SunFDDI/P™ Adapter 2.0 User's Guide

Regulatory Compliance Statements

Your Sun product is marked to indicate its compliance class:

*   Federal Communications Commission (FCC) — USA
*   Department of Communications (DOC) — Canada
*   Voluntary Control Council for Interference (VCCI) — Japan

Please read the appropriate section that corresponds to the marking on your Sun product before attempting to install the product.

FCC Class A Notice

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Shielded Cables: Connections between the workstation and peripherals must be made using shielded cables in order to maintain compliance with FCC radio frequency emission limits. Networking connections can be made using unshielded twisted-pair (UTP) cables.

Modifications: Any modifications made to this device that are not approved by Sun Microsystems, Inc. may void the authority granted to the user by the FCC to operate this equipment.

FCC Class B Notice

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

*   Reorient or relocate the receiving antenna.
*   Increase the separation between the equipment and receiver.
*   Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
*   Consult the dealer or an experienced radio/television technician for help.

Shielded Cables: Connections between the workstation and peripherals must be made using shielded cables in order to maintain compliance with FCC radio frequency emission limits. Networking connections can be made using unshielded twisted pair (UTP) cables.

Modifications: Any modifications made to this device that are not approved by Sun Microsystems, Inc. may void the authority granted to the user by the FCC to operate this equipment.

DOC Class A Notice - Avis DOC, Classe A

This Class A digital apparatus meets all of requirements the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

DOC Class B Notice - Avis DOC, Classe B

This Class B digital apparatus meets all of requirements the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

ＶＣＣＩ基準について

第一種VCCI基準について

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>
> 取り扱い説明書に従って正しくお取り扱いください。

Declaration of Conformity

Compliance ID: PCI-S10-100

Product Name: SunFDDI/P SAS Adapter

This equipment complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: 1) This equipment may not cause harmful interference and 2) This equipment must accept any interference that may cause undesired operation.

In addition this equipment complies with the following requirements of the EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC;

EMC:	EN55022 / CISPR22 (1991)		Class B
	EN50082-1	IEC801-2 (1991)	4 kV (Direct), 8 kV (Air)
		IEC801-3 (1984)	3 V/m
		IEC801-4 (1988)	1.0 kV Power Lines, 0.5 kV Signal Lines
	EN61000-3-2/IEC1000-3-2(1994)		Pass (Class D)

Supplementary Information:
      This product was tested and complies with all the requirements for the CE Mark.

_____ / S / _____	_____ / S / _____
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Declaration of Conformity

Compliance ID: PCI-D10-100

Product Name: SunFDDI/P DAS Adapter

This equipment complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: 1) This equipment may not cause harmful interference and 2) This equipment must accept any interference that may cause undesired operation.

In addition this equipment complies with the following requirements of the EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC;

EMC:	EN55022 / CISPR22 (1991)	Class B
	EN50082-1 IEC801-2 (1991)	4 kV (Direct), 8 kV (Air)
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Supplementary Information:

This product was tested and complies with all the requirements for the CE Mark.

_____ / S / _____   _____ / S / _____
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Preface

The *SunFDDI/P™ 2.0 Adapter User's Guide* describes how to turn your system into an FDDI station attached to an FDDI network. It is intended for experienced network administrators who are familiar with the Solaris™ 7 operating environment or compatible versions. The SunFDDI/P 2.0 Adapter is supported on Sun4u PCI-based system architecture types.

How This Book Is Organized

The *SunFDDI/P™ 2.0 Adapter User's Guide* is organized as follows:

Chapter 1 "SunFDDI/P Overview," describes the SunFDDI/P 2.0 implementation of the FDDI protocols and includes a list of the specifications to which it conforms.

Chapter 2 "Hardware Installation," tells you where to find detailed instructions on how to install your SunFDDI/P PCI card in your machine and describes how to connect the FDDI cable.

Chapter 3 "Installing SunFDDI/P Software," describes how to install the SunFDDI/P device driver and utilities on machines running a Solaris 7 environment. It includes a description of the post-installation scripts that configure your machine as an FDDI station.

Chapter 4 "Using the SunFDDI Network Utilities," describes the network utilities of SunFDDI/P.

Chapter 5 "Improving Network Performance," describes the configurable network parameters and provides advice on how to obtain the best performance from your network.

Chapter 6 "Troubleshooting and Diagnostics," tells you how to detect and resolve problems with your FDDI network.

Appendix A "Frequently Asked Questions About SunFDDI," contains a list of common questions and their responses.

Using UNIX Commands

Use this section to alert readers that not all UNIX commands are provided.
For example:

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

See one or more of the following for this information:

- *Solaris Handbook for Sun Peripherals* (*If you are incorporating Solaris software commands in your document, delete this sentence.*)

- AnswerBook™ online documentation for the Solaris™ software environment

- Other software documentation that you received with your system

Typographic Conventions

TABLE P-1   Typographic Conventions

Typeface	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 Documents

For a more detailed description of FDDI technology and the relevant FDDI protocols, see these documents:

Title	Author/Publisher	Part Number
Handbook of Computer-Communications Standards, Volume 2,	William Stallings, Macmillan Publishing Company: 1987	NA
FDDI Technology and Applications	Edited by Sonu Mirchandani and Raman Khanna, John Wiley & Sons: 1993	NA
FDDI A High Speed Network	Amit Shah and G. Ramakrisnan, Prentice Hall, Inc.: 1994	NA
STREAMS DLPI Specification	Sun Microsystems	800-6915

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Please include the part number of your document in the subject line of your email.

SunFDDI/P Overview

- Feature Summary—page 1
- FDDI Conformance—page 2

This chapter describes the Sun FDDI (Fiber Distributed Data Interface) implementation of the FDDI protocols, including a list of the ANSI/FDDI standards to which it conforms.

Feature Summary

The SunFDDI/P 2.0 product is a combination of hardware and software that turns your system into an FDDI station. There are two hardware options:

- SunFDDI/P SAS — single attached station on fiber
- SunFDDI/P DAS — dual attached station on fiber

SunFDDI/P is a high-speed networking product that provides significantly greater bandwidth (up to 10 times) compared to 10-megabit Ethernet networks. It is designed for Sun4u PCI-based system architecture types running Solaris 7 or compatible versions.

SunFDDI/P provides the following capabilities:

- Implements FDDI single-attached station (SunFDDI/P) and FDDI dual-attached station (SunFDDI/P Dual)
- Provides connection to multimode fiber (SunFDDI/P and SunFDDI/P Dual) networks
- Supports data transfer rates of up to 100 Mbps
- Provides power-up self test and system diagnostic tests
- Provides high reliability and availability through distributed, automatic recovery (DAS adapter only)

- Supports up to four SunFDDI/P PCI cards installed in one PCI bus and up to eight SunFDDI/P PCI cards installed in one machine
- Conforms to the 32-bit Peripheral Component Interconnect (PCI) specification for short form adapter cards
- Supports 33 MHz operating frequency and 5.0 volt I/O signaling
- Supports 62.5/125 micrometer, multimode fiber (MMF)
- Provides SunNet Manager™ agents for the effective management of FDDI stations and networks from a centralized SunNet Manager console; (requires SunNet Manager 2.2 or later in addition to SunFDDI/P)
- Complies with the ANSI X3T9.5 standard for single-attached LAN fiber rings and with revision 7.3 of the ANSI/FDDI SMT specification

FDDI Conformance

SunFDDI/P conforms to the following standards and specifications:

- ANSI/FDDI Media Access Control (MAC) X.3.139-1987
- ANSI/FDDI physical sublayer (PHY) X3.148-1988
- ANSI/FDDI physical medium dependent (PMD) X3.166-1990
- ANSI/FDDI Station Management (SMT) X3.299 R7.3 (formally R7.2.99)
- PCI Spec. Rev 2.1 (Part Number 802-2387-02)

Hardware Installation

- Installation Items—page 3
- Installing SunFDDI/P Adapter Cards—page 4
- MIC-to-SC Converter—page 5
- MIC-to-MIC Coupler—page 6
- Connecting Fiber-optic Cables—page 6
- Cleaning the Fiber-optic Cable—page 8
- Link Status Indicator (Diagnostic LED)—page 9

This chapter provides step-by-step procedures for installing PCI cards, including how to connect fiber-optic cables.

> **Caution –** Before opening your machine, always ensure that the power switch is off (O position). When the power is off, the green light on the front of the machine is unlit and the fan in the power supply is not running. Always take care to protect your equipment from the effects of static electricity.

Installation Items

Before proceeding with the installation, make sure you have the following items. Contact your sales representative if any of these items are missing.

- SAS or DAS SunFDDI PCI adapter
- FDDI converter cable
- MIC (Media Interface Connector) coupler
- Disposable grounding wrist strap
- CD-ROM containing SunFDDI/P 2.0 Adapter software

Installing SunFDDI/P Adapter Cards

Caution – The SunFDDI/P adapter card is sensitive to static electricity. Always use the wrist strap supplied with SunFDDI/P when handling the card and ensure that the wrist strap is properly grounded. Handle the SunFDDI/P adapter card by the edges and avoid touching any of the components

There are no user-configurable jumpers or switches on the SunFDDI/P adapter card. Altering any of the components on the card may affect its operation adversely and will render any product warranty void.

▼ To Install the Adapter

Note – Refer to your system installation or service manual for detailed instructions for the following tasks.

1. **Power off your system and open the system unit.**

2. **Attach the adhesive copper strip of the wrist strap to the metal casing of the power supply. Wrap the other end twice around your wrist, with the adhesive side against your skin.**

3. **Holding the adapter by the edges, unpack and place it on an antistatic surface.**

4. **Remove the filler panel from the slot in which you want to insert the adapter.**

5. **Holding the adapter by the edges, align the adapter edge connector with the PCI slot. Slide the adapter face plate into the small slot at the end of the PCI opening.**

6. **Applying even pressure at both corners of the adapter, push the adapter until it is firmly seated in the slot.**

Caution – Do not use excessive force when installing the adapter into the PCI slot. You may damage the adapter's PCI connector. If the adapter does not seat properly when you apply even pressure, remove the adapter and carefully reinstall it.

7. **If necessary, reinstall the filler panel in the unused PCI opening.**

8. **Detach the wrist strap and close the system unit.**

9. **Connect fiber-optic cables to the adapter and to the FDDI network.**

> **Caution –** Conecting your node to the network could affect other nodes on the network.

MIC-to-SC Converter

If you are connecting the SunFDDI/P card to a network that has a Media Interface Connector (MIC) connector, a converter cable is required. Earlier versions of SunFDDI used MIC connectors.

Sun provides converter cables that enable existing MIC-based networks to connect to the SunFDDI/P adapter without making cabling changes. Networks that have already been designed for SC connections do not need the converter cable. Less than one decibel of signal integrity is lost when using the adapter. Borderline applications may need to reconfigure the network directly for SC connection if the signal loss materially affects the error rate.
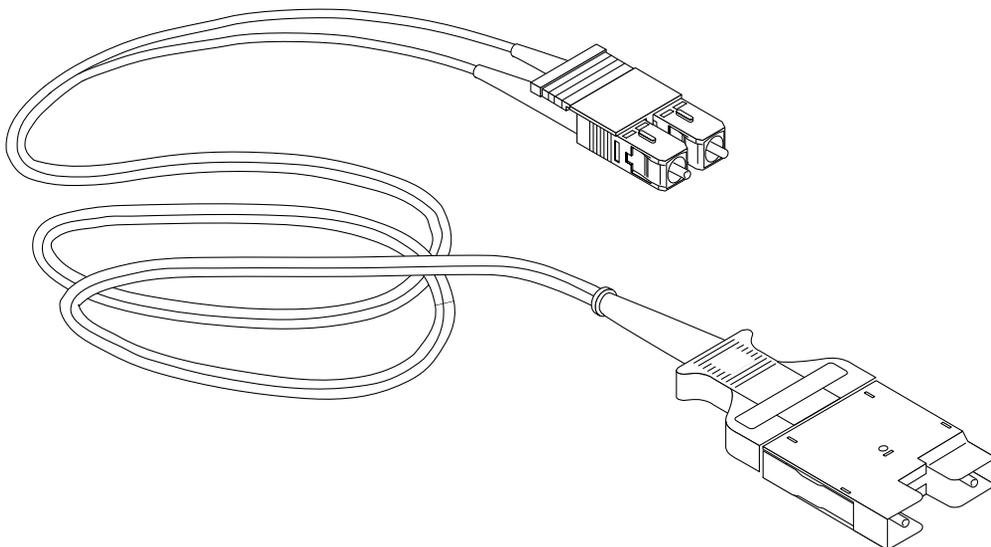
FIGURE 2-1   MIC-to-SC Converter Cable

MIC-to-MIC Coupler

A separate MIC coupler is shipped with the SunFDDI/P 2.0 Adapter product to support MIC-to-MIC network connections.

Two different versions of the coupler are available:

- One with raised keys to help you properly orient the connection
- One without raised keys, which has specific connecting instructions

Note – Make sure you properly connect the coupler. An improper connection will "twist" or "cross" the ring.

Connecting Fiber-optic Cables

Fiber-optic cable is fragile and should not be subjected to mechanical stress or impact. Always observe the following precautions when handling fiber-optic cable and connectors:

- Fiber-optic cable connectors consist of a ceramic or steel ferrule through which the optical fiber passes. Do not touch the tip of the ferrule, as marring or depositing oil or dirt on its delicate surface will destroy its ability to transmit light.
- Use the protective caps provided on the fiber-optic cable connectors and optic data links whenever the cable is not connected.
- Fiber-optic cable has a limited turn radius. Do not bend it in a way that could damage the fiber or cause signal loss.

▼ To Connect the Fiber-optic Cable

1. **Unpack the cable, remove the plastic protective caps or plugs from each end, and remove the plug from the transceiver unit on the card.**

2. **Orient the fiber-optic cable to the connector on the SunFDDI/P card.**

Most fiber-optic cables have raised keys on one side of the connectors (see FIGURE 2-2). There are also keyway notches on the inside of the connector on the card; orient the fiber-optic cable so that the keys on the cable connectors line up with the keyway notches on the card. Also make sure to connect the cable to the proper port, either Port A or Port B (see FIGURE 2-2).

Caution – Not all cables have raised keys to help you orient the connection.
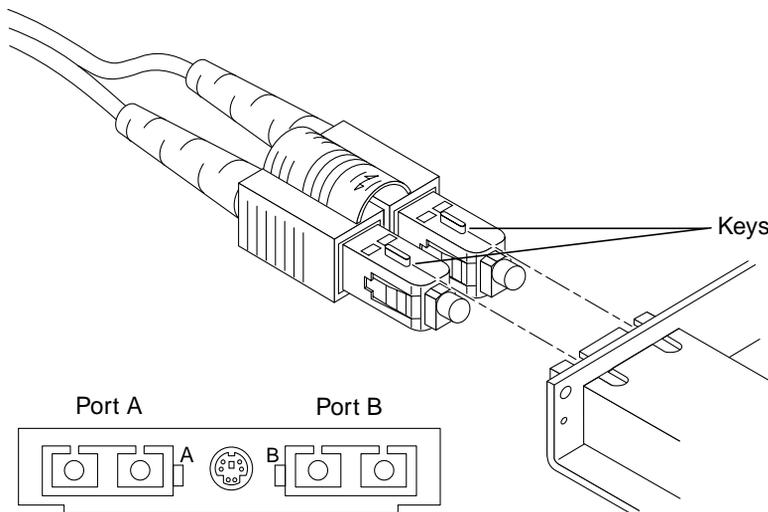
FIGURE 2-2   Aligning SC-Type Fiber Optic Cable Connectors

3. **Plug the cable into the card connector.**

A "click" tells you that the cable is properly mated with the card connector.

Cleaning the Fiber-optic Cable

Fiber-optic cable connectors can be cleaned if they become contaminated with dirt, dust, or oil, which can cause signal noise on the network.

▼ To Clean the Fiber-optic Cable

1. Gently wipe the end of the ferrule with an alcohol-moistened cotton swab.
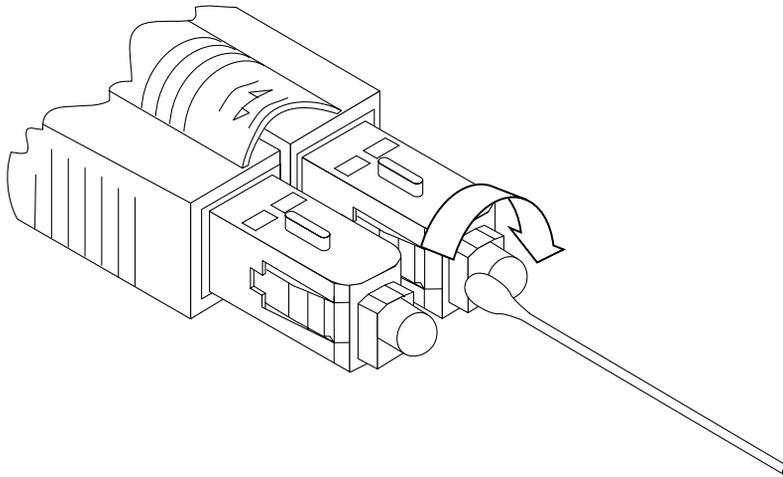
FIGURE 2-3 Cleaning the End of a Fiber-optic Cable

2. Blow clean, dry compressed air around the end of the connector and around the ferrule to dislodge loose dust and grit.

3. Clean the adapter by running a pipe cleaner moistened in alcohol running though it.

4. Repeat Step 3 with a dry pipe cleaner.

5. Dry the adapter with clean, dry compressed air.

Link Status Indicator (Diagnostic LED)

A link status indicator is mounted on the SunFDDI/P adapter card. The color of the LED indicates the current status of the connection to the FDDI network as follows:

- **No LED lit:** Either the driver is loaded and the interface is *not* configured or the driver has not been loaded.
- **Amber:** Interface configured, no valid line state to an active FDDI network exists.
- **Green:** Connection established to an active FDDI network.
- **Blinking green**: In a dual-ring environment, this is an invalid connection. In a dual-homing environment, this is normal. The connection is in Standby mode.
- **Red:** Adapter fails FDDI path test.

Refer to **Chapter 6 "Troubleshooting and Diagnostics**," for more information on diagnosing problems with your FDDI network.

Installing SunFDDI/P Software

- Installation Requirements—page 11
- Installing SunFDDI/P—page 12
- Configuring the Host File—page 14
- Installing SunNet Manager Agents for SunFDDI/P—page 16
- Removing SunFDDI/P—page 16

This chapter assumes that you have already installed the SunFDDI/P adapter card in your machine and that you are loading the software from a local CD-ROM drive.

This chapter tells you how to install the SunFDDI/P device drivers, utilities, and SunNet Manager agents for Solaris 2.5.1 Hardware: 4/97, Solaris 2.6, or Solaris 7. It includes instructions on how to check your installation and how to remove the SunFDDI/P software, if necessary.

Installation Requirements

- **Hardware and Software Platforms**

  SunFDDI/P is designed for Sun4u PCI-based system architecture types (32 Mbytes RAM minimum) running Solaris 2.5.1 Hardware: 4/97, Solaris 2.6, or Solaris 7.

- **Disk Space**

  A machine with 1600 KBytes of disk space is required to install SunFDDI/P.

Installing SunFDDI/P

Use pkgadd(1M) to install unbundled software. See the *Solaris 7 Software and AnswerBook Packages Administration Guide* for detailed information on installing software products using pkgadd.

For detailed instructions on how to load software from a CD-ROM drive mounted on a remote directory, see the *Solaris 7 Software and AnswerBook Packages Administration Guide.*

▼ To Install SunFDDI/P Using pkgadd

1. **Become superuser.**

2. **Place the CD-ROM in its caddy and load the caddy into the CD-ROM drive.**

   The CD-ROM is mounted automatically under
   /cdrom/sunfddi_s6_0_and_p2_0/

3. **Start** pkgadd **by typing:**

   ```
   # cd /cdrom/sunfddi_s6_0_and_p2_0/Product/pci
   # pkgadd —d .
   ```

4. **Enter the number that corresponds to the package you want to install or type** all **to install all packages and press Return. Respond to any prompts that are displayed.**

   ```
     The following packages are available:
      1  SUNWpfd     SunFDDI PCI Drivers
                     (sparc) 2.0
      2  SUNWpfh     SunFDDI PCI Header files.
                     (sparc) 2.0
      3  SUNWpfm     SunFDDI PCI Man pages.
                     (sparc) 2.0
      4  SUNWpfu     SunFDDI PCI Utilities.
                     (sparc) 2.0
   Select package(s) you wish to process (or "all" to process all
   packages). (default: all) [?,??,q]:
   ```

5. **Type** `1` **to install the PCI drivers (**`SUNWpfd`**).**

   The `SUNWpfd` package contains the SunFDDI/P device driver. By default, the base directory *<basedir>* for this package is `/`. You can change the default base directory for this package when you start `pkgadd(1M)` with the `-R` option. `SUNWpfd` must be installed on every machine that runs SunFDDI/P.

6. **Type** `2` **to install the header files.**

7. **Type** `3` **and** `4` **to install the man pages, utilities, and SNM agents.**

   The `SUNWpfm` package contains the SunFDDI/P man pages, and the `SUNWpfu` package contains the utilities and the SNM agents. By default, the base directory *<basedir>* for this packages is `/opt`. You can change the default base directory when you start `pkgadd(1M)`with the `-R` option. `SUNWpfm` can be installed on a server and shared between multiple machines, if required.

8. **Type** `y` **to accept the installation of files with** `setuid/setgid` **permission.**

   If you are installing the `SUNWpfu` package for the first time, this step will not occur.

   ```
   Do you want to install these setuid/setgid files [y,n,?,q] y
   ```

9. **Type** `y` **to accept the installation scripts.**

   ```
   This package contains scripts which will be executed with
   superuser permission during the process of installing the
   package.

   Do you want to continue with the installation [y,n,?] y
   ```

10. **Type** `q` **to stop** `pkgadd` **when the list of available packages is displayed again.**

    ```
      The following packages are available:
       1  SUNWpfd     SunFDDI PCI Drivers
                      (sparc) 2.0
       2  SUNWpfh     SunFDDI PCI Header files.
                      (sparc) 2.0
       3  SUNWpfm     SunFDDI PCI Man pages.
                      (sparc) 2.0
       4  SUNWpfu     SunFDDI PCI Utilities.
                      (sparc) 2.0
    Select package(s) you wish to process (or "all" to process all
    packages). (default: all) [?,??,q]:
    ```

11. Eject the CD-ROM from the CD-ROM drive.

```
# eject cdrom
```

Configuring the Host File

After installing the SunFDDI driver software, you must create a `hostname.pf`*num* file for the interfaces on the adapter. You must also create both an IP address and a host name for the interfaces in the `/etc/hosts` file.

▼ To Configure the Host File

1. At the command line, use the `grep` command to search the `/etc/path_to_inst` file for `pf` devices.

For a SunFDDI PCI adapter:

```
# grep pf /etc/path_to_inst
"/pci@1f,2000/pci@2/SUNW,pf@0,1" 0 "pf"
"/pci@1f,2000/pci@2/SUNW,pf@1,1" 1 "pf"
"/pci@1f,2000/pci@2/SUNW,pf@2,1" 2 "pf"
"/pci@1f,2000/pci@2/SUNW,pf@3,1" 3 "pf"
```

In the example above, the four `SUNW,pf@`*x*`,1` instances are from a SunFDDI PCI adapter installed in slot 2. For clarity, the instance numbers are bold.

2. Create an `/etc/hostname.pf`*num* file, where *num* is the instance number of each interface you plan to use.

If you want to use all of the network interfaces from the example in Step 1, you will need to create four files:

File Name	Instance Number	Adapter Ethernet Network Interface
/etc/hostname.pf0	0	0
/etc/hostname.pf1	1	1
/etc/hostname.pf2	2	2
/etc/hostname.pf3	3	3

- Do not create /etc/hostname.pf*num* files for SunLink OSI network interfaces you plan to leave unused.
- The /etc/hostname.pf*num* file must contain the host name for the appropriate network interface.
- The host name should have an IP address that will need to be entered in the /etc/hosts file.
- The host name should be different from any other host name of any other interface, for example: /etc/hostname.hme0 and /etc/hostname.pf2 cannot share the same host name.

Using the instance examples in Step 1, the following example shows the four /etc/hostname.pf*num* files required for a system called zardoz that has a SunLink OSI (zardoz-11, zardoz-12, zardoz-13, and zardoz-14).

```
# cat /etc/hostname.hme0
zardoz
# cat /etc/hostname.pf0
zardoz-11
# cat /etc/hostname.pf1
zardoz-12
# cat /etc/hostname.pf2
zardoz-13
# cat /etc/hostname.pf3
zardoz-14
```

3. **Create an appropriate entry in the** /etc/hosts **file for each active** pf **network interface.**

Using the previous example, you will have:

```
# cat /etc/hosts
#
# Internet host table
#
127.0.0.1      localhost
129.144.10.57 zardoz     loghost
129.144.11.83 zardoz-11
129.144.12.41 zardoz-12
129.144.13.67 zardoz-13
129.144.14.30 zardoz-14
```

4. **Reboot your system.**

Installing SunNet Manager Agents for SunFDDI/P

Use `pf_install_agents` to install the SunNet Manager agents for SunFDDI/P. This script copies the FDDI schema files to the directory where the standard agents are installed and updates the configuration files for SunNet Manager. Run `pf_install_agents` on each SunNet Manager console, and on each SunFDDI/P station you want to manage using SunNet Manager. The `SUNWpfu` package puts the utilities for SunNet Manager Agents in the `/etc/opt/SUNWpf` directory.

▼ To Use `pf_install_agents`

1. **Become superuser.**

2. **Start** `pf_install_agents` **by typing:**

```
# /etc/opt/SUNWpf/bin/pf_install_agents
```

3. **Type the host names of the console machines that will receive SMT Request Frame (SRF) trap reports from the local station.**

   You can send SRF trap reports to more than one console. Each console must have the schemas for SunFDDI/P installed, for example:

```
Enter hostnames (if any) to send SRF Trap reports to:
(enter blank to terminate)
          enter hostname:opus
          enter hostname:rigel
          enter hostname:
```

Removing SunFDDI/P

If you remove the SunFDDI/P hardware interfaces from your machine, you also need to remove the SunFDDI/P software to prevent the device driver from starting each time you reboot the machine.

Use pkgrm(1M) to remove unbundled software from machines running the Solaris 7 or compatible environment. Refer to *Installing Solaris Software* for detailed information on removing software packages using pkgrm.

▼ To Remove SunFDDI/P

1. **Become superuser.**

2. **Use** pkginfo **to find all the SunFDDI/P software packages that have been installed on the system:**

```
# /usr/bin/pkginfo | grep pf
system SUNWpfd SunFDDI PCI Drivers
system SUNWpfu SunFDDI PCI Utilities
```

3. **Use** pkgrm **to remove all SunFDDI PCI software packages. Remember to remove** SUNWpfd *last*

   The post-remove script removes the modifications made to the system files and updates the package information on your machine.

```
# /usr/sbin/pkgrm SUNWpfu SUNWpfd
```

CHAPTER **4**

Using the SunFDDI Network Utilities

- Changing the Default MAC Address (pf_macid)—page 19
- Displaying SunFDDI/P Statistics (pf_stat)—page 21
- Monitoring SMT Frames (pf_smtmon)—page 30

This chapter describes the network utilities of SunFDDI/P.

Throughout this chapter, it is assumed that you have installed the SunFDDI/P software under the default base directory *<basedir>* for your operating system:

The default base directory *<basedir>* is:

```
/opt/SUNWconn/bin
```

Changing the Default MAC Address (`pf_macid`)

Each attachment to an FDDI network is identified by a unique 48-bit MAC address. By default, the first SunFDDI/P card takes the host-resident MAC address, which is stored in nonvolatile memory (NVRAM) on the motherboard of the machine. Each subsequent SunFDDI/P card adopts the card-resident MAC address stored in its own IDPROM.

In general, this convention is sufficient to ensure that each SunFDDI/P card installed in the machine has a unique MAC address. However, there may be a conflict with other LAN interfaces that also take the host-resident MAC address—for example, an Ethernet (le) interface, or a SunFDDI/P 2.0 (bf) interface. In this event, change the default MAC address assigned to the first SunFDDI/P card installed in the system.

▼ To Change the Default MAC Address with pf_macid

Use the pf_macid(1M) utility to recover the card-resident MAC address, and then modify the system files to override the default MAC address:

1. **Become superuser.**

2. **Use the** pf_macid(1M) **utility to recover the MAC address from the IDPROM on the SunFDDI/P interface identified by the instance number** *<inst>*.

   ```
   # <basedir>/pf_macid pf<inst>
   <mac_address>
   ```

3. **Modify the start-up file on your machine so that the MAC address is assigned correctly when the system is rebooted.**

   a. **Edit the** /etc/rcS.d/S30rootusr.sh **file to add the following** if **statement immediately** *after* **the** ifconfig **command that initializes the interface** pf*<inst>*.

   If you are changing the MAC address of more than one interface, add one if statement for each interface.

   ```
   ifconfig $1 plumb
       if [ $1 = "pf<inst>" ]; then
           ifconfig pf<inst> ether <mac_address>
       fi
   ```

   On most systems, the /etc/rcS.d/S30rootusr.sh file is a hard link to the /etc/rootusr file.

4. **Reboot your machine to assign the new MAC address to the SunFDDI interface.**

   When a SunFDDI/P card takes the host-resident MAC address, it can be swapped to another system without affecting the existing network. However, once a station starts sending packets on the network, the Address Resolution Protocol (ARP) updates the ARP tables on other stations to include the MAC address of its interface.

The ES-IS protocol performs the same function for SunFDDI OSI running over FDDI. If you swap SunFDDI/P cards that use the card-resident MAC address, you must wait until the ARP entries time-out, or remove the ARP entries from every active station manually before packets can be routed correctly.

Displaying SunFDDI/P Statistics (`pf_stat`)

The `pf_stat(1M)` utility interrogates a specified SunFDDI/P interface and displays the accumulated statistics. This command must be executed as `root` and has the general form:

```
# <basedir>/pf_stat [-m] pf<inst> [<interval>] [<count>]
```

pf<inst> specifies the SunFDDI/P interface

<interval> is the elapsed time (in seconds) between interrogations

<count> the total number of interrogations

The `pf_stat` utility displays information using column headings that conform to SMT revision 7.3, which differ from SMT revision 5.1 and 4.2 headings in the following cases:

- The ECM heading corresponds to the 5.1 MIM heading.
- The RMT heading does not have an analog in SMT revision 4.2. If you run SunFDDI/P at revision level 4.2, ignore any data displayed under the RMT heading of `pf_stat`.

Displaying Local Interface Statistics

When you enter the `pf_stat` command *without* the -m option, it displays statistics recovered from the local interface pf<inst>.

For example, to display the accumulated statistics for the interface pf0, type:

```
# <basedir>/pf_stat pf0
Ring    ECM       RMT       PCMS    Ring_OP     XmitP     RecvP
UP      IN     RING_OP    ACTIVE        c      16fde     1862d
```

You can also monitor the interface dynamically (active monitor), by specifying the *interval* (the elapsed time between interrogations) and *count* (the total number of interrogations). This displays the incremental difference between the current state and the previous state. The minimum interval is one second and the accumulated statistics are displayed after every tenth interrogation.

For example, to monitor the interface pf0 once every 60 seconds for 3 minutes (a total of 3 interrogations), type:

```
# <basedir>/pf_stat pf0 60 3
Ring    ECM        RMT       PCMS    Ring_OP     XmitP      RecvP
UP      IN    RING_OP    ACTIVE          c      131a0      131aa
UP      IN    RING_OP    ACTIVE          0          0          0
UP      IN    RING_OP    ACTIVE          0          1          1
```

Interpreting Local Statistics

Running the pf_stat utility *without* the −m option displays information about the various SMT state machines and the network to which the local station is attached:

Ring *(Ring Status)*

The Ring status shows the current state of the physical connection to the FDDI network. The following states may be returned by pf_stat under the Ring heading

- UP–SunFDDI/P interface physically connected to the active network
- DOWN–SunFDDI/P interface disconnected, or connected to the inactive network

ECM (Entity Coordination Management)

ECM shows the current state of the Entity Coordination Management state machine, which controls the following features and facilities:

- Media availability
- Trace
- Path Test
- Optical Bypass (optional)
- Hold Policy (optional)

TABLE 4-1 lists the states that may be returned by `pf_stat` under the ECM heading.

TABLE 4-1   `pf_stat` States Under the ECM Heading

State	Meaning
OUT	ECM is inactive and is waiting for a connect request (initial state).
IN	ECM is active; normal state after successful connection request.
TRACE	ECM is propagating a trace request to the appropriate entity.
LEAVE	ECM is closing all connections prior to the station leaving the ring.
PATH_TEST	ECM is entering a path test state following trace completion.
INSERT	ECM is sending a request to the optical bypass switch to indicate that the station is entering the ring. This disengages the switch.
CHECK	ECM is verifying that symbols are being received from the network.
DEINSERT	ECM is sending a request to the optical bypass switch, to indicate that the station is leaving the ring. This engages the switch.

RMT (Ring Management)

RMT shows the current state of the Ring Management state machine, which controls the following features and facilities:

- MAC availability
- Detection and resolution of duplicate addresses
- Identification of stuck beacon and initiation of trace

TABLE 4-2 lists the states that may be returned by `pf_stat` under the RMT heading.

TABLE 4-2   `pf_stat` States Under the RMT Heading

State	Meaning
ISOLATED	RMT is inactive (initial state).
NON_OP	RMT is waiting for an operational ring.
RING_OP	RMT is operating normally.
DETECT	RMT is checking for duplicate addresses (transient state during initialization).
NON_OP_DUP	RMT has detected that its address is duplicated and is initiating recovery. The ring is not operational in this state.

TABLE 4-2   `pf_stat` States Under the RMT Heading   *(Continued)*

RING_OP_DUP	RMT has detected that the MAC address is duplicated and flagged the error. The ring is operational in this state.
DIRECTED	RMT has been beaconing for an extended period of time and is transmitting a stream of directed beacons prior to initiating recovery.
TRACE	RMT has initiated a trace to recover a stuck beacon.

PCM (Physical Connection Management)

PCM shows the current state of the Physical Connection Management state machine that controls the following features and facilities:

- Connection initialization
- Maintenance support

This heading is modified to indicate the type of port that is being managed:

- PCMS: single-attached station, S-port
- PCMA: dual-attached station, A-port
- PCMB: dual-attached station, B-port

TABLE 4-3 lists the states that may be returned by `pf_stat` under the PCM heading.

TABLE 4-3   `pf_stat` States Under the PCM Heading

State	Meaning
OFF	PCM is inactive (initial state).
BREAK	PCM is starting the connection synchronization phase.
CONNECT	PCM is synchronizing the connection end-points prior to the signaling sequence.
NEXT	PCM is transmitting PDUs prior to entering SIGNAL state.
SIGNAL	PCM is transmitting and receiving signal bits (information) following a NEXT state.
JOIN	First state in the sequence leading to a synchronized connection.
VERIFY	Second state in the sequence leading to a synchronized connection.
ACTIVE	Final state indicating that the port is successfully incorporated in the token path.
TRACE	PCM is localizing a stuck beacon condition.

The normal sequence of PCM states leading to a fully synchronized connection and incorporation of the port into the token path is shown in FIGURE 4-1. Note that the minimum interval between interrogations is one second and that this is not always fast enough to recover and display the complete sequence of PCM states.
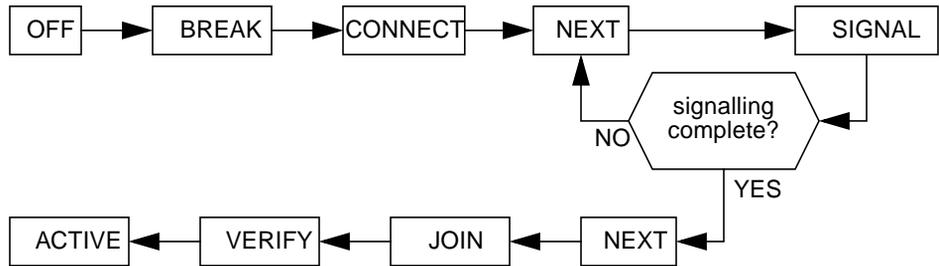
FIGURE 4-1   Normal Sequence of PCM States

Ring_OP *(Ring Operational)*

Ring_OP shows the number of Ring_OP (Ring Operational) signals received. This signal is generated when the station is incorporated into an operational network.

XmitP *(Transmit Packets)*

Running pf_stat *without* an interval and count, displays the total number of packets transmitted since the interface was activated. Running pf_stat *with* an interval and count, displays the number of packets transmitted since the last interrogation.

RecvP *(Receive Packets)*

Running pf_stat *without* an interval and count displays the total number of packets received since the interface was activated. Running pf_stat *with* an interval and count displays the number of packets received since the last interrogation.

Example Local Statistics

The following output was recovered from a single-attached station using the command shown. A temporary fault condition was simulated by disconnecting the FDDI cable from the SunFDDI/P card and then reconnecting it.

```
# <basedir>/pf_stat pf0 1 20
Ring    ECM       RMT      PCMS    Ring_OP    XmitP    RecvP
UP      IN    RING_OP    ACTIVE        2         26       1d
UP      IN    RING_OP    ACTIVE        0          0        0
UP      IN    RING_OP    ACTIVE        0          0        0
UP      IN    RING_OP    ACTIVE        0          0        0
DOWN    IN   ISOLATED   CONNECT        0          1        1
DOWN    IN   ISOLATED   CONNECT        0          0        0
DOWN    IN   ISOLATED      NEXT        0          0        0
UP      IN    RING_OP    ACTIVE        1          0        0
UP      IN    RING_OP    ACTIVE        0          1        1

Ring    ECM       RMT      PCMS    Ring_OP    XmitP    RecvP
UP      IN    RING_OP    ACTIVE        3         29       20
UP      IN    RING_OP    ACTIVE        0          0        0
UP      IN    RING_OP    ACTIVE        0          1        1
UP      IN    RING_OP    ACTIVE        0          0        0
UP      IN    RING_OP    ACTIVE        0          0        0
UP      IN    RING_OP    ACTIVE        0          0        0
UP      IN    RING_OP    ACTIVE        0          0        0
UP      IN    RING_OP    ACTIVE        0          0        0
UP      IN    RING_OP    ACTIVE        0          0        0
UP      IN    RING_OP    ACTIVE        0          1        1
```

Note the following observations regarding this example:

- Accumulated statistics are displayed automatically after every tenth interrogation.
- The combination of Ring=DOWN and RMT=ISOLATED indicate that the station is disconnected from the network.
- The minimum interval of one second is not fast enough to recover and display the complete sequence of PCM states during the path re-establishment phase.
- A Ring_OP signal is received when the path is re-established indicating that the ring is operational.

The link status indicator mounted on the SunFDDI/P card displays the following sequence of events:

Green (connected) —> **Amber** (disconnected) —> **Green** (connected)

Displaying Statistics from Neighboring Stations

When you use the pf_stat command *with* the -m option, it displays information about the neighboring stations attached to the local interface pf*<inst>* and the frames received from the network.

For example, to display information about the neighboring stations attached to the interface pf0, type:

```
# <basedir>/pf_stat —m pf0
PhyS Frame      Error       Lost       SA       UNA       DNA
M   b43eb2          0          3 <mac_addr1> <mac_addr2> <mac_addr3>
```

You can also monitor the neighboring stations dynamically (active monitor), by specifying the *interval* (the elapsed time in seconds between interrogations) and *count* (the total number of interrogations). The minimum interval is one second and the accumulated statistics are displayed after every tenth interrogation.

For example, to monitor the stations attached to pf0 once every 10 seconds for 1 minute (a total of 6 interrogations), type:

```
# <basedir>/pf_stat —m pf0 10 6
PhyS Frame      Error       Lost       SA       UNA       DNA
M   c460a6d         0          3 <mac_addr1> <mac_addr2> <mac_addr3>
M    27224          0          0 <mac_addr1> <mac_addr2> <mac_addr3>
M    27227          0          0 <mac_addr1> <mac_addr2> <mac_addr3>
M    27220          0          0 <mac_addr1> <mac_addr2> <mac_addr3>
M    2722e          0          0 <mac_addr1> <mac_addr2> <mac_addr3>
M    27223          0          0 <mac_addr1> <mac_addr2> <mac_addr3>
```

Interpreting Statistics from Neighboring Stations

Running the pf_stat utility *with* the -m option displays information about the neighboring stations attached to the local interface pf*<inst>*.

Phy (Physical Connection)

PHY shows the type of physical connection to the FDDI network. This heading is modified to indicate the type of port being managed:

- PhyS: single-attached station, port S
- PhyA: dual-attached station, port A
- PhyB: dual-attached station, port B

The following states may be returned by `pf_stat` under the `Phy` heading:

Table 4-4   States Returned by `pf_stat`

State	Meaning
NONE	Port disconnected
M	Port connected to Port M on a concentrator
S	Port connected to Port S on a single-attached station
A	Port connected to Port A on a dual-attached station
B	Port connected to Port B on a dual-attached station

Frame (Frames Received)

Running `pf_stat` *without* an interval and count displays the total number of SMT frames received since the interface was activated. Running `pf_stat` *with* an interval and count displays the number of SMT frames received since the last interrogation.

More detailed information about the SMT frames can be recovered using the `pf_smtmon(1M)` utility described in "Monitoring SMT Frames (pf_smtmon)" on page 30.

Error (Error Frames)

Running `pf_stat` *without* an interval and count displays the total number of error frames received since the interface was activated. Running `pf_stat` *with* an interval and count displays the number of error frames received since the last interrogation. An error frame is defined as an SMT frame whose E (error) bit is set, and whose E bit is first detected by the local station. It does not indicate the location of the cause of the error. Frequent error frames can indicate a noise problem on the network, either dirt (optical fiber) or electrical interference (UTP).

Lost (Lost Frames)

Running `pf_stat` *without* an interval and count displays the total number of lost frames since the interface was activated. Running `pf_stat` *with* an interval and count displays the number of lost frames since the last interrogation. A lost frame is defined as an SMT frame whose reception is aborted by the local station. It does not indicate the location of the cause of the error. A large number of lost frames can indicate a noise problem on the network, either dirt (optical fiber) or electrical interference (UTP).

SA (Station Address)

Displays the MAC address for the local station.

UNA (Upstream Neighbor Address)

Displays the MAC address for the neighboring station, connected upstream on the ring from the local station.

DNA (Downstream Neighbor Address)

Displays the MAC address for the neighboring station, connected downstream on the ring from the local station.

Example Neighbor Statistics

The following output was recovered from a single-attached station using the command shown. A temporary fault condition was simulated by disconnecting the FDDI cable from the SunFDDI/P card and then reconnecting it.

```
#  <basedir>/pf_stat —m pf0 1 20
PhySFrameError Lost     SA      UNA          DNA
   Mc45d5463    1      1b    <mac_addr1>   <mac_addr2>   <mac_addr3>
   M    27437    0      0    <mac_addr1>   <mac_addr2>   <mac_addr3>
   M    27427    0      0    <mac_addr1>   <mac_addr2>   <mac_addr3>
   M    27435    0      0    <mac_addr1>   <mac_addr2>   <mac_addr3>
   NONE182f1     0      0    <mac_addr1>   <mac_addr2>   <mac_addr3>
   NONE    0     0      0    <mac_addr1>   <mac_addr2>   <mac_addr3>
   NONE    0     0      0    <mac_addr1>   <mac_addr2>   <mac_addr3>
   M     d432    0      7    <mac_addr1>   <mac_addr2>   <mac_addr3>
   M    2707e    0      0    <mac_addr1>   <mac_addr2>   <mac_addr3>

PhySFrameError Lost     SA      UNA          DNA
   Mc46e5ce7    1      22    <mac_addr1>   <mac_addr2>   <mac_addr3>
   M    27228    0      0    <mac_addr1>   <mac_addr2>   <mac_addr3>
   M    27230    0      0    <mac_addr1>   <mac_addr2>   <mac_addr3>
   M    27227    0      0    <mac_addr1>   <mac_addr2>   <mac_addr3>
   M    2722e    0      0    <mac_addr1>   <mac_addr2>   <mac_addr3>
   M    2722c    0      0    <mac_addr1>   <mac_addr2>   <mac_addr3>
   M    27228    0      0    <mac_addr1>   <mac_addr2>   <mac_addr3>
   M    27231    0      0    <mac_addr1>   <mac_addr2>   <mac_addr3>
   M    2722b    0      0    <mac_addr1>   <mac_addr2>   <mac_addr3>
   M    27227    0      0    <mac_addr1>   <mac_addr2>   <mac_addr3>
```

Note the following observations regarding this example:

- Accumulated statistics are displayed automatically after every tenth interrogation.
- The combination of PhyS=NONE and the loss of frame activity indicates that the station is disconnected from the network.

Monitoring SMT Frames (pf_smtmon)

The pf_smtmon(1M) utility is an active monitor that displays the SMT frames received by the local station. It is particularly useful for diagnosing communication problems with the SunNet Manager proxy agent.

This command must be executed as root (or superuser) and has the general form:

```
# <basedir>/pf_smtmon [-i pf<inst>] [—x] [—h] [<frameclass>]
```

-i pf<inst> specifies the SunFDDI/P interface

-x displays the received SMT frames in hexadecimal

-h displays help information, including a list of valid frame classes

<frameclass> specifies one or more SMT frame classes (used to filter output)

If you do not specify an interface, pf_smtmon returns the SMT frames received by pf0. If you do not specify a frame type, pf_smtmon displays all the SMT frames that it receives. Use Ctrl-C to stop pf_smtmon.

To display the encoded SMT frames received by interface pf1, type:

```
# <basedir>/pf_smtmon -i pf1
pf1: nif_request  v=0x1 t=0xfc03e781 s=10-0-4-48-6f-a5 i=0x28
pf1: nif_response v=0x1 t=0xfc03e781 s=10-0-4-8-24-5c  i=0x28
pf1: nif_request  v=0x1 t=0xfc00dec6 s=10-0-4-b8-6e-ab i=0x28
pf1: nif_request  v=0x1 t=0xfc03e787 s=10-0-4-48-6f-a5 i=0x28
pf1: nif_response v=0x1 t=0xfc03e787 s=10-0-4-8-24-5c  i=0x28
```

The elements of the SMT frames are defined as follows:

Table 4-5 Elements of the SMT Frames

Element	Description
class_type	Identifies the SMT frame class and type (see page 33)
v	Version ID; identifies the structure of the SMT information field
t	Transaction ID; used to pair SMT response and request frames
s	Station ID; uniquely identifies the station transmitting the frame
i	InfoField Length; defines the length of the SMT information field

- **To display the SMT frames received by interface** `pf1` **in hexadecimal format, type:**

```
# <basedir>/pf_smtmon -i pf1 —x
pf1: nif_request v=0x1 t=0x170 s=10-0-4-8-24-5c i=0x28
004DC000 0000004F FFFFFFFF FFFF1000 0408245C 01020001 00000170 00001000
0408245C 00000028 00010008 00001000 04B86EAB 00020004 00010100 00030004
00002100 200B0008 00000001 00000001 76C467A0

pf1: nif_request v=0x1 t=0x5e0f s=10-0-d4-78-42-4d i=0x28
004D0000 0000004F FFFFFFFF FFFF1000 D478424D 01020001 00005E0F 00001000
D478424D 00000028 00010008 00001000 0408245C 00020004 01010208 00030004
00001200 200B0008 0000000B 00000002 A522BBA1

pf1: nif_response v=0x1 t=0xfc00d94a s=10-0-4-8-24-5c i=0x28
004D0000 00000041 100004B8 6EAB1000 0408245C 01030001 FC00D94A 00001000
0408245C 00000028 00010008 00001000 04B86EAB 00020004 00010100 00030004
00002100 200B0008 00000001 00000001 865549E2 0049C020 F0154E4F FFFFFFFF
FFFF1000 04B86EAB 01020001 FC00D94A 00001000 04B86EAB 00000028 00010008
00001000 D478424D 00020004 00010100 00030004 00002000 200B0008 00000001
00000001

pf1: nif_request v=0x1 t=0x5e13 s=10-0-d4-78-42-4d i=0x28
004D0000 0000004F FFFFFFFF FFFF1000 D478424D 01020001 00005E13 00001000
D478424D 00000028 00010008 00001000 0408245C 00020004 01010208 00030004
00001200 200B0008 0000000B 00000002 4AD75A79

pf1: nif_request v=0x1 t=0x5e17 s=10-0-d4-78-42-4d i=0x28
004D0000 0000004F FFFFFFFF FFFF1000 D478424D 01020001 00005E17 00001000
D478424D 00000028 00010008 00001000 0408245C 00020004 01010208 00030004
00001200 200B0008 0000000B 00000002 DCEBADA2

pf1: nif_request v=0x1 t=0x171 s=10-0-4-8-24-5c i=0x28
004DC000 0000004F FFFFFFFF FFFF1000 0408245C 01020001 00000171 00001000
0408245C 00000028 00010008 00001000 04B86EAB 00020004 00010100 00030004
00002100 200B0008 00000001 00000001 127B1D3B

pf1: nif_request v=0x1 t=0x5e1b s=10-0-d4-78-42-4d i=0x28
004D0000 0000004F FFFFFFFF FFFF1000 D478424D 01020001 00005E1B 00001000
D478424D 00000028 00010008 00001000 0408245C 00020004 01010208 00030004
00001200 200B0008 0000000B 00000002 626FA878
```

SMT Frame Classes and Types

SMT frames are used for peer-to-peer (station-to-station) management. They are divided into *classes*, which define the function of the frame. Each class is then divided into up to three *types*, which define whether the frame is an announcement (information only), a request for service, or a response to a request. Refer to the *ANSI/FDDI Station Management (SMT) X3.299 R7.3 Specification* for a detailed description of SMT frames and their functions.

The pf_smtmon utility is used to monitor the following SMT frame classes:

NIF (Neighbor Information Frames)

These are the most common frames displayed when you run pf_smtmon. As the name suggests, they carry information about a neighboring station (for example, address, description, state, MAC capabilities) and are used as keep-alive notifications that a station is still attached to the ring and functioning. An NIF frame can be an announcement, a request, or a response.

SIF (Status Information Frames)

These frames carry more detailed information about a station. SIF configuration frames describe the station configuration (for example, number of ports, number of MAC entities, connection policy). SIF operation frames describe the current status of the station. A SIF frame can be either a request or a response.

ECF (Echo Frames)

These frames are equivalent to ICMP ping packets and are used to test connectivity between stations. An ECF frame can be either a request or a response.

RDF (Request Denied Frame)

These frames are used to indicate that the request is rejected. If an SMT agent (such as the SunNet Manager proxy agent delivered with SunFDDI/P) receives an unsupported or unrecognized request, it issues an RDF frame to indicate that the request is rejected. An RDF frame is always a response.

ESF (Extended Service Frame)

These frames are implementation dependent. An ESF frame can be an announcement, a request, or a response.

PMF (Parameter Management Frame)

These frames are used to access remote station attributes. The Parameter Management Protocol supports both get (display) and set (modify) functions. However, the pf_smtmon utility can display only PMF_get frames. A PMF_get frame can be either a request or a response.

Filtering Output from `pf_smtmon`

By default, pf_smtmon displays all of the SMT frames received by the local station. You can filter the output generated by pf_smtmon by specifying one or more frame classes on the command-line: nif, sif_config, sif_operat, ecf, rdf, esf, pmf_get.

For example:

● **To display only the RDF frames received by interface** pf0, **type:**

```
# <basedir>/pf_smtmon rdf
```

● **To display the SIF configuration and SIF operation frames received by interface** pf1, **type:**

```
# <basedir>/pf_smtmon —i pf1 sif_config sif_operat
```

● **To display the NIF frames, SIF configuration frames, and SIF operation frames received by interface** pf1, **type:**

```
# <basedir>/pf_smtmon —i pf1 nif sif_config sif_operat
```

Improving Network Performance

- High-Performance FDDI Networks—page 35
- Ring Latency Improvement—page 36
- Data Throughput Improvement—page 36
- Performance Across Bridges—page 37
- To Tune the Socket Options—page 38
- MTU Path Discovery—page 38
- Tuning pf Parameters—page 39

This chapter tells you how to obtain the best performance from your FDDI network. It assumes that you are familiar with FDDI network architecture and related terminology.

Caution – There are a number of ways to improve network performance, some of which are discussed in this chapter. However, these improvements should be undertaken only by experienced system administrators. Tuning your network incorrectly can affect network performance adversely.

High-Performance FDDI Networks

FDDI networks increase the potential to carry *more* information, rather than create a faster connection. If the applications running over the network do not use the available bandwidth efficiently, you will not see much improvement in the performance of your network by using FDDI.

You can obtain optimum performance by balancing the complementary objectives of maximum throughput and minimum access delay:

- Throughput is a measure of the ring utilization. Network efficiency is defined as the ratio of actual throughput to theoretical maximum bandwidth (100 Mbps).
- Access delay is the time a station has to wait before it can transmit on the network. This is largely dependent on how fast the permission token rotates around the ring.

For some applications (for example, bulk data transfers), throughput is critical. Other applications (for example, voice or video applications) are more sensitive to access delay.

Ring Latency Improvement

The ring latency is the physical delay inherent in the FDDI network. It is dependent on the number of stations in the ring and the overall length of the ring. The speed of the microprocessor in the FDDI station also has a significant effect on ring latency.

The FDDI specifications define a network that supports up to 1000 physical connections with a total ring length of 200 km (100 km per ring in a dual-ring topology). There are two physical connections for each dual-attached station. Therefore, in theory, up to 500 dual-attached stations could be connected in a single ring. In reality, optimum performance is obtained by limiting the number of connections to fewer than 100 stations in an unsegmented ring.

It is possible to realize performance improvements by changing the topology of the network, trading off the total number of stations in comparison to the overall length of the ring, and selecting faster machines to act as FDDI stations. However, these modifications are rarely practical in an established network.

Data Throughput Improvement

The most significant improvements in throughput are achieved by maximizing the rate at which data is transferred to and from the FDDI network. If you are running TCP/IP or UDP/IP applications, you can improve throughput by modifying the parameters that control the rate at which these protocols transfer data to and from the SunFDDI/P device driver—that is, between user space and kernel space.

Send and Receive Buffers

The send and receive buffers control the maximum rate at which data is transferred between user space and kernel space by applications that use sockets. The size of these buffers defines the amount of data that can be transferred at one time.

To optimize performance, consistent values must be assigned for the send and receive buffers. The default value (4 Kbytes) assigned to these parameters is optimized for transmission across Ethernet connections. For applications running over FDDI, the send and receive buffers should be set to 32 Kbytes.

Performance Across Bridges

The *maximum transfer unit* (MTU) for each physical layer in the network defines the maximum size (in octets) of the transmitted packets. A larger MTU means that more data can be transmitted in a single packet; a larger MTU usually means higher throughput.

For SunFDDI/P, the MTU is set to 4352 by default[1], and for an Ethernet interface, the MTU is 1500. This difference can cause performance problems in mixed FDDI/Ethernet networks.

Packets are transmitted between the two networks across a bridge, which handles the translation between the two protocols. When data is transmitted across the bridge from the FDDI network, the larger FDDI packets need to be fragmented so that they do not exceed the MTU of the Ethernet network. Some low-cost bridges that do not support fragmentation will reject the 4352-byte packets.

Fragmenting and reassembling the packets introduces a considerable overhead that affects performance. It also increases the risk of out-of-sequence or dropped packets. Therefore, if there is heavy network traffic across the bridge, it may be more efficient to force the MTU in the FDDI network to be 1500 to match the MTU on the Ethernet side of the bridge. The above argument can also be applied to a mixed FDDI/NetWare network. In this case, the MTU in the NetWare LAN is 4178 octets.

---

1. This value makes allowance for the frame header and has been demonstrated to be the optimum value of MTU for pure FDDI networks (see RFC 1390).

To Tune the Socket Options

For applications that use sockets, the application developer can make more efficient use of the increased bandwidth provided by an FDDI connection by increasing the size of the send and receive buffers used by a specific application. This manipulation is restricted to applications and do not affect the other socket connections.

The Solaris 7 environment and compatible versions support program calls to `pftsockopt(3N)` and `setsockopt(3N)`. The options `SO_SNDBUF` and `SO_RCVBUF` are used to set the size of the TCP send and receive buffers for a specified socket. See the man page for more detailed information.

To optimize performance, assign consistent values for the transmit and receive buffers. The default value (4 Kbytes) assigned to these parameters is optimized for transmitting across Ethernet connections. For applications running over FDDI, the send and receive buffers should be set to 32 Kbytes.

MTU Path Discovery

Machines running the Solaris 7 environment and compatible versions support MTU path discovery, which allows the optimum MTU to be negotiated. Under most circumstances, this ensures efficient use of the network resources. However, to enable MTU path discovery to work, the "don't fragment" bit in the packet is set, which causes a problem with some bridges and routers that do not support this feature. In this case, packets are not transmitted across the bridge, and the error messages generated as a result can be misleading.

Refer to "To Disable MTU Path Discovery" on page 39 for detailed instructions on how to accommodate bridges and routers that do not support this feature.

▼ To Disable MTU Path Discovery

Many bridges do not support MTU path discovery.

- **To disable this feature in order to transmit packets across a bridge, type:**

```
# ndd –set /dev/ip ip_path_mtu_discovery 0
```

MTU path discovery is enabled each time the machine is rebooted.

Tuning `pf` Parameters

You can set the pf parameters using the pf.conf file in the /kernel/drv directory.

The man pages for `prtcopf(1M)` and `driver.conf(4)` include additional details.

Tuning the Maximum Transfer Unit (MTU)

For SunFDDI/P, the maximum transfer unit (MTU) has been optimized for pure FDDI networks. Follow these steps to change the value of the MTU on a station running SunFDDI/P in the Solaris 7 environment or compatible versions:

Note – Additionally, the `ifconfig(1M)` command can be used to change the MTU.

Target Token Rotation Time (TTRT)

Caution – Modifying the target token rotation time (TTRT) can affect network performance adversely. In the worst case, it can reduce network throughput to zero. In general, the TTRT should not be set to less than 8000 microseconds (ms).

The target token rotation time (TTRT) is the key FDDI parameter used for network performance tuning. In general, increasing the TTRT increases throughput and increases access delay.

For SunFDDI/P, the TTRT must be between 4000 and 165,000 microseconds (ms), and is set to 8000 ms by default. The optimum value for the TTRT is dependent on the application and the type of traffic on the network:

- If the network load is very irregular (*bursty* traffic), the TTRT should be set as high as possible to avoid lengthy queueing at any one station.

- If the network is used for the bulk transfer of large data files, the TTRT should be set relatively high to obtain maximum throughput, without allowing any one station to monopolize the network resources.

- If the network is used for voice, video, or real-time control applications, the TTRT should be set low to decrease access delay.

The TTRT is established during the *claim process*. Each station on the ring bids a value (`T_req`) for the operating value of the TTRT (`T_opr`) and the station with the lowest bid wins the claim. Setting the value of `T_req` on a single station does not guarantee that this bid will win the claim process.

Setting parameters using `pf.conf`

● **Obtain the hardware path names for the `pf` devices in the device tree.**

Typically the path names and the associated instance numbers will be present in the `/etc/path_to_inst` file.

```
# grep -w pf /etc/path_to_inst
# "/iommu@f,e0000000/pci@f,e0001000/pf@3,7ff0" 0 "pf"
```

- In the above lines:
    - The first part within the double quotes specifies the hardware node name in the device tree.
    - The second number is the instance number.
    - The last part in double quotes is the driver name.
- In the device path name, the last component after the last `/` character and before the `@` character is the device name.
- The path name before the last component is the parent name.

5. **To identify a PCI device unambiguously in the `pf.conf` file, use the name and parent name of the device. Refer to the `pci`(4) man page for more information about the PCI device specification.**

In the previous example:

- Name = `pf`
- Parent = `/iommu@f,e0000000/pci@f,e0001000`

6. **Set the pf_mtu and the pf_tReq parameters for the above device in the** `/kernel/` `drv/pf.conf` **file.**

```
name = "pf" parent = "/iommu@f,e0000000/pci@f,e0001000"
reg="0x3 0x7ff0 0x110"
pf_mtu=4500
pf_tReq=5000
```

7. **Save the** `pf.conf` **file.**

8. **Close all applications which communicate via the pf device driver. For example, run pf_snmd_kill.**

9. **Use the** `ifconfig` **command to bring down the interface and unplumb it.**

10. **Use the** `modunload` **command to remove the pf device driver from the memory.**

11. **Use the** `ifconfig` **command to reconfigure the interface.**

12. **Restart your applications.**

Troubleshooting and Diagnostics

- Troubleshooting Checklist—page 43
- Solving Common Problems—page 48
- Running the Hardware Self-Test Program—page 54
- SunFDDI/P Adapters Cannot Boot Sun4d Diskless Clients—page 55

This chapter describes how to detect and resolve common problems with your FDDI network. It includes instructions on how to load and configure the SunFDDI/P device driver manually, if required. Note that SunFDDI/P supports almost all of the standard SunOS™ network diagnostic utilities, including `snoop(1M)`, `netstat(1M)`, `ping(1M)`, and `etherfind(8C)`.

The default base directory *<basedir>* is:

```
/opt/SUNWpf/bin
```

Troubleshooting Checklist

Use the following checklist to verify the major components of your SunFDDI/P station and to check that it is installed, configured, and attached to the network correctly.

▼ To Check the Connection to the Station

● **Check that the cable connector is seated firmly into the plug on the SunFDDI/P adapter card.**

You should feel the connector click into place.

▼ To Check the Connections Between Stations

● **Check that the cables are connected correctly between ports of different types.**

The keys provided with most FDDI cables will help you to avoid "crossing" or "twisting" the ring. See "MIC-to-MIC Coupler" on page 6 for a detailed description.

■ For single attached stations (SAS), cables should be connected by either SM (to a concentrator) or SS (back-to-back).

■ For dual attached stations (DAS), cables should be connected by either ABBA (dual-ring) or AMMB (dual-homing).

▼ To Check the Link Status Indicator

1. **Check the status of the SunFDDI/P interface by looking at the Link Status Indicator (diagnostic LED) mounted on the backplate of the SunFDDI/P adapter card.**

   ■ If the LED is green, the SunFDDI/P driver is loaded, the `pf` interface is configured, and the station is attached to an active FDDI network. This is the operating state.

   ■ If the LED is amber, the SunFDDI/P driver is loaded, the `pf` interface is configured, but no valid line state to an active FDDI network exists.

2. **Check the physical connections between the station and the ring, or the station and the concentrator.**

3. **Check the status of the neighboring station.**

   ■ If this station is down, it will bring down the link between the stations.

   ■ If the LED is red, the adapter failed the FDDI path test.

   ■ If no LED is lit, either the SunFDDI/P driver is loaded and the interface is *not* configured, or the driver has not been loaded.

4. **Configure the `pf` interface with the `ifconfig(1M)` command of the form:**

   ```
   # ifconfig plumb pf<inst> <hostname> netmask <mask> up
   ```

   ■ If the LED is red, the SunFDDI/P driver is not loaded, or is loaded incorrectly.

5. **Check that the software is installed.**

6. **Remove the existing version, if necessary, and reload the software.**

Checking the MAC Address

By default, the first SunFDDI/P interface installed in the machine adopts the host-resident Media Access Control (MAC) address stored on the motherboard. Each subsequent SunFDDI/P interface takes the card-resident MAC address stored in its IDPROM.

`local-mac-address` Property

Each of the network interfaces of the SunLink OSI have been assigned a unique MAC (Media Access Control) address, which represents the 48-bit ethernet address for that channel. 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 Solaris 7 operating systems, you can use a channel'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 SunLink OSI, set the NVRAM configuration variable `local-mac-address?` to `true`.

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

▼ To Check the SunFDDI/P Driver

● Use `netstat(1M)` to check that the SunFDDI/P (`pf`) driver is installed correctly, and to check for an excessive number of errors and collisions:

```
% netstat -i
Name Mtu   Net/Dest Address   Ipkts Ierrs Opkts Oerrs Collis
Queue
lo0  8232  loopback localhost  21    0     21    0     0       0
le0  1500  our-lan  hysop     2146   0     950   1     13      0
pf0  4352  our-fddi hysop-pf  1086   0     907   0     0       0
```

A sudden increase in the number of errors could indicate a noisy connection caused by a dirty cable.

▼ To Check the IP Addresses

You must assign a unique IP address to each SunFDDI/P interface. If you have more than one IP interface installed in your machine—either multiple SunFDDI/P interfaces, or some other LAN interface (for example, an Ethernet interface)—each interface must be attached to a different subnetwork.

● **Use** `ifconfig(1M)` **to check the IP addresses assigned to the two SunFDDI/P interfaces:**

```
# ifconfig -a
pf0: flags=843(UP,BROADCAST,RUNNING,MULTICAST) mtu 4352
     inet 123:123:201:71 netmask ffffff00 broadcast
123:123:201:255
pf1: flags=843(UP,BROADCAST,RUNNING,MULTICAST) mtu 4352
     inet 123:123:201:75 netmask ffffff00 broadcast
123:123:201:255
```

If the interfaces have the same subnetwork number, as shown in this example, you must change the IP address assigned to one of the interfaces.

Ensure that the IP addresses and host names for each SunFDDI/P interface are entered in the NIS map, or in `/etc/hosts` on the local machine if you are not using NIS/NIS+.

▼ To Check the IP Routing

1. **Check the IP routing table using the** `netstat(1M)` **command:**

```
% netstat —nr
```

2. **Check that the FDDI subnetwork is featured in the routing table.**

If the routing table is empty, check that the routing daemon (`in.routed`) is running on your machine.

▼ To Check the Protocol Statistics

● **Use** netstat(1M) **to check the per-protocol (IP, TCP, UDP, and so forth) statistics for errors:**

```
# netstat -s
UDP
    udpInDatagrams      =   1423udpInErrors          =      0
    udpOutDatagrams     =    540

TCP tcpRtoAlgorithm     =      4tcpRtoMin            =    200
    tcpRtoMax           = 60000tcpMaxConn           =     -1
    tcpActiveOpens      =     38tcpPassiveOpens      =      1
    tcpAttemptFails     =      0tcpEstabResets       =     33
    tcpCurrEstab        =      2tcpOutSegs           =    427
    tcpOutDataSegs      =    264tcpOutDataBytes      = 15917
    tcpRetransSegs      =     38tcpRetransBytes      =      0
    tcpOutAck           =    143tcpOutAckDelayed     =     56
    tcpOutUrg           =      1tcpOutWinUpdate      =      0
    tcpOutWinProbe      =      0tcpOutControl        =    111
    tcpOutRsts          =     36tcpOutFastRetrans    =      0
    tcpInSegs           =    606
    tcpInAckSegs        =    292tcpInAckBytes        = 15949
    tcpInDupAck         =     62tcpInAckUnsent       =      0
    tcpInInorderSegs    =    311tcpInInorderBytes    = 99169
    tcpInUnorderSegs    =      0tcpInUnorderBytes    =      0
    .
    .
    .
```

● **Use** netstat(1M) **to check the driver statistics:**

```
# netstat -k
pfo
    ipacket = x, ierror = y, opackets = z
    .
    .
    .
```

▼ To Check the SMT Traffic

If the target station is not running SunFDDI/P, it does not necessarily support the same set of SMT frames. If the target station receives an SMT request for an unsupported service, it issues a Request Denied Frame (RDF).

● **Use** `pf_smtmon(1M)` **to examine the SMT frames:**

```
# <basedir>/pf_smtmon [-i pf<inst>] [—x] [—h] [<frameclass>]
```

Solving Common Problems

Use the information in TABLE 6-1 and TABLE 6-2 to diagnose and resolve some of the common problems that can occur when installing, configuring, or running SunFDDI/P.

TABLE 6-1 Problems Installing SunFDDI/P

Problem	Action
The SunFDDI/P software package (`SUNWpfr`) cannot be found. The SunFDDI/P man pages/utilities package (`SUNWpft`) cannot be found.	Check that you have inserted the CD-ROM in the CD-ROM drive and that the CD-ROM is mounted on a local directory. The SunFDDI/P software is located in the following directory: `/cdrom/fddi_s6_0_and_p2_0/Product/pci`
The configuration script cannot configure the IP address. "What ip address do you want to use for xyz [] [?] 0.0.0.0 Illegal ip address. . . . Try again"	Check that you have entered the valid IP address. The script will keep prompting you until you enter a valid address.
The configuration script cannot find the hardware devices installed in the machine.	Check that the SunFDDI/P adapter card is installed correctly and is seated firmly in the PCI slot. Use the `prtconf` command to see if the `pf` card exists.

TABLE 6-1   Problems Installing SunFDDI/P *(Continued)*

Problem	Action
The configuration script cannot load the SunFDDI/P driver. The procedure fails with the message, "`no available major numbers.`"	The number of major numbers—that is, the maximum number of device drivers that can be installed—is limited to 127. This number is quickly exhausted by the large number of drivers installed in a typical system. Remove an existing driver before loading SunFDDI/P.
The configuration script cannot load the device driver.	Check whether the driver is already installed on the system. If you removed a previous version of the package using `pkgrm(1M)`, you must reboot the system before attempting another `add_drv`.
The configuration script cannot configure the device driver. The procedure fails with the message, "`Duplicate MAC address.`"	Two or more interfaces have been assigned the same MAC address. The most likely conflict lies between the first SunFDDI/P 2.0 interface (`pf0`) and one or more SunFDDI/P interfaces (`pf1`, etc) installed in the same machine.

TABLE 6-2   Problems Running SunFDDI/P

Problem	Action
The link status indicator (diagnostic LED) remains red.	Check that the SunFDDI/P software is installed correctly and that the driver is loaded and configured.
The link status indicator (diagnostic LED) remains amber.	Check that the SunFDDI/P adapter card is connected to the network.
The link status indicator (diagnostic LED) remains amber, even after the local station is connected to the network and the driver is configured and loaded.	Check that the other end of the cable is connected and that the neighboring station or concentrator is configured correctly. Some concentrators have diagnostic LEDs that indicate if the ring is operating correctly. Check that the ring is not crossed.
The SunFDDI/P interface (`pf`) is not displayed by `netstat`.	Check that the SunFDDI/P device driver is loaded, using `modinfo(1M)` to display information about loaded kernel modules.
The SunFDDI/P interface (`pf`) is not displayed by `ifconfig`.	Check that the SunFDDI/P device driver is loaded, using `modinfo(1M)` to display information about loaded kernel modules.
The local station can reach FDDI stations located on the same subnetwork, but these stations cannot reach the local station.	Check that the IP address and host name of the local station are entered in the NIS map or NIS+ tables (or in `/etc/hosts` on each remote station if you are not running NIS or NIS+).

TABLE 6-2 Problems Running SunFDDI/P *(Continued)*

Problem	Action
The local station cannot reach other FDDI stations located on the same subnetwork.	Check that the link status indicator is green, indicating that the SunFDDI/P interface is attached to an active network. Use `ifconfig(1M)` to check that the SunFDDI/P interface (`pf`) is up. Check that the IP address and host name of the remote station are entered in the NIS map or NIS+ tables (or in `/etc/hosts` on the local station if you are not running NIS or NIS+).
Running `pf_stat` without the −m option (to display information about the local station) shows the ring alternating frequently between UP and DOWN.	Check that the link status indicator is green, indicating that the SunFDDI/P interface is attached to an active network. Check the connections to the concentrator. Some concentrators have diagnostic LEDs that indicate if the ring is operating correctly.
Running `pf_stat` without the −m option (to display information about the local station) shows that the ring is ISOLATED.	Check that the link status indicator is green, indicating that the SunFDDI/P interface is attached to an active network. Check the connections to neighboring stations or the concentrator. Some concentrators have diagnostic LEDs that indicate if the ring is operating correctly. Check that the neighboring stations are configured correctly. If everything else seems to be working, check the cable itself. Fiber optic cable is fragile and should not be subjected to stress or impact. If the turning curve around objects is too tight, the light path is interrupted. Clean the connectors.

TABLE 6-2 Problems Running SunFDDI/P *(Continued)*

Problem	Action
The local station cannot reach FDDI stations located on a remote FDDI network.	Check that the IP address and host name of the remote station are entered in the NIS map or NIS+ tables (or in /etc/hosts on each remote station if you are not running NIS or NIS+).
	Check that the routing tables are using netstat −r. Check for an pf interface that shows a route to a gateway with the UG flags set. If you can reach the local gateway, then the problem probably lies with the IP routing.
	Try to confirm that the remote station is configured and running, and if possible try to reach the local station from the remote station. If you can, it indicates that the problem lies with the local IP routing.
	Try to reach the router nearest the remote station. If you can, it indicates that the fault lies between the remote station and the router. If you cannot, try to reach a router that is closer to the local station. Continue in this way until you have isolated the router that is dropping or misrouting packets.
	If the dynamic routing protocol is not adding routes, try adding a static route to the remote station. This method is not recommended for large networks with a large number of nodes.

TABLE 6-2   Problems Running SunFDDI/P *(Continued)*

Problem	Action
The local station cannot reach FDDI stations located on a remote Ethernet network.	Check that the IP address and host name of the remote station are entered in the NIS map or NIS+ tables (or in /etc/hosts on each remote station if you are not running NIS or NIS+).
	If you are operating in Solaris 7 or compatible environment, which uses MTU path discovery, check that packets are being transmitted across the bridge between the networks. Many bridges do not yet support MTU path discovery and do not fragment the large packets sent by the FDDI stations. In this case you may need to disable this feature on your station by typing:
| | ```
# ndd —set /dev/ip
ip_path_mtu_discovery 0
``` |
	Check that the routing tables are using netstat -r. Check for an pf interface that shows a route to a gateway with the UG flags set. If you can reach the local gateway, then the problem probably lies with the IP routing.
	Try to confirm that the remote station is configured and running, and if possible try to reach the local station from the remote station. If you can, it indicates that the problem lies with the local IP routing.
	Try to reach the router nearest the remote station. If you can, it indicates that the fault lies between the remote station and the router. If you cannot, try to reach a router that is closer to the local station. Continue in this way until you have isolated the router that is dropping or misrouting packets.
	If the dynamic routing protocol is not adding routes, try adding a static route to the remote station. This method is not recommended for large networks with a large number of nodes.

TABLE 6-2   Problems Running SunFDDI/P *(Continued)*

Problem	Action
Running `pf_stat` with the `-m` option (to display information about the neighboring stations) shows frequent `error` frames and `lost` frames.	This could indicate a noisy network. For fiber connections, noise is probably caused by dirt or grease on the optical surface or by a damaged cable. Unshielded twisted-pair is sensitive to electrical and electromagnetic interference. Note that the receipt of `error` frames and `lost` frames does not give any indication of where the problem is occurring on the ring.
Running `pf_smtmon` shows the frequent occurrence of request denied frames (RDF).	The SMT entity on one of the remote stations does not support the same set of SMT services. This should not occur on a station running SunFDDI/P. You can use this facility to detect problems communicating with a remote station using the SunNet Manager proxy agent.

TABLE 6-3   Problems Using the SNM Agents for SunFDDI/P

Problem	Action
Cannot select `pf_fddi` or `pf_fddismt7_2` agent for quick dump.	Check that the SNM agents for SunFDDI/P are enabled in the properties window for the proxy station.
Cannot recover SMT statistics from the proxy agent. The procedure fails with the error message, "`Cannot create RPC client: program is not registered.`"	Check that you specified the host name or MAC address for the target machine in the properties window for the target station. Check that the SNM daemons are started on the proxy and the target machines: `# ps -ef	grep snm` `root <pid> <date&time> <path>/pf_snmd` `root <pid> <date&time> <path>/pf_snmd` `root <pid> <date&time> <path>/pf_snmd`  On a client running Solaris 7 or commpatible environment, you can start the SunNet Manager daemons for SunFDDI/P by typing:  `# /usr/sbin/pf_snmd`

Running the Hardware Self-Test Program

If you suspect a problem with the SunFDDI/P adapter card, you can use the built-in hardware self-test to check the state of its primary components and the connection to the network.

▼ To Run the Hardware Self-Test

1. **Become superuser.**

2. **Halt the machine.**

```
# sync;sync;halt
```

3. **At the boot prompt, type:**

```
ok test /pci/pf

    Local MAC Address 0:80:d8:10:3:ed (Canonical)
    Interrupt register read/write test .... PASS
    CMT Processor read/write test ........ PASS
    S Port register test ................. PASS
    MAC register test .................... PASS
    DMA register test .................... PASS
    DMA bus master test .................. PASS
    Performing FDDI path test ............ PASS
    Connection Management (CMT) test ...... PASS
    Local loopback packet test ........... PASS
    Network loopback packet test ......... connection not active

/pci/pf selftest failed. Return code = -1
```

This example shows that the primary components on the board are working, but that the board is not currently connected to the network.

SunFDDI/P Adapters Cannot Boot Sun4d Diskless Clients

Sun4d diskless clients cannot be booted using SunFDDI/P adapters installed in servers running the Solaris 7 operating evironment. If you are running Solaris 7 and you want to use a Sun4d as a diskless client, deploy it in an ethernet section of your network.

Frequently Asked Questions About SunFDDI

This appendix contains the responses to some of the most frequently asked questions about SunFDDI/P. It also contains references to more detailed information.

1. The network performance is much lower than I expected. Why can't I transfer data at 100 Mbps over my FDDI connection?

If the applications running over FDDI don't use the available bandwidth efficiently you will see much lower performance than expected. See **Chapter 5 "Improving Network Performance"** for advice on how to get the best performance from your SunFDDI/P station.

2. Can I connect a dual-attached FDDI station to two different subnetworks?

No. A dual-attached station must be either connected to the primary and secondary rings in a dual-ring configuration, or connected in a dual-homing configuration. See "Dual-Attached Station (DAS)" on page 51 for more information.

3. Can I use a dual-attached station in single-attached mode?

Yes. Simply connect one port to the network. No overhead is incurred when you operate a dual-attached station in this way.

4. Can I use SunFDDI/P 2.0 in a redundant single-attached station (RSAS) configuration?

No. This configuration, which was supported by SunFDDI 5.0 SBus, provides a redundant connection that is used in the event of a link failure. The equivalent configuration for SunFDDI/P 2.0 is provided by a dual-attached station connected in dual-homing mode.

5. Can I use the SunFDDI/P 2.0 software with a hardware interface from a third-party vendor?

No. The device driver does not support any third-party hardware products.

6. Can I connect two single-attached stations "back-to-back," without connecting them to a concentrator?

Yes. This configuration is supported by the FDDI specifications. You can also connect two single-attached stations and one dual-attached station directly in a ring, but this configuration is not supported by the FDDI specifications and is not recommended.

7. What is dual-homing?

Dual-homing is a special configuration that connects a single dual-attached station to two concentrators so that there is a redundant path, which is used in the event of a link failure

8. What is the MTBF for the various SunFDDI/P options?

The calculated mean time before fail (MTBF) for each of the SunFDDI/P interface cards is 1,231,176 hours

This number was obtained using the standard method for calculating MTBF.

9. Why can't I connect port A to port A, or port B to port B?

This type of configuration is forbidden by the FDDI specifications. It is called "twisting" or "crossing" the ring. If you connect your FDDI station in this configuration, the link status indicator will remain blinking green to indicate an invalid connection. See **Chapter 2 "Hardware Installation**," for a description of the different diagnostic LEDs.

10. Why do I get the error message "`duplicate address`" or "`duplicate macid`"?

By default, the first SunFDDI/P interface installed in the machine adopts the host-resident MAC address stored on the motherboard. Each subsequent SunFDDI/P interface takes the card-resident MAC address stored in its IDPROM.

11. Why is performance poor when I use NFS over FDDI?

For a single file transfer, the maximum data transfer rate is limited to 0.5 Mbytes/second when writing to an NFS mounted file system and 1.5 Mbytes/second when reading from an NFS mounted file system. This performance limitation, which affects Ethernet, FDDI, and any other fast network, is due to the NFS version 2 protocol. It will be removed by NFS version 3.

Note – When several NFS operations are performed in parallel (several reads and writes in parallel), the aggregate throughput is much higher with FDDI than it is with Ethernet.

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12. How do I disable the SunFDDI/P interface?

Use `ifconfig(1M)` to disable the SunFDDI/P interface temporarily. It will be reconfigured when you reboot your machine.

```
# ifconfig pf<inst> down
```

To disable the SunFDDI/P interface so that it is not reconfigured when you reboot the machine, change the name of the `/etc/hostname.pf<inst>` file.

```
# mv /etc/hostname.pf<inst> /etc/oldhostname.pf<inst>
```

13. How do I disable the Ethernet interface?

Use `ifconfig(1M)` to disable the Ethernet interface temporarily. It will be reconfigured when you reboot your machine.

```
# ifconfig le<inst> down
```

To disable the Ethernet interface so that it is not reconfigured when you reboot the machine, change the name of the `/etc/hostname.le<inst>` file.

```
# mv /etc/hostname.le<inst> /etc/oldhostname.le<inst>
```

14. How do I use the host name assigned to the SunFDDI/P interface as the primary host name for my machine?

In Solaris 7 or compatible environments, the primary host name is defined in the `/etc/nodename` file. Normally, this file contains the host name assigned to the Ethernet interface built in to your machine. Edit `/etc/nodename` to enter the host name assigned to the SunFDDI/P interface.

15. Can I associate several IP addresses with a single SunFDDI/P interface?

Yes. To associate multiple IP addresses with a single interface, type:

```
# ifconfig pf0    <ip_address_1> netmask <mask> up
# ifconfig pf0:1 <ip_address_2> netmask <mask> up
# ifconfig pf0:2 <ip_address_3> netmask <mask> up
 .
 .
 .
```

16. How many SunFDDI/P 2.0 cards can I install in one machine?

You can install up to eight SunFDDI/P 2.0 cards in one machine.

17. What kind of connector can be used to connect SunFDDI/P 2.0 to optical fiber networks?

The connector type has been changed to an SC-type connector. See **Chapter 2 "Hardware Installation**" for a description of FDDI cables and connectors.

18. What kind of optical fiber can be used to link SunFDDI/P 2.0?

SunFDDI/P uses a 62.5/125 μm standard twin optical fiber. A compliant link design will have no more than 11 db of end-to-end loss. This includes loss incurred in the fiber (typically 1.2 db/km), the connectors (typically 0.5 db/connector), and any bypass switches (typically 2.5 db/switch). It also allows loss margins for source aging (typically 1 to 3 db), safety (typically 1 to 2 db), and temperature variation (typically 1 db).

19. Does SunFDDI/P Dual incorporate an optical bypass?

No. You must order an optical bypass switch from a third-party vendor.

20. Why does my optical bypass switch not work when I plug it in?

Optical bypass switches require a power cycle to be initialized. Plug in the optical bypass switch, switch off the FDDI station, and then reboot to initialize the station.

21. How can I increase the distance between two SunFDDI/P stations?

SunFDDI/P supports multimode fiber connections only. This limits the maximum distance between stations to two kilometers (1.24 miles). To increase the distance between stations, either:

■ Use converters from multi- to single-mode fiber, and a single-mode connection between converters.

■ Add more nodes between the stations to act as repeaters.

Glossary

This glossary defines FDDI-related acronyms, abbreviations, and terms.

ARP *(Address Resolution Protocol).* A protocol used within local networks that support broadcast (such as Ethernet or FDDI) that binds IP addresses to MAC addresses. View the current contents of a Sun machine's ARP table with the SunOS command, `arp -a`; specified in RFC 826.

baud A measure of the rate of data transfer, based on the number of times per second the signal can change states on the transmission line. The transmission line ordinarily uses just two signal states to indicate data transfer, making the baud rate equal the number of bits per second that can be transferred. See also **bps**, **Bps**, **kbps**, and **Mbps**.

bps *(bits per second).* A measure of the rate of data transmission. See also, **baud**, **Bps**, **kbps**, and **mbps**.

Bps *(bytes per second).* A measure of the rate of data transmission. See also, **baud**, **bps**, **kbps**, and **mbps**.

CFM *(Configuration Management).* The portion of CMT that manages the internal configuration of the station's MAC and PHY entities.

CMT *(connection management).* The portion of the FDDI SMT that manages the operation of physical layer insertion and removal, and the logical connection of PHY entities to the MAC entities.

DAS *(dual-attachment station).* An FDDI station that connects to both primary and secondary rings. A Class A station, capable of dynamic reconfiguration to accommodate certain levels of failure. Two rings are used to interconnect the stations so that the failure of any station or link causes the remaining stations to reconfigure the network to maintain connectivity: wrapping.

dotted decimal

notation   A way of representing the 32-bit Internet address: four decimal integers separated by decimal points, where each integer is the decimal value of one octet of the Internet address. For example, the 32-bit Internet address (binary) `11000000 00001001 11001001 00000111` is represented as `192.9.201.7` (decimal).

ECM   *(Entity Coordination Management).* The portion of CMT that manages the media interface to the FDDI network, which includes coordinating the activity of all the PHYs associated with that physical attachment and controlling the optional optical bypass function within the station.

FDDI   (*Fiber Distributed Data Interface*). A standard specified by the American National Standards Institute for fiber-optic links of up to 100 Mbits/s.

gateway   A dedicated computer that connects to two or more networks and routes packets from one network "community" to the other. Gateways route packets to other gateways until the packets can be delivered directly to their specified destination across one physical network. In general usage, the term identifies any computer that transfers information between networks.

kbps   *(kilobits per second).* A measure of the rate of data transmission. See also, **baud**, **bps**, **Bps**, and **Mbps**.

LLC   *(Logical Link Control).* Local area network protocol functions corresponding to the OSI data link layer (layer 2), but providing only service access points (SAP).

MAC   *(Media Access Control).* Local area network protocol functions corresponding to the OSI data link layer (layer 2), but providing the following: 1) on transmission, assembles data into a frame with address and error-detection fields; 2) on reception, disassembles frame, performs address recognition and error detection; 3) links communications management.

Mbps   *(millions of bits per second).* A measure of the rate of data transmission. See also, **baud**, **bps**, **Bps**, and **kbps**.

NRZI-4B/5B   *(nonreturn to zero inverted).* A differential encoding technique that encodes four-bit data groups as five bits (data plus a signal element); satisfies the minimum signal transition requirements to transmit synchronization (clock) within the data stream.

OSI   *(Open System Interconnection).* The OSI model is a standard for computer-communications protocols and the implementation of these protocols. The model is a product of the *International Standards Organization* (ISO), and specifies a seven-layer architecture with one or more protocol standards at each layer.

PCM   *(Physical Connection Management).* The portion of CMT that manages a physical connection between the PHY being managed and another PHY, likely in an adjacent station on the FDDI network.

PHY *(Physical Layer Protocol).* Performs the clock recovery and serial-to-parallel (on receive) or parallel-to-serial (on transmit) of data between the transmission medium and the MAC entity.

PMD *(physical medium dependent).* Specifies the optical-to-electrical conversion mechanism to conform to FDDI.

RARP *(Reverse Address Resolution Protocol).* A protocol used by diskless machines and their servers within local networks such as Ethernet or FDDI. In a RARP exchange, a diskless machine broadcasts its MAC address. A boot server responds to that client with the client's IP address, enabling the client to begin the boot process.

RMT *(Ring Management).* The portion of CMT that monitors the MAC. It provides a trace mechanism to handle the stuck beaconing condition, and also detects duplicate addresses on the ring.

RSAS *(redundant single-attach station).* An FDDI station in which single-attach interfaces are paired, with one active and the other a hot standby. In an RSAS with connections to two different dual-attach concentrators, you enjoy the network availability afforded by concentrators with single-attach connections, plus, for the RSAS itself, the station availability of a dual-attach station.

SAP *(service access point).* A logical interface between two adjacent protocol layers (such as LLC and IP).

SAS *(single attachment station).* An FDDI station that attaches to a single FDDI ring, as distinguished from a dual-attached station, which attaches to both rings in a dual ring.

SMT *(Station Management).* The complete standard of PHY layer and frame-based protocols to be supported by conforming FDDI stations.

THT *(Token-Holding Timer).* A timer in the FDDI MAC protocol that controls the length of time a station can hold a token for asynchronous transmission.

timing jitter The deviation of clock recovery that can occur when the receiver attempts to recover both clocking and data from the received signal. The PHY specification describes a phase lock loop (PLL) and elasticity buffer to eliminate jitter.

TRT *(Token Rotation Timer).* A timer in the FDDI MAC protocol that measures the time between receipt of tokens. It expires when it reaches a value that exceeds the Target Token Rotation Time (TTRT).

TTRT *(Target Token Rotation Time).* A parameter in the FDDI MAC protocol that is negotiated by all of the stations on a ring at the time a ring is brought up. FDDI uses the TTRT in conjunction with the TRT and THT to allocate bandwidth to individual stations on the ring. The FDDI MAC protocol guarantees that the worst-case delay a token will experience while circulating the ring will never exceed twice the negotiated TTRT.

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