Sun Trunking™ 1.2.1 Installation and User's Guide

Sun microsystems

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Contents

Preface

The *Sun Trunking 1.2.1 Installation and User's Guide* describes how to install and configure the Sun Trunking™ 1.2.1 software. These instructions are designed for an experienced system administrator with networking knowledge.

How This Book Is Organized

This manual describes how to install and configure the Sun Trunking 1.2.1 software on a Sun Quad FastEthernet™ adapter or a Sun GigabitEthernet™ adapter.

Chapter 1, "Installation of the Sun Trunking 1.2.1 Software for Sun Quad FastEthernet Adapters," describes how to install and configure the Sun Trunking 1.2.1 software for use with a Sun Quad FastEthernet adapter. It also includes hardware and software requirements.

Chapter 2, "Installation of the Sun Trunking 1.2.1 Software for Sun GigabitEthernet Adapters," describes how to install and configure the Sun Trunking 1.2.1 software for use with a Sun GigabitEthernet adapter. It also includes hardware and software requirements.

Appendix A, "Changing Device Names to Use the Quad FastEthernet 2.0 Device Driver," describes how to change the device name from `hme` to `qfe` if you are upgrading to a Sun Quad FastEthernet adapter. If you are using a Sun GigabitEthernet adapter, this material is not applicable.

Using UNIX Commands

This document may not contain information on basic UNIX® commands and procedures such as shutting down the system, booting the system, and configuring devices.

See one or more of the following for this information:

- *Solaris Handbook for Sun Peripherals*
- AnswerBook™ online documentation for the Solaris™ 2.x software environment
- Other software documentation that you received with your system

Typographic Conventions

Typeface or Symbol	Meaning	Examples
AaBbCc123	The names of commands, files, and directories; on-screen computer output	Edit your `.login` file. Use `ls -a` to list all files. `% You have mail.`
AaBbCc123	What you type, when contrasted with on-screen computer output	`% `**`su`** `Password:`
AaBbCc123	Book titles, new words or terms, words to be emphasized	Read Chapter 6 in the *User's Guide*. These are called *class* options. You *must* be superuser to do this.
	Command-line variable; replace with a real name or value	To delete a file, type `rm` *filename*.

Shell Prompts

Shell	Prompt
C shell	*machine_name*%
C shell superuser	*machine_name*#
Bourne shell and Korn shell	$
Bourne shell and Korn shell superuser	#

Related Documentation

TABLE P-1   Related Documentation

Application	Title	Part Number
Install	*Sun Quad FastEthernet SBus Adapter Installation and User's Guide*	805-0732-10
Install	*Sun Quad FastEthernet SBus Adapter Release Notes*	805-1444-13
Install	*Sun Quad FastEthernet PCI Adapter Installation and User's Guide*	805-1797-10
Install	*Sun Quad FastEthernet PCI Adapter Release Notes*	805-2901-11
Install	*Sun GigabitEthernet/S 2.0 Adapter Installation and User's Guide*	805-2784-10
Install	*Sun GigabitEthernet/S 2.0 Adapter Release Notes*	805-5937-10
Install	*Sun GigabitEthernet/P 2.0 Adapter Installation and User's Guide*	805-2785-13
Install	*Sun GigabitEthernet/P 2.0 Adapter Release Notes*	805-5938-13
Install	*Sun GigabitEthernet SBus Adapter 1.1 User's Guide*	805-1797-10
Install	*Sun GigabitEthernet SBus Adapter 1.1 Product* Notes	805-3950-10
Install	*Sun GigabitEthernet PCI Adapter 1.1 User's Guide*	805-2901-11
Install	*Sun GigabitEthernet PCI Adapter 1.1 Product Notes*	805-3952-11

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```
http://www1.fatbrain.com/documentation/sun
```

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Installing Sun Trunking 1.2.1 Software for Sun Quad FastEthernet Adapters

Sun Trunking 1.2.1 software provides the ability to aggregate up to eight 10/100 Mbps FastEthernet ports into a single virtual link. Once aggregated, these point-to-point links act as a single "fat pipe" to provide increased network bandwidth. For a given link, trunking enables you to incrementally add bandwidth, up to the maximum bandwidth supported by the QuadFastEthernet card.

Note – The Sun Enterprise 10000 system does not support Quad FastEthernet PCI adapters.

Hardware and Software Requirements

Before installing the Sun Trunking 1.2.1 software, make sure your system meets the following hardware and software requirements:

Hardware and Software	Requirements
Hardware	Sun Ultra Enterprise 3x00, 4x00, 5x00, 6x00, E450 or Sun™ Enterprise 10000 system.
Software	Solaris 2.5.1, 2.6, and Solaris 7, 8

You can use any trunking-capable switch with the Sun Trunking 1.2.1 software. The switches listed in TABLE 1-1 were tested and found to work with the Sun Trunking 1.2.1 software, but must first be configured for Trunking (Refer to switch manual) .

TABLE 1-1 Switches Tested to Interoperate With Sun Trunking 1.2.1 Software and Sun Quad FastEthernet Adapters

Vendor Name	Software Revision	Model Name
Bay Networks	2.0.0 or compatible	Accelar 1200
Cabletron Systems	2.0 or compatible	SSR 2000, SSR 8000, SSR 16000
Cisco Systems	4.2 or compatible	Catalyst 5000
Extreme Networks	2.1.7 or compatible	Summit 4
Foundry Networks	4.6 or compatible	TurboIron 8
3COM Corporation	3.0.0 or compatible	3900

CPU Requirement

If you are trunking QuadFastEthernet links on an Ultra Enterprise server, use CPUs of 248 MHz or faster. The server must have an aggregate CPU speed of about 500 MHz per QuadFastEthernet card. Two 248 MHz CPUs satisfies this requirement.

Key Features

The Sun Trunking 1.2.1 software implements the following key features:

- Fast Ethernet links—The Sun Quad FastEthernet network interface cards support Sun Trunking 1.2.1 software. Sun Quad FastEthernet cards deliver scalable bandwidth with up to eight 10/100 auto-negotiating Ethernet ports.

- Load balancing—Sun Trunking 1.2.1 software supports static load balancing and failure recovery within a trunk. It distributes traffic, including unicast, broadcast, and multicast traffic, across the aggregated links, based on the policy selected. In the event of a link failure, Sun Trunking 1.2.1 software automatically redistributes loads across the remaining links.

Note – Sun Trunking 1.2.1 software load balances only the *outgoing* packets, not the incoming ones. Sun Trunking 1.2.1 software has no control over incoming packets.

- Single MAC address—Because ports aggregated with Sun Trunking 1.2.1 software share a single, logical Media Access Control (MAC) address, there is no need to assign individual MAC addresses to aggregated ports.
- Additional Policies—Sun Trunking 1.2.1 software includes MAC address, round robin, IP destination address, and IP source address/IP destination address policies. These policies enable you to set the load distribution path for network traffic based on policy-level parameters.

Preparing for the Software Installation

Before installing the Sun Trunking 1.2.1 software, you must install either the Sun Quad FastEthernet SBus or PCI adapter. Refer to either *Sun Quad FastEthernet SBus Adapter Installation and User's Guide* or the *Sun Quad FastEthernet PCI Adapter Installation and User's Guide* for installation instructions.

▼ To Remove Previously Installed Sun Trunking Packages

If previous versions of Sun Trunking software (version 1.2 or earlier) are installed, you must remove them before installing the new Sun Trunking 1.2.1 software.

1. **Become superuser:**

```
% su
Password: password
#
```

2. **Enter the following command to see if any Sun Trunking packages are currently installed:**

```
# pkginfo | grep Trunking
```

Depending on the version installed, outputs will look like:

```
application    SUNWqfetr       Sun Trunking Utility
application    SUNWqfetx       Sun Trunking Man Pages

system         SUNWtrkm        Sun Trunking Man Pages
application    SUNWtrku        Sun Trunking Utility
```

3. **Enter the following command(s) to remove all existing Sun Trunking packages:**

```
# pkgrm SUNWqfetr SUNWqfetx
```

```
# pkgrm SUNWtrkm SUNWtrku
```

▼ To Check Previously Installed `qfe` Packages Using `pkginfo`

1. **Become superuser.**

```
% su
Password: password
#
```

2. **Check to see if any `qfe` packages are currently installed:**

```
# pkginfo | grep SUNWqfe
```

Note – If no package names are displayed, you can immediately install the Sun Trunking and Sun Quad FastEthernet packages.

> **Note –** For Sun Enterprise 10000 users, with `qfe` as the primary network interface, removing the `qfe` packages will hang the system. See your system administrator for further instructions. If you are a Sun Enterprise 10000 user and `qfe` is not your primary interface, remove any existing `qfe` packages, and continue to "Installing the Sun Trunking 1.2.1 Software".

If previous versions of `qfe` are installed, the package names are displayed as follows:

Solaris 2.5.1 and 2.6 operating environments:

```
SUNWqfed    Sun Quad FastEthernet Adapter Driver
SUNWqfedu   Sun Quad FastEthernet Adapter Driver Headers
```

Solaris 7 operating environment:

```
SUNWqfed    Sun Quad FastEthernet Adapter Driver
SUNWqfedu   Sun Quad FastEthernet Adapter Driver Headers
SUNWqfedx   Sun Quad FastEthernet Adapter 64bit Driver
```

Solaris 8 operating environment:

```
SUNWqfed    Sun Quad FastEthernet Adapter Driver
SUNWqfedu   Sun Quad FastEthernet Adapter Driver Headers
SUNWqfedx   Sun Quad FastEthernet Adapter Driver (64-bit)
```

3. **Check to see if the existing version is 3.1 or higher:**

```
# pkginfo -l SUNWqfed |grep VERSION
example of Solaris 2.6 output: VERSION:   3.1,REV=5.6.98.04.03
```

If the version number is 3.1 or higher, Step 4. If the version number is earlier than 3.1, non-Sun Enterprise 10000 users must remove all existing `qfe` packages.

For example on the Solaris 2.5.1 operating environment:

```
# pkgrm SUNWqfed SUNWqfedu
```

4. **Use the** `showrev` **command to see if the latest** `qfe` **patches are currently installed.**

 If the following patches (or more recent versions) are present, proceed with the Sun Trunking 1.2.1 software installation. If the patch version is less than indicated below, install the `qfe` patches as described in the next section.

For Solaris 2.5.1 operating environment:

```
# showrev -p | grep 106531
```

The correct version is 106531-04 or higher.

For Solaris 2.6 operating environment:

```
# showrev -p | grep 106532
```

The correct version is 106532-04 or higher.

For Solaris 7 operating environment:

```
# showrev -p | grep 107743
```

The correct version is 107743-04 or higher.

For Solaris 8 operating environment:

```
# showrev -p | grep 108806
```

The correct version is 108806-01 or higher.

Installing the Sun Trunking 1.2.1 Software

Before installing the Sun Trunking 1.2.1 software, you must first install the appropriate `qfe` patches for your system.

Note – If any of the following Sun Quad FastEthernet patches (106531-04, 106532-04, 107743-04, or 108806-01) or later are already installed on your system, skip the `qfe` patch installation. You will only need to install the Sun Trunking software packages.

▼ To Install the `qfe` Patches

1. **At the system console, become superuser (root).**

2. **Place the Sun Trunking 1.2.1 CD in the CD-ROM drive.**

3. **Mount the CD-ROM on a local directory.**

   If the Volume Manager (vold) is running on your machine, then the CD-ROM is mounted automatically under /cdrom/cdrom0 directory.

   If the Volume Manager (vold) is not running on your machine, create a directory called /cdrom/cdrom0 and mount the CD-ROM manually.

   ```
   # mkdir /cdrom/cdrom0
   # mount -F hsfs -o ro /dev/dsk/c0t6d0s2 /cdrom/cdrom0
   ```

   For detailed instructions on how to load software from a CD-ROM drive, mounted on a remote directory, see the *Solaris Software and Answer Book Packages Administrative Guide.*

4. **Install the Sun Quad FastEthernet patches if you do not already have the most recent patches installed on your system.**

   - If your system is running Solaris 2.5.1, install the Sun Quad FastEthernet software patch required for the Solaris 2.5.1 operating environment:

   ```
   # cd /cdrom/cdrom0/Solaris_2.5.1/QuadfastEthernet/Patches/106531-
   04
   # ./installpatch .
   ```

   A message similar to the following is displayed to indicate that patch number 106531-04 has been successfully installed:

   ```
   Patch packages installed:
     SUNWqfed
     SUNWqfedu
   ```

   - If your system is running Solaris 2.6, install the Sun Quad FastEthernet software patch required for the Solaris 2.6 operating environment:

   ```
   # cd /cdrom/cdrom0/Solaris_2.6/QuadfastEthernet/Patches/106532-04
   # ./installpatch .
   ```

A message similar to the following is displayed to indicate that patch number 106532-04 has been successfully installed:

```
Patch packages installed:
  SUNWqfed
  SUNWqfedu
```

■ If your system is running the Solaris 7 operating environment, install the Sun Quad FastEthernet software patch required for the Solaris 7 operating environment:

```
# patchadd /cdrom/cdrom0/Solaris_7/QuadfastEthernet/Patches/
107743-04
```

A message similar to the following is displayed to indicate that patch number 107743-04 has been successfully installed:

```
Patch packages installed:
  SUNWqfed
  SUNWqfedu
  SUNWqfedx
```

■ If your system is running the Solaris 8 operating environment, install the Sun Quad FastEthernet software patch required for the Solaris 8 operating environment:

```
# patchadd /cdrom/cdrom0/Solaris_8/QuadfastEthernet/Patches/
108806-01
```

A message similar to the following is displayed to indicate that patch number 108806-01 has been successfully installed:

```
Patch packages installed:
  SUNWqfed
  SUNWqfedu
  SUNWqfedx
```

▼ To Install the `qfe` Packages

> **Note –** If no `qfe` packages exist on your system, follow these procedures for installing the Sun Trunking software packages. If you already have the correct patch version installed on your machine, skip to "Installing the Sun Trunking Software."

> **Note –** For Sun Enterprise 10000 users, with `qfe` as your primary network interface, removing the `qfe` packages will hang the system. See your system administrator for further instructions. If you are an Sun Enterprise 10000 user and `qfe` is not your primary interface, remove any existing `qfe` packages, and continue to "Installing the Sun Trunking Software".

1. **At the system console, become superuser (root).**

2. **Place the Sun Trunking 1.2.1 CD in the CD-ROM drive.**

3. **Mount the CD-ROM on a local directory.**

   If the Volume Manager (vold) is running on your machine, then the CD-ROM is mounted automatically under `/cdrom/cdrom0` directory.

   If the Volume Manager (vold) is not running on your machine, create a directory called `/cdrom/cdrom0` and mount the CD-ROM manually.

   ```
   # mkdir /cdrom/cdrom0
   # mount -F hsfs -o ro /dev/dsk/c0t6d0s2 /cdrom/cdrom0
   ```

   For detailed instructions on how to load software from a CD-ROM drive mounted on a remote directory, see the *Solaris Software and Answer Book Packages Administrative Guide.*

4. **Install the Sun Quad FastEthernet packages if you do not already have any** `qfe` **packages on your system.**

■ If your system is running Solaris 2.5.1, install the Sun Quad FastEthernet software packages required for the Solaris 2.5.1 operating environment:

```
# pkgadd -d /cdrom/cdrom0/Solaris_2.5.1/QuadfastEthernet/Packages
```

A message similar to the following is displayed to indicate the available packages:

```
  1   SUNWqfed       Sun Quad FastEthernet Adapter Driver
                     (sparc) 3.1,REV=5.5.1.98.04.03
  2   SUNWqfedu      Sun Quad FastEthernet Adapter Driver Headers
                     (sparc) 3.1,REV=5.5.1.98.04.03
```

Type `all` and press Return to install all the software packages.

■ If your system is running Solaris 2.6 install the Sun Quad FastEthernet software packages required for the Solaris 2.6 operating environment:

```
# pkgadd -d /cdrom/cdrom0/Solaris_2.6/QuadfastEthernet/Packages
```

A message similar to the following is displayed to indicate the available packages:

```
  1   SUNWqfed       Sun Quad FastEthernet Adapter Driver
                     (sparc) 3.1,REV=5.6.98.04.03
  2   SUNWqfedu      Sun Quad FastEthernet Adapter Driver Headers
                     (sparc) 3.1,REV=5.6.98.04.03
```

Type `all` and press Return to install all the software packages.

■ If your system is running Solaris 7 install the Sun Quad FastEthernet software packages required for the Solaris 7 operating environment:

```
# cd /cdrom/cdrom0/Solaris_7/QuadfastEthernet/Packages
# pkgadd -d . SUNWqfedx SUNWqfed SUNWqfedu
```

> **Note –** When installing Sun Quad FasEthernet on the Solaris 7 operating environment, you must first install the `SUNWqfedx` package.

- If your system is running Solaris 8 install the Sun Quad FastEthernet software packages required for the Solaris 8 operating environment:

```
# pkgadd -d /cdrom/cdom0/Solaris_8/QuadfastEthernet/Packages
```

A message similar to the following is displayed to indicate the available packages:

```
  1   SUNWqfed       Sun Quad FastEthernet Adapter Driver
                     (sparc) 5.0,REV=5.8.1999.12.07
  2   SUNWqfedu      Sun Quad FastEthernet Adapter Driver Headers
                     (sparc) 5.0,REV=5.8.1999.12.07
  3   SUNWqfedx      Sun Quad FastEthernet Adapter Driver (64-bit)
                     (sparc) 5.0,REV=5.8.1999.12.07
```

Type `all` and press Return to install all the software packages.

▼ To Install the Sun Trunking Software Packages

1. **At the system console, become superuser (root).**

2. **Place the Sun Trunking 1.2.1 CD in the CD-ROM drive.**

3. **Mount the CD-ROM on a local directory.**

   If the Volume Manager (vold) is running on your machine, then the CD-ROM is mounted automatically under `/cdrom/cdrom0` directory.

   If the Volume Manager (vold) is not running on your machine, create a directory called `/cdrom/cdrom0` and mount the CD-ROM manually.

```
# mkdir /cdrom/cdrom0
# mount -F hsfs -o ro /dev/dsk/c0t6d0s2 /cdrom/cdrom0
```

   For detailed instructions on how to load software from a CD-ROM drive mounting on a remote directory, see the *Solaris Software* and *Answer Book Packages Administrative Guide.*

■ To install the Sun Trunking 1.2.1 software packages for the Solaris 2.5.1 operating
environment:

```
# pkgadd -d /cdrom/cdrom0/Solaris_2.5.1/Trunking/Packages
```

A message similar to the following is displayed to indicate the available packages:

```
1   SUNWtrkm        Sun Trunking Man Pages
                     (sparc) 1.2.1,REV=5.5.1.00.02.11
2   SUNWtrku        Sun Trunking Utility
                     (sparc) 1.2.1,REV=5.5.1.00.02.11
```

Type all and press Return to install all the software packages.

■ To install the Sun Trunking 1.2.1 software packages for the Solaris 2.6 operating
environment:

```
# pkgadd -d /cdrom/cdrom0/Solaris_2.6/Trunking/Packages
```

A message similar to the following is displayed to indicate the available packages:

```
1 SUNWtrkm        Sun Trunking Man Pages
                   (sparc) 1.2.1,REV=5.6.00.02.11
2 SUNWtrku        Sun Trunking Utility
                   (sparc) 1.2.1,REV=5.6.00.02.11
```

Type all and press Return to install all the software packages.

■ To install the Sun Trunking 1.2.1 software packages for the Solaris 7 operating
environment:

```
# pkgadd -d /cdrom/cdrom0/Solaris_7/Trunking/Packages
```

A message similar to the following is displayed to indicate the available packages:

```
1 SUNWtrkm      Sun Trunking Man Pages
               (sparc) 1.2.1,REV=5.7.00.02.11
2 SUNWtrku      Sun Trunking Utility
               (sparc) 1.2.1,REV=5.7.00.02.11
```

Type `all` and press Return to install all the software packages.

- To install the Sun Trunking 1.2.1 software packages for the Solaris 8 operating environment:

```
# pkgadd -d /cdrom/cdrom0/Solaris_8/Trunking/Packages
```

A message similar to the following is displayed to indicate the available packages:

```
1 SUNWtrkm      Sun Trunking Man Pages
               (sparc) 1.2.1,REV=5.8.2000.02.11
2 SUNWtrku      Sun Trunking Utility
               (sparc) 1.2.1,REV=5.8.2000.02.11
```

Type `all` and press Return to install all the software packages.

4. **After the installation is complete, verify that the Sun Trunking 1.2.1 software packages have been installed.**

```
# pkginfo | grep SUNWtrk
```

The following packages should be displayed:

```
system   SUNWtrku      Sun Trunking Utility
system   SUNWtrkm      Sun Trunking Man Pages
```

5. **Add** `/etc/opt/SUNWconn/bin` **to your** `$PATH` **variable and**
   `/opt/SUNWconn/man` **to your** `$MANPATH` **variable.**

   The Sun Trunking software is now installed. Before rebooting your system, however, you must first configure the Sun Trunking software files as described in the next section.

Configuring the Sun Trunking Software

Before rebooting your system, you must first edit and create configuration files to define how you will link the Quad FastEthernet network interfaces. To configure these files, you need to know the following for each Quad FastEthernet adapter:

- The device instance numbers of each FastEthernet network interface.
- The number of trunks you want per adapter (1 or 2).
- The device instance number for each trunk.
- The trunking policy you want to use: MAC, Round Robin, IP Destination Address, or IP Source Address/IP Destination Address. (See "Trunking Policies" on page 19.)

Note – All procedures described throughout this document can be applied to both PCI and SBus adapters, unless otherwise specified.

Checking for Link Mode

Always confirm that the link mode is set to run full-duplex.

Use the `nettr -debug` or the `ndd` command to verify the link mode. If the information returned indicates that your trunking device is not running at full-duplex, refer to "Defining the Current Status" in your *Sun Quad FastEthernet Adapter User's Guide* for information on setting the link mode.

Booting From the Network

Once you have installed `qfe` and connected the `qfe` interfaces to a switch that is configured for trunking, you cannot use the `qfe` interfaces to boot from the network.

Determining Instance Numbers

Each Quad FastEthernet adapter has four network interfaces. You will need to know the device instance numbers for these network interfaces before you can configure the Sun Trunking software files. FIGURE 1-1 shows the four FastEthernet network interfaces of the Quad FastEthernet SBus adapter.
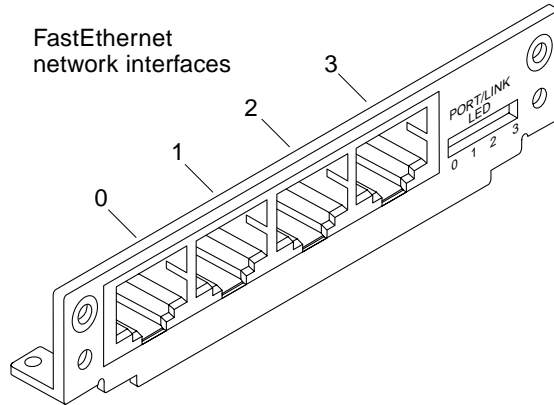
FIGURE 1-1   Four Network Interfaces of the Sun Quad FastEthernet SBus Adapter

While these network interfaces are labeled 0 to 3 on the adapter's back plate, their device instance numbers are generated by the machine at boot time.

You can find the instance numbers in two ways: by searching the /etc/path_to_inst file or by typing nettr -conf in the /etc/opt/SUNWconn/bin directory.

Both files contain the physical name, the instance number, and driver name for each device on the system. By searching this file for Quad FastEthernet (qfe) devices, you can find the instance numbers that will be used with the Sun Trunking software.

Using the `grep` command, search the `path_to_inst` file for all of the `qfe` devices on your system:

```
# grep qfe /etc/path_to_inst
"/sbus@3,0/SUNW,qfe@0,8c20000" 6 "qfe"
"/sbus@3,0/SUNW,qfe@0,8c30000" 7 "qfe"
"/sbus@3,0/SUNW,qfe@0,8c00000" 4 "qfe"
"/sbus@3,0/SUNW,qfe@0,8c10000" 5 "qfe"
"/sbus@2,0/SUNW,qfe@1,8c20000" 2 "qfe"
"/sbus@2,0/SUNW,qfe@1,8c30000" 3 "qfe"
"/sbus@2,0/SUNW,qfe@1,8c00000" 0 "qfe"
"/sbus@2,0/SUNW,qfe@1,8c10000" 1 "qfe"
```

In the example above, the SUNW,qfe@0 instances are from a Quad FastEthernet adapter installed in SBus slot 0, and the four SUNW,qfe@1 instances are from a Quad FastEthernet SBus Adapter installed in slot 1. For clarity, the instance numbers are shown in **boldface** type. TABLE 1-2 lists the network interface number, physical name, and instance number for each Quad FastEthernet instance on this example system.

TABLE 1-2   Example Quad FastEthernet Instance Numbers

Network Interface #	Device Name	Instance Number
0	/sbus@2,0/SUNW,qfe@1,8c10000	**0**
1	/sbus@2,0/SUNW,qfe@1,8c10000	**1**
2	/sbus@2,0/SUNW,qfe@1,8c20000	**2**
3	/sbus@2,0/SUNW,qfe@1,8c30000	**3**
4	/sbus@3,0/SUNW,qfe@0,8c00000	**4**
5	/sbus@3,0/SUNW,qfe@0,8c10000	**5**
6	/sbus@3,0/SUNW,qfe@0,8c20000	**6**
7	/sbus@3,0/SUNW,qfe@0,8c30000	**7**

To use the `nettr -conf` command, you must be in the `/etc/opt/SUNWconn/bin` directory. If you added `/etc/opt/SUNWconn/bin` to your search path, you will not need to change directories.

```
# cd /etc/opt/SUNWconn/bin
/etc/opt/SUNWconn/bin
# nettr -conf
Name      Head          Policy  DEVType       Original-Mac-Addr

qfe0      non-trunk             qfe-sbus      8:0:20:89:b2:30
qfe1      non-trunk             qfe-sbus      8:0:20:89:b2:31
qfe2      non-trunk             qfe-sbus      8:0:20:89:b2:32
qfe3      non-trunk             qfe-sbus      8:0:20:89:b2:33
```

You need to know the instance numbers of the Quad FastEthernet network interfaces to configure the Sun Trunking software.

Note – You cannot trunk an interface that is already plumbed. To display a list of all plumbed interfaces, execute the `ifconfig -a` command .

Accessing Trunk Members

Trunk members can be accessed only through the trunk head. Use the `ifconfig` command to determine your trunk head.

For example, you cannot do a DLPI attach on a non-head member. The following error message was returned for a `snoop` command for a non-head member:

```
# snoop -d qfe1
dlattachreq: DL_ERROR_ACK:  dl_errno 8 unix_errno 0
```

In this example, `qfe1` is a member of a trunk. The trunk head for that trunk is `qfe0`. To use the `snoop` command, for example, in such a case, the following would be the correct usage:

```
# snoop -d qfe0
Using device /dev/qfe (promiscuous mode)
        ? -> (multicast)  ETHER Type=0C34 (Unknown), size = 52 bytes
        ? -> (multicast)  ETHER Type=0C34 (Unknown), size = 52 bytes
        ? -> (multicast)  ETHER Type=0C34 (Unknown), size = 52 bytes
        ? -> (multicast)  ETHER Type=0C34 (Unknown), size = 52 bytes
```

Number of Links per Quad FastEthernet Adapter

The four network interfaces of the Quad FastEthernet (qfe) adapter can be linked in a number of ways, depending on the needs of your network. All four of the network interfaces can be linked into one trunk, or two network interfaces can be linked into one trunk. FIGURE 1-2 shows four different common linking possibilities.
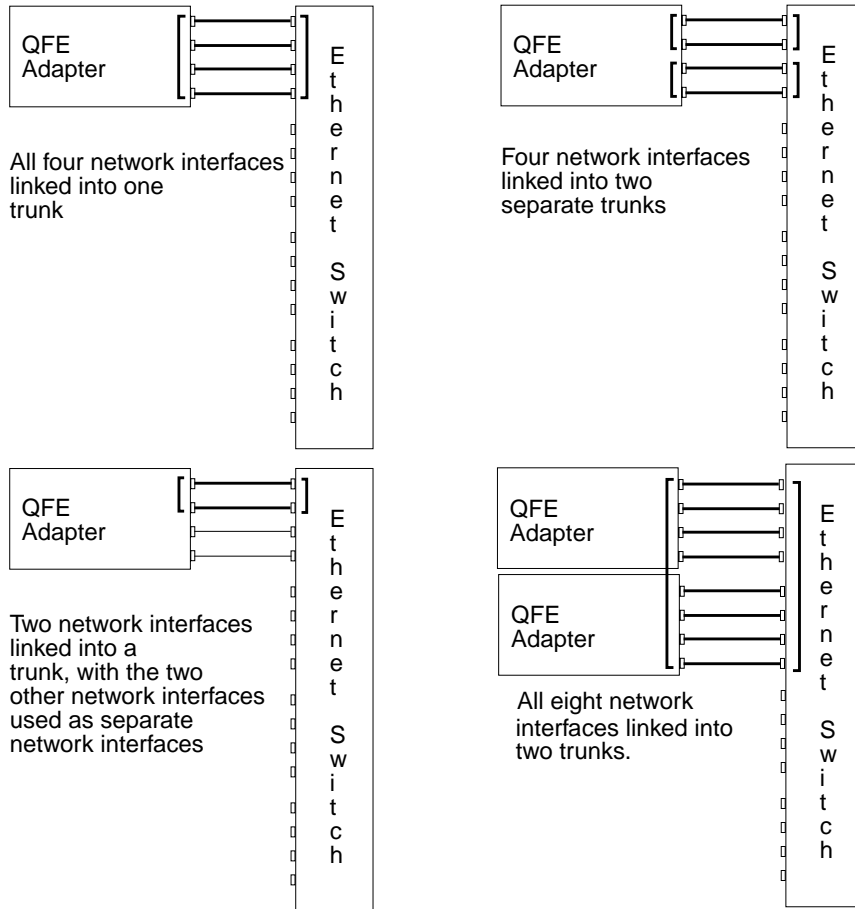
FIGURE 1-2 Four Trunking Network Configuration Examples

The configuration of the Sun Trunking software files will depend on how you want to organize the Ethernet network. You must also configure the Ethernet switch software to be symmetrical with how you configured the Sun Trunking software. Refer to your Ethernet switch documentation for the switch configuration instructions.

`local-mac-address` Property

Each of the network interfaces of the Sun Quad FastEthernet adapter has been assigned a unique Media Access Control (MAC) address, which represents the 48-bit Ethernet address for that network interface. The OpenBoot™ firmware reports this MAC address via the `local-mac-address` property in the device nodes corresponding to the network interfaces.

A system is not obligated to use this assigned MAC address if it has a system-wide MAC address. In such cases, the system-wide MAC address applies to all network interfaces on the system.

The device driver, or any other adapter utility, can use the network device's MAC address (`local-mac-address`) while configuring it. In the Solaris 2.6 and later operating environments, you can use a network device's MAC address when booting over the network.

The `mac-address` property of the network device specifies the network address (system-wide or `local-mac-address`) used for booting the system. To start using the MAC addresses assigned to the network interfaces of the Sun Quad FastEthernet adapter, set the NVRAM configuration variable `local-mac-address?` to `true`.

```
ok setenv local-mac-address? true
```

Client machines with multiple interfaces that communicate with the trunked machine should also set `local-mac-address` to `true`.

Configuring the Sun Trunking Software Files

After locating the instance numbers of the Quad FastEthernet network interfaces, and deciding how you want to organize your network, you can begin to configure the Sun Trunking software.

Trunking Policies

The four supported trunking policies used in the Sun Trunking 1.2.1 software are MAC, Round Robin, IP Destination, and IP Source/IP Destination. With these policies, if a link fails, the traffic goes to the next available link. The policies are defined below:

MAC

- Is the default policy used by the Sun Trunking 1.2.1 software. MAC is the preferred policy to use with switches. Most trunking-capable switches require using the MAC-hashing policy, but check your switch documentation.
- Uses the last three bits of the MAC address of both the source and destination. For two ports, the MAC address of the source and destination are first XORed: Result = 00, 01, which selects the port.
- Favors a large population of clients. For example, this ensures that 50 percent of the client connections will go through one of two ports in a two-port trunk.
- Is required by most trunking-capable switches.

Note – Do not use MAC-hashing for connecting two servers back to back.

Round Robin

- Round Robin is the preferred policy with a Back to Back connection, used between the output of a transmitting device, and the input of an associated receiving device.
- Uses each network interface of the trunk in turn, as a method of distributing packets over the assigned number of trunking interfaces.
- May have an impact on performance since the temporal ordering of packets is not observed.

IP Destination Address

- Uses the four bytes of the IP Destination address to determine the transmission path.
- If a trunking interface host has one IP source address, and it is necessary to communicate to multiple IP clients connected to the same router, then the IP Destination Address policy is the preferred policy to use.

IP Source Address/IP Destination Address

- Connects the source server to the destination, based on where the connection originated or terminated.
- Uses the four bytes of the source and destination IP addresses to determine the transmission path.

The primary use of the IP Source/IP Destination Address policy occurs where you use the IP virtual address feature to give multiple IP addresses to a single physical interface. For example, you might have a cluster of servers providing network services, in which each service is associated with a virtual IP address over a given interface. If a service associated with an interface fails, the virtual IP address migrates to a physical interface on a different machine in the cluster. In such an arrangement, the IP Source Address/IP Destination Address policy gives you a greater chance of using more, different links within the trunk than would the IP Destination Address policy.

The `-hash` option to the `nettr` (1M) command enables you to determine over which link a given packet will travel. The following section describes hashing in greater detail.

▼ To Edit the `nettr.sh` File

The main configuration file of the Sun Trunking 1.2.1 software is the `/etc/opt/SUNWconn/bin/nettr.sh` file. You will define each trunk by adding commands to this file. Before you edit the `nettr.sh` file, you need to know how many FastEthernet network interfaces you want to link into a trunk, the first instance number of each trunk (also called the "trunk head"), and the trunking policy you want to use.

● **Using a text editor, add commands to the** `nettr.sh` **file to define your trunking network.**

In the `nettr.sh` file, add lines containing the `nettr` command to define the trunked network. The format of this command is:

```
nettr -setup head-instance device=<qfe | ge>
                    members=<instance,instance,.,.>
                    [ policy=<number> ]
```

In the command above, the *head instance* is the instance number of the first linked network interface of the trunk. The device represents the adapter type (`qfe` for a Quad FastEthernet adapter or `ge` for GigabitEthernet adapter). The member option is used to select members of a trunk. The `policy` option can either be the default value of 1 for MAC, 2 for round robin, 3 for IP Destination, or 4 for IP Source/IP Destination.

If you check the output that results from executing the nettr -conf command before executing any nettr -setup commands, it will be similar to the following:

```
# nettr -conf
Name    Head       Policy  DEV Type   Original-Mac-Addr

qfe0    non-trunk          qfe-sbus   8:0:20:89:b2:30
qfe1    non-trunk          qfe-sbus   8:0:20:89:b2:31
qfe2    non-trunk          qfe-sbus   8:0:20:89:b2:32
qfe3    non-trunk          qfe-sbus   8:0:20:89:b2:33
```

Note – The examples below use the instance numbers found in TABLE 1-2 on page 16. *The instance numbers on your system will be different.* See "Determining Instance Numbers" on page 15 for more information.

■ For one trunk containing all four network interfaces and using the MAC trunking policy (policy 1), add this line to the nettr.sh file:

```
nettr -setup 0 device=qfe policy=1 members=0,1,2,3
```

To verify whether you have set up the trunking configuration file correctly, invoke the nettr -run command. You should see information similar to the following:

```
# nettr -run
Configuring Sun Trunking devices

qfe trunk members:
    qfe0 (head)
    qfe1
    qfe2
    qfe3
```

Then, execute the nettr -conf command to check the configuration.

```
# nettr -conf
Name    Head      Policy DEV Type   Original-Mac-Addr

qfe0    qfe0      1      qfe-sbus   8:0:20:89:b2:30
qfe1    qfe0             qfe-sbus   8:0:20:89:b2:31
qfe2    qfe2             qfe-sbus   8:0:20:89:b2:32
qfe3    qfe2             qfe-sbus   8:0:20:89:b2:33
```

- For one trunk containing all four network interfaces and using the Round Robin trunking policy (policy 2), add this line to the `nettr.sh` file:

```
nettr -setup 0 device=qfe policy=2 members=0,1,2,3
```

To verify whether you have set up the trunking configuration file correctly, invoke the `nettr -run` command. You should see information similar to the following:

```
# nettr -run
Configuring Sun Trunking devices

qfe trunk members:
    qfe0 (head)
    qfe1
    qfe2
    qfe3
```

Then, execute the `nettr -conf` command to check the configuration.

```
# nettr -conf
Name    Head      Policy DEV Type   Original-Mac-Addr

qfe0    qfe0      2      qfe-sbus    8:0:20:89:b2:30
qfe1    qfe0             qfe-sbus    8:0:20:89:b2:31
qfe2    qfe2             qfe-sbus    8:0:20:89:b2:32
qfe3    qfe2             qfe-sbus    8:0:20:89:b2:33
```

- For two trunks, containing two network interfaces each using the MAC policy, add these two lines:

```
nettr -setup 0 device=qfe policy=1 members=0,1
nettr -setup 2 device=qfe policy=1 members=2,3
```

To verify whether you have set up the trunking configuration file correctly, invoke the nettr -run command. You should see information similar to the following:

```
# nettr -run
Configuring Sun Trunking devices

qfe trunk members:
    qfe0 (head)
    qfe1

qfe trunk members:
    qfe2 (head)
    qfe3
```

Then, execute the nettr -conf command again.

```
# nettr -conf
Name    Head       Policy DEV Type   Original-Mac-Addr

qfe0    qfe0       1      qfe-pci     8:0:20:8d:5a:a5
qfe1    qfe0              qfe-pci     8:0:20:8d:5a:a6
qfe2    qfe2       1      qfe-pci     8:0:20:8d:5a:a7
qfe3    qfe2              qfe-pci     8:0:20:8d:5a:a8
```

■ For one trunk, containing two network interfaces and using the round robin policy, add this line:

```
nettr -setup 0 device=qfe policy=2 members=0,1
```

To verify whether you have set up the trunking configuration file correctly, invoke the nettr -run command. You should see information similar to the following:

```
# nettr -run
Configuring Sun Trunking devices

qfe trunk members:
    qfe0 (head)
    qfe1
```

Then, execute the `nettr -conf` command to check the configuration.

```
# nettr -conf
Name    Head    Policy QFE Type    Original-Mac-Addr

qfe0    qfe0    2       qfe-sbus    8:0:20:89:b2:30
qfe1    qfe0            qfe-sbus    8:0:20:89:b2:31
```

■ For one trunk, containing two network interfaces each using the IP Destination policy, add these two lines:

```
nettr -setup 0 device=qfe policy=3 members=0,1
```

To verify whether you have set up the trunking configuration file correctly, invoke the `nettr -run` command. You should see information similar to the following:

```
# nettr -run
Configuring Sun Trunking devices

qfe trunk members:
    qfe0 (head)
    qfe1
```

Then, execute the `nettr -conf` command to check the configuration.

```
# nettr -conf

Name      Head      Policy DEV Type    Original-Mac-Addr

qfe0      qfe0      3       qfe-pci    8:0:20:8d:5a:a5
qfe1      qfe0              qfe-pci    8:0:20:8d:5a:a6
qfe2      non-trunk         qfe-pci    8:0:20:8d:5a:a7
qfe3      non-trunk         qfe-pci    8:0:20:8d:5a:a8
```

For one trunk, containing two network interfaces each using the IP Source/IP Destination policy, you would add these two lines:

```
nettr -setup 0 device=qfe policy=4 members=0,1
```

To verify whether you have set up the trunking configuration file correctly, invoke the `nettr -run` command. You should see information similar to the following:

```
# nettr -run
Configuring Sun Trunking devices

qfe trunk members:
    qfe0 (head)
    qfe1
```

Then, execute the `nettr -conf` command to check the configuration.

```
# nettr -conf

Name      Head       Policy DEV Type    Original-Mac-Addr

qfe0      qfe0       4      qfe-pci      8:0:20:8d:5a:a5
qfe1      qfe0              qfe-pci      8:0:20:8d:5a:a6
qfe2      non-trunk         qfe-pci      8:0:20:8d:5a:a7
qfe3      non-trunk         qfe-pci      8:0:20:8d:5a:a8
```

▼ To Use the Hashing Feature

Note – Trunking interfaces must be set up prior to using hashing features. If, for example, on one trunk, the link to transmit is 1, with the following hash command input, the policy IP Source and Destination Address would read as follows :

```
# /etc/opt/SUNWconn/bin/nettr -hash 0 ip=191.191.44.70/
191.191.44.99

Name  Head  Policy  Source Address   Dest Address   Link to Transmit
qfe1  qfe0   4       191.191.44.70    191.191.44.99      1
```

Note – The `-hash` option to the `nettr` (1M) command enables you to determine over which link a given packet will travel. For example, if you use the Destination IP Address policy, you can supply an IP address to a `nettr -hash` command to determine over which link a packet with the specified IP address will travel.

▼ To Configure the FastEthernet Host Files

Before you can use these trunked Ethernet network interfaces, you must create an `/etc/hostname.qfe#` file, and add an entry in the `/etc/hosts` file for each trunk.

1. **For each trunk, create a** `/etc/hostname.qfe#` **file, where # corresponds to the instance number used as the trunk head.**

For example, if you had two trunks using two network interfaces each, you would have to create two files containing the host name of the trunk as seen by network. The extensions of these files would have to correspond with the trunk head interface numbers of the trunks.

TABLE 1-3 Example `hostname.qfe#` Files

File name	Trunk Head Instance Number	Quad FastEthernet Adapter Network Interfaces Used in the Trunk[1]
`/etc/hostname.qfe0`	0	0, 1
`/etc/hostname.qfe2`	2	2, 3

[1] See FIGURE 1-1 on page 15 for more information.

- The `/etc/hostname.qfe#` file must contain an appropriate host name for the trunk.
- The host name should be different from any other host name of any other interface, for example: `/etc/hostname.qfe0` and `/etc/hostname.qfe2` cannot share the same host name.
- The host name should have an IP address that should be entered in the `/etc/hosts` file (see Step 2).

Using the example trunk head instance numbers in TABLE 1-3, the following example shows the three `/etc/hostname.qfe#` files required for a system called `proboscis`, which has an onboard FastEthernet device (`proboscis`), and two trunks (`proboscis-11`, `proboscis-12`).

```
# cat /etc/hostname.hme0
proboscis
# cat /etc/hostname.qfe0
proboscis-11
# cat /etc/hostname.qfe2
proboscis-12
```

Note – Only trunk *heads* are visible.

2. **Create an appropriate entry in the** /etc/hosts **file for each trunk.**

Using the example from Step 1, you would have:

```
# cat /etc/hosts
#
# Internet host table
#
127.0.0.1      localhost
129.144.10.57 proboscisloghost
129.144.11.83 proboscis-11
129.144.12.41 proboscis-12
```

Note – Make sure you configure the switch software to be symmetrical with the Sun Trunking 1.2.1 software. Refer to your Ethernet switch documentation for instructions.

3. **Setup the** qfe **adapter using the** ifconfig **command, where** *ip_address* **corresponds to the system IP address to use the adapter without rebooting.**

```
# ifconfig qfe0 plumb
# ifconfig qfe0 ip_address up
```

Create an entry in the /etc/hosts file for each active ge interface.

The following example shows the /etc/hosts file.

```
# cat /etc/hosts
#
# Internet host table
#
127.0.0.1      localhost
129.144.10.57 proboscis loghost
129.144.11.83 proboscis-11
```

Note – Make sure you configure the switch software to be symmetrical with the Sun Trunking 1.2.1 software. Refer to your Ethernet switch documentation for instructions.

▼ To Activate the Trunked Networks Without `ifconfig`

If you do not use `ifconfig`, you will need to reboot your system to make these trunked networks active. If you used the previous `ifconfig` instructions, you can ignore this section.

1. **Shut down your system.**

```
# sync
# init 0
Shutdown messages.
```

2. **Set** `local-mac-address` **to true.**

```
ok setenv local-mac-address? true
```

3. **Perform a reconfiguration boot.**

```
ok boot -r
```

Installing the Adapter with Dynamic Reconfiguration (DR)

Note – If you are using Solaris 2.6 Hardware: 5/98, 11/98, Solaris 7, or later versions, and you are using an SBus adapter, you may be able to install the adapter with Dynamic Reconfiguration (DR). Otherwise, you cannot use DR.

If you have a Sun Enterprise 6x00, 5x00, 4x00, or 3x00 system that supports Dynamic Reconfiguration (DR), you do not have to reboot your system. The process of adding and configuring an adapter with DR involves (1) connecting the attachment point and (2) configuring its occupant. In most cases, the `cfgadm(1M)` command can perform both steps at once.

▼ To Install a Sun Quad FastEthernet Adapter on non-Sun Enterprise 10000 Systems

1. **If trunking software is already in use, run the** `nettr -release` **command to unconfigure it. Before you run the following command, unplumb the interface if not already unplumbed.**

   ```
   # nettr -release head-instance device=qfe
   ```

2. **Verify that the trunking software has been released:**

   ```
   # ifconfig -a
   ```

3. **Verify that the selected board slot is ready for the adapter:**

   ```
   # cfgadm
   ```

   The states and conditions should be:
   - Receptacle state—Empty
   - Occupant state—Unconfigured
   - Condition—Unknown

   or
   - Receptacle state—Disconnected
   - Occupant state—Unconfigured
   - Condition—Unknown

4. **If the status of the slot is not empty or disconnected, enter:**

   ```
   # cfgadm -c disconnect sysctrl#:slot#
   ```

5. **Physically insert the adapter into the slot and look for an acknowledgment on the console, such as, "name board inserted into slot3."**

   After an I/O board is inserted, the states and conditions should become:
   - Receptacle state—Disconnected
   - Occupant state—Unconfigured
   - Condition—Unknown

   Any other states or conditions should be considered an error.

6. **Connect any peripheral cables and interface modules to the adapter.**

7. **Configure the board with the command:**

```
# cfgadm -v -c configure sysctrl#:slot#
```

This command should both connect and configure the receptacle. Verify with the cfgadm command.

The states and conditions for a connected and configured attachment point should be:

- Receptacle state—Connected
- Occupant state—Configured
- Condition—OK

Now the system is also aware of the usable devices reside on the adapter and all devices can be mounted or configured to be used.

If the command fails to connect and configure the adapter and slot (the status should be shown as "configured" and "ok"), do the connection and configuration as separate steps:

a. **Connect the adapter and slot:**

```
# cfgadm -v -c connect sysctrl#:slot#
```

The states and conditions for a connected attachment point should be:

- Receptacle state—Connected
- Occupant state—Unconfigured
- Condition—OK

Now the system is aware of the adapter, but not the usable devices that reside on the adapter. Temperature is monitored and power and cooling affect the attachment point condition.

b. **Configure the adapter and slot by entering:**

```
# cfgadm -v -c configure sysctrl#:slot#
```

The states and conditions for a configured attachment point should be:

- Receptacle state—Connected
- Occupant state—Configured
- Condition—OK

Now the system is also aware of the usable devices that reside on the adapter and all devices can be mounted or configured to be used.

8. **Run the** `nettr -run` **command to verify the connection.**

```
# nettr -run
```

9. **Reconfigure the devices on the adapter by entering:**

```
# drvconfig; devlinks; disks; ports; tapes; ucbliniks;
```

The console should display a list of devices and their addresses.

Note – Refer to your system user's guide or the Sun QuadEthernet documentation for further instructions.

▼ To Install the Sun Quad FastEthernet Adapter on Sun Enterprise 10000 Systems

---

Note – Once the system board is attached you do not have to reboot your system.

---

1. **If trunking software is already in use, run the** `nettr -release` **command to unconfigure it. Before you run the following command, unplumb the interface.**

```
# nettr -release head-instance device=qfe
```

2. **Verify that the trunking software has been released.**

```
# ifconfig -a
# nettr -conf (For the above head-instance, trunking has not been
configured.)
```

3. **Drain and detach the desired system board. Based on the Solaris operating environment version the domain is running, refer to the** *Sun Enterprise 10000 Dynamic Reconfiguration User's Guide* **for configuration and detaching instructions.**

4. **From the SSP, power off the system board the adapter is to be installed on.**

```
xf9-ssp:domain_name% power -off -sb <system_board_number>
```

5. **Remove system board, install the adapter, and connect the cables.**

6. **Reinstall the system board back to its original location.**

7. **From the SSP, power on the system board.**

```
xf9-ssp:domain_name% power -on -sb <system_board_number>
```

8. **Initiate and complete the attaching of the system board. Based on the Solaris version the domain is running, refer to the** *Sun Enterprise 10000 Dynamic Reconfiguration User's Guide* **for configuration and attaching instructions.**

9. **If this is the first time a** qfe **has been installed in this slot, reconfigure the domain:**

```
# drvconfig; devlinks;
```

10. **Verify the** qfe **is configured into the domain:**

```
# grep qfe /etc/path_to_inst
```

A list of qfe instances will be displayed based on the system board, SBus, and slot location.

11. **If this adapter replaced an existing adapter and is part of a trunk, run the** nettr -run **command to verify the connection.**

```
# nettr -run
```

Note – Refer to your system's user guide or Sun Quad FastEthernet documentation for further instructions.

Using Sun Trunking 1.2.1 Software on Sun Enterprise 10000 with Alternate Pathing 2.3

Note – Alternate Pathing (AP) does not support Sun Trunking 1.2.1 software for Solaris 2.5.1.

Note – Alternate Pathing (AP) allows for two trunks to be put under AP control, but only physical devices can be trunked.

The process of setting up Sun Trunking and creating AP meta-network interfaces involves:

- defining trunking configuration
- selecting network interfaces for a trunked network pathgroup
- creating a trunked network pathgroup and AP meta-network
- creating the hostname file for a AP meta-network and
- bringing up the AP meta-network

Refer to *"Configuring the Sun Trunking Software" on page 14* of your *Sun Trunking™ 1.2.1 Installation and User's Guide* and the *Sun Enterprise Server Alternate Pathing User's Guide* for more information. The following procedures assume that the AP database has been created and the trunks involved are non-primary network interfaces. To use AP on the primary interface, refer to "Alternately Pathing the Primary Network Interface" chapter in the *Sun Enterprise Server Alternate Pathing User's Guide*.

▼ To Configure Sun Trunking and AP Network `pathgroup`

Note – When setting up a trunk for use with AP and DR, the trunk must be defined so that all trunk members are on the same system board.

1. **Edit the trunking configuration file** `/etc/opt/SUNWconn/bin/nettr.sh`**.**

   Before you edit the `nettr.sh` file, you need to know how you want to configure a trunk group. For one trunk containing both network interfaces and using the default MAC trunking policy on `qfe` devices with trunk head of 0, you would add this line to the `nettr.sh` file:

   ```
   # nettr -setup 0 device=qfe policy=1 members=0,1
   ```

2. **Select the two physical network interfaces for a network pathgroup that you will create later.**

   One of these two network interfaces must be a trunk head instance of a trunk group. For instance, `qfe0` from the above example may be used as part of a network pathgroup and you may choose `qfe4` as another alternate network device. Then you need to decide if you want the other alternate, `qfe4` in this example, to be defined as trunking as well. If `qfe4` will not be setup as a trunk, you don't have to modify the `nettr.sh` file. To set up a trunk with `qfe4` as the trunk head, you would add this line to the `nettr.sh` file:

   ```
   # nettr -setup 4 device=qfe policy=1 members=4,5
   ```

3. **To verify whether you have set up the trunking file correctly, verify that both alternates of the pathgroups are not currently plumbed by running command** `ifconfig -a` **(see** `ifconfig(1M)`**) and then invoke the** `nettr -run` **command.**

   You should see information similar to the following:

   ```
   # nettr -run
   Configuring Sun Trunking devices

   qfe trunk members:
       qfe0 (head)
       qfe1

   qfe trunk members:
       qfe4 (head)
       qfe5
   ```

4. **Create a network pathgroup and AP meta-network by using AP commands.**

Before proceeding refer to the *Sun Enterprise Server Alternate Pathing User's Guide* for detailed instructions and procedures.

For a network pathgroup containing two physical devices `qfe0` and `qfe4` with `qfe0` as the primary controller name, you can run the following commands to create the network pathgroup, list uncommitted network entries in the database, commit the network entry, and list the committed network entries in the database:

```
# apnet -c -a qfe0 -a qfe4 (Creating AP meta-network.)
# apdb -C (Committing AP meta-network to database.)
```

```
# apconfig -N

metanetwork:     mether0
physical devices:
                 qfe4
                 qfe0 A
```

5. **Create an** `/etc/hostname.mxxx` **file (such as** `/etc/hostname.mether0` **from the above example) for a meta-network that you want to configure at system reboot.**

If you want to bring up the network manually, you must verify that both alternates are not already plumbed and then run trunking command `nettr -run`.

6. **Bring up the meta-network by using the meta-network name instead of the physical network name.**

You can do this by either rebooting the system or manually using the `ifconfig`(1M) command to configure the meta-network.

Verifying the Sun Trunking Interfaces

You can verify trunking networks using the `ifconfig` and the `nettr` commands.

Use the ifconfig -a command to print out the addressing information for each interface on the system.

```
# /usr/sbin/ifconfig -a
ge0: flags=863<UP,BROADCAST,NOTRAILERS,RUNNING,MULTICAST> mtu 1500
       inet 192.100.11.200 netmask ffffff00 broadcast 192.100.11.255
         ether 8:0:20:8f:1f:f6
hme0: flags=863<UP,BROADCAST,NOTRAILERS,RUNNING,MULTICAST> mtu 1500
        inet 129.144.131.75 netmask ffffff00 broadcast
129.144.131.255
         ether 8:0:20:a4:b2:1f
qfe0: flags=863<UP,BROADCAST,NOTRAILERS,RUNNING,MULTICAST> mtu 1500
       inet 192.100.30.200 netmask ffffff00 broadcast 192.100.30.255
         ether 8:0:20:89:b9:26
```

Even though a trunk may comprise four linked FastEthernet network interfaces, the ifconfig -a command will only print out the addressing information for the trunk head interfaces (qfe0 in the example above).

For a more complete listing of the qfe devices, use the nettr -conf command. This command prints out a list of all of the qfe instances on the system, including how the qfe instances are organized into trunks.

```
# nettr -conf
Name     Head       Policy DEV Type   Original-Mac-Addr

qfe0     qfe0       1      qfe-sbus    8:0:20:89:b2:30
qfe1     qfe0              qfe-sbus    8:0:20:89:b2:31
qfe2     qfe2       1      qfe-sbus    8:0:20:89:b2:32
qfe3     qfe2              qfe-sbus    8:0:20:89:b2:33
```

In the example above, the qfe0 interface is the trunk head for a four-network interface trunk, composed of the qfe0, qfe1, qfe2, and qfe3 interfaces. The nettr -conf command will also show the policy of each trunk on the system, as well as listing the original MAC address of each interface.

Use the `nettr -stat` *trunkhead* command to monitor the network statistics of each interface on the system (replace *trunkhead* with the trunk head interface number of the trunk you want to monitor).

```
# /etc/opt/SUNWconn/bin/nettr -stats 0 device=qfe
Mar 30 15:34:25 1999

Name   Ipkts    Ierrs Opkts   Oerrs Collis  Crc      %Ipkts  %Opkts

qfe0   8        0     0        0     0       0        5.71    0.00
qfe1   2        0     0        0     0       0        1.43    0.00
qfe2   4        0     8        0     0       0        2.86    5.71
qfe3   126      0     132      0     0       0        90.00   94.29
```

This command will list each interface and the network performance statistics, summarized in TABLE 1-4, of the specified trunk.

TABLE 1-4   Output of the `nettr -stats` Command

Network Statistic	Definition
Ipkts	The number of Ethernet packets input to the interface.
Ierrs	The number of errors that occurred while inputting these Ethernet packages.
Opkts	The number of Ethernet packets outputted through the interface.
Oerrs	The number of errors that occurred while outputting these Ethernet packages.
Collis	The number of collisions detected on the interface.
Crc	The number of cyclic redundancy check (CRC) errors detected on the interface.
%Ipkts	The percent of Ethernet packets input to the interface.
%Opkts	The percent of Ethernet packets output through the interface.

You can also monitor the network statistics of a trunk at regular intervals. The full usage of the command is nettr -stats *trunkhead* head-instance device=<qfe | ge> [interval=<time>] [type=<number>]. In the example below, the trunk is monitored once each second.

```
# /etc/opt/SUNWconn/bin/nettr -stats 0 device=qfe interval=1
Mar 30 15:38:52 1999

Name   Ipkts   Ierrs  Opkts   Oerrs  Collis  Crc    %Ipkts  %Opkts

qfe0   8        0      0        0      0       0      1.97    0.00
qfe1   2        0      0        0      0       0      0.49    0.00
qfe2   4        0      8        0      0       0      0.99    1.97
qfe3   392      0      398      0      0       0      96.55   98.03
```

You can also use the netstat(1M) command to monitor the network statistics. Refer to the netstat(1M) man page for more information.

Disabling the Sun Trunking Interface

If you need to disable a trunk for any reason, use the nettr -release *trunkhead* command, with *trunkhead* being the trunk head interface number of the trunk you want to disable.

```
# /etc/opt/SUNWconn/bin/nettr -release 0 device=qfe
```

To permanently disable the trunking interface, comment out the nettr command in the /etc/opt/SUNWconn/bin/nettr.sh file. You must reconfigure the /etc/hostname.qfe# and /etc/hosts files if you want to use the *Sun Quad FastEthernet* network interfaces separately. Refer to the *Sun Quad FastEthernet SBus Adapter Installation and User's Guide* or the *Sun Quad FastEthernet PCI Adapter Installation and User's Guide* more information.

TCP/IP Performance

Changes to the TCP/IP `ndd` values in most instances will not significantly improve performance. Beginning with Solaris 2.5.1, TCP values have been optimized and should not be changed, with the exception of `tcp_rexmit_interval_max` on Solaris 2.6.

▼ To Increase TCP/IP Performance on Solaris 2.6

If you are running your Solaris 2.6 system with a large TCP window and you experience slowdowns during high network traffic, decrease the TCP default maximum retransmission timeout interval variable (`tcp_rexmit_interval_max`) to 60000.

1. **As superuser, type:**

```
# ndd -set /dev/tcp tcp_rexmit_interval_max 60000
```

The changes are immediate and affect all the networking interfaces in the system. However, the changes are lost when you reboot your machine.

Note – You may not need to perform this workaround if you are using a smaller TCP window (for example, an 8-Kbyte or 16-Kbyte window). You can acheive better network performance by adjusting your application's data buffer size and socket buffer size to be less than or equal to 8 Kbytes. Refer to the application's documentation for instructions on how to set these buffer sizes.

---

2. **To avoid losing the TCP/IP setting at reboot, add the parameter change to a run control script in the** `/etc/rc2.d` **directory, similar to the following example:**

```
#!/sbin/sh
# Local kernel modifications
#
case "$1" in
'start')
    echo "Setting local kernel parameters...\c"
    ndd -set /dev/tcp tcp_rexmit_interval_max 60000
    echo ""
    ;;
'stop')
    echo "No kernel parameters changed."
    ;;
*)
    echo "Usage: $0 {start|stop}"
    ;;
esac
exit 0
```

Performance Tuning

To increase the size of STREAMS synchronized queues, thereby increasing performance, add `sq_max_size` to the `/etc/system` file.

```
set sq_max_size=<xxx>
```

where *<xxx>* is the maximum number of messages that are allowed for each IP queue. A safe value to set is 25 for each 64Mbytes of RAM in the system (that is, it would be a maximum of 25 for 64 Mbytes, 50 for 128 Mbytes, 100 for 256 Mbytes, and so on).

You can be more aggressive if you choose; the only potential drawback is that you can overrun STREAMS resources.

Refer to the Solaris operating environment user documentation for more information.

Troubleshooting

If you have problems with the Sun Trunking 1.2.1 software, use the following commands to gather information that may help resolve the problems.

Using the `debug` Command

Use the `nettr -debug` command to check for configuration and connection problems.

```
   # /etc/opt/SUNWconn/bin/nettr -debug
 Name Head Policy Link Speed Dup Xcvr ipg0 ipg1 ipg2 adv our lp

 qfe0  qfe0   4    Up   100   Full Intl 16   8    4    2f   2f  28
 qfe1  qfe0        Up   100   Full Intl 16   8    4    2f   2f  28
 qfe2  qfe0        Up   100   Full Intl 16   8    4    2f   2f  28
 qfe3  qfe0        Up   100   Full Intl 16   8    4    2f   2f  28
```

In this instance, there are no problems. All the links are Up, showing the speed is 100 Mbps and the Mode is Fdx (full duplex). If the speed were less than 100 on any of the interfaces or if any showed hdx (half duplex), you would use the `ndd` command to correct the speed or mode. Refer to "Setting Forced Mode," in Appendix C of the *Sun Quad FastEthernet SBus Adapter Installation and User's Guide* or the *Sun Quad FastEthernet PCI Adapter Installation and User's Guide*.

TABLE 1-5 describes the information shown by the `nettr -debug` command and lists the likely problems and their solutions.

TABLE 1-5   Output of the `nettr -debug` Command

Configuration	Definition	Problem	Solution
Name	Interface name	See footnote 1.[1]	See footnote 1.
Head	Interface name of trunk head	Wrong interface listed as the trunk head	Reconfigure using configuration instructions
Policy	Number of trunking policy: 1 is MAC, 2 is Round Robin, 3 is IP Destination, and 4 is IP Source+Destination.	Incorrect policy	Reconfigure using configuration instructions

TABLE 1-5   Output of the `nettr -debug` Command *(Continued)*

Configuration	Definition	Problem	Solution
Link	Shows whether link is Up or Down.	Link is Down	Check connection to the ethernet switch, card, and cable.
Speed	Shows speed in Mbps.	Speed is less than 100.	Configure the switch for the proper speed and use the `ndd` command to check the device status.
Duplex	Shows whether full-duplex (Full) is running.	Half-duplex (half) is running.	Configure the switch for the proper mode and use the `ndd` command to check the device status.
Xcvr	Shows whether transceiver is internal (Intl) or external.	Transceiver is external (Extl).	Sun Quad FastEthernet card is probably bad.
ipg	Shows inner packet gap value (ipg0, ipg2, ipg2).	See footnote 1.	See footnote 1.
adv	Shows the local transceiver capabilities advertised by the hardware.	See footnote 1.	See footnote 1.
our	Shows the read-only transceiver capabilities.	See footnotee 1.	See footnote 1.
lp	Shows the read-only link partner capabilities.	See footnote 1.	See footnote 1.

1. There are several problems and solutions that might occur for this field. Refer to "Setting Parameters Using the ndd Utility" in Appendix C of the *Sun Quad FastEthernet SBus Adapter Installation and User's Guide or the Sun Quad FastEthernet PCI Adapter Installation and User's Guide* for more information.

Using the `stats` Command

Use the `nettr - stats` command to check whether network packets are showing in each trunk instance. In the following example, 1 represents the trunk head instance being monitored.

```
# /etc/opt/SUNWconn/bin/nettr -stats 0 device=qfe interval=1
Mar 30 15:38:52 1999

Name   Ipkts    Ierrs  Opkts   Oerrs  Collis  Crc    %Ipkts  %Opkts

qfe0   8        0      0       0      0       0       1.97    0.00
qfe1   2        0      0       0      0       0       0.49    0.00
qfe2   4        0      8       0      0       0       0.99    1.97
qfe3   392      0      398     0      0       0      96.55   98.03
```

If you use MAC policy, you may not see packets on certain interfaces, as shown in the example. This occurs because two or more clients may have MAC addresses with the last two bits identical. See "Trunking Policies" on page 19 for more information.

Using the `snoop` Command

Use the `snoop -d` command to capture and inspect network packets. This command enables you to troubleshoot network problems at the packet level, allowing examination of the contents of a packet. The following shows example output for `qfe0`.

```
# snoop -d qfe0
Using device /dev/qfe (promiscuous mode)
  10.1.7.100 -> 10.1.7.14    ICMP Echo reply
          ? -> (multicast)  ETHER Type=0000 (LLC/802.3), size =
52 bytes
  10.1.7.100 -> 10.1.7.14    ICMP Echo reply
  10.1.7.100 -> 10.1.7.14    ICMP Echo reply
          ? -> (multicast)  ETHER Type=0000 (LLC/802.3), size =
52 bytes
  10.1.7.100 -> 10.1.7.14    ICMP Echo reply
  10.1.7.100 -> 10.1.7.14    ICMP Echo reply
          ? -> (multicast)  ETHER Type=0000 (LLC/802.3), size =
52 bytes
  10.1.7.100 -> 10.1.7.14    ICMP Echo reply
  10.1.7.100 -> 10.1.7.14    ICMP Echo reply
          ? -> (multicast)  ETHER Type=0000 (LLC/802.3), size =
52 bytes
  10.1.7.100 -> 10.1.7.14    ICMP Echo reply
  10.1.7.100 -> 10.1.7.14    ICMP Echo reply
          ? -> (multicast)  ETHER Type=0000 (LLC/802.3), size =
52 bytes
```

In this example, if there were packets meant for host name `hs4-net11`, but none showed in the output from the `snoop` command, you would know a problem existed. In that case, you would check your host file, network connect, or your Ethernet switch setup. Refer to the `snoop(1M)` man page for more information.

Using the `conf` Command

Use the `nettr -conf` command to verify your trunking configuration.

```
# nettr -conf
Name     Head        Policy DEV Type   Original-Mac-Addr

qfe0     qfe0        1      qfe-sbus    8:0:20:89:b2:30
qfe1     qfe0               qfe-sbus    8:0:20:89:b2:31
qfe2     qfe2        1      qfe-sbus    8:0:20:89:b2:32
qfe3     qfe2               qfe-sbus    8:0:20:89:b2:33
```

Make sure the ethernet switch software and the Sun Trunking 1.2.1 software are configured symmetrically. For example, both Sun Trunking and the switch should be configured with the same number of links per trunk.

Once you have configured Sun Trunking, be sure to reconfigure your switch to match the trunking configuration.

Getting Help

If you cannot resolve the problems and you have a Sun Service contract, send the information gathered from these commands to your Sun Service representative. You must have the following information ready:

- Product name and release number (Sun Trunking 1.2.1)
- Model number of your machine
- Solaris release number

Use the `showrev` command to display your operating environment release:

```
% showrev
Hostname: proboscis-11
Hostid: 8081d6ca
Release: 5.8
Kernel architecture: sun4u
Application architecture: sparc
Hardware provider: Sun_Microsystems
```

Installing Sun Trunking 1.2.1 Software for Sun GigabitEthernet Adapters

Sun Trunking 1.2.1 software provides the ability to aggregate up to two gigabit ports into a single virtual link. Once aggregated, these point-to-point links act as a single "fat pipe" to provide increased network bandwidth. For a given link, Sun Trunking 1.2.1 software enables you to incrementally add bandwidth, up to the maximum bandwidth supported by the GigabitEthernet card.

Note – On Sun Enterprise 10000 systems, running Solaris 2.5.1, there is no support for PCI Sun GigabitEthernet adapters.

Hardware and Software Requirements

Before installing the Sun Trunking 1.2.1 software, make sure your system meets the following hardware and software requirements:

Hardware and Software	Requirements
Hardware	Sun Ultra Enterprise 3x00, 4x00, 5x00, 6x00, E450 or Sun Enterprise 10000 system.
OpenBoot PROM	Revision 3.x
Software	Solaris 2.5.1, 2.6, and Solaris 7, 8

You can use any trunking-capable switch with the Sun Trunking 1.2.1 software. The switches listed in TABLE 2-1 were tested and found to work with the Sun Trunking 1.2.1 product, but must first be configured for trunking (Refer to switch manual) .

TABLE 2-1 Switches Tested to Interoperate With Sun Trunking 1.2.1 software and Sun GigabitEthernet adapters

Vendor Name	Software Revision	Model Name
Bay Networks	2.0.0 or compatible	Accelar 1200
Cabletron Systems	2.00 or compatible	SSR 2000, SSR 8000, SSR 16000
Cisco Systems	4.4 or compatible	Catalyst 4000
Extreme Networks	2.1.7 or compatible	Summit 1 and Summit 4
Foundry Networks	4.6 or compatible	FastIron II
3COM Corporation	3.0.0 or compatible	3900, 9300

Key Features

Sun Trunking 1.2.1 software implements the following key features:

- GigabitEthernet Links—The Sun GigabitEthernet 2.0 network interface card supports Sun Trunking 1.2.1. The GigabitEthernet adapter delivers scalable bandwidth with the high density of two high-speed 1000 auto-negotiating Ethernet ports.
- Load balancing—Sun Trunking 1.2.1 supports static load balancing and failure recovery capabilities within a trunk. It distributes traffic, including unicast, broadcast, and multicast traffic, across the aggregated links based on the policy selected. In the event of a link failure, Sun Trunking 1.2.1 automatically redistributes loads across the remaining links.

Note – Sun Trunking 1.2.1 load balances only the *outgoing* packets, not the incoming ones. Sun Trunking 1.2.1 software has no control over incoming packets.

- Single MAC address—Because ports aggregated with Sun Trunking 1.2.1 share a single, logical Media Access Control (MAC) address, there is no need to assign individual MAC addresses to aggregated ports.
- Additional Policies—Sun Trunking 1.2.1 includes MAC address, Round Robin, IP Destination Address, and IP Source Address/IP Destination Address policies. These policies allow you to set the load distribution path for network traffic based on policy-level parameters.

Preparing for the Software Installation

Before installing the Sun Trunking 1.2.1 software, you should have already installed either the Sun GigabitEthernet∕S or GigabitEthernet∕P adapter. Refer to either *Sun GigabitEthernet/S Adapter Installation and User's Guide* or the *Sun GigabitEthernet/P Adapter Installation and User's Guide* for those installation instructions.

▼ To Remove Previously Installed Sun Trunking Packages

If previous versions of Sun Trunking software (version 1.2 or earlier) are installed, you must remove them before installing the new Sun Trunking 1.2.1 software.

1. **Become superuser:**

```
% su
Password: password
#
```

2. **Enter the following command to see if any Sun Trunking packages are currently installed:**

```
# pkginfo | grep Trunking
```

Depending on the version installed, outputs will look like:

```
application     SUNWgetr      Sun Trunking Utility
application     SUNWgetx      Sun Trunking Man Pages

system          SUNWtrkm       Sun Trunking Man Pages
application      SUNWtrku       Sun Trunking Utility
```

3. **Enter the following command(s) to remove all existing Sun Trunking packages:**

```
# pkgrm SUNWgetr SUNWgetx
```

```
# pkgrm SUNWtrkm SUNWtrku
```

▼ To Check Previously Installed ge Packages Using pkginfo

1. Become superuser.

```
% su
Password: password
#
```

2. Check to see if any ge packages are currently installed.

```
# pkginfo | grep SUNWged
```

Note – If no package names are displayed, you can immediately install the Sun Trunking and Sun GigabitEthernet packages.

Note – For Sun Enterprise 10000 users, with ge as the primary network interface, removing the ge packages will hang the system. See your system administrator for further instructions. If you are a Sun Enterprise 10000 user and ge is not your primary interface, remove any existing ge packages, and continue to "Installing the Sun Trunking 1.2.1 Software".

If previous versions of ge are installed, the package names are displayed as follows:

```
SUNWged     Sun Gigabit Ethernet Adapter Driver
SUNWgedm    Sun Gigabit Ethernet Adapter Driver Man Pages
SUNWgedu    Sun Gigabit Ethernet Adapter Driver Headers
```

3. **Check to see if the existing version is 2.0 or higher:**

```
# pkginfo -l SUNWged |grep VERSION
example of Solaris 7 output: VERSION:   2.0,REV=5.7.98.09.01
```

If the version number is 2.0 or higher, continue to Step 4. If the version number is earlier than 2.0, non-Sun Enterprise 10000 users will need to remove all existing ge packages.

For example on the Solaris 2.5.1 operating environment:

```
# pkgrm SUNWged SUNWgedu
```

4. **Use the** showrev **command to see if the latest** ge **patches are installed.**

If the following patches (or more recent versions) are present, proceed with the Sun Trunking 1.2.1 software installation. If the patch version is less than indicated below, install the ge patches as described in the next section.

For Solaris 2.5.1 operating environment:

```
# showrev -p | grep 106745
```

The correct version is 106745-05 or higher.

For Solaris 2.6 operating environment:

```
# showrev -p | grep 106764
```

The correct version is 106764-05 or higher.

For Solaris 7 operating environment:

```
# showrev -p | grep 106765
```

The correct version is 106765-05 or higher.

For Solaris 8 operating environment:

```
# showrev -p | grep 108813
```

The correct version is 108813-01 or higher.

Installing the Sun Trunking 1.2.1 Software

Before installing the Sun Trunking 1.2.1 software, you must first install the appropriate `ge` patches for your system.

Note – If any of the following Sun GigabitEthernet patches (106745-05, 106764-05, 106765-05, or 108813-01) or later are already installed on your system, skip the `ge` patch installation. You only need to install the Sun Trunking 1.2.1 software packages.

▼ To Install the `ge` Patches

1. **At the system console, become superuser (root).**

2. **Place the Sun Trunking 1.2.1 CD in the CD-ROM drive.**

3. **Mount the CD-ROM on a local directory.**

   If the Volume Manager (vold) is running on your machine, then the CD-ROM is mounted automatically under `/cdrom/cdrom0` directory.

   If the Volume Manager (vold) is not running on your machine, create a directory called `/cdrom/cdrom0` and mount the CD-ROM manually.

   ```
   # mkdir /cdrom/cdrom0
   # mount -F hsfs -o ro /dev/dsk/c0t6d0s2 /cdrom/cdrom0
   ```

   For detailed instructions on how to load software from a CD-ROM drive mounted on a remote directory, see the *Solaris Software and Answer Book Packages Administrative Guide.*

4. **Install the Sun GigabitEthernet patches if you do not already have the most recent patches installed on your system.**

- If your system is running Solaris 2.5.1, install the Sun Gigabit Ethernet software patch required for the Solaris 2.5.1 operating environment:

```
# cd /cdrom/cdrom0/Solaris_2.5.1/GigabitEthernet/Patches/106745-
05
# ./installpatch .
```

A message similar to the following is displayed to indicate that patch number 106745-05 has been successfully installed:

```
Patch packages installed:
   SUNWged
```

- If your system is running Solaris 2.6, install the Sun Gigabit Ethernet software patch required for the Solaris 2.6 operating environment:

```
# cd /cdrom/cdrom0/Solaris_2.6/GigabitEthernet/Patches/106764-05
# ./installpatch .
```

A message similar to the following is displayed to indicate that patch number 106764-05 has been successfully installed:

```
Patch packages installed:
   SUNWged
```

- If your system is running the Solaris 7 operating environment, install the Sun Gigabit Ethernet software patch required for the Solaris 7 operating environment:

```
# patchadd /cdrom/cdrom0/Solaris_7/GigabitEthernet/Patches/
106765-05
```

A message similar to the following is displayed to indicate that patch number 106765-05 has been successfully installed:

```
Patch packages installed:
   SUNWged
```

■ If your system is running the Solaris 8 operating environment, install the Sun GigabitEthernet software patch required for the Solaris 8 operating environment:

```
# patchadd /cdrom/cdrom0/Solaris_8/GigabitEthernet/Patches/
108813-01
```

A message similar to the following is displayed to indicate that patch number 108813-01 has been successfully installed:

```
Patch packages installed:
   SUNWged
```

▼ To Install the ge Packages

Note – If no ge packages exist on your system, follow these procedures for installing the Sun Trunking software packages. If you already have the correct patch version installed on your machine, skip to the next section, "Installing the Sun Trunking Software" packages.

Note – For Sun Enterprise 10000 users, with ge as your primary network interface, removing the ge packages will hang the system. See your system administrator for further instructions. If you are an Sun Enterprise 10000 user and ge is not your primary interface, remove any existing ge packages, and continue to "Installing the Sun Trunking 1.2.1 Software".

1. **At the system console, become superuser (root).**

2. **Place the Sun Trunking 1.2.1 CD in the CD-ROM drive.**

3. **Mount the CD-ROM on a local directory.**

   If the Volume Manager (vold) is running on your machine, then the CD-ROM is mounted automatically under /cdrom/cdrom0 directory.

   If the Volume Manager (vold) is not running on your machine, create a directory called /cdrom/cdrom0 and mount the CD-ROM manually.

   ```
   # mkdir /cdrom/cdrom0
   # mount -F hsfs -o ro /dev/dsk/c0t6d0s2 /cdrom/cdrom0
   ```

   For detailed instructions on how to load software from a CD-ROM drive, mounted on a remote directory, see the *Solaris Software and Answer Book Packages Administrative Guide.*

4. **Install the Sun GigabitEthernet packages if you do not already have any** ge **packages on your system.**

   ■ If your system is running Solaris 2.5.1, install the Sun GigabitEthernet software packages required for the Solaris 2.5.1 operating environment:

   ```
   # pkgadd -d /cdrom/cdrom0/Solaris_2.5.1/GigabitEthernet/Packages
   ```

   A message similar to the following is displayed to indicate the available packages:

   ```
   1  SUNWged      Sun Gigabit Ethernet Adapter Driver
                   (sparc) 2.0,REV=5.5.1.98.09.01
   2  SUNWgedm     Sun Gigabit Ethernet Adapter Driver Man Pages
                   (sparc) 2.0,REV=5.5.1.98.09.01
   3  SUNWgedu     Sun Gigabit Ethernet Adapter Driver Headers
                   (sparc) 2.0,REV=5.5.1.98.09.01
   ```

   Type all and press Return to install all the software packages.

   ■ If your system is running Solaris 2.6 install the Sun GigabitEthernet software packages required for the Solaris 2.6 operating environment:

   ```
   # pkgadd -d /cdrom/cdrom0/Solaris_2.6/GigabitEthernet/Packages
   ```

A message similar to the following is displayed to indicate the available packages:

```
1   SUNWged       Sun Gigabit Ethernet Adapter Driver
                  (sparc) 2.0,REV=5.6.98.09.01
2   SUNWgedm      Sun Gigabit Ethernet Adapter Driver Man Pages
                  (sparc) 2.0,REV=5.6.98.09.01
3   SUNWgedu      Sun Gigabit Ethernet Adapter Driver Headers
                  (sparc) 2.0,REV=5.6.98.09.01
```

Type `all` and press Return to install all the software packages.

■ If your system is running Solaris 7 install the Sun GigabitEthernet software
   packages required for the Solaris 7 operating environment:

```
# pkgadd -d /cdrom/cdom0/Solaris_7/GigabitEthernet/Packages
```

A message similar to the following is displayed to indicate the available packages:

```
1   SUNWged       Sun Gigabit Ethernet Adapter Driver
                  (sparc) 2.0,REV=5.7.98.09.01
2   SUNWgedm      Sun Gigabit Ethernet Adapter Driver Man Pages
                  (sparc) 2.0,REV=5.7.98.09.01
3   SUNWgedu      Sun Gigabit Ethernet Adapter Driver Headers
                  (sparc) 2.0,REV=5.7.98.09.01
```

Type `all` and press Return to install all the software packages.

■ If your system is running Solaris 8 install the Sun GigabitEthernet software
   packages required for the Solaris 8 operating environment:

```
# pkgadd -d /cdrom/cdom0/Solaris_8/GigabitEthernet/Packages
```

A message similar to the following is displayed to indicate the available packages:

```
   1   SUNWged       Sun Gigabit Ethernet Adapter Driver
                     (sparc) 3.0,REV=5.8.1999.11.16
   2   SUNWgedm      Sun Gigabit Ethernet Adapter Driver Man Pages
                     (sparc) 3.0,REV=5.8.1999.11.16
   3   SUNWgedu      Sun Gigabit Ethernet Adapter Driver Headers
                     (sparc) 3.0,REV=5.8.1999.11.16
```

Type `all` and press Return to install all the software packages.

▼ To Install the Sun Trunking Software Packages

1. **At the system console, become superuser (root).**

2. **Place the Sun Trunking 1.2.1 CD in the CD-ROM drive.**

3. **Mount the CD-ROM on a local directory.**

   If the Volume Manager (vold) is running on your machine, then the CD-ROM is mounted automatically under /cdrom/cdrom0 directory.

   If the Volume Manager (vold) is not running on your machine, create a directory called /cdrom/cdrom0 and mount the CD-ROM manually.

```
# mkdir /cdrom/cdrom0
# mount -F hsfs -o ro /dev/dsk/c0t6d0s2 /cdrom/cdrom0
```

   For detailed instructions on how to load software from a CD-ROM drive mounting on a remote directory, see the *Solaris Software and Answer Book Packages Administrative Guide.*

■ To install the Sun Trunking 1.2.1 software packages for the Solaris 2.5.1 operating environment:

```
# pkgadd -d /cdrom/cdrom0/Solaris_2.5.1/Trunking/Packages
```

A message similar to the following is displayed to indicate the available packages:

```
1   SUNWtrkm      Sun Trunking Man Pages
                    (sparc) 1.2.1,REV=5.5.1.00.02.11
2   SUNWtrku      Sun Trunking Utility
                    (sparc) 1.2.1,REV=5.5.1.00.02.11
```

Type all and press Return to install all the software packages.

■ To install the Sun Trunking 1.2.1 software packages for the Solaris 2.6 operating environment:

```
# pkgadd -d /cdrom/cdrom0/Solaris_2.6/Trunking/Packages
```

A message similar to the following is displayed to indicate the available packages:

```
1 SUNWtrkm      Sun Trunking Man Pages
                  (sparc) 1.2.1,REV=5.6.00.02.11
2 SUNWtrku      Sun Trunking Utility
                  (sparc) 1.2.1,REV=5.6.00.02.11
```

Type all and press Return to install all the software packages.

■ To install the Sun Trunking 1.2.1 software packages for the Solaris 7 operating environment:

```
# pkgadd -d /cdrom/cdrom0/Solaris_7/Trunking/Packages
```

A message similar to the following is displayed to indicate the available packages:

```
1 SUNWtrkm       Sun Trunking Man Pages
                 (sparc) 1.2.1,REV=5.7.00.02.11
2 SUNWtrku       Sun Trunking Utility
                 (sparc) 1.2.1,REV=5.7.00.02.11
```

Type all and press Return to install all the software packages.

■ To install the Sun Trunking 1.2.1 software packages for the Solaris 8 operating
  environment:

```
# pkgadd -d /cdrom/cdrom0/Solaris_8/Trunking/Packages
```

A message similar to the following is displayed to indicate the available packages:

```
1 SUNWtrkm       Sun Trunking Man Pages
                 (sparc) 1.2.1,REV=5.8.2000.02.11
2 SUNWtrku       Sun Trunking Utility
                 (sparc) 1.2.1,REV=5.8.2000.02.11
```

Type all and press Return to install all the software packages.

4. **After the installation is complete, verify that the Sun Trunking 1.2.1 software
   packages have been installed.**

```
# pkginfo | grep SUNWtrk
```

The following packages should be displayed:

```
system   SUNWtrku      Sun Trunking Utility
system   SUNWtrkm      Sun Trunking Man Pages
```

5. **Add** /etc/opt/SUNWconn/bin **to your** $PATH **variable and**
   /opt/SUNWconn/man **to your** $MANPATH **variable.**

   The Sun Trunking 1.2.1 software is now installed. Before rebooting your system,
   however, you must configure the Sun Trunking software files as described in the
   next section.

Configuring the Sun Trunking Software

Before rebooting your system, you must edit and create configuration files to define how you will link the GigabitEthernet network interfaces. To configure these files, you need to know the following for each GigabitEthernet adapter:

■ The device instance numbers of each GigabitEthernet network interface.
■ The device instance number for each trunk (optional).
■ The trunking policy you want to use: MAC, Round Robin, IP Destination, or IP Source/IP Destination. (See "Trunking Policies" on page 64.)

Note – All procedures described throughout this document can be applied to both PCI and SBus adapters, unless specified.

Checking for Link Mode

Always check to be sure the link mode is set to run full-duplex.

Use the `nettr -debug` or the `ndd` command to verify link mode. If the information returned indicates that your trunking device is not running at full-duplex, refer to "Defining the Current Status" in your *Sun GigabitEthernet Adapter User's Guide* for information on setting the link mode.

Booting from the Network

Once you have installed `ge` and connected the `ge` interfaces to a switch that is configured for trunking, you cannot use the `ge` interfaces to boot from the network.

Determining Instance Numbers

Each GigabitEthernet adapter has a network interface. You will need to know the device instance numbers for each network interface before you can configure the Sun Trunking software files. FIGURE 2-1 shows the GigabitEthernet network interface of the GigabitEthernet/S adapter.
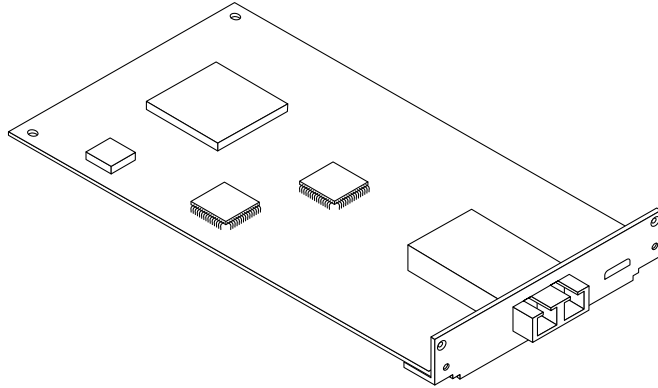
FIGURE 2-1   Network Interface for the Sun GigabitEthernet/S Adapter

You can find the instance numbers in two ways: by searching the `/etc/path_to_inst` file or by typing `nettr -conf` in the `/etc/opt/SUNWconn/bin` directory.

Both files contain the physical name, the instance number, and driver name for each device on the system. By searching this file for GigabitEthernet (`ge`) devices, you can find the instance numbers that will be used with the Sun Trunking 1.2.1 software.

Using the `grep` command, search the `path_to_inst` file for all of the `ge` devices on your system:

```
# grep ge /etc/path_to_inst
"/pci@1f,4000/network@2" 0 "ge"
"/pci@1f,4000/network@4" 1 "ge"
```

In the example above, instances `0` and `1` are GigabitEthernet adapters. TABLE 2-2 lists the network interface number, physical name, and instance number for each GigabitEthernet instance on this example system.

TABLE 2-2   Example GigabitEthernet Instance Numbers

Network Interface Number	Device Name	Instance Number
0	/pci@1f,4000/network@2	0
1	/pci@1f,4000/network@4	1

To use the `nettr -conf` command, you must be in the `/etc/opt/SUNWconn/bin` directory. If you added `/etc/opt/SUNWconn/bin` to your search path, you will not need to change directories.

```
# cd /etc/opt/SUNWconn/bin
/etc/opt/SUNWconn/bin
# nettr -conf
Name      Head         Policy  DEV Type    Original-Mac-Addr

ge0       non-trunk            ge-pci      8:0:20:8d:2f:ff
ge1       non-trunk            ge-pci      8:0:20:80:1:d2
```

You will need to know the instance numbers of the GigabitEthernet network interfaces in order to configure the Sun Trunking software.

Note – You cannot trunk an interface that is already plumbed. To display a list of all plumbed interfaces, execute the `ifconfig -a` command .

Accessing Trunk Members

Trunk members can be accessed only through the trunk head. Use the `ifconfig` command to determine your trunk head.

For example, you cannot do a DLPI attach on a non-head member. The following error message was returned for a `snoop` command for a non-head member:

```
# snoop -d ge1
dlattachreq:  DL_ERROR_ACK:  dl_errno 8 unix_errno 0
```

In this example, `ge1` is a member of a trunk. The trunk head for that trunk is `ge0`. To use the `snoop` command, for example, in such a case, the following would be the correct usage:

```
# snoop -d ge0
Using device /dev/ge (promiscuous mode)
        ? -> (multicast)  ETHER Type=0C34 (Unknown), size = 52 bytes
        ? -> (multicast)  ETHER Type=0C34 (Unknown), size = 52 bytes
        ? -> (multicast)  ETHER Type=0C34 (Unknown), size = 52 bytes
        ? -> (multicast)  ETHER Type=0C34 (Unknown), size = 52 bytes
```

Number of Links per GigabitEthernet Adapter

The two network interfaces of the GigabitEthernet (`ge`) adapter can be linked as follows.
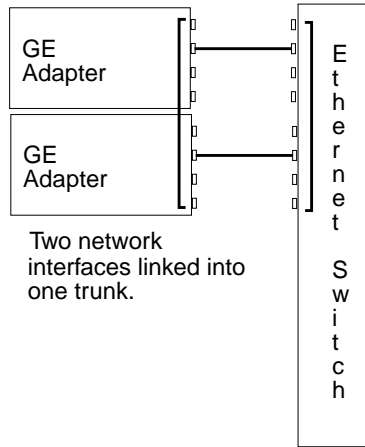
FIGURE 2-2   GigabitEthernet Trunking Network Configuration Example

The configuration of the Sun Trunking 1.2.1 software files depends on how you want to organize the Ethernet network. You must also configure the Ethernet switch software to be symmetrical with how you configured the Sun Trunking 1.2.1 software. Refer to your Ethernet switch documentation for the switch configuration instructions.

`local-mac-address` Property

The network interface of the Sun GigabitEthernet adapter has been assigned a unique Media Access Control (MAC) address, which represents the 48-bit Ethernet address for that network interface. The OpenBoot firmware reports this MAC address via the `local-mac-address` property in the device nodes corresponding to the network interfaces.

A system is not obligated to use this assigned MAC address if it has a system-wide MAC address. In such cases, the system-wide MAC address applies to all network interfaces on the system.

The device driver, or any other adapter utility, can use the network device's MAC address (`local-mac-address`) while configuring it. In the Solaris 2.6 and later operating system, you can use a network device's MAC address when booting over the network.

The `mac-address` property of the network device specifies the network address (system-wide or `local-mac-address`) used for booting the system. To start using the MAC addresses assigned to the network interface of the Sun GigabitEthernet adapter, set the NVRAM configuration variable `local-mac-address?` to `true`.

```
ok setenv local-mac-address? true
```

Client machines with multiple interfaces that communicate with the trunked machine should also set `local-mac-address` to `true`.

Configuring the Sun Trunking 1.2.1 Software Files

After locating the instance numbers of the GigabitEthernet network interfaces, and deciding how you want to organize your network, you can begin to configure the Sun Trunking 1.2.1 software.

Trunking Policies

The four supported trunking policies used in the Sun Trunking 1.2.1 software are MAC, Round Robin, IP Destination, and IP Source+Destination. With these policies, if a link fails, the traffic goes to the next available link. The policies are defined below.

MAC

- Is the default policy used by the Sun Trunking 1.2.1 software. MAC is the preferred policy to use with switches. Most trunking-capable switches require using the MAC-hashing policy, but check your switch documentation.
- Uses the last three bits of the MAC address of both the source and destination. For two ports, the MAC address of the source and destination are first XORed: Result = 00, 01, which selects the port.
- Favors a large population of clients. For example, this ensures that 50 percent of the client connections will go through one of two ports in a two-port trunk.

- Is required by most trunking-capable switches.

Note – Do not use MAC-hashing for connecting two servers back to back.

Round Robin

- Round Robin is the preferred policy with a Back to Back connection, used between the output of a transmitting device, and the input of an associated receiving device.
- Uses each network interface of the trunk in turn, as a method of distributing packets over the assigned number of trunking interfaces.
- May have an impact on performance since the temporal ordering of packets is not observed.

IP Destination Address

- Uses the four bytes of the IP Destination address to determine the transmission path.
- If a trunking interface host has one IP source address, and it is necessary to communicate to multiple IP clients connected to the same router, then the IP Destination Address policy is the preferred policy to use.

IP Source Address/IP Destination Address

- Connects the source server to the destination, based on where the connection originated or terminated.
- Uses the four bytes of the source and destination IP addresses to determine the transmission path.

  The primary use of the IP Source/IP Destination Address policy occurs where you use the IP virtual address feature to give multiple IP addresses to a single physical interface. For example, you might have a cluster of servers providing network services, in which each service is associated with a virtual IP address over a given interface. If a service associated with an interface fails, the virtual IP address migrates to a physical interface on a different machine in the cluster. In such an arrangement, the IP Source Address/IP Destination Address policy gives you a greater chance of using more, different links within the trunk than would the IP Destination Address policy.

The `-hash` option to the `nettr` (1M) command enables you to determine over which link a given packet will travel. The following section describes hashing in greater detail.

▼ To Edit the `nettr.sh` File

The main configuration file of the Sun Trunking 1.2.1 software is the `/etc/opt/SUNWconn/bin/nettr.sh` file. You will define each trunk by adding commands to this file. Before you edit the `nettr.sh` file, you need to know how many GigabitEthernet network interfaces you want to link into a trunk, the first instance number of each trunk (also called the "trunk head"), and the trunking policy you want to use.

● **Using a text editor, add commands to the** `nettr.sh` **file to define your trunking network.**

In the `nettr.sh` file, add lines containing the `nettr` command to define the trunked network. The format of this command is:

```
nettr -setup head-instance device=<qfe | ge>
                              members=<instance,instance,.,.>
                              [ policy=<number> ]
```

In the command above, the head instance is the instance number of the first linked network interface of the trunk. The device represents the adapter type (`qfe` for a Quad FastEthernet adapter or `ge` for GigabitEthernet adapter). The member option is used to select members of a trunk. The `policy` option can either be the default value of 1 for MAC or 2 for round robin, 3 for IP Destination, or 4 for IP Source/IP Destination. If you wanted to use the MAC trunking policy and 2 links for a trunk, you would only need to add the following line to the `nettr.sh` file:

```
nettr -setup 0 device=ge policy=1 members=0,1
```

If you check the output that results from executing the `nettr -conf` command after executing `nettr -setup` commands, it will be similar to the following:

```
# nettr -conf
Name     Head      Policy DEV Type   Original-Mac-Addr

ge0      ge0       1      ge-pci     8:0:20:8d:2f:ff
ge1      ge0              ge-pci     8:0:20:80:1:d2
```

- For one trunk containing both network interfaces and using the default MAC trunking policy (policy 1), you would need to add this line to the `nettr.sh` file:

```
nettr -setup 0 device=ge policy=1 members=0,1
```

To verify whether you have set up the trunking configuration file correctly, invoke the `nettr -run` command. You should see information similar to the following:

```
# nettr -run
Configuring Sun Trunking devices

ge trunk members:
    ge0 (head)
    ge1
```

Then, execute the `nettr -conf` command to check the configuration.

```
# nettr -conf
Name     Head      Policy DEV Type   Original-Mac-Addr

ge0      ge0       1      ge-pci      8:0:20:8d:2f:ff
ge1      ge0              ge-pci      8:0:20:80:1:d2
```

- For one trunk containing both network interfaces and using the Round Robin trunking policy (policy 2), you would only need to add this line to the `nettr.sh` file:

```
nettr -setup 0 device=ge policy=2 members=0,1
```

To verify whether you have set up the trunking configuration file correctly, invoke the `nettr -run` command. You should see information similar to the following:

```
# nettr -run
Configuring Sun Trunking devices

ge trunk members:
    ge0 (head)
    ge1
```

After editing the Sun Trunking 1.2.1 software files, execute the `nettr -conf` command again.

```
# nettr -conf
Name      Head       Policy DEV Type   Original-Mac-Addr

ge0       ge0        2      ge-pci      8:0:20:8d:2f:ff
ge1       ge0               ge-pci      8:0:20:80:1:d2
```

■ For two trunks, containing two network interfaces each using the MAC policy, you would add these two lines:

```
nettr -setup 0 device=ge policy=1 members=0,1
nettr -setup 2 device=ge policy=1 members=2,3
```

To verify whether you have set up the trunking configuration file correctly, run the `nettr -run` command. You should see information similar to the following:

```
# nettr -run
Configuring Sun Trunking devices

ge trunk members:
    ge0 (head)
    ge1

ge trunk members:
    ge2 (head)
    ge3
```

Then, execute the `nettr -conf` command to check the configuration.

```
# nettr -conf
Name      Head      Policy DEV Type   Original-Mac-Addr

ge0       ge0       1      ge-pci     8:0:20:89:b2:30
ge1       ge0              ge-pci     8:0:20:89:b2:31
ge2       ge0       1      ge-pci     8:0:20:89:b2:32
ge3       ge0              ge-pci     8:0:20:89:b2:33
```

■ For one trunk, containing two network interfaces and using the round robin policy, you would add this line:

```
nettr -setup 0 device=ge policy=2 members=0,1
```

To verify whether you have set up the trunking configuration file correctly, invoke the `nettr -run` command. You should see information similar to the following:

```
# nettr -run
Configuring Sun Trunking devices

ge trunk members:
    ge0 (head)
    ge1
```

Then, execute the `nettr -conf` command to check the configuration.

```
# nettr -conf
Name      Head      Policy DEV Type   Original-Mac-Addr

ge0       ge0       2      ge-pci     8:0:20:89:b2:30
ge1       ge0              ge-pci     8:0:20:89:b2:31
```

■ For one trunk, containing two network interfaces each using the IP Destination policy, you would add these two lines:

```
nettr -setup 0 device=ge policy=3 members=0,1
```

To verify whether you have set up the trunking configuration file correctly, invoke the `nettr -run` command. You should see information similar to the following:

```
# nettr -run
Configuring Sun Trunking devices

ge trunk members:
    ge0 (head)
    ge1
```

Then, execute the `nettr -conf` command to check the configuration.

```
# nettr -conf

Name     Head   Policy   DEV Type    Original-Mac-Addr

ge0    ge0      3         ge-pci     8:0:20:8d:5a:a5
ge1    ge0                ge-pci     8:0:20:8d:5a:a6
ge2    non-trunk          ge-pci     8:0:20:8d:5a:a7
ge3    non-trunk          ge-pci     8:0:20:8d:5a:a8
```

■ For one trunk, containing two network interfaces each using the IP Source/IP Destination policy, you would add these two lines:

```
nettr -setup 0 device=ge policy=4 members=0,1
```

To verify whether you have set up the trunking configuration file correctly, invoke the `nettr -run` command. You should see information similar to the following:

```
# nettr -run
Configuring Sun Trunking devices

ge trunk members:
    ge0 (head)
    ge1
```

Then, execute the `nettr -conf` command to check the configuration.

```
# nettr -conf

Name   Head      Policy    DEV Type   Original-Mac-Addr

ge0    ge0       4         ge-pci     8:0:20:8d:5a:a5
ge1    ge0                 ge-pci     8:0:20:8d:5a:a6
ge2    non-trunk           ge-pci     8:0:20:8d:5a:a7
ge3    non-trunk           ge-pci     8:0:20:8d:5a:a8
```

▼ To Use the Hashing Feature

Note – Trunking interfaces must be set up prior to using hashing features. If, for example, on one trunk, the link to transmit is 1, with the following hash command input, the policy IP Source and Destination Address would read as follows:

```
# /etc/opt/SUNWconn/bin/nettr -hash 0 device=ge ip=199.100.1.29/
199.100.1.3

Name  Head  Policy  Source Address   Dest Address    Link to Transmit
ge0   ge0   4       199.100.1.29     199.100.1.3     0
```

Note – The `-hash` option to the `nettr` (1M) command enables you to determine over which link a given packet will travel. For example, if you use the Destination IP Address policy, you can supply an IP address to a `nettr -hash` command to determine over which link a packet with the specified IP address will travel.

▼ To Configure the GigabitEthernet Host Files

Before you can use these trunked Ethernet network interfaces, you must create an `/etc/hostname.ge#` file, and add an entry in the `/etc/hosts` file for each trunk.

1. **For each trunk, create a** `/etc/hostname.ge#` **file, where** # **corresponds to the instance number used as the trunk head.**

   For example, if you had two trunks using two network interfaces each, you would have to create two files containing the host name of the trunk as seen by network. The extensions of these files would have to correspond with the trunk head interface numbers of the trunks.

   TABLE 2-3   Example `hostname.ge#` Files

Filename	Trunk Head Instance Number	GigabitEthernet Adapter Network Interfaces Used in the Trunk[1]
`/etc/hostname.ge0`	0	0, 1
`/etc/hostname.ge2`	2	2, 3

   [1] See FIGURE 2-1 on page 61 for more information.

   - The `/etc/hostname.ge#` file must contain an appropriate host name for the trunk.
   - The host name should be different from any other host name of any other interface, for example: `/etc/hostname.ge0` and `/etc/hostname.ge2` cannot share the same host name.
   - The host name should have an IP address that is entered in the `/etc/hosts` file (see Step 2).

   Using the example trunk head instance numbers in TABLE 2-3, the following example shows the three `/etc/hostname.ge#` files required for a system called `proboscis`, which has an onboard GigabitEthernet device (`proboscis`), and two trunks (`proboscis-11`, `proboscis-12`).

   ```
   # cat /etc/hostname.hme0
   proboscis
   # cat /etc/hostname.ge0
   proboscis-11
   # cat /etc/hostname.ge2
   proboscis-12
   ```

   Note – Only trunk *heads* are visible.

2. **Create an appropriate entry in the** `/etc/hosts` **file for each trunk.**

Using the example from Step 1, you would have:

```
# cat /etc/hosts
#
# Internet host table
#
127.0.0.1      localhost
129.144.10.57 proboscisloghost
129.144.11.83 proboscis-11
129.144.12.41 proboscis-12
```

Note – Make sure you configure the switch software to be symmetrical with the Sun Trunking 1.2.1 software. Refer to your Ethernet switch documentation for instructions.

3. **Setup the** `ge` **adapter using the** `ifconfig` **command, where** *ip_address* **corresponds to the system IP address to use the adapter without rebooting.**

```
# ifconfig ge0 plumb
# ifconfig ge0 ip_address up
```

Create an entry in the `/etc/hosts` file for each active `ge` interface.

The following example shows the `/etc/hosts` file.

```
# cat /etc/hosts
#
# Internet host table
#
127.0.0.1      localhost
129.144.10.57 proboscis loghost
129.144.11.83 proboscis-11
```

Note – Make sure you configure the switch software to be symmetrical with the Sun Trunking 1.2.1 software. Refer to your Ethernet switch documentation for instructions.

▼ To Activate the Trunked Networks Without `ifconfig`

If you do not use `ifconfig`, you will need to reboot your system to make these trunked networks active. If you did use the previous `ifconfig` instructions, you can ignore this section.

1. Shut down your system.

```
# sync
# init 0
Shutdown messages.
```

2. Set `local-mac-address` **to** `true`.

```
ok setenv local-mac-address? true
```

3. Perform a reconfiguration boot.

```
ok boot -r
```

Installing the Adapter with Dynamic Reconfiguration (DR)

Note – If you are using Solaris 2.6 Hardware: 5/98, 11/98, or Solaris 7, 8 and you are using an SBus adapter, you may be able to install the adapter with Dynamic Reconfiguration (DR). Otherwise, you can not use DR.

If you have a Sun Enterprise 6x00,5x00, 4x00, or 3x00 system that supports Dynamic Reconfiguration (DR), you do not have to reboot your system. The process of adding and configuring an adapter with DR involves (1) connecting the attachment point and (2) configuring its occupant. In most cases, the `cfgadm(1M)` command can perform both steps at once.

▼ To Install a Sun GigabitEthernet Adapter on non-Sun Enterprise 10000 Systems

1. **If trunking software is already in use, run the** `nettr -release` **command to unconfigure it. Before you run the following command, unplumb the interface if not already unplumbed.**

```
# nettr -release head-instance device=ge
```

2. **Verify that the trunking software has been released.**

```
# ifconfig -a
```

3. **Verify that the selected board slot is ready for the adapter.**

```
# cfgadm
```

The states and conditions should be:
- Receptacle state—Empty
- Occupant state—Unconfigured
- Condition—Unknown

or

- Receptacle state—Disconnected
- Occupant state—Unconfigured
- Condition—Unknown

4. **If the status of the slot is not empty or disconnected, enter:**

```
# cfgadm -c disconnect sysctrl#:slot#
```

5. **Physically insert the adapter into the slot and look for an acknowledgment on the console, such as, "name board inserted into slot3."**

After an I/O board is inserted, the states and conditions should become:
- Receptacle state—Disconnected
- Occupant state—Unconfigured
- Condition—Unknown

Any other states or conditions should be considered an error.

6. **Connect any peripheral cables and interface modules to the adapter.**

7. **Configure the board with the command:**

```
# cfgadm -v -c configure sysctrl#:slot#
```

This command should both connect and configure the receptacle. Verify with the cfgadm command.

The states and conditions for a connected and configured attachment point should be:

- Receptacle state—Connected
- Occupant state—Configured
- Condition—OK

Now the system is also aware of the usable devices which reside on the adapter and all devices may be mounted or configured to be used.

If the command fails to connect and configure the adapter and slot (the status should be shown as configured and ok), do the connection and configuration as separate steps:

a. **Connect the adapter and slot by entering:**

```
# cfgadm -v -c connect sysctrl#:slot#
```

The states and conditions for a connected attachment point should be:

- Receptacle state—Connected
- Occupant state—Unconfigured
- Condition—OK

Now the system is aware of the adapter, but not the usable devices which reside on the adapter. Temperature is monitored and power and cooling affect the attachment point condition.

b. **Configure the adapter and slot by entering:**

```
# cfgadm -v -c configure sysctrl#:slot#
```

The states and conditions for a configured attachment point should be:

- Receptacle state—Connected
- Occupant state—Configured
- Condition—OK

Now the system is also aware of the usable devices which reside on the adapter and all devices may be mounted or configured to be used.

8. **Run the** `nettr -run` **command to verify the connection.**

```
# nettr -run
```

9. **Reconfigure the devices on the adapter by entering:**

```
# drvconfig; devlinks; disks; ports; tapes; ucblinks;
```

The console should display a list of devices and their addresses.

Note – Refer to your system user's guide or the Sun GigabitEthernet documentation for further instructions.

▼ To Install the Sun GigabitEthernet Adapter on Sun Enterprise 10000 Systems

Note – Once the system board is attached you do not have to reboot your system.

1. **If trunking software is already in use, run the** `nettr -release` **command to unconfigure it. Before you run the following command, unplumb the interface.**

```
# nettr -release head-instance device=ge
```

2. **Verify that the trunking software has been released.**

```
# ifconfig -a
# nettr -conf (For the above head-instance, trunking has not been
configured.)
```

3. **Drain and detach the desired system board. Based on the version of the Solaris operating environment running on the domain, refer to the** *Sun Enterprise 10000 Dynamic Reconfiguration User's Guide* **for configuration and detaching instructions.**

4. **From the SSP, power off the system board the adapter is to be installed on.**

```
xf9-ssp:domain_name% power -off -sb <system_board_number>
```

5. **Remove system board and install adapter and connect cables.**

6. **Reinstall system board back to original location.**

7. **From the SSP, power on the system board.**

```
xf9-ssp:domain_name% power -on -sb <system_board_number>
```

8. **Initiate and complete the attaching of the system board. Based on the Solaris version the domain is running, refer to the** *Sun Enterprise 10000 Dynamic Reconfiguration User's Guide* **for configuration and attaching instructions.**

9. **If this is the first time a** ge **has been installed in this slot, reconfigure the domain:**

```
# drvconfig; devlinks;
```

10. **Verify the** ge **is configured into the domain:**

```
# grep ge /etc/path_to_inst
```

A list of ge instances will be displayed based on the system board, SBus, and slot location.

11. **If this adapter replaced an existing adapter and is part of a trunk, run the** nettr -run **command to verify the connection.**

```
# nettr -run
```

Note – Refer to your system's user guide or Sun GigabitEthernet documentation for further instructions.

Using Sun Trunking 1.2.1 Software on Sun Enterprise 10000 with Alternate Pathing 2.3

Note – Alternate Pathing (AP) does not support Sun Trunking 1.2.1 software for Solaris 2.5.1.

Note – Alternate Pathing (AP) allows for two trunks to be put under AP control, but only physical devices can be trunked.

The process of setting up Sun Trunking and creating AP meta-network interfaces involves:

- defining trunking configuration
- selecting network interfaces for a trunked network pathgroup
- creating a trunked network pathgroup and AP meta-network
- creating the hostname file for a AP meta-network and
- bringing up the AP meta-network.

Refer to *"Configuring the Sun Trunking Software" on page 60* of your *Sun Trunking™ 1.2.1 Installation and User's Guide* and the *Sun Enterprise Server Alternate Pathing User's Guide* for more information. The following procedures assume that the AP database has been created and the trunks involved are non-primary network interfaces. To use AP on the primary interface, refer to "Alternately Pathing the Primary Network Interface" chapter in the *Sun Enterprise Server Alternate Pathing User's Guide.*

▼ To Configure Sun Trunking and AP Network `pathgroup`

Note – When setting up a trunk for use with AP and DR, the trunk must be defined so that all trunk members are on the same system board.

1. **Edit the trunking configuration file** `/etc/opt/SUNWconn/bin/nettr.sh`.

   Before you edit the `nettr.sh` file, you need to know how you want to configure a trunk group. For one trunk containing both network interfaces and using the default MAC trunking policy on `ge` devices with trunk head of 0, you would add this line to the `nettr.sh` file:

   ```
   # nettr -setup 0 device=ge policy=1 members=0,1
   ```

2. **Select the two physical network interfaces for a network pathgroup that you will be creating later.**

   One of these two network interfaces should be a trunk head instance of a trunk group. For instance, `ge0` from the above example may be used as part of a network pathgroup and you may choose `ge4` as another alternate network device. Then you need to decide if you want the other alternate, `ge4` in this example, to be defined as trunking as well. If `ge4` will not be setup as a trunk, you don't have to modify the `nettr.sh` file. To setup a trunk with `ge4` as the trunk head, you would append this line to the `nettr.sh` file:

   ```
   # nettr -setup 4 device=ge policy=1 members=4,5
   ```

3. **To verify whether you have set up the trunking file correctly, verify that both alternates of the pathgroups are not currently plumbed by running command** `ifconfig -a` **(see** `ifconfig` **(1M)) and then invoke the** `nettr -run` **command.**

   You should see information similar to the following:

   ```
   # nettr -run
   Configuring Sun Trunking devices

   ge trunk members:
       ge0 (head)
       ge1

   ge trunk members:
       ge4 (head)
       ge5
   ```

4. **Create a network pathgroup and AP meta-network by using AP commands.**

Before proceeding refer to the *Sun Enterprise Server Alternate Pathing User's Guide* for detailed instructions and procedures.

For a network pathgroup containing two physical devices `ge0` and `ge4` with `ge0` as the primary controller name, you can run the following commands to create the network pathgroup, list uncommitted network entries in the database, commit the network entry, and list the committed network entries in the database:

```
# apnet -c -a ge0 -a ge4 (Creating AP meta-network.)
# apdb -C (Committing AP meta-network to database.)
```

```
# apconfig -N

metanetwork:    mether0
physical devices:
                ge4
                ge0 A
```

5. **Create an** `/etc/hostname.mxxx` **file (such as** `/etc/hostname.mether0` **from the above example) for a meta-network that you want to configure at system reboot.**

If you want to bring up the network manually, you will need to verify that both alternates are not plumbed already and then run trunking command `nettr -run`.

6. **Bring up the meta-network by using the meta-network name instead of the physical network name.**

You can do this by either rebooting the system or manually using the `ifconfig`(1M) command to configure the meta-network.

Verifying the Sun Trunking Interfaces

You can verify trunking networks using the `ifconfig` and the `nettr` commands.

Use the `ifconfig -a` command to print out the addressing information for each interface on the system.

```
# /usr/sbin/ifconfig -a
lo0: flags=849<UP,LOOPBACK,RUNNING,MULTICAST> mtu 8232
        inet 127.0.0.1 netmask ff000000
hme0: flags=863<UP,BROADCAST,NOTRAILERS,RUNNING,MULTICAST> mtu 1500
        inet 129.144.131.27 netmask ffffff00 broadcast
129.144.131.255
        ether 8:0:20:8f:bf:79
ge0: flags=863<UP,BROADCAST,NOTRAILERS,RUNNING,MULTICAST> mtu 1500
        inet 199.100.2.10 netmask ffffff00 broadcast 199.100.2.255
        ether 8:0:20:8d:2f:ff
ge0:1: flags=863<UP,BROADCAST,NOTRAILERS,RUNNING,MULTICAST> mtu
1500
        inet 199.100.1.10 netmask ffffff00 broadcast 199.100.1.255
```

Even though a trunk may be composed of two linked GigabitEthernet network interfaces, the `ifconfig -a` command will only print out the addressing information for the trunk head interfaces (`ge0` in the example above).

For a more complete listing of the `ge` devices, use the `nettr -conf` command. This command will print out a list of all of the `ge` instances on the system, including how the `ge` instances are organized into trunks.

```
# /etc/opt/SUNWconn/bin/nettr -conf
Name    Head      Policy DEV Type   Original-Mac-Addr

ge0     ge0       1      ge-pci     8:0:20:8d:2f:ff
ge1     ge0              ge-pci     8:0:20:80:1:d2
```

In the example above, the `ge0` interface is the trunk head for a two network interface trunk, composed of the `ge0`, and `ge1` interfaces. The `nettr -conf` command will also show the policy of each trunk on the system, as well as listing the original MAC address of each interface.

Use the nettr -stat *trunkhead* command to monitor the network statistics of each interface on the system (replace *trunkhead* with the trunk head interface number of the trunk you want to monitor).

```
# /etc/opt/SUNWconn/bin/nettr -stats 0 device=ge
Mar 30 15:26:58 1999

Name    Ipkts      Ierrs   Opkts    Oerrs   Collis   Crc    %Ipkts  %Opkts

ge0    66518099    0       67498218    0       0        0      50.00   50.00
ge1    66527490    0       67498218    0       0        0      50.00   50.00
```

This command will list each interface and the network performance statistics, summarized in TABLE 2-4, of the specified trunk.

TABLE 2-4   Output of the nettr -stats Command

Network Statistic	Definition
Ipkts	The number of Ethernet packets inputted into the interface.
Ierrs	The number of errors that occurred while inputting these Ethernet packages.
Opkts	The number of Ethernet packets outputted through the interface.
Oerrs	The number of errors that occurred while outputting these Ethernet packages.
Collis	The number of collisions detected on the interface.
Crc	The number of cyclic redundancy check (CRC) errors detected on the interface.
%Ipkts	The percent of Ethernet packets input to the interface.
%Opkts	The percent of Ethernet packets output through the interface.

You can also monitor the network statistics of a trunk at regular intervals. The full usage of the command is `nettr -stats` *trunkhead interval*, with *interval* being the number of seconds between monitoring the trunk's interfaces. In the example below, the trunk is monitored once each second.

```
# /etc/opt/SUNWconn/bin/nettr -stats 0 device=ge
Mar 30 15:26:58 1999

Name   Ipkts     Ierrs  Opkts    Oerrs  Collis  Crc   %Ipkts %Opkts

ge0   66518099   0      67498218   0      0       0     50.00  50.00
ge1   66527490   0      67498218   0      0       0     50.00  50.00
```

You can also use the `netstat(1M)` command to monitor the network statistics. Refer to the `netstat(1M) man` page for more information.

Disabling the Sun Trunking Interface

If you need to disable a trunk for any reason, use the `nettr -release` *trunkhead* command, with *trunkhead* being the trunk head interface number of the trunk you want to disable. Unplumb the interface if not already unplumbed.

```
# /etc/opt/SUNWconn/bin/nettr -release 0 device=ge
```

To permanently disable the trunking interface, comment out the `nettr` command in the `/etc/opt/SUNWconn/bin/nettr.sh` file. You will need to reconfigure the `/etc/hostname.ge#` and `/etc/hosts` files if you want to use the GigabitEthernet network interfaces separately. Refer to the *Sun GigabitEthernet/S 2.0 Adapter Installation and User's Guide* or the *Sun GigabitEthernet/P 2.0 Adapter Installation and User's Guide* more information.

TCP/IP Performance

Changes to the TCP/IP `ndd` values in most instances will not significantly improve performance. Beginning with Solaris 2.5.1, TCP values have been optimized and should not be changed, with the exception of `tcp_rexmit_interval_max` on Solaris 2.6.

▼ To Increase TCP/IP Performance on Solaris 2.6

If you are running your Solaris 2.6 system with a large TCP window and you experience slowdowns during high network traffic, decrease the TCP default maximum retransmission timeout interval variable (`tcp_rexmit_interval_max`) to 60000.

1. **As superuser, type:**

```
# ndd -set /dev/tcp tcp_rexmit_interval_max 60000
```

The changes are immediate and affect all the networking interfaces in the system. However, the changes are lost when you reboot your machine.

Note – You may not need to perform this workaround if you are using a smaller TCP window (for example, an 8-Kbyte or 16-Kbyte window). You can acheive better network performance by adjusting your application's data buffer size and socket buffer size to be less than or equal to 8 Kbytes. Refer to the application's documentation for instructions on how to set these buffer sizes

---

2. **To avoid losing the TCP/IP setting at reboot, add the parameter change to a run control script in the** `/etc/rc2.d` **directory, similar to the following example:**

```
#!/sbin/sh
# Local kernel modifications
#
case "$1" in
'start')
    echo "Setting local kernel parameters...\c"
    ndd -set /dev/tcp tcp_rexmit_interval_max 60000
    echo ""
    ;;
'stop')
    echo "No kernel parameters changed."
    ;;
*)
    echo "Usage: $0 {start|stop}"
    ;;
esac
exit 0
```

Performance Tuning

To increase the size of STREAMS synchronized queues, thereby increasing performance, add sq_max_size to the /etc/system file.

```
set sq_max_size=<XXX>
```

where *<xxx>* is the maximum number of messages that are allowed for each IP queue. A safe value to set is 25 for each 64 Mbytes of RAM in the system (that is, it would be a maximum of 25 for 64 Mbytes, 50 for 128 Mbytes, 100 for 256 Mbytes, and so on).

You can be more aggressive if you choose, the only potential drawback is that you can overrun STREAMS resources.

Refer to the Solaris operating environment user documentation for more information.

Troubleshooting

If you have problems with Sun Trunking 1.2, use the following commands to gather information that may help resolve the problems.

Using the debug Command

Use the nettr -debug command to check for configuration and connection problems.

```
# /etc/opt/SUNWconn/bin/nettr -debug
Name    Head   Policy Link   Speed   Duplex Xcvr ipg0 ipg1 ipg2 adv   our   lp


ge0     ge0     2     Up      1000    Full     8    8    4    1d   1d   1d
ge1     ge0           Up      1000    Full     8    8    4    1d   1d   1d


```

In this instance, there are no problems. All the links are Up, showing the speed is 1000 Mbps and the duplex is full. If any showed half, you would use the ndd command to correct the speed or duplex. Refer to "Setting Forced Mode," in Appendix C of the *Sun GigabitEthernet Adapter Installation and User's Guide*.

TABLE 2-5 describes the information shown by the `nettr -debug` command and lists likely problems and their solutions.

TABLE 2-5 Output of the `nettr -debug` Command

Configuration	Definition	Problem	Solution
Name	Interface name	See footnote 1.[1]	See footnote 1.
Head	Interface name of trunk head	Wrong interface listed as the trunk head	Re-configure using configuration instructions
Policy	Number of trunking policy: 1 is MAC, 2 is Round Robin, 3 is IP Destination, and 4 is IP Source+Destination.	Incorrect policy	Re-configure using configuration instructions
Link	Shows whether link is Up or Down.	Link is Down	Check connection to the ethernet switch, card, and cable.
Speed	Shows speed in Mbps.		
Duplex	Shows whether full-duplex (Full) is running.	Half-duplex (half) is running.	Configure the switch for the proper mode and use the ndd command to check the device status.
Xcvr	Shows whether transceiver is internal (Intl) or external.	Transceiver is external (Extl).	Sun GigabitEthernet card is probably bad.
ipg	Shows inner packet gap value (ipg0, ipg2, ipg2).	See footnote 1.	See footnote 1.
adv	Shows the local transceiver capabilities advertised by the hardware.	See footnote 1.	See footnote 1.
our	Shows the read-only transceiver capabilities.	See footnote 1.	See footnote 1.
lp	Shows the read-only link partner capabilities.	See footnote 1.	See footnote 1.

1. There are several problems and solutions that might occur for this field. Refer to Chapter 3 of the *Sun GigabitEthernet/S Adapter Installation and User's Guide or the Sun GigabitEthernet/P Adapter Installation and User's Guide* for more information.

Using the `stats` Command

Use the `nettr - stats` command to check whether network packets are showing in each trunk instance. In the following example, 1 represents the trunk head instance being monitored.

```
# /etc/opt/SUNWconn/bin/nettr -stats 0 device=ge
Mar 30 15:26:58 1999

Name   Ipkts     Ierrs    Opkts  Oerrs  Collis  Crc   %Ipkts  %Opkts

ge0   66518099    0     67498218    0     0      0      50.00   50.00
ge1   66527490    0     67498218    0     0      0      50.00   50.00
```

If you use MAC policy, you may not see packets on certain interfaces, as shown in the example. This occurs because two or more clients may have MAC addresses with the last two bits identical. See "Trunking Policies" on page 64 for more information.

Using the `snoop` Command

Use the `snoop -d` command to capture and inspect network packets. This command enables you to troubleshoot network problems at the packet level, allowing examination of the contents of a packet. The following shows example output for qfe0.

```
# snoop -d ge0
Using device /dev/ge (promiscuous mode)
199.100.1.10 -> 199.100.1.11 TCP D=5100 S=59412  Ack=2577009842
Seq=391268307  Len=1460 Win=8760
199.100.1.10 -> 199.100.1.11 TCP D=5100 S=59412  Ack=2577009842
Seq=391269767 Len=1460 Win=8760
199.100.1.10 -> 199.100.1.11 TCP D=5100 S=59412  Ack=2577009842
Seq=391271227  Len=1460 Win=8760
```

In this example, if there were packets meant for hostname `hs4-net11`, but none showed in the output from the `snoop` command, you would know a problem existed. In that case, you would check your host file, network connect, or your ethernet switch setup. Refer to the `snoop(1M)` man page for more information.

Using the `conf` Command

Use the `nettr -conf` command to verify your trunking configuration.

```
# nettr -conf
Name     Head     Policy DEV Type     Original-Mac-Addr

ge0      ge0        2       ge-pci       8:0:20:8d:2f:ff
ge1      ge0                ge-pci       8:0:20:80:1:d2
```

Make sure the ethernet switch software and the Sun Trunking 1.2.1 software are configured symmetrically. For example, both Sun Trunking and the switch should be configured with the same number of links per trunk.

Once you have configured Sun Trunking 1.2.1 software, be sure to re-configure your switch to match the trunking configuration.

Getting Help

If you cannot resolve the problems and you have a SunService contract, send the information gathered from these commands to your SunService representative. You must have the following information ready:

- Product name and release number (Sun Trunking 1.2.1)
- Model number of your machine
- Solaris release number

Use the `showrev` command to display your operating system release:

```
% showrev
Hostname: proboscis-11
Hostid: 8081d6ca
Release: 5.5.1
Kernel architecture: sun4u
Application architecture: sparc
Hardware provider: Sun_Microsystems
```

Changing Device Names to Use the Sun Quad FastEthernet 2.0 Device Driver

To use the Sun Quad FastEthernet 2.0 with the `qfe` driver software, you must change the device names of the Sun Quad FastEthernet SBus adapter's four network interfaces. These device names must be changed to `SUNW,qfe` so that the device driver can recognize the adapter's four Ethernet network interfaces. You must make this change *before* installing the Sun Quad FastEthernet 2.0 driver software.

Note – This workaround is not supported by Sun Service. If you want to use the Sun Quad FastEthernet 2.0 driver software, contact your local Sun representative for assistance, or contact your local Sun authorized service provider for information on how to receive a replacement adapter.

▼ To Change the `hme` Device Name to Use the `qfe` Device Driver

1. **Shut down your system.**

   Use the standard shutdown procedures described in the *Solaris Handbook for Sun Peripherals.*

2. **At the** `ok` **prompt, type:**

```
ok setenv use-nvramrc? true
ok show-devs
```

The `show-devs` command lists the system devices. You should see the full path
name of the `hme` network interfaces, similar to the example below:

```
/sbus@1f,0/SUNW,hme@1,8c30000
/sbus@1f,0/SUNW,hme@1,8c20000
/sbus@1f,0/SUNW,hme@1,8c10000
/sbus@1f,0/SUNW,hme@1,8c00000
```

3. **At the** `ok` **prompt, execute the** `nvedit` **command:**

```
ok nvedit
```

4. **Type the following, spaces and quotation marks included, pressing the Return
   key at the end of all but the last line.**

```
 0: probe-all install-console banner
 1: cd <full path to network interface 1>
 2: " SUNW,qfe" nameprop
 3: device-end
 4: cd <full path to network interface 2>
 5: " SUNW,qfe" nameprop
 6: device-end
 7: cd <full path to network interface 3>
 8: " SUNW,qfe" nameprop
 9: device-end
10: cd <full path to network interface 4>
11: " SUNW,qfe" nameprop
12: device-end
```

5. **Press the Control-C keys after typing the final** `device-end`**.**

6. **At the** `ok` **prompt, execute the** `nvstore` **command:**

```
ok nvstore
```

7. **Reset your system.**

   Use the command to reset your system for your system's version of the OpenBoot PROM. Refer to the *OpenBoot Command Reference* manual for more information.

   Your system will reset and the banner will be displayed.

8. **Press the Stop-A keys to get to the** ok **prompt.**

9. **At the** ok **prompt, type** show-devs **to list your system devices and verify that the name property was changed correctly.**

   You should see the full path name of the qfe devices similar to the example below:

   ```
   /sbus@1f,0/SUNW,qfe@1,8c30000
   /sbus@1f,0/SUWN,qfe@1,8c20000
   /sbus@1f,0/SUNW,qfe@1,8c10000
   /sbus@1f,0/SUNW,qfe@1,8c00000
   ```

10. **Perform a reconfiguration boot on the system.**

    ```
    ok boot -r
    ```