

Sun™ Trunking™ 1.0.1

Installation and User's Guide



THE NETWORK IS THE COMPUTER™

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Part No. 805-4584-10
Revision A, May 1998

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Preface

Sun Trunking 1.0.1 Installation and User's Guide describes how to install and configure the Trunking 1.0.1 software. These instructions are designed for an experienced system administrator with networking knowledge.

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 SMCC 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 <code>.login</code> file. Use <code>ls -a</code> to list all files. % You have mail.
AaBbCc123	What you type, when contrasted with on-screen computer output.	% su Password:
<i>AaBbCc123</i>	Book titles, new words or terms, words to be emphasized. Command-line variable; replace with a real name or value.	Read Chapter 6 in the <i>User's Guide</i> . These are called <i>class</i> options. You <i>must</i> be <code>root</code> to do this. To delete a file, type <code>rm filename</code> .

Shell Prompts

TABLE P-2 Shell Prompts

Shell	Prompt
C shell	<i>machine_name</i> %
C shell superuser	<i>machine_name</i> #
Bourne shell and Korn shell	\$
Bourne shell and Korn shell superuser	#

Related Documentation

TABLE P-3 Related Documentation

Application	Title	Part Number
Other	<i>Sun Quad FastEthernet SBus Adapter Installation and User's Guide</i>	805-0732-10
Other	<i>Sun Quad FastEthernet SBus Adapter Release Notes</i>	805-1444-13
Other	<i>Sun Quad FastEthernet PCI Adapter Installation and User's Guide</i>	805-1797-10
Other	<i>Sun Quad FastEthernet PCI Adapter Release Notes</i>	805-2901-11

Ordering Sun Documents

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TABLE P-4 SunExpress Contact Information

Country	Telephone	Fax
Belgium	02-720-09-09	02-725-88-50
Canada	1-800-873-7869	1-800-944-0661
France	0800-90-61-57	0800-90-61-58
Germany	01-30-81-61-91	01-30-81-61-92
Holland	06-022-34-45	06-022-34-46
Japan	0120-33-9096	0120-33-9097
Luxembourg	32-2-720-09-09	32-2-725-88-50
Sweden	020-79-57-26	020-79-57-27
Switzerland	0800-55-19-26	0800-55-19-27
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Please include the part number of your document in the subject line of your email.

Installing and Configuring the Sun Trunking 1.0.1 Software

Sun™ Trunking™ 1.0.1 software provides the ability to aggregate up to four 10/100 Mbps Fast Ethernet 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 1.0.1 software, make sure your system meets the following hardware and software requirements:

Hardware and Software	Requirements
Hardware Requirements	• Sun Ultra™ 2 or 30, or Sun Ultra Enterprise™ 450, 3000, 4000, 5000, or 6000 system
Software Requirements	• Solaris 2.5.1, 2.5.1 Hardware: 4/97, 8/97, 11/97, 2.6, and 2.6 Hardware: 3/98, and later

With Sun Trunking 1.0.1, you can use any switch with trunking functionality. Those listed in TABLE 1-1 were available for testing prior to the release of Sun Trunking 1.0.1.

TABLE 1-1 Switches Tested to Interoperate with Sun Trunking 1.0.1

Switch	Software Revision	Module/Order Code
Bay Networks Baystack	2.0	350T, 350F, 350F-HD, 350T-HD
Cabletron SmartSwitch	2.01.08 or later	6H122-08
	2.01.05 or later	6E122-26
	2.01.05 or later	2E42-27
	1.08.05 or later	9H422-12
	1.08.05 or later	9H423-28
Cisco Catalyst 5000 series	2.3 or later	WS-X5203 (Fast EtherChannel Switching Module - TX) WS-X5509 (Supervisor engine II TX and MII)
	3.1(1) or later	WS-X5530-E1 + WS-U5521-FETX (Supervisor Engine III with dual port 100BaseTX uplink module)
Extreme Summit Switches	1.0 or later	Summit1 = 11001 Summit2 = 12001
Foundry FastIron Switch	1.0.2	FWS 16, FBS 88, FBS 168, FBS 1632
HP Advancestack Switch 800T	B.01 or later	J3245A
Plaintree WaveSwitch 9200	2.0.1	PTP700A (WaveSwitch 9200 chassis)
Prominet P550 Cajun Switch	V1.0.10 or later	P5500SW and M5520-100TX

Key Features

Sun Trunking 1.0.1 consists of the following key features:

- **Fast Ethernet Links**—The Sun Quad FastEthernet™ network interface card comprises the heart of Sun Trunking 1.0.1. Combining 100 Mbps performance with the high density of four high-speed 10/100 auto-negotiating Ethernet ports, Quad FastEthernet delivers scalable bandwidth, multi-homing and redundancy solutions in a single-wide interface card.
- **Load balancing**—Sun Trunking 1.0.1 supports true load balancing and failure recovery capabilities. It distributes traffic, including unicast, broadcast, and multicast traffic, evenly across the aggregated links. In the event of a link failure, Sun Trunking 1.0.1 automatically redistributes loads across the remaining links.
- **Single MAC address**—Because ports aggregated with Sun Trunking 1.0.1 share a single, logical Media Access Control (MAC) address, there is no need to assign individual MAC addresses to aggregated ports.

Preparing for the Software Installation

Before installing the Sun Trunking 1.0.1 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 will have to remove it before installing the Sun Trunking 1.0.1 software.

Removing Previously Installed `qfe` Packages

Note – If your system is running a Solaris 2.6 release later than Hardware: 3/98, disregard this section.

If any `qfe` packages have been previously installed, you must remove them before installing Sun Trunking 1.0.1 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. At the system console, become superuser.

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

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

```
# pkginfo | grep qfe
```

If no package names appear, you can immediately install the Sun Trunking software.

If previous versions of `qfe` are installed, the package names appear. For example, if Sun Quad FastEthernet 2.0 is currently installed, the following output would appear:

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

3. Remove *all* existing `qfe` packages, for example:

```
# pkgrm SUNWqfed SUNWqfedu
```

Installing the Trunking 1.0.1 Software

The Trunking 1.0.1 software is composed of four 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. **At the system console, become superuser (root).**
2. **Place the CD-ROM 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_0_1` 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_0_1` and mount the CD-ROM manually.

```
# mkdir /cdrom/sun_trunking_1_0_1
# mount -F hsfs -r /dev/sr0 /cdrom/sun_trunking_1_0_1
```

4. **Install the Sun Trunking 1.0.1 packages**

- If your system is running Solaris 2.5.1, install the Sun Trunking 1.0.1 software packages required for Solaris 2.5.1 operating systems:

```
# cd /cdrom/sun_trunking_1_0_1/Sol_2.5.1
# pkgadd -d .
```

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

```
The following packages are available:
 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
 3  SUNWqfetr    Sun Trunking Utility
      (sparc) 1.0.1,REV=5.5.1
 4  SUNWqfetx    Sun Trunking Man Pages
      (sparc) 1.0.1
Select package(s) you wish to process (or 'all' to process
all packages). (default: all) [?,??,q]:
```

- Type **all** and press **Return** to install all the software packages.
- If your system is running Solaris 2.6, install the Sun Trunking 1.0.1 software packages required for Solaris 2.6 operating systems:

```
# cd /cdrom/sun_trunking_1_0_1/Sol_2.6
# pkgadd -d .
```

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

```
The following packages are available:
 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
 3  SUNWqfetr    Sun Trunking Utility
      (sparc) 1.0.1,REV=5.6
 4  SUNWqfetx    Sun Trunking Man Pages
      (sparc) 1.0.1
Select package(s) you wish to process (or 'all' to process
all packages). (default: all) [?,??,q]:
```

5. Select the packages appropriate to your operating system.

Note – To determine the version number of your operating system, use the `showrev` command.

If your system is running a Solaris 2.6 release later than Hardware: 3/98, you only need to install packages 3 and 4 (SUNWqfetr and SUNWqfetx).

6. After the installation is complete, verify that the Sun Trunking 1.0.1 software packages have been installed.

```
# pkginfo | grep qfe
```

The following packages should appear:

```
system    SUNWqfed    Sun Quad FastEthernet Adapter Driver
system    SUNWqfedu   Sun Quad FastEthernet Adapter Driver Headers applications
system    SUNWqfetr   Sun Trunking Utility
system    SUNWqfetx   Sun Trunking Man Pages
```

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

```
# cd /
# umount /cdrom/sun_trunking_1_0_1
# eject cdrom
```

8. Add `/etc/opt/SUNWqfetr/bin` to your `$PATH` variable and `/opt/SUNWqfetx/man` to your `$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.

Sun Trunking Directories and Files

FIGURE 1-1 shows the hierarchy of directories and files for Sun Trunking 1.0.1

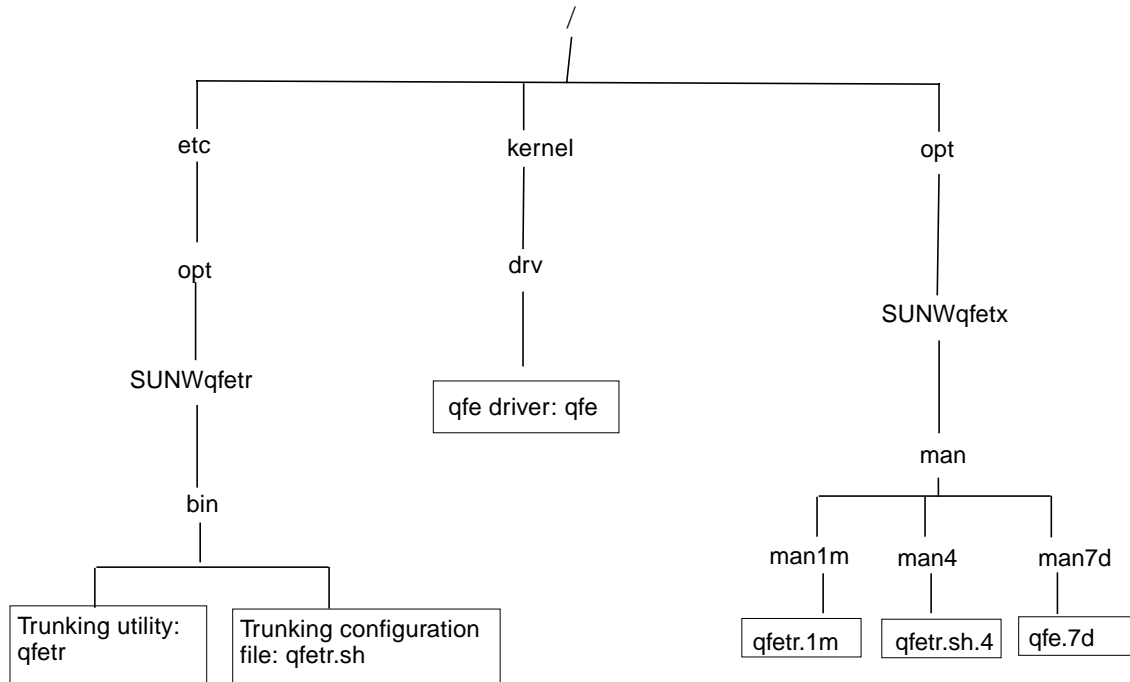


FIGURE 1-1 Sun Trunking 1.0.1 Directories and Files

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 (optional)
- The trunking policy you want to use: MAC or Round Robin (See “Trunking Policies” on page 14.)

Checking for Link Mode

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

Use the `qfetr -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 “Setting Forced Mode” in Appendix C of your *Sun Quad FastEthernet Adapter User’s Guide* for information on setting forced mode.

Booting from the Network

Once you have installed `qfe` and connected the `qfe` interfaces to your switch, which is configured to do 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 of for these network interfaces before you can configure the Trunking software files. FIGURE 1-2 shows the four FastEthernet network interfaces of the Quad FastEthernet SBus adapter.

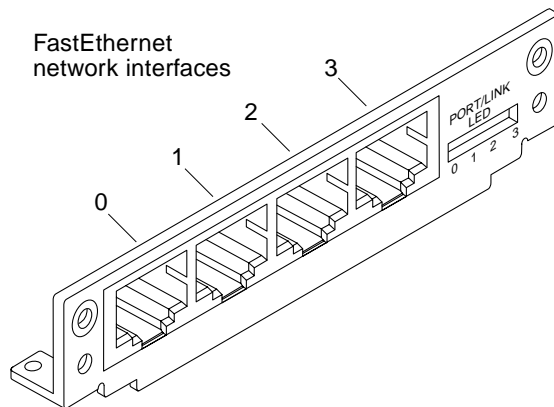


FIGURE 1-2 Four Network Interfaces of the Sun Quad FastEthernet SBus Adapter

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

TABLE 1-2 Example Quad FastEthernet Instance Numbers

Network Interface 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

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

```
# cd /etc/opt/SUNWqfetr/bin
# qfetr -conf
Name      Head      Policy  QFE 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 1-3 shows three different linking possibilities for a single adapter.

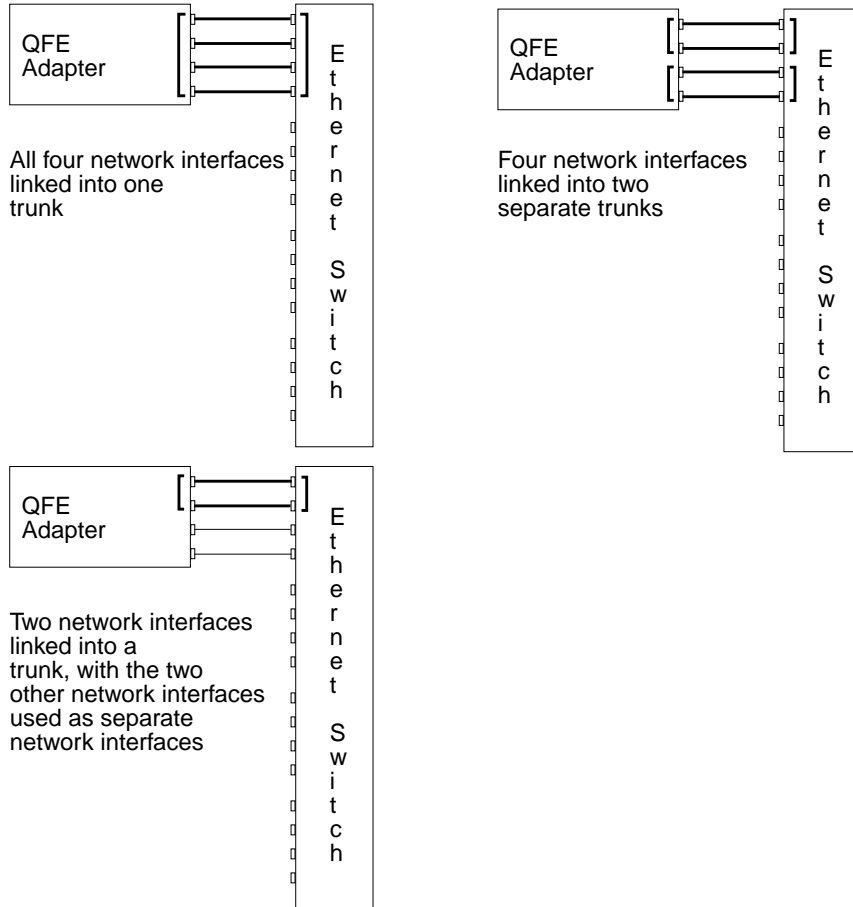


FIGURE 1-3 Three Trunking Network Configuration Examples

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

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

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

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

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

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

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 two supported trunking policies used in the Trunking software are MAC and Round Robin. With both 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. Your system *must* be set to use the *same policy* as your switch.
- Uses the last two bits of the MAC address of both the source and destination. For four ports the source and destination addresses are XORed: Result = 00, 01, 10, 11, which selects the port. For two ports, the MAC address of the source and destination are first XORed then the result is ANDed with 01: Result = 00, 01, which selects the port.
- Favors a large population of clients, which ensures that 25 percent of the client connections will go through one of four pipes 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

- Is the only policy supported for connecting two servers back-to-back.
- 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.

▼ To Edit the `qfetr.sh` File

The main configuration file of the Trunking software is the `/etc/opt/SUNWqfetr/bin/qfetr.sh` file. You will define each trunk by adding commands to this file. Before you edit the `qfetr.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 `qfetr.sh` file to define your trunking network.**

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

```
qfetr -setup trunk head instance [links=<2/4>] [policy=<1/2>]
[members=<instance, instance...]
```

In the command above, the *trunk head instance* is the instance number of the first linked network interface of the trunk. The `links` option defines the number of network interfaces, either 2 or 4, that are linked into a trunk (the default value is 4). The `policy` option can either be the default value of 1 for MAC or 2 for round robin. If you want to select your own instance member for a trunk member, the instance numbers must belong to the same adapter. If you wanted to use the default option, which is MAC policy and 4 links for a trunk, you would only need to add the following line to the `qfetr.sh` file:

```
qfetr -setup 0
```

Following are some example `qfetr.sh` entries.

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

```
# qfetr -conf
Name      Head    Policy QFE Type    Original-Mac-Addr
qfe0          qfe-sbus  8:0:20:89:b2:30
qfe1          qfe-sbus  8:0:20:89:b2:31
qfe2          qfe-sbus  8:0:20:89:b2:32
qfe3          qfe-sbus  8:0:20:89:b2:33
```

Note – The examples below use the instance numbers found in TABLE 1-2 on page 10. *The instance numbers on your system will be different.* See “Determining Instance Numbers” on page 9 for more information.

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

```
qfetr -setup 0 links=4 policy=1 members=0,1,2,3
```

To verify whether you have set up the trunking configuration file correctly, view the `qfetr.sh` file. You should see information similar to the following:

```
# qfetr.sh
    Configuring QFE trunking devices

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

After you edit the trunking software files, execute the `qfetr -conf` command again.

```
# qfetr -conf
Name      Head      Policy  QFE Type      Original-Mac-Addr
qfe0     qfe0      1       qfe-sbus   8:0:20:89:b2:30
qfe1     qfe0      1       qfe-sbus   8:0:20:89:b2:31
qfe2     qfe0      1       qfe-sbus   8:0:20:89:b2:32
qfe3     qfe0      1       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 `qfetr.sh` file:

```
qfetr -setup 0 links=4 policy=2 members=0,1,2,3
```


To verify whether you have set up the trunking configuration file correctly, view the `qfetr.sh` file. You should see information similar to the following:

```
# qfetr.sh
    Configuring QFE trunking devices

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

After editing the trunking software files, execute the `qfetr -conf` command again.

```
# qfetr -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
qfe2      qfe0              qfe-sbus  8:0:20:89:b2:32
qfe3      qfe0              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:

```
qfetr -setup 0 links=2 policy=1 members=0,1
qfetr -setup 2 links=2 policy=1 members=2,3
```

To verify whether you have set up the trunking configuration file correctly, view the `qfetr.sh` file. You should see information similar to the following:

```
# qfetr.sh
    Configuring QFE trunking devices

qfe trunk members:
    qfe0 (head)
    qfe1

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

After you edit the trunking software files, execute the `qfetr -conf` command again.

```
# qfetr -conf
Name   Head   Policy QFE 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   1      qfe-sbus 8:0:20:89:b2:32
qfe3   qfe0           qfe-sbus 8:0:20:89:b2:33
```

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

```
qfetr -setup 0 links=2 policy=2 members=0,1
```

To verify whether you have set up the trunking configuration file correctly, view the `qfetr.sh` file. You should see information similar to the following:

```
# qfetr.sh
    Configuring QFE trunking devices

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

After you edit the trunking software files, execute the `qfetr -conf` command again.

```
# qfetr -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
qfe2   qfe0           qfe-sbus 8:0:20:89:b2:32
qfe3   qfe0           qfe-sbus 8:0:20:89:b2:33
```

▼ To Configure the FastEthernet Host Files

Before you can use these trunked Ethernet network interfaces, you need to create an `/etc/hostname.qfe#` 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.qfe#` file, where # corresponds to the instance number used as the trunk head.

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

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

Filename	Trunk Head Instance Number	Quad FastEthernet Adapter Network Interfaces Used in the Trunk ¹
<code>/etc/hostname.qfe0</code>	0	0, 1
<code>/etc/hostname.qfe2</code>	2	2, 3

¹ See FIGURE 1-2 on page 9 for more information.

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

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

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

Note – Only trunk *heads* are visible.

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

Using the example from Step 1, you would have:

```
# cat /etc/hosts
#
# Internet host table
#
127.0.0.1    localhost
129.144.10.57 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.

After editing these files, you will need to reboot your system to make these trunked networks active.

3. Shut down your system.

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

4. Set local-mac-address to true.

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

5. Perform a reconfiguration boot.

```
ok boot -r
```

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.

- **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).

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
```

Verifying the Trunking Interfaces

You can verify trunking networks using the `ifconfig` and the `qfetr` 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 192.144.11.151 netmask ffffffff broadcast 192.144.11.255
    ether 8:0:20:80:8c:f1
qfe0: flags=843<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.144.14.151 netmask ffffffff broadcast 192.144.14.255
    ether 8:0:20:ac:b2:30
```

Even though a trunk may be composed of 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 `qfetr -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.

```
# /etc/opt/SUNWqfetr/bin/qfetr -conf
Name      Head      Policy QFE 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
```

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 `qfetr -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 `qfetr -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/SUNWqfetr/bin/qfetr -stats 0
Name      Ipkts      Ierrs      Opkts      Oerrs      Collis      Crc

qfe0      18254004   101         0           0           0           0
qfe1      18418495   1150        14496974    0           0           0
qfe2      0           0           13224734    0           0           0
qfe3      635        0           3           0           0           0
```

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

TABLE 1-4 Output of the `qfetr -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.

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

Network Statistic	Definition
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.

You can also monitor the network statistics of a trunk at regular intervals. The full usage of the command is `qfetr -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/SUNWqfetr/bin/qfetr -stats 0 1
```

Name	Ipkts	Ierrs	Opkts	Oerrs	Collis	Crc
qfe0	18254004	101	0	0	0	0
qfe1	18418495	1150	14496974	0	0	0
qfe2	0	0	13224734	0	0	0
qfe3	635	0	3	0	0	0

Name	Ipkts	Ierrs	Opkts	Oerrs	Collis	Crc
qfe0	9408	0	0	0	0	0
qfe1	9407	0	7681	0	0	0
qfe2	0	0	6773	0	0	0
qfe3	0	0	0	0	0	0

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 `qfetr -release trunkhead` command, with *trunkhead* being the trunk head interface number of the trunk you want to disable.

```
# /etc/opt/SUNWqfetr/bin/qfetr -release 0
```

To permanently disable the trunking interface, comment out the `qfetr` command in the `/etc/opt/SUNWqfetr/bin/qfetr.sh` file. You will need to 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.

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 1.0.1, use the following commands to gather information that may help resolve the problems.

Using the debug Command

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

```
# /etc/opt/SUNWqfetr/bin/qfetr -debug
```

Name	Head	Pcy	Link	Spd	Mode	Xcvr	ipg0	ipg1	ipg2	adv	our	lp
qfe0	qfe1		Up	100	Fdx	Intl	16	8	4	2f	2f	2f
qfe1	qfe1	1	Up	100	Fdx	Intl	16	8	4	2f	2f	2f
qfe2	qfe1		Up	100	Fdx	Intl	16	8	4	2f	2f	2f
qfe3	qfe1		Up	100	Fdx	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 1-5 describes the information shown by the `qfetr -debug` command and lists likely problems and their solutions.

TABLE 1-5 Output of the `qfetr -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	Re-configure using configuration instructions
Pcy	Number of trunking policy: 1 is MAC, 2 is Round Robin.	Incorrect policy	Re-configure using configuration instructions
Link	Shows whether link is Up or Down.	Link is Down	Check connection to the ethernet switch, card, and cable.
Spd	Shows speed in Mbps.	Speed is less than 100.	Configure the switch for the proper speed and use the <code>ndd</code> command to check the device status.
Mode	Shows whether full-duplex (Fdx) is running.	Half-duplex (hdx) is running.	Configure the switch for the proper mode and use the <code>ndd</code> 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 `qfetr - 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/SUNWqfetr/bin/qfetr -stats 1 1
```

Name	Ipkts	Ierrs	Opkts	Oerrs	Collis	Crc
qfe0	81207377	221596	39254129	0	0	0
qfe1	77282679	273118	104051423	0	0	0
qfe2	77501339	271540	97093100	0	0	0
qfe3	0	0	262	0	0	0

Name	Ipkts	Ierrs	Opkts	Oerrs	Collis	Crc
qfe0	7614	32	3549	0	0	0
qfe1	7307	34	10756	0	0	0
qfe2	6896	40	10073	0	0	0
qfe3	0	0	0	0	0	0

Name	Ipkts	Ierrs	Opkts	Oerrs	Collis	Crc
qfe0	8040	31	3651	0	0	0
qfe1	6983	29	10349	0	0	0
qfe2	7259	30	9718	0	0	0
qfe3	0	0	0	0	0	0

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 14 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 `qfe1`.

```
# snoop -d qfe1

Seq=1433697461 Len=1460 Win=8760
  hs4-net11 -> hs2-net11    TCP D=6102 S=32802    Ack=3609213440
Seq=1433698921 Len=1460 Win=8760
  hs4-net11 -> hs2-net11    TCP D=6102 S=32802    Ack=3609213440
Seq=1433700381 Len=1460 Win=8760
  hs4-net11 -> hs2-net11    TCP D=6102 S=32802    Ack=3609213440
Seq=1433701841 Len=1460 Win=8760
  hs4-net11 -> hs2-net11    TCP D=6103 S=32803    Ack=3609335122
Seq=1521211593 Len=1460 Win=8760
  hs4-net11 -> hs2-net11    TCP D=6103 S=32803    Ack=3609335122
Seq=1521213053 Len=1460 Win=8760
  hs4-net11 -> hs2-net11    TCP D=6103 S=32803    Ack=3609335122
Seq=1521214513 Len=1460 Win=8760
  hs4-net11 -> hs2-net11    TCP D=6103 S=32803    Ack=3609335122
Seq=1521215973 Len=1460 Win=8760
  hs4-net11 -> hs2-net11    TCP D=6103 S=32803    Ack=3609335122
Seq=1521217433 Len=1460 Win=8760
  hs4-net11 -> hs2-net11    TCP D=6103 S=32803    Ack=3609335122
Seq=1521218893 Len=1460 Win=8760
  hs4-net11 -> hs2-net11    TCP D=6102 S=32802    Ack=3609213440
Seq=1433703301 Len=1460 Win=8760
  hs4-net11 -> hs2-net11    TCP D=6102 S=32802    Ack=3609213440
```

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 `qfetr -conf` command to verify your trunking configuration.

```
# /etc/opt/SUNWqfetr/bin/qfetr -conf
Name      Head      Policy  QFE Type  Original-Mac-Addr
qfe0     qfe0      1       qfe-sbus  8:0:20:89:b2:30
qfe1     qfe0      1       qfe-sbus  8:0:20:89:b2:31
qfe2     qfe0      1       qfe-sbus  8:0:20:89:b2:32
qfe3     qfe0      1       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 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 1.0.1)
- Model number of your machine
- Solaris release number

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

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

Changing Device Names to Use the 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 the SunServicesm organization. If you wish to use the Sun Quad FastEthernet 2.0 driver software, contact your local SunService representative for assistance, or contact your local SunService 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 SMCC 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 that exists in 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/SUNW,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
```

Note – You may need to install a Feature Enhancement patch on your system before you can use the Sun Quad FastEthernet SBus Adapter. Refer to the *Sun Quad FastEthernet SBus Adapter Release Notes (805-1444-12)* for more information.

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