Sun Trunking 1.2 Installation and User's Guide

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Preface

The *Sun Trunking 1.2 Installation and User's Guide* describes how to install and
configure the Sun Trunking™™ 1.2 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 Trunking 1.2 software on a
Sun Quad FastEthernet™ adapter or a Sun GigabitEthernet™ adapter.

Chapter 1 "Installation of the Sun Trunking 1.2 Software for Sun Quad FastEthernet
Adapters", (as you might guess from the title) describes how to install and configure
the Sun Trunking 1.2 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 Software for Sun GigabitEthernet
Adapters", describes how to install and configure the Sun Trunking 1.2 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 2.x 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

TABLE P-1 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

TABLE P-2 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-3   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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Installation of the Sun Trunking 1.2 Software for Sun Quad FastEthernet Adapters

Sun Trunking 1.2 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 deliver increased performance to areas of the network that are experiencing congestion.

Hardware and Software Requirements

Before installing the Trunking 1.2 software, make sure your system meets the following hardware and software requirements:

TABLE 1-1

Requirement Type	Specifications
Hardware	Sun Ultra Enterprise™ 60, 250, 450, 3x00, 4x00, 5x00, or 6x00 system
Software	Solaris 2.5.1, 2.6, and Solaris 7

Note – You can trunk only an even number of Quad FastEthernet links. For example, you can trunk two, four, or six Quad FastEthernet links, but you cannot trunk three links.

You can use any trunking-capable switch with the Sun Trunking 1.2 software. The switches listed in TABLE 1-2 were tested and found to work with Sun Trunking 1.2 product.

TABLE 1-2 Switches Tested to Interoperate With Sun Trunking 1.2 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

Key Features

The Sun Trunking 1.2 software implements the following key features:

- Fast Ethernet links—The Sun Quad FastEthernet network interface cards support Sun Trunking 1.2 software. Sun Quad FastEthernet cards deliver scalable bandwidth with up to eight 10/100 auto-negotiating Ethernet ports.
- Load balancing—Sun Trunking 1.2 software supports load balancing and failure recovery within a trunk. It distributes traffic, including unicast, broadcast, and multicast traffic, evenly across the aggregated links. In the event of a link failure, Sun Trunking 1.2 software automatically redistributes loads across the remaining links.
- Single MAC address—Because ports aggregated with Sun Trunking 1.2 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 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 software, you should have already installed 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 those installation instructions.

If you have also installed the driver software that came with it, you may have to remove it before installing the Sun Trunking 1.2 software.

The Sun Trunking 1.2 CD contains packages for three products: Sun Trunking, Sun Quad FastEthernet, and Sun GigabitEthernet. For each product, there is a version for each of three Solaris versions, 2.5.1, 2.6, and 2.7. Not everyone need install the Sun Quad FastEthernet packages. The following instructions make clear the requirements for updating the Quad FastEthernet packages.

▼ Removing Previously Installed Trunking Packages

If previous versions of Trunking software are installed, you should remove them before installing the new Trunking 1.2 software.

1. **Become superuser.**

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

2. **Check to see if any Trunking packages are currently installed.**

```
# pkginfo | grep qfet
```

The previous versions of Trunking packages will look similar to the following:

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

3. Remove all existing Trunking packages, for example:

```
# pkgrm SUNWqfetr SUNWqfetx
```

▼ Checking and Removing Previously Installed `qfe` Packages

Note – If any of the following Sun Quad FastEthernet 2.2 patches (106531-02, 106532-02, or 107743-01) are already installed on your system, disregard the `qfe` software installation. You will only need to install the Sun Trunking software packages.

Caution – If you are using `qfe` as your main network interface, do this de-installation and installation process from the system console *only*. Make sure no users or applications are on the system since a reboot will be necessary.

To remove previously installed packages:

1. Become superuser.

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

2.

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

```
# pkginfo | grep qfe
```

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

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

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

Check 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 software installation.

For Solaris 2.5.1:

```
# showrev -p | grep 106531-02
```

For Solaris 2.6:

```
# showrev -p | grep 106532-02
```

For Solaris 7:

```
# showrev -p | grep 107743-01
```

3. If you do not have the required patches, remove *all* existing `qfe` packages.

```
# pkgrm SUNWqfed SUNWqfedu SUNWqfedx
```

4. Confirm that all `qfe` packages have been removed.

```
# pkginfo | grep qfe
```

Installing the Trunking 1.2 Software

The Trunking 1.2 software is composed of six software packages that are distributed on a CD.

▼ To Install the Trunking 1.2 Software

Note – If the CD-ROM drive that you are using for software installation is attached to a remote machine, refer to your Solaris installation guide for remote CD-ROM access.

---

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

2. **Place the Trunking 1.2 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/sun_trunking_1_2 when it is loaded in the drive.

   If the Volume Manager (vold) is not running on your machine, create a directory called /cdrom/sun_trunking_1_2 and mount the CD-ROM manually.

   ```
   # mkdir /cdrom/sun_trunking_1_2
   # mount -F hsfs -r /dev/dsk/c0t6d0s2 /cdrom/sun_trunking_1_2
   ```

4. **Install the Sun Trunking 1.2 packages only.**

   ■ If your system is running Solaris 2.5.1 and it has Sun Quad FastEthernet 2.2 patch ID 106531-02 or later, install the Sun Trunking 1.2 software packages required for the Solaris 2.5.1 operating environment:

   ```
   # cd /cdrom/sun_trunking_1_2/Solaris_2.5.1/Trunking
   # pkgadd -d .
   ```

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

```
1 SUNWtrkm     Sun Trunking Man Pages
               (sparc) 1.2,REV=5.5.1
2 SUNWtrku     Sun Trunking Utility
               (sparc) 1.2,REV=5.5.1
```

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

■ If your system is running Solaris 2.6 and it has Sun Quad FastEthernet 2.2 patch ID 106532-02 or later, install the Sun Trunking 1.2 software packages required for the Solaris 2.6 operating environment:

```
# cd /cdrom/sun_trunking_1_2/Solaris_2.6/Trunking
# pkgadd -d .
```

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

```
1 SUNWtrkm     Sun Trunking Man Pages
               (sparc) 1.2,REV=5.6
2 SUNWtrku     Sun Trunking Utility
               (sparc) 1.2,REV=5.6
```

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

■ If your system is running Solaris 7 and it has Sun Quad FastEthernet 2.2 patch ID 106871-01 or later, install the Sun Trunking 1.2 software packages required for the Solaris 7 operating environment:

```
# cd /cdrom/sun_trunking_1_2/Solaris_7/Trunking
# pkgadd -d .
```

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

```
1 SUNWtrkm     Sun Trunking Man Pages
               (sparc) 1.2,REV=5.7
2 SUNWtrku     Sun Trunking Utility
               (sparc) 1.2,REV=5.7
```

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

5. **Install the Sun Quad FastEthernet packages 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
       packages required for the Solaris 2.5.1 operating environment:

    ```
    # cd /cdrom/sun_trunking_1_2/Solaris_2.5.1/Quad_FastEthernet
    # pkgadd -d .
    ```

    ■ 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
    2   SUNWqfedu   Sun Quad FastEthernet Adapter Driver Headers
                    (sparc) 3.1, REV=5.5.1
    ```

    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:

    ```
    # cd /cdrom/sun_trunking_1_2/Solaris_2.6/Quad_FastEthernet
    # pkgadd -d .
    ```

    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
    2   SUNWqfedu   Sun Quad FastEthernet Adapter Driver Headers
                    (sparc) 3.1, REV=5.6
    ```

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

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

    ```
    # cd /cdrom/sun_trunking_1_2/Solaris_7/Quad_FastEthernet
    # pkgadd -d .
    ```

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

```
1  SUNWqfed   Sun Quad FastEthernet Adapter 32bit Driver
              (sparc) 4.0, REV=5.7
2  SUNWqfedu  Sun Quad FastEthernet Adapter Driver Headers
              (sparc) 4.0, REV=5.7
3  SUNWqfedx  Sun Quad FastEthernet Adapter 64bit Driver
              (sparc) 4.0, REV=5.7
```

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

6. **After the installation is complete, verify that the Sun Trunking 1.2 software packages have been installed.**

```
# pkginfo | grep trk
```

The following packages should be displayed:

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

7. **After the software has been installed, unmount and eject the CD.**

```
# cd /
# umount /cdrom/sun_trunking_1_2
# eject cdrom
```

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

You should have now successfully installed the Trunking software. Before rebooting your system, however, you must first configure the Trunking software files as described in the next section.

Configuring the 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 23.)

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.
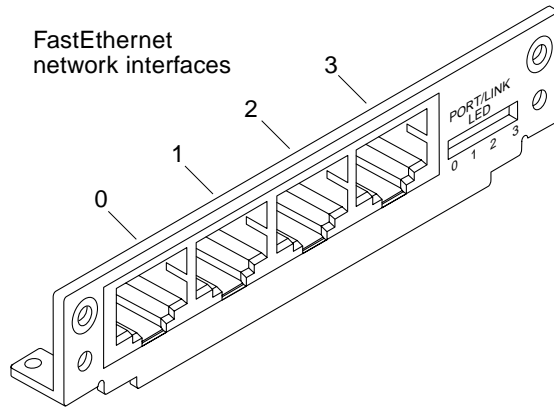
FIGURE 1-1   Four Network Interfaces of the Sun Quad FastEthernet SBus Adapter

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 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 1-3 lists the network interface number, physical name, and instance number for each Quad FastEthernet instance on this example system.

TABLE 1-3   Example Quad FastEthernet Instance Numbers

Network Interface Number	Device Name	Instance Number
0	/sbus@2,0/SUNW,qfe@1,8c00000	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 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    qfe0               qfe-sbus   8:0:20:89:b2:32
qfe3    qfe0               qfe-sbus   8:0:20:89:b2:33
```

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

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 a trunk. FIGURE 1-2 shows four different linking possibilities for a single adapter.
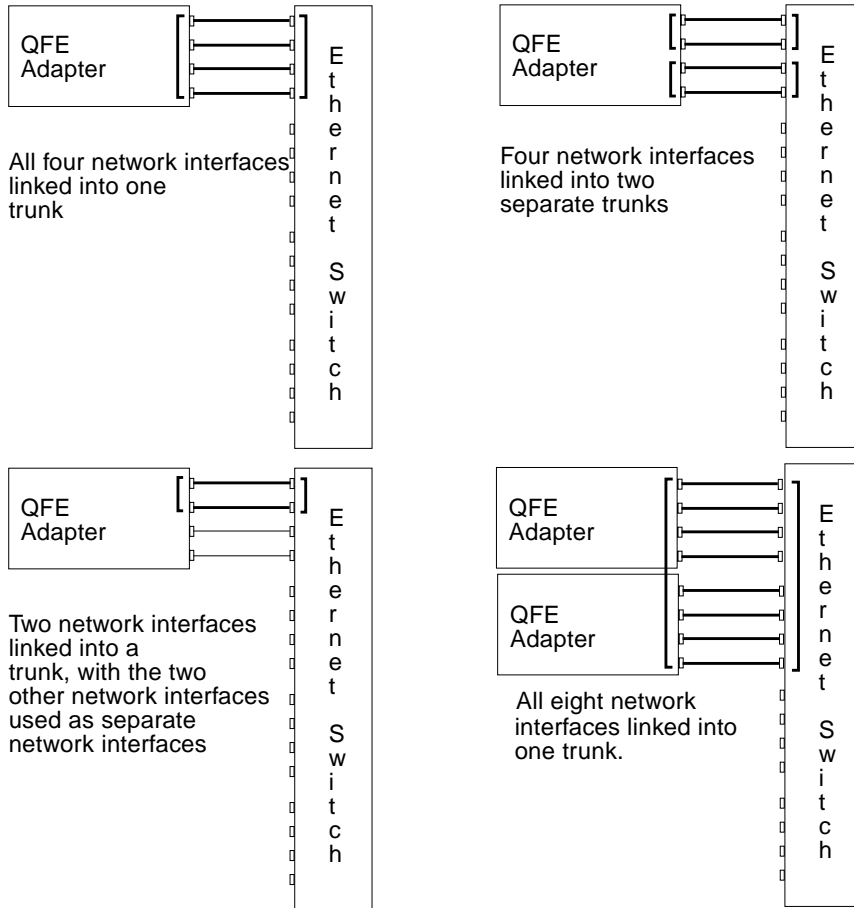
FIGURE 1-2   Four Trunking Network Configuration Examples

The configuration of the 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 Trunking software. Refer to your Ethernet switch documentation for the switch configuration instructions.

`local-mac-address` Property

By default, every network interface in a system uses the MAC address stored in a machine's NVRAM. If you set the `local-mac-address` property to true, each interface on a QuadFastEthernet card uses one of the four MAC addresses resident on the card rather than the NVRAM address. (The primary interface, for example, `hme0`, continues to use the NVRAM MAC address.)

At the `ok` prompt, use the following command to set local-mac-address to true.

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

In response to an `ifconfig` command (invoked as root), a `qfe` interface displays with the NVRAM MAC address by default or with its own, unique MAC address if local-mac-address is set to true. (Of trunked interfaces, `ifconfig` displays only the trunk head.)

We recommend you set local-mac-address to true. If you use the MAC address trunking policy (see below), the default policy, you *must* set local-mac-address to true. Even if you are not using this policy, having a unique MAC address for each interface can be an aid in network troubleshooting.

Configuring the 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 Trunking software.

Trunking Policies

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

MAC
- Is the default policy used by the Trunking software. MAC is the preferred policy to use with switches. Most trunking-capable switches require using the MAC-hashing policy, but check your switch.

- Uses up to the last three bits of the MAC addresses of both the source and destination. For eight ports, the MAC addresses of the source and destination are XORed: Result = 000, 001, 010, 011, 100, 101, 110, 111 which selects the port. For four ports, the source and destination addresses are XORed: Result = 00, 01, 10, 11, which selects the port. For two ports, the MAC addresses of the source and destination are XORed: Result = 00, 01, which selects the port.
- Favors a large population of clients. For example, this ensures that 25 percent of the client connections will go through one of four ports in a four-port trunk, or 50 percent of the client connections will go through each port in a two-port trunk.
- Required by most trunking-capable switches.

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

Round Robin

- Uses each network interface of the trunk in turn, as the name suggests.
- 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.

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 IP Source and IP Destination addresses to determine the transmission path.

The primary use of this 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 trunking policy gives you a greater chance of using more, different links within the trunk than would the IP Destination Address policy.

Editing Configuration Files

▼ To Edit the `nettr.sh` File

The main configuration file of the Trunking 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 1-3 on page 20. *The instance numbers on your system will be different.* See "Determining Instance Numbers" on page 18 for more information.

For one trunk containing all four network interfaces and using the MAC trunking policy (policy 1), you would only need to 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), you would only need to 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, you would 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, you would 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 trunks, containing two network interfaces each using the IP Destination policy, you would 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 trunks, 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 Configure the FastEthernet Host Files

Before you can use these trunked Ethernet network interfaces, you must create an `/etc/hostname.qfe#` file, and you must 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 1-4   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 19 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.

Using the example trunk head instance numbers in TABLE 1-4, 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
```

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

Using the example from TABLE 1-4, you would have:

```
# cat /etc/hosts
#
# Internet host table
#
127.0.0.1      localhost
129.144.10.57 proboscis loghost
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 Trunking software. Refer to your Ethernet switch documentation for instructions.

Note – Only trunk *heads* are visible to standard Solaris utilities such as ifconfig, snoop, and netstat. (However, you can use netstat –I<*ifname*> to see the status of a trunked interface that is not the trunk head.) Most often, the nettr utility gives you the best means of viewing the status of a trunked interfaces.

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

To Shutdown Your System

Reboot your system to make these trunked networks active.

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
```

4. **Using the example from Step 1, you would have:**

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

Installing the Adapter (with DR)

Note – If you are using Solaris 2.6 Hardware: 5/98, 11/98, or Solaris 7 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 Quad FastEthernet Adapter

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

   ```
   # 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 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; 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.

Verifying the 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 will print 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 1-5, of the specified trunk.

TABLE 1-5   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 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 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, you should 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 a 16-Kbyte window).

2. **To avoid losing the TCP/IP setting, you can 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 mb of RAM in the system (that is, it would be 25 for 64 mb, 50 for 128 mb, 100 for 256 mb, 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 user documentation for more information.

Troubleshooting

If you have problems with the Sun Trunking 1.2 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  Duplex Xcvr    ipg0 ipg1 ipg2 adv  our  lp


qfe0    qfe0        1     Up      100    Full   Intl    16   8    4    2f   2f   2f
qfe1    qfe0              Up      100    Full   Intl    16   8    4    2f   2f   2f
qfe2    qfe0              Up      100    Full   Intl    16   8    4    2f   2f   2f
qfe3    qfe0              Up      100    Full   Intl    16   8    4    2f   2f   2f
```

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 1-6 describes the information shown by the `nettr -debug` command and lists likely problems and their solutions.

TABLE 1-6 Output of the `nettr -debug` Command

Configuration	Definition	Problem	Solution
`Name`	Interface name	See 1.	See 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 1-6 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 1.	See 1.
adv	Shows the local transceiver capabilities advertised by the hardware.	See 1.	See 1.
our	Shows the read-only transceiver capabilities.	See 1.	See 1.
lp	Shows the read-only link partner capabilities.	See 1.	See 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
(Aggregate Throughput(Mb/sec):    142.88(New Peak)    142.88(Past Peak)
100.00%(New/Past))
```

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 23 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 should 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 trunking 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)
- 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: 5.5.1
Kernel architecture: sun4u
Application architecture: sparc
Hardware provider: Sun_Microsystems
```

Installation of the Sun Trunking 1.2 Software for Sun GigabitEthernet Adapters

Sun™ Trunking™ 1.2 software provides the ability to aggregate up to two 1000 Mbps GigabitEthernet ports into a single virtual link. Once aggregated, these point-to-point links act as a single "fat pipe" to deliver increased performance to areas of the network that are experiencing congestion.

Hardware and Software Requirements

Before installing the Trunking 1.2 software, make sure your system meets the following hardware and software requirements:

TABLE 2-1

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

Note – You can trunk only two GigabitEthernet links.

You can use any trunking-capable switch with the Sun Trunking 1.2 software. The switches listed in TABLE 2-2 were tested and found to work with Sun Trunking 1.2 product.

TABLE 2-2   Switches Tested to Interoperate With Sun Trunking 1.2 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 software implements the following key features:

- GigabitEthernet Links—The Sun GigabitEthernet 2.0 network interface card supports Sun Trunking 1.2. 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 supports load balancing and failure recovery capabilities within a trunk. It distributes traffic, including unicast, broadcast, and multicast traffic, evenly across the aggregated links. In the event of a link failure, Sun Trunking 1.2 automatically redistributes loads across the remaining links.
- Single MAC address—Because ports aggregated with Sun Trunking 1.2 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 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 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.

▼ Removing Previously Installed ge Packages

The Sun Trunking 1.2 CD contains packages for three products: Sun Trunking, Sun Quad FastEthernet, and Sun GigabitEthernet. For each product, there is a version for each of three Solaris versions, 2.5.1, 2.6, and 2.7. Not everyone need install the Sun GigabitEthernet packages. The following instructions make clear the requirements for updating the GigabitEthernet packages.

Note – If you have any of the following Sun GigabitEthernet 2.0 patches (106745-04, 106764-04, or 106765-04) already installed on your system, disregard this section and proceed to installing the Sun Trunking 1.2 packages.

If previous versions of Trunking software are installed, you should remove them before installing the new Trunking 1.2 software.

1. **Become superuser.**

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

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

```
# pkginfo | grep ge
```

If there aren't previous versions of the software installed on your system, you will not see any packages listed. If there are, the list of previous versions will look similar to the following:

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

3. **Use the** `showrev` **command to see if the current patches are installed.**

If the patch listed for your operating environment is already installed on your system, you may skip to the "Installing the Trunking 1.2 Software" on page 49

For Solaris 2.5.1 operating environment, type:

```
# showrev -p | grep 106745-04
```

For Solaris 2.6 operating environment, type:

```
# showrev -p | grep 106764-04
```

For Solaris 7 operating environment, type:

```
# showrev -p | grep 106765-04
```

4. **If the patch ID for your operating environment does not appear, remove all existing** `ge` **packages.**

```
# pkgrm SUNWged SUNWgedm SUNWgedu
```

Installing the Trunking 1.2 Software

The Trunking 1.2 software is composed of six software packages that are distributed on a CD-ROM.

▼ To Install the Trunking Software

Note – If the CD-ROM drive that you are using for software installation is attached to a remote machine, refer to your Solaris installation guide for remote CD-ROM access.

---

1. **Become superuser (root).**

2. **Place the 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/sun_trunking_1_2.

   If the Volume Manager (vold) is not running on your machine, create a directory called /cdrom/sun_trunking_1_2 and mount the CD-ROM manually.

   ```
   # mkdir /cdrom/sun_trunking_1_2
   # mount -F hsfs -o ro /dev/dsk/c0t6d0s2 /cdrom/sun_trunking_1_2
   ```

4. **Install the Sun Trunking 1.2 packages only.**

   - If your system is running Solaris 2.5.1 and it has Sun GigabitEthernet 2.0 patch ID 106745-04 or later, install the Sun Trunking 1.2 software packages required for Solaris 2.5.1 operating systems:

   ```
   # cd /cdrom/sun_trunking_1_2/Solaris_2.5.1/Trunking
   # pkgadd -d .
   ```

- A message similar to the following will appear to indicate the available packages:

```
1 SUNWtrkm     Sun Trunking Man Pages
              (sparc) 1.2,REV=5.5.1
2 SUNWtrku     Sun Trunking Utility
              (sparc) 1.2,REV=5.5.1
```

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

- If your system is running Solaris 2.6 and it has Sun GigabitEthernet 2.0 patch ID 106764-04 or later, install the Sun Trunking 1.2 software packages required for the Solaris 2.6 operating system:

```
# cd /cdrom/sun_trunking_1_2/Solaris_2.6/Trunking
# pkgadd -d .
```

A message similar to the following then appears indicating the available packages:

```
1 SUNWtrkm     Sun Trunking Man Pages
              (sparc) 1.2,REV=5.6
2 SUNWtrku     Sun Trunking Utility
              (sparc) 1.2,REV=5.6
```

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

- If your system is running Solaris 7 and it has Sun GigabitEthernet 2.0 patch ID 106765-04 or later, install the Sun Trunking 1.2 software packages required for the Solaris 7 operating system:

```
# cd /cdrom/sun_trunking_1_2/Solaris_7/Trunking
# pkgadd -d .
```

A message similar to the following then appears indicating the available packages:

```
1 SUNWtrkm     Sun Trunking Man Pages
              (sparc) 1.2,REV=5.7
2 SUNWtrku     Sun Trunking Utility
              (sparc) 1.2,REV=5.7
```

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

5. **Install the Sun GigabitEthernet packages 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 GigabitEthernet software packages required for Solaris 2.5.1 operating systems:

   ```
   # cd /cdrom/sun_trunking_1_2/Solaris_2.5.1/GigabitEthernet
   # pkgadd -d .
   ```

   ■ A message similar to the following will appear to indicate the available packages:

   ```
   1  SUNWged   Sun Gigabit Ethernet Adapter Driver
                 (sparc) 2.0, REV=5.5.1
   2  SUNWgedm  Sun Gigabit Ethernet Adapter Driver Man Pages
                 (sparc) 2.0, REV=5.5.1
   3  SUNWgedu  Sun Gigabit Ethernet Adapter Driver Headers
                 (sparc) 2.0, REV=5.5.1
   ```

   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 system:

   ```
   # cd /cdrom/sun_trunking_1_2/Solaris_2.6/GigabitEthernet
   # pkgadd -d .
   ```

   A message similar to the following then appears indicating the available packages:

   ```
   1  SUNWged   Sun Gigabit Ethernet Adapter Driver
                 (sparc) 2.0, REV=5.6
   2  SUNWgedm  Sun Gigabit Ethernet Adapter Driver Man Pages
                 (sparc) 2.0, REV=5.6
   3  SUNWgedu  Sun Gigabit Ethernet Adapter Driver Headers
                 (sparc) 2.0, REV=5.6
   ```

   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 system:

   ```
   # cd /cdrom/sun_trunking_1_2/Solaris_7/GigabitEthernet
   # pkgadd -d .
   ```

A message similar to the following then appears indicating the available packages:

```
1  SUNWged   Sun Gigabit Ethernet Adapter Driver
              (sparc) 2.0, REV=5.7
2  SUNWgedm  Sun Gigabit Ethernet Adapter Driver Man Pages
              (sparc) 2.0, REV=5.7
3  SUNWgedu  Sun Gigabit Ethernet Adapter Driver Headers
              (sparc) 2.0, REV=5.7
```

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

6. **After the software has been installed, unmount and eject the CD-ROM.**

```
# cd /
# umount /cdrom/sun_gigabit_ethernet_2_0
# eject cdrom
```

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

You should have now successfully installed the Trunking software. Before rebooting your system, however, you must first configure the Trunking software files as described in the next section.

Configuring the 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 & Destination. (See "Trunking Policies" on page 56.)

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 Chapter 3 of your *Sun GigabitEthernet 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.
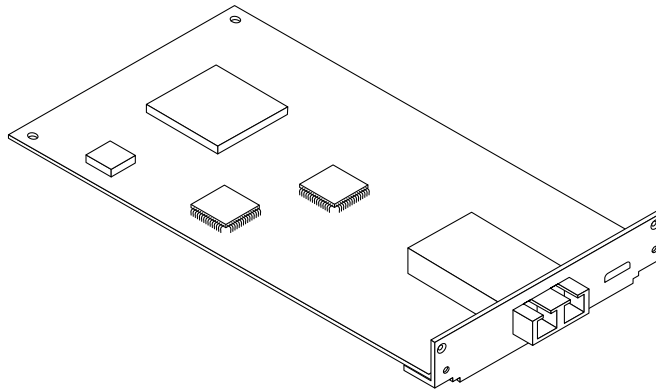
FIGURE 2-1   Network Interface for the Sun GigabitEthernet/S Adapter

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 Trunking 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 2-3 lists the network interface number, physical name, and instance number for each GigabitEthernet instance on this example system.

TABLE 2-3   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     ge0       2      ge-pci     8:0:20:8d:2f:ff
ge1     ge0              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 Trunking software.

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.
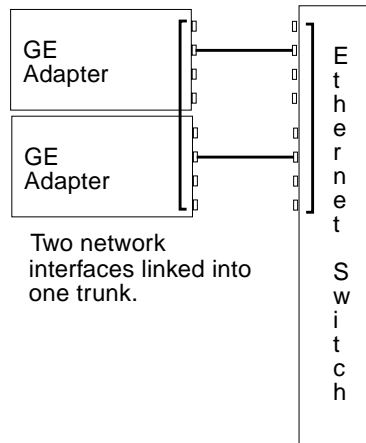

FIGURE 2-2   GigabitEthernet Trunking Network Configuration Example

The configuration of the 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 Trunking software. Refer to your Ethernet switch documentation for the switch configuration instructions.

`local-mac-address` Property

By default, every network interface in a system uses the MAC address stored in a machine's NVRAM. If you set the `local-mac-address` property to true, the ge interface on a GigabitEthernet card uses the MAC address resident on the card rather than the NVRAM address. (The primary interface, for example, `hme0`, continues to use the NVRAM MAC address.)

At the `ok` prompt, use the following command to set local-mac-address to true.

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

In response to an `ifconfig` command (invoked as root), a `ge` interface displays with the NVRAM MAC address by default or with its own, unique MAC address if local-mac-address is set to true. (Of trunked interfaces, `ifconfig` displays only the trunk head.)

We recommend you set local-mac-address to true. If you use the MAC address trunking policy (see below), the default policy, you *must* set local-mac-address to true. Even if you are not using this policy, having a unique MAC address for each interface can be an aid in network troubleshooting.

Configuring the Trunking 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 Trunking software.

Trunking Policies

The four supported trunking policies used in the Trunking 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 Trunking 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.
- Required by most trunking-capable switches.

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

Round Robin

- Uses each network interface of the trunk in turn, as the name suggests.
- 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.

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 latter 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 trunking policy gives you a greater chance of using more, different links within the trunk than would the IP Destination Address policy.

Editing Configuration Files

▼ To Edit the `nettr.sh` File

The main configuration file of the Trunking 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
```

Note – The examples below use the instance numbers found in TABLE 2-3 on page 54. *The instance numbers on your system will be different.* See "Determining Instance Numbers" on page 53 for more information.

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 trunking 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 trunks, 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 trunks, 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 -confName  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 Configure the GigabitEthernet Host Files

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

1. **For each trunk, create a** `/etc/hostname.ge`*num* **file, where** *num* **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 2-4   Example `hostname.ge`*num* 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 53 for more information.

   - The `/etc/hostname.ge`num 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, below).

Using the example trunk head instance numbers in TABLE 2-4, the following example
shows the three /etc/hostname.ge*num* 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 probosisloghost
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
Trunking 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 – Only trunk *heads* are visible to standard Solaris utilities such as `ifconfig`,
`snoop`, and `netstat`. (However, you can use `netstat -I`*<ifname>* to see the status
of a trunked interface that is not the trunk head.) Most often, the `nettr` utility gives
you the best means of viewing the status of a trunked interfaces.

▼ To Shutdown Your System

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 DR)

Note – If you are using Solaris 2.6 Hardware: 5/98, 11/98, or Solaris 7 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

1. **If trunking software is already in use, run the** nettr -release **command to unconfigure it. For example:**

```
# nettr -release 0 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.

Verifying the 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
(Aggregate Throughput(Mb/sec):    1542.88(New Peak)    1586.41(Past Peak)
97.25%(New/Past))
```

This command will list each interface and the network performance statistics, summarized in TABLE 2-5, of the specified trunk.

TABLE 2-5   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 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=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.qfe#` 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, you should 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 a 16-Kbyte window).

---

2. **To avoid losing the TCP/IP setting, you can 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 64mb of RAM in the system (that is, it would be 25 for 64mb, 50 for 128mb, 100 for 256mb, etc.).

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

Refer to the Solaris 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 2-6 describes the information shown by the `nettr -debug` command and lists likely problems and their solutions.

TABLE 2-6 Output of the `nettr -debug` Command

Configuration	Definition	Problem	Solution
Name	Interface name	See 1.	See 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
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 1.	See 1.
adv	Shows the local transceiver capabilities advertised by the hardware.	See 1.	See 1.
our	Shows the read-only transceiver capabilities.	See 1.	See 1.
lp	Shows the read-only link partner capabilities.	See 1.	See 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 56 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 should 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 trunking 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 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)
- 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 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 2.x 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. **Type:**

```
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, type:**

```
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
```