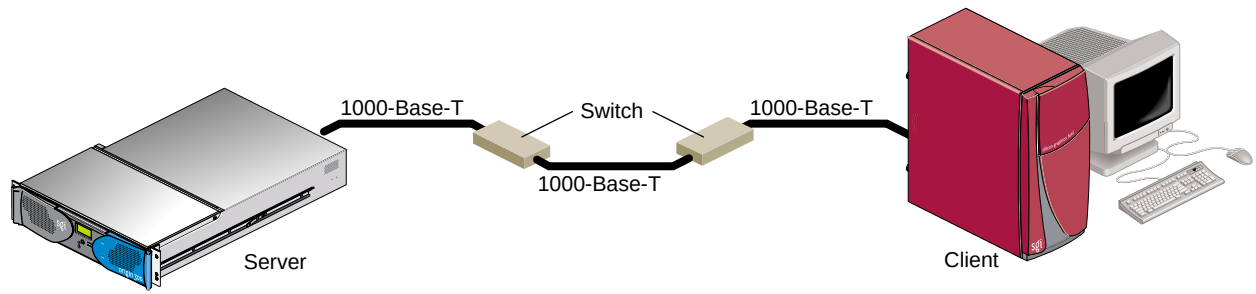

Figure 1-5 Example of 1000-Base-T Configuration

Configuration Limits

Table 1-4 summarizes the configuration limits for the Fiber-Optic and Copper Gigabit Ethernet boards.

Table 1-4 Configuration Limits

System	Maximum Per Bus	Maximum Per Module	Maximum Number of Boards
Altix 350	1	2	8
Altix 3000	1	3	8

Connecting the Gigabit Ethernet Board to a Network

This chapter shows you how to connect the Fiber-Optic Gigabit Ethernet board or the Copper Gigabit Ethernet board to a network, and how to configure your system for the board.

Following is a description of each section:

Installing the Board

The installation instructions for the Gigabit Ethernet board are different for different systems. Refer to the following sources for installation instructions:

- Altix 3000: Your Gigabit Ethernet board must be installed by an SGI certified service provider.
- Altix 330: See the instructions for installing a PCI card in the user's or owner's guide that came with your system.
- Altix 350: See the instructions for installing a PCI card in the user's or owner's guide that came with your system.
- Silicon Graphics Prism Visualization System: See the instructions for installing a PCI card in the user's or owner's guide that came with your system.
- Silicon Graphics Prism Deskside Visualization System: See the instructions for installing a PCI card in the user's or owner's guide that came with your system.

Connecting to the Network

This section shows you how to connect the Gigabit Ethernet board to a network in the following sections:

Connecting the Fiber-Optic Board

To connect your Fiber-Optic Gigabit Ethernet board to a network, insert the LC connector on one end of the fiber-optic cable into the Gigabit Ethernet board, as shown in Figure 2-1. Ensure that the connector is inserted completely into the jack. Then insert the connector on the other end of the fiber-optic cable into the connector on the Ethernet switch, or another computer system (as appropriate).

Note: If your network connects to an Ethernet switch, consult the operating manual for the switch to ensure that the switch port is enabled and configured correctly.

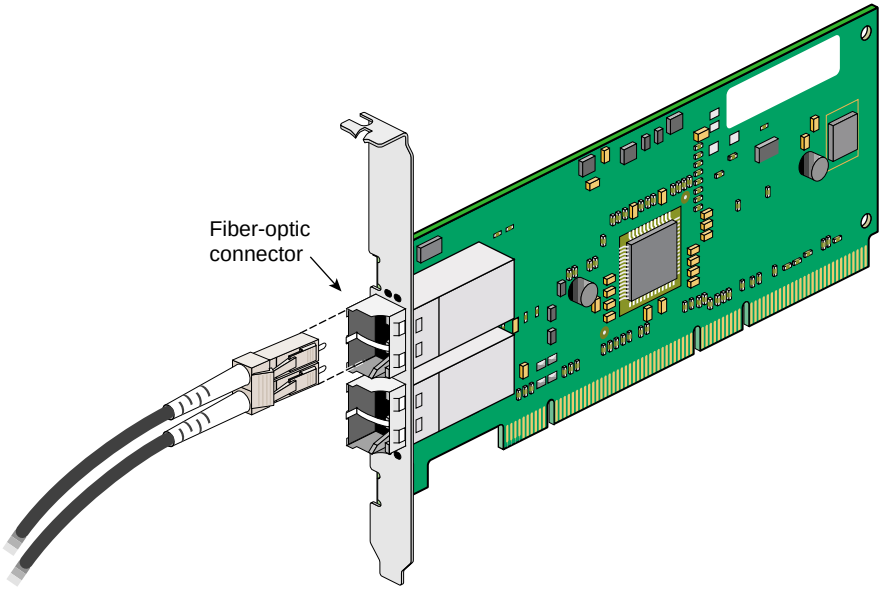

Figure 2-1 Connecting the Fiber-Optic Cable

Connecting the Copper Board

To connect your Copper Gigabit Ethernet board to a network, insert the RJ45 connector on one end of the copper cable into the Gigabit Ethernet board, as shown in Figure 2-2. Make sure the connector is inserted completely into the jack, and then insert the connector on the other end of the copper cable into the jack on the Ethernet switch, or another computer system (as appropriate).

Note: If your network connects to an Ethernet switch, consult the operating manual for the switch to ensure that the switch port is enabled and configured correctly.

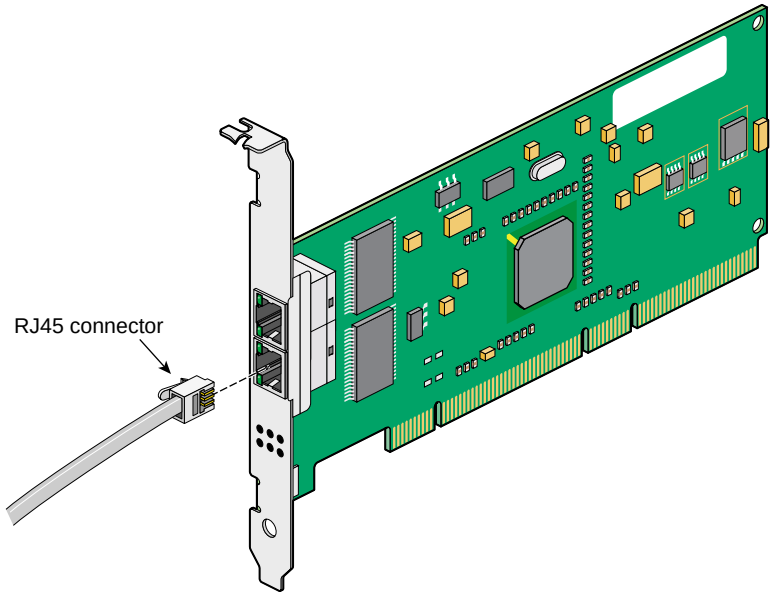

Figure 2-2 Connecting the Copper Cable

Configuring the Board

The io9 and io10 ports are both Gigabit Ethernet ports, therefore, you do not need to configure one port as the primary interface and the other as the secondary interface.

Note: Diskless workstation configurations are not supported.

Operating the Gigabit Ethernet Board

This chapter describes various issues that may occur when using a Gigabit Ethernet network. It includes the following sections:

Verifying Functionality

This section explains the following:

Using LEDs to Determine Board Functionality

The Fiber-Optic and Copper Gigabit Ethernet boards have light-emitting diodes (LEDs) that indicate whether the board is configured correctly and connected to an active Ethernet, as discussed in the following sections.

Fiber-Optic Board LEDs

Figure 1-2 on page 3 shows the location of the two small LEDs on the Fiber-Optic Gigabit Ethernet board. Table 3-1 describes the functions of these LEDs.

Table 3-1 LEDs on the Fiber-Optic Gigabit Ethernet Board

LED	State	Purpose
ACT	Blinking	Data detected
	Off	No data detected
LINK1000	On	Good link
	Off	No link: faulty cable, faulty connector, or communication mismatch

During normal operation, the link LED is on; the data LED blinks whenever the board is receiving traffic.

Copper Board LEDs

The Copper Gigabit Ethernet board has four small LEDs, one for each port speed option (10 Mbps, 100 Mbps, and 1 Gbps). These LEDs indicate which link speed is active and the status of data transfer. Figure 1-3 on page 5 shows the location of these LEDs. Table 3-2 describes the functions of these LEDs.

Table 3-2 LEDs on the Copper Gigabit Ethernet Board

LED	State	Purpose
ACT	Blinking	Brief bursts of data detected on the port
	On	Streams of data detected on the port
	Off	No data detected on the port
10	On	Good 10-Mbps Ethernet link
	Off	No 10-Mbps link; possible link at different speed, possible bad cable, bad connector, or configuration mismatch
100	On	Good 100-Mbps Fast Ethernet link
	Off	No 100-Mbps link; possible link at different speed, possible bad cable, bad connector, or configuration mismatch
1000	On	Good Gigabit Ethernet link
	Off	No 1000-Mbps link; possible link at different speed, possible bad cable, bad connector, or configuration mismatch

Verifying Board Recognition

The network interface name for the Fiber-Optic and Copper Gigabit Ethernet boards is *tg*<*N*>, where <*N*> is 0 for the first board, 1 for the second board (if installed), and so on. Use the commands in the example below to display the network interface names.

To verify that the operating system has located the Gigabit Ethernet board, use the Linux PCI utilities `lspci`(8) command:

```
% lspci
```

Information similar to the following appears:

```
02:01.0 Ethernet controller: Broadcom Corporation NetXtreme BCM5701 Gigabit
Ethernet (rev 15)
02:01.1 Ethernet controller: Broadcom Corporation NetXtreme BCM5701 Gigabit
Ethernet (rev 15)
```

In `02:01.0 Ethernet controller identitication`, `02` is the bus number, `01` is the slot number, and `0` is the port, respectively.

Verifying Board Configuration and Enabling

To verify that the network interface is configured properly and is enabled, enter the following:

```
% /usr/etc/netstat -ina
```

Columns with the following headings should appear:

```
Name Mtu Network Address
```

In the `Name` column, the *tg* number should appear. If it is followed by an asterisk (*), the interface is disabled for some reason.

In the `Mtu` column, the size of the current Maximum Transmission Unit (MTU) should appear. The MTU size is set via the `-mtu` switch of the `ifconfig` command. If no size is specified by the `-mtu` switch, the board defaults to an MTU size of 1500.

In the `Network` column, the IP network address should appear.

In the `Address` column, the canonical MAC address of the Gigabit Ethernet board should appear, which looks similar to

```
08:00:69:0b:e0:41
```

In this address, the organizationally unique identifier (OUI) of the board vendor is represented by the first three sets of numbers (for example, 08:00:69). The last three sets vary, depending on the system.

See the `netstat`(8) man page for more details.

Resetting the Board

In the unlikely event that you need to reset the Fiber-Optic or Copper Gigabit Ethernet board, enter the following:

```
ifconfig tg<N> down
ifconfig tg<N> up
```

where <*N*> is the board number.

For more information on `ifconfig`, see the `ifconfig`(8) man page.

Configuration Parameters

Configuration changes for Ethernet devices drivers are made by means of the `ethtool`(8) command. The `ethtool` command works with all Linux Ethernet drivers, some of which support features that the tigon3 card does not. Additionally, features are added and removed from `ethtool` and various Ethernet drivers on a release-to-release basis.

In general, each feature has a `query` and a `modify` variant. If you are wondering whether the current tigon3 driver and `ethtool` support a specific feature, attempt to run the `query` option first, an example is, as follows:

```
bash-2.05# ethtool -a eth0
Pause parameters for eth0:
Autonegotiate:  off
RX:             off
TX:             off
```

This shows the current settings of the `pause` (or flow control) parameters. You can then change these parameters with the `ethtool -A` option.

Here is another example using the interrupt coalescing `query` option, as follows:

```
bash-2.05# ethtool -c eth0
Coalesce parameters for eth0:
Cannot get device coalesce settings: Operation not supported
```

This example shows that the current tigon3 driver does not support interrupt coalescing. This is because it uses new API (NAPI) protocol, which implements a polling mechanism.

As with any system configuration changes, make sure to have a back out strategy, read the most recent documentation for potential changes and pitfalls, and consult with a relevant Linux archives for examples of common usage.

Specifications

This appendix provides the following information:

Physical and Performance Characteristics

Table A-1 summarizes the physicfiber-optic board:characteristicsal and performance characteristics of the Fiber-Optic and Copper boards.

Table A-1 Specifications of the Gigabit Ethernet Boards

Characteristic	Feature	Value
Dimensions	Length Width	17.3 cm (6.8 in.) 6.4 cm (3.6 in.)
Performance	Maximum PCI clock rate	66 MHz max
	Maximum PCI-X clock rate	133 MHz max
	PCI data burst transfer rate	132 Mbps (32-bit bus) 264 Mbps (64-bit bus) 528 Mbps (64-bit bus at 66 MHz)
	PCI/data/address	32-bit and 64-bit
	PCI modes	Master/slave
Power requirements	Operating voltage	+5V 5%
	Maximum consumption	10 watts 2A @ +5V DC

Environmental Specifications

Table A-2 provides the environmental specifications for the Fiber-Optic board and Copper boards.

Table A-2 Environmental Specifications

Condition	Operating Specification	Storage Specification
Temperature	0 °C to 55 °C (32 °F to 131 °F)	-40 °C to +85 °C (-40 °F to +185 °F)
Relative humidity	5% to 85% noncondensing 40 °C (104 °F), 16 hour dwells at extremes	5% to 95% noncondensing 10 °C/hour (50 °F/hour)
Altitude	Up to 3048 m (10,000 ft)	Up to 10668 m (35,000 ft)
Shock	10 g, 1/2 sine wave, 11 msec	60 g, 1/2 sine wave, 11 msec
Vibration, peak-to-peak displacement	0.005 in. max (5 to 32 Hz)	0.1 in. max (5 to 17 Hz)
Vibration, peak acceleration	0.25g (5 to 500 Hz) (sweep rate = 1 octave/minimum)	0.25g (5 to 500 Hz) (sweep rate = 1 octave/minimum)

Operating Ranges (1000-Base-SX and 1000-Base-LX)

Table A-3 lists operating ranges for connecting to 1000-Base-SX and 1000-Base-LX ports, as defined by the IEEE 802 LAN/MAN Standards Committee.

Table A-3 Fiber-Optic Operating Range

Standard	Fiber Type	Diameter (Microns)	Modal Bandwidth (MHz * km)	Range (Meters)
1000-Base-SX	MM	62.5	160	2 to 220[a]
	MM	62.5	200	2 to 275[b]
	MM	50	400	2 to 500
	MM	50	500	2 to 550[c]
1000-Base-LX	MM	62.5	500	2 to 550
	MM	50	400	2 to 550
	MM	50	500	2 to 550
	SM	9	N/A	2 to 5000

a. The TIA 568 building wiring standard specifies 160/500 MHz * km multimode fiber.

b. The international ISO/IEC 11801 building wiring standard specifies 200/500 MHz * km multimode fiber.

c. The ANSI Fibre Channel specification specifies 500/500 MHz * km 50 micron multimode fiber, and 500/500 MHz * km fiber has been proposed for addition to ISO/IEC 11801.

Glossary

acknowledge (Ack) packet

The Ack packet informs the PE that initiated a message that the destination PE accepted the message.

autonegotiation

The process by which two computers (or a computer and a switch) connected by Gigabit Ethernet determine the speed and other parameters with which they will communicate.

CD-ROM (CD)

A flat metallic disk that contains information that you can view and copy onto your own hard disk; you cannot change or add to the disk. CD-ROM is an abbreviation for compact disc read-only memory.

Ethernet

A communication network used to connect computers.

gigabit

A communication rate of 2^30 bits per second.

host

Any system connected to the network.

hostname

The name that uniquely identifies each host (system) on the network.

IP address

A number that uniquely identifies each host (system) on a TCP/IP network.

IRIX

The SGI version of the UNIX operating system.

LED

Light-emitting diode, a light on a piece of hardware that indicates status or error conditions.

MAC

Medium access control, also called the physical layer.

MAC address

The physical address of the Gigabit Ethernet board, which is distinct from the IP address.

MTU

Maximum Transmission Unit is a configuration parameter that controls the size of the Ethernet frames that the Gigabit Ethernet board can transmit and receive.

man (manual) page

An online document that describes how to use a particular IRIX command. Also called reference page.

NIS

Network Information Service, a distributed database mechanism for user accounts, host names, mail aliases, and so on.

PCI

Peripheral Component Interconnect, a bus specification. The PCI bus is a high-performance local bus used to connect peripherals to memory and a microprocessor. Many vendors offer devices that plug into the PCI bus.

reference page

See man (manual) page.

TCP/IP

A standard networking protocol that is included in the IRIX software.

Index