IRIS® Gigabit Ethernet Owner's Guide

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Introduction

Welcome to SGI Gigabit Ethernet!

With the Fiber-Optic or Copper Gigabit Ethernet board, you can replace the Silicon Graphics Origin2000, Onyx2, Origin200, or OCTANE built-in Ethernet network connection, or use either board in addition to it. The Gigabit Ethernet Fiber-Optic board operates under IRIX 6.4 or later. The Gigabit Ethernet copper board operates under IRIX 6.5.7 or later

This guide describes the Fiber-Optic and Copper Gigabit Ethernet boards and shows you how to connect each of these boards to an Ethernet network

Audience

This guide is written for users of the Fiber-Optic or Copper Gigabit Ethernet board. It assumes you have general knowledge of Ethernet networks and the Silicon Graphics system in which the board is installed.

Structure of This Document

This guide consists of the following chapters and appendixes:

- Chapter 1, “Gigabit Ethernet Board Features and Capabilities,” lists the protocols and interfaces with which the board is compatible, gives board configuration limits for various Silicon Graphics systems, and summarizes board features.
- Chapter 2, “Connecting the Gigabit Ethernet Board to a Network,” shows you how to connect the Gigabit Ethernet board to your network.
- Chapter 3, “Gigabit Ethernet Board Operation,” explains how to verify proper installation of the board and software, how to reset the board if necessary, and how to set parameters to improve performance.

- Appendix A, “Specifications” summarizes board physical characteristics, environmental information, and operating ranges.

A glossary and an index complete this guide.

Other Required Documentation

This guide does not provide installation instructions for the Gigabit Ethernet board; for this information, see the owner’s guide that comes with your Silicon Graphics system. For some systems, such as Origin 2000, the Gigabit Ethernet board must be installed by an authorized service provider. To install the Gigabit Ethernet driver, install and read the release notes on the CD included with the board.

For instructions on configuring a system for networking, see the latest version of *IRIX Admin: Networking and Mail*.

If you do not have these guides handy, you can get them and other SGI documentation online in the following locations:

- If you installed the guide on your system, or if it is installed on a server on your network, you can use the IRIS InSight Library: from the Toolchest, choose Help > Online Books > SGI EndUser or SGI Admin, and select the applicable owner’s or hardware guide.
- If you have access to the Internet, you can use the Technical Publications Library: enter the following URL in your Web browser location window: http://techpubs.sgi.com/library/

  Once you are in the library, choose Catalogs > Hardware Catalog > and look under the Owner’s Guides for the applicable owner’s guide.

Conventions

In command syntax descriptions and examples, square brackets ([ ]) surrounding an argument indicate an optional argument. Variable parameters are in *italics*. If the variable appears in an italics context, angle brackets (< >) are used around the variable to differentiate it from the literal. Replace these variables with the appropriate string or value.

Command-line flags and switches are in **boldface regular type**; these are preceded with dashes or with a plus or minus, for example, **-e**.

Commands, IRIX filenames, and document titles are in *italics*.

Helvetica Bold font is used for labels on hardware, such as the names of LEDs on the board's I/O panel.

Messages and prompts that appear onscreen are shown in `fixed-width type`. Entries that are to be typed exactly as shown are in **`boldface fixed-width type`**

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SGI provides a comprehensive product support and maintenance program for its products. If you are in North America, and would like support for your SGI-supported products, contact the Technical Assistance Center at 1-800-800-4SGI or your authorized service provider. If you are outside North America, contact the SGI subsidiary or authorized distributor in your country.

Gigabit Ethernet Board Features and Capabilities

Gigabit Ethernet[1] is an extension of existing Ethernet technology that allows computer systems to communicate at speeds up to 1 gigabit per second (Gbps)—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. It can be installed in an Origin2000, Onyx2, Origin200, or OCTANE system running IRIX version 6.4 or later.

This chapter provides a basic description of the gigabit Ethernet network, and the SGI 1000-BASE-SX Fiber-Optic Gigabit Ethernet board and 10/100/1000-BASE-T Copper Gigabit Ethernet board.

Following is a description of each section:

- "Board Features" on page 1
- "Protocols and Interfaces" on page 5
- "Cabling" on page 6
- "Configuration Limits" on page 8

Board Features

The Fiber-Optic and Copper Gigabit Ethernet boards are available in two formats, which are adapted for the various Silicon Graphics systems:

- Origin2000 and Onyx2 systems: XIO version, installed in a system XIO slot
- Origin200 and OCTANE systems: PCI version, installed in a PCI slot (Origin200) or the PCI module (OCTANE)

---

[1] 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.

Fiber-Optic Board

Figure 1-1 shows the Fiber-Optic PCI board.

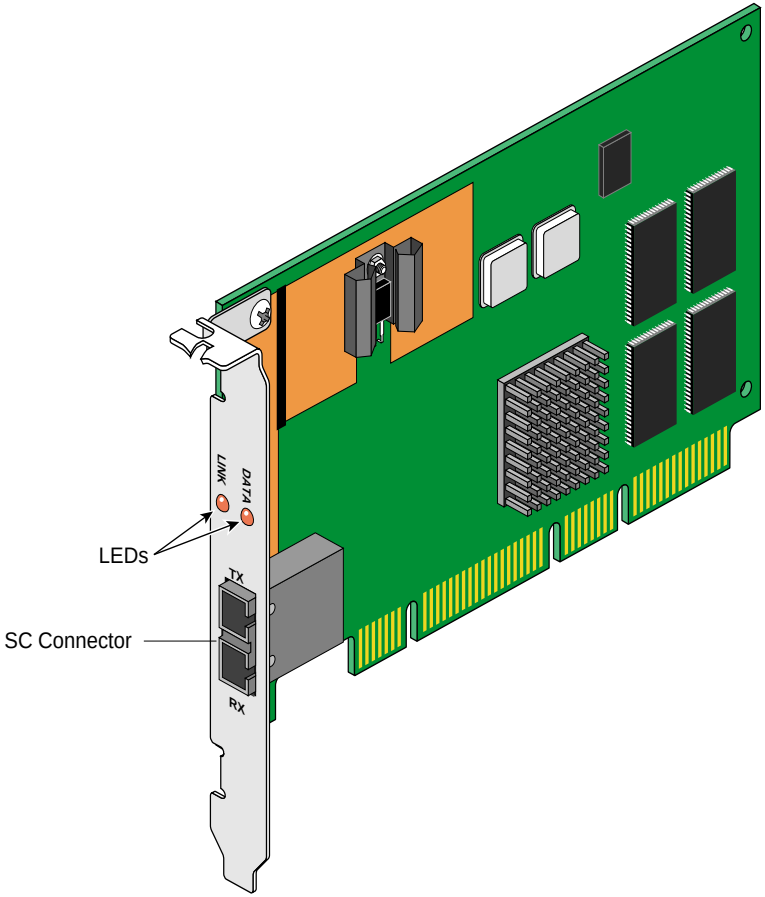

Figure 1-1 Gigabit Ethernet Fiber-Optic Board (PCI Version)

Fiber-Optic Board Features

The Fiber-Optic Gigabit Ethernet board includes these features:

- full-duplex Gigabit Ethernet interface as defined in the IEEE P802.3z approved standard
- standard Ethernet frame size (up to 1518 bytes)
- dual DMA channels
- adaptive interrupt frequency (maximizes network throughput; adapts to traffic load)
- ASIC with on-chip MAC and RISC processors (two)
- duplex SC fiber connector
- 32 MHz, 64-bit and 33 MHz, 66 bit PCI bus master with adaptive DMA
- universal dual voltage signaling (3.3 V and 5 V)
- compliance with PCI Local Bus Revision 2.1

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

Copper Board

Figure 1-2 shows the PCI Copper board.

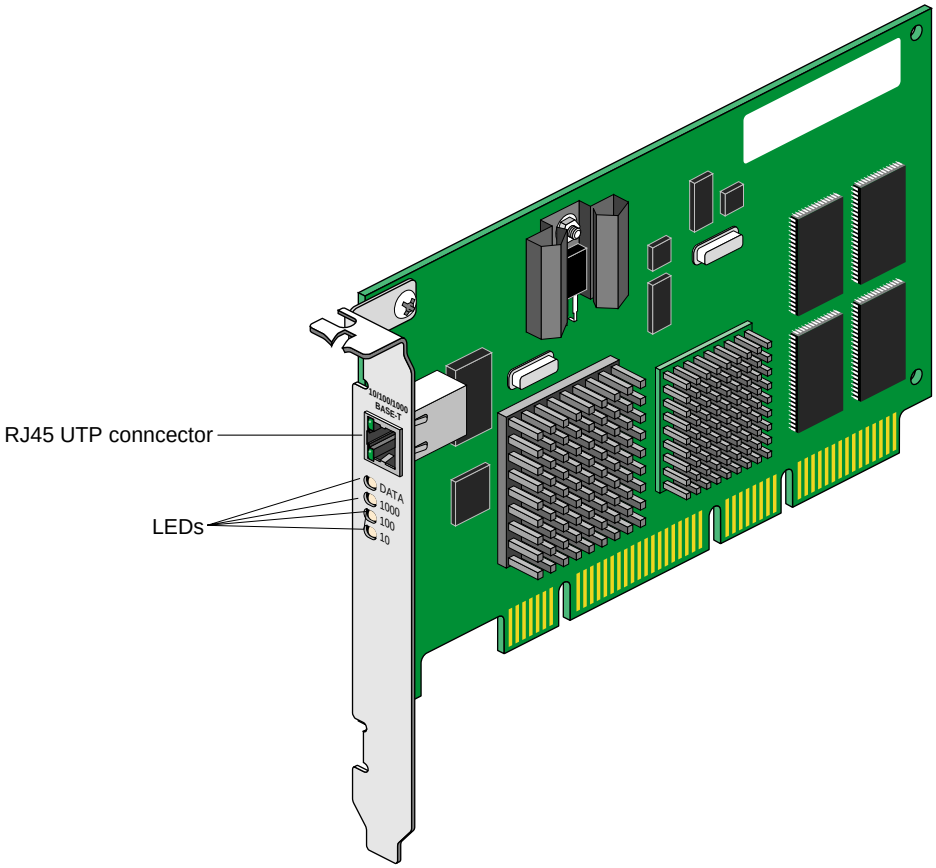

Figure 1-2 Gigabit Ethernet Copper Board (PCI Version)

Copper Board Features

The Copper Gigabit Ethernet board includes these features:

- full-duplex Gigabit Ethernet interface as defined in the IEEE P802.3ab approved standard
- standard Ethernet frame size (up to 1518 bytes)
- dual DMA channels
- adaptive interrupt frequency (maximizes network throughput; adapts to traffic load)
- ASIC with on-chip MAC and RISC processors (two)
- RJ45 UTP connector for Category-5 copper cabling
- 32 MHz, 64-bit and 33 MHz, 66 bit PCI bus master with adaptive DMA
- compliance with PCI Local Bus Revision 2.1

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

Protocols and Interfaces

The Gigabit Ethernet board is interoperable with existing Ethernet equipment assuming standard Ethernet minimum and maximum frame size (64 to 1518 bytes), frame format, and compliance with the following standards and protocols:

Fiber-Optic Board

- gigabit Ethernet (IEEE P802.3z and 802.3u compliant)
- logical link control (IEEE 802.2)
- flow control (IEEE 802.3x)

Copper Board

- gigabit Ethernet (IEEE 802.3ab and IEEE 802.3u compliant)
- logical link control (IEEE 802.2)
- flow control (IEEE 802.3x)

Cabling

Fiber-Optic Board

The Gigabit Ethernet Fiber-Optic board is implemented 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 SC connector at each end. 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 feet)	X-F-OPT-3M
10 m (39.3 feet)	X-F-OPT-10M
25 m (82 feet)	X-F-OPT-25M
100 m (328 feet)	X-F-OPT-100M

Table 1-2 lists operating ranges for 50-micron and 62.5-micron cables for a 1000-BASE-SX port. Fibre 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 1-3 diagrams an example configuration.

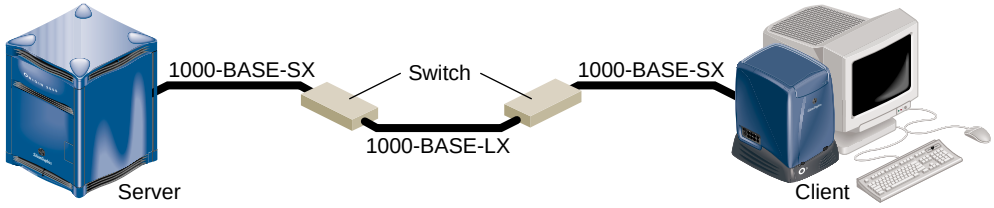

Figure 1-3 1000-BASE-LX Example Configuration

Copper Board

The Gigabit Ethernet copper 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 feet).

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-Tports. Figure 1-4 diagrams an example configuration.

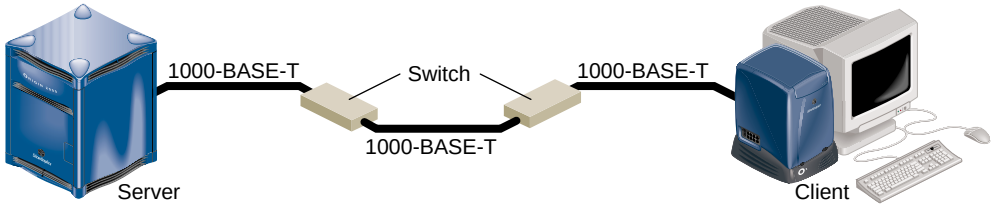

Figure 1-4 1000-BASE-T Example Configuration

Configuration Limits

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

Table 1-4 Configuration Limits

System	Maximum Number of Boards	Format
OCTANE	One	PCI
Origin200 (two-CPU system)	One	PCI
Origin200 (four-CPU system)	One per module/two total	PCI
Origin200 GIGAchannel	One per module/two total	PCI
Onyx2 rackmount	Six per module/six total	XIO
Onyx2 deskside	Three	XIO
Origin2000	Six per module/six total	XIO

Connecting the Gigabit Ethernet Board to a Network

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

Following is a description of each section:

- "Connecting to the Network" on page 9
- "Configuring the Gigabit Ethernet Board" on page 12

Note: Install the Gigabit Ethernet board as follows, depending on your Silicon Graphics system:

- Origin2000 and Onyx2: A qualified SGI Graphics service provider installs the board.
- Origin200: Follow the instructions in your system's owner's guide for installing a PCI card.
- OCTANE: Follow the instructions in your system's owner's guide for installing a PCI card, or see the *OCTANE PCI Module Installation Guide*.

Connecting to the Network

This section shows you how to connect the Fiber-Optic and Copper boards to a network.

Fiber-Optic Board

To connect your Gigabit Ethernet Fiber-Optic board to a network, insert the SC connector on one end of the fiber-optic cable into the Gigabit Ethernet board, as shown in Figure 2-1. Make sure the connector is inserted completely into the jack, then insert the connector on the other end of the fiber-optic 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.

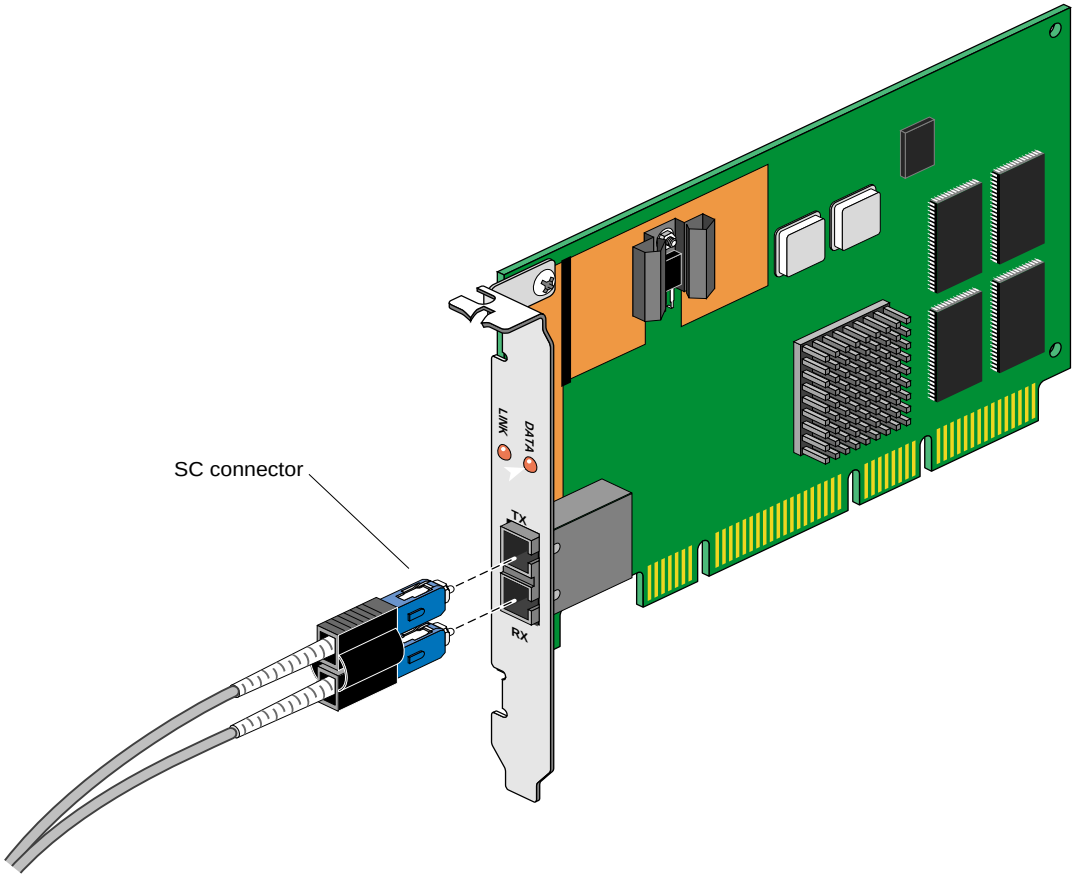

Figure 2-1 Connecting the Fiber-Optic Cable

Copper Board

To connect your Gigabit Ethernet Copper 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, 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.

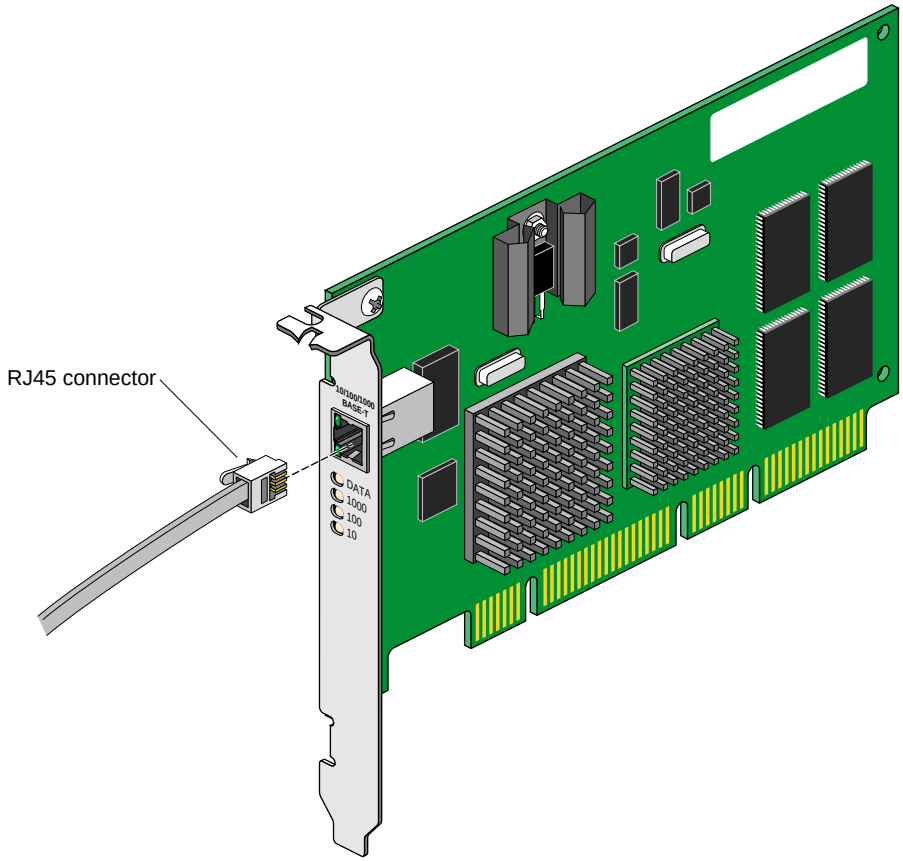

Figure 2-2 Connecting the Copper Cable

Configuring the Gigabit Ethernet Board

This section explains three ways to configure your system for gigabit Ethernet:

- "Gigabit Ethernet as Primary and Fast Ethernet as Secondary" on page 12

  Recommended for systems with two network connections and a disk, this configuration provides the best performance.

- "Fast Ethernet as Primary and Gigabit Ethernet as Secondary" on page 14

  This configuration is recommended for a diskless workstation.

- "Gigabit Ethernet as the Only Network Interface" on page 15

Note: The instructions in this section assume that your system already has (or has had) a functional Ethernet connection. If this is not the case, see the latest version of *IRIX Admin: Networking and Mail* for instructions on configuring your system for networking (giving it a hostname, IP address, and so on).

Gigabit Ethernet as Primary and Fast Ethernet as Secondary

This section explains how to set up your system with the Gigabit Ethernet connection serving as the primary network interface and fast Ethernet as the secondary network interface. This configuration is the easiest to set up and provides the best performance. Follow these steps:

1. If necessary, become superuser (root):

   ```
   % su
   Password: thepassword
   #
   ```

2. Determine your system's hostname: enter

   ```
   # hostname
   ```

3. Use your favorite editor to edit the */etc/hosts* file. To open the file with *nedit*, enter

   ```
   # /usr/sbin/nedit /etc/hosts
   ```

4. Find the line with your system's hostname and add the IP address entries. For example, if you are making an entry for a system with a hostname of *systemname* residing in the domain *group1.com* with a gigabit Ethernet IP address of 187.8.27.6 and a fast Ethernet IP address of 199.26.34.6, enter these lines in the */etc/hosts* file:

   ```
   187.8.27.6 systemname.group1.com systemname # gigabit ethernet
   199.26.34.6 gate-systemname.group1.com gate-systemname # fast
   ethernet
   ```

5. If your site uses an NIS service, make the changes in step 4 to the hosts database on the NIS server.
6. Open the file */etc/config/netif.options* and find this line:

   ```
   : if1name=
   ```

7. Change it to

   `if1name=eg0`

8. Find this line:

   ```
   : if1addr=
   ```

9. Change it to

   `if1addr=`*systemname*

10. Find this line:

    ```
    : if2name=
    ```

11. Change it to

    `if2name=ef0`

12. Find the line:

    ```
    : if2addr=
    ```

13. Change it to

    `if1addr=gate-`*systemname*

14. Find this line:

    ```
    : if_num=8
    ```

15. Change it to

    `if_num=2`

16. Save and close the file.

Note: If you need to change the net mask or other options for the network interface cards, refer to *IRIX Admin: Networking and Mail*.

Fast Ethernet as Primary and Gigabit Ethernet as Secondary

To configure your system with fast Ethernet as the primary interface and Gigabit Ethernet as the secondary interface, follow these steps:

1. If necessary, become superuser (root):

   ```
   % su
   Password: thepassword
   #
   ```

2. Determine your system's hostname: enter

   ```
   # hostname
   ```

3. Use your favorite editor to edit the */etc/hosts* file. To open the file with *nedit*, enter

   ```
   # /usr/sbin/nedit /etc/hosts
   ```

4. Find the line with your system's hostname and add the IP address entries. For example, if you are making an entry for a system with a hostname of *systemname* residing in the domain *group1.com* with a gigabit Ethernet IP address of 187.8.27.6 and a fast Ethernet IP address of 199.26.34.6, enter these lines in the */etc/hosts* file:

   ```
   187.8.27.6 gate-systemname.group1.com gate-systemname # gigabit
   ethernet
   199.26.34.6 systemname.group1.com systemname # fast ethernet
   ```

5. If your site uses an NIS service, make the changes in step 4 to the hosts database on the NIS server.

6. Open the file */etc/config/netif.options* and find this line:

   ```
   : if1name=
   ```

7. Change it to

   ```
   if1name=ef0
   ```

8. Find this line:

   ```
   : if1addr=
   ```

9. Change it to

   `if1addr=`*`systemname`*

10. Find this line:

    `: if2name=`

11. Change it to

    `if2name=eg0`

12. Find the line:

    `: if2addr=`

13. Change it to

    `if1addr=gate-`*`systemname`*

14. Find this line:

    `: if_num=8`

15. Change it to

    `if_num=2`

16. Save and close the file.

Note: If you need to change the net mask or other options for the network interface cards, refer to *IRIX Admin: Networking and Mail*.

Gigabit Ethernet as the Only Network Interface

To set up your system with the Gigabit Ethernet connection as the only network connection, follow these steps:

1. If necessary, become superuser (root):

   `% su`
   `Password:` *thepassword*
   `#`

2. Determine your system's hostname: enter

   `# hostname`

3. Use your favorite editor to edit the */etc/hosts* file. To open the file with *nedit*, enter

   ```
   # /usr/sbin/nedit /etc/hosts
   ```

4. Find the line with your system's hostname and add the IP address entries. For example, if you are making an entry for a system with a hostname of *systemname* residing in the domain *group1.com* with a gigabit Ethernet IP address of 187.8.27.6, enter this line in the */etc/hosts* file:

   ```
   187.8.27.6 systemname.group1.com systemname # gigabit ethernet
   ```

5. If your site uses an NIS service, make the changes in step 4 to the hosts database on the NIS server.

6. Open the file */etc/config/netif.options* and find this line:

   ```
   : if1name=
   ```

7. Change it to

   ```
   if1name=eg0
   ```

8. Find this line:

   ```
   : if_num=8
   ```

9. Change it to

   ```
   if_num=1
   ```

10. Save and close the file.

Note: If you need to change the net mask or other options for the network interface cards, refer to *IRIX Admin: Networking and Mail*.

Gigabit Ethernet Board Operation

This chapter describes various issues which may occur when using a gigabit Ethernet network:

Following is a description of each section:

- "Verifying Functionality" on page 17
- "Resetting the Board" on page 21
- "Performance Tuning" on page 21
- "Disabling Autonegotiation" on page 22

Verifying Functionality

This section explains

- "Using LEDs to Determine Board Functionality" on page 18
- "Verifying Board Recognition" on page 20
- "Verifying Board Configuration and Enabling" on page 20

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.

Fiber-Optic Board LEDs

The Fiber-Optic Gigabit Ethernet board has two small light-emitting diodes (LEDs). Figure 1-1 on page 2 shows the location of these LEDs. Table 3-1 describes LED functions on the Fiber-Optic Gigabit Ethernet board.

Table 3-1 Gigabit Ethernet Fiber-Optic Board LEDs

LED	State	Purpose
DATA	Blinking	Data detected
	Off	No data detected
LINK	On	Good link
	Blinking	Port has been disabled by software
	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. If the ifconfig(1M) command is used to mark the interface as being down, the link LED flashes until the interface is re-enabled.

Copper Board LEDs

The Copper Gigabit Ethernet board has four small light-emitting diodes (LEDs), one for each port speed option (10Mps, 100Mps, and 1Gbps) to indicate which link is active, and one LED for data transfer status. Figure 1-2 on page 4 shows the location of these LEDs. Until the driver software is installed, all four LEDs remain lit when the server is powered on. Table 3-2 describes LED functions on the Copper Gigabit Ethernet board.

Table 3-2 Gigabit Ethernet Copper Board LEDs

LED	State	Purpose
DATA	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	Blinking slowly	Port has been disabled by software
	On	Good 10Mbps Ethernet link
	Off	No 10Mbps link; possible link at different speed, possible bad cable, bad connector, or configuration mismatch
100	Blinking slowly	Port has been disabled by software
	On	Good 100Mbps Fast Ethernet link
	Off	No 100Mbps link; possible link at different speed, possible bad cable, bad connector, or configuration mismatch
1000	Blinking slowly	Port has been disabled by software
	On	Good Gigabit Ethernet link
	Off	No 1000Mbps 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 *eg*<*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, enter

```
% /bin/hinv
```

A line similar to the following should appear:

```
Gigabit Ethernet: eg<N>, module 1, XIO slot io6, firmware version
11.3.1
```

where *eg*<*N*> is the number of the board; for example, `eg0`.

If a similar line does not appear, a required patch may not be installed correctly on your system.

Note: After installing the Gigabit Ethernet patch, run *autoconfig* to reconfigure the kernel and reboot the system.

Verifying Board Configuration and Enabling

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

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

Columns with the following headings should appear:

```
Name Mtu Network Address
```

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

In the `Mtu` column, the number 1500 should appear.

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

Refer also to the netstat(1) 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

```
egconfig eg<N>
ifconfig eg<N> down
ifconfig eg<N> up
```

where <*N*> is the board number. Unlike other network adapters, the Gigabit Ethernet board must be reset with *egconfig* (as shown above) as well as with *ifconfig*.

Performance Tuning

To take full advantage of your gigabit Ethernet network's performance, tune TCP/IP. Set the following parameters to the values shown in Table 3-3.

Table 3-3 TCP/IP Tuning

Parameter	Value
tcp_recvspace	186368
tcp_sendspace	186368

Use the method appropriate for the IRIX release on your system:

- For IRIX 6.5, use systune(1M).

- For IRIX 6.4, hand-edit the variables *tcp_sendspace* and *tcp_recvspace* in the file */var/sysgen/master.d/bsd*.

Disabling Autonegotiation

The Gigabit Ethernet Fiber-Optic and Copper boards have autonegotiation on by default. However, some equipment does not implement the most up-to-date standard for autonegotiation of link speed. For such cases, you can disable the Gigabit Ethernet board's autonegotiation. For example, if you attach the Gigabit Ethernet board to a switch or end system that does not support autonegotiation, the link LED (see "Using LEDs to Determine Board Functionality" on page 18) might not illuminate.

Note: You do not have to set a speed or duplex mode if you turn autonegotiation off; the Gigabit Ethernet board maintains its gigabit speed and full duplex setting.

To disable autonegotiation, follow these steps:

1. Make sure all users are off the system and that no I/O operations are in progress.
2. Enter

   ```
   egconfig -l eg<N>
   ifconfig eg<N> down
   ifconfig eg<N> up
   ```

   where <*N*> is the board number.
3. To preserve this configuration for the required reboot, open */etc/config/eg<N>.options* and add **-l**, which is a hyphen followed by the letter l.
4. Save and exit the file.

   Options in this file are automatically passed to the *egconfig* command when the system comes up after reboot.

Specifications

This appendix summarizes

- "Physical Characteristics" on page 23
- "Environmental Specifications" on page 24
- "Operating Ranges (1000-BASE-SX and 1000-BASE-LX)" on page 25

Physical Characteristics

Table A-1 summarizes the Fiber-Optic and Copper board physical characteristics.

Table A-1 Gigabit Ethernet Adapter Board Specifications

	Feature	Value
Dimensions	Length Width	6.60 inches 3.75 inches
Performance	Maximum PCI clock rate	33 MHz
	PCI data burst transfer rate	132 MBps
	PCI/Data/address	32-bit and 64-bit
	PCI modes	Master/slave
Power requirements	Maximum consumption (fiber)	14 watts 2.8A @ +5VDC
	Maximum consumption (copper)	14 watts 4.0A @ +5VDC

Environmental Specifications

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

Table A-2 Environmental Specifications

Condition	Operating Specification	Storage Specification
Temperature	0˚ to 55˚ C (32˚ to 131˚ F)	-40˚ to +85˚ C (-40˚ 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 feet)	Up to 10668 m (35,000 feet)
Shock	10g, 1/2 sine wave, 11 msec	60g, 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 short 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.

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. A wide range of vendors make 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.

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