

# IRIS<sup>®</sup> Gigabit Ethernet Owner's Guide

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# Introduction

The 1000-BASE-SX Gigabit Ethernet network connection board for your Silicon Graphics Origin2000, Onyx2, Origin200, or OCTANE system can replace the system's built-in Ethernet network connection, or it can be used in addition to it. The Gigabit Ethernet board operates under release 6.4 or later of the IRIX operating system.

This guide describes the Gigabit Ethernet board and tells you how to use it to connect it to the Ethernet.

## Audience

This guide is written for owners and users of the Gigabit Ethernet board. It presumes general knowledge of the Ethernet and of the Silicon Graphics system in which it 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 the Network," explains how to connect the Gigabit Ethernet board to your network.
- Chapter 3, "Gigabit Ethernet Board Operation," explains how to verify that you have installed the board and software properly, how to reset the board if necessary, and how to set parameters to improve performance.
- Appendix A, "Specifications," summarizes board physical characteristics and supplies information about interface signals for the board.

A glossary and an index complete this guide.

## Other Required Documentation

This guide does not explain installing 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 it and other Silicon Graphics documentation online in the following locations:

- If you have installed the guide on your system, or if it is installed on a server on the 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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## Gigabit Ethernet Board Features and Capabilities

Gigabit Ethernet<sup>1</sup> 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 offers a basic description of the gigabit Ethernet network and the Silicon Graphics 1000-BASE-SX Gigabit Ethernet board that connects your system to it:

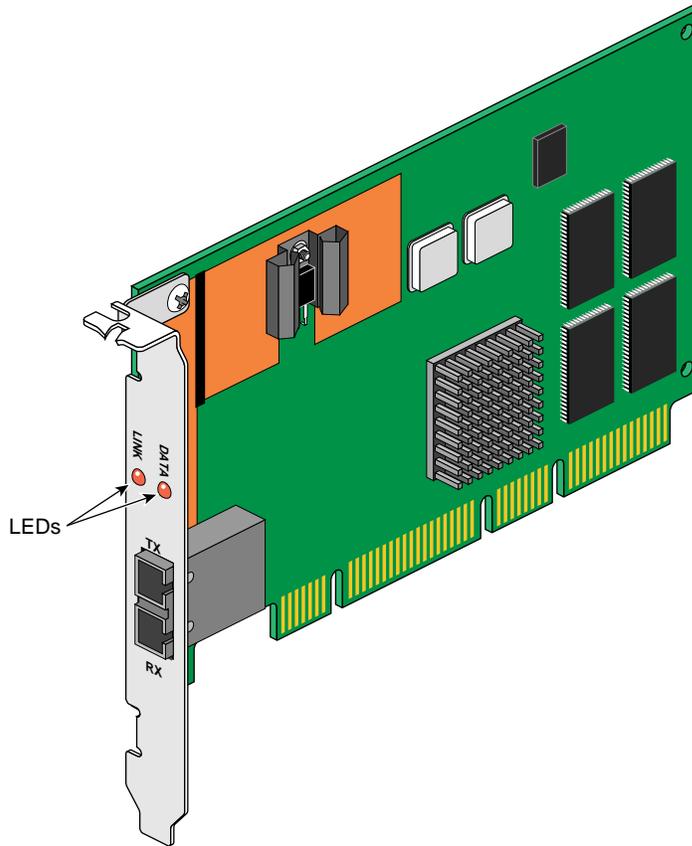
- “Board Features” on page 2
- “Protocols and Interfaces” on page 3
- “Cabling” on page 4
- “Configuration Limits” on page 5

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<sup>1</sup> Gigabit Ethernet is defined in the IEEE standard P802.3z. The Gigabit Ethernet board is compatible with draft 4.1 of that document.

## Board Features

Figure 1-1 shows the board.



**Figure 1-1** Gigabit Ethernet Board (PCI Version)

The Gigabit Ethernet board is presented in two formats adapted to 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)

The Gigabit Ethernet board includes these features:

- full-duplex Gigabit Ethernet interface as defined in IEEE P802.3z, draft 4.1
- 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 processor
- duplex SC fiber connector
- 33 MHz, 64-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.”

## 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:

- logical link control (IEEE 802.2)
- flow control (IEEE 802.3x)
- gigabit Ethernet (IEEE P802.3z, draft 4.1)

## Cabling

The Gigabit Ethernet 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 Silicon Graphics fiber-optic cables.

**Table 1-1** 62.5-Micron Cable Options for 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 <sup>a</sup>
62.5	200	2 to 275 <sup>b</sup>
50	400	2 to 500
5	500	2 to 550 <sup>c</sup>

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.

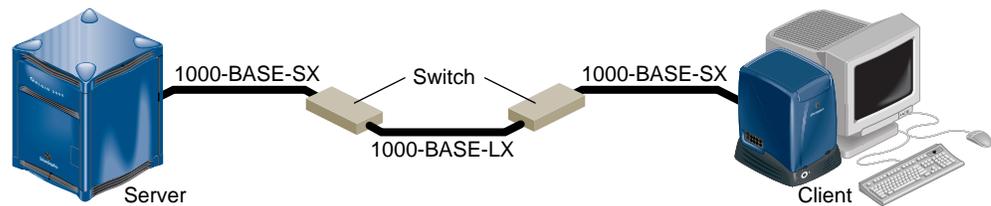
## Configuration Limits

Table 1-3 summarizes configuration limits for the 1000-BASE-SX Gigabit Ethernet board.

**Table 1-3** 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

To achieve the longer distances available with 1000-BASE-LX, use a switch with 1000-BASE-LX ports. Figure 1-2 diagrams an example configuration.



**Figure 1-2** 1000-BASE-LX Example Configuration



## Connecting the Gigabit Ethernet Board to the Network

This chapter explains connecting your Gigabit Ethernet board to the network and configuring your system to use it:

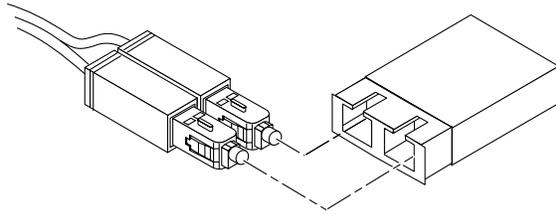
- “Connecting to the Network” on page 8
- “Configuring the Gigabit Ethernet Board” on page 8

**Note:** Install the Gigabit Ethernet board as follows, depending on the Silicon Graphics system you have:

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

## Connecting to the Network

To connect your Gigabit Ethernet board to the network, insert the SC connector on one end of the fiber-optic cable into the Gigabit Ethernet board. Ensure that the connector is inserted completely into the jack. See Figure 2-1.



**Figure 2-1** Connecting the Cable

Insert the other connector into the jack on the Ethernet switch, or another computer system as appropriate.

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

## 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 9  
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 10  
This configuration is recommended for a diskless workstation.
- “Gigabit Ethernet as the Only Network Interface” on page 12

**Note:** The instructions in this section assume that the 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 the system for networking (giving it a hostname, IP address, and so on).

## Gigabit Ethernet as Primary and Fast Ethernet as Secondary

This section provides instructions to set up your system so the Gigabit Ethernet connection serves as the primary network interface and fast Ethernet is the secondary network interface. This configuration is the easiest to do 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, put 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:

```
: iflname=
```

7. Change it to

```
iflname=eg0
```

8. Find this line:

```
: ifladdr=
```

9. Change it to

```
ifladdr=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`, put 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`, put 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:

```
: iflname=
```

7. Change it to

```
iflname=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 lists various issues which may arise during usage of the gigabit Ethernet network:

- “Verifying Functionality” on page 13
- “Resetting the Board” on page 16
- “Performance Tuning” on page 16
- “Disabling Autonegotiation” on page 17

### **Verifying Functionality**

This section explains

- “Using LEDs to Determine Board Functionality” on page 14
- “Verifying Board Recognition” on page 14
- “Verifying Board Configuration and Enabling” on page 15

### Using LEDs to Determine Board Functionality

The Gigabit Ethernet board has two small light-emitting diodes (LEDs) that you can use to determine whether the board is correctly configured and attached to an active Ethernet. (Figure 1-1 on page 2 shows the location of the LEDs.) Table 3-1 describes LED functions on the Gigabit Ethernet board.

**Table 3-1** Gigabit Ethernet 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.

### Verifying Board Recognition

The network interface name for the Gigabit Ethernet board 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 shown below to display the network interface names.

To verify that the operating system has located the Gigabit Ethernet board, enter

```
% /bin/hinv
```

The response should be something like the following:

```
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 line resembling this does not appear, a required patch might 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
```

The response should be columns with the following headings:

```
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 something like

```
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 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 Table 3-2.

**Table 3-2** TCP/IP Tuning

Parameter	Value
<i>tcp_recvspace</i>	186368
<i>tcp_sendspace</i>	186368

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

- For IRIX 6.5, use `systemtune(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 board has 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 14) 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 `-1`, which is a hyphen followed by the letter l. 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 19
- “Interface Signals” on page 20

### Physical Characteristics

Table A-1 summarizes board physical characteristics.

**Table A-1** Gigabit Ethernet Adapter Board Specifications

	<b>Feature</b>	<b>Value</b>
Dimensions	Length	17.2 cm (6.8 inches)
	Width	10.7 cm (4.2 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	7.5 watts
		1.5A @ +5VDC

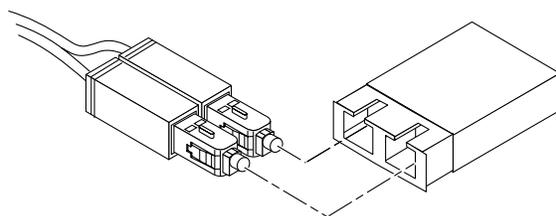
Table A-2 gives board environmental specifications.

**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)

## Interface Signals

Figure A-1 illustrates an SC-type connector used for gigabit Ethernet connections on the board.



**Figure A-1** SC Connector

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 <sup>a</sup>
	MM	62.5	200	2 to 275 <sup>b</sup>
	MM	50	400	2 to 500
	MM	50	500	2 to 550 <sup>c</sup>
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.



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## Glossary

### **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 Silicon Graphics 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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