# FDDIXPress™ Administrator's Guide

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# Introduction

FDDIXPress™ connects Silicon Graphics® computers to FDDI networks.

This *FDDIXPress Administrator's Guide* is your guide to configuring, testing, and monitoring your FDDI network connection. This guide has been written so you can perform all the basic FDDI station and ring administration tasks, whether you are a newcomer to IRIX™ and networking, or a seasoned IRIX network administrator.

This guide describes the administrative user interface to a Silicon Graphics' computer's FDDI connection; the guide can be used with any Silicon Graphics' FDDI board and driver.

This guide tells you how to

- configure your FDDI station (Chapter 2)
- verify that the FDDI connection is working (Chapter 2)
- monitor and maintain your station's FDDI connection (Chapter 3)
- monitor and maintain your FDDI ring (Chapter 3)
- resolve problems (Chapter 4 and Appendix A)

In addition, this guide contains a chapter describing how FDDI works and a glossary defining FDDI terms.

## Audience

This guide has been written for the person who keeps the FDDI network connection on a station working. This person might be an experienced network administrator or a novice. The format in this guide is task-oriented and assumes no prior knowledge of FDDI or network administration. This guide provides all the information you need to maintain a single FDDIXPress station's connection to the FDDI ring.

**Note:** This guide is not an in-depth network administration guide; it does not provide information for planning, managing, and maintaining an FDDI network. The product FDDIVisualizer™ is designed for this purpose.

## Typographical Conventions

This guide uses the following typographical conventions:

`Fixed-width type`
: Indicates system output, such as responses to commands that you see on the screen. Code samples, onscreen text, error messages, and file contents also appear in this font.

**`Bold fixed-width type`**
: Indicates user input, including keyboard keys (printing and nonprinting), and literals supplied by the user in examples.

*italics*
: Designates book titles, command and utility names, filenames, and filename suffixes. Indicates generic, place-holding variable names and variables to be supplied by the user.

[ ]
: Encloses optional command arguments.

...
: Denotes omitted material or indicates that the preceding optional items may appear more than once in succession.

## Additional Reading

This section lists reference material for the IRIX operating system, networking, and FDDI.

### IRIX Operating System Manuals

The following documents are available from Silicon Graphics, Inc.:

- *IRIX Admin* guide set
  a set of guides intended for administrators of the IRIX operating system and accessible through the online viewer IRIS Insight
- *IRIX Admin: Selected Reference Pages*
  an item in the optional IRIX Admin guide set
- *IRIS Software Installation and Licensing*
  an item in the optional IRIX Admin guide set

### Networking Manuals

The following documents are available from Silicon Graphics, Inc.:

- *IRIX Admin: Networking and Mail*
  an item in the optional IRIX Admin guide set
- *ONC3/NFS Administration Guide*
- *NIS Administration Guide*
- *NetVisualyzer User's Guide*

### FDDI Station and Ring Management Manuals

The following document is available from Silicon Graphics, Inc.:

- *FDDIVisualyzer User's Guide*

## ANSI and ISO Documents for FDDI

The following documents are available from the American National Standards Institute:

- PHY:
  *ANSI FDDI Physical Layer (PHY)*
  *X3.148:1988; ISO 9314-1: 1989*;
  Information Processing Systems—Fiber Distributed Data Interface (FDDI)—Part 1: Token Ring Physical Layer Protocol (PHY)
- MAC:
  *ANSI FDDI Media Access Control (MAC)*
  *X3.139:1987; ISO 9314-2: 1989*;
  Information Processing Systems—Fiber Distributed Data Interface (FDDI)—Part 2: Token Ring Media Access Control (MAC)
- PMD:
  *ANSI FDDI Physical Medium Dependent (PMD)*
  *X3.166:1990; ISO 9314-3: 1990*;
  Information Processing Systems—Fiber Distributed Data Interface (FDDI)—Part 3: Token Ring Physical Layer Medium Dependent (PMD)
- SMT:
  *ANSI FDDI Station Management (SMT)*
  *X3T9.5/revision 6.2* dated *18 May 199*0. (The SMT version listed here is a draft that, at the time this document went to print, had not been approved as a standard. When you order the ANSI SMT document, a newer revision may be available. The older version is not available once it has been replaced by a new one.)

To order ANSI documents, contact

American National Standards Institute
11 West 42nd Street
New York, NY 10036
Telephone: (212) 642-4900
Fax: (212) 302-1286
Telex: 42 42 96 ANSI UI

## Product Support

Silicon Graphics, Inc., provides a comprehensive product support and maintenance program for its products. If you are in North America and would like support for your Silicon Graphics supported products, contact the Technical Assistance Center at 1-800-800-4SGI. If you are outside North America, contact the Silicon Graphics subsidiary or authorized distributor in your country.

*Chapter 1*

# Introducing FDDI

This chapter introduces the basic concepts of the FDDI protocol. After reading this chapter, you will know how FDDI works and be familiar with the most common FDDI terms.

## FDDI Features

Fiber Distributed Data Interface (FDDI) is a local area network (LAN) communications protocol that is based on a basic token ring architecture. It is fast, reliable, and manageable. It is emerging as the standard alternative to slower protocols like Ethernet and 802.5 token ring. Table 1-1 compares FDDI with Ethernet (the built-in communications medium offered on Silicon Graphics workstations and servers) and token ring 802.5.

**Table 1-1** FDDI versus Ethernet and Token Ring

| Feature | FDDI | Ethernet | Token Ring 802.5 |
|---|---|---|---|
| Maximum physical transmission speed | 100 Mbps | 10 Mbps | 4 or 16 Mbps |
| Maximum packet size | 4500 bytes | 1518 bytes | 4500 bytes for 4<br>18,000 for 16 |
| Typical maximum length of LAN cable | 100 kilometers<br>(200 km wrapped) | < 2.5 kilometers | < 42 kilometers |
| Typical max. length between nodes | 2 kilometers | 500 meters | 300 meters |
| Maximum number of nodes per LAN | 500 | 1024 | 255 |

## FDDI Standard

FDDI is an international standard. It has been approved and accepted by the two major standards committees: American National Standards Institute (ANSI) and International Standards Organization (ISO).

The FDDI components of FDDIXPress and the accompanying FDDI board conform to the ANSI and ISO FDDI standards. The specific FDDI components (and the ANSI and ISO standards on which they are based) are listed below:

- physical layer medium dependent sublayer (PMD)
  ANSI X3.166-1990 and ISO 9314-3:1990
- physical layer protocol sublayer (PHY)
  ANSI X3.148-1988 and ISO 9314-1:1989
- media access control sublayer (MAC)
  ANSI X3.139-1987 and ISO 9314-2:1989
- station management module (SMT)
  ANSI X3T9.5/84-49, Revision 6.2, May 18, 1990

Figure 1-1 shows how the FDDI components correspond to ISO's seven-layer Open Systems Interconnection (OSI) reference model.

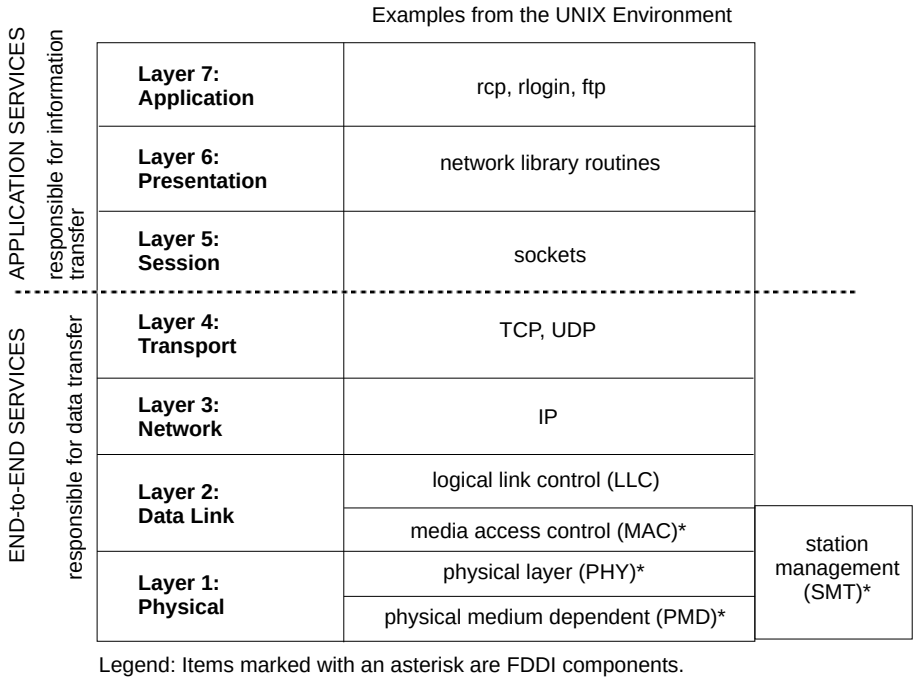



**Figure 1-1** FDDI as Related to the OSI Model

The OSI model defines a hierarchical structure for organizing the different functions (services) of telecommunications systems. In theory, each layer is completely independent, so changes to one layer have no effect on other layers. Standard interfaces are defined for communication between the adjacent layers. As Figure 1-1 shows, the FDDI standard occupies the two lowest layers—the entire physical layer and a portion of the data link layer—just as Ethernet and token ring do.

The physical layer defines the electrical, mechanical, and logical characteristics for transmitting bits across the physical medium. Examples of physical media include twisted pair, coaxial, and fiber optic cable. Dual ring FDDI specifies fiber optic cable as the physical medium.

The data link layer specifies the way a node (for example, the FDDIXPress board) accesses the underlying physical medium and how it formats data for transmission. FDDI specifies formatting data into frames, using a special set of symbols and following

a special set of rules. The MAC sublayer within the data link layer specifies the physical address (MAC address) used for uniquely identifying FDDI nodes.

Functionally, FDDI is similar to the 802.5 token ring and Ethernet standards, as summarized below:

- Like Ethernet and 802.5 token ring, FDDI uses the interface to the logical link control (LLC) sublayer of the data link layer, so switching from Ethernet to FDDI does not affect the higher layers. Layer 3 and 4 software (for example, TCP-UDP/IP) works over FDDI just as it does over Ethernet or token ring.
- Like Ethernet and 802.5 token ring, FDDI uses frames to deliver data between stations.
- Like 802.5 token ring (but unlike Ethernet), FDDI prevents collisions on its physical medium (cable) by passing a token; at any specific instant, only the station with the token may transmit onto the ring.

The subsections that follow describe each of the FDDI components. Figure 1-2 illustrates one possible configuration of these FDDI components.

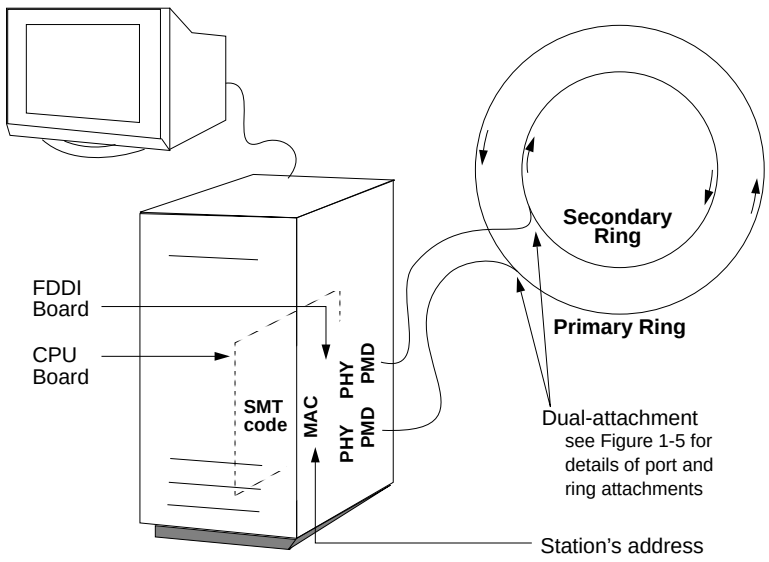



**Figure 1-2** FDDI Components of FDDIXPress and an FDDI Board

## Physical Layer Medium Dependent Protocol

The physical layer medium dependent protocol (PMD) defines the lowest FDDI protocol; it occupies the lower sublayer of the physical layer. PMD specifies the requirements for the cable (for example, fiber optic), the transmitter and receiver, the media interface connectors (MIC), and the optional optical bypass switch. PMD functionality is contained within a chip on the FDDI board.

## Physical Layer Protocol

The physical layer protocol (PHY) defines the upper sublayer of the physical layer. It establishes the connection between the PMD and MAC. In addition, the PHY provides encoding and decoding of data and control symbols. The PHY synchronizes incoming and outgoing code-bit clocks. This functionality is contained inside a chip on the FDDI board.

## Media Access Control Protocol

The media access control protocol (MAC) schedules and performs data transfer on the FDDI cable. The MAC is the FDDI component that contains the FDDI connection's identity, commonly referred to as a MAC address.

When a MAC begins to receive a block of information (a frame) from the FDDI cable, it checks the destination address field of the frame to see if the address is one of its own addresses. If the address matches one of its own addresses, the MAC simultaneously repeats the frame onto the physical medium and copies the frame into its local memory.

While repeating the frame, the MAC modifies the frame's status to indicate that the frame has been seen and received. The modified frame continues along the ring until it reaches the original transmitting station, which interprets the modified frame as an acknowledgment. This functionality is handled by a chip on the FDDI board.

## Station Management Protocol

The station management protocol (SMT) monitors and controls all FDDI activity on its station. SMT manages processes in the various FDDI layers (PMD, PHY, and MAC) at the station level and ensures the correct operation of the station on the ring. (See "FDDI Ring" for a description of the FDDI ring.) SMT's responsibilities include overseeing station insertion and removal from the ring, initializing the station to conform with the current ring status, and identifying, isolating, and recovering from faults on the ring.

An FDDIXPress station's SMT functionality is distributed. Some of it is contained within a software module that includes the SMT daemon (*smtd*) and a special database file called the management information base (MIB); some functionality is located within chips on the FDDI board.

The MIB resides in the local memory on each FDDI station. This database maintains statistical and operational information used to manage the ring.

Control within an FDDI ring is distributed among the SMT entities of all the stations on that ring; control is not handled by a master station. SMT entities communicate with each other to manage the administration of addressing, allocation of network bandwidth, and configuration and control of the ring. Some of these SMT parameters are site-configurable. For FDDIXPress, the SMT configuration file is */etc/fddi/smtd.conf*.

For more information about the SMT daemon, see the smtd(1M) man page.

## FDDI Ring

An FDDI ring is a length of cable laid out in a closed loop. Current standards require that the ring cable be fiber optic cable. An optical signal (light) passes through the cable (around the ring) and returns to its point of origin. Whenever a station is connected to the ring, it is physically inserted into the ring so that the optical signal passes through the station (illustrated in Figure 1-3). Stations on the ring are referred to as upstream or downstream in relation to each other. The downstream neighbor station is the first station to see a transmitting station's transmission. In Figure 1-3, station A is station C's downstream neighbor and station B's upstream neighbor.

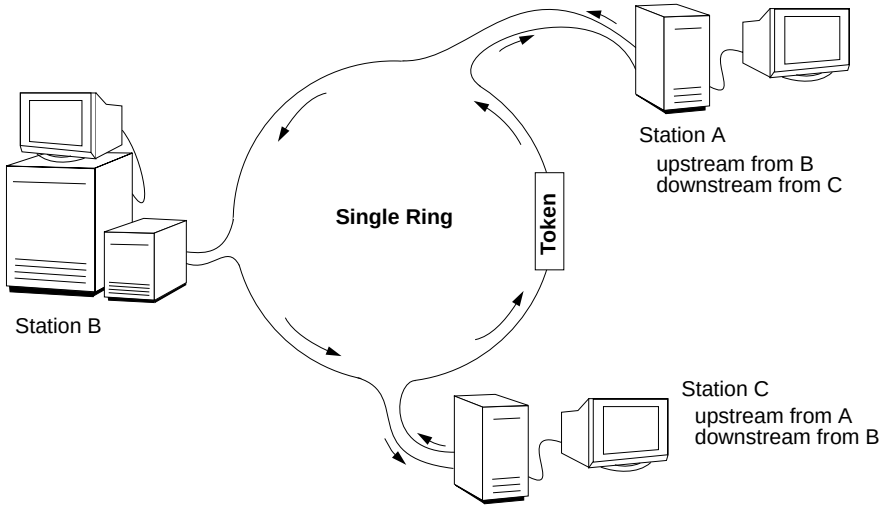



**Figure 1-3** Simple Token Ring

The FDDI dual ring (or trunk ring) has two separate loops (rings). One ring is called the primary ring and the other is the secondary ring, as illustrated in Figure 1-4. Most sites use the secondary ring as a backup ring. The light signal within each loop of a dual ring travels in the opposite direction from the signal in the other ring; in FDDI jargon this is referred to as counter-rotating. Because the signal travels in different directions, upstream and downstream neighbors are opposite on each ring. In Figure 1-5, where station 2 is station 1's downstream neighbor on the primary ring, station 2 is the upstream neighbor on the secondary ring.

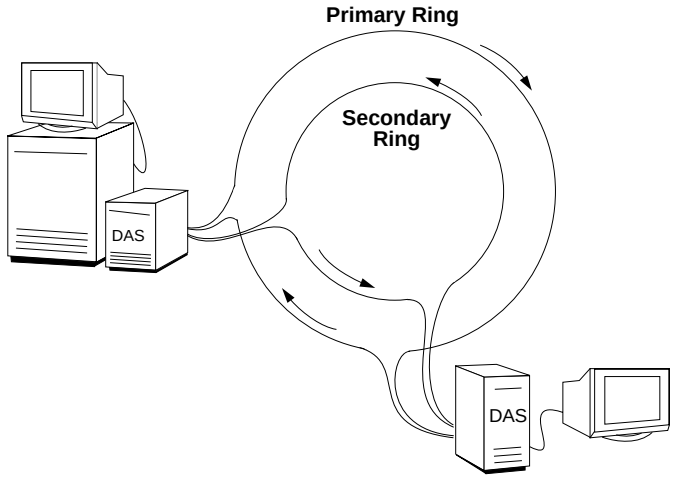



**Figure 1-4** A Basic FDDI Ring

The cabling for FDDI is available in a number of forms. Multimode (62.5 micron) fiber optic cable was the first transmission medium (cable) defined for FDDI. Recently, the use of single-mode (50-micron) fiber optic cable was approved. Copper cable has also been approved, for use only between concentrators and stations.

## FDDI Devices

In addition to the FDDI components, the FDDI standard defines the types of devices that can be connected to the ring. These devices include (but are not limited to) the following:

- stations
  - DAS: dual attach station (usually attaches directly to FDDI dual ring)
  - SAS: single attach station (attaches to the FDDI ring through a concentrator)
- concentrators
  - DAC: dual attach concentrator (usually attaches directly to the FDDI dual ring)
  - SAC: single attach concentrator (attaches to the FDDI ring through another concentrator)
- optical bypass switch

## Dual Attach Station

A dual attach station (DAS) has two ports (A and B). A DAS can be connected to the dual ring or to a concentrator.

When connected to the dual ring, each port connects to both the primary ring and the secondary ring (as shown in Figure 1-5). This dual connection is known in FDDI jargon as "connecting to the dual ring." The station's SMT ensures that the station can continue to transmit and receive data even when the primary ring experiences a break. (A break in the ring occurs when the signal cannot make a complete trip around the ring; this can be caused by a station failing or by a faulty cable.)

When connected to a concentrator, the two ports can each be connected to one of the concentrator's M ports. A DAS station can behave as a single attach station (SAS) if configured to do so, in which case only one of its ports is connected to the concentrator and the other port is not used.

**Note:** As illustrated in Figure 1-5, for DAS connections to the dual ring, port A must always be connected to port B of the downstream station, while port B connects to port A of the upstream station.

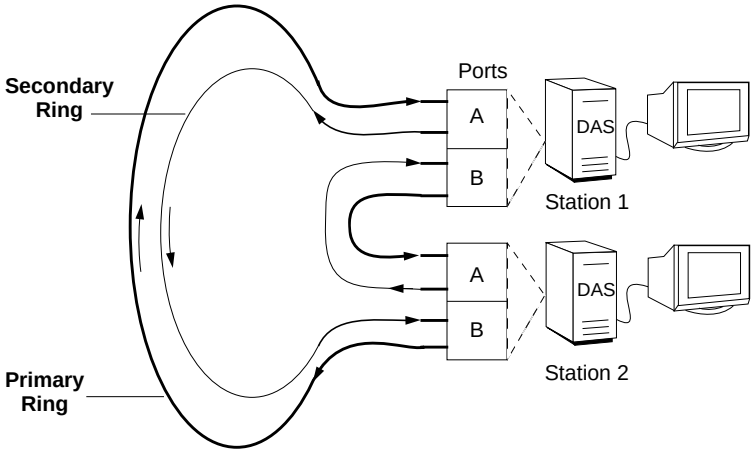



**Figure 1-5** Connection of DAS Ports to Primary and Secondary Rings

## Single Attach Station

A single attach station (SAS) has a single slave (S) port that attaches to the ring through a master (M) port on a concentrator. The concentrator routes the signal from the functioning ring through every SAS connected to that concentrator.

## Concentrators

A concentrator allows many single-attachment FDDI devices to obtain their connection to the FDDI ring through one device—the concentrator. Concentrators have one or more master ports (M), each of which accepts a connection from one single-attachment device.

The FDDI standard defines two types of concentrators: dual-attachment and single-attachment. A dual attach concentrator (DAC) has two ports (A and B), each of which connects to both the primary and secondary rings, just like the DAS. A single attach concentrator (SAC) connects to an FDDI ring through another concentrator, in the same manner as an SAS. Figure 1-6 illustrates the use of concentrators on an FDDI ring.

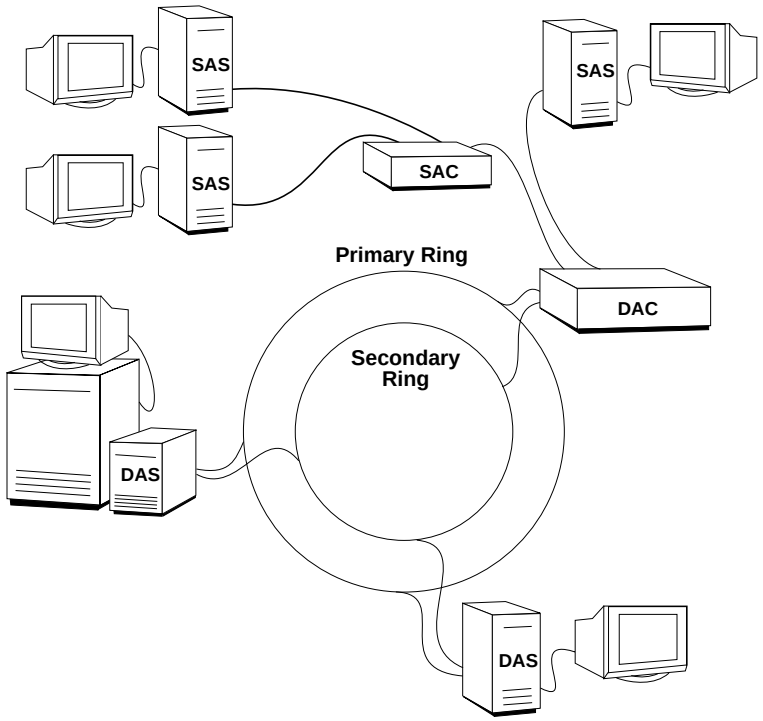



**Figure 1-6** FDDI Ring With Concentrators

## Optical Bypass Switch

An optical bypass switch (OBS) is an optional device that can be attached between a dual ring and a DAS or DAC. The OBS allows a dual-attachment device to become dysfunctional without wrapping the ring.

## How FDDI Works

The FDDI local area network consists of two or more stations or nodes connected serially by fiber optic cables to form a closed loop, the ring. Each FDDI local area network has two rings: a primary ring and a secondary ring. Figure 1-6 and Figure 1-10 show common FDDI ring configurations. The secondary ring is usually configured as a backup ring.

### Operational Ring

An optical signal (light), encoded to represent data, is beamed into the cable by a transmitting station. The signal travels through the cable and is read by each station on the ring, until it returns to the original sender. As long as the signal can make a complete trip around the loop, the ring is operational. When a break or fault occurs in the ring, the signal cannot complete the loop. Situations that break the ring include, among other things, a missing or damaged cable, a loose connection, and a dysfunctional station.

### Fixing a Broken Ring

The optical signal travels in opposite directions in each ring. This design makes closure of a broken primary ring feasible. When the SMT module within a station notices that the primary ring is broken, it connects the secondary ring to the primary one to complete the loop. This action bypasses (cuts out) the faulty section, as illustrated in Figure 1-7. In FDDI jargon, fixing a broken primary ring in this manner is called “wrapping the ring.” The original two rings are joined to form a single loop (ring). Notice that the ring must wrap in two locations to complete the loop. In this condition, transmission proceeds without interruption for all the stations on the functioning portion of the ring.

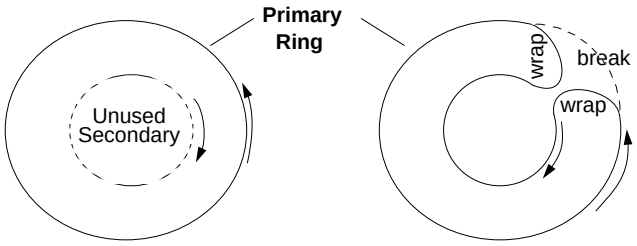



**Figure 1-7** Wrapping the Ring

When a ring wraps, two stations change their internal optical signal paths. Instead of the signal passing through both port A and port B (as illustrated in Figure 1-5), it is received and transmitted through a single port (either A or B). Figure 1-8 illustrates the altered optical signal paths. The two stations that make this change are located at the ends of the functional portion of the primary ring.

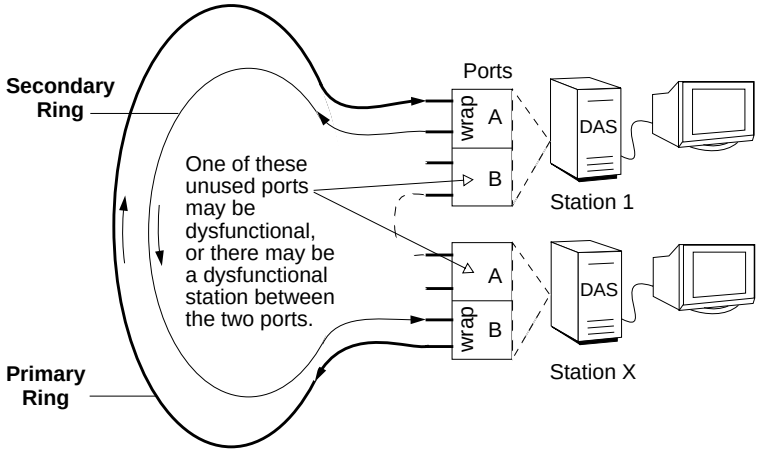



**Figure 1-8** Connection of DAS Ports at Points Where Ring Is Wrapped

If more than one fault occurs on the FDDI ring, the ring may become fragmented, as shown in Figure 1-9. In this condition, communication continues among the stations within each fragment, but communication is not possible with stations located on a different fragment.

FDDI management tools such as *smtstat* and *smtring* (or the graphical product, FDDIVisualyzer) can be used to identify problems with the ring.

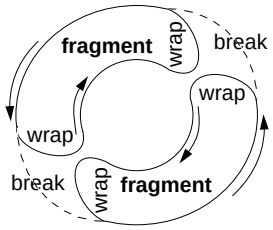



**Figure 1-9** A Fragmented Ring

## Optical Bypass Switch

FDDI defines an optional device that allows a DAS to become dysfunctional without wrapping the ring. This device is called an optical bypass switch (OBS). The optical bypass switch is connected between a station's two ports and the dual ring.

Without an optical bypass switch, when a DAS becomes dysfunctional, the signal going around the ring cannot continue past the dysfunctional station; stations downstream from this station do not receive any signal. The ring is broken, which causes an automatic wrap.

When an optical bypass switch is present in this situation, it maintains an intact loop by simply routing the signal through the switch, bypassing the dysfunctional station as if it were not attached to the ring. The SMT modules of neighboring stations will notice that they have acquired different neighbors, but they will continue to communicate without the disruption caused by a wrapped ring.

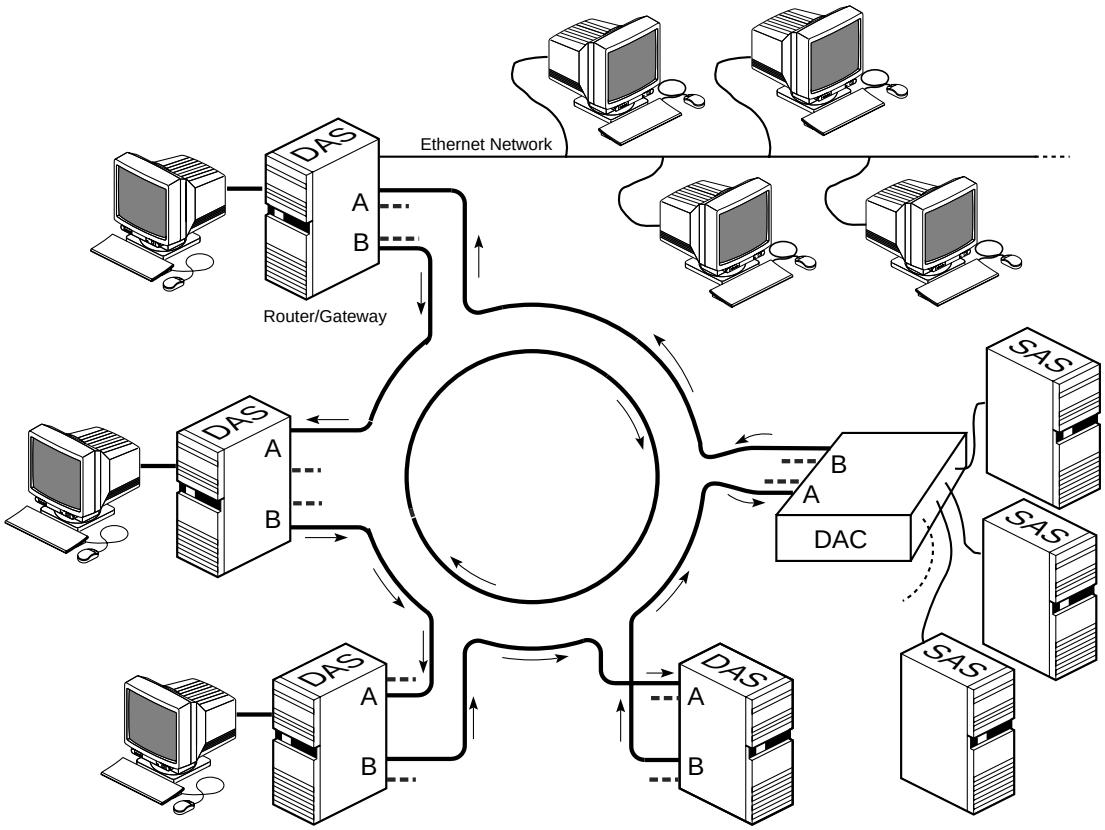
## Transmitting and Receiving on the Ring

A station on a ring gains access to transmit information onto that ring by capturing the ring's token. Only one token is allowed on each ring. Various controls are built into FDDI to limit or specify the length of time the token can be held. Once a station captures the token, it can transmit data onto the network. When the station finishes transmitting, or its time expires, it places the token back onto the ring, thus allowing the next station the opportunity to capture it. When a station does not have anything to transmit, it does not capture the token.

Once a frame is transmitted onto the ring, it moves around the ring in the following manner: Each station reads the frame and transmits it back onto the ring. If a station makes a local copy of the frame, it indicates this action by altering various bits in the copy that it retransmits onto the ring. As frames pass around the ring, the transmitting station recognizes the return of its own data and determines if reception has been successful and error free by checking the changed bits in the frame. Each station is responsible for removing (stripping) all the data that it placed on the ring.

## Multiprotocol Networking With FDDI

You can use FDDI as a standalone network, or you can incorporate it into an existing internetwork. When incorporating FDDI with an existing network, it is standard practice to use FDDI as the backbone and the slower networks (Ethernet or token ring) as subnetworks. This involves using a router (for example, an FDDI-to-Ethernet router) that is connected to both the non-FDDI network and the FDDI ring. The router allows information (packets) to flow between the two networks even though they use different protocols. Figure 1-10 shows FDDI with an Ethernet network; the ring illustrated has five dual-attachment nodes, one of which is a concentrator. A Silicon Graphics workstation or server that has two network interfaces automatically and by default performs as a router.




DAS = dual−attachment station
SAS = single−attachment station
DAC = dual−attachment concentrator
= not in use
= in use

**Figure 1-10** FDDI With an Ethernet Network

*Chapter 2*

# Configuring FDDIXPress Software

This chapter explains how to configure your new FDDI station. You can also use these instructions to reconfigure an already functioning station.

The section "Quick and Easy Configuration Instructions" provides step-by-step instructions for a basic, nonpersonalized configuration.

## FDDIXPress Package

FDDIXPress is a software option to accompany your Silicon Graphics computer's FDDI board. FDDIXPress software includes a driver for the FDDI board, an FDDI SMT module (including software to maintain its management information database [MIB]), and some utilities (SMT commands).

Depending on the specific release, FDDIXPress software may be shipped with the FDDI board or with your computer's operating system; the FDDIXPress release notes and the *FDDI Board's Installation Guide* or *Installation Instructions* provide details.

## Installing FDDIXPress

The step-by-step instructions for installing FDDIXPress software are located in your FDDIXPress release notes. General instructions for installing Silicon Graphics software are included in the *IRIX Admin: Software Installation and Licensing* and on the inst(1M) man page.

After installing the software, follow the steps in either "Quick and Easy Configuration Instructions" or "Complete and Complex Configuration Information" to configure the new FDDI station.

## Number Assignment to Interfaces

This section describes how identification numbers (for example, *xpi0*, *xpi3*) are assigned to the FDDIXPress network interfaces.

### Overview

The number assignment for network interfaces varies, depending on the hardware platform. Table 2-1 summarizes some of the implemented schemes.O

**Table 2-1** Number Assignment for FDDIXPress Network Interfaces

| Hardware Platform | FDDIXPress Interface Name | Number Assignment Scheme |
|---|---|---|
| Crimson™ | ipg0 - ipg3 | Network interface number matches a jumper setting on each board. Jumper setting 0 has network interface *ipg0*. |
| Indigo™ | xpi0 | Always *xpi0* for a single FDDI connection. |
| Indigo²™ | xpi0 | Network interface number depends on the order in which FDDIXPress boards are found during startup. See “Number Assignment for CHALLENGE M” for details. |
| Indy™ | xpi0 | Always *xpi0* for a single FDDI connection. |
| CHALLENGE™ M | xpi0 | Always *xpi0* for a single FDDI connection. |
| CHALLENGE L and XL | xpi0, xpi1, xpi# | Network interface number depends on the order in which FDDIXPress boards are found during startup. See “Number Assignment for CHALLENGE and Onyx” for details. |
| Onyx™ | xpi0, xpi1, xpi# | Same scheme used for CHALLENGE L and XL. |
| Octane, Origin200, Origin 2000, and O² | rns0, rns1, rns# | Network interface number is automatically assigned at system startup. Numbering depends on the interface numbers currently in the *ioconfig.conf* file. See “Number Assignment for Octane, Origin200, Origin 2000, and O2” on page 21. |

## Number Assignment for CHALLENGE M

During startup of a CHALLENGE M workstation, the operating system searches for FDDIXPress boards starting at the topmost GIO Bus slot. The network interfaces are subsequently assigned to the FDDI connections in the order they were located: the first board is assigned *xpi0* and the second is assigned *xpi1*.

## Number Assignment for CHALLENGE and Onyx

During startup of a CHALLENGE L, CHALLENGE XL, or Onyx system, the operating system searches for FDDIXPress mezzanine boards attached to system IO4 boards in the order shown below. When it locates a board, it adds the board to its hardware inventory.

1. Main IO4 board, lower mezzanine position (adapter 5)
2. Main IO4 board, upper mezzanine position (adapter 6)
3. Second IO4 board, lower mezzanine position (adapter 5)
4. Second IO4 board, upper mezzanine position (adapter 6)

The order continues as established above. You can display the contents of the hardware inventory with the *hinv* command, as shown below. The FDDIXPress boards are listed in the order in which they were found.

```
% /sbin/hinv
...
description: slot #, adapter #, xpi#-xpi#
description: slot #, adapter #, xpi#-xpi#
...
```

The driver then uses the information summarized in Table 2-2 to assign network interface numbers to the FDDIXPress mezzanine boards in the hardware inventory. For each FDDIXPress mezzanine board, the operating system assigns two consecutive numbers.

**Note:** Numbering for FDDIXPress boards installed in VME slots is controlled by jumpers on the board.

**Table 2-2** Number Assignments for Network Interfaces on CHALLENGE and Onyx Platforms

| Order In Which Boards Are Found | Network Interfaces Serviced by FDDIXPress Board | Mapping IO Panel Plate Labels to Network Interfaces | |
|---|---|---|---|
| | | Daughter Card | Interface |
| First FDDIXPress board | *xpi0* and *xpi1* | bottom<br>top | xpi1<br>xpi0 |
| Second FDDIXPress board | *xpi2* and *xpi3* | bottom<br>top | xpi3<br>xpi2 |
| And so on | | | |

The network interface names and numbers cannot be changed or configured. The naming/numbering scheme is embedded in the software.

The last two columns of Table 2-2 summarize how to match the labelling on the IO panel plates to the network interfaces (that is, the connections at the daughter cards on the FDDIXPress mezzanine boards). The bottom daughter card of each installed FDDIXPress board is assigned the first number within the assigned pair of numbers (for example, *xpi0* or *xpi2*); the top daughter card, is assigned the higher number of the pair (for example, *xpi1* or *xpi3*).

This method of assigning numbers has the following consequences that should be considered when FDDIXPress boards are added, removed, or moved:

- When additional FDDIXPress boards are installed, the network interfaces on FDDIXPress boards downstream from the new board become dysfunctional. For example, if a second FDDIXPress board is added upstream from the first FDDIXPress board, network interfaces *xpi0* and *xpi1* are assigned to the new board during the next powerup and, unless the software has been reconfigured, the IP network addresses do not match the cables that are attached to the ports.

  To fix this, the cables attached to the panel plates for the original board must be moved to the panel plates for the new board. Or, alternatively, the *netif.options* file must be edited so that the lines for the interfaces on the original board reflect the new numbers (for example, `if#name=xpi0` is changed to `if#name=xpi2`, and `if#name=xpi1` is changed to `if#name=xpi3`).

- When FDDIXPress boards are removed, moved, or are not found by the operating system during startup, the interfaces that used to be serviced by the missing board are assigned to the next downstream FDDIXPress board, so all downstream network interfaces become dysfunctional. For example, if the first FDDIXPress board is not found during a powerup, its network interfaces (*xpi0* and *xpi1*) are assigned to the next board. This shifting of network interfaces affects all boards downstream from the missing board. The networks physically attached to the ports no longer match the assigned IP addresses.

  To remedy this problem, the cables attached to the panel plates for each board can be moved to the next downstream board. Or, alternatively, the *netif.options* file can be edited so that the lines for the FDDIXPress interfaces reflect the new numbers (for example, `if#name=xpi2` is changed to `if#name=xpi0`, and `if#name=xpi3` is changed to `if#name=xpi1`).

## Number Assignment for Octane, Origin200, Origin 2000, and O²

These workstations are PCI bus-based systems and their interface numbering scheme is automatically determined at system startup by the *ioconfig* utility (see ioconfig(1M)).

At system startup, *ioconfig* inventories the FDDIXPress boards in the system and tries to match them with the devices found in the */etc/ioconfig.conf* file. If *ioconfig* detects a new board, it assigns the next number available for that class (in this case, *rns*).

For example, upon initial startup after adding two FDDIXPress boards, the first board is labeled *rns0* and the second board is *rns1*. These numbers remain during subsequent system reboots and even if the boards are moved. If a board is moved, it receives the next available number (*rns2*, for example) unless you edit the */etc/ioconfig.conf* file and remove the initial entry.

## Default Configurations

If the only configuration task you perform is adding entries to the */etc/hosts* file, the system automatically configures all network interfaces with the default configuration described in this section. The defaults for ordering and naming network connections is summarized in Table 2-3. The default settings for operational parameters are summarized in Table 2-4.

**Table 2-3** Default Network Interface Configuration

| Interface | Default Configuration |
|---|---|
| primary interface | |
| interface selected | FDDI (for example, *ipg0* or *xpi0*) |
| network connection name assigned | Same as the hostname defined in the */etc/sys_id* file. |
| IP address | The IP address in */etc/hosts* file that is associated with the station's hostname. |
| secondary interface | |
| interface selected | Built-in Ethernet (for example, *ec0* or *et0*) |
| network connection name assigned | gate-*hostname* |
| IP address | The IP address in */etc/hosts* file that is associated with the name "gate-*hostname*." |

The default configuration for FDDI will not succeed if the */etc/hosts* file does not contain an entry with the station's hostname paired with an FDDI network IP address. The name in the */etc/hosts* file must match the name displayed when the *hostname* command is invoked from a shell window, as shown:

```
% /usr/bsd/hostname
```

If the line in the */etc/hosts* file with the station's hostname has an non-FDDI IP address (for example, an IP address for an Ethernet network), the configuration process will complete, but neither the FDDI nor Ethernet connection will function.

For this station to be a router/gateway, it must have two network interfaces. For example, if the station is to perform as an Ethernet-to-FDDI router, it must have an Ethernet interface in addition to the FDDI interface. A station with two network interfaces, by default, functions as a router.

The network interfaces are configured with default operational parameter settings, as summarized in Table 2-4.

**Table 2-4** Default Network Interface Parameters

| Parameter | Default | Description |
|---|---|---|
| netmask | No subnet.<br>(That is, the bits in the standard network portion of the Internet address are set to 1; the bits in the standard host portion of the Internet address are set to 0. For class B addresses, 0xFFFF0000. For class C, 0xFFFFFF00.) | 32-bit value used to create two or more subnetworks from a single Internet address, by increasing the number of bits used as the network portion and decreasing the number of bits used as the host portion. When creating the mask, assign 1 to each network bit and 0 to each host bit. |
| broadcast address | For the Internet address family, the host portion of the IP address is set to 1s. (For class B addresses, *x.x*.255.255. For class C addresses, *x.x.x*.255.) | Address used by this interface for contacting all stations on the local area network. |
| route metric | 0 | Hop count value advertised by the routing daemon (*routed*) to other routers. Higher numbers make the route less desirable and less likely to be selected as a route. Settings range from 0 (most favorable) to 16 (least favorable, infinite). |
| arp | Address Resolution Protocol is enabled and used by the interface. | Address Resolution Protocol (ARP) translates IP addresses to link-layer (hardware) addresses.<br>When this parameter is disabled, interface does not use ARP. |
| debug | Disabled. | When debugging is enabled, a wider variety of error messages are displayed when errors occur. |

If the configuration described in this section fits your needs, you do not need to perform any of the configuration tasks. Skip to "Install the FDDI Board" on page 41. Otherwise, follow the instructions in one or more of the sections in this chapter to change the configuration to suite your needs.

## Quick and Easy Configuration Instructions

To configure your FDDI station quickly, follow the step-by-step instructions in the appropriate example:


- "FDDI as the Primary Interface and Ethernet as Secondary" on page 24
- "FDDI as the Secondary Interface and Ethernet as Primary" on page 25
- "FDDI as the Only Network Interface" on page 27


### FDDI as the Primary Interface and Ethernet as Secondary

The configuration described here contains no special items, just the most basic functionality.

If your site uses an NIS service, the changes described in this section must *also* be made to the database on the NIS server .

1. Open a shell window.
2. Log on as superuser:

   ```
   % /sbin/su
   Password: thepassword
   ```

3. Determine your station's hostname:

   ```
   # /usr/bsd/hostname
   ```

4. Open the */etc/hosts* file:

   ```
   # /usr/sbin/jot /etc/hosts
   ```

5. Find the line containing your station's hostname.

   If the file does not contain a line for your hostname, follow the instructions in "Complete and Complex Configuration Information" on page 28,

6. Copy the line and place the copy immediately below the original.
7. Return to the original line and change the address (numbers on the left) to the IP address for the FDDI network.

8. On the new line, change each instance of the hostname to gate-*hostname*.

   For example, the lines for a station with a hostname of *mickey*, residing in a domain of *disney.com*, would look like this:

   ```
   x.x.x.x mickey.disney.com      mickey      #FDDI  primary
   x.x.x.x gate-mickey.disney.com gate-mickey #Ether secondary
   ```

   Each *x* represents one, two, or three decimal digits.

9. Do not change the address on the new line. This is your original Ethernet IP address and will continue to be used.
10. Save and close the file.
11. You are now ready to install the FDDI board. Follow the instructions in the board's installation guide or installation instructions.

    If the board is already installed, type the following commands to build your changes into the operating system:

    ```
    # /etc/autoconfig
    Automatically rebuild the operating system (y/n)? y
    # /etc/reboot
    ```

## FDDI as the Secondary Interface and Ethernet as Primary

The configuration described here contains no special items, just the most basic functionality. This configuration makes it possible for a Silicon Graphics system to load the miniroot over the primary Ethernet network (or boot from the network).

1. Open a shell window.
2. Log on as superuser:

   ```
   % /sbin/su
   Password: thepassword
   #
   ```

3. Determine your station's hostname:

   ```
   # /usr/bsd/hostname
   ```

4. Open the */etc/hosts* file:

   ```
   # /usr/sbin/jot /etc/hosts
   ```

5. Find the line containing your station's hostname.

   If the file does not contain a line for your hostname, follow the instructions in "Complete and Complex Configuration Information" on page 28.

6. Copy the line and place the copy immediately below the original.
7. On this new line, change the IP address (all the numbers on the left) to the FDDI IP address.
8. Also on the new line, change each instance of the hostname to fddi-*hostname*.

   For example, the lines for a station with a hostname of *mickey*, residing in a domain of *disney.com*, would look like this:

   ```
   x.x.x.x mickey.disney.com       mickey      #Ether primary
   x.x.x.x fddi-mickey.disney.com  fddi-mickey #FDDI  secondary
   ```

   Each *x* represents one, two, or three decimal digits.

9. Save and close the file.

   If your site uses an NIS service, the changes described above must *also* be made to the database on the NIS server.

10. Determine the name of your primary Ethernet interface with the command shown below. Some common examples include *ec0*, *et0*, *enp0*, *ep0*.

    ```
    # /usr/etc/netstat -i
    ```

11. Determine the name of your FDDI interface. This information is in the FDDIXPress release notes. Common names include *xpi0* and *ipg0*.
12. Open the */etc/config/netif.options* file:

    ```
    # /usr/sbin/jot /etc/config/netif.options
    ```

13. Find this line:

    ```
    : if1name=
    ```

    Change it as shown below. Be sure to remove the colon and leading space.

    `if1name=`*Ethernetinterfacename*

14. Find this line:

    ```
    : if2name=
    ```

    Change it as shown below. Be sure to remove the colon and leading space.

    ```
    if2name=FDDIinterfacename
    ```

15. Find this line:

    ```
    : if2addr=gate-$HOSTNAME
    ```

    Change it as shown below. Be sure to remove the colon and leading space.

    ```
    if2addr=fddi-$HOSTNAME
    ```

16. Save and close the file.

17. You are now ready to install the FDDI board. Follow the instructions in the board's installation guide or installation instructions.

    If the board is already installed, type the following commands to build your changes into the operating system:

    ```
    # /etc/autoconfig
    Automatically rebuild the operating system (y/n)? y
    # /etc/reboot
    ```

## FDDI as the Only Network Interface

The configuration described here contains no special items, just the most basic functionality.

1. Open a shell window.

2. Log on as superuser:

    ```
    % /sbin/su
    Password: thepassword
    #
    ```

3. Determine your station's hostname:

    ```
    # /usr/bsd/hostname
    ```

4. Open the */etc/hosts* file:

   ```
   # /usr/sbin/jot /etc/hosts
   ```

5. Find the line containing your station's hostname.

   If the file does not contain a line for your hostname, follow the instructions in "Complete and Complex Configuration Information" on page 28.

6. Change the address (numbers on the left) to the IP address for the FDDI network.

   For example, the line for a station with a hostname of *mickey,* residing in a domain of *disney.com*, would look like this:

   *x.x.x.x* `mickey.disney.com mickey #FDDI primary`

   Each *x* represents one to three decimal digits.

7. Save and close the file.

   If your site uses an NIS service, the changes described above must *also* be made to the database on the NIS server.

8. You are now ready to install the FDDI board. Follow the instructions in the board's installation guide or installation instructions.

   If the board is already installed, type the following commands to build your changes into the operating system:

   ```
   # /etc/autoconfig
   Automatically rebuild the operating system (y/n)? y
   # /etc/reboot
   ```

## Complete and Complex Configuration Information

This section describes configurations and configuration issues not covered by "Quick and Easy Configuration Instructions." The configuration instructions in this section are more complex and complete. This section explains when and why you need to configure an FDDI station, in addition to how to do it.

The following is an overview of the procedure for installing and configuring FDDIXPress. For a new FDDI station, the tasks must be performed in the order listed. Each task is divided into detailed steps and described in the referenced section.

1. Prepare for configuration, as described in “Prepare for Configuration” on page 29.
2. Perform the required configuration tasks:
   - Ensure your station’s network connection names and IP addresses are in the */etc/hosts* file, as described in “Network Connection Names and IP Addresses” on page 31.
   - Verify and, if necessary, modify the */etc/config/netif.options* file as described in “Configure the Station’s Network Interfaces” on page 33.
   - If necessary, create or modify the */etc/config/ifconfig-#.options* file, as described in “Changing Settings for the Operational Parameters” on page 38.
3. Perform the FDDI board installation, as described in “Install the FDDI Board” on page 41.
4. Optionally, make your environment user friendly, as described in “Configure the Environment for User Friendliness and Safety (Optional)” on page 42.
5. Check that the FDDI connection is functional, as described in “Verifying the FDDI Connection” on page 47.

## Prepare for Configuration

Before starting the installation, collect the necessary information and perform housekeeping so the installation goes smoothly.

1. If your computer has not been networked before, follow the instructions in the *Personal System Administration Guide* to set up your system as a networked workstation. These tasks include assigning your system a hostname, a network connection name, an IP address, as well as enabling TCP/IP.
2. If the FDDIXPress software has not been installed, do so now.
3. Determine the number of networks to which your station will be connected after FDDIXPress is installed. For example, if your station is currently connected to an Ethernet network, will the station continue to use the Ethernet connection in addition to the FDDI connection?
4. If the station will have more than one network connection, decide which will be the primary network. The primary network interface should be the one where all or most of your station’s network services or clients reside.

   **Note:** The network you select as primary experiences the heaviest usage. It is recommended that FDDI be the primary network connection. However, for systems that need to boot over the network, Ethernet must be primary.

5. For each network connection, select a network connection name and IP address.

   The network connection name of the primary network connection must be the same as the system's hostname. You can display your system's hostname by using the *hostname* command within a shell window:

   ```
   % /usr/bsd/hostname
   ```

   You can display the current IP address associated with the network connection name *hostname* by typing one of the following commands in a shell window:

   ```
   % /sbin/grep hostname /etc/hosts
   ```

   ```
   % /usr/bin/ypmatch hostname hosts
   ```

   The names you create for non-primary network interfaces can be anything you want. To facilitate recognition, the names usually include both the hostname and an indication of the protocol (for example, *fddi-mars* or *fddi2-mars*).

6. Determine if any of your station's network interfaces require special configuration for any of the following items: subnetwork mask (netmask), broadcast address, route metric, or use of Address Resolution Protocol.

   The default configuration settings for these operational parameters are listed in Table 2-4, in "Default Configurations." In most cases, the defaults are the desired settings.

   If any of these operational parameters needs special configuration, the network administrator must create an */etc/config/ifconfig-#.options* file, where the pound sign (#) matches the network interface's order in the *netif.options* file. Once these files are created, you can proceed with the configuration.

7. For sites using an NIS server:

   The network administrator needs to update the site's hosts and ethers databases to include the correct information about this station. The hosts database should be updated to include all the station's network connection names and IP addresses before you restart the system after installing the board. The ethers database can be updated only after the board has been installed.

8. You are ready to start configuring. Follow the instructions in "Network Connection Names and IP Addresses."

## Network Connection Names and IP Addresses

Your FDDI station must have a network connection name[1] and IP address for each FDDI network interface. It may also need network connection names and IP addresses for other network interfaces (for example, Ethernet).

This section provides instructions for entering your network connection names and IP addresses into the local */etc/hosts* file.

If your site uses an NIS service, the changes described in this section must *also* be made to the NIS server's database.

1. Open a shell window.
2. Log on as superuser:

   ```
   % /sbin/su
   Password: thepassword
   #
   ```

3. Use your favorite editor (for example, *jot* or *vi*) to open the */etc/hosts* file. For example, the command line below opens the */etc/hosts* file for editing:

   ```
   # /usr/sbin/jot /etc/hosts
   ```

4. Locate the line containing the network connection name that you selected for your FDDI connection. If you do not find an entry for this name, search for the FDDI IP address. If you do not find either, skip to step 6. If you find the FDDI name or address, continue.

   Searching for all instances of the station's hostname will usually identify all the network connection names for the system. You can display the system's hostname with the */usr/bsd/hostname* command.

5. Verify that the IP address and the name are correct for the FDDI connection. (Make sure the IP address is not the Ethernet address.) If the name and address are correct, skip to step 7, otherwise continue.

[1] The network connection name is a name entered in the */etc/hosts* file. This name is paired with an IP address. Each network interface must have one network connection name that is unique to the domain and one globally unique IP address.

6. If the line is not correct or is missing, edit the file so that there is a line containing the IP address and network connection name for the FDDI network interface.

   A typical format for an entry in */etc/hosts* file is as shown:

   *IPaddress fullnetworkconnectionname aliases*

   For example, a portion of an */etc/hosts* file might look like this, where the host *goofy* has two entries and *mickey* has one:

   ```
   198.45.91.1 mickey.mrktg.disney.com mickey
   198.45.91.5 goofy.mrktg.disney.com goofy
   198.45.65.1 fddi-goofy.engr.disney.com fddi-goofy
   ```

7. If your station will be using more than one network connection, for each one (in addition to FDDI), verify that the name and IP address are the correct.
8. Save and close the file.
9. Decide if the following statements are true for your system, then choose the relevant substep, below:

   - In the */etc/hosts* file, the FDDI IP address is assigned to the station's hostname
   - The Ethernet IP address to the entry gate
   - FDDI is the primary network interface
   - The station has no more than two network interfaces

   ■ If all the statements are true, you do not need to perform any other configuration tasks. If the FDDI board is not installed, install it now. Otherwise, if the board is installed, use these commands to build your changes into the operating system:

   ```
   % /sbin/su
   Password: thepassword
   # /etc/autoconfig
   Automatically rebuild the operating system (y/n)? y
   # /etc/reboot
   ```

   ■ If any of the statements are false, you need to configure the network interface(s). Follow the instructions in the next section, "Configure the Station's Network Interfaces."

For more information about the */etc/hosts* file, see the hosts(4) man page and *IRIX Admin: Networking and Mail*.

## Configure the Station's Network Interfaces

This section explains how to configure your station's network interface (or interfaces). If you do not perform any of the procedures in this section, the system configures the station with the default settings described in "Default Configurations" on page 22.

This section contains the following subsections:



### Making FDDI the Secondary Network Interface

To make FDDI the secondary network interface, edit the */etc/config/netif.options* file as explained in this procedure. This allows a Silicon Graphics workstation or server to boot from the primary Ethernet network.

1. Determine the names of your system's network interfaces.
   - If you are installing the FDDI board for the first time, the FDDIXPress release notes indicate the name of the FDDI network interface for your system (for example, *ipg#* or *xpi#*).
   - Other interface names can be displayed with the *netstat* command.

     Open a shell window and use the */usr/etc/netstat -in* command to list the currently available network interfaces, as demonstrated in Figure 2-1. If an FDDI connection is operating, its name is listed. The names you see may be different than those shown in Figure 2-1.

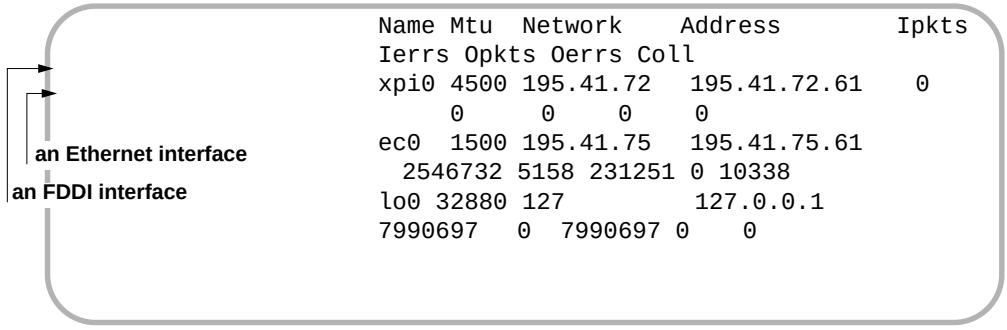



**Figure 2-1** Displaying Available Interfaces With netstat -in

2. Open the */etc/config/netif.options* file with your favorite editor.
3. Change the following lines

   ```
   : if1name=
   : if1addr=$HOSTNAME
   : if2name=
   : if2addr=gate-$HOSTNAME
   ```

   to

   ```
   if1name=name of interface you want to be primary
   : if1addr=$HOSTNAME
   if2name=FDDIinterfacename
   if2addr=fddi-$HOSTNAME
   ```

   Do not alter the line containing `: if1addr`
4. Remove the colons and leading spaces.

   For example:

   ```
   if1name=ec0
   : if1addr=$HOSTNAME
   if2name=xpi0
   if2addr=fddi-$HOSTNAME
   ```
5. If you do not want to use the network connection name shown above (fddi-*hostname*), you may replace the name with one of your own choice.

   Make sure the name or name format you enter corresponds to an entry in the */etc/hosts* file.
6. If this is your final configuration change, go to the subsection “Build Configuration Changes Into the System” to finish.

**Example 2-1** FDDI as Primary Interface Configuration

A workstation named *minnie* has an FDDI interface, *xpi0*, and an Ethernet interface, *ec0*. If the *netif.options* file is not altered, the default configuration is: *xpi0* is assigned the IP address corresponding to *minnie*, and *ec0* is assigned the IP address for *gate-minnie*. If there is no entry in */etc/hosts* for *gate-minnie*, the secondary interface is not configured.

For example, *minnie*'s */etc/hosts* file contains this information:

```
195.41.91.3  minnie.disney.com       minnie
195.41.184.2 gate-minnie.disney.com  gate-minnie
```

The unaltered */etc/config/netif.options* file contains this information:

```
: if1name=
: if1addr=$HOSTNAME
: if2name=
: if2addr=gate-$HOSTNAME
```

This is the resulting configuration:

- *minnie* (195.41.91.3) is configured as the primary FDDI interface.
- *gate-minnie* (195.41.184.2) is configured as the secondary Ethernet interface.

**Example 2-2** FDDI as Secondary Interface Configuration

To make the Ethernet (*ec0*) interface primary and the FDDI *(xpi0*) secondary for the system described in Example 2-1, you need to change the lines in the *netif.options* file to the following:

```
if1name=ec0
: if1addr=$HOSTNAME
if2name=xpi0
: if2addr=gate-$HOSTNAME
```

This is the result:

- *minnie* (195.41.91.3) is configured as the primary Ethernet interface.
- *gate-minnie* (195.41.184.2) is configured as the secondary FDDI interface.

**Example 2-3** Changing the Secondary FDDI Interface Name

To change the FDDI secondary interface name to *fddi-minnie* for the system described in Example 2-1 and Example 2-2, the */etc/hosts* file and the */etc/config/netif.options* file need to be altered.

The */etc/config/netif.options* file must have the following entries:

```
if1name=ec0
: if1addr=$HOSTNAME
if2name=xpi0
if2addr=fddi-$HOSTNAME
```

The */etc/hosts* file must have the following entries:

```
195.41.91.3    minnie.disney.com        minnie
195.41.184.2   fddi-minnie.disney.com   fddi-minnie
```

### Explanation of Network Configuration Process

During system startup and anytime it is invoked specifically, the shell command file */etc/init.d/network* configures and initializes the network interfaces and software. Some of the script's procedures are accomplished by calling other utilities and reading configuration files. Some of the tasks the */etc/init.d/network* command file performs are:

- Determines the station's hostname. This information is defined in the */etc/sys_id* file.
- Determines the network hardware and interfaces available in the operating system. This information can be viewed with the *hinv* command.
- Determines the ordering for the network interfaces. This information is defined in the */etc/config/netif.options* file. If the *netif.options* file has not been altered, the default ordering is configured (explained in "Default Configurations" on page 22 and defined within the *network* script).
- Determines the network connection name for each network interface. This information is defined by the `if#addr` lines in the */etc/config/netif.options* file. If the *netif.options* file has not been altered, the default names (explained in "Default Configurations" and defined in the *network* script) are used.
- Determines the IP address for each interface by looking up each network connection name in the */etc/hosts* file.
- Determines the settings for each network interface's operational parameters. This information is defined in the */etc/config/ifconfig-#.options*. If an *ifconfig-#.options* file does not exist for the interface, the default settings are assigned (described in "Default Configurations").

- Configures the number of network interfaces specified by the `if_ num` variable in the network script.
- Starts (enables) each successfully configured interface.

The results of the *network* script's configuration can be viewed with the */usr/etc/netstat -i* and */usr/etc/ifconfig* commands.

### Changing the Ethernet's Name

Ethernet is automatically configured as the secondary network interface. It is assigned a network connection name of *gate-hostname*. This section provides instructions for changing the name used for the Ethernet network connection.

If a station does not have a second entry in the */etc/hosts* file, the system does not configure a second network interface.

To configure Ethernet with a different */etc/hosts* entry (for example, *ether-hostname*), follow these instructions:

1. Log on as superuser and open the */etc/config/netif.options* file with your favorite editor.
2. Change the following line:

   `: if2addr=gate-$HOSTNAME`

   to

   `if2addr=`*newname*

   or

   `if2addr=`*newname*`-$HOSTNAME`
3. Save and close the file.
4. Use one of the following commands to verify that the name you have entered in the *netif.options* file exists in the */etc/hosts* file or hosts database. If the name does not exist, follow the instructions in "Network Connection Names and IP Addresses" on page 31 to modify the */etc/hosts* file.

   `% /sbin/grep` *name* `/etc/hosts`

   `% /usr/bin/ypmatch` *name* `hosts`

   *name* is either the new name or *newname-hostname*.
5. If this is your final configuration change, go to the subsection "Build Configuration Changes Into the System" on page 40 to finish.

### Configuring Multiple FDDI Interfaces

There is no default configuration for FDDI network interfaces other than the first one. If a system has two or more FDDI connections, you need to add a pair of lines to the */etc/config/netif.options* file for each additional FDDI network interface and possibly change the *if_num* variable in the */etc/init.d/network* file.

The following lines are an example of *netif.options* entries for a system with three FDDI connections and one Ethernet. The lines for the first and second network interfaces have not been edited, so the default configuration for a primary FDDI and secondary Ethernet are automatically configured.

```
: if1name=
: if1addr=

: if2name=
: if2addr=

if3name=xpi1
if3addr=fddi2-goofy

if4name=xpi2
if4addr=fddi3-goofy
```

The network connection names (for example, *fddi3-goofy*) must exist in the */etc/hosts* file.

The following is a single line in a *network* file that has been altered to configure twelve network interfaces:

```
if_num=12
```

### Changing Settings for the Operational Parameters

To change the default settings for operational parameters (summarized in Table 2-4), create or edit the */etc/config/ifconfig-#.options* file for the network interface. The pound sign (#) in the filename must match the number in the *netif.options* file that was used to configure the network connection. For example, for the *netif.options* line `if3name=xpi0`, create or edit the file */etc/config-3.options*.

The following is an example of the contents of an */etc/config/ifconfig-#.options* file. This file enables the IP address resolution protocol, sets a route metric, and specifies a subnetwork mask for the associated network:

```
arp  metric 9 netmask 0xFFFFFF80
```

Complete instructions for configuring operational parameters are provided in the device configuration instructions in *IRIX Admin: Networking and Mail*.

### Disabling Forwarding and Routing

By default, the routing daemon (*routed*) is started and IP forwarding (in the operating system) is enabled whenever a system has two or more network interfaces. This default configuration causes the system to advertise itself as a router to other systems on the networks, maintain tables of routes it knows, and to transfer (that is, route, forward) packets between its networks whenever it encounters packets that need to be routed in order to be delivered.

If your station has two (or more) network interfaces and you do not want the system to transfer or route packets between its networks or to advertise itself as a router, follow the steps in the examples below for the configuration you want.

**Example 2-4** Disable Forwarding and Route Advertising

This example disables the capability to forward data from one network to another and advertisement of all routing information. (This configuration does not disable the routing daemon's maintenance of routing tables, only its advertisement of the routing information.)

1. Edit the */etc/config/routed.options* file so that it contains the characters `-hq`. This prevents the system from advertising its network connections (routes) or its presence (the host route) on any of the system's networks.
2. Edit the */var/sysgen/master.d/bsd* file so that the line containing `int ipforwarding = 1` is changed to `int ipforwarding = 0`. This prevents the system from passing (transferring) any messages between its networks.
3. Go to the subsection "Build Configuration Changes Into the System" on page 40 to finish.

**Example 2-5** Disable Route Advertising

This example allows data to be forwarded from one network to another, but prevents the system from advertising its network connections (thus preventing the system from becoming known as a router).

1. Edit the */etc/config/routed.options* file so that it contains the characters `-hq`. This causes the system to refrain from all rout advertising; it does not advertise its network connections (routes) and it does not advertise its own presence has a host (host routes) on its connected networks.
2. Go to the subsection "Build Configuration Changes Into the System" on page 40 to finish.

**Example 2-6** Disable Route Advertising Except For the Primary Interface

This example allows data to be forwarded from one network to another and prevents the system from advertising its network connections (thus preventing the system from becoming known as a router). However, it allows the system to advertise its own presence as a host on the network attached as its primary network interface.

1. Edit the */etc/config/routed.options* file so that it contains the characters `-hmq`. This causes the system to advertise (on all its connected networks) its presence as a host (the host route) on its primary network, but prevents the system from advertising its network connections and other host routes.
2. Go to the subsection "Build Configuration Changes Into the System" on page 40 to finish.

For more information, see the routed(1M) and chkconfig(1M) man pages and the comments in the */var/sysgen/master.d/bsd* file.

## Build Configuration Changes Into the System

To build your network interface or driver configuration changes into the operating system, follow the procedure that is appropriate:

- If the FDDI board has not been installed, do not rebuild the operating system now. Instead, follow the instructions in the FDDI board's installation guide or installation instructions to install the board.
- If the FDDI board is installed, rebuild the operating system, and reboot to start using the new operating system with these commands:

```
% /sbin/su
Password: thepassword
# /etc/autoconfig
Automatically rebuild the operating system (y/n)? y
# /etc/reboot
```

## Install the FDDI Board

The FDDIXPress board should be installed after the FDDIXPress software has been installed and configured. The instructions for installing an FDDI board are described in the board's installation guide or installation instructions.

The following is an overview of the procedure for installing the FDDIXPress product (software and hardware). The steps must be performed in the order shown.

1. Install the FDDIXPress software.
2. Perform these required configuration tasks:
   - Update your station's name(s) and IP address(es) in the */etc/hosts* file. Instructions are provided in "Network Connection Names and IP Addresses" on page 31.
   - Configure the network interface(s). Instructions are provided in "Configure the Station's Network Interfaces" on page 33.
3. Install the FDDI board. Follow the instructions in the board's installation guide or installation instructions.

   Installation of the board includes the following three steps. The FDDI connection will not function if you do not finish your installation with these steps:
   - Restart the system.
   - Answer **`yes`** to the prompt `Automatically rebuild the operating system (y/n)?`
   - Reboot the system.
4. (Optional) When you finish installing the board, continue with "Configure the Environment for User Friendliness and Safety (Optional)" to make your station's environment user friendly and safe.
5. Verify the FDDI connection. Instructions are provided in "Verifying the FDDI Connection" on page 47.

## Configure the Environment for User Friendliness and Safety (Optional)

This section describes how to make your environment user friendly and safe. All procedures in this section are optional.

Four actions are recommended:

- Set the *path* variable to include the SMT commands.
- Create backup copies of important FDDIXPress files.
- For sites without an NIS service: Create an */etc/ethers* file so that names can be used with SMT commands instead of MAC addresses.
- For sites with an NIS service: Create local copies of the ethers and hosts databases.

### Setting the Path to the SMT Commands (Optional)

To invoke the SMT commands from any directory, the system must know where the commands reside. This section shows how to configure your environment so that the SMT commands are always available, regardless of the directory you are currently logged into.

If you do not configure the path, you must type the complete path to the directory where the SMT commands reside each time you invoke an SMT command.

1. Find the path to the SMT commands by reading any of the SMT command man pages. For example, enter the command:

   ```
   % /usr/bin/man smtring
   ```

   In the display that appears in your shell window, the text under the heading `SYNOPSIS` indicates the path. Make note of the path; it is everything up to, but not including, the command name. In the following display, */usr/etc/* is the path:

   ```
   NAME
   smtring - examines the state of FDDI ring
   SYNOPSIS
   /usr/etc/smtring [-adn] [-i interval] . . .
   ```

2. Open your *.login* file (or *.cshrc* file) with your favorite editor. For example, type a command line like this:

   ```
   % /usr/sbin/jot /usr/people/yourloginname/.login
   ```

3. Locate the line that sets the *path* variable. The line looks like this:

   ```
   set path=(. ~/bin /usr/bsd /usr/sbin /usr/lib /etc)
   ```

4. At the end of the *path* variable's last line, but before the closing parenthesis, add the new path. For example, if you were editing the example *.login* (or *.cshrc*) file, it should look like this example:

   ```
   set path=(. ~/bin /usr/bsd /usr/sbin /usr/lib /etc /usr/etc)
   ```

### Setting Up the ethers File (Optional)

The FDDIXPress SMT commands use MAC (physical) addresses to contact other FDDI stations on the ring. If you want to use the commands with names, instead of MAC addresses, your system must have access to an ethers database. (The ethers database maps physical addresses—MAC and Ethernet addresses—to network connection names.) Your station can obtain ethers database information from the site's Network Information Service (NIS) or from a local */etc/ethers* file.

**Note:** If any of your station's networks uses an NIS server, this procedure must be done at the NIS server, not on the local station.

Edit the */etc/ethers* file so it lists this station's MAC address and those of all the other stations on the FDDI ring:

1. Open a shell window and log on as superuser.
2. Use the */usr/etc/netstat -ia* command to determine the MAC address of your station's FDDI board and the name of the FDDI interface. Be sure to find the MAC address for the FDDI board (for example, the MAC address listed under *xpi0* or *ipg0*), not the Ethernet board (for example, *ec0*). In a default configuration, FDDI is the first interface listed. The MAC address is the number displayed in hexadecimal format, as shown in Figure 2-2.

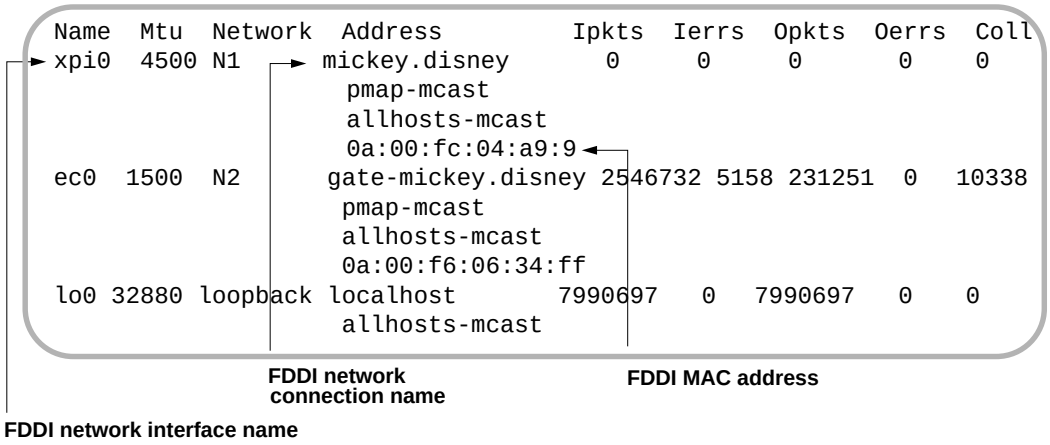



**Figure 2-2** Screen Display for /usr/etc/netstat -ia Command

3. Open the */etc/ethers* file with your favorite editor.
4. Add a line to the */etc/ethers* file that specifies the FDDI board's MAC address and the station's FDDI network connection name. In the */etc/ethers* file, use the format displayed with the */usr/etc/netstat* command for the MAC address and network connection name:

   *x:x:x:x:x:x networkconnectionname # comments*

   *x:x:x:x:x:x* is the 48-bit, hexadecimal MAC address of each network interface board. Each *x* represents one byte and can be a hexadecimal numeral from 0 to ff. The *networkconnectionname* corresponds to the name in the */etc/hosts* file that is paired with the FDDI IP address. Comments start after the # character and are optional.
5. In another shell window, determine the broadcast address for your network by using the following command. The broadcast address is the sequence of digits displayed in the location illustrated in Figure 2-3.

   % **/usr/etc/smtconfig** *networkinterfacename*

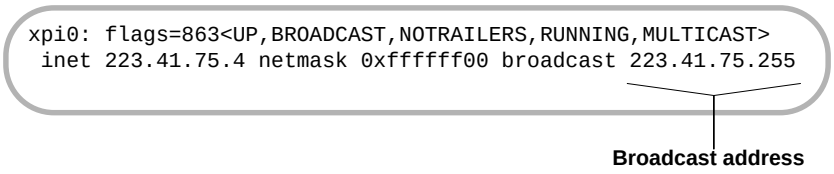



**Figure 2-3** Displaying Broadcast Address

6. Using the broadcast address from step 5, make each station on the ring provide its MAC address and network connection name:

   % **/usr/etc/ping -r -c 10** *broadcastaddress*

7. Display the gathered information:

   % **/usr/etc/arp -a**

8. Copy all the displayed MAC addresses and host names into your */etc/ethers* file. Be sure to use the proper format as explained above and shown in Example 2-7.

**Example 2-7** Sample ethers File

In this example, a station with a hostname of *goofy*, shows first a portion of an *arp* display, and second a corresponding portion of the */etc/ethers* file. *goofy* has two network interfaces and has been configured with the default configurations. Note that the *arp* display does not list *goofy*'s information.

The *arp* display:

```
mickey.disney.com (187.41.75.61) at a:0:69:6:34:ff
donald.disney.com (187.41.75.1) at a:0:69:2:4:45
minnie.disney.com (187.41.75.5) at a:0:69:2:15:ff
```

The */etc/ethers* file:

```
a:0:69:da:5c:f   goofy# local FDDI MAC addr
2:c:1f:1:e2:88   gate-goofy# local Ethernet addr
a:0:69:6:34:ff   mickey# an FDDI remote station
a:0:69:2:4:45    donald# an FDDI remote station
a:0:69:2:15:ff   minnie# an FDDI remote station
```

The above addresses can also be in this format:

```
0a:00:69:da:5c:0f   goofy
02:0c:1f:01:e2:88   gate-goofy
```

For more information, see the ethers(4), ping(1M), and arp(1M) man pages. For more information about the role of the */etc/ethers* file, see *IRIX Admin: Networking and Mail.* For information about NIS, see the *NIS Administration Guide* and man pages.

Some of the FDDIXPress tools and commands (such as *smtping* and *smtstat*) depend on the */etc/ethers* file (either local or on the NIS server) to know stations by their network connection names instead of by their MAC addresses. The */etc/ethers* file maps MAC addresses to network connection names. You need to enter each FDDI station into the ethers database. (The file */etc/ethers* is the ethers database.) If you do not update this database, FDDIXPress commands know stations only by their MAC addresses, in hexadecimal numerical format and Ethernet order, as defined in the Glossary.

The stations listed by *arp -a* are stations that your station has communicated with in the last few minutes. You can add entries to the *arp* display by invoking `ping` *name* or `ping` *IPaddress*.

If your site uses a Network Information Service (NIS) server, you may want to keep local (backup) copies of the *ethers* and *hosts* files for use when the NIS server is unavailable. (The local copies are not used as long as NIS is available.) For example, an NIS server could become unavailable when the FDDI ring wraps. If you decide to keep local backup copies, remember to update them when changes are made.

Type the following command lines to make local copies of */etc/hosts* and */etc/ethers* files, including the changes the network administrator has made to the database:

```
% /sbin/su
Password: thepassword
# /usr/bin/ypcat hosts > /etc/hosts
# /usr/bin/ypcat ethers > /etc/ethers
```

Do not perform this step until you are certain the network administrator has made all the changes pertaining to your station.

### Backing Up SMT Files (Optional)

Files can become corrupted. It is a wise practice to keep backup copies of important files. To create backup copies of two FDDIXPress files that the SMT module (daemon) uses frequently, follow this procedure.

1. Go to the *fddi* directory:

   ```
   % cd /etc/fddi
   ```

2. Become superuser:

   ```
   % /sbin/su
   Password: thepassword
   #
   ```

3. Make backup copies of the *smtd.conf* and *smtd.mib* files:

   ```
   # /sbin/cp smtd.conf smtd.conf.orig
   # /sbin/cp smtd.mib smtd.mib.orig
   ```

Performing this step can save you from reinstalling the FDDIXPress software if either file becomes corrupted or is deleted.

## Verifying the FDDI Connection

To verify that the station's FDDI connection is working, follow the steps in this section. Many of these steps use the *smtstat -s* command to view key items from the SMT information database. For details on how to use the *smtstat* command, see "Display SMT Information (MIB)" on page 65. If any of the following tests fail, see Chapter 4 for troubleshooting ideas.

1. Open a shell window.
2. Type the following command to verify that the FDDI board is recognized by the system software:

   ```
   % /sbin/hinv
   ```

   The *hinv* display, shown in Figure 2-4, lists all the hardware known to the system. An FDDI controller must display in the list. If an FDDI controller is not listed, refer to "Recognition of Board by Software" on page 80.

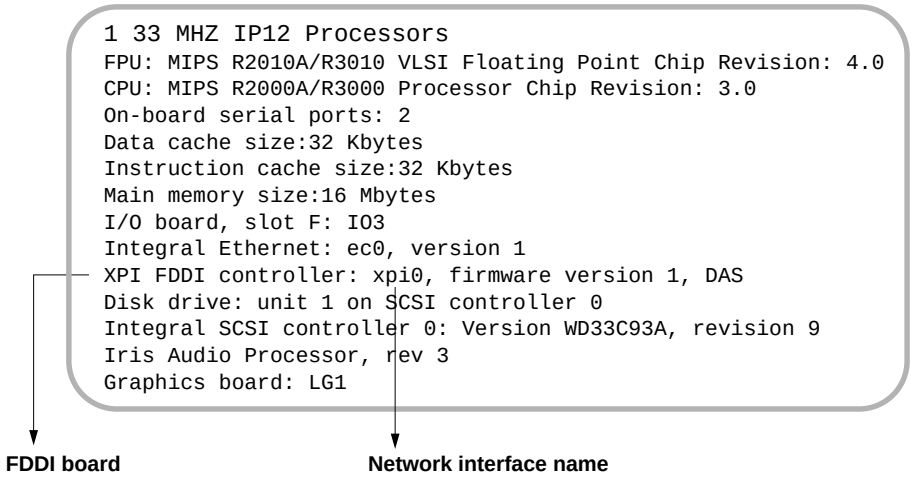



**Figure 2-4** An Example of the hinv Display

3. List all network interfaces on the system. An FDDIXPress interface, such as *ipg#* or *xpi#*, must be listed.

   % **/usr/etc/netstat -in**

   If the listing does not include an FDDI network interface, the FDDIXPress software may not have been installed, may not be configured, or may not be built into the operating system. Fix the problem before continuing.

4. Invoke the report display for the first FDDIXPress interface:

   % **/usr/etc/smtstat -I** *FDDIinterface* **-s**

   If an error message displays, look up the error message in Appendix A for troubleshooting instructions.

5. Verify that the FDDI board sees the ring's token.

   - Type **1** to view the MAC (#1) report.
   - Type **z** to reset the counters and start accumulating. The accumulating total displays every second.
   - Look at the "MAC state" field. It should display `ACTIVE`.
   - Watch the "tokens" field for 15 seconds. The number should increment rapidly. If the "tokens" field does not increment, refer to "Token Count Not Incrementing" on page 87.

6. Verify that the ports are working.
   - Type **2** to view the Port (#2) report.
   - For a dual ring DAS, the following fields should have the statuses shown:

```
                    Port B    Port A
neighbor            A         B
PCM state           ACTIVE    ACTIVE
PC withhold         NONE      NONE
conn state          ACTIVE    ACTIVE
tx line state       THRU      THRU
rcv line state      ILS       ILS
```

     A WRAP entry indicates that the ring is wrapped at this port. This may be due to an illegal port connection or it may indicate a fault on the ring. If the WRAP is on port B, the fault domain starts somewhere upstream from this station; if the WRAP is on port A, the fault is downstream.

     A WRAP entry on a DAS connected to a concentrator is functioning normally. If the ring is wrapped, refer to "Ring Is Wrapped" on page 88.

   - For an SAS, the following fields should have the statuses shown:

```
                    Port S
neighbor            M
PCM state           ACTIVE
PC withhold         NONE
conn state          ACTIVE
tx line state       THRU
rcv line state      ILS
```

     A QLS or HLS entry on the transmit line state indicates the connection at this station is faulty. This may be due to an illegal port connection or it may indicate a faulty cable or connection. Follow the instructions in "Check Cables and Connectors" on page 83 to correct the connection.

7. Verify that the optical signal is being received without errors.
   - Continue viewing the Port (#2) report.
   - Type **r** to view the totals accumulated since the last reboot.
   - Look at the "Link errors: short-term" field. The number should be 9 or greater. If the short-term link error value is less than 9, refer to "Link-Level Errors" on page 87.

8. Verify that there are no beacon or claim errors.
   - Type **3** to view the Ring Mgt (#3) report.
   - Type **z**.
   - Monitor the "Claims received" and "Beacons received" areas for 1 minute. The values should be close to zero for a ring functioning normally. If you observe an increase of two or more beacons or claims, wait a few minutes and repeat your observations two more times.

     If you consistently see more than two additional claims or beacons during your monitoring periods, refer to "Too Many Claims or Beacons" on page 88.
9. Verify upstream and downstream neighbors:
   - Type **5** to view the Neighbors (#5) report.
   - In the bottom section of the display, verify that a nonzero address is listed for upstream and downstream neighbor stations. Ignore the "old" listings. If one or both of the neighbors are listed with an address of zero, refer to "Current Neighbor's Address Is Zero" on page 93.
   - Take note of the names or MAC addresses for the upstream and downstream neighbors. You will use these in a subsequent step. If the screen display lists MAC addresses only with no names, the */etc/ethers* database has not been set up. The */etc/ethers* database is an optional configuration task explained in "Setting Up the ethers File (Optional)" on page 43.
10. Type **q** to quit the report display.
11. Verify that this station can communicate with other stations on the ring.
    - Type one of the following commands for each of the station's neighbors:

      % **/usr/etc/smtping -c 10** *fddinetworkconnectionname*

      or

      % **/usr/etc/smtping -c 10** *MACaddress*

      Names and MAC addresses of other stations on your FDDI ring are listed in the */etc/ethers* file or ethers database.
    - Verify that the message in the next-to-last line of the *smtping* display indicates less than 10 percent packet loss. If *smtping* does not elicit a response from a station, see "Cannot Communicate With Other Stations" on page 90 for troubleshooting instructions.

      If the ring is losing packets at a rate over 10 percent, see "High Rate of Packet Loss" on page 90.

*Chapter 3*

# Managing Your FDDI Station and Ring

This chapter describes how to manage your station's connection to the FDDI ring. Specifically, the following topics are covered:



If you are the FDDI ring's network administrator, you need to devise a way to keep track of the stations on your FDDI ring to ensure that they are operational and that the network traffic is flowing freely. How do you determine whether a particular station is on the ring or whether the ring has wrapped? How do you find out what, if anything, is wrong with a station? This chapter provides some of the information you need to answer these questions.

## Station Management Commands

FDDIXPress provides station management (SMT) commands (listed in Table 3-1) for managing and monitoring both the FDDI ring and the FDDI connections at each station. You execute these commands from a shell window.

FDDIXPress includes a graphical tool for maintaining FDDI rings: FDDIVisualyzer. This application displays a color-coded graphical representation of the FDDI ring, thus allowing you to see the ring status and view all the station statuses. Unlike the SMT

commands that work best for monitoring a single station, FDDIVisualyzer provides complete ring status at a single glance.

You can use the SMT commands to verify that a station is reachable on the ring, to list all the stations on the ring, to monitor the status of a particular station's FDDI connection, and so forth. Table 3-1 lists the SMT commands.

Something the SMT commands do not do for you is maintain a list of all the stations that are supposed to be on the ring. In general, SMT information is always current, so only the currently operating stations can be listed and contacted. However, at times, it is convenient to have a list of all the stations that should be functioning on a particular ring. This is a task the network administrator for the FDDI ring should do.

The SMT commands are specialized versions of the IRIX networking commands. For example, a few of the SMT commands that are similar to the networking commands include *smtstat* (like *netstat*), *smtping* (like *ping*), and *smtconfig* (like *ifconfig*). Be sure to use the SMT commands for the FDDI connections; use the standard network commands for the Ethernet connections. See Appendix D for the man pages for the SMT commands.

**Table 3-1** FDDIXPress (SMT) Commands

| Target | Utility | Description |
|---|---|---|
| Ring | *smtring* | Lists all the functioning stations on the ring. |
| Remote station or local station | *smtinfo* | Shows SMT information for one station on the ring. |
| | *smtping* | Verifies that a particular station on the ring can be reached. Proves that the local station's FDDI connection is functional. |
| Local station (only) | *smtconfig* | Configures or displays local station's FDDI interface parameters. Superuser access is required to (re)configure. |
| | *smtmaint* | Sets FDDI PCM line states for debugging local station's FDDI connection. Intended for use by FDDI experts only. Superuser access required. |
| | *smtstat* | Shows SMT statistics and information for local station; displays selected contents of MIB, organized into six different reports. |

## Verifying the Connection to a Station

To see if a station is on the FDDI ring:

```
% /usr/etc/smtping –I fddiinterface -c 2 host
```

*host* is a name in the */etc/ethers* file or a MAC address, and *fddiinterfac*e is the network interface (for example, *ipg0*, *ipg1*, and so on, or *xpi0*, *xpi1*, and so on).

This command sends a request for a response (analogous to an RSVP). The previous request is sent twice (`-c 2`) to a host (either a MAC address or a name defined in */etc/ethers*) on the specified FDDI network connection. As the host receives each request, it responds by sending some data. If *host* is not responding for any reason, *smtping* will time out, and the screen display indicates the problem with the message `... 0 packets received, 100% packet loss`.

When a station is on the ring and responds, you see a display similar to Figure 3-1.

```
SMTPING goofy -- 8 data bytes
68 bytes from 0a:00:1b:04:00:07: xid=0 time=10 ms
68 bytes from 0a:00:1b:04:00:07: xid=1 time=10 ms


---- goofy SMTPING Statistics ----
2 packets transmitted, 2 packets received, 0% packet loss
round-trip (ms) min/avg/max = 10/10/10
```

**Figure 3-1** smtping Display

For additional information about *smtping* and its options, see smtping(1M).

## Listing the Stations on the Ring

To list all the functioning stations on the FDDI ring, use the *smtring* command:

```
% /usr/etc/smtring
```

*smtring* broadcasts to all the stations and concentrators on the ring, waits 60 seconds to collect all responses, and then lists the responding stations in logical order. The local station is at the top of the list (unless a specific host has been specified in the command line). Each line shows three items of information, described from left to right:

- the station ID for the station listed on the right (under the label `MAC Address`)
- the station's upstream neighbor
- the station's *name* (or, if the *ethers* database is not maintained, the MAC address in canonical order)

Figure 3-2 shows an example of responses. In this example, the *smtring* command has been invoked from a station named *goofy* whose MAC address is a:0:1b:4:0:7 and whose upstream neighbor is *mickey*. From this listing you can construct a ring, as shown in Figure 3-3.

```
Logical FDDI Ring Dump(4 nodes)

Station ID                Upstream Nbr              MAC Address
00:00:0a:00:1b:04:00:07   mickey.disney.com         -> fddi-goofy.disney.com
00:00:0a:00:1b:d6:b5:10   fddi-goofy.disney.com     -> donald.disney.com
00:00:0a:00:1b:04:1c:0f   donald.disney.com         -> gate-minnie.disney.com
00:00:0a:00:1b:05:62:c4   gate-minnie.disney.com    -> mickey.disney.com
```

**Figure 3-2** smtring Display

In Figure 3-2, *goofy's* station ID is the default one created by the FDDIXPress SMT daemon from the MAC address.

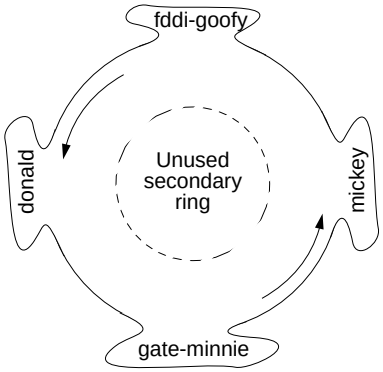



**Figure 3-3** Ring Created From smtring Display

You can use the *–I* option to *smtring* if you have more than one FDDI controller board installed (for example, *xpi0* and *xpi1*) and want to examine the state of the second board's ring. To do this, use:

```
% /usr/etc/smtring -I interfacename
```

## Displaying SMT Information for a Remote Station

With the *smtinfo* command, you can see SMT information for a specified remote host, including station configuration and operation information and supported SMT versions.

### Display the SMT Version

To display the SMT version for a remote *host* (for example, 0a:00:1b:04:00:07 or *goofy*), use:

```
% /usr/etc/smtinfo host
```

*host* is a name in the */etc/ethers* file or a MAC address.

The output looks like the following line and shows the host *goofy* is currently using SMT version 2, and can communicate with stations using SMT versions 1 or 2.

```
goofy uses SMT version 2 (supported versions: 1-2)
```

## Display a Station's Configuration Information

To see station configuration information for a remote host (for example, 0a:00:1b:04:00:07 or *goofy*), use:

```
% /usr/etc/smtinfo -c host
```

*host* is a name in the */etc/ethers* file or a MAC address.

An example of *smtinfo -c* output is shown in Figure 3-4 and the information is explained in Table 3-2.

```
Msg Timestamp:     659039603.045009
Station Dscrpt:    1 MAC, 0 masters, 2 nonmaster STATION
Supported Vers:    v1-v1, opvers=1
Station States:    topology=ROOTSTA, dupa=0
Station Policy:    conf=NONE, conn=REJECT(MM)
MAC3 Nbrs:         una=0a:00:1b:05:62:c4, dna=0a:00:1b:d6:b5:10
Path Descriptors:
                   port1:  pc=B state=ACTIVE pc_nbr=A remotemac=0 conn_rid=2
                   port2:  pc=A state=ACTIVE pc_nbr=B remotemac=1 conn_rid=3
                   mac3:   addr=0a:00:1b:04:00:07 conn_rid=1
```

**Figure 3-4** smtinfo -c Display

**Table 3-2** Information Displayed by smtinfo -c

| Item | Description |
|---|---|
| `Msg Timestamp` | This information is not useable. |
| `Station Dscrpt` | Description of the station |
| `Supported Vers` | SMT versions supported and currently used |
| `Station States` | Station's states.<br>dupa=0 indicates that there are no duplicate MAC addresses.<br>ROOTSTA indicates that the station is connected to a dual ring, not a concentrator. |
| `MAC3 Nbrs` | Upstream (una) and downstream (dna) neighbor addresses. |
| `Path Descriptors` | Descriptions of the port or ports and the interface's MAC address in canonical order. |

If the host has an additional FDDI board installed and you want to see configuration information about that interface (for example, *ipg1*), use:

`% /usr/etc/smtinfo -c -I` *interfacename host*

For more information about *smtinfo*, see smtinfo(1).

## Recognizing Faults on the FDDI Ring

The network administrator for an FDDI ring needs to monitor the ring and recognize faults when they occur. One type of fault, for example, occurs when a station on the network goes down. The SMT modules within the FDDI stations isolate the fault and wrap to the secondary ring. If an optical bypass switch is installed on the dysfunctional station, the switch causes the ring to bypass the station and no wraps occur. The network continues to function. Figure 3-5 shows an example of wrapped ring when one station goes down.

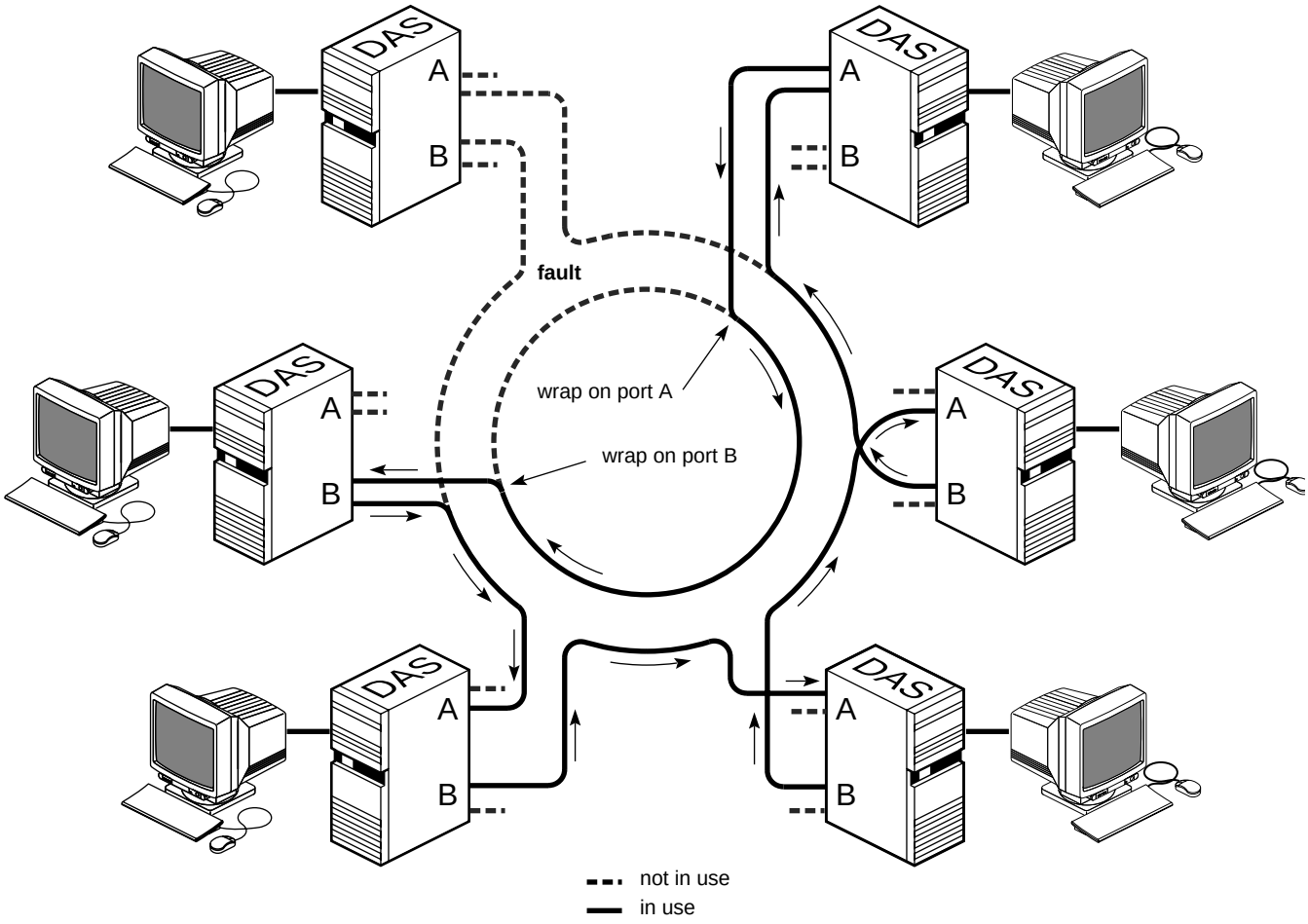



**Figure 3-5** Fault Isolation and Ring Wrap

As you can see in Figure 3-5, when one station experiences an error, only that station is out of the loop. It is also possible for one port on one station to malfunction (as illustrated by fault 1 in Figure 3-6), in which case the ring wraps, but no station is out of the loop. Traffic on the network continues as usual. Notice that when a station fails (both ports are off the ring), the wraps do not occur on the faulty port, but on its two neighbor ports.

If two or more stations go down, the network may become fragmented into a number of smaller loops, and users may not be able to access stations that have become isolated onto a different loop. It is important to locate the faults and make the necessary repairs as quickly as possible. Figure 3-6 shows a fragmented network with two stations down.

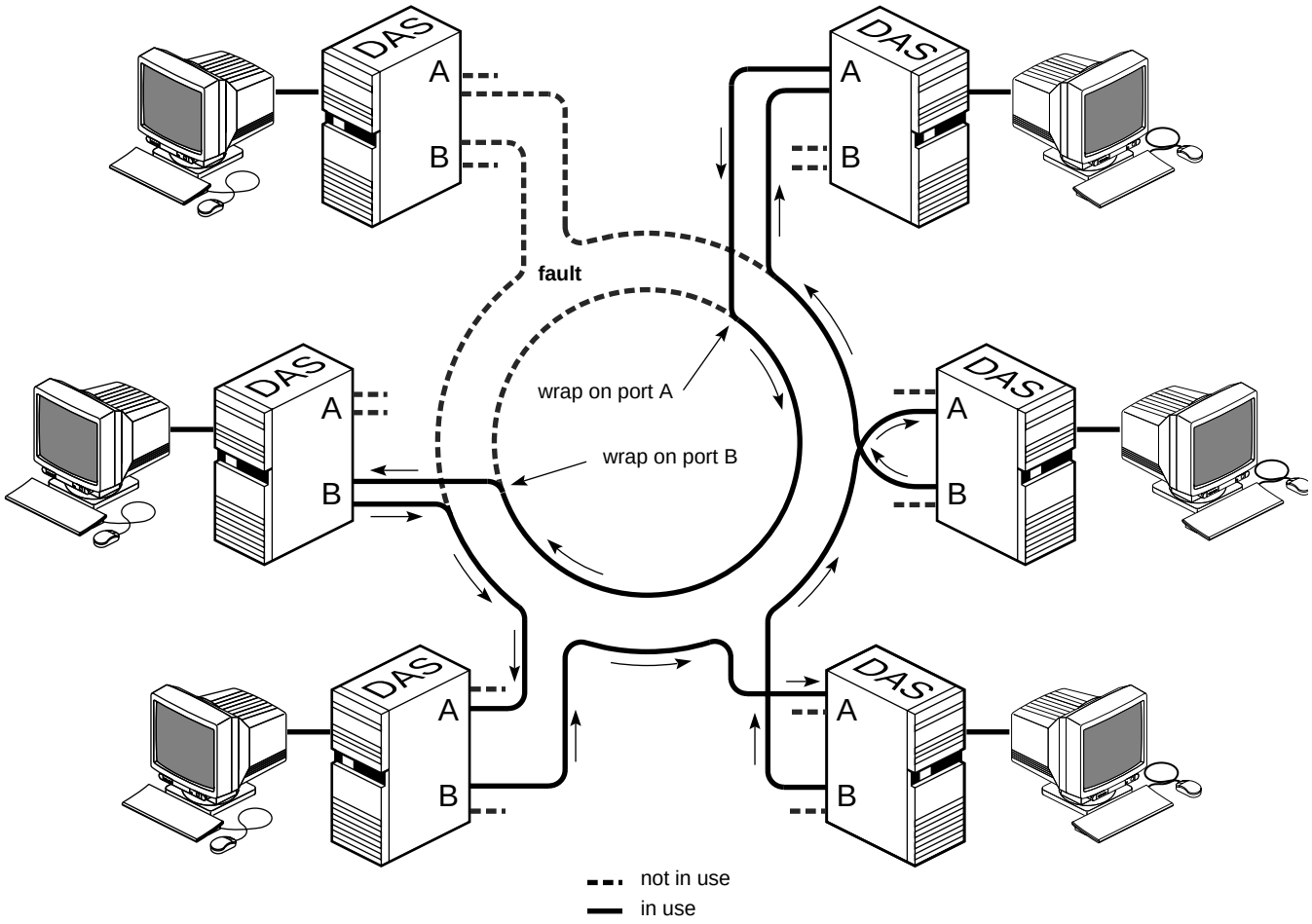



**Figure 3-6** Fragmented Ring

How do you know there is a fault on the ring? One way is to use *smtping* at each station to verify that each one responds. Another way is to use *smtring* to create a complete list, then verify that all known stations appear on the list. The easiest method is to use the FDDIVisualyzer product, which graphically indicates faults on the ring. In all of these instances, an up-to-date, complete list of all stations that are physically attached to the ring is vital. The network administrator should maintain this list. In many cases, once a station fails, it is not possible to communicate with it remotely over the ring. Its failure is deduced from its absence or lack of response. To debug the faulty station, log on to that station through a second network connection or at the station.

You can log on to any station and use *smtstat* to display status information about that station's FDDI interfaces. This command does not access a station remotely; rather, it displays information about the local host, even when the host is not functioning on the ring. A step-by-step verification process is described in "Verifying the FDDI Connection" on page 47.

## Monitoring a Station's FDDI Status

You can display and monitor the status of a station's FDDI connection by logging on to the station and entering the following command:

```
% /usr/etc/smtstat
```

The *smtstat* report is shown in Figure 3-7 and a listing of its columns follows. Table 3-3 explains the entries for the columns in more detail.

```
SM_DAS: Station ID=00-00-50-00-d8-20-00-e0 SMT Version 1 (1-1)
Name Address              MAC port  nbr  PCM    tls  rls   flags
ipg0 0a:00:1b:04:00:07    ACT B      A   ACTIVE THRU ILS <LS,RC,JOIN,THRU,RNGOP>
                              A      B   ACTIVE THRU ILS   <LS,RC,JOIN,THRU>
```

**For a DAS**

```
SM_SAS: Station ID=00-00-50-00-d8-20-88-40 SMT Version 1 (1-1)
Name Address              MAC port  nbr  PCM    tls  rls   flags
xpi0 0a:00:1b:04:11:02    ACT S      M   ACTIVE THRU ILS <LS,RC,JOIN,THRU,RNGOP>
```

**For an SAS**

**Figure 3-7** smtstat Display

In the DAS display, the first line contains the following information:

- the type of station (SM_DAS is a single MAC, dual-attachment station)
- the SMT station ID
- supported SMT versions

The second line contains column headings while subsequent lines display the information:

- Name: names of FDDI interfaces (for example, *ipg0*, *xpi0*)
- Address: MAC address (in canonical order) associated with each interface
- MAC: status of the MAC (for example, ACT for active is normal)
- port: ports present for each MAC
- nbr: port on neighbor station to which each local port is connected (A-to-B, B-to-A, and S-to-M are normal)
- PCM: status of each port's physical connection management (PCM) where ACTIVE is normal
- tls: transmit line state for each port (THRU is normal)
- rls: receive line state for each port (ILS is normal)
- flags: flags for each port (RNGOP, LS, RC, JOIN, THRU, and OBS are normal)

By monitoring SMT status, you can see the connection state, transmitting and receiving line states, and the flags indicating the ring state. In the *smtstat* display shown in Figure 3-7, the primary ring is operating (RNGOP), its transmit line is working (THRU), its receive line is idle (ILS), and the secondary ring is functional (LS, RC, JOIN) but not operating. If the ring were wrapped at this station, you would see a WRAP indication.

**Table 3-3** smtstat Report Fields

| Field | Possible Entries | Description |
|---|---|---|
| MAC | | MAC status |
| | ACT | active |
| | CON | connect |
| | OFF | MAC could not be read by software |

**Table 3-3 (continued)** smtstat Report Fields

| Field | Possible Entries | Description |
|---|---|---|
| port | | local port connection type |
| | A | receive on SAS, or receive for primary ring and transmit for secondary ring on DAS |
| | B | transmit on SAS, or transmit for primary ring and receive for secondary ring on DAS |
| | M | master |
| | S | slave |
| | ? | no connection |
| nbr | same as port | neighbor port connection type |
| PCM | | physical connection management state |
| | ACTIVE | active |
| | CONNECT | connected |
| | JOINED | joined |
| tls, rls | | transmit and receive line states |
| | ALS | active line state |
| | ILS | idle line state |
| | QLS | quiet line state |
| | HLS | halt line state |
| | MLS | master line state |
| | THRU | through connection (the ring is working at this station) |
| | WRAP | port is wrapped, which can mean that the ring is wrapped at this station, or (for a DAS board attached to a concentrator) that the port is wrapped to support an SAS connection |
| flags | | special flags associated with station's ports |
| | LS | line state desirable |

**Table 3-3 (continued)** smtstat Report Fields

| Field | Possible Entries | Description |
|---|---|---|
| | RC | ring connected; neighbor sending symbols |
| | JOIN | ring joined; neighbor handshaking finished. |
| | RNGOP | ring in operation |
| | OBS | optical bypass switch in use |
| | CON-Undesirable | undesirable SMT connection |
| | CON-Illegal | illegal SMT connection |
| | WA | withhold Port A as a back-up link |
| | WAT | withhold Port A in Tree mode |

## Display Kernel and SMT Daemon Statistics

By using the *–v* (verbose) option with *smtstat*, you can display additional statistics, including the following:

- Physical connection management (PCM) status.
- A log showing line states for PHY0 (usually port B).
- Kernel statistics, described in Table 3-4. These statistics are reset to zero each time the system is booted. Of the kernel statistics, only the following items normally have steadily increasing values: `frame_ct`, `A-bit`, `C-bit`, and `tok_ct`.

**Table 3-4** smtstat -v Kernel Statistics

| Field | | Description |
|---|---|---|
| Left column | | |
| | frame_ct | Frames seen |
| | A-bit | Address-recognized bits seen |
| | rngop | Times ring transitioned from nonoperational to operational |
| | tkerr | Duplicate tokens seen |

**Table 3-4 (continued)** smtstat -v Kernel Statistics

| Field | Description |
|---|---|
| tvxexp | Times valid-transmission-timer (TVX) expired |
| myclm | Station's own claims seen |
| mybec | Station's own beacons seen |
| eovf | Elasticity buffer overflows experienced |
| tx_under | Transmit FIFO underflows experienced |
| flsh | Frames flushed |
| tot_junk | Frames discarded |
| error | Errors detected by MAC |
| rx_ovf | Receive FIFO overflows experienced |
| Middle column | |
| tok_ct | Tokens seen |
| C-bit | Frame-copied bits seen |
| rngbroke | Times ring has become nonoperational. |
| clm | Claims seen |
| trtexp | Times token-rotation-timer (TRT) expired |
| loclm | Claims seen that were lower than this station's |
| otrbec | Other stations' beacons |
| noise | Noise events from PMD and PHY |
| err_ct | Frames seen with bad checksums (CRCs) |
| abort | Frames aborted |
| junk_void | Badly formatted void frames |
| shorterr | Frames seen that were too short |
| buf_ovf | Buffer overflows experienced |
| Right column | |

**Table 3-4 (continued)** smtstat -v Kernel Statistics

| Field | Description |
|---|---|
| E-bit | Error-detected bits seen |
| multda | Frames seen with station's address and A bit already set |
| bec | Beacons seen |
| tkiss | Tokens issued |
| hiclm | Claims seen that were higher than mine |
| dup_mac | Times duplicate MAC addresses detected |
| xmtabt | Transmission aborts experienced |
| lost_ct | Badly formatted frames seen |
| miss | Frames seen but unable to copy |
| junk_bec | Badly formatted beacons seen |
| longerr | Frames seen that were too long |

Using *–vv* (extra verbose) displays even more information, including SMT daemon (*smtd*) statistics. The report displays

- additional station information
- physical connection management (PCM) status
- line state log for PHY0 (usually port B)
- MAC statistics and configuration information (referred to as a MAC dump)
- PHY1 (usually port A) configuration information

## Display SMT Information (MIB)

To monitor continually the FDDI activity of a configured interface on the local system, use:

```
% /usr/etc/smtstat –s -I fddiinterface
```

*fddiinterface* is the interface (for example, *ipg0*, *ipg1*, *xpi0*, *xpi3*).

The output of this command produces the following six *smtstat* reports.

- MAC status
- port status
- ring management status
- configuration information
- neighbor information
- miscellaneous SMT information

This output requires a shell window or a terminal at least 80 columns wide by 24 lines high. When the window is too small, the display is not usable. Make your display area at least this size before invoking the command.

The reports are viewed one at a time. The top of each report displays the report name, date, and time. At the bottom of each report is a menu line listing all the available reports, as shown in Figure 3-8.

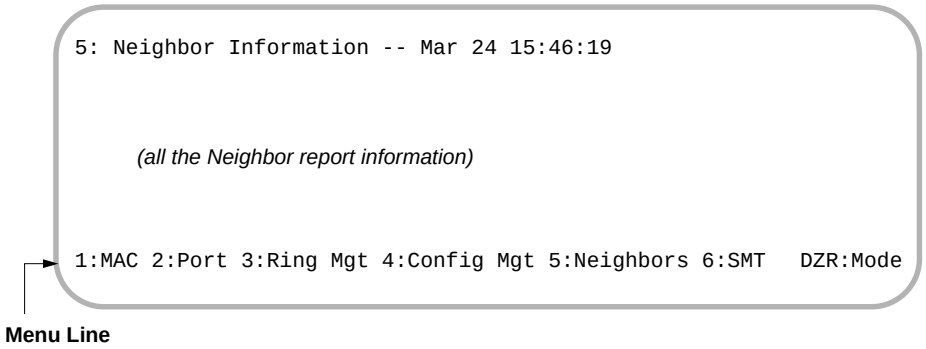



**Figure 3-8** smtstat -s Display: General Report Format

The following user interface allows you to manipulate the reports:

- To display a different report, type the report's number. The numbers are displayed in the menu line on the bottom of the screen. For example, to view the SMT report, type `6`.
- To quit, type `q` or `Ctrl+c`.
- To refresh the screen, type `Ctrl+l`.
- To change the time interval for the report statistics display, press one of the these keys:

| | |
|---|---|
| `r` | Each second, shows totals accumulated since last reboot. |
| `d` | Resets fields to zero every second, and each second shows totals accumulated within that last second. |
| `z` | Resets fields to zero when `z` is pressed, and every second displays the accumulating totals. |

For a description of all the fields in each report, see Appendix B, "smtstat Reports." For a complete definition of each field, refer to the ANSI standard entitled *ANSI FDDI Station Management (SMT)*. For information about command usage, refer to the smtstat(1M) man page.

## Displaying and Configuring Network Interface Information

As network administrator, you may need to display or temporarily alter a station's network interface parameters. The command *smtconfig* allows you to do this.

### Display the Configuration

To display the current configuration of the FDDI interface, follow these steps:

1. Use *smtstat* to determine the name of the FDDI network interface(s) on your station. The FDDI interface name is listed under the column heading `Name`. Examples: *ipg0*, *xpi0*.
2. Use *smtconfig* with the name of the interface discovered in the first step:

   `% /usr/etc/smtconfig` *interfacename*

Sample output from *smtconfig* is shown in Figure 3-9. A description of the fields follows, starting with the first item on the left of the top line and moving right.

```
xpi0: flags=863<UP,BROADCAST,NOTRAILERS,RUNNING,MULTICAST,OBS>
 inet 187.51.80.4 netmask 0xffffff00 broadcast 187.51.80.255
```

**Figure 3-9** smtconfig Display

- First line:
  - The interface name.
  - Flags that are enabled, with the following meanings:

| | |
|---|---|
| `UP` | The network interface is enabled and should be functioning. When `UP` is displayed, `RUNNING` should also be displayed. |
| `BROADCAST` | A broadcast address is set. |
| `DEBUG` | Debugging is enabled. |
| `NOTRAILERS` | The link layer encapsulation does not use trailers. |
| `RUNNING` | The driver is running and should be functional. This flag and UP should always appear together. |
| `NOARP` | The Address Resolution Protocol is not enabled. |
| `MULTICAST` | A multicast address is set. |
| `CKSUM` | The driver is generating checksums for transmitted packets. |
| `OBS` | An optical bypass switch is present. |

- Second line:
  - The address family configured for this interface: `inet` is the default.
  - The address assigned to this network interface: The default is the IP address associated with the *hostname* in the */etc/hosts* file.
  - The network mask (`netmask`) used for the IP subnetwork: The default is a value that, when applied, implements no mask.
  - The address used for broadcasting to all stations on the ring: The default is an IP address where the host portion is all ones.

## Change the Configuration

As superuser, you can enable and disable the FDDI interface or (re)configure the FDDI interface parameters manually using the smtconfig(1M) command. Most of the time, it is not necessary to set interface parameters manually using *smtconfig* because FDDI is configured automatically with default settings (as described in Table 2-3) when the system is started or rebooted.

**Note:** Changes made with *smtconfig* are not saved; at reboot they return to their default settings (or the */etc/config/ifconfig-#.options* and */etc/config/netif.option*s files). To change the configuration so the changes survive rebooting, follow the instructions in Chapter 2 or in *IRIX Admin: Networking and Mail*.

To change the configuration of a network interface, perform the following steps:

1. Become superuser:

   ```
   % /sbin/su
   Password: thepassword
   #
   ```

2. Use *smtstat* to determine the name of the FDDI network interface(s) on your station. The FDDI interface name is listed under the column heading `Name`. Examples of FDDI interfaces include *ipg0*, *ipg1*, *xpi0*, *xpi3*.

3. Use *smtconfig* with one of the following formats.

   Superuser can use the *smtconfig* command to change the FDDI operational parameters listed below, in much the same manner as *ifconfig*. For information about the creation and purpose of these parameters, refer to *IRIX Admin: Networking and Mail*.

   - Enable or disable the interface:

     ```
     # /usr/etc/smtconfig interfacename up
     # /usr/etc/smtconfig interfacename down
     ```

   - Set a network mask value for an IP subnetwork:

     ```
     # /usr/etc/smtconfig interfacename netmask value_or_name
     ```

   - Change the address used for broadcasting:

     ```
     # /usr/etc/smtconfig interfacename broadcast address
     ```

- Enable or disable driver debugging messages:

  ```
  # /usr/etc/smtconfig interfacename debug
  # /usr/etc/smtconfig interfacename -debug
  ```

- Enable or disable Address Resolution Protocol. ARP is enabled when there is no flag about ARP:

  ```
  # /usr/etc/smtconfig interfacename arp
  # /usr/etc/smtconfig interfacename -arp
  ```

- Set the routing metric used by the route daemon (*routed*):

  ```
  # /usr/etc/smtconfig interfacename metric digit
  ```

- Change the IP address for this interface:

  ```
  # /usr/etc/smtconfig interfacename IPaddress
  ```

- Select a different interface to be the primary network interface for this station:

  ```
  # /usr/etc/smtconfig interfacename primary
  ```

### Examples

This section describes some scenarios in which the different *smtconfig* command options can be used.

- Before performing computer maintenance work that will require rebooting a station, disable the FDDI network interface, *xpi0*, with the command:

  ```
  # /usr/etc/smtconfig xpi0 down
  ```

- On a router with an FDDI interface named *ipg0*, you want to decrease the number of packets going through the station enroute to other networks. One way to do this is by advertising the route as less favorable. Use this command:

  ```
  # /usr/etc/smtconfig ipg0 metric 5
  ```

For information about creating netmasks, route metrics, broadcast addresses, and IP addresses, or about altering network interface configurations, see "Changing Settings for the Operational Parameters" in Chapter 2, the smtconfig(1M) man page, or *IRIX Admin: Networking and Mail*.

## Verifying a Station's PCM Functionality

The *smtmaint* command allows you, as superuser, to set the Physical Connection Management (PCM) line state for each PHY on a station's FDDI board. An SAS has one PHY (PHY0); a DAS has two PHYs (in most cases, PHY0 for port B and PHY1 for port A).

Use *smtmaint* judiciously and only if you are an FDDI expert. Setting a line state can make the ring nonfunctional.

You can set these six line states:

| | |
|---|---|
| QLS | PHY sends a continuous stream of Quiet symbols so the transceiver emits no signal. |
| ILS | PHY sends a continuous stream of Idle symbols; this is a normal condition between transmissions. |
| HLS | PHY sends a continuous stream of Halt symbols; this forces a break in the ring. |
| MLS | PHY sends a continuous stream of alternating Halt and Quiet symbols; this is used to propagate a trace along the ring. |
| ALS | PHY functions normally; it is Active and incorporated into the ring. |
| -t | PHY enters PC_TRACE state (trace function) attempting to recover the ring from a stuck beacon condition. |

To change a line state, follow these steps:

1. Become superuser:

   ```
   % /sbin/su
   Password: thepassword
   #
   ```

2. Use *smtstat* to discover the name of the FDDI network interface on your station. The FDDI interface name is listed under the column heading `Name`. Examples of FDDI interfaces include *ipg0*, *ipg1*, *xpi0*.

3. Use this command to change the line state:

   # **/usr/etc/smtmaint** *interfacename 0or1 linestate*

   *0or1* identifies the PHY (port) and *linestate* is one of the line states listed above (for example, ALS, -t, or ILS).

## Removing a Station From the FDDI Ring

When an FDDI station is removed from the ring, the SMT modules reconfigure the ring. If the removal is done in a way that makes it impossible for the optical signal to complete its loop around the ring, the ring wraps. Generally, it is best to avoid wrapped rings for long periods. The procedures described in this section describe how to avoid or minimize a wrapped ring when removing a station from the ring.

The situations listed below constitute taking an FDDI station off the ring; any of these has the potential to cause the FDDI ring to wrap (sometimes for a very short period of time).

- Rebooting a system, which includes any of the following: invoking the *reboot* or *init* commands, pressing the station's reboot button, and crashing the station's system. A crash usually results in an automatic reboot.
- Hanging the station's system (usually due to software failures).
- Shutting down the station's system, which includes using any of the following commands: *shutdown*, *reboot*, *halt*, *init 0*.
- Removing power from the station by pressing the power switch or disconnecting the power cable.
- Disconnecting the station's FDDI cables.
- Disabling the FDDI network interface, which includes invoking any of the following commands with the *down* or *stop* option: *smtconfig*, *ifconfig*, */etc/init.d/network*.
- Removing an optical bypass switch from a station.

The procedure for safely removing a station from the ring differs, depending on three factors:

- whether the removal is temporary or permanent
- whether the station is directly attached to the dual ring (DAS) or is attached to a concentrator (SAS or dual-homed DAS)
- whether an optical bypass switch is present or not (applies only to a DAS attached directly to the dual ring)

## Temporarily Disable Any Station's FDDI Interface

To temporarily disable any FDDI interface for a *short* period of time, use the *smtconfig* command described in "Change the Configuration" on page 69.

If the station is a DAS, is not attached to a concentrator, and does not have an optical bypass switch, the ring will wrap when the FDDI network interface is disabled. However, this is usually not a problem for a short period of time.

## Remove a Device Attached to a Concentrator

Four types of devices can be attached to concentrators: single-attachment stations and concentrators (SAS and SAC) and dual-homed, dual-attachment devices (DAS and DAC). It is simple to remove any of these from the ring. Because the concentrator maintains the integrity of the ring, it is not important whether the station will be out of the ring for a long or short period of time. You need only decide whether the removal is temporary or permanent.

### Temporarily Removing a Device

To temporarily remove a device attached to the ring through a concentrator, perform the following steps:

1. Become superuser and shut down the system. As soon as you do this, the station is out of the ring. The command lines below are one way of doing this:

   ```
   % /sbin/su
   Password: thepassword
   # /etc/shutdown
   ```

2. You can now perform system maintenance or physically disconnect the station from ring (actually, from the concentrator). The concentrator will maintain the integrity of the ring. However, since the station's identity as an FDDI station remains in the system files, the station should be returned to the ring at some point. When reinserted into the ring, the station does not have to be reconnected at the same location.

### Permanently Removing a Device

To permanently remove a concentrator-attached device from the ring, do the following:

1. Become superuser and disable the FDDI interface using these commands:

   ```
   % /sbin/su
   Password: thepassword
   # /usr/etc/smtconfig interfacename down
   ```

2. Edit the files described in "Complete and Complex Configuration Information" on page 28 to remove or comment out the lines referring to this station. One or more of the following files may need to be edited: */etc/hosts*, */etc/ethers*, */etc/config/netif.options*.
3. Shut down the system using the *shutdown* or *halt* command.
4. Power off the station by pressing its power switch.
5. Disconnect the FDDI cable(s).
6. At this point, you can move the workstation or server. If you ever decide to reinsert this station into this ring, you will need to reconfigure it.

## Removing a DAS That Has an Optical Bypass Switch

Removing a DAS that has an optical bypass switch is simple. Because the optical bypass switch maintains the integrity of the ring, it is not important whether the station is out of the ring for a long or short period of time. You need only decide whether the removal is temporary or permanent.

As long as you leave the optical bypass switch in place and move only the station, the ring will not wrap.

### Temporarily Removing a DAS

To temporarily take a DAS with an optical bypass switch out of its ring follow these steps.

1. Become superuser and shut down the system. For example:

   ```
   % /sbin/su
   Password: thepassword
   # /etc/shutdown
   ```

2. Disconnect the optical bypass switch's DC power cable from the FDDI board.
3. If you need to, power off the station by pressing the station's power switch, and disconnect the station's FDDI cable(s). Do not disconnect the connections between the ring and the optical bypass switch.
4. You can now perform system maintenance or physically disconnect the station from ring. The optical bypass switch maintains the integrity of the ring. However, since the station's identity as an FDDI station remains in the system files, the station should be returned to the ring at some point. When reinserted into the ring, the station does not have to be reconnected at the same location.

### Permanently Removing a DAS

To permanently remove a DAS with an optical bypass switch from the ring, perform the steps below:

1. Become superuser and disable the FDDI interface with these commands:

   ```
   % /sbin/su
   Password: thepassword
   # /usr/etc/smtconfig interfacename down
   ```

2. Edit the configuration files to remove or comment out the lines referring to this station. One or more of the following files may need to be edited: */etc/hosts*, */etc/ethers*, */etc/config/netif.options*.
3. Shut down the system using the *shutdown* or *halt* command.
4. Power off the station by pressing its power switch.
5. Disconnect the optical bypass switch's DC power cable from the FDDI board.
6. Disconnect the FDDI board's cables from the optical bypass switch.
7. At this point, you can move the workstation or server. If you ever want to insert this station into this ring, you need to reconfigure the station. Another station can be attached to the optical bypass switch at any time.

## Remove a DAS Without an Optical Bypass Switch

Removing a DAS that does not have an optical bypass switch always disrupts the ring; removal of a station causes the ring to wrap in configurations where the secondary ring is a backup. There is no way to avoid this; hence, your primary concern is the length of time the ring will be disrupted. After you remove the station, you need to do one of the following as soon as possible to reestablish the integrity of the ring:

- Insert the same or another station at the location.
- Insert an optical bypass switch at the location.
- Patch the ring (for example, by inserting a barrel connector or section of fiber optic cable at the location).

### Temporarily Removing a DAS

To temporarily remove a DAS without an optical bypass switch from its ring, follow the instructions below.

**Note:** This procedure causes the ring to wrap.

1. Become superuser and shut down the system. For example:

   ```
   % /sbin/su
   Password: thepassword
   # /etc/shutdown
   ```

2. Power off the station by pressing the station's power switch, and disconnect the station's FDDI cable(s).
3. As soon as possible, do something to reestablish the ring's integrity. A list of possible actions is provided at the beginning of this section.
4. You can now perform system maintenance or physically move the station. Since the removed station's identity as an FDDI station remains in the system files, the station should be returned to the ring at some point. When reinserted into the ring, the station does not have to be reconnected at the same location.

### Permanently Removing a DAS

To permanently remove a DAS station without an optical bypass switch from the ring, follow the instructions below.

**Note:** The ring will wrap as soon as you disable the FDDI interface.

1. Become superuser:

   ```
   % /sbin/su
   Password: thepassword
   #
   ```

2. Edit the configuration files to remove or comment out the lines referring to this station. One or more of the following files may need to be edited: */etc/hosts*, */etc/ethers*, */etc/config/netif.options*.

3. Disable the FDDI interface:

   ```
   # /usr/etc/smtconfig interfacename down
   ```

4. Shut down the system using the *shutdown* or *halt* command.

5. Power off the station by pressing its power switch.

6. Disconnect the station's FDDI cable(s).

7. As soon as possible, do something to reestablish the ring's integrity. A list of possible actions is provided in the beginning of this section.

8. At this point, you can move the workstation or server. If you want to reinsert this station into this ring, you will need to reconfigure the station.

For more information, see the smtconfig(1M), halt(1M), and shutdown(1M) man pages or "Change the Configuration" in this chapter.

## Removing FDDIXPress

To permanently remove an FDDIXPress board and software from a station, follow the steps below:

1. Use *inst* to remove the FDDIXPress software:

   ```
   # /usr/sbin/inst
   ...
   Inst> remove FDDIXPress
   ...
   Inst> quit
   ```

2. Follow the set of instructions in "Removing a Station From the FDDI Ring" on page 72 that is appropriate for your configuration.

3. Once the power is off, remove the board.

   The board's installation guide or installation instructions provides hardware details that are useful for removing the board.

4. When the FDDI board has been removed, press the power switch to turn the system on.

5. Answer the questions on the terminal to restart the system.

6. Answer yes to the prompt to rebuild the operating system. This step removes the FDDI driver from the operating system (kernel).

   ```
   Automatically reconfigure the operating system (y or n)? y
   ```

7. Reboot the system to start using the new operating system.

*Chapter 4*

# Troubleshooting

This chapter describes what to do when your FDDI network connection has problems. The chapter describes the following topics:



## General Advice

When you experience difficulty with the FDDI network connection at a particular station, you can:

1. Check the physical connections at the station as detailed in "Checking Physical Connections."
2. Search or read the */var/adm/SYSLOG* file and console window for error messages. If you find any FDDI driver or SMT messages, read about them in Appendix A.
3. Use the SMT commands (or FDDIVisualyzer) to identify problematic status indicators, and if you find any, read about them in "Status Indicators and Symptoms" on page 87.

The following sections will help you with each of these suggested steps.

## Checking Physical Connections

Check each of the following, using the step-by-step instructions:


- "Recognition of Board by Software" on page 80
- "Check Cables and Connectors" on page 83
- "Cable Lengths" on page 86


### Recognition of Board by Software

Complete inability to access the FDDI ring may indicate that the board and software are not communicating. Follow the instructions below to figure out why.

1. In a shell window, type this command:

   ```
   % /sbin/hinv
   ```

   When a board is listed by *hinv*,, this does not mean that the board and driver are functional; it means that the operating system was able to recognize the board. For an explanation of the *hinv* screen display, see "Verifying the FDDI Connection" on page 47 or the hinv(1M) man page.

2. If *hinv* displays an entry for the FDDI hardware, the operating system is recognizing the board. The problem may be bad cable connections or improperly configured software. First, follow one of the sets of instructions below, then (if necessary) follow the instructions in "Check Cables and Connectors."

   If *hinv* does not display an entry for the FDDI hardware, the operating system did not find the FDDI board the last time the station was booted. The problem may be an incompatible operating system, or a loose or dysfunctional board. First, follow the instructions below to verify the board, then follow the instructions in "FDDI Connection Has Not Been Functional Since Last Boot" on page 81.

#### Verify the Board

Verify that the LEDs on the FDDI board indicate that the board is receiving power. If the LEDs indicate that there is no power to the FDDI board or that the board is not operational, follow the instructions in the board's hardware manual to troubleshoot the problem. It is possible that the board is not seated firmly into its connection to the system, or that the board is dysfunctional.

If you reinstall the board, take extra precautions to seat the FDDI board firmly.

### FDDI Connection Has Not Been Functional Since Last Boot

If the FDDI connection has not been working since the last time the station was booted or if this is an initial installation of an FDDI product, one or more of the following could be occurring:

- The operating system installed on the station is not compatible with the FDDI board installed.
- The operating system has not been rebuilt to include the driver for the board.
- The network interface for the board has not been configured properly.

Follow the instructions below to determine the cause of the problem:

1. Verify that the installed IRIX operating system (*oeo1*) and FDDIXPress software are the correct versions by doing the following:
   - Determine the correct versions. The FDDIXPress release notes indicate the correct IRIX and FDDIXPress versions for your FDDI board.
   - Use the *versions* command (shown below) to display the installed release identifications (versions). If the version is not correct, install the correct version. Then invoke *hinv*.

     ```
     % /usr/sbin/versions eoe1
     eoe1 date Execution Only Environment 1, version
     ```

     ```
     % /usr/sbin/versions FDDIXPress
     FDDIXPress date FDDIXPress release Option
     ```

2. Use the *netstat* command, as shown below, to display the currently configured network interfaces. If the FDDI interface is not displayed, continue to the next step. If the interface is displayed, but the configuration is incorrect, follow the instructions in "Configure the Station's Network Interfaces" on page 33 to reconfigure it.

   ```
   % /usr/etc/netstat -ina
   ```

3. Verify the FDDI entries in the */etc/config/netif.options* file. For example, the network interface may be misspelled.
4. Use */etc/autoconfig* to rebuild the operating system to include the FDDIXPress driver. Then, reboot the system to start using the new operating system. Finally, invoke *netstat -ina* again. If the FDDI interface is still missing, contact the Silicon Graphics Technical Assistance Center.

### FDDI Connection Has Been Functional In the Recent Past

If new software (operating system, FDDIXPress, or another network communications software) has been installed since the FDDI connection was last functional, the problem is probably incompatible software. Verify that the software you last installed supports the FDDI board installed in the station.

If the FDDI connection has been functional after the last new software was installed, the problem is probably the board. The board may have become loosened from its connection to the system or it may be dysfunctional.

Follow these steps to resolve the problem:

1. Verify that the LEDs on the FDDI board indicate that the board is receiving power. If the LEDs indicate that there is no power to the FDDI board or that the board is dysfunctional, follow the instructions in the board's hardware manual to troubleshoot the problem. Otherwise, continue.
2. Ensure that the system is using the operating system that was built most recently. Use the */etc/autoconfig* command to rebuild the operating system, then *reboot* to start using it. During the reboot, begin step 3.
3. Watch the messages on the terminal during restart to verify that each network interface is configured correctly. The messages should look similar to these examples:

   ```
   Configuring xpi0 as mickey
   Configuring ec0 as gate-mickey
   ```

   If the FDDI driver is not mentioned on the terminal during startup, there is a problem with the software. Continue to step 4.

   If a startup terminal message indicates that the hardware is missing, as in the following example, start again at the beginning of "Recognition of Board by Software" on page 80.

   ```
   xpi0: missing
   ```

4. Use the *netstat* command to display the currently configured network interfaces. If the interface is displayed, but the configuration is incorrect, follow the instructions in section "Configure the Station's Network Interfaces" on page 33 to reconfigure it.

   ```
   % /usr/etc/netstat -in
   ```

   The */etc/config/netif.options* file may have an incorrect entry (for example, a misspelled network interface); verify all file contents carefully.

   If the FDDI interface does not display, it is possible the board or software is dysfunctional. Contact the Silicon Graphics Technical Assistance Center.

## Check Cables and Connectors

A wrap on an A or B port, a high level of link-layer errors, or a stagnant token count can indicate a faulty cable, a loose or damaged connection, or a dirty cable end. The problematic cable or connection can be found at or near the station where the error is occurring.

### Connections

At each cable connection, along the entire length of the ring where there is a problem, verify two things:

- Each connection is tight. Many connectors must snap or click together to be tight. (Remember to verify the connections at each station's I/O panel.)
- Each connection is correct.
  - For cable-to-cable connections, the labels on the two cable connections must pair as a valid (V) connection, as summarized in Figure 4-1, where U indicates that the connection is undesirable, invalid indicates that it is invalid, and V indicates it is valid. Figure 4-2 illustrates valid connections for a typical ring.

| | A | B | S | M |
|---|---|---|---|---|
| **A** | U | V | U | V |
| **B** | V | U | U | V |
| **S** | U | U | V | V |
| **M** | V | V | V | invalid |

**Figure 4-1** Cable-to-Cable Connections

– For cable-to-station connections, the labels on the connectors must match (for example, A-to-A or red-to-red, not B-to-A or red-to-blue). (Remember to verify the connections at each station's I/O panel. The cable's label must match the port where it is connected.)

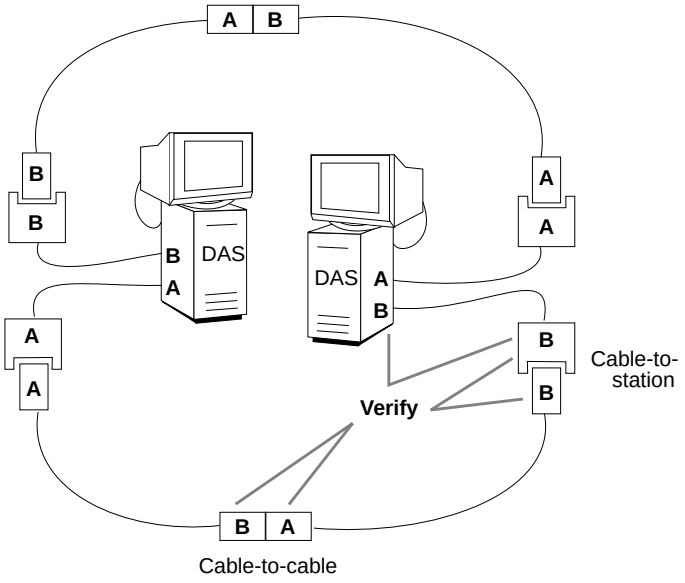



**Figure 4-2** Correct Cable Connections

### Dirty Fiber End

The ends of fiber optic cable can become dirty and interfere with the transmission of the optical signal. Common pollutants are oil (from being touched by human fingers) and dust (from being left uncapped).

**Note:** Do not touch the ends of fiber optic cable. Do not leave the fiber optic cable uncapped when it is not connected. The cap prevents dust and other pollutants from collecting on the exposed fiber optic material.

- Gently clean cable ends with 96% isopropyl alcohol and a non-lint producing soft material, or an alcohol-wipe product.

### Faulty Cable

Fiber optic cable can become damaged if excessively bent (or coiled), twisted, or sharply struck. Replace suspect cables with functional cables.

When no replacement cable is available, use a small, powerful flashlight (as described in the bulleted steps below) to verify that the light signal passes through the cable. This test identifies broken or incorrectly built cables, but cannot identify borderline conditions.

1. Identify the direction that light travels within each optical fiber line of the suspect cable. (FDDI MIC connectors and cable contain two optical fibers.)

   Fiber optic material is designed somewhat like a funnel. Light travels in only one direction: from the wide end to the narrow end. Some cable manufacturers label each fiber with arrows. Some cables have connectors constructed so that the input end of each fiber is indicated by the connector's cover; the wider portion of the cover (the funnel's mouth) indicates the input end, as shown in Figure 4-3.

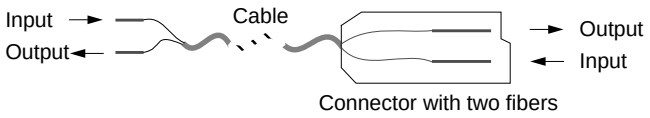



**Figure 4-3** Direction Indicators With Media Interface Connector

2. Shine the flashlight into one of the inputs. Verify that the light is visible and bright at the output end of that line. If the light is not visible or is dim, the cable is faulty. Replace it.

   If the light is visible when shone in the opposite direction, the cable has been built improperly. Replace it.

3. Repeat step 2 for the other input line.

**Note:** Special equipment is needed to accurately measure whether the optical signal is full strength. The flashlight test cannot tell if the signal is partially obstructed.Visible light at the other end of the cable does not guarantee that the cable is fully functional.

## Cable Lengths

An increasing bit-error rate may indicate that power is being lost because the cable is too long.

### Cable Between Stations

A typical manufacturer's maximum length of cable between DAS stations is 2 kilometers (approximately 1.24 miles) for regular fiber optic cable, but can be much longer (for example, 10 km) for newer low-loss fiber optic cable. Length is measured from the FDDI connector on the I/O panel of one station to the FDDI connection on the I/O panel of a neighbor station. This length is not the distance between the two stations; it is the length of the cable lying between two stations. Coils of cable lying in the closets, floors, or ceilings of buildings can quickly add up to this maximum, so beware.

### Total Length of Ring Cable

A typical manufacturer's maximum length of cable allowed for one ring is 100 kilometers (approximately 62 miles). The total ring cable length is calculated by summing all the between-station lengths (as described in the paragraph above).

**Note:** Special equipment is needed to measure the amount of power loss on a fiber optic cable.

## Status Indicators and Symptoms

This section contains some common symptoms and *smtstat* status indicators accompanied by descriptions of what they may indicate and what you can do to remedy the problem.

### Link-Level Errors

A high rate of link-layer errors can indicate a cable problem very close to or on the local station. Follow the instructions for verifying and cleaning cable connections.

### Token Count Not Incrementing

When the token count is not incrementing, the FDDI board is not seeing the light signals on the ring (neither port is functioning or there may be a problem with the ring).

1. This symptom may indicate that the FDDI network interface has been turned off. When this is the case, the Port Status report indicates that the MAC is `OFF`. Verify that the FDDI cables are connected, then use *smtconfig* to stop and restart the FDDI network interface.

   If the problem persists, proceed to step 2.

2. Use the *smtstat -s* Port Status report to check the status of the receive line states.

   - If the report shows `HLS`, the problem is probably one of the neighbor stations or the ring. Verify that each neighbor station is functioning properly.
   - If the report indicates `QLS`, the problem is probably local to this station. The problem may be loose or damaged connectors, faulty cabling, or incorrectly connected ports. Follow the instructions in "Checking Physical Connections" on page 80 for all cabling between the station's I/O panel and the ring.

   Be especially careful to verify that the ends of the fiber optic cable at the I/O panel have not been damaged.

## Too Many Claims or Beacons

When claims or beacons increment rapidly for more than a few seconds, a station on the ring is malfunctioning or inserting itself. When the symptom persists for more than 5 minutes or is observed on three consecutive occasions (when you are certain no new stations are being added), follow these steps to locate the dysfunctional station, then remove it from the ring. This procedure can be very time consuming. A malfunctioning station is sometimes difficult to locate.

1. Locate a patch for the ring. The following items can be used to patch a ring: an optical bypass switch, a fiber optic barrel connector, or an extra length of your ring's fiber optic cabling with appropriate connectors.
2. Physically disconnect one station from the ring.
3. Insert the patch into the ring (to fill the gap where the station was).
4. Wait two or three minutes. During this time, the stations remaining on the ring rearrange themselves.
5. Go to another station. Check if the problem has been remedied.
6. If the problem no longer manifests, you know that all the remaining stations are functioning properly. Do not return the dysfunctional station to the ring until it has been fixed.

   If the problem still exists, go to step 7.
7. Reinsert the disconnected station. Repeat steps 2–6.

## Ring Is Wrapped

When the ring is wrapped, follow these instructions:

1. At each dual ring DAS, use the *smtstat -s* Port Status report to verify that neither port's transmit line state is in `WRAP`.

   The transmit lines for a two-port FDDI board that is connected to a concentrator normally indicate `WRAP`. This is normal and not a problem.

2. When you locate a `WRAP`, look at the Port Status report's flags to verify that the `WRAP` is not caused by an undesirable (`CON_undesirable`) or illegal connection (`C_illegal`). If you identify a problematic connection, follow the instructions in "Check Cables and Connectors" on page 83 to remedy the problem. Otherwise, proceed to step 3.
3. When you locate two dual ring DASes, each with one of its ports in `WRAP`, you have identified the boundaries of the functioning and nonfunctioning sections of the ring. The fault can be found somewhere between the two stations: downstream from the station whose port A is wrapped and upstream from the station whose port B is wrapped.
4. Follow the instructions in "Checking Physical Connections" on page 80 for the connectors and cables within the identified fault domain. If the problem persists, proceed to step 5.
5. Starting with either of the boundary stations, perform these steps to determine whether the fault is caused by the operating system or SMT module within one of the stations located along the fault domain.
   - Locate a patch for the ring. The following items can be used to patch a ring: an optical bypass switch, a fiber optic barrel connector, or an extra length of your ring's fiber optic cabling with appropriate connectors.
   - Disconnect the station from the ring.
   - Patch the ring.
   - Connect the station's A connector (port) to its B connector (port) with a length of fiber optic cable.
   - Use the *smtstat -s* MAC Status report to verify that the station's token count increments rapidly. An incrementing token indicates that the station is functioning properly.
   - If the token increments rapidly, reconnect the station to the ring and repeat this procedure on the next station within the fault domain.
   - If you locate a dysfunctional station, do not reinsert it into the ring until it is fixed.

## High Rate of Packet Loss

If the packet loss is 100%, go to "Cannot Communicate With Other Stations" on page 90. Otherwise, perform these steps:

1. If the high packet loss is displayed by the *ping* command, not by *smtping* , check any routers connected to the ring for overloading.

   Use */usr/etc/netstat -ina* (or FDDIVisualyzer) at each station to identify all the stations on the ring that are routers. A router has two or more MAC addresses, two or more network addresses, and the routing daemon (*routed*) is running and is not configured with the -**q** and **-h** options. (The routing daemon is configured by the */etc/config/routed* and */etc/config/routed.options* files.)

2. If the high packet loss is indicated by both *ping* and *smtping*, use *smtstat -s* (or FDDIVisualyzer) to locate additional symptoms.

   High packet loss when using the **-f** option or the **-i** option with a short interval does not necessarily indicate a problem. It is normal for *ping* and *smtping* to place echo request packets onto the send queue faster than they can be processed, resulting in a perceived loss of packets. In these instances, the packets are lost within the initiating host, not on the network.

## Cannot Communicate With Other Stations

If *smtping* or *ping* do not elicit a response, identify the appropriate subsection below and follow the instructions.

### Neither ping Nor smtping Works

1. If neither *smtping* nor *ping* elicits responses from any station, the */etc/hosts* and */etc/config/netif.options* files may not have been set up properly. For example, the files may be configuring the FDDI network interface with the Ethernet IP address. Verify that the IP (inet) addresses for all network interfaces are correct. To display the currently configured IP addresses for FDDI and Ethernet network interfaces:

   ```
   % /usr/etc/netstat -in
   ```

   If the IP addresses are correct, proceed to step 2. If the addresses are not correct, follow the instructions in Chapter 2 to reconfigure FDDIXPress.

2. If the IP addresses are correct, the station may not be connected to any of its networks. At each of the station's neighbors, use *smtstat -s* to find a wrapped FDDI ring. If both neighbors indicate a `WRAP`, follow the instructions in "Checking Physical Connections" on page 80 to reconnect this station to the ring.
3. If the problem persists, identify other problems, as described in "Verifying the FDDI Connection" on page 47.

### ping Works But smtping Does Not

If *smtping* does not elicit a response from a particular station but *ping* does, any of the following may be the problem:

- The MAC address for the station may be incorrect.
- The station may be off the FDDI ring.
- The ring may be wrapped so that the two stations are on different fragments.

In the last two cases, the *ping* response is arriving over another connection, not the FDDI connection in question, and the success of the *ping* indicates that the station is reachable through a router.

The *smtping* command uses physical (MAC) addresses, not IP addresses, so it can communicate only with stations on the same physical medium (that is, local area network). For example, a station with an IP address of 223.62.4.51 (where the network portion is 223.62.4) cannot *smtping* a station residing on a network with the address 223.62.5; however, it can contact address 223.62.4.11 (assuming that no subnetworks have been created). You can verify the IP address of the other station with one of these command lines:

```
% /usr/bin/ypmatch name hosts
% /sbin/grep name /etc/hosts
```

1. Use *ping* with the **-r** option and the IP address (not the host name) to verify that the station is being reached over the FDDI network (not through a router or another network connection). Make sure that the network portion of the IP address matches the FDDI network (not that of another network). If the station answers, continue. If the station does not answer, follow the instructions in "Neither ping Nor smtping Works" on page 90.

   ```
   % /usr/etc/ping -r IPaddress
   ```

2. Verify the MAC address for the station you are trying to contact. You can obtain a station's MAC address with *smtstat* at that station's terminal. Then, use *smtping* with the MAC address (not the hostname) and specify the FDDI interface. If the station answers, the station's MAC address in the */etc/ethers* file may be incorrect. If the problem persists, continue with step 3.

   % **/usr/etc/smtping -I** *fddiinterface* ##:##:##:##:##:##

3. Use *smtstat -s* at each station on the ring to verify the ports that indicate a WRAP.

### ping Does Not Work But smtping Does

If *smtping* works but *ping* does not, it is possible that the */etc/hosts* file has not been set up properly. For example, the station may have both an FDDI and an Ethernet cable connected but the network connection names and IP addresses in the */etc/hosts* or */etc/config/netif.options* files are mismatched.

1. Display the currently configured IP (inet) address for each network interface:

   % **/usr/etc/netstat -ina**

   Verify that the displayed addresses correctly match the connected networks. If everything is correct, proceed to step 2. If any IP addresses is not correct, follow the instructions in "Network Connection Names and IP Addresses" on page 31 to reconfigure FDDIXPress.

2. Again invoke *smtping* using the MAC address for the station (not the hostname) and specify the FDDI interface. If the station answers, continue. If the station does not answer, follow the instructions in "Neither ping Nor smtping Works" on page 90.

   % **/usr/etc/smtping -I** *fddiinterface* ##:##:##:##:##:##

3. Use *ping* with the -**r** option and the station's IP address (not the hostname) to verify that the station is being reached over the FDDI network in question (not through a router or another network connection). Make sure that the network portion of the IP address matches the network address (from the *netstat* display) for the *fddiinterface* used in the *smtping* command above. If the station answers, all is well. If the station does not answer, go to step 4.

   % **/usr/etc/ping -r** *IPaddress*

4. Disable then re-enable the FDDI interface, then repeat steps 1-3:

   % **/usr/etc/smtconfig** *fddiinterface* **down**
   % **/usr/etc/smtconfig** *fddiinterface* **up**

## Current Neighbor's Address Is Zero

When both current neighbor addresses are zero, the station is not seeing a signal from any other station on the ring. This condition is normal if the station is the only station on the ring. This condition is not normal and indicates a wrapped ring when the site's configuration is a multistation dual ring with one ring as a backup. The zero addresses indicate that the station is located within a fault domain (a nonfunctional section of the ring). Follow the instructions in "Ring Is Wrapped" on page 88.

When one of the current neighbor addresses is zero, the station is not seeing any signal from that neighbor's direction (which is either upstream or downstream). A dual ring configuration with one ring as a backup wraps when this occurs. You can see this wrap by using the *smtstat -s* reports at this station. Follow the instructions in "Ring Is Wrapped" on page 88. The zero address indicates the direction you should start looking for the fault. Be sure to start your search at the nonwrapped port on this station's I/O panel. The wrapped port is a functional port.

## Ring Is Not Wrapped and Token Count Increments But smtping Does Not Work

If the ring is not wrapped, *smtping* does not work with any station, and *smtstat -s* indicates that the token count increments normally, there is probably something wrong with the station's software.

To resolve this problem, follow this procedure:

1. Verify that the problem is not caused by your station's configuration.
   - Use *smtping* with a valid MAC address. To determine all valid MAC addresses, use *smtring*.
   - If *smtping* works with the MAC addresses, but does not work with station names, the ethers database (the */etc/ethers* file, local or on an NIS server) is incorrectly set up. Follow the instructions in "Setting Up the ethers File (Optional)" on page 43 to set up an ethers database.
2. If *smtping* does not work with MAC addresses, use these commands to disable and reenable the software and board:

   ```
   % /sbin/su
   Password: thepassword
   # /usr/etc/smtconfig interfacename down up
   ```

3. Verify the FDDI connection again.
4. If the problem is still present, reinstall your station's software (following the instructions in the release notes) and reconfigure it (following the instructions in Chapter 2, "Configuring FDDIXPress Software" of this manual).
5. If the problem is still present, contact the Silicon Graphics Technical Assistance Center.

## System Does Not Load Miniroot or Boot From the Network

Silicon Graphics workstations and servers are capable of loading a small-sized version of the operating system (the miniroot) and booting themselves over the network; however, they are capable of doing this only over Ethernet local area networks (they cannot boot over FDDI networks) that are configured as the primary network interface.

If your system is unable to load the miniroot (or boot over the network), verify that its primary network interface is an Ethernet connection by following these instructions:

1. Restart the system from the System Maintenance menu. Do not rebuild the operating system during this restart.
2. Log on and open a shell window.
3. Use these commands to display the ordering of the network interfaces:

```
% /usr/etc/netstat -i
<primary interface>
<secondary interface>
...
```

4. If the primary interface is an Ethernet (for example, *ec0*, *et0*, *enp#*), the Ethernet network connection may be dysfunctional. See *IRIX Admin: Networking and Mail* for information about Ethernet network connections.

   If the primary interface is not an Ethernet, go to step 5.
5. Configure an Ethernet connection as the primary interface, following the instructions in "FDDI as the Secondary Interface and Ethernet as Primary" on page 25.
6. Reboot the system. When the system is up and running, it should be capable of loading the miniroot over the network and booting from it.

*Appendix A*

# Error Messages

This appendix contains an alphabetical list of all the error messages that can be displayed by FDDIXPress drivers, SMT commands, and the SMT module. The error messages are divided into three sections:


- "SMT Error Messages" on page 97
- "xpi Driver Error Messages" on page 149
- "ipg Driver Error Messages" on page 157
- "rns Driver Error Messages" on page 161


The error messages in this appendix are those that are unique to FDDIXPress. Standard system error messages, even when caused by the FDDIXPress code, are not included.

## How Messages Are Listed

With each error message is a discussion of the problems that may cause the message. The list contains only messages that indicate an error or problem; it does not contain informational messages that occur during normal operation.

Messages are alphabetized according to the following rules:

- Each message is alphabetized by the numerals (0–9) and letters (a–z) of the message's text. Numerals precede letters. Capitalization makes no difference. (Figure A-1 illustrates the text of an error message.)

- Nonletters (for example, - or %) and blank spaces are shown in the text of the message, but are ignored in alphabetization. For example, the message `sm_open` appears between `smnet` and `smp`.
- When an error message includes an item that the software specifies differently for each instance of the message (a variable), this item is displayed in italic font and labeled with a generic name (for example, *filename*). The generic names are skipped for alphabetization purposes. For example, the error message `goofy not responding` is located among the "n" listings as *hostname* `not responding`. Common generic names used in this listing include *hostname*, *interfacename*, *phyID*, *version#*, *userentry*, *systemmessage*, *digit*, *filename*, and *hexnumeral*.

  **Note:** If you cannot find an error message in the listing, identify potential fill-in words, then look up the message without those words.
- The creator of each message is listed, in angled brackets, below the text of the message: (<*creator*>).

FDDIXPress error messages created by the SMT daemon (*smtd*) and the SMT commands are written into the file */var/adm/SYSLOG* or displayed at the terminal; some messages appear in both places. Within the *SYSLOG* file, each message is preceded by the date, time, hostname, the name of the process that created the message, and its process ID number, as illustrated in Figure A-1. Only the text of the error message is included in the alphabetic list that follows.

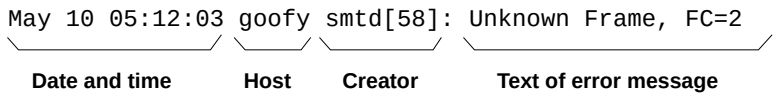



**Figure A-1** Error Message Format in the /var/adm/SYSLOG File

## SMT Error Messages

`A<->A twist detected`
`<smtd>`

A twist in the fiber was detected. The software was expecting an A-to-B connection. Follow the instructions in the section "Checking Physical Connections" in Chapter 4 to fix the cable or connection problem.

`A general error occurred`
`<smtd>`

The SMT daemon has encountered a problem with its MIB information. This may indicate that the MIB file (*/etc/fddi/smtd.mib*) is corrupted. Make a new copy from the backup, then use *smtconfig* to stop and restart the network interface. This also can indicate that the requesting SMT module has requested invalid MIB information.

`ANNOUNCE: Illegal FC=`*hexnumeral*
`<smtd>`

The SMT daemon was attempting to send an announce frame, but found that the frame control (FC) value, which was created by another module of the software, is not supported.

*interfacename*`.#: arm failed`
`<smtd>`

While attempting to configure and bring up the SMT daemon, the software was unable to set a new interrupt level in the operating system for the network interface indicated.

`Bad access type (`*token*`): On line` *digit*
`<smtd>`

An ACCESS entry in the MIB file (*/etc/fddi/smtd.mib*) contains a type of access (*token*) not recognized by the software. The problem is on the line of the file indicated. Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the network interface.

`Bad CONF_SIF frame type(`*digit*`) received`
`<smtd>`

An illegal Configuration SIF frame was received; the frame was not of a known type (for example, `REQUEST` and `RESPONSE`).

`Bad echo frame type(`*digit*`) received`
`<`*smtd*`>`

An illegal ECF (ECHO) frame was received; the frame was not of a known type (for example, `REQUEST` and `RESPONSE`).

`Bad FC=`*hexnumeral* `recv`
`<`*smtd*`>`

An FDDI frame was received with an illegal FC (frame control) value in the header. The illegal two-symbol (2-byte) FC value is indicated in the message as a hexadecimal number.

`Bad format for OBJECT TYPE (`*token*`): On line` *digit*
`<`*smtd*`>`

An object (*token*) in the MIB file (*/etc/fddi/smtd.mib*) was an unrecognized type. The problem is on the line of the file indicated. Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the network interface.

`Bad format (`*token*`): On line` *digit*
`<`*smtd*`>`

When reading the MIB file (*/etc/fddi/smtd.mib*), a formatting entry was not found when expected. Instead, *token* was encountered. The problem is on the line of the file indicated. Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the network interface.

`bad header`
`<`*smtd*`>`

This is a minor internal error not requiring any action on your part. An invalid packet header was detected.

*remotehost* `-- BAD` *type* `len=`*digits*
`<`*smtd*`>`

The SMT software could not parse an entry in a frame received from the station indicated (*remotehost*). The illegal entry was of the type and length indicated. This indicates an incompatibility between the two stations. You may want to report this problem to the Silicon Graphics Technical Assistance Center.

`Bad object identifier: On line` *digit*
`<smtd>`

When reading the MIB file (*/etc/fddi/smtd.mib*), an entry (object) on the line of the file indicated could not be properly identified. Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the network interface.

`Bad operator: On line` *digit*
`<smtd>`

An unrecognized entry was found in the MIB file (*/etc/fddi/smtd.mib*) on the line indicated. Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the network interface.

`Bad OP SIF frame type(`*digit*`) received`
`<smtd>`

An illegal Operation SIF frame was received; the frame was not of a known type (for example, `REQUEST` and `RESPONSE`).

`BAD parameter type=`*hexnumeral* `len=`*digit*
`<smtd>`

As the SMT daemon was processing a packet, it encountered an unknown parameter of the type and length indicated. The invalid parameter was skipped; the rest of the packet was processed.

`bad parse of community`
`<smtd>`

This is a minor internal error not requiring any intervention. An invalid field was found in the header of a received packet.

`Bad parse of object id: On line` *digit*
`<smtd>`

A NULL object identifier was encountered unexpectedly in the MIB file (*/etc/fddi/smtd.mib*) on the line of the file indicated. Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the network interface.

`Bad parse of object type: On line` *digit*
`<smtd>`

A NULL object type was encountered unexpectedly in the MIB file (*/etc/fddi/smtd.mib*). The problem is on the line of the file indicated. Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the network interface.

`bad parse of version`
`<smtd>`

This is a minor internal error not requiring any intervention. An invalid version was found in the header of a received packet.

`bad phy/mac count`

The number of PHYs and MACs defined in the file */etc/fddi/smtd.conf* is invalid. For example, four PHYs cannot be defined for one MAC. See Appendix B for descriptions of valid entries for this file.

`Bad status (`*token*`): On line` *digit*
`<smtd>`

An unrecognized type of status (*token*) was encountered in the MIB file (*/etc/fddi/smtd.mib*) on the line of the file indicated. Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the network interface.

`Bad syntax (`*token*`): On line` *digit*
`<smtd>`

An entry (*token*) in the MIB file (*/etc/fddi/smtd.mib*) could not be parsed (understood) and is probably improperly put together. The problem is on the line of the file indicated. Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the network interface.

`bad una`
`<smtring>`

A received packet contained a missing or malformed upstream neighbor address field. If the message occurs frequently, check the stations upstream.

`bad una purged`
`<smtring>`

A received packet contained a missing or malformed field and was discarded. The problematic field contained the address of the upstream neighbor (una). The frame has been discarded.

*userentry*`: bad value`
`<smtconfig>`

The *netmask* option of the *smtconfig* command failed. The entry is not a legal IP address represented in standard format (decimal, dot notation). See *dotted decimal notation* in the Glossary. A zero address (0.0.0.0) is not legal.

`B<->B twist detected`
`<smtd>`

A twist in the fiber was detected. The software was expecting an A-to-B connection. Follow the instructions in the section "Checking Physical Connections" in Chapter 4 to fix the cable or connection problem.

`bind`
`<smtinfo>, <smtd>, <smtping>, <smtd>`

When attempting to set up a reception socket, the *bind* system or library call failed. During a boot or restart of the network interface, this condition is common and does not indicate a malfunction. However, if the message occurs frequently during normal operation, it indicates a problem with the operating system. For example, it may be overloaded.

`bind port(`*interfacename*`)`
`<smtping>`

When attempting to set up a transmission socket to the indicated network interface, the *bind* system call failed. During a boot or restart of the network interface, this condition is common and does not indicate a malfunction. However, if the message occurs frequently during normal operation, it indicates a problem with the operating system. For example, it may be overloaded.

`buildheader`
`<smtd>`

This is a minor internal error not requiring any intervention. An error was detected when attempting to create a packet header.

`buildint`
`<smtd>`

This is a minor internal error not requiring any intervention. An error was detected when attempting to create an SMT packet.

`buildstring`
`<smtd>`

This is a minor internal error not requiring any intervention. An error was detected when attempting to build an SMT packet.

`build una failed`
`<smtring>`

The SMT software was unable to build the upstream neighbor's address from the response frame received. This error probably indicates an incompatibility between the two machines. This error is not serious; however, you may want to report the problem to the Silicon Graphics Technical Assistance Center.

`Can't find variable name in this MIB`
`<smtd>`

The SMT daemon has encountered a problem with the MIB. This message probably indicates an incompatibility within the different FDDIXPress software files and modules. For example, the SMT daemon and the FDDI driver were started at different times. Use the *smtconfig* command to stop then restart the FDDI network interface (which also starts the SMT daemon).

This can also indicate that the MIB file (*/etc/fddi/smtd.mib*) is corrupted. Make a new copy from the backup, then use *smtconfig* to stop and restart the network interface. In rare circumstances, this can indicate that the requesting SMT has requested invalid MIB information.

`Can't get response from daemon`
`<smtconfig>, <smtping>, <smtring>, <smtstat>`

When attempting to start, the command could not contact the SMT daemon (*smtd*), indicating that the SMT daemon probably is not running. Use *smtconfig* to stop and restart the network interface (which restarts the SMT daemon).

`Can’t get smtd version`
`<smtinfo>, <smtping>, <smtring>, <smtstat>`

The version of the SMT daemon cannot be determined. This may indicate that the FDDI interface is disabled or that the SMT daemon was stopped then restarted manually. Use *smtconfig* to stop and restart the network interface.

`can't open` *configurationfilename*
`<smtd>`

While configuring itself, the SMT daemon was unable to open the file */etc/fddi/smtd.conf*. This may indicate that the file is missing. Verify its presence in the */etc/fddi* directory. If the file does exist, it may be corrupted. Make a new copy of it from your backup copy.

`conf: bad entry:` *fieldname*
`<smtd>`

A problem was encountered during configuration of the SMT daemon and FDDI network interface. The field name displayed in the message was found in the file */etc/fddi/smtd.conf*, but is not recognized by the configuration software. See Appendix B for descriptions of proper formatting for this file.

`conf: bad format:` *linenumber*
`<smtd>`

A problem was encountered during configuration of the SMT daemon and FDDI network interface. An entry in the file */etc/fddi/smtd.conf* is formatted improperly or the file is missing a required entry at the line indicated. See Appendix B for descriptions of proper formatting for this file.

Examples of formatting errors include the following:

- forgetting to terminate each station section with ENDSTATION
- forgetting to terminate each MAC section with ENDMAC
- forgetting to terminate each PHY section with ENDPHY
- allowing an uncommented entry to contain less than three items: the field's name, an equal sign (=), and a value

`conf: bad mac addr:` *badaddress*
`<smtd>`

A problem was encountered during configuration of the SMT daemon and FDDI network interface. The value entered for the MAC address (`addr`) in the file */etc/fddi/smtd.conf* is not a valid entry. See Appendix B for descriptions of valid entries for this file.

`conf: bad MAC entry: name not set`
`<smtd>`

A problem was encountered during configuration of the SMT daemon and FDDI network interface. The line containing the name of the network interface was missing from one of the MAC sections in the file */etc/fddi/smtd.conf*. See Appendix B for descriptions of required entries for this file.

`conf: bad phy_ct=:` *illegalentry*
`<smtd>`

A problem was encountered during configuration of the SMT daemon and FDDI network interface. The number of PHYs specified (`phy_ct` field) in the file */etc/fddi/smtd.conf* is not a valid entry. See Appendix B for descriptions of valid entries for this file.

`conf: bad sid:` *stationID*
`<smtd>`

A problem was encountered during configuration of the SMT daemon and FDDI network interface. The value entered in the file */etc/fddi/smtd.conf* for StationID is not a valid entry. See Appendix B for descriptions of valid entries for this file.

`conf: bad SRF address:` *address*
`<smtd>`

A problem was encountered during configuration of the SMT daemon and FDDI network interface. The value entered for the SRF multicast address (`sr_mid`) in the file */etc/fddi/smtd.conf* is not a valid entry. See Appendix B for descriptions of valid entries for this file.

`conf: bad station entry:` *text*
`<smtd>`

A problem was encountered during configuration of the SMT daemon and FDDI network interface. Some undefined problem has been encountered within a station section in the file */etc/fddi/smtd.conf*. The text indicated in the message identifies the item in the file that could not be processed. See Appendix B for descriptions of valid entries for this file.

*interfacename*`: config missing`
`<smtd>`

While configuring itself with the file */usr/etc/smtd.conf*, the SMT daemon did not find a required configuration parameter for the MAC specified in the message. See Appendix B for details about this configuration file.

`conf: ignored 3rd phy for` *interfacename*
`<smtd>`

During configuration of the SMT daemon and FDDI network interface, a value for a nonexistent third PHY was detected in the file */etc/fddi/smtd.conf*. The entry has been ignored. Processing has continued.

`conf: primary missing for` *interfacename*
`<smtd>`

During configuration of the SMT daemon and FDDI network interface, a problem was encountered. The primary path for the MAC (network interface) indicated was not found. This could indicate that the PHY sections for that MAC and/or the `phy_ct` field have been set improperly in the file */etc/fddi/smtd.conf*. See Appendix B for descriptions of valid entries for this file.

`conf: secondary missing for` *interfacename*
`<smtd>`

A problem was encountered during configuration of the SMT daemon and FDDI network interface. The secondary path for the MAC (network interface) indicated was not found. This could indicate that the PHY sections for this MAC and/or the `phy_ct` field have been set improperly in the file */etc/fddi/smtd.conf*. See Appendix B for descriptions of valid entries for this file.

`conf: user data too long`
`<smtd>`

A problem was encountered during configuration of the SMT daemon and FDDI network interface. The value entered as user data (`user_data`) in the file */etc/fddi/smtd.conf* contains too many characters. See Appendix B for descriptions of valid entries for this file.

`couldn't bind remotesocket`
`<smtd>`

A *bind* system call failed. This indicates a problem with the operating system.

`couldn't get fdditree`
`<smtd>`

The SMT daemon could not read the MIB file (*/etc/fddi/smtd.mib*). This could indicate that the file is missing. Verify its presence. This message could also indicate that the file is corrupted. Make a new copy of it from a backup, then use *smtconfig* to stop and restart the network interface.

`couldn't get hostent`
`<smtd>`

The *gethostbyname* system call failed for `localhost`. This could indicate that the `localhost` information about the local station (the station where *smtd* was invoked) is missing from the local */etc/hosts* file. Verify that the following line exists in the */etc/hosts* file:

```
127.0.0.1 localhost localhost.x.x.x loghost
```

The alternate format is this:

```
127.1 localhost localhost.x.x.x loghost
```

*x.x.x* contains the station's domain information.

`couldn't get hostname`
`<smtring>`

When attempting to set up a reception socket, the *gethostname* system call failed. This may indicate a problem with the operating system. For example, it may be overloaded. This may indicate that the station specified on the *smtring* command line was not found in the hosts database (either the local */etc/hosts* file or the NIS server).

`couldn't get localport`
`<smtd>`

The SMT daemon was unable to obtain a local communication port. This indicates a problem with the operating system.

`couldn't get remotesocket`
`<smtd>`

A *socket* system call failed. This indicates a problem with the operating system.

`couldn't get socket name`
`<smtd>`

A *getsockname* system call failed. This indicates a problem with the operating system.

`couldn't open remote SNMP session`
`<smtd>`

The SMT daemon could not open a session with an SNMP module. This may indicate that the SNMP daemon is not running. This may also indicate that the file descriptor obtained for the port is invalid.

`couldn't open SNMP session`
`<smtd>`

The SMT daemon could not obtain a communication channel (session). This indicates a problem with FDDIXPress software. Reboot the system. If the problem persists, reinstall the software shipped with your FDDI board.

`Denied REQUEST: bad version` *digit*
`<smtd>`

The SMT daemon was attempting to respond to an FDDI request frame; however, it discovered that the received frame was encoded in an unsupported version of the SMT protocol. Use the "SMT Information" report of the *smtstat -s* command to discover the range of supported versions on this station.

`DUP!`
`<smtping>`

The number of duplicate response frames was excessive. This indicates a problem at the remote station, except when the *smtping* command has been invoked with a broadcast address (ff:ff:ff:ff:ff:ff), in which case duplicate frames are normal.

`Encapsulation Routing`
`<smtconfig>`

A *setsockopt* system or library call failed. This indicates a problem with the operating system. For example, it may be overloaded.

`Error:` *interfacename PHYindex*`:` *actionname errormessage*
`<smtd>`

The specified action (*actionname*) caused an error as detailed in the text of *errormessage* for the interface and PHY indicated. This indicates something wrong with the SMT software. Reboot the system. If the problem continues, reinstall the software that was shipped with the FDDI board. If the problem persists, call the Silicon Graphics Technical Assistance Center.

`Error building packet`

The SNMP daemon could not build an SMT packet as requested (for example, the size may be too large). The requested packet was not sent.

`Error in config file: can't decode section delimiter:` *delimiter*
`<smtd>`

While configuring itself, the SMT daemon could not parse (understand) the section delimiter (as indicated in the message) in the file */usr/etc/smtd.conf*. See Appendix B for details about this configuration file.

`Error in config file: too many stations defined: max=`*digit*
`<smtd>`

While configuring itself, the SMT daemon found too many stations defined in the file */usr/etc/smtd.conf*. The maximum number of stations allowed is defined in the message. See Appendix B for details about this configuration file.

`Error in config file: unknown section delimiter:` *delimiter*
`<smtd>`

While configuring itself, the SMT daemon could not parse (understand) the section delimiter (as indicated in the message) in the file */usr/etc/smtd.conf*. See Appendix B for details about this configuration file.

`Error: smt` *phyID*`:` *actionname errormessage*
`<smtd>`

The specified action (*actionname*) caused an error as detailed in the text of *errormessage* for the interface and PHY indicated. This indicates something wrong with the SMT software. Reboot the system. If the problem continues, reinstall the software that was shipped with the FDDI board. If the problem persists, call the Silicon Graphics Technical Assistance Center.

`event 0x`*hexnumeral* `tlvget failed`
`<smtd>`

It was not possible to parse and build the SMT event identified by the hexadecimal numeral.

`fatal path rid mismatch`
`<smtd>`

The SMT daemon found an inconsistency in the MAC, PHY, and path configurations (`rid` = resource identification, a software variable). Use *smtconfig* to stop, then restart the network interface (and the SMT daemon) so that it can rebuild its information. If the problem persists, the MIB file may be corrupted; create a new */etc/fddi/smtd.mib* file from a backup copy, then use *smtconfig* to stop and restart the network interface.

`frame too large: len =` *digits*
`<smtd>`

An illegal FDDI frame was received. The frame had too many bits.

`fs_reg: socket`
`<smtd>`

A *socket* system or library call failed. This may indicate a problem with the operating system.

`gethostbyname`
`<smtring>`

The *gethostbyname* system or library call failed for one of the stations. This could indicate that the station's network connection name has not been added to the hosts database (NIS service or local */etc/hosts* file), or that the station's IP address is invalid. This error could indicate a problem with the NIS server. For example, it may be overloaded or not currently functional.

`get localhost failed`
`<smtping>`

When attempting to set up a reception socket, the *gethostbyname* system call failed for `localhost`. This could indicate that `localhost` information about the local station (the station where *smtping* was invoked) is missing from the local */etc/hosts* file. Verify that one of the following lines exists in the */etc/hosts* file:

```
127.0.0.1 localhost localhost.x.x.x loghost
```

The alternate format is as follows:

```
127.1 localhost localhost.x.x.x loghost
```

*x.x.x* contains the station's domain information.

`getsockname`
`<smtinfo>`

A *getsockname* system or library call failed. This indicates a problem with the operating system. For example, it may be overloaded.

`getsockname failed(`*errornumber*`)`
`<`*smtping*`>, <`*smtring*`>`

When attempting to set up a reception socket on the local host, the *getsockname* system call failed. This indicates a problem with the operating system. For example, it may be overloaded.

`gettimeofday failed`
`<`*smtd*`>`

The *gettimeofday* system or library call failed. This indicates a problem with the operating system. For example, it may be overloaded.

`init_mib: mibfile = NULL`
`<`*smtd*`>`

An internal error was detected when the SMT daemon attempted to initialize the MIB file (*/etc/fddi/smtd.mib*). This may indicate that the file is corrupted or missing. Create a new MIB file using the command lines below. If you do not have a backup copy (*/etc/fddi/smtd.mib.orig*) of the MIB file, reinstall your FDDIXPress software.

```
% /sbin/su
# cd /etc/fddi
# /bin/cp smtd.mib.orig smtd.mib
# /usr/etc/smtconfig FDDIinterfacename down up
```

*interfacename*`: `*phy*` info missing`
`<`*smtd*`>`

While reading the file */usr/etc/smtd.conf* to configure itself, the SMT daemon did not find a required configuration parameter for the MAC (network interface) and PHY indicated in the message. The *phy* variable will be replaced by the word `primary` or `secondary`, where primary usually identifies port B and secondary port A. See Appendix B for details about this configuration file.

`Invalid device name:` *interfacename*
`<`*smtinfo*`>, <`*smtping*`>, <`*smtring*`>, <`*smtstat*`>`

The interface name specified for the SMT command using the *-I* option was not recognized as an FDDI interface at that station. Verify (with the *netstat -ina* command) that the interface name you specified exists on that station and is correctly typed on the command line. You also can use the *hinv* command to identify the station's FDDI hardware and its associated network interface.

`invalid event 0x`*hexnumeral* `ignored`
`<`*smtd*`>`

The SMT event identified by the hexadecimal numeral is not recognized, so it has been ignored.

*characters*`: invalid PCM line state`
`<`*smtmaint*`>`

The characters indicated are not valid. They do not correspond to any physical connection (PCM) line state recognizable by *smtmaint*. Valid line states are limited to the values specified in "Verifying a Station's PCM Functionality" on page 71 and on the *smtmaint* man page.

*digit*`: invalid PHY index`
`<`*smtmaint*`>`

The decimal number indicated is not a valid entry. The number was entered as the second parameter in the *smtmaint* command line, corresponding to a PHY. The entry must be a decimal digit of 0 or 1.

*characters* `is a reserved word: On line` *digit*
`<`*smtd*`>`

The entry indicated by *characters* has been improperly used in the MIB file *(/etc/fddi/smtd.mib*). The problem is on the line of the file indicated. Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the network interface.

`invalid response type:` *type*
`<`*smtinfo*`>`

The responding SMT module sent information of an invalid type. The type, which must be RESPONSE, is specified within one of the fields of the response. This indicates that the responding station is either dysfunctional or not behaving in conformance with the FDDI SMT protocol.

`ioctl (`*requestparameter*`)`
`<smtconfig>`

During configuration of the SMT daemon and network interface, an *ioctl* system or library call failed for the indicated *requestparameter.* This may indicate an invalid configuration parameter (user entry) on the *smtconfig* command line. The configuration has failed; the parameter has not been changed.

The following *requestparameters* indicate the invalid user entry:

| | |
|---|---|
| `SIOCGIFFLAGS` | network interface name |
| `SIOCSIFADDR` | inet (IP or internet) address |
| `SIOCSIFNETMASK` | netmask |
| `SIOCSIFBRDADDR` | broadcast address |
| `SIOCSIFHEAD` | make network interface primary |
| `SIOCSIFDSTADDR` | destination address |
| `set metric` | route metric |

This error message may also indicate a problem with the operating system. When the *requestparameter* is not listed above, this message usually indicates a problem with the operating system.

*interfacename*`,` *phyID*`: ioctl(`*requestparameter*`)`
`<smtd>`

An *ioctl* system or library call with the *requestparameter* indicated failed. The call was made for the network interface and PHY indicated. This indicates a problem with the operating system.

*interfacename*`,` *phyID*`: LEM_FAIL`
`<smtd>`

This is a serious error condition. The SMT daemon has detected too many link errors occurring at the network interface and PHY indicated. When this message is displayed, the SMT daemon is not able to reestablish the ring, so the indicated port is not functioning. The problem lies between this station and the upstream neighbor. Follow the instructions in sections “Checking Physical Connections” on page 80 and “Link-Level Errors” on page 87.

*interfacename*`.`*digit*`: LER alarm =` *currentLER*
`<`*smtd*`>`

The Link Error Alarm was activated for the network interface (MAC address) and PHY (*digit*) specified in the message, indicating that the link error rate (LER) exceeded the alarm threshold. Follow the instructions in the section "Checking Physical Connections" in Chapter 4 to fix the cable problem.

`localhost`
`<`*smtinfo*`>`

A *gethostbyname* system or library call failed when using the localhost parameter. This could indicate that the `localhost` information about the local station (the station where *smtinfo* was invoked) is missing from the local */etc/hosts* file. Verify that the one of the following lines exists in the */etc/hosts* file:

```
127.0.0.1 localhost localhost.x.x.x loghost
```

An alternate format is this:

```
127.1 localhost localhost.x.x.x loghost
```

*x.x.x* completes the address.

`local port`
`<`*smtd*`>`

A *getsockname* system call failed. This indicates a problem with the operating system.

`mac dump for` *station* `failed`
`<`*smtinfo*`>, <`*smtping*`>, <`*smtring*`>`

An attempt to obtain information from another station failed. This may indicate the SMT daemon on the local machine has failed or the interface is disabled. Use the *smtconfig* command to stop and restart the FDDI network interface.

`Malloc failed`
`<`*smtd*`>`

A *malloc* system or library call failed. This indicates a problem with the operating system when attempting to allocate memory.

`map_open: mktemp failed`
`<smtd>`

In attempting to update the MIB, a *mktemp* system or library call failed to create a unique, temporary file. This may indicate that the operating system is overloaded.

`map_smt: BAD command` *action*
`<smtd>`

The action (internal software command) specified when this routine was called is not a valid one. Another error message will provide more detail about the problem, including the name of the process that provided the invalid command. This indicates a problem with the SMT software. Reboot the system. If the problem continues, reinstall the software that was shipped with the FDDI board. If the problem persists, call the Silicon Graphics Technical Assistance Center.

`map_smt:` *variable* `doesn't exist`
`<smtd>`

The specified variable caused an error. This indicates a problem with the SMT software. The MIB file may be corrupted. Make a new copy of */etc/fddi/smtd.mib* from your backup copy. Reboot the system. If the problem continues, reinstall the software that was shipped with the FDDI board. If the problem persists, call the Silicon Graphics Technical Assistance Center.

`map_smt: FDDI interface` *interfacename* `not found`
`<smtd>`

The indicated FDDI network interface is not known to the system. Another error message will provide more detail about the problem, including the name of the process that provided the invalid name. (The *map_smt* routine is an internal SMT routine called by many FDDIXPress processes.)

`map_smt: Invalid action:` *action*
`<smtd>`

The specified action (internal software command) is not a valid one. This indicates something wrong with the SMT software. Reboot the system. If the problem continues, reinstall the software that was shipped with the FDDI board. If the problem persists, call the Silicon Graphics Technical Assistance Center.

`Mib not initialized. Exiting`
`<smtd>`

An operating system error was detected. The MIB file (*/etc/fddi/smtd.mib*) could not be initialized. This may indicate that the file is corrupted or missing. Create a new MIB file using the command line below. If you do not have a backup copy (for example, */etc/fddi/smtd.mib.orig*) of the MIB file, reinstall your FDDIXPress software.

```
% /sbin/su
# cd /etc/fddi
# /bin/cp smtd.mib.orig smtd.mib
# /usr/etc/smtconfig FDDIinterface down up
```

`Mib table is bad. Exiting`
`<smtd>`

The MIB file (*/etc/fddi/smtd.mib*) could not be parsed. Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the network interface.

`Missing end of oid: On line` *digit*
`<smtd>`

The end of an entry (object) in the MIB file (*/etc/fddi/smtd.mib*) was missing. The problem was encountered on the line of the file indicated. Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the network interface.

`newiphase for` *interfacename* `failed`
`<smtd>`

The SMT daemon failed to configure and bring up (get running) the software for the network interface indicated in the message. This indicates that the network interface name is not known to the system. Use the command below to verify that the driver has been built into the operating system:

`% /sbin/grep` *FDDIinterface* `/var/sysgen/master.c`

*FDDIinterface* is ipg or xpi (without the final digit). If there are no entries for the FDDI interface (for example, if_ipgintr), use the */etc/autoconfig* command to rebuild the operating system, then reboot to start using the new operating system.

If the problem persists, reinstall the software that was shipped with the installed FDDI board, rebuild the operating system, and reboot. If the message continues to be displayed, contact the Silicon Graphics Technical Assistance Center.

`No end to oid: On line` *numeral*
`<smtd>`

The final entry in a series of an entries for an object in the MIB file (*/etc/fddi/smtd.mib*) was missing. The problem was encountered on the line of the file indicated. Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the network interface.

`No frame sent successfully during last # seconds`
`<smtd>`

A *send* system or library call has failed to complete successfully during the indicated period of time. This indicates a problem with the operating system.

`No response from daemon: timed-out`
`<smtd>`

The SMT daemon has halted or quit. This indicates a problem with the FDDIXPress software files. Use *smtconfig* to stop and restart the FDDI network interface. If the problem persists, reboot the system to restart everything. If this does not solve the problem, reinstall the software shipped with your FDDI board. If the message continues to display, contact the Silicon Graphics Technical Assistance Center.

`No SMT frames received for` *numeral* `seconds`
`<smtd>`

The SMT daemon has not received any SMT protocol frames within the number of seconds indicated, so the SMT daemon has reset the driver. This message can indicate the ring is totally quiet, which would be normal only when the station was the only one on the ring. It could indicate the station has been isolated onto a ring fragment. Check if any of this station's ports are wrapped. This message might indicate a problem with the board. Error messages created by the driver will help you identify this condition.

`Not a sequence: On line` *digit*
`<smtd>`

When reading the MIB file *(/etc/fddi/smtd.mib*), an ASN.1 entry (object) was encountered, on the line of the file indicated, that was not a SEQUENCE type. Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the network interface.

`No terminating parenthesis (`*token*`): On line` *digit*
`<smtd>`

When reading the MIB file *(/etc/fddi/smtd.mib*), the SMT daemon found that a required parenthesis was missing on the line of the file indicated. Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the network interface.

`nt_send: rc=`*digit*
`<smtd>`

An attempt to send an NIF request frame failed. The reason for the failure is indicated by the reason code (`rc`). See the `rc` entry in this listing for the reasons associated with each code. The SMT daemon software is not functioning correctly. Reboot the system. If this error message continues to be displayed, reinstall the software. If the problem still persists, contact the Silicon Graphics Technical Assistance Center.

`object identifier too long`
`<smtd>`

An invalid entry was found in the MIB file */etc/fddi/smtd.mib*. This may indicate that the file is corrupted. Create a new MIB file and restart the network interface using the command lines below. If you do not have a backup copy (*/etc/fddi/smtd.mib.orig*) of the MIB file, reinstall your FDDIXPress software.

```
% /bin/su
Password: thepassword
# cd /etc/fddi
# /bin/cp smtd.mib.orig smtd.mib
# /usr/etc/smtconfig FDDIinterface down up
```

`-p` *pattern* `???:`
`<smtping>`

The *smtping -p* command specified characters that are not hexadecimal. Use only hexadecimal characters: 0 to 9 and a to f.

*digits*`% packet loss`
`<smtping>`

The number of response ECHO packets received is less than the number of request ECHO packets sent. The loss is expressed as a percentage: the number of received packets divided by the number sent. Low percentages of packet loss are not usually a problem. The number that constitutes "low" is somewhat subjective. However, when the percentage of lost packets is greater than ten (10%) and when this symptom persists for over an hour, it is a good idea to investigate what is causing the loss. Follow the instructions in "Status Indicators and Symptoms" on page 87.

`packet too short (`*number* `bytes)`
`<smtping>`

As *smtping* attempted to display the response packet, it discovered that the packet was shorter than the one it had sent. This may indicate that the responding station is creating malformed packets.

`patterns must be specified as hex digits`
`<smtping>`

The pattern specified on the *smtping -p* command line contained characters that are not valid hexadecimal characters. The following characters are valid: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, a, A, b, B, c, C, d, D, e, E, f, F, and blank spaces.

`Premature end of file: On line` *digit*
`<smtd>`

When reading the MIB file (*/etc/fddi/smtd.mib*), the SMT daemon found that an end-of-file indicator was encountered unexpectedly on the line of the file indicated. Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the network interface.

*interfacename*`.#: primary PC_UNKNOWN`
`<smtd>`

When attempting to configure and bring up a new network interface and SMT daemon, the software could not locate a primary PHY for the MAC. This can indicate a problem with the configuration file (*/etc/fddi/smtd.conf*) or with the board. See Appendix B for details about this configuration file. If the problem persists, contact the Silicon Graphics Technical Assistance Center.

`rc`

The *reason code*s (`rc`) are listed in Table A-1 with their hexadecimal and decimal (digit) representations.

**Table A-1** Reason Codes Used in Error Messages

| Reason Name | Hex Code | Decimal Code | Description |
|---|---|---|---|
| RC_NOCLASS | 0x1 | 1 | Frame class not supported. Supported classes are NIF, SIF, ECF, RAF, ESF, and PMF. |
| RC_NOVERS | 0x2 | 2 | Frame version not supported. |
| RC_SUCCESS | 0x3 | 3 | Success. |
| RC_BADSETCOUNT | 0x4 | 4 | Bad SETCOUNT. |

**Table A-1 (continued)** Reason Codes Used in Error Messages

| Reason Name | Hex Code | Decimal Code | Description |
|---|---|---|---|
| RC_READONLY | 0x5 | 5 | Attempt to change read-only parameter. |
| RC_NOPARM | 0x6 | 6 | Requested parameter is not supported. |
| RC_NOMORE | 0x7 | 7 | No more room or parameter for add or remove. |
| RC_RANGE | 0x8 | 8 | Out of range. |
| RC_AUTH | 0x9 | 9 | Authentication failed. |
| RC_PARSE | 0xa | 10 | Parameter parsing failed. |
| RC_TOOLONG | 0xb | 11 | Frame too long. |
| RC_INVALID | 0xc | 12 | Unrecognized parameter. |

`READ_MIB FAILED`
`<smtd>`

An internal error was detected when attempting to initialize the MIB file (*/etc/fddi/smtd.mib*). This may indicate that the file is corrupted or missing. Create a new MIB file using the command lines below. If you do not have a backup copy of the MIB file (*/etc/fddi/smtd.mib.orig*), reinstall your FDDIXPress software.

```
% /sbin/su
# cd /etc/fddi
# /bin/cp smtd.mib.orig smtd.mib
# /usr/etc/smtconfig FDDInetworkinterface down up
```

`Recv Frame error`
`<smtd>`

An *recv* system or library call failed during reception of a request frame. This indicates a problem with the operating system.

`recvfrom`
`<smtd>`

A *recvfrom* system or library call failed. This indicates a problem with the operating system.

`REQUEST: Illegal FC=`*hexnumeral*
`<smtd>`

The SMT daemon was attempting to send a request frame, but found that the frame control (FC) value was for a class that does not allow request frames (for example, RDF).

`REQUEST: Unsupported FC=`*hexnumeral*
`<smtd>`

The SMT daemon was attempting to send a request frame, but found that the frame control (FC) value, which was created by another module of the software, is not supported. For example, RDF requests were not supported in early versions of FDDIXPress.

`Reset` *interfacename*
`<smtd>`

There is a problem with the FDDI board associated with the network interface indicated. An automatic reset is in progress. If this message appears infrequently, it does not indicate a problem. However, if it occurs frequently, follow the instructions in the section "Checking Physical Connections" on page 80. If the message continues to display frequently, contact the Silicon Graphics Technical Assistance Center.

`resp_map: sendto`
`<smtd>`

The *sendto* system or library call failed. This may indicate a problem with the operating system.

`response from` *station1* `instead of` *station2*
`<smtinfo>`

The host specified in the *smtinfo* command line did not respond. Instead, information was obtained from a different host. This may indicate that there are duplicate or switched IP addresses in the hosts database. Verify the IP addresses for *station1* and *station2* in the */etc/hosts* file (either local or on the NIS server).

`Response message would have been too large`
`<smtd>`

The SMT daemon has encountered a problem. This probably indicates that the MIB file (*/etc/fddi/smtd.mib*) is corrupted. Make a new copy from the backup. This can indicate that the requesting SMT module has requested invalid MIB information.

`sanity check for` *interfacename board*`# failed`
`<smtd>`

An invalid value was detected in the file */etc/fddi/smtd.conf*. In most cases, another error message will identify the specific problem. See Appendix B for details about this configuration file.

`sanity: unsupported MACtype=`*type*
`<SMT daemon>`

The file */etc/fddi/smtd.conf* has an entry in a `type` field (PHY section) that is not supported by the network interface being configured by this entry. The entry may be incorrect, or the network interface being configured with this section of the file may not be the target (intended) interface. The configuration file must be corrected before the station can function. See Appendix B for details about this configuration file.

`sanity:` *interfacename* `unsupported mac type =` *type*
`<SMT daemon>`

The file */etc/fddi/smtd.conf* has a `StationType` entry that is not supported by the indicated network interface, which is being configured with this entry. The entry may simply be incorrect, or the network interface being configured with this section of the file may not be the intended one. See Appendix B for details about this configuration file.

`sanity: unsupported station type=`*type*
`<SMT daemon>`

The file */etc/fddi/smtd.conf* has an entry in the `StationType` field that is not supported by the network interface configured with that station entry. The entry may be incorrect, or the network interface being configured with this section of the file may not be the target (intended) interface. The configuration file must be corrected before the station can function. See Appendix B for details about this configuration file.

*interfacename*`.#: secondary PC_UNKNOWN`
`<`*`smtd`*`>`

When attempting to configure and bring up a new network interface and SMT daemon, the software could not locate a secondary PHY for the MAC. This can indicate a problem with the configuration file (*/etc/fddi/smtd.conf*) or with the board. See Appendix B for details about this configuration file. If the problem persists, contact the Silicon Graphics Technical Assistance Center.

`select`
`<`*`smtd`*`>`

The *select* system or library call failed. This indicates something wrong with the operating system. For example, it may be overloaded.

`select:` *systemmessage*
`<`*`smtstat`*`>`

When attempting to read the status information files, the *select* system or library call failed. The system error message will provide more details about the reason for the failure.

`send`
`<`*`smtping`*`>`

A *send* system call failed. This indicates a problem with the operating system. For example, it may be overloaded.

`sendto`
`<`*`smtd`*`>`

A *sendto* system call failed. This indicates a problem with the operating system. For example, it may be overloaded.

`send_frame: # bytes not sent`
`<`*`smtd`*`>`

A *send* system or library call failed. This indicates a problem with the operating system.

`Should be ACCESS (`*token*`): On line` *digit*
`<`*smtd*`>`

An expected ACCESS entry was not found in the MIB file (*/etc/fddi/smtd.mib*). Instead, the software encountered *token*. The problem is on the line of the file indicated. Make a new copy of the file from a backup copy, then use *smtconfig* to disable and reenable the network interface.

`Should be STATUS (`*token*`): On line` *digit*
`<`*smtd*`>`

An expected STATUS entry was not found in the MIB file (*/etc/fddi/smtd.mib*) on the line of the file indicated. Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the network interface.

`sm_conf: oport failed`
`<`*smtd*`>`

During SMT startup, a system call to set up (*open* and *bind*) a raw socket failed. An additional error message generated by *sm_open* provides more detail about the reason for the failure.

`sm_multi: SIOCADDMULTI`
`sm_multi: SIOCDELMULTI`
`<`*smtd*`>`

When the SMT daemon was attempting to add or delete a multicast address, an *ioctl* system or library call with the `SIOCADDMULTI` or `SIOCDELMULTI` request parameter failed.

`sm_open: bind port(`*portID*`,` *portname*`)`
`<`*smtd*`>`

The *bind* system or library call failed to bind the socket (identification number and name) indicated. This indicates a problem with the operating system. For example, it may be overloaded.

`sm_open: socket`
`<`*smtd*`>`

The *socket* system or library call failed to open (obtain) a socket. This indicates a problem with the operating system. For example, it may be overloaded.

`sm_open: setsockopt (`*portID*`)`
`<`*smtd*`>`

The *setsockopt* system or library call failed to set the options for the socket indicated by *portID*. This indicates a problem with the operating system. For example, it may be overloaded.

`sm_reset: ioctl(~IFF_UP)`
`sm_reset: ioctl(IFF_UP)`
`<`*smtd*`>`

During an FDDI board reset, the SMT daemon's attempt to contact the network interface's driver failed. Specifically, the *ioctl* call to the driver with the `~IFF_UP` or `IFF_UP` request parameter failed. If this message occurs infrequently and if the network interface is functioning within a few minutes of the message appearing, it does not indicate a problem. If this message is displayed frequently or if the network interface does not work, there is probably a problem with the driver.

Try manually restarting all the network interfaces on this station with the command below:

```
% /bin/su
Password: thepassword
# /etc/init.d/network stop
# /etc/init.d/network start
```

Then check if the FDDI connection is working. If it is not working, halt or shut down the system, turn the power off, wait a few minutes, turn the power back on, and restart the system. If this same error message occurs, or if the FDDI connection is not working, reinstall the FDDIXPress software that was shipped with the installed FDDI board. If the problem persists, contact the Silicon Graphics Technical Assistance Center.

`sm_reset: ioctl(SIOCGIFFLAGS)`
`<`*smtd*`>`

During an FDDI board reset, the SMT daemon's attempt to enable the network interface driver and verify or save the network interface's flag settings, failed. In other words, the *ioctl* call with the `SIOCGIFFLAGS` request parameter failed. Follow the instructions detailed under the error message `sm_reset: ioctl(IFF_UP)`.

`sm_reset: socket`
`<smtd>`

While the SMT daemon was attempting to reset itself during an FDDI board reset, a *socket* system or library call failed. This indicates a problem with the operating system. For example, it may be overloaded. This message does not indicate a problem unless it occurs frequently.

`sm_set_macaddr: socket`
`<smtd>`

While the SMT daemon was attempting to associate the network interface with the FDDI board's MAC address, a *socket* system call failed. This indicates a problem with the operating system.

`sm_set_macaddr: ioctl(SIOCSIFADDR)`
`<smtd>`

While the SMT daemon was attempting to associate the FDDI board's MAC address with a network interface, an *ioctl* system call with the `SIOCSIFADDR` request parameter failed. This indicates a problem with the operating system.

`smtconfig bind`
`<smtconfig>`

*A bind* system or library call failed. This indicates a problem with the operating system. For example, it may be overloaded.

`smtconfig: bind`
`<smtd>`

A *bind* system or library call failed. This indicates a problem with the operating system. For example, it may be overloaded.

`smtconfig: cannot turn on` *interfacename* `except as root`
`<smtconfig>`

The effective user ID of the calling process (value returned by the *geteuid* system call) does not include superuser (root) privileges. Only a superuser can enable a network interface. Become superuser (**su**) and try again.

`smtconfig: can't exec smtd`
`<smtconfig>`

An *execl* system or library call failed to make a new process for the SMT daemon. This indicates a problem with the operating system.

`smtconfig: Command not found.`
`<smtconfig>`

The path to the directory containing the SMT command has not been defined in the logged-on user's environment `PATH` variable. See "Configure the Environment for User Friendliness and Safety (Optional)" on page 42 for details on how to solve this problem. You can also type the full path to the command, as follows:

`% /usr/etc/smtconfig` *interfacename*

If this command line does not invoke the command, the FDDIXPress software or the command is not installed. Reinstall the FDDIXPress software.

`smtconfig:` *interfacename* `failed to start:` *systemmessage*
`<smtconfig>`

The software was unable to start the indicated network interface for the reasons provided in the standard system message.

`smtconfig:` *entry*`: no such interface`
`<smtconfig>`

The indicated network interface that was entered on the *smtconfig* command line is not known to the system. Follow the instructions below to resolve the problem:

- Use */usr/etc/netstat -i* to list the known, running interfaces.

  If the interface you want is listed, try *smtconfig* again.

  If the interface you want is not listed, this indicates that the FDDI driver is not running. It may not be built into the operating system or the board may not be recognized. Proceed to the next step.

- Use the command */usr/sbin/versions FDDIXPress* to verify that the software is installed.

  If *versions* does not find FDDIXPress, install the FDDIXPress software, following the instructions in the FDDIXPress release notes, and configure it, following the instructions in Chapter 2.

  If FDDIXPress is listed, proceed to the next step.

- Type the */bin/hinv* command to verify that the board is installed and recognized.

  If the FDDI controller is not listed, follow the instructions in the section "Recognition of Board by Software" on page 80.

`smtconfig:` *entry*`: permission denied`
`<`*`smtconfig`*`>`

The requested *smtconfig* change (*entry*) requires that the user have superuser (root) access privileges. Become superuser (enter **`su`**). Then try again.

`smtconfig: smtd failed:` *systemmessage*`\`*numeral*
`<`*`smtconfig`*`>`

A process could not be created for starting the SMT daemon. This indicates a problem with the operating system, as detailed in the *systemmessage*.

`smtconfig SIOC_XPI_EXEC`
`<`*`smtconfig`*`>`

While loading new firmware into the FDDI board's memory, an *ioctl* system or library call with the `SIOC_XPI_EXEC` request parameter failed. This probably indicates a mismatch between the hardware (FDDI board) and software. Reinstall the software shipped with the installed board. If the problem persists, contact the Silicon Graphics Technical Assistance Center.

`smtconfig SIOC_XPI_SIGNAL`
`<`*`smtconfig`*`>`

While loading new firmware into the FDDI board's memory, an *ioctl* system or library call with the `SIOC_XPI_SIGNAL` request parameter failed. This indicates a problem with the operating system, but not the I/O system. The software was unable to load the newer firmware.

`smtconfig SIOC_XPI_STO`
`<`*`smtconfig`*`>`

The *ioctl* system or library call with the `SIOC_XPI_STO` request parameter failed while the SMT daemon was attempting to load firmware onto an FDDI board. This indicates an incompatibility between the operating system and *smtconfig*. Use */usr/sbin/versions eoe1* to display the operating system's version (release). Use */usr/sbin/relnotes FDDIXPress* to display the FDDIXPress release notes. Verify that your operating system is the correct version, as indicated in the release notes.

`smtconfig SIOC_XPI_VERS`
`<`*`smtconfig`*`>`

The *ioctl* system or library call with the `SIOC_XPI_VERS` request parameter failed while the SMT daemon was attempting to verify the firmware on an FDDI board. This probably indicates a mismatch between the hardware (FDDI board) and software. Reinstall the software shipped with the installed board. If the problem persists, contact the Silicon Graphics Technical Assistance Center.

`smtconfig socket`
`smtconfig: socket`
`<`*`smtconfig`*`>`

A *socket* system or library call failed. This indicates a problem with the operating system. For example, it may be overloaded.

`smtconfig: unrecognized interface:` *systemmessage*
`<`*`smtconfig`*`>`

The network interface entered on the *smtconfig* command line is not known to the system as an FDDI interface. Use */usr/etc/netstat -ina* to list the known interfaces or use */bin/hinv* to identify the FDDI hardware and its associated FDDI interface, then try again. If the network interface you want to configure is not listed, verify that the board and software are installed, then rebuild the operating system with */etc/autoconfig*, and reboot to start using the new operating system.

`smtconfig: WARNING: Writing` *interfacename* `EEPROM`
`Do not reset the machine`
`<`*`smtconfig`*`>`

This is not an error message. It is included here because it is an extremely important informational message. When this message is displayed, the software is in the process of loading (writing) new firmware into one of the FDDI board's chips. Nothing is wrong; however, the computer must not be interrupted until another *smtconfig* message has been displayed.

`smtd: can't fork`
`<`*`smtd`*`>`

The *fork* system or library call failed. This indicates something wrong with the operating system. For example, it may be overloaded.

`smtd dump`
`<`*`smtping`*`>`

An attempt to obtain status from the remote SMT module failed. This may indicate that the SMT daemon on the local system has failed. Use the *smtconfig* command to stop and restart the network interface. If the problem persists, contact the Silicon Graphics Technical Assistance Center

`smtd_fs: frame too large (len=`*`digits`*`)`
`<`*`smtd`*`>`

An illegal FDDI frame was received; the frame had too many bits.

`smtd_fs: frame too small (len=`*`digits`*`)`
`<`*`smtd`*`>`

A received FDDI frame was illegally small.

`smtdfs:` *digit* `of` *digit* `bytes written`
`<`*`smtd`*`>`

A *sendto* system or library call successfully sent only some of the requested data. The number of bytes sent and the number requested are indicated. This may indicate a problem with the operating system.

`SMT_DOWN`
`<smtconfig>`

An attempt by *smtconfig* to disable the SMT daemon has failed. Use */usr/etc/smtconfig interfacename down* to manually disable the interface. If this fails, reinstall the software shipped with the board.

`SMT_FS_NIF: unknown type(`*digit*`)`
`<smtd>`

An illegal NIF frame was received; the frame was not of a known type (that is, `ANNOUNCE`, `REQUEST`, or `RESPONSE`). Another FDDI station is transmitting invalid NIF packets.

`SMT_FS_RDF: bad length`
`<smtd>`

An RDF response frame was received with an invalid length. Another FDDI station is transmitting invalid RDF packets.

`SMT_FS_RDF: req denied by` *stationID*`, rc=`*hexnumeral*
`<smtd>`

A response RDF frame was received indicating that one of this station's request frames has been denied. The station denying the request is indicated with the reason (`rc`) indicated. See the `rc` entry in this listing for the reasons associated with each code.

`smtinfo: can't find MAC address for` *station*
`<smtinfo>`

No MAC address was found for the station specified on the SMT command line. (Verify that the name for the specified station has been typed correctly on the command line.) This error message usually indicates that the station has not been added to the ethers or hosts databases.Verify that the station's name appears in the local or NIS server's */etc/hosts* and */etc/ethers* files. If the name is missing from either file, add it (as explained in "Setting Up the ethers File (Optional)" on page 43). Or, if your network uses the NIS service, have your network administrator add it to the network's databases.

If you maintain local (backup) copies, be sure to copy the NIS server's files to the local machine using the command lines below:

```
% /bin/su
Password: thepassword
# /usr/bin/ypcat ethers > /etc/ethers
# /usr/bin/ypcat hosts > /etc/hosts
```

`smtinfo: Command not found.`
`<smtinfo>`

The path to the directory containing the SMT command has not been defined in the logged on user's environment `PATH` variable. See "Configure the Environment for User Friendliness and Safety (Optional)" on page 42 for details on how to solve this problem. You can also type the full path to the command:

```
% /usr/etc/smtinfo station
```

*station* can be the network connection name or the MAC address.

If this command line does not invoke the command, the FDDIXPress software or the command is not installed. Reinstall the FDDIXPress software.

`smtinfo: invalid timeout: userinput`
`<smtinfo>`

The user entered an invalid time-out value. The time-out parameter entered on the *smtinfo -t* command line must be a value greater than zero. Zero and negative values are not legal.

`smtinfo: recv`
`<smtinfo>`

A *recv* system or library call failed. This indicates a problem with the operating system. For example, it may be overloaded. This message indicates a problem only if it occurs frequently.

`smtinfo: recv socket`
`<smtinfo>`

A *socket* system or library call failed. This indicates a problem with the operating system. For example, it may be overloaded. This message indicates a problem only if it occurs frequently.

`smtinfo register failed`
`<smtinfo>`

An attempt to obtain information from another station failed. This may indicate an overloaded network or individual station.

`smtinfo: sendframe failed`
`<smtinfo>`

A *sendframe* system or library call failed. This indicates a problem with the operating system. For example, it may be overloaded. This is a problem only if it occurs frequently.

`smtinfo version` *version#* `doesn't match daemon's (`*version#*`)`
`<smtinfo>`

The *smtinfo* code is a different version from the SMT daemon's code. SMT commands must be the same release as the SMT daemon. If the SMT daemon's version number has been altered in the */etc/fddi/smtd.conf* or */etc/fddi/smtd.mib* file, the discrepancy could cause this problem. If you are sure that this is the cause, edit the altered file's `version` setting back to the original.

This message may indicate that different versions of *smtd* and the SMT command have been installed. To remedy this problem, reinstall the FDDIXPress software, use */etc/autoconfig* to rebuild the operating system with the new driver, then reboot the system.

`smtmaint: Command not found`
`<smtmaint>`

The path to the directory containing the SMT command has not been defined in the logged on user's environment `PATH` variable. See "Configure the Environment for User Friendliness and Safety (Optional)" on page 42 for details on how to solve this problem. You can also type the full path to the command:

`# /usr/etc/smtmaint #` *linestate*

If this command does not invoke the command, the FDDIXPress software or the command is not installed. Reinstall the FDDIXPress software.

`SMT_MAINT: oport failed`
`<smtd>`

When the SMT daemon was called by the *smtmaint* command, a system call to setup (*open* and *bind*) a raw socket failed. An additional error message generated by *sm_open* provides more detail about the reason for the failure.

`smtping: bad preload value`
`<smtping>`

The value entered for the number of preloaded frames on the *smtping -l* command line is not valid. The preloaded frames must be zero or greater than zero. Negative values are not valid.

`smtping: bad timing interval`
`<smtping>`

The value entered for a timing interval on the *smtping -i* command line is not valid. The timing interval must be greater than zero. Zero and negative values are not valid.

`smtping: can't find MAC address for` *station*
`<smtping>`

No MAC address was found for the station specified on the SMT command line. (Verify that the name has been typed correctly on the command line.) This error message usually indicates that the station has not been added to the ethers or hosts databases.Verify that the station's network connection name appears in the local or NIS server's */etc/hosts* and */etc/ethers* files. If the name is missing from either file, add it (as explained in Chapter 2). Or, if your network uses the NIS service, have your network administrator add it to the network's databases.

If you maintain local (backup) copies, be sure to copy the NIS server's files to the local machine using the command lines below:

```
% /bin/su
Password: thepassword
# /usr/bin/ypcat ethers > /etc/ethers
# /usr/bin/ypcat hosts > /etc/hosts
```

`smtping: Command not found.`
`<smtping>`

The path to the directory containing the SMT command has not been defined in the logged on user's environment `PATH` variable. See "Configure the Environment for User Friendliness and Safety (Optional)" on page 42 for details on how to solve this problem. You can also type the full path to the command, as shown in the example below:

`% /usr/etc/smtping` *station*

*station* can be the network connection name or the MAC address.

If this command line does not invoke the command, the FDDIXPress software or the command is not installed. Reinstall the FDDIXPress software.

`smtping: -d is meaningful only with -x`
`<smtping>`

The *smtping* command has been invoked with an invalid *-d* option.

`smtping: -f and -i incompatible options`
`<smtping>`

The two *smtping* command line options *-f* and *-i* cannot be used together.

`smtping: illegal packet size.`
`<smtping>`

The value entered for setting packet size (in bytes) on the *smtping -s* command line is not valid. Packet size must be greater than zero. Zero and negative values are illegal.

`smtping: packet size too large.`
`<smtping>`

The value entered for setting packet size (in bytes) on the *smtping -s* command line is not valid. The maximum packet size allowed may vary from release to release, but is generally less than 4436 bytes.

`smtping: recv`
`<smtping>`

A *recv* system call failed. This indicates a problem with the operating system. For example, it may be overloaded. This message indicates a problem only if it occurs frequently.

`smtping: recv socket`
`<smtping>`

A *recvsock* system call failed. This indicates a problem with the operating system. For example, it may be overloaded. This message indicates a problem only if it occurs frequently.

`smtping register failed`
`<smtping>`

An attempt to obtain information from (open the connection to) another station failed. This may indicate an overloaded network or individual station.

`smtping: send socket`
`<smtping>`

A *sendsock* system call failed. This indicates a problem with the operating system. For example, it may be overloaded. This message indicates a problem only if it occurs frequently.

`smtping unregister failed`
`<smtping>`

An attempt to obtain information from (close the connection to) another station failed. This may indicate an overloaded network or individual station.

`smtping version %d doesn't match daemon's (`*version*`#)`
`<smtping>`

The *smtping* code is a different version from the SMT daemon's code. SMT commands must be the same release as the SMT daemon. If the SMT daemon's version number has been altered in the */etc/fddi/smtd.conf* or */etc/fddi/smtd.mib* file, the discrepancy could cause this problem. If you are sure that this is the cause, edit the altered file's `version` setting back to the original. This message may indicate that different versions of *smtd* and the SMT command have been installed. To remedy this problem, reinstall the FDDIXPress software and reboot the system (to rebuild the operating system with the new driver).

`smtring bind`
`<`*`smtring`*`>`

The *bind* system or library call failed when the SMT daemon attempted to set up a reception socket. This indicates a problem with the operating system. For example, it may be overloaded. This message indicates a problem only if it occurs frequently.

`smtring: can't find MAC address for` *station*
`<`*`smtring`*`>`

No MAC address was found for the station specified on the SMT command line. (Verify that the name has been typed correctly on the command line.) This error message usually indicates that the station has not been added to the ethers or hosts databases.Verify that the station's network connection name appears in the local or NIS server's */etc/hosts* and */etc/ethers* files. If the name is missing from either file, add it (as explained in Chapter 2). Or, if your network uses the NIS service, have your network administrator add it to the network's databases.

If you maintain local (backup) copies, be sure to copy the NIS server's files to the local machine using these commands:

```
% /sbin/su
Password: thepassword
# /usr/bin/ypcat ethers > /etc/ethers
# /usr/bin/ypcat hosts > /etc/hosts
```

`smtring: Command not found.`
`<`*`smtring`*`>`

The path to the directory containing the SMT command has not been defined in the logged on user's environment `PATH` variable. See "Configure the Environment for User Friendliness and Safety (Optional)" in Chapter 2 for details on how to solve this problem. You can also type the full path to the command, as shown in the example below:

```
% /usr/etc/smtring
```

If this command does not invoke the command, the FDDIXPress software or the command is not installed. Reinstall the FDDIXPress software.

`smtring: invalid interval:` *interval*
`<smtring>`

The interval specified on the *smtring -i* command line was not valid. The value must be a decimal digit greater than zero.

`smtring: invalid timeout:` *timeout*
`<smtring>`

The time-out specified on the *smtring -t* command line was not valid. The value must be a decimal digit greater than zero.

`smtring: recv`
`<smtring>`

A *recv* system call failed. This indicates a problem with the operating system. For example, it may be overloaded. This message indicates a problem only if it occurs frequently.

`smtring: recv socket`
`<smtring>`

A *socket* system or library call failed. This indicates a problem with the operating system. For example, it may be overloaded. This message indicates a problem only if it occurs frequently.

`smtring register failed`
`<smtring>`

An attempt to obtain information from (open the connection to) another station failed. This may indicate an overloaded network or individual station.

`smtring unregister failed`
`<smtring>`

An attempt to obtain information from (close the connection to) another station failed. This may indicate an overloaded network or individual station.

`smtring version # doesn't match daemon's (`*version*`#)`
`<smtring>`

The *smtring* code is a different version from the SMT daemon's code. SMT commands must be the same software release as the SMT daemon. To remedy this problem, reinstall the FDDIXPress software.

`smtring: xmit failed`
`<smtring>`

The *smtring* command was unable to successfully transmit a frame to one particular station (station is not indicated). The reason for this failure will be indicated in a subsequent *map_smt* error message.

`smtstat: Command not found.`
`<smtstat>`

The path to the directory containing the SMT command has not been defined in the logged on user's environment `PATH` variable. See "Configure the Environment for User Friendliness and Safety (Optional)" on page 42 for details on how to solve this problem. You can also type the full path to the command:

```
% /usr/etc/smtstat
```

If this command does not invoke the command, the FDDIXPress software or the command is not installed. Reinstall the FDDIXPress software.

`smtstat: mac dump for` *interface* `failed`
`<smtstat>`

While attempting to obtain status information, *smtstat* could not contact the SMT daemon (*smtd*), which indicates that the daemon is not running or that the interface is disabled. Use *smtconfig* to stop then restart the network interface (including the SMT daemon).

`smtstat: mac status for` *interface*`:# failed`
`<smtstat>`

While attempting to obtain status information, *smtstat* could not contact the SMT daemon (*smtd*), which indicates that the daemon probably is not running. Use *smtconfig* to stop then restart the network interface (including the SMT daemon).

`smtstat: NN dump for` *interface* `failed`
`<smtstat>`

While attempting to obtain status information, *smtstat* could not contact the SMT daemon (*smtd*), which indicates that the daemon is not running or the interface is disabled. Use *smtconfig* to stop then restart the network interface (including the SMT daemon).

`SMT_STAT: oport failed`
`<smtd>`

A call to set up (*open* and *bind*) a raw socket failed while the SMT daemon was updating the MIB. An additional error message generated by *sm_open* provides more detail about the reason for the failure.

`smtstat: port status for` *interface*`:# failed`
`<smtstat>`

While attempting to obtain status information, *smtstat* could not contact the SMT daemon (*smtd*). This indicates that the daemon is not running or the interface is disabled. Use *smtconfig* to stop then restart the network interface (including the SMT daemon).

`smtstat: select:` *standarderror*
`<smtstat>`

The *select* system or library call failed. The text of the standard system error indicates the problem.

`smtstat: smt status for failed`
`<smtstat>`

While attempting to obtain status information, *smtstat* could not contact the SMT daemon (*smtd*), which indicates that the daemon probably is not running. Use *smtconfig* to stop then restart the network interface (including the SMT daemon).

`smt status failed`
`<smtinfo>, <smtring>, <smtstat>`

An attempt to obtain information from another station's SMT module failed. This may indicate an overloaded network or individual station. Another error message, created by *sm_map*, will provide further details about the reason for the failure.

`smtstat version` *version*`# doesn't match daemon's (`*version*`#)`
`<smtstat>`

The *smtstat* code is a different version from the SMT daemon's code. SMT commands must be from the same software release as the SMT daemon. To remedy this problem, reinstall the FDDIXPress software.

`SMT_TRACE: oport failed`
`<smtd>`

A system call to set up (*open* and *bind*) a raw socket failed while the SMT daemon was attempting to trace a stuck beacon condition. An additional error message generated by *sm_open* provides more detail about the reason for the failure.

`SMT_TRAPPORT NUMBER not defined yet`
`<smtd>`

The *getservbyname* system or library call failed to return a UDP port. This can indicate that something is wrong with the network services database file or the operating system.

`SMT_UP`
`<smtconfig>`

An attempt by *smtconfig* to restart the SMT daemon has failed. Use */usr/etc/smtconfig interfacename up* to manually start the interface. If this fails, reinstall the software shipped with the board.

`SNMP PORT !=` *filedescriptor*
`<smtd>`

The UDP socket (port) for the SMT daemon has an incorrect file descriptor. This indicates an operating system problem.

`socket`
`<smtd>`

The *socket* system or library call failed to open (obtain) a socket. This indicates a problem with the operating system. For example, it may be overloaded.

`-- somebody's printing up packets!`
`<smtping>`

The number of response ECHO packets is greater than the number of request packets sent, meaning that the responding station is creating more than one response to each request or that two stations are responding to each request.

`Someone is using my MAC address(`*macaddress*`)`
`<`*smtd*`>`

The SMT daemon has detected another station using the same MAC address as this station. This condition will cause serious confusion on the ring. Remove this station from the ring. Do not return it until it has a unique MAC address. This problem can be caused by defining the MAC address in the SMT daemon configuration file (discussed in Appendix B) instead of using the MAC address from the hardware.

`SRF failed for` *interfacename*
`<`*smtd*`>`

There was an unsuccessful attempt to send an announcement Status Report Frame (SRF) for the network interface indicated in the message. This may indicate a problem with the multicast address (`sr_mid`) defined in the station section of the */etc/fddi/smtd.conf* file. See Appendix B for details about valid entries for this file.

`Station info failed`
`<`*smtstat*`>`

An attempt to obtain information from the station's SMT module failed. An error message created by *sm_map* will provide further details about the reason for the failure.

`sub-identifier not found:` *entry*
`<`*smtd*`>`

A required entry was not found in the MIB file */etc/fddi/smtd.mib*. This may indicate that the file is corrupted. Create a new MIB file using the following commands. If you do not have a backup copy (*/etc/fddi/smtd.mib.orig*) of the MIB file, reinstall your FDDIXPress software.

```
% /sbin/su
# cd /etc/fddi
# /bin/cp smtd.mib.orig smtd.mib
# /usr/etc/smtconfig FDDIinterface down up
```

`sub-identifier too large:` *entry*
`<smtd>`

An invalid entry was found in the MIB file */etc/fddi/smtd.mib*. This may indicate that the file is corrupted. Create a new MIB file using the command lines above. If you do not have a backup copy (*/etc/fddi/smtd.mib.orig*) of the MIB file, reinstall your FDDIXPress software.

`TERMINATE`
`<smtd>`

This is a very serious error message. Troubleshooting activity should be started as soon as possible. The SMT daemon has attempted and failed to reset the FDDI board. The FDDI connection on this station is not functioning at all.

- Try restarting all the network interfaces manually with the commands below:

  ```
  % /bin/su
  Password: thepassword
  # /etc/init.d/network stop
  # /etc/init.d/network start
  ```

- Follow the instructions in Chapter 2 to verify the FDDI connection.
- If the error message reappears or if nothing in Chapter 2 remedies the nonfunctional FDDI network connection, restart the system and write down the messages displayed on the terminal during the system's restart. Then contact the Silicon Graphics Technical Assistance Center.

`The mib description doesn't seem to be consistent.`
`Some nodes can't be linked under the 'iso' tree.`
`these nodes are left:` *label* `::= {`*parent subID*`} (`*nodetype*`)`
`<smtd>`

Some inconsistencies were found while the SMT daemon was attempting to parse (read and understand) the MIB file (*/etc/fddi/smtd.mib*). Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the network interface.

`The value given has the wrong type or length`
`<smtd>`

The SMT daemon has encountered a problem. This probably indicates that the MIB file (*/etc/fddi/smtd.mib*) is corrupted. Make a new copy from the backup, then use *smtconfig* to disable and reenable the network interface. This can indicate that the requesting SMT module has requested invalid MIB information.

`This variable is read only`
`<smtd>`

The SMT daemon has encountered a problem. This probably indicates that the MIB file (*/etc/fddi/smtd.mib*) is corrupted. Make a new copy from the backup, then use *smtconfig* to disable and reenable the network interface. This can indicate that the requesting SMT module has requested invalid MIB information.

`Too large packet:`
`<smtd>`

The SMT daemon received a frame with too many bits, so the frame was not processed. This is a minor error and can be ignored unless it occurs frequently, in which case you should report it to the Silicon Graphics Technical Assistance Center.

*interfacename*`,` *phyID*`: TRACE`
`<smtd>`

This is a serious error condition. The SMT daemon has detected a stuck beacon on the ring. The beacon was detected at the network interface and PHY indicated. The entire ring is dysfunctional because at least one station is malfunctioning. The best method for locating the dysfunctional station is to remove each station, one at a time, from the ring, and then follow these steps:

1. Remove one station from the ring and patch the ring.
2. At any functional station on the ring, use *smtstat -s* (Ring Management report, `status` field) to monitor the ring status. The field shows `DIRECTED` when the beacon is stuck and `RINGOP` when the ring is functioning.

3. If *smtstat* indicates that the beacon is stuck, return the removed station to the ring, remove a different station, patch the ring, and monitor the ring status.
4. The stuck beacon condition disappears when you remove the dysfunctional station.
5. Repeat steps 2 and 3 until you have identified the dysfunctional station or until all the stations have been tested.

`type=`*type*`, len=`*length*`: suppressed`
`<smtinfo>`

An error message of the type and length indicated was suppressed so as not to appear in the system log.

`Unaligned parameter:`
`<smtd>`

The SMT daemon encountered improperly aligned data in a received frame. The frame was not processed. This message can indicate a minor incompatibility between two stations on the ring.

`Unexpected EOF: On line` *digit*
`<smtd>`

An unexpected end of file (EOF) occurred on the line of the file indicated when the SMT daemon was reading the MIB file (*/etc/fddi/smtd.mib*). Make a new copy of the file from a backup copy, then use *smtconfig* to stop and restart the FDDI network interface. If you do not have a backup copy of the MIB file, reinstall your FDDIXPress software.

`Unexpected FC =`
`<smtinfo>`

The responding SMT module sent an SMT frame that was not marked with the proper frame control label. Frame control information is specified within one of the fields of the response. This may indicate that the frame was malformed, or it may indicate the responding station is misbehaving.

`Unexpected (`*token*`): On line` *digit*
`<`*smtd*`>`

An unexpected entry (token) was encountered when the SMT daemon was reading the MIB file *(/etc/fddi/smtd.mib*). The problem is on the line of the file indicated. Make a new copy of the file from a backup copy.

`Unknown Frame, FC=`*hexnumeral*
`<`*smtd*`>`

An FDDI frame was received with an illegal frame control (FC) value in the header; the received FC value is indicated in the message.

`Unknown frame type: 0x`*hexnumeral*
`<`*smtd*`>`

The SMT daemon was attempting to respond to an FDDI request frame; however, it discovered that the received frame was an illegal type.

`Usage:`
`usage:`
`<`*smtinfo*`>, <`*smtping*`>, <`*smtconfig*`>, <`*smtmaint*`>`

The SMT command has been invoked without the correct number of arguments or parameters. Correct usage for the command is described in lines displayed after this one. Further detail about the command is available by typing:

`% /usr/bin/man` *commandname*

*station* `uses SMT version # (supported versions: #-#)`
`<`*smtinfo*`>`

The SMT module on the remote station specified in the *smtinfo* command line does not support the version of the SMT standard used by the SMT module on this station. The remote SMT module supports only those versions displayed in the message.

`Variable has bad type`
`<smtd>`

An invalid entry was found in the MIB file */etc/fddi/smtd.mib*. This may indicate that the file is corrupted. Create a new MIB file using the following commands. If you do not have a backup copy (*/etc/fddi/smtd.mib.orig*) of the MIB file, reinstall your FDDIXPress software.

```
% /bin/su
# cd /etc/fddi
# /bin/cp smtd.mib.orig smtd.mib
# /usr/etc/smtconfig FDDinterface down up
```

`version` *digit* `not supported.`
`<smtd>`

The SMT daemon was attempting to respond to an FDDI request frame; however, it discovered that the received frame indicated that it was encoded in an unsupported version of the SMT protocol.

`Warning: This entry is pretty silly: On line` *digit*
`<smtd>`

When reading the MIB file (*/etc/fddi/smtd.mib*), the SMT daemon encountered an entry (object) that was incomplete. The problem is on the line of the file indicated. Make a new copy of the file from a backup copy, then use *smtconfig* to disable and reenable the network interface.

`wrong auth header type`
`<smtd>`

This is a minor internal error not requiring any intervention. An authentication error was detected: invalid packet header type.

`wrong data byte # should be` *hexnumeral* `but was` *hexnumeral*
`<smtping>`

When *smtping* was processing a response packet, it noticed that a data byte (identified in the error message by its sequence within the packet) was not what was expected. The responding station changed the value to the value indicated in the error message.

`Wrong Type (should be` *text*`)`
`<smtd>`

An invalid entry was found in the MIB file */etc/fddi/smtd.mib*. This may indicate that the file is corrupted. Create a new MIB file using the following commands. These command lines assume that you have named your backup copy */etc/fddi/smtd.mib.orig*. If you do not have a backup copy of the MIB file, reinstall your FDDIXPress software.

```
% /bin/su
Password: thepassword
# cd /etc/fddi
# /bin/cp smtd.mib.orig smtd.mib
# /usr/etc/smtconfig FDDinterface down up
```

`You are not superuser`
`<smtmaint>`

The command was invoked when the user was not logged in as superuser. Before using this command, become superuser.

```
% /bin/su
Password: thepassword
#
```

`You must be superuser.`
`<smtd>`

The logged-on user who invoked *smtd* does not have superuser privileges. Use the */sbin/su* command to log on as superuser.

## xpi Driver Error Messages

The error messages described in this section are produced by the *xpi* driver included in FDDIXPress 3.6. Other releases may have additional messages, not included here.

The XPI error messages indicate the FDDIXPress board's location, as illustrated in Figure A-2. The hardware location information is not included in the alphabetized messages in this section.

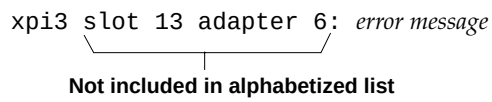



**Figure A-2** Information Not Included in Alphabetized List of xpi Messages

`xpi#: bad firmware checksum`

The firmware on the board has been corrupted; the driver calculated the checksum for the firmware and the calculation did not match the firmware's known correct checksum. Use *smtconfig* to disable then reenable the *xpi#* interface. If the problem persists, the board may need to be replaced. If so, contact the Silicon Graphics Technical Assistance Center.

`xpi#: bad firmware version`

See the message "`firmware too old or new.`"

`xpi#: bad GIO ID` *hexnumeral*

During probing, the first device on an FDDIXPress mezzanine board responded to the driver with an invalid identification. The indicated *hexnumeral* is not a valid identification for a GIO Bus device. This indicates a problem with the board. Contact the Silicon Graphics Technical Assistance Center.

`xpi#: bad MAC address ##:##:##:##:##:##`

The driver considers the board's MAC address invalid. The invalid value is displayed in canonical order and in hexadecimal format. Because of this problem, the driver has disabled the *xpi#* interface. Contact the Silicon Graphics Technical Assistance Center.

`xpi#: bad MAC address checksum`

The MAC address, stored within a chip on the board, has become corrupted. Contact the Silicon Graphics Technical Assistance Center.

`xpi#: bad probe`

The driver's attempt to probe an FDDIXPress mezzanine board failed to retrieve any valid information about the board. This may indicate an incompatibility between the software and the hardware. Use *versions* to verify that the version of FDDIXPress that is currently installed is the correct version for the installed board. Then, use *autoconfig* to rebuild the operating system to include the FDDIXPress driver, and *reboot* the system to start using the new driver. If the problem reoccurs, contact the Silicon Graphics Technical Assistance Center.

`xpi#: bad second GIO ID` *hexnumeral*

During probing, the second FDDI device on an FDDIXPress mezzanine board responded to the driver with an invalid identification. The indicated *hexnumeral* is not a valid identification for a GIO Bus device. This indicates a problem with the board. Contact the Silicon Graphics Technical Assistance Center.

`xpi#: board asleep at` *`linenumber`* `with` *`curaddr`* `not` *`lstaddr`*

The board is not responding. This does not indicate a serious problem, but should appear very infrequently. Each time this message occurs during normal operation, the driver attempts to reset the board. If the message appears only occasionally and the driver successfully resets the board and it functions, you do not need to do anything. For an FDDIXPress DAS board installed into an Indigo or Indy workstation, use the SMT Information Report from the *smtstat -s* command to verify that the board's "station type" is being identified properly as DAS (not SAS). If the board is listed as SAS, the daughter card on the FDDIXPress board may be loose.

If the message occurs frequently or if the board does not function after the message has been displayed, it is possible the board is defective. Contact the Silicon Graphics Technical Assistance Center.

`xpi#: cannot handle address family`

While attempting to send a packet, the driver encountered an unknown address family. The known address families are IP (inet family, which includes TCP and UDP), SDL (supporting the data link provider interface), unspecified (for example, an ARP packet), and raw. Any other address will cause this error message to be displayed. The application that made the transmission request should be altered to use destination addresses for known address families. Nothing is wrong with the FDDIXPress driver or board.

`xpi#: ELM programming errors` *hexaddress*

While checking the status of the FDDIXPress board, the system found a problem with the ELM chip. Contact the Silicon Graphics Technical Assistance Center.

`xpi#: extra board`

The driver found that too many FDDIXPress mezzanine boards are installed. The extra board has not been initialized and is not operational. Driver functionality is not affected by this extra board.

`xpi#: extra board in slot #`

The driver found that too many FDDIXPress boards are installed in this system. The indicated board has not been initialized and is not operational. Driver functionality is not affected by this extra board.

`xpi#: failed to allocate interrupt`

The driver was unable to program the DANG chip on the FDDIXPress mezzanine board to handle interrupts. Contact the Silicon Graphics Technical Assistance Center.

`xpi#: failed to get MAC address`

The driver could not read the MAC address from the board. It is possible that the FDDIXPress board is not firmly seated into its option slot on the CPU board. Follow the instructions to reinstall the board. If this error message continues to be displayed, contact the Silicon Graphics Technical Assistance Center.

`xpi#: failed to reset`

The driver attempted to reset the board, but the board did not respond. Use *smtconfig* to disable then reenable the *xpi#* interface. If the message appears again, halt or shut down the system, turn off the power, and turn the power back on. If the message continues to be displayed, it is possible that the board is not seated firmly into its connector on the CPU board. Follow the instructions to reinstall the board; verify that the FDDIXPress board is firmly seated in the option slot connector. If the problem persists, contact the Silicon Graphics Technical Assistance Center.

`xpi#: failure`

The driver has determined that the board is dead. Contact the Silicon Graphics Technical Assistance Center.

`xpi#:` *digit* `false interrupts`

The driver has experienced the indicated number of unaccountable (false) interrupts. The interrupt count has been reset and the driver is continuing to function as usual. A single occurrence or infrequent display of this message is not a problem. However, if the message is displayed repeatedly, power cycle the system to reset the board. If this does not resolve the problem, contact the Silicon Graphics Technical Assistance Center.

`xpi#: firmware too old or new`

The driver is not compatible with the firmware on the board. This error message is a problem only in the three situations:

- when the message is displayed every time the system is rebooted
- when the system fails to load (write) new firmware onto the board immediately after it displays this message

  You know the system is writing new firmware when it displays the message `Warning: Writing EEPROM. Do not reset the system until finished. ............`

  `Finished.`

- when the message is followed by other error messages

If any of the above three conditions occur, use *smtconfig* to disable then reenable the *xpi#* interface. If *smtconfig* cannot be invoked or if the problem persists, reinstall the FDDIXPress software, invoke the command */etc/autoconfig* to rebuild the operating system, then reboot the system. Upon rebuilding the operating system, be sure to answer `y`, when prompted with `Automatically reconfigure the operating system (y or n)?`

If this error message continues to be displayed, contact the Silicon Graphics Technical Assistance Center.

`xpi#: FSI internal error`

While checking the status of the FDDIXPress board, the system found and recovered from a problem with the FSI component. Contact the Silicon Graphics Technical Assistance Center.

`xpi#: impossible output checksum`

While attempting to calculate the checksum for a transmit packet, the driver encountered a protocol for which it does not perform checksumming. There is no malfunction; the packet was transmitted.

`xpi#: MAC programming error` *hexaddress*

While checking the status of the FDDIXP board, the system found a problem with the MAC chip. Contact the Silicon Graphics Technical Assistance Center.

`xpi#: missing`

The operating system (kernel) has been configured with a driver for an FDDIXPress board, but the board is not responding. The board may have never been installed, it may have been removed, it may be loose from its connection to the system, or it may be dysfunctional.

If the board has not yet been installed, follow the instructions to install it.

If the board has been removed, the driver should be removed from the configured operating system (kernel). Use these commands to rebuild the operating system:

```
% /sbin/su
Password: thepassword
# /etc/autoconfig
...
Automatically reconfigure the operating system (y or n)? y
...
# /etc/reboot
```

If the board is installed, it may be loose. Follow the installation instructions to reinstall it. Take extra precautions to seat its connectors firmly. If this error message continues to be displayed, contact the Silicon Graphics Technical Assistance Center.

`xpi#: missing first PHY card`

The lower daughter card (for example, the hardware servicing *xpi0* or *xpi2*) on the FDDIXPress mezzanine board did not respond to probing. Contact the Silicon Graphics Technical Assistance Center.

`xpi#: missing from slot #`

The board installed in the indicated slot did not respond to the driver's probe for information. The board may not be installed, it may not be seated firmly into it connection to the backplane, or it may be dysfunctional. Reinstall the board, taking extra care to seat it firmly. If the problem persists, contact the Silicon Graphics Technical Assistance Center.

`xpi#: missing second PHY card`

The upper daughter card (for example, the hardware servicing *xpi1* or *xpi3*) on the FDDIXPress mezzanine board did not respond to probing. Contact the Silicon Graphics Technical Assistance Center.

`xpi#: no memory`

The driver was unable to allocate memory for use by an FDDIXPress (*xpi*) interface. This does not indicate a problem with FDDIXPress. A shared system resource is unavailable.

`xpi#: no memory for frame filter`

The driver was unable to allocate memory for use by an FDDIXPress (*xpi*) interface. This does not indicate a problem with FDDIXPress. A shared system resource is unavailable.

`xpi#: no memory for slot #`

The driver was unable to allocate memory for use by an FDDIXPress (*xpi*) interface. This does not indicate a problem with FDDIXPress. A shared system resource is unavailable.

`xpi#: not an FDDI board in slot #`

The board that the driver found in the slot indicated is not an FDDIXPress board.

`xpi#: present`

When resetting the board, the driver found the board. This message is displayed only when the *showconfig* flag is set during the boot. This message does not indicate any problem.

`xpi#: second probe failed`

The driver's attempt to probe the second FDDI device (for example, *xpi1* or *xpi3*) on an FDDIXPress mezzanine board failed to retrieve any valid information. This may indicate an incompatibility between the software and the hardware. Use *versions* to verify that the version of FDDIXPress that is currently installed is the correct version for the installed board. Then, use *autoconfig* to rebuild the operating system to include the FDDIXPress driver, and *reboot* the system to start using the new driver. If the problem reoccurs, contact the Silicon Graphics Technical Assistance Center.

## ipg Driver Error Messages

The error messages described in this section are produced by the *ipg* driver included in FDDIXPress 3.6. Other releases may have additional messages not found here.

`ipg#: bad EDT entry`

The Equipped Device Table (EDT) entry for the FDDIXPress board is incorrect. This is caused by conflicting or duplicate lines in the file */usr/sysgen/system*. Remove all edits that you have made to this file. Then reboot the system to rebuild the operating system (kernel) and reboot it again to start using the new operating system.

`ipg#: bad NVRAM contents`

During startup, the driver attempted to read the contents of the board's non-volatile read-only memory (NVRAM) and found it corrupted. The FDDIXPress board is dysfunctional. Contact the Silicon Graphics Technical Assistance Center.

`ipg#: board asleep at` *linenumber* `with` *curaddr*

The board is not responding. This does not indicate a serious problem, but should appear very infrequently. Each time this message occurs during normal operation, the driver attempts to reset the board. If the message appears only occasionally and the driver successfully resets the board and it functions, you do not need to do anything. If the message occurs frequently or if the board does not function after the message has been displayed, it is possible the board is defective. Contact the Silicon Graphics Technical Assistance Center.

`ipg#: cannot handle address family`

While attempting to send a packet, the driver encountered an unknown address family. The known address families are IP (`inet` family, which includes TCP and UDP);, SDL (supporting the data link provider interface); unspecified (for example, an ARP packet); and raw. Any other type of address will cause this error message to be displayed. The application that made the transmission request should be altered to use destination addresses for known address families. Nothing is wrong with the FDDIXPress driver or board.

`ipg#: download failed with` *hexnumeral hexnumeral*

While the driver was attempting to start the board, it failed to successfully write into the board's memory. The board is dysfunctional. Contact the Silicon Graphics Technical Assistance Center.

`ipg#: duplicate EDT entry`

The Equipped Device Table (EDT) entry for the FDDIXPress board is a duplicate. This is caused by conflicting or duplicate lines in the file */usr/sysgen/system*. Remove all edits that you have made to this file. Then use */etc/autoconfig* to rebuild the operating system (kernel), and reboot the system to start running the new operating system.

`ipg#: failed to get NVRAM`

During startup, the driver was unable to read the FDDIXPress board's memory. The board may be dysfunctional. Contact the Silicon Graphics Technical Assistance Center.

`ipg#: failed to reset`

The driver attempted to reset the board, but the board did not respond. Use *smtconfig* to disable then reenable the *ipg#* interface. If the message appears again, halt or shut down the system, turn off the power, then turn the power back on. If the message continues to display, it is possible that the board is not seated firmly into its connection. Follow the instructions to reinstall the board; verify that the FDDIXPress board is firmly seated. If the problem persists, contact the Silicon Graphics Technical Assistance Center.

`ipg#: firmware failed to start: sig=`*hexnum* `flag=`*hexnum*

When the driver attempted to start the firmware on the board, it failed to start. The board is dysfunctional. Contact the Silicon Graphics Technical Assistance Center.

`ipg#:` *digit*

During an attempt to communicate with the FDDIXPress board (for synchronization or to process an incoming frame), the driver determined that the board is dysfunctional. Contact the Silicon Graphics Technical Assistance Center.

`ipg#: missing`

The operating system (kernel) has been configured with a driver for an FDDIXPress board, but the board is not responding. The board may have never been installed, it may have been removed, it may be loose from its connection to the system, or it may be dysfunctional.

If the board has not yet been installed, follow the instructions to install it.

If the board has been removed, the driver should be removed from the configured operating system (kernel). Use these commands to rebuild the operating system:

```
% su
Password: thepassword
# /etc/autoconfig
...
Automatically reconfigure the operating system (y or n)? y
...
# /etc/reboot
```

If the board is installed, it may be loose. Follow the instructions to reinstall it. Take extra precautions to seat its connectors firmly. If this error message continues to be displayed, contact the Silicon Graphics Technical Assistance Center.

`ipg#: no interrupt vector`

When preparing to reset the FDDIXPress board, the driver did not obtain a necessary piece of information (how to contact the board). The failure was due to a problem with the system or the software (not with the FDDIXPress board). The FDDIXPress software may not be complete or correct; the operating system may have a problem. Reinstall the software that is appropriate for the installed FDDIXPress board. If this does not remedy the problem, contact the Silicon Graphics Technical Assistance Center.

`ipg#: PIO map failed`

When preparing to reset the board, the driver could not obtain necessary information about the board. The failure was due to a problem with the system or the software (not with the FDDIXPress board). The FDDIXPress software may not be complete or correct; the operating system may have a problem. Reinstall the software that is appropriate for the installed FDDIXPress board. If this does not remedy the problem, contact the Silicon Graphics Technical Assistance Center.

`ipg#: present`

When resetting the board, the driver found the board. This message is displayed only when the *showconfig* flag is set during the boot. This message does not indicate any problem.

`ipg#: stray interrupt`

The driver received a message (an interrupt) from the board when it was not expecting one. This occurs when the board and driver are not synchronized with each other. This message does not indicate a problem if the FDDI network interface subsequently becomes functional. If the message appears with each restart of the network interface and if the FDDI network interface does not become functional, the board is probably dysfunctional. In this situation, contact the Silicon Graphics Technical Assistance Center.

`ipg#: unlikely NVRAM MAC address`

During startup, the driver read the MAC address from the board's non-volatile read-only memory (NVRAM) and encountered an address that it believes is incorrect. The NVRAM data is probably corrupted. This is cause for concern, since an incorrect MAC address can cause serious problems for a local area network. Contact the Silicon Graphics Technical Assistance Center.

## rns Driver Error Messages

The error messages described in this section are produced by the *rns* driver included in FDDIXPress 6.3. Other releases may have additional messages, not included here.

The *rns* error messages indicate the location of the FDDIXPress board, as illustrated in Figure A-3. The *bus*# identifies the PCI bus where the FDDI card is connected and the *dev*# is the PCI device number of the card on the bus.

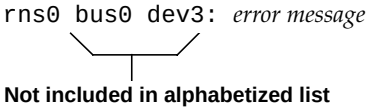



**Figure A-3** Information Not Included in Alphabetized List of rns Messages

The hardware location information is not included in the alphabetized messages in this section.

`rns#: bad IFDDI status 0x%x`

The FDDIXPress driver has encountered an internal problem. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: bad unit number #`

There is a problem in the IRIX software. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: CAMEL NP error`

The FDDIXPress driver has encountered an internal problem. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: cannot handle address family x`

There is a problem in the IRIX software. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: Can't alloc something`

The driver was unable to allocate memory for use by the *rns*# interface. This does not indicate a problem with the FDDIXPress driver. A shared system resource is not available.

`rns#: Can't get MAC address`

The driver could not read the MAC address from the card. It is possible that the FDDIXPress card is not firmly seated into its option slot. Follow the instructions to reinstall the card. If this error message continues to display, contact the Silicon Graphics Technical Assistance Center.

`rns#: Can't handle address family`

While attempting to send a packet, the driver encountered an unknown address family. The known address families are IP (`inet` family, which includes TCP and UDP); SDL (supporting the data link provider interface); unspecified (for example, an ARP packet); and raw. Any other address causes this error message to display. The application that made the transmission request should be altered to use destination addresses for known address families. Nothing is wrong with the FDDIXPress driver or card.

`rns#: Can't initialize card`

The driver attempted to reset the card, but the card did not respond. Use *smtconfig* to disable then reenable the *rns*# interface. If the message appears again, halt or shut down the system, turn off the power, and turn the power back on.

If the message continues to display, it is possible that the board is not seated firmly into its option slot. Follow the instructions to reinstall the card. If this error message continues to display, contact the Silicon Graphics Technical Assistance Center.

`rns#: Can't install isr`

There is a problem in the IRIX software. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: Corrupted read descriptor ring`

The FDDIXPress driver has encountered an internal problem. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: Corrupted write descriptor ring`

The FDDIXPress driver has encountered an internal problem. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: Extra card`

The driver found too many FDDIXPress cards installed in this system. The indicated card has not been initialized and is not operational. Driver functionality is not affected by this extra card.

`rns#: FSI host error`

The FDDIXPress driver has encountered an internal problem. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: FSI internal error`

While checking the status of the FDDIXPress card, the system found and recovered from a problem with the FSI component. Contact the Silicon Graphics Technical Assistance Center.

`rns#: FSI port error`

The FDDIXPress driver has encountered an internal problem. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: FSI ring error`

The FDDIXPress driver has encountered an internal problem. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: hwgraph_char_device_add`

There is a problem in the IRIX software. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: IFDDI CMR asleep`

The FDDIXPress driver has encountered an internal problem. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: IFDDI CMR broken`

The FDDIXPress driver has encountered an internal problem. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: IFDDI FCR fetch asleep`

The FDDIXPress driver has encountered an internal problem. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: IFDDI FCR stor asleep`

The FDDIXPress driver has encountered an internal problem. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: MAC programming error`

The FDDIXPress driver has encountered an internal problem. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: MAC address` *xx*:*xx*:*xx*:*xx*:*xx*:*xx*

The system has been started with "showconfig=1" command.

`rns#: no memory`

There is a problem in the IRIX software. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: no memory for driver`

There is a problem in the IRIX software. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: no memory for frame filter`

There is a problem in the IRIX software. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: port error type #`

The FDDIXPress driver has encountered an internal problem. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: rings not 4GB aligned at 0x%x`

There is a problem in the IRIX software. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: stray interrupt`

The FDDIXPress driver has encountered an internal problem. Please contact the Silicon Graphics Technical Assistance Center.

`rns#: wrong vhdl`

There is a problem in the IRIX software. Please contact the Silicon Graphics Technical Assistance Center.

*Appendix B*

# smtstat Reports

This appendix explains the individual reports that */usr/etc/smtstat -s* displays on the screen.

For information on the usage of *smtstat*, see the smtstat(1M) man page.

The *smtstat -s* command generates the following reports containing SMT information. Each report is explained in a separate section of this appendix:



In each section, all the fields contained in the report are described. For each field, the following information is described:

- Field name as displayed in the report. Fields that correspond to variables in the SMT management information base (MIB) use the MIB variable name.
- Possible entries or range of values for that field.
- Definition of the field and flags. Some items include the official ANSI name (in parentheses) for the item. For example, (fddiMAC72). More information can be obtained by reading the section on MIB structure in the ANSI SMT document.

The example in Table B-1 defines a field labeled `PC withhold` from an unnamed report.

**Table B-1** smtstat Report Field

| Field | Possible Entries | Description |
|---|---|---|
| `PC withhold` | | The reason for withholding a port connection. (fddiPORT63) |
| | `NONE` | Normal entry. No connection has been withheld. |
| | `MM` | Connection was withheld due to illegal port connection: Port M to Port M. |
| | `OTHER` | Connection was withheld for a nonspecified reason. |

ANSI FDDI documents are the source for much of the text in this appendix. See "Additional Reading" on page xiii for information about obtaining these documents.

The following user interface allows you to manipulate the reports:

- To display a different report, type the report's number. For example, to view the SMT report, type `6`.
- To quit, press `q` or `Ctrl+C`.
- To refresh the screen, press `Ctrl+L`.
- To change the time interval for which report statistics are displayed, press one of the following keys:

  `r` Each second, shows totals accumulated since last reboot.

  `d` Resets fields to zero every second, and each second shows totals accumulated within that last second.

  `z` Resets fields to zero when `z` is pressed, and every second displays the accumulating totals.

## MAC Status Report

The MAC Status report monitors the number of packets transmitted and received and the number of frames and tokens. These numbers are continuously updated on the screen. You can also see the number of address bits (A bits) and copied bits (C bits). These numbers should be almost equal; if they are not, a MAC may have recognized an A bit but was unable to copy it. Figure B-1 shows an example of a MAC Status report.

```
1: MAC Status for goofy -- Oct 29 10:54:23 D: Delta/second

                     ipg0                                    ipg0
MAC state            ACTIVE              Transmit Errors:
packets xmit         889106               underflow          7
packets rcvd         981925               abort              3
frames               10842285            Receive Errors:
A bit                142890               E bit rcvd         554
C bit                142861               set E bit          11
void frames          65835                bad CRC,len        554
total junk           55738                missed             0
tokens issued        954853               others' miss       29
tokens               2474866620           no host bufs       1
ring latency         34usec               lost               0
ring load            74%                  flushed            3552
token latency          0.052              aborted            0
t_neg                159.990              small gap          0
t_max                165.002              too short          0
t_min                  4.000              too long           0
t_req                165.000              poss dup addr      0
tvx                    4.019              FIFO overflow      0
                                          stray tokens       0


1:MAC  2:Port  3:Ring Mgt  4:Config Mgt  5:Neighbors  6:SMT   DZR:Mode
```

**Figure B-1** MAC Status Report

The information on the MAC Status report screen is organized into two columns: the left and the right. Table B-2 explains the left column fields, and Table B-3 describes the right column fields.

**Table B-2** MAC Status, Left Column

| Field | Possible Entries | Description |
|---|---|---|
| `MAC state` | | The state of the MAC. |
| | `ACTIVE` | Normal state—transmitting and receiving frames normally. |
| | `OFF` | Hardware off. Normal for initial state. Abnormal once system is configured, rebooted, and SMT daemon is running. |
| | `CLAIM` | In process of sending claim tokens during ring recovery. |
| | `BEACON` | In process of sending beacons after ring recovery failed. |
| `packets xmit` | `0-n` | The count of the frames transmitted by this MAC. (fddiMAC73) |
| `packets rcvd` | `0-n` | The count of the frames successfully received into this station's buffers by this MAC. (fddiMAC72) |
| `frames` | `0-n` | The number of valid frames that have been seen by this MAC, including those received by this station. This number also includes packets (not addressed to this station and so not received by it) that have passed this MAC on the ring. (fddiMAC71) |
| `A bit` | `0-n` | The count of frames received into this station's buffers with the "destination address matched" bit set by a previous station. This bit is set in the frame as it passes a station whose individual address matches the destination address in the frame. |
| `C bit` | `0-n` | The count of frames received into this station's buffers with the "frame copied" bit set by a previous station. This bit is set in the frame as it passes a station that copies the frame into the station's buffers. |

**Table B-2 (continued)** MAC Status, Left Column

| Field | Possible Entries | Description |
|---|---|---|
| `void frames` | `0-n` | The count of discarded frames with the void frame control value transferred into this station's buffers and then discarded. These happen most often when the hardware is in "promiscuous" mode for monitoring by NetLook. Another source is corruption of frames by noise not detected by the frame check sequence (FCS). Such infrequent problems are detected and fixed by higher layer protocols. (NetLook is described in the *NetVisualyzer User's Guide*.) |
| `total junk` | `0-n` | This count includes frames received into a station buffer but discarded because they were void frames, "aborted" (that is, truncated before a proper ending), or "flushed" (that is, the station was too busy to realize that a frame was not meant for it before copying the first part of the frame into a buffer). |
| `tokens issued` | `0-n` | The number of tokens sent by this station. The station issues a token after every burst of packets it sends (after grabbing the circulating token) and after winning the claim process when restoring the ring. |
| `tokens` | `0-n` | The total number of times this station has seen a token on this MAC. This count is valuable for determining network load. (fddiMAC74) |
| `token latency` | `0-n` | The current token rotation time (TRT) in milliseconds. |
| `ring latency` | `0-n usec` | The minimum token rotation time in microseconds. |
| `ring load` | `0-n%` | The load on the ring, expressed as a percentage. |
| `t_neg` | `0-n` | Negotiated target token rotation time (TTRT) in milliseconds obtained during the claim process. (fddiMAC52) |
| `t_max` | `0-n` | Maximum TTRT (in milliseconds) supported by this station. (fddiMAC53) |
| `t_min` | `0-n` | Minimum TTRT (in milliseconds) supported by this station. (fddiMAC5) |

**Table B-2 (continued)** MAC Status, Left Column

| Field | Possible Entries | Description |
|---|---|---|
| t_req | 0-n | This station's bid for the TTRT in milliseconds. (fddiMAC51) |
| tvx | 0-n | The valid transmission timer (TVX) used for ring recovery. If a valid frame or token is not received within the specified time (in milliseconds), the claim process is started. (fddiMAC54) |

**Table B-3** MAC Status, Right Column

| Field | Possible Entries | Description |
|---|---|---|
| Transmit Errors: | | |
| underflow | 0-n | The hardware output first-in, first-out buffer underflowed during frame transmission. A large number of these problems indicate a hardware problem. |
| abort | 0-n | The line state changed during transmission or the station received a MAC frame (that is, claim or beacon) while the station was transmitting a frame, indicating that the ring is recovering itself. |
| Receive Errors: | | |
| E bit rcvd | 0-n | The number of frames copied into the station's buffers with the frame status error bit already set by a previous station. |
| set E bit | 0-n | The count of frames with bad CRC or length that caused this station to set the E bit on a frame passing by this station, including those frames copied into the station's buffers. |
| bad CRC, len | 0-n | The count of frames with bad CRC or length copied into station buffers. |
| missed | 0-n | Frames this station should have received, but for some reason the station was too busy to copy the frames into a buffer. |

**Table B-3 (continued)** MAC Status, Right Column

| Field | Possible Entries | Description |
|---|---|---|
| `others' miss` | `0-n` | The count of frames missed by other stations. (This is equal to A bit count minus C bit count.) |
| `no host bufs` | `0-n` | This generally counts frames that were received into one set of buffers but discarded because of a lack of buffers at the next stage. |
| `lost` | `0-n` | Count of frames dropped by the FORMAC due to, for example, invalid symbols from the PHY. (fddiMAC82) |
| `flushed` | `0-n` | Count of flushed frames (that is, the system was too busy to realize that a frame was not meant for it before copying the first part of the frame into a buffer). |
| `aborted` | `0-n` | Count of aborted frames (that is, frames truncated before a proper ending). |
| `small gap` | `0-n` | Number of times when too small a gap between frames occurred. |
| `too short` | `0-n` | Count of frames less than the minimum size. |
| `too long` | `0-n` | Count of frames more than the maximum size. |
| `poss dup addr` | `0-n` | Count of frames addressed to this MAC that have the A bit set. Frames directly addressed to this station that already have the A bit set indicate that some other station has the same MAC address as this station. This may count frames with multicast addresses, and so is not a reliable indication of a duplicate address. |
| `FIFO overflow` | `0-n` | Hardware input first-in, first-out buffer overflow count. |
| `stray tokens` | `0-n` | Count of tokens received while in "Transmit Data" or "Issue Token" states (that is, unexpected tokens). This may indicate a dysfunctional token ring controller somewhere on the ring. |

## Port Status Report

The Port Status report shows the state of the ports (A and B, or S), including various types of errors, such as a wrap. Highlighted ratio or alarm fields indicate a problem with the port. Figure B-2 is an example of port status information for a DAS.

The Port Status report screen information is organized as two main columns (left and right) and a bottom section. Each column has two subcolumns that list entries for each port (B and A, or S). Table B-4 explains the fields for the left column, Table B-5 describes the right column fields, and Table B-6 describes the bottom section fields.

```
2: Port Status -- Oct 7 18:26:28 D: Delta/second

                    Port B      Port A                          Port B   Port A
neighbor            A           B             noise             0        0
PCM state           ACTIVE      ACTIVE        elasticity ovf    0        0
PC withhold         NONE        NONE          Not copied err:
conn state          ACTIVE      ACTIVE         threshold        0.023%   0.023%
tx line state       THRU        THRU           ratio            0.000%   0.000%
rcv line state      ILS         ILS           Link errors:      0        0
LCT failures        0           0              estimate         16       16
connects            0           0              alarm            8        8
Frame errors:                                  cutoff           7        7
 threshold          0.023%      0.023%         long-term        16       16
 ratio              0.000%      0.000%

B flags               <LS,RC,JOIN,THRU,RNGOP>
A flags                           <LS,RC,JOIN,THRU>
# signal bits        10          10
B r_val               <Port_A,CONN,SHORT_LCT>
B t_val               <Port_B,CONN,SHORT_LCT>
A r_val                           <Port_B,CONN,SHORT_LCT>
A t_val                           <Port_A,CONN,SHORT_LCT>


1:MAC  2:Port  3:Ring Mgt  4:Config Mgt  5:Neighbors  6:SMT   DZR:Mode
```

**Figure B-2** Port Status Report (for a Dual Ring DAS)

**Table B-4** Port Status, Left Column

| Field | Possible Entries | Description |
|---|---|---|
| neighbor | A, B, M, ? | The type of the port connector (PC) at the other end of the physical connection. This should be watched to detect twisted cables. Port B's neighbor type should be A, and vice versa for a DAS, dual-ring. (fddiPORT13) |
| PCM state | | Current state of the physical connection management (PCM) state machine. (fddiPORT62) |
| | OFF | Initial state. |
| | BREAK | Start of connection. |
| | TRACE | Localizing stuck beacon condition. |
| | CONNECT | Synchronizing the connection for signaling. |
| | NEXT | Signaling state. |
| | SIGNAL | Sending/receiving signal bits. |
| | JOIN | Initial state for active connection establishment. |
| | VERIFY | Verifying state for connection establishment. |
| | ACTIVE | Normal entry. Connection established and port is incorporated into ring. |
| | MAINT | Maintenance state. |
| | BYPASS | Optical bypass switch active or just passing frames or tokens. |
| PC withhold | | The reason for withholding a connection. (fddiPORT63) |
| | NONE | Normal entry. |
| | MM | When an M port is connected to another M port, the connection is withheld. |
| | OTHER | |

**Table B-4 (continued)** Port Status, Left Column

| Field | Possible Entries | Description |
|---|---|---|
| conn state | | Gives a higher-level view of the connect state of the port combining the PCM state and PC withhold values. (fddiPORT61) |
| | DISABLED | |
| | CONNECTING | Attempting to connect. |
| | STANDBY | |
| | ACTIVE | Normal entry for functioning port. |
| tx line state | | Current transmitted line state. THRU is normal. |
| | QLS | Quiet: absence of activity on the medium. |
| | HLS | Halt: forced logical break in activity. |
| | ILS | Idle: normal condition between transmissions. |
| | MLS | Master. |
| | ALS | Active. |
| | ULS | Unknown (invalid). |
| | NLS | Noise. |
| | LSU | Cannot determine current state. |
| | REP | Repeat, act as a bypass. |
| | SIG | Ready to do CMT signaling. |
| | THRU | Normal entry. PHY is connected to the ring. |
| | WRAP | Ring is wrapped on this port. For a station with two ports where one or both ports are connected to a concentrator, this is normal. |
| | LCT | Performing link confidence test. |
| | LCTOFF | Link confidence test disabled. |
| | BREAK | Break state entered. |

**Table B-4 (continued)** Port Status, Left Column

| Field | Possible Entries | Description |
|---|---|---|
| `rcv line state` | | Current line state received by this port. ILS is the normal value. |
| | `QLS` | Quiet: used as part of physical connection establishment process. May also indicate absence of a physical connection. |
| | `HLS` | Halt. |
| | `ILS` | Idle: establish and maintain clock synchronization. |
| | `MLS` | Master. |
| | `ALS` | Active: indicates reception of a MAC frame. |
| | `ULS` | Unknown: invalid value. |
| | `NLS` | Noise: indicates noisy physical link. |
| | `LSU` | Cannot determine current state. |
| `LCT failures` | `0-n` | Count of total failures of the link confidence test (LCT). The LCT is used to test a link to determine if the link quality is adequate for ring operation. |
| `connects` | `0-n` | Count of times since the link was last functional that port has been through the break state without joining. |
| `Frame errors:` | | Frame errors occur when a frame is lost or is received with errors. |
| `threshold` | `0.023%` | The threshold for frame errors. When the ratio exceeds this value, the ratio field becomes highlighted. (fddiMAC95) |
| `ratio` | `0-n%` | Ration of current frame errors to total received frames; highlighted when ratio exceeds threshold. (fddiMAC96) |

**Table B-5** Port Status, Right Column

| Field | Possible Entries | Description |
|---|---|---|
| `noise` | `0-n` | Count of times when the line state is bad for a while. The SMT daemon tests the link on which such a "noise event" occurs. |
| `elasticity ovf` | `0-n` | Count of elasticity buffer overflows. |
| `Not copied errors:` | `0-n` | Not copied errors occur when a bit is seen (that is, the A bit is set) but not copied (that is, the C bit is not set) on a received frame. |
| `threshold` | `0.023%` | The threshold for not copied errors. When the ratio exceeds this value, the `ratio` field becomes highlighted. (fddiMAC103) |
| `ratio` | `0-n%` | Current ratio of not copied errors to total received frames; highlighted when ratio exceeds threshold. (fddiMAC105) |
| `Link errors:` | | Link error values are average link error rates (LER) that range from a high rate of 4 (indicating 10e–4 or one error in every $10^4$ bits) to a low of 16 (indicating 10e–16 or one error in every $10^{16}$ bits). This attribute is reported as the absolute value of the base 10 logarithm of the LER estimate value. The LER estimate is expressed as LEM CT/(T*125*10e6). Since T (time duration) is not specified in the SMT standard, the time duration during which the LER is computed is implementation-specific. |
| `estimate` | `16` (meaning less than one error in every $10^{16}$ bits) | This is the official error rate value advertised in SMT frames for other stations. It is for the link on the indicated port. (fddiPORT51) |
| `alarm` | `8` (meaning less than one error in every $10^8$ bits) | The link error rate at which a link connection generates an alarm. This field becomes highlighted when the alarm condition is met. (fddiPORT59) |

**Table B-5 (continued)** Port Status, Right Column

| Field | Possible Entries | Description |
|---|---|---|
| `cutoff` | `7` (meaning less than one error in every $10^7$ bits) | The link error rate at which the connection is broken. The SMT daemon shuts down and tests the link when the link error rate becomes more frequent than this level. (fddiPORT58) |
| `long-term` | `4-16` | Long-term link error rate estimate based on all errors seen since the last time the link was reset (that is, the PCM state was BS, for break state). A 4 indicates a high error rate while a 16 indicates a low rate. |

**Table B-6** Port Status, Bottom Section

| Field | Possible Entries | Description |
|---|---|---|
| `A, B, and S flags:` | | PCM operational flags (from section 9.4.3.1 of ANSI SMT document). |
| | `BS` | Break state: PCM not leaving break state at appropriate time. |
| | `LS` | A line state has been received since entering current state. |
| | `RC` | Receive code. |
| | `TC` | Transmit code. |
| | `TD` | Transmit delay. |
| | `JOIN` | The port is ready to be incorporated in the token path. |
| | `HOLD` | If dual attach, don't wrap when a fault occurs on a single ring. |
| | `THRU` | The PHY is connected to the ring. |
| | `DISABLED` | Stay in "maint" state. |
| | `WA` | Withhold Port A as a backup link. |
| | `WAT` | Withhold Port A in Tree mode. |

**Table B-6 (continued)** Port Status, Bottom Section

| Field | Possible Entries | Description |
|---|---|---|
| | LEMFAIL | Recently suffered LER cutoff. |
| | NE | Noise Event timer expired, indicating that a "noise event" or burst of many 4-bit symbols was corrupted. The link is shut down and retested when a noise event occurs. |
| | RNGOP | Ring is operational. |
| | OBS | Optical bypass switch present. |
| | CON_ Undesirable | Undesirable physical connection such as A-to-A or B-to-B. |
| | C_Illegal | Illegal connection attempted (for example, M-to-M connection). |
| | TR_REQ | Trace request. |
| | DRAG | Indicates one of the following conditions: taking too long with the link turned off after receiving a TRACE request, or too many consecutive failed attempts to complete PC signaling, including the link confidence test. |
| # signal bits | | The number of PCM signal bits received or transmitted in the most recent effort to complete PC signaling. If the most recent PC signaling was successful, then 10 bits will have been sent and received. (Section 9.6.3 of ANSI SMT document) |
| A and B r_val: | | Received (set) PCM signal bits. |
| | A, B, M, S | Type of port. |
| | CONN | Current connection is compatible. |
| | CON_ Undesirable | Current connection is undesirable. |
| | short | There is no recent history of excessive link errors. |
| | medium, long | A rejection occurred, due to link errors. Many rejections occurred. |

**Table B-6 (continued)** Port Status, Bottom Section

| Field | Possible Entries | Description |
|---|---|---|
| | `extended` | The port is being withheld from any connection due to an undesirable connection. |
| | `MAC available for LCT` | |
| `A and B t_val:` | Same as for `r_val.` | Transmitted (set) PCM signal bits. |

## Ring Management Status Report

The Ring Management Status report shows the status of the ring for an FDDI network interface. An actively growing number of received claims or beacons indicates a problem with the ring, except when a station is being added to the ring. Figure B-3 shows an example of the Ring Management Status report.

```
3: RMT Status for fddi-sol -- Oct 29 10:55:33 D: Delta/second

                 xpi0                                    xpi0

ring ok          ON               Claims received:
ring up cnt      262               mine                  0
TRT expires      0                 lower                 39
TVX expires      143               higher                529
dup MAC cnt      0                Beacons received:
                                   mine                  0
started          02/24 16:09:26    from others           0
                                   promisc drop          0
                                  Claim state            164
                                  Beacon state           0
RMT state        RINGOP
RMT flags:
 xpi0            <JOIN,MAC_AVAIL,RE>


1:MAC  2:Port  3:Ring Mgt  4:Config Mgt  5:Neighbors  6:SMT   DZR:Mode
```

**Figure B-3** Ring Management Status Report

The Ring Management Status report screen information is organized as two columns (left and right) and a bottom section. Table B-7 explains the fields for the left column, Table B-8 describes the right column fields, and Table B-9 describes the bottom section fields.

**Table B-7** Ring Management Status, Left Column

| Field | Possible Entries | Description |
|---|---|---|
| `ring ok` | `ON` | Indicates if the ring is in the operational state. This field displays `ON` while tokens and other frames are circulating. |
| `ring up cnt` | `0-n` | Count of times the ring has entered the operational state from the nonoperational state; number of times the token has been lost. (fddiMAC86) |
| `TRT expires` | `0-n` | Count of times that the token rotation timer (TRT) expired, indicating that the token was lost which forces ring recovery. See the `t_neg` and `t_req` values on MAC Status report. |
| `TVX expires` | `0-n` | Count of times that the valid transmission timer (TVX) expired. It can expire when there are no valid frames seen on the ring. It means that the ring must be recovered. See the `tvx` value on MAC Status report. (fddiMAC83) |
| `dup MAC cnt` | `0-n` | Number of indications of possible duplicate MAC address. |
| `started` | *date time* | The date (month/day) and time (hour:minute:second) when the SMT module started functioning. |

**Table B-8** Ring Management Status, Right Column

| Field | Possible Entries | Description |
|---|---|---|
| `Claims received:` | | MAC claim frames containing "requested token rotation timer" (RTRT). Claim frames are used during ring recovery. |
| `mine` | `0-n` | Count of station's own claims. |
| `lower` | `0-n` | Count of frames with lower values than this station's. The value is either a lower RTRT value, or if the timer value matches this station's, a lower address value. |
| `higher` | `0-n` | Count of frames with higher values than this station's. The value is either a higher RTRT value, or if the timer value matches this station's, a higher address value. |
| `Beacons received:` | | MAC beacon frames are used when there is a serious ring failure, indicating that the claim process failed. |
| `mine` | `0-n` | Count of station's own beacons. |
| `from others` | `0-n` | Count of other stations' beacons. |
| `promisc drop` | `0-n` | Count of beacons received but not copied to host memory (that is, dropped). This can happen when the station is promiscuously receiving (copying into buffers) all frames in order to "snoop" on the fiber while using NetLook. |
| `Claim state` | `0-n` | Number of times this station has entered the claim state, when it will transmit MAC claim frames to recover the ring. |
| `Beacon state` | `0-n` | Number of times this station has entered the beacon state, when it will transmit MAC beacon frames to recover the ring. |

**Table B-9** Ring Management Status, Bottom Section

| Field | Possible Entries | Description |
|---|---|---|
| `RMT state` | | Current state of the Ring Management state machine. (fddiMAC111) |
| | `ISOLATED` | Initial state. |
| | `NONOP` | Ring recovery in progress; ring not operational. |
| | `RINGOP` | Ring is operational. |
| | `DETECT` | Ring not operational for a while. |
| | `NONOP_DUP` | Ring is not operational; this MAC address is likely a duplicate. |
| | `RINGOP_DUP` | Ring operational; however, this MAC address is likely a duplicate. |
| | `DIRECTED` | Stuck beacon (beaconing more than 7 seconds). |
| | `TRACE` | Trace in progress. |
| `RMT flags:` *network interface name* | | (Section 10.3.1 of ANSI SMT document) |
| | `JOIN` | The port has been incorporated in the token path. |
| | `MAC_AVAIL` | The MAC is available for transmitting and receiving. |
| | `JM` | Jamming has been initialized. |
| | `NO` | The ring has not been operational for an extended period. |
| | `BN` | The MAC is in the beacon state. |
| | `CLM` | The MAC is in the claim state. |
| | `RE` | Recovery enabled. |

## Configuration Information Report

The Configuration Information report shows the types of connection paths available and the current paths that pass through the station (the PRiMary and SECondary paths). A CE (Connection Entity) value of `INSERT_X` indicates that both the primary and secondary paths are used and the ring is wrapped. The report also shows whether an optical bypass switch (OBS) is installed; in this case, an OBS is present. Figure B-4 shows an example of configuration information.

```
4: Configuration Information -- Oct 7 18:26:16 D: Delta/second
                  xpi0                                    xpi0
path avail        PRM,SEC,ISO             DNA port        A
path requested    PRM,SEC                 msloop status   UNKNOWN
cur path          SEC                     root DNA port   ?
root concent      FALSE                   root cur path   UNKNOWN

                  Port B     Port A                       Port B     Port A
undes. conn       OFF        OFF          PCM target      CMT        CMT
remote MAC        OFF        ON           maint line st   QLS        QLS
CE state          INSERT_S   INSERT_P     TB max          50         50
path request      SEC        PRM          break state     OFF        OFF
MAC placemt       3          3            optical bypass  present    present
path avail        PRM,SEC    PRM,SEC      OB insert max   25         25
loop time         0          0            inserted        yes        yes
fotx              MULTI      MULTI        insert policy   ok         ok
llc priority      0          0            debug level     2          2
B conn policy     LCT,PLACEMENT
A conn policy                 LCT,PLACEMENT


1:MAC  2:Port  3:Ring Mgt  4:Config Mgt  5:Neighbors  6:SMT    DZR:Mode
```

**Figure B-4** Configuration Information Report

The Configuration Information report screen information is organized as a top section (with two columns), a bottom left column, and a bottom right column. Table B-10 explains the fields for the top section, Table B-11 describes the bottom left column fields, and Table B-12 describes the bottom right column fields.

**Table B-10** Configuration Information, Top Section

| Field | Possible Entries | Description |
|---|---|---|
| `path avail` | | Indicates the paths available. (fddiPATHClass.PATH11) |
| | `PRM` | Primary. |
| | `SEC` | Secondary. |
| | `ISO` | Isolated. |
| | `LOC` | Local. |
| `path requested` | same as above | Indicates the path requested. (fddiPATHClass.PATH11) |
| `cur path` | same as above | Indicates the association of the MAC with a station path. (fddiMAC23) |
| `root concent` | `FALSE, TRUE` | `TRUE` indicates a root concentrator MAC. (fddiMAC28) |
| `DNA port` | `A, B, M` | Downstream neighbor port connection type. (fddiMAC33) |
| `msloop status` | `UNKNOWN` | Master-slave loop status. (fddiMAC121) |
| `root DNA port` | `?, A, B, M` | If a root MAC, indicates downstream neighbor port type (? means unknown). (fddiMAC122) |
| `root cur path` | `UNKNOWN` | If a root MAC, indicates the current path. (fddiMAC123) |

**Table B-11** Configuration Information, Bottom Left Column

| Field | Possible Entries | Description |
|---|---|---|
| undes. conn | OFF<br>ON | Set to ON when an undesirable connection attempt has been made. Indicates that a fiber cable is plugged into the wrong socket. (fddiPORT81) |
| remote MAC | OFF<br>ON | When set to ON, indicates that the remote partner intends to place a MAC in the output token path of this port. (fddiPORT15) |
| CE state | | Current connection entity's (CE) state. (fddiPORT16) |
| | | Not inserting. |
| | ISOLATED | Inserting on primary. |
| | INSERT_P | Inserting on secondary. |
| | INSERT_S | Connected to a concentrator. |
| | INSERT_X | Connected to a local path. |
| | Local | |
| path request | same as path avail | Indicates the desired path for the port. (fddiPORT17) |
| MAC placemt | 0-n | Indicates MAC whose transmit path exits the station through this port. Values start at "total phy count + 1" if there is MAC. (fddiPORT18) |
| path avail | same as previous path avail | Indicates the paths available for the M and S ports. (fddiPORT19) |
| loop time | 0-n | Time (in msec) for the optional MAC local loop to prevent deadlock. (fddiPORT21) |
| fotx | SINGLE<br>MULTI | The fiber optic transmitter (cable) class: single-mode or multi-mode. (fddiPORT22) |
| llc priority | 0-n | Link-level control priority. |
| B and A, or S conn policy | | The port connection policies on this node. (fddiPORT14) |
| | LCT | Link confidence test is performed. |

**Table B-11 (continued)** Configuration Information, Bottom Left Column

| Field | Possible Entries | Description |
|---|---|---|
| | LOOP | MAC local loop is made active before connection. |
| | PLACEMENT | MAC exists. |

**Table B-12** Configuration Information, Bottom Right Column

| Field | Possible Entries | Description |
|---|---|---|
| PCM target | CMT | Indicates whether CMT is turned on or off. |
| maint line st | QLS | Specifies the symbol stream to be transmitted when the PCM is in the maintenance state. See smtmaint(1) reference page. (fddiPORT31) |
| TB max | 0-n msec | Break time before the Break State flag is set. (fddiPORT32) |
| break state | ON, OFF | When ON, indicates that the PCM state machine is not leaving the break state in an expected time interval and that a problem is suspected. (fddiPORT33) |
| optical bypass | none, present | Indicates if an optical bypass switch is present. (fddiATTACHMENT12) |
| OB insert max | 0-n | Maximum optical bypass switch insertion/ deinsertion time for this station. (fddiATTACHMENT13) |
| inserted | yes, no | Indicates whether the attachment is currently inserted in the node. (fddiATTACHMENT14) |
| insert policy | ok | Indicates that it is all right to insert the port. (fddiATTACHMENT15) |
| debug level | 0-6 | Current level of debugging/error message logging by the FDDI kernel. |

## Neighbor Information Report

The Neighbor Information report shows information about a station's upstream and downstream neighbors. It shows whether or not the upstream neighbor address (UNA) and downstream neighbor address (DNA) are valid and if addresses are duplicated. In this case, no duplicate addresses are seen. The report also lists the addresses in FDDI order and canonical order. Figure B-5 shows an example of neighbor information for a station called *fddi-sol*.

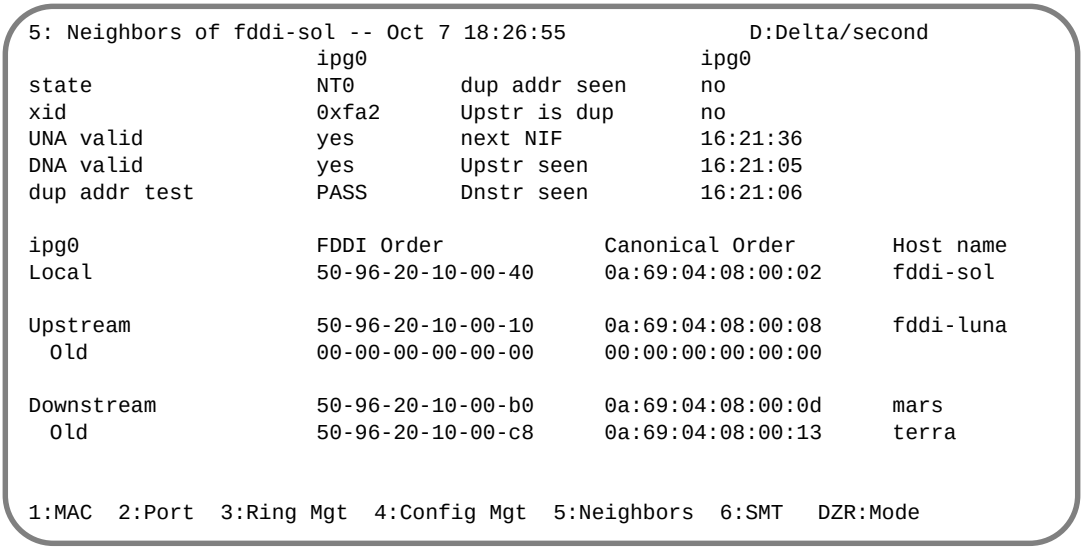



**Figure B-5** Neighbor Information Report

The Neighbor Information report screen information is organized as a top section (with two columns) and a bottom section. Table B-13 explains the fields for the top section, and Table B-14 describes the bottom section fields.

**Table B-13** Neighbor Information, Top Section

| Field | Possible Entries | Description |
|---|---|---|
| `state` | | Neighbor notification (NN) transmitter state. |
| | `NT0` | Wait. |
| | `NT1` | Send. |
| `xid` | `0-n` (in hex) | Current NN transaction ID. |
| `UNA valid` | `yes, no` | Upstream neighbor address displayed in neighbor ID list (in bottom section) is valid. |
| `DNA valid` | `yes, no` | Downstream neighbor address displayed in neighbor ID list (in bottom section) is valid. |
| `dup addr test` | | Current status of duplicate address detection. (fddiMAC29) |
| | `NONE` | Test not performed. |
| | `PASS` | No duplicate address detected. |
| | `FAIL` | Duplicate address detected. |
| `dup addr seen` | `yes, no` | This MAC has the same address as another MAC on the ring. (fddiMAC112) |
| `Upstr is dup` | `yes, no` | Upstream neighbor has reported a duplicate address condition. (fddiMAC113) |
| `next NIF` | `time` | The time (hour, minute, second) when the next Neighbor Information Frame will be sent. |
| `Upstr seen` | *time* in 24-hour format | The time (hour, minute, second) when Neighbor Information Frame (NIF) from upstream neighbor was last seen. |
| `Dnstr seen` | *time* in 24-hour format | The time (hour, minute, second) when Neighbor Information Frame (NIF) from downstream neighbor was last seen. |

**Table B-14** Neighbor Information, Bottom Section

| Field | Possible Entries | Description |
|---|---|---|
| *network interface name* | `ipg#, xpi#, rns#` | Identifies the network interface for which information is being displayed. |
| | `Local` | Information about this station. |
| | `Upstream` | Information about the current neighbor immediately upstream. |
| | `Old` | Information about the previous upstream neighbor. |
| | `Downstream` | Information about the current neighbor immediately downstream. |
| | `Old` | Information about the previous downstream neighbor. |
| `FDDI Order` | | MAC address in FDDI order. |
| | `00-00-00-00-00-00` | No station at this location. For `Upstream` and `Downstream`, this indicates a wrap. For `Old`, this is the default when there has not been a change in neighbors. |
| | nonzero hex addr | MAC address of a station. |
| `Canonical Order` | | MAC address in canonical order. |
| | `00:00:00:00:00:00` | Same description as for FDDI order. |
| | nonzero hex addr | MAC address of a station. |
| `Host name` | | Network connection name from */etc/ethers* file. If *ethers* file is not available, MAC address is displayed instead of name. |

## SMT Information Report

The SMT Information report displays miscellaneous SMT information not covered in the other reports. It shows the configuration management (CFM) state; if the ring is wrapped, the `CFM state` field will show `WRAP_AB`. Figure B-6 displays an example of SMT information.

```
6: SMT Information -- Oct 7 18:27:09          D: Delta/second

Station          ID 00-00-50-96-20-10-00-40      MAC count        1
cur version      1                               nonmaster ct     2
low version      1                               master ct        0
high version     1                               path avail       PRM,SEC
station type     SM_DAS                          config cap       WRAPAB
XID              0xfa4                           config policy    NONE
ECM state        IN                              conn policy      REJECT(MM)
CFM state        THRU_B                          report limit     5
hold state       DISABLED                        t_notify         30
rem disconn      OFF                             status report    OFF
topology         ROOTSTA,DO_SRF
Manufacturer data
 OUI             0a:69:04
 data            Silicon Graphics ipg0
User data        SGI FDDI Station Manager v3.6


1:MAC  2:Port  3:Ring Mgt  4:Config Mgt  5:Neighbors  6:SMT   DZR:Mode
```

**Figure B-6** SMT Information Report

The SMT Information report screen information is divided into left and right columns. Table B-15 explains the fields for the left column, and Table B-16 describes the right column fields.

**Table B-15** SMT Information Status, Left Column

| Field | Possible Entries | Description |
|---|---|---|
| Station ID | 64-bit hex address | Used to uniquely identify an FDDI station. Bottom 48 bits are station's MAC address in FDDI order. (fddiSMT11) |
| cur version | 0-n | The version of SMT that is used. (fddiSMT13) |
| low version | 0-n hex | The lowest version of SMT that this station supports. (fddiSMT15) |
| high version | 0-n hex | The highest version of SMT that this station supports. (fddiSMT14) |
| station type | | Identifies the station type. |
| | SAS | Single-attachment station. |
| | SAC | Single-attachment concentrator. |
| | SM_DAS | Single-MAC, dual-attachment station. |
| | DM_DAS | Dual-MAC, dual-attachment station. |
| XID | 0-n hex | Current transaction ID. |
| ECM state | | Current entity coordination management (ECM) state. ECM controls the optical bypass switch. (fddiSMT41) |
| | IN | Switch is not in bypassed state. |
| | OUT | Switch is in bypassed state. |
| | TRACE | Indicates stuck beacon condition. |
| | LEAVE | Allows time to break connections. |
| | INSERT | Allows time for switching. |
| | PATHTEST | Testing state. |
| | CHECK | State to confirm both switches have switched. |
| CFM state | | Current configuration management (CFM) state. CFM performs the interconnection of PHYs and MACs to configure the ports and MACs within a node. (fddiSMT42) |

**Table B-15 (continued)** SMT Information Status, Left Column

| Field | Possible Entries | Description |
|---|---|---|
| | ISOLATED | No connections to PHYs. |
| | WRAP_A | Frames can be transmitted on MAC attached to port A. |
| | WRAP_B | Frames can be transmitted on MAC attached to port B. |
| | WRAP_AB | Displayed for dual-homed DAS only. |
| | THRU_A | This MAC is operating on secondary ring. |
| | THRU_B | This MAC is operating on primary ring. |
| | THRU_AB | Displayed for dual MAC only when it is attached to a concentrator. Both ports are being used. |
| hold state | ENABLED<br>DISABLED | Current state of the hold function. (fddiSMT43) |
| rem disconn | ON<br>OFF | Indicates if the station was remotely disconnected from the network. (fddiSMT44) |
| topology | | Flags indicating station topology conditions. (Section 7.3.1.3 of ANSI SMT document) |
| | WRAPPED | Ring is wrapped at this station. For a station with two ports where one or both ports are connected to a concentrator, this is normal. |
| | AA_TWIST | A-to-A connection detected. |
| | BB_TWIST | B-to-B connection detected. |
| | ROOTSTA | Station is on dual ring and not on tree. |
| | DO_SRF | Status Report Frames (SRF) reporting is enabled. |

**Table B-16** SMT Information Status, Right Column

| Field | Possible Entries | Description |
|---|---|---|
| MAC count | 0-n | Number of MACs in this station. (fddiSMT21) |
| nonmaster ct | 0-n | Number of nonmaster ports (A, B, or S ports) in this station. (fddiSMT22) |
| master ct | 0-n | Number of master ports in this node. Nonzero only for concentrators. (fddiSMT23) |
| path avail | | Indicates the path types available in the station. (fddiSMT24) |
| config cap | | Configuration capabilities of the node. (fddiSMT25) |
| | HOLDAVAIL | Supports optional hold function. |
| | WRAPAB | Wrap state is forced (for example, for attachment to a concentrator). |
| config policy | | Current configuration policies. (fddiSMT26) |
| conn policy | | Current types of connections that are rejected. (fddiSMT27) |
| | REJECT(MM) | Reject master-master connections. |
| report limit | 0-n | Limit on the number of Status Report Frames (SRFs) to be queued for transmission after the supported condition becomes inactive or after any supported event has been detected. (fddiSMT28) |
| t_notify | 0-n seconds | Interval between transmissions of Neighborhood Information Frames (NIFs) by the Neighbor Notification protocol. (fddiSMT29) |
| status report | ON, OFF | Indicates whether the node implements the Status Reporting Protocol. (fddiSMT30) |
| Manufacturer data: | | Manufacturer-defined information. (fddiSMT16) |

**Table B-16 (continued)** SMT Information Status, Right Column

| Field | Possible Entries | Description |
|---|---|---|
| `OUI` | `24-bit value in hex format` | Organization unique identification number in canonical format. This value matches the most significant 3 bytes (24 bits) of the MAC address. |
| `data` | `string` | Text. |
| `User data` | | User-defined data. (fddiSMT17) |

*Appendix C*

# Configuring the SMT Daemon and the FDDIXPress Driver

This appendix contains instructions for configuring the SMT daemon and the FDDIXPress driver with site-specific (nondefault) settings.

## Configuring the SMT Daemon

The SMT daemon can be configured for three kinds of parameters: SMT station, MAC, and PHY parameters.

**Note:** Only FDDI experts should change the SMT daemon configuration. Many of these parameters can have disastrous effects on the FDDI ring. It is relatively easy to make the entire FDDI ring dysfunctional if these parameters are set incorrectly.

The SMT daemon configuration file is */etc/fddi/smtd.conf*. The file is organized into two types of sections, as illustrated in Figure C-1 and described below:

- The station section (labeled SMT_STATION ) has one area (labeled station #) for each instance of an FDDI network interface on the station, up to four.
- The numerous FDDI board sections are each labeled with an FDDI interface name (for example, *xpi* , *rns*, or *ipg*). There is one board section for each type of FDDI board supported by Silicon Graphics. Each type-of-board section has four subareas: one subarea for each instance (network interface) of that type (for example, *ipg0*, *ipg1*, *ipg2*, *ipg3*). Each subarea can contain parameters for one MAC and, for each MAC, one or more PHYs.

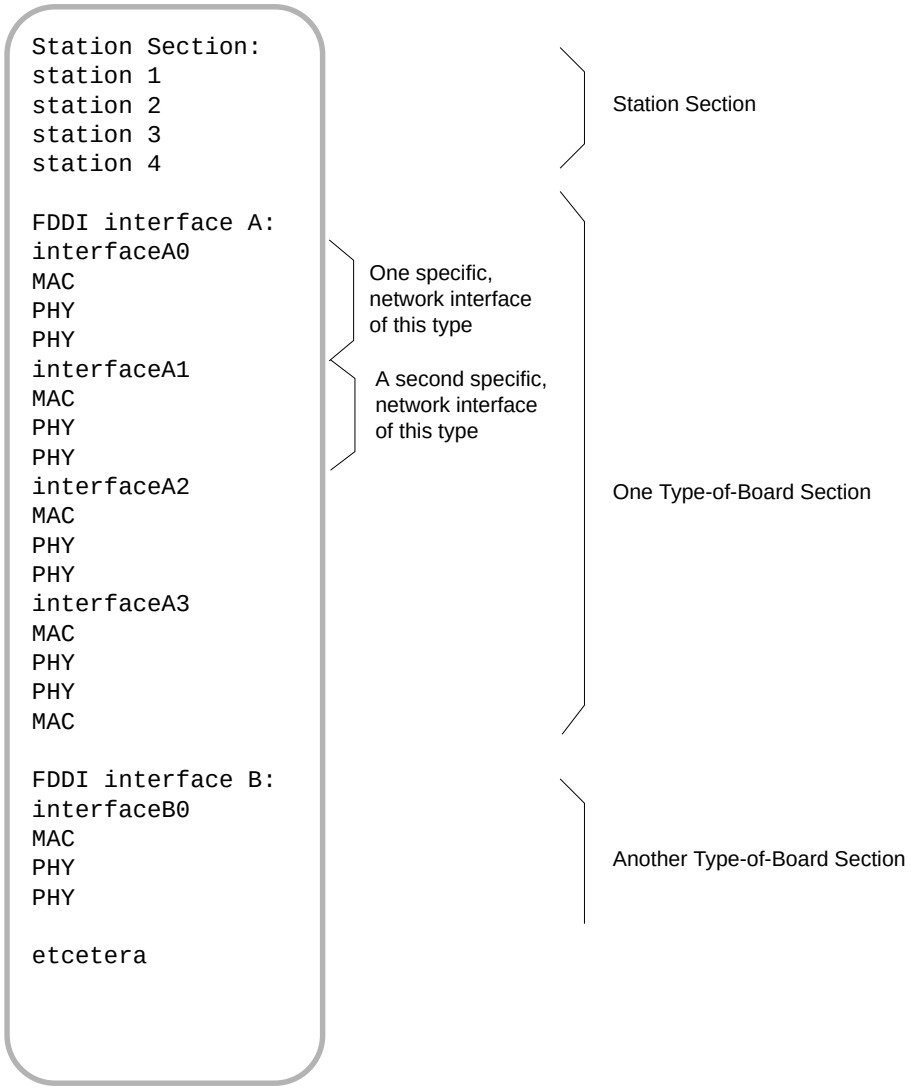
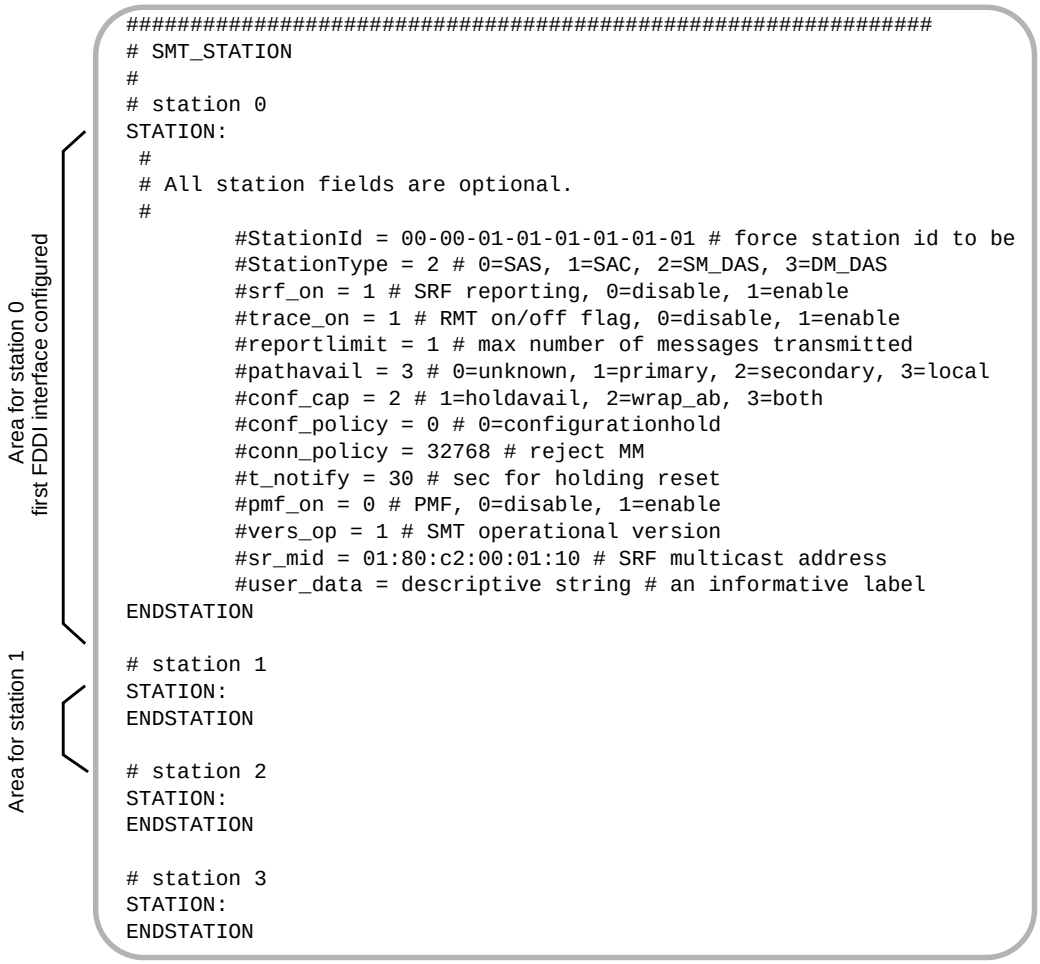



**Figure C-1** Outline of smtd.conf File

## Station Section

The SMT_STATION section of the *smtd.conf* looks like Figure C-2. Before any alteration has been made to this file, the station parameters are listed only under the first instance (`station 0`), and they are marked with a pound sign (commented out) indicating that they are not currently used for configuration. When the file looks like this, each FDDI network interface is configured with default station settings, as summarized in Table C-1.




```
#####################################################################
# SMT_STATION
#
# station 0
STATION:
 #
 # All station fields are optional.
 #
        #StationId = 00-00-01-01-01-01-01-01 # force station id to be
        #StationType = 2 # 0=SAS, 1=SAC, 2=SM_DAS, 3=DM_DAS
        #srf_on = 1 # SRF reporting, 0=disable, 1=enable
        #trace_on = 1 # RMT on/off flag, 0=disable, 1=enable
        #reportlimit = 1 # max number of messages transmitted
        #pathavail = 3 # 0=unknown, 1=primary, 2=secondary, 3=local
        #conf_cap = 2 # 1=holdavail, 2=wrap_ab, 3=both
        #conf_policy = 0 # 0=configurationhold
        #conn_policy = 32768 # reject MM
        #t_notify = 30 # sec for holding reset
        #pmf_on = 0 # PMF, 0=disable, 1=enable
        #vers_op = 1 # SMT operational version
        #sr_mid = 01:80:c2:00:01:10 # SRF multicast address
        #user_data = descriptive string # an informative label
ENDSTATION

# station 1
STATION:
ENDSTATION

# station 2
STATION:
ENDSTATION

# station 3
STATION:
ENDSTATION
```

**Figure C-2** smtd.conf: Station Section

Once the file has been altered to contain uncommented parameters, the SMT daemon is configured to use those settings with the network interface that corresponds to that station section. The manner in which the *smtd.conf* sections (`station 0`, `station 1`, and so on) are matched to network interfaces is detailed below:

- The network configuration script (*/etc/init.d/network*) uses the settings located under `station 0` to configure the first FDDI network interface it sets up.

  You can discover the order in which a station's network interfaces are configured with the command */usr/etc/netstat -i*.

- The script uses the settings under `station 1` for the next FDDI network interface it configures, and so on, up to the fourth.

The default settings for station parameters are summarized in Table C-1.

Explanations for changing the settings are listed immediately after the table. Whenever a parameter matches a parameter in one of the FDDI standards, the official FDDI name is shown in parentheses (*fddiname*).

**Table C-1** smtd.conf: Station Parameter Defaults

| Parameter | Default Setting | Description |
|---|---|---|
| `StationId` | 00-00-MAC address (in canonical order) | Forces SMT StationID to be this value. |
| `StationType` | read from hardware | Station type: 0=SAS, 1=SAC, 2=SM_DAS, 3=DM_DAS |
| `srf_on` | 1 | Status report protocol (SRF) on/off: 1=on/enable |
| `trace_on` | 1 | Trace function on/off: 1=on/enable |
| `reportlimit` | 5 | Maximum number of status report frames transmitted during a reset. |
| `pathavail` | 3 | SMT paths available: 3=local |
| `conf_cap` | 2 | Configuration capabilities: 2=wrap_ab |
| `conf_policy` | 0 | Configuration policy: 0=configurationhold |

**Table C-1 (continued)** smtd.conf: Station Parameter Defaults

| Parameter | Default Setting | Description |
|---|---|---|
| `conn_policy` | 32768 | SMT connection policy: 32768=bit15=reject MM |
| `t_notify` | 30 | Seconds for holding reset. |
| `pmf_on` | 0 | Parameter management protocol (PMF) on/off: 0=disable |
| `vers_op` | varies | SMT operational version. |
| `sr_mid` | `01:80:c2:00:01:10` | Status report protocol (SRF) multicast address. |
| `user_data` | none | Text entry available for customer to use. |

### Instructions for Changing a Station Parameter

To change one or more of the station parameters, follow these steps:

1. Open the */etc/fddi/smtd.conf* file with your favorite editor.
2. Locate the line containing the parameter you want to alter.
3. If you are configuring a second, third, or fourth FDDI interface, copy the entire line into the area associated with the network interface you want to configure.
4. Uncomment the line by removing the leftmost pound sign (#). Do not remove the other pound sign (in the center portion of the line) that marks the parameter's description.
5. Alter the setting of the parameter.
6. Save the file.
7. Stop, then restart the network interface, with the commands below:

```
% su
Password: thepassword
# smtconfig interfacename down
# smtconfig interfacename up
```

### Station Parameter Descriptions

`StationId`
`(fddiSMTStationId)`

An 8-byte identification number displayed in canonical order. The least significant six bytes must be a universally administered address (that is, the MAC address). The most significant two bytes can be assigned at each site. FDDIXPress (by default) uses the MAC address of the first MAC (MAC0) for the lower six bytes and zeros for the upper two, as illustrated in Figure C-3. The entry is in hexadecimal characters where bytes are separated by colons (for example, 00:01:0a:00:d9:04:00:07).

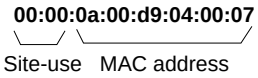



**Figure C-3** Station ID

`StationType`

Identifies the type of device associated with this interface:

0=single-attachment station (SAS)
1=single-attachment concentrator (SAC)
2=single-MAC, dual-attachment station, (SM_DAS)
3=dual-MAC, dual-attachment station (DM_DAS)

`srf_on`
`(fddiSMTStatRptPolicy)`

A switch to turn Status Report Frame protocol (SRF) on and off. SRF is used by a station to periodically announce its status (for example, a change in configuration, initiation of a trace event, detection of an illegal connection). This functionality is useful to other SMTs for maintaining the ring.

0=disable
1=enable

`trace_on`

A switch to turn Trace capabilities on and off. The trace function is one of the basic FDDI methods for recovering a disfunctional ring.

0=disable
1=enable

`reportlimit`

The maximum number of status report frames (SRFs) that can be sent during a board reset. The entry is a decimal digit equal to or greater than 0.

`pathavail`
`(fddiSMTPathsAvailable)`

This setting defines the path (or paths) available to the SMT on this station for communicating with other SMTs. Each path consists of a communication route: one media connection, one PHY, and one MAC. The primary and secondary paths usually, but not necessarily, correspond to connections to the primary and secondary rings. The local path is a route by which the SMT can access other SMTs without using the main trunk ring. Each increase in the `pathavail` setting adds an additional path; for example, when the setting is 3, primary and secondary paths are available as well as an alternate, local path.

Settings 0-2 are dynamically overidable, but 3 is not. When the entry is 0, 1, or 2, the actual connection to the ring overides the file setting, and the SMT daemon is allowed to use whatever paths are identified. For example, if the entry in the *smtd.conf* file is 0 but two paths are found, the SMT daemon will have both a primary and secondary path available. The 3 (local) setting cannot be overidden. For example, if the setting is 2, the local path will not be made available, even if the path actually exists.

0=isolated
1=primary
2=secondary
3=local

`conf_cap`
`(fddiSMTConfigCapabilities)`

The configuration capabilities for this MAC. These items apply only to dual-attachment devices; the settings are ignored for single-attachment devices.

1=holdavail (prevents wrapping when a fault occurs)
2=wrap_ab (a dual-homed connection)
3=both

`conf_policy`
`(fddiSMTConfigPolicy)`

The configuration policy for this MAC. For this configuration to be set up, the selected items must be supported (as set in the conf_cap parameter).

0=configuration hold

`conn_policy`
`(fddiSMTConnectionPolicy)`

The connection policy for the MAC. The selections are controlled by a 16-bit register in which each bit controls one policy. One or more of the bits can be set. The entry in the configuration file must be a decimal numeral representing the value of the 16-bit binary sequence with all the desired bits set to one. For example, if you want to set bits 0 and 1 (binary 0000 0000 0000 0011), assign a 3 to `conn_policy`. Below are the meanings for each bit when it is set to one:

bit 0: reject AA
bit 1: reject AB
bit 2: reject AS
bit 3: reject AM
bit 4: reject BA
bit 5: reject BB
bit 6: reject BS
bit 7: reject BM
bit 8: reject SA
bit 9: reject SB
bit 10: reject SS
bit 11: reject SM
bit 12: reject MA
bit 13: reject MB
bit 14: reject MS
bit 15: reject MM

**Note:** The most significant bit (bit 15) must always be set.

`pmf_on`

Switch to turn Parameter Management protocol (PMF) on and off. PMF makes it possible for SMTs to ask for and receive MIB information about other stations on the ring. The protocol also allows SMTs to alter some of the information in other stations' MIBs.

0=disable
1=enable

`vers_op`
`(fddiSMTOpVersionId)`

The SMT version to which this SMT daemon conforms. This entry should not be altered.

`sr_mid`

Address used for Status Report Frame protocol (SRF) multicast group communication. The default entry is the address specified in the SMT standard and should not be altered.

`user_data`
`(fddiSMTUserData)`

User data that, if defined, is included in the SMT Info field of each SMT frame's header. The entry can be up to 32 characters (blank spaces are allowed and are counted as characters); quotation marks are not required.

## Board Sections

The board sections of the *smtd.conf* file are labeled with the name of the network interface (for example, *ipg* , *rns*, or *xpi*) for that type of board. There is one section for each type of FDDI board supported by Silicon Graphics. Figure C-4 illustrates two type-of-board sections; however, there is no limit to these kinds of sections.

Each type-of-board section contains four specific network interface areas. The file must contain one network interface area for each MAC of that type installed into the station (for example, *xpi0*, *xpi1*, *xpi2*, *xpi3*). One MAC parameter and one or more PHY parameters can be placed into each of the specific interface areas.

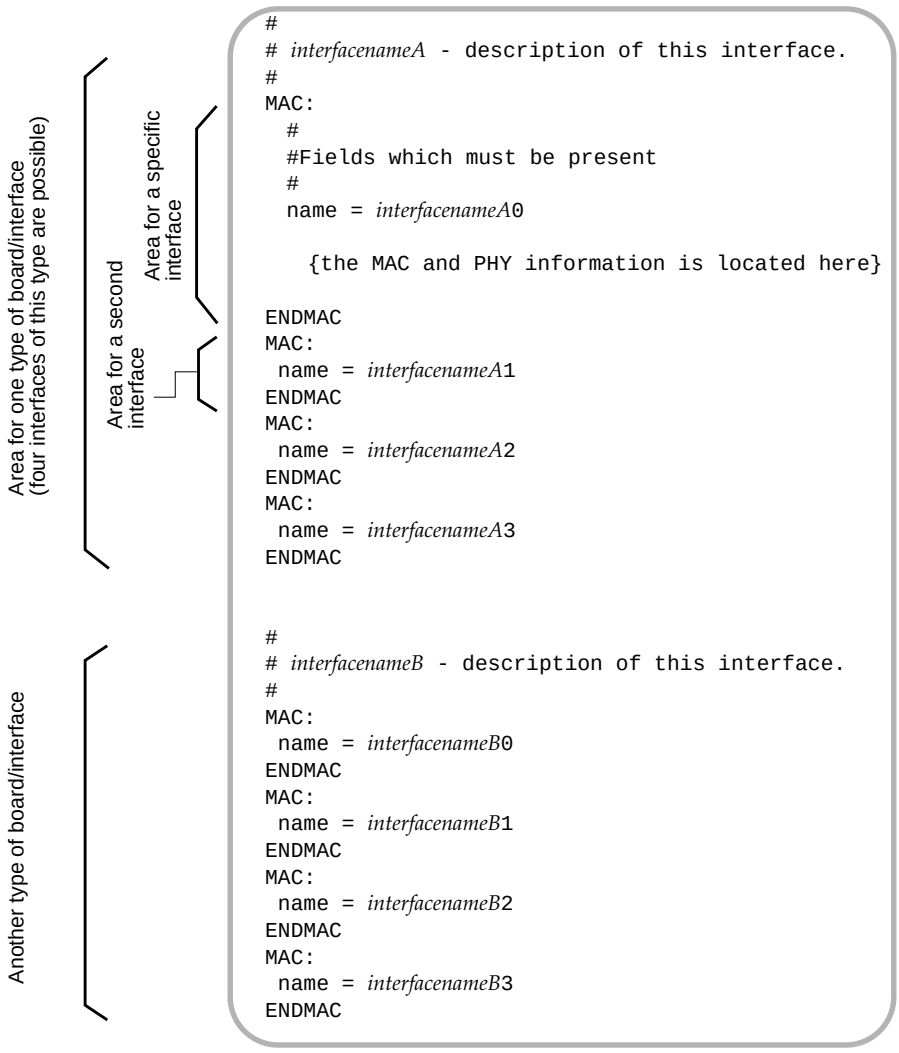



**Figure C-4** smtd.conf: Board Sections

## MAC Parameters

The MAC section of the *smtd.conf* file looks like Figure C-5. Each MAC section configures one MAC.

Unlike the other sections of this file, the MAC area contains a required line. This line, identified by arrows in Figure C-5, must never be missing and must contain a valid FDDI network interface name.

Before any alteration has occurred, the MAC parameters are listed only once, under the first specific-interface area of the first type-of-board section. All but one of the parameters are marked with a pound sign (commented out), indicating that they are not currently used for configuration. The single, uncommented line (`name=`*interfacename*) must never be removed or commented out; this line is required. When the file looks like this, the SMT daemon is configured with default settings, as summarized in Table C-2.

When a board has more than one MAC, there can be one MAC section for each MAC. In these configurations, each MAC section must have a unique entry for `name=`*interfacename*.

Explanations for changing the MAC settings are listed immediately after the table. Whenever a parameter matches a parameter in one of the FDDI standards, the official FDDI name is shown in parentheses (*fddiname*).

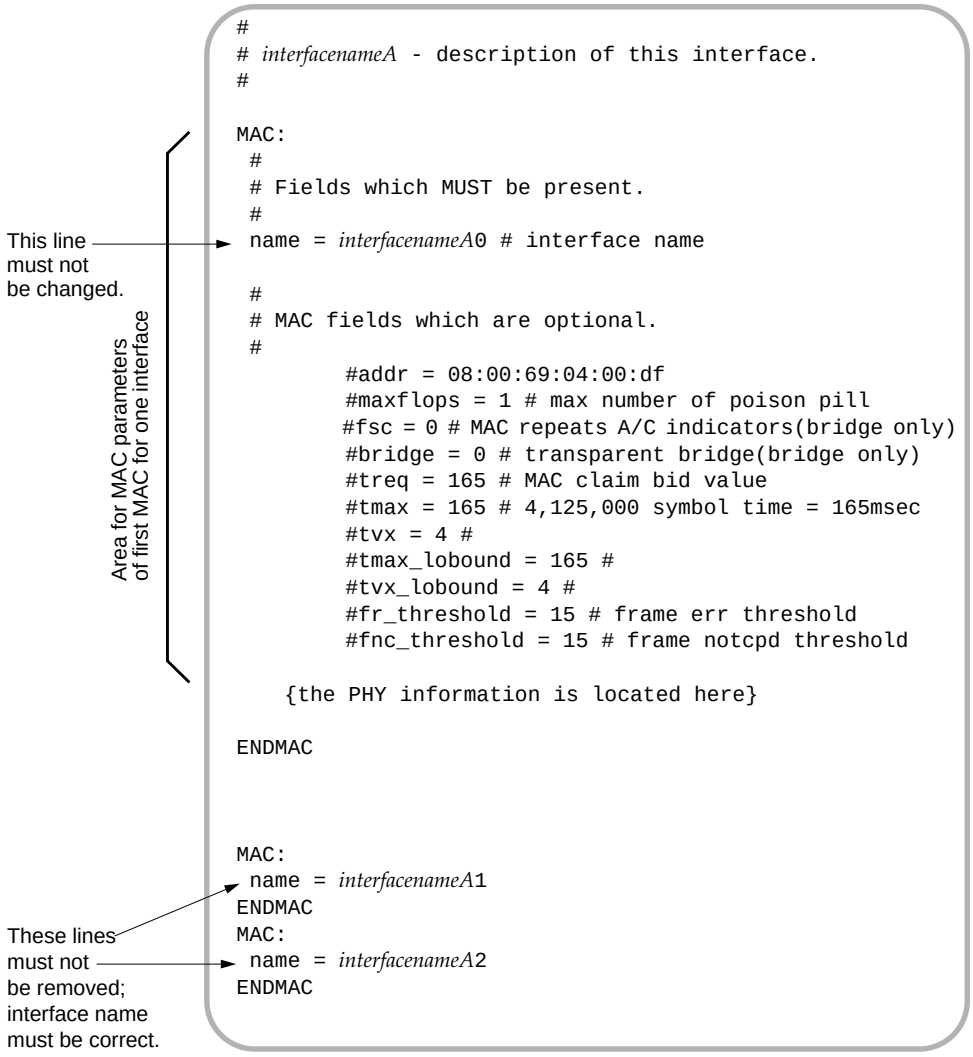



**Figure C-5** smtd.conf: MAC Parameters

**Table C-2** smtd.conf: MAC Parameter Defaults

| Parameter | Default Setting | Description |
|---|---|---|
| addr | read from hardware | MAC address in canonical order |
| maxflops | 1 | Maximum number of times the board can be reset |
| fsc | 0 | Frame Status Capabilities: (set only on bridges):<br>0=MAC repeats Abit/Cbit indicators. |
| bridge | 0 | Bridge type (set only for bridges):<br>0=transparent bridge |
| treq | 165 | MAC claim bid value:<br>165 msec=lowest priority |
| tmax | 165 | Maximum bid supported:<br>165 msec=4,125,000 symbol time |
| tvx | 4 | Valid transmission timer:<br>4 msec |
| tmax_lobound | 165 | Lowest supported value for tmax. |
| tvx_lobound | 4 | Lowest supported value for tvx. |
| fr_threshold | 15 | Frame error threshold:<br>15 = one error in $10^{15}$ is allowed. |
| fnc_threshold | 15 | Frames not copied threshold:<br>15 = one error in $10^{15}$ is allowed. |

### Instructions for Changing a MAC Parameter

If you wish to change one or more of the MAC parameters, follow these steps:

1. With your favorite editor, open the */etc/fddi/smtd.conf* file.
2. Locate the line containing the MAC parameter you want to alter.
3. Locate the area labeled with the network interface you wish to configure. Be sure to locate the correct type-of-board section (*interfacename*) as well as the correct specific-interface area (*interfacename0*, *interfacename1*, and so on).

   The *netstat -ina* command displays all network interfaces on the station.

4. Copy the entire line into the area.
5. Uncomment the line by removing the leftmost pound sign (#). Do not remove the other pound sign (in the center portion of the line) that marks the parameter's description.
6. Alter the setting of the parameter.
7. Save the file.
8. Disable, then enable the network interface, with the commands below:

```
% su
Password: thepassword
# smtconfig interfacename down
. . .
# smtconfig interfacename up
```

### MAC Parameter Descriptions

`addr`
`(fddiMACSMTAddress)`

The 6-byte MAC address in canonical order. This entry should not be changed because duplicate MAC addresses will cause the ring to malfunction seriously. The entry is in hexadecimal characters with bytes separated by colons.

`maxflops`

The maximum number of times the board will be allowed to reset. Once this maximum has been reached, the SMT daemon removes the station from the ring. The entry is a decimal numeral greater than zero.

`fsc`
`(fddiMACFrameStatusCapabilities)`

Frame Status Capabilities determines how the station, functioning as a bridge, handles the A and C bits within frames. This parameter should be set only for a station performing as a bridge.

0=MAC only repeats A-bit and C-bit indicators
1=MAC set Abit on all frames; sets Cbit when forwarding
2=MAC inverts A and C bits

`bridge`
`(fddiMACBridgeFunction)`

Indicates how the bridge will function. This parameter should be set only for a station performing as a bridge.

0=transparent bridge, 802.1b
1=source routing bridge, 802.5

`treq`
`(fddiMACTReq)`

Defines the priority (target token rotation time: TTRT) used in the MAC's claim bids. Only one or two stations on a ring should have this value altered to a higher priority (for example, to 8).

0= highest priority
165=lowest priority

`tmax`
`(fddiMACTMax)`

Maximum token rotation time (TRT) in milliseconds supported by this station. The entry is a decimal digit greater than or equal to 165.

`tvx`
`(fddiMACTvxValue)`

Valid transmission timer in milliseconds. The entry sets the amount of time the station will wait before it initiates a claim process. The time is measured from reception of the last valid frame or token. The entry is a decimal number greater than 2.35.

`tmax_lobound`
`(fddiPATHClassT-MAXLowerBound)`

Lowest supported value for `tmax` parameter (above). For FDDIXPress, this entry should be the same as that for `tmax`.

`tvx_lobound`
`(fddiPATHClassTVXLowerBound)`

Lowest supported value for `tvx` parameter (above). For FDDIXPress, this entry should be the same as the entry for `tvx`.

`fr_threshold`
`(fddiMACFrameErrorThreshold)`

Frame error threshold. The entry is the number of frames with errors allowed in every 65,536 frames processed. When the threshold is reached, SMT removes the station from the ring. The entry is a decimal number between 0 and 65536 inclusive, in which no commas are included.

`fnc_threshold`
`(fddiMACNotCopiedThreshold)`

Frames not copied threshold. The entry is the number of uncopied frames allowed in every 65,536 frames seen. When the threshold is reached, SMT removes the station from the ring. The entry is a decimal number between 0 and 65536 inclusive, in which no commas are included.

## PHY Parameters

The PHY section of the *smtd.conf* file looks like Figure C-6. Before any alteration has occurred, the PHY parameters are listed only once, under the first specific-interface area of the first type-of-board section. All the parameters are marked with a pound sign (commented out), indicating that they are not currently used for configuration. When the file looks like this, the SMT daemon is configured with default settings, as summarized in Table C-3.

If a MAC has two PHYs, there can be two PHY sections (PHY0 and PHY1) for one MAC.

Explanations for changing the PHY settings are listed immediately after the table. Whenever a parameter matches a parameter in one of the FDDI standards, the official FDDI name is shown in parentheses (*fddiname*).

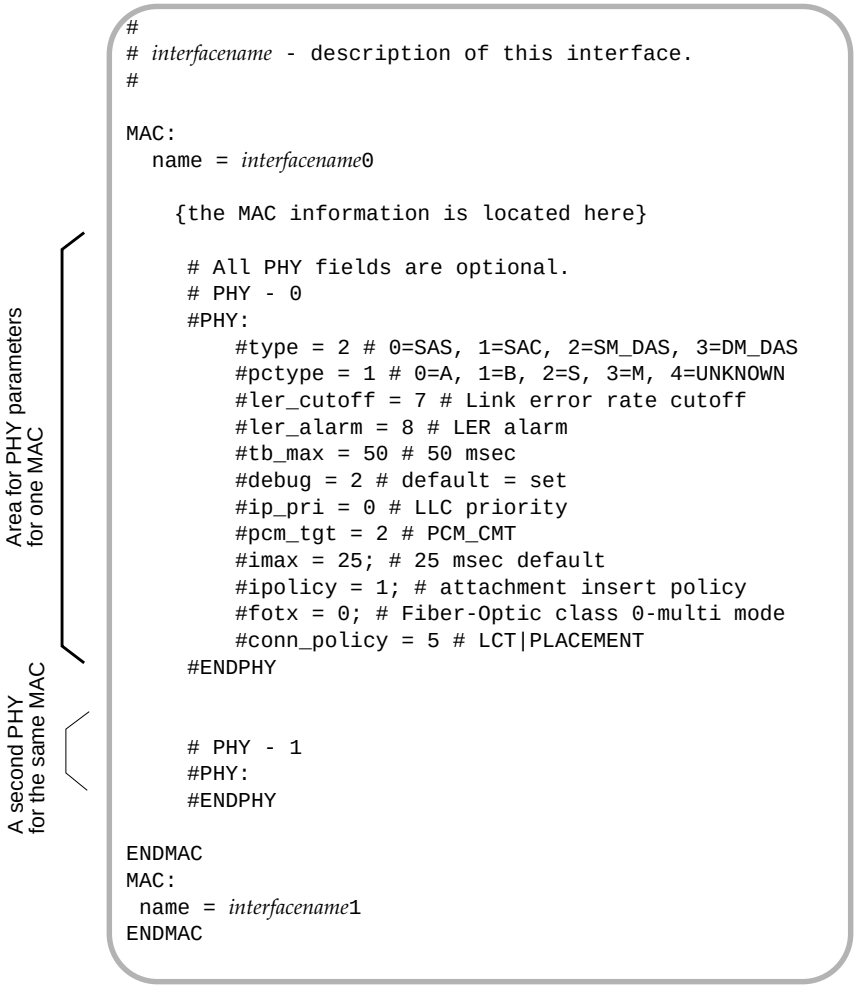



**Figure C-6** smtd.conf: PHY Parameters

**Table C-3** smtd.conf: PHY Parameter Defaults

| Parameter | Default Setting | Description |
|---|---|---|
| `type` | read from hardware | Type of device:<br>0=SAS, 1=SAC, 2=SM_DAS, 3=DM_DAS. |
| `pctype` | read from hardware | Port type:<br>0=A, 1=B, 2=S, 3=M, 4=unknown. |
| `ler_cutoff` | 7 | Link error rate cutoff:<br>7 = one error in $10^7$ is allowed. |
| `ler_alarm` | 8 | LER alarm:<br>8=alarm occurs after errors exceed one in $10^8$. |
| `tb_max` | 50 | Break State timer in msec. |
| `debug` | 2 | 2 = highest debug level. |
| `ip_pri` | 0 | LLC priority. |
| `pcm_tgt` | 2 | PCM_CMT is enabled. |
| `imax` | 25 | Maximum time, in msec, for an Optical bypass switch to insert into ring. |
| `ipolicy` | 1 | Optical bypass switch insertion policy:<br>1=don't insert. |
| `fotx` | 0 | Fiber-optic class:<br>0=multi mode. |
| `conn_policy` | 5 | PHY connection policy:<br>5=LCT and PLACEMENT (also referred to as CF_MAC). |

### Instructions for Changing a PHY Parameter

To change one or more of the PHY parameters, follow these steps:

1. Open the */etc/fddi/smtd.conf* file with your favorite editor.
2. Locate the line containing the PHY parameter you want to alter.
3. Locate the area labeled with the network interface you want to configure. Be sure to locate the correct type-of-board section (*interfacename*) as well as the correct specific-interface area (*interfacename0*, *interfacename1*, and so on).

   The *netstat -ina* command displays all network interfaces on the station.
4. Locate the correct PHY area (for example, `PHY0` or `PHY1`) within the MAC area.
5. Copy the entire line into the area.
6. Uncomment the line by removing the leftmost pound sign (#). Do not remove the other pound sign (in the center portion of the line) that marks the parameter's description.
7. Alter the setting of the parameter.
8. Save the file.
9. Disable, then enable the network interface, with the commands below:

```
% su
Password: thepassword
# smtconfig interfacename down
. . .
# smtconfig interfacename up
```

### PHY Parameter Descriptions

`type`

Type of device.

0=SAS
1=SAC
2=SM_DAS
3=DM_DAS

`pctype`
`(fddiPORTMy-Type)`

The entry defines the type of port (PC_TYPE) for this PHY.

0=A
1=B
2=S
3=M
4=unknown

`ler_cutoff`
`(fddiPORTLer-Cutoff)`

Link error rate cutoff. Expressed as the cutoff's exponent. For example, 7 means that one error in $10^7$ is allowed before the PHY is removed from ring. The entry is a decimal digit ranging from 4 to 15 inclusive.

`ler_alarm`
`(fddiPORTLer-Alarm)`

Link error alarm. Expressed as the exponent of the threshold. For example, 8 means that the alarm occurs after the number of errors exceeds one in $10^8$. The entry is a decimal digit ranging from 4 to 15 inclusive.

`tb_max`
`(fddiPORTTB-Max)`

Break state timer for optical bypass switches, set in milliseconds. This entry defines the amount of time that an optical bypass switch will be allowed to continue in a break state before the SMT daemon indicates that the switch is stuck in the break state (sets the BS_Flag) . The entry is a decimal number greater than 30.

`debug`

Sets the debugging level, which determines the kinds of error messages displayed by the SMT daemon.

0=low debug level
2=high debug level

`ip_pri`

Sets the LLC priority. IRIX does not currently support this functionality. The only valid setting is 0.

`pcm_tgt`

Defines the behavior of the physical connection management (PCM). The only valid setting is 2, which enables PCM.

`imax`
`(fddiATTACHMENTI-MaxExpiration)`

Maximum time, in milliseconds, for an optical bypass switch to insert into ring. The entry is a decimal number ranging from 0 to 25 inclusive.

`ipolicy`
`(fddiATTACHMENTInsertPolicy)`

Sets the insertion policy for the optical bypass switch.

0=insert
1=don't insert

`fotx`
`(fddiPORTFotxClass)`

Fiber optic transmitter class. See fiber optic cable in the Glossary.

0=multimode
1=single mode

`conn_policy`
`(fddiPORTConnectionPolicies)`

Sets the connection policies (CMT capability flags) supported by this PHY. The entry is a decimal numeral from 0 to 6 inclusive.

**Table C-4** CMT Capability Flags

| Flag | Description |
|---|---|
| 0=none | No policy. |
| 1=LCT | Link confidence testing enabled. |
| 2=loop | MAC local loop enabled. |
| 3=LCT and loop | Link confidence and MAC local loop enabled. |
| 4=placement | MAC is connected to a port (not floating) and is available for link confidence and loop; also referred to as CF_MAC. |
| 5=LCT and placement | |
| 6=Loop and placement | |

## Configuring the FDDIXPress Driver

FDDIXPress drivers usually have a few configurable parameters (for example, the size for the maximum transmission unit, MTU). The specific items vary from driver to driver, so they are explained fully within the driver's configuration file.

Driver configuration files reside in the */var/sysgen/master.d* directory. Examples of configuration files include *if_xpi* for the *xpi* driver and *if_ipg* for the *ipg* driver.

After making changes to a configuration file, the operating system (kernel) must be rebuilt to include a driver with the new parameter settings, then the system must be rebooted. The instructions in "Build Configuration Changes Into the System" on page 40 describe this procedure.

*Appendix D*

# Man Pages

This appendix describes the FDDIXPress man pages. Table D-1 lists and summarizes the functions.

**Table D-1** FDDIXPress Man Pages

| Man Page | Function |
|---|---|
| fddi(7) | General information about FDDI controllers. |
| smtconfig(1M) | Configure or display FDDI network interface parameters. |
| smtd(1M) | The FDDI Station Management protocol (SMT) daemon. |
| smtinfo(1) | Collect and display SMT information from any station on the ring. |
| smtmaint(1M) | Set FDDI line state (requires superuser privileges). |
| smtping(1M) | Send FDDI ECHO_REQUEST frames to an FDDI station on the ring. |
| smtring(1M) | Display a list of stations currently connected to the ring. |
| smtstat(1) | Show local station's SMT status. Can display six different reports. |

The *man* command can be used to display complete information about each command. For example, to read about *smtconfig*, use this command:

```
% man smtconfig
```

# Glossary

### American National Standards Institute (ANSI)

The United States standardization body. ANSI produces documents that describe standards for information systems and input/output interfaces such as FDDI. ANSI is a member of the International Standards Organization (ISO).

### ANSI

*See* American National Standards Institute.

### attenuation

The weakening or diminishing of signal strength that can result in a loss of data.

### bandwidth

The range of frequencies that can be used for transmitting information on a channel, equal to the difference in hertz (Hz) between the highest and the lowest frequencies available on that channel. Bandwidth indicates the transmission capacity of a channel; the larger the bandwidth, the greater the amount of information that can pass through a circuit.

### beacon process

A fault isolation process that is initiated after a ring fault occurs and the claim process fails. Stations within the ring send beacon frames to isolate the fault.

### bypass

The ability of a node to isolate itself optically from the ring while maintaining the integrity of the rest of the ring.

### canonical order

In the computer world, the term *bit order* is analogous to the order for reading a flow of letters in text. Canonical order is somewhat like reading across the page from left to right, but reading each word from right to left. So, the characters `TIME WAR` would be read as "emit raw." To compare this to a very different ordering, *see* FDDI order.

In more technical terms, canonical order is a method for representing the 48-bit (6-byte) sequences used for addresses in FDDI. This method considers the first bit transmitted within each byte to be the *least significant* bit, as illustrated in Figure Gl-1. For example, the sequence <1 followed by 0, 0, 0> is represented as 1 in decimal (not as 8). This is the ordering traditionally used for Ethernet addresses and is bit-swapped within each byte with respect to FDDI ordering. For the bytes themselves, the first transmitted byte is considered to be the most significant byte.

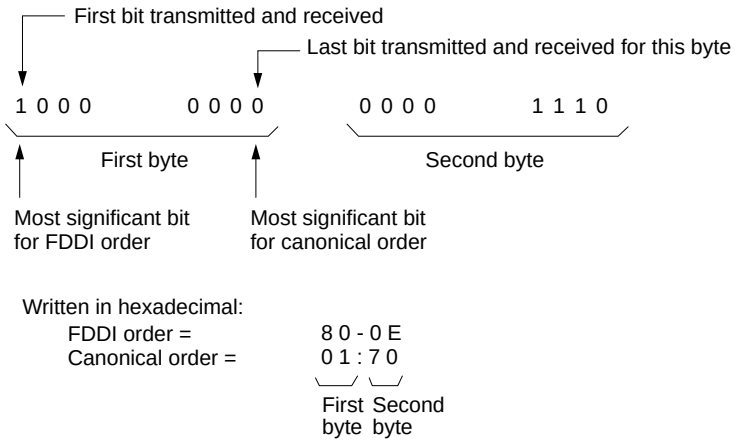



**Figure Gl-1** Canonical Order

The SMT commands represent each byte of a canonically ordered FDDI address as a hexadecimal value (two hexadecimal characters) separated by a colon (:), for example, 08:00:69:a4:0c:d0. *See also* FDDI order.

### CDDI

*See* copper distributed data interface.

### CEM

*See* configuration element management.

### CFM

*See* configuration management.

### cladding

The low refractive index material that surrounds the core of an optical cable.

### claim process

A process in which stations bid for the right to initialize the ring.

### CMT

*See* connection management.

### CON

*See* concentrator.

### configuration element management (CEM)

The portion of connection management (CMT) that manages the configuration of a port and, if present, its MAC. There is one instance of this functionality for each port on a station or concentrator.

### concentrator (CON)

An FDDI node that has additional ports beyond those required for its own attachment to an FDDI network. These additional ports (type M) are for attaching other FDDI nodes (including other concentrators) in a tree topology.

### configuration management (CFM)

The portion of the station management that manages the configuration of the station's MAC and PHY entities.

### connection management (CMT)

The portion of the FDDI SMT that manages the operation of the physical layer. CMT functionality is divided into three areas: physical connection management (PCM), configuration element management (CEM), and entity coordination management (ECM). CMT performs the following:

- monitors the primary and secondary ring
- isolates and wraps around noisy or quiet links
- prevents stations from entering the ring in an illegal topology
- verifies when a faulty link has been fixed and unwraps the ring

### connector plug

A device used to terminate an optical signal transmission cable. The connector plug is the male half of an optical signal transmissions cable connection. Plugs connect to receptacles. *See also* media interface connector, straight tip connector.

### connector receptacle

A device used to terminate an optical signal transmission cable. The connector receptacle is the female half of an optical signal transmissions cable connection. Receptacles connect to plugs. *See also* media interface connector, straight tip connector.

### copper distributed data interface

An FDDI-like protocol that uses copper cabling (either shielded or unshielded twisted pair) instead of fiber optic cabling for attaching nodes to concentrators.

### core

The central transmission area of a fiber. The core always has a refractive index higher than that of the cladding. The core acts as a wave guide and confines the signal.

### counter-rotating

An arrangement in which the light signal within each loop of a dual ring travels in opposite directions.

### DA

*See* destination address.

### DAS

*See* dual-attachment station.

### decibel (dB)

A standard unit that uses a logarithmic scale for expressing transmission gain or loss and relative power levels.

### destination address (DA)

The address of the station to receive the data. Consists of 4 (16-bit address) or 12 (48-bit address) symbols. A physical connection to the ring that performs the conversion from optical to electrical signals, symbol detection and decoding, and error detection and line state detection.

### dotted decimal notation

A way of representing a 32-bit (4-byte) Internet address in ASCII. Each byte of the address is represented as a decimal number (ranging in value from 0 to 255). Bytes are separated by a dot (.). For example, 126.52.4.89. *See also* Internet address.

### downstream

The direction of an optical signal's flow within the ring.

### dual-attachment station (DAS)

An FDDI station that offers two connections (attachments) to the FDDI ring. The two connections can connect to the primary and secondary rings, or the two can be attached to a concentrator for a dual-homed configuration.

### dual-fiber cable

A type of optical fiber cable that has two single-fiber cables enclosed in a jacket of extruded PVC, with a ripcord for pulling back the jacket to access the fibers.

### dual-homed

A DAS configuration in which both ports are connected as S-type ports to a concentrator. Port A is connected to one M-type port and B is connected to a different M-type port on the same or a different concentrator. This configuration provides a backup interface if one port should fail. Synonym: tree connection with redundancy.

### dual ring

An FDDI ring configuration with two separate loops (rings) of fiber optic cable. It is common for one loop to be the main (primary) ring and the other to be used as a backup. In this configuration, the ring can wrap to reestablish communication when there are problems with the primary ring. It is also possible to configure both rings as main (data carrying) networks.

### ECM

*See* entity coordination management.

### entity coordination management (ECM)

The portion of CMT that manages the media interface to the FDDI network, which includes coordinating the activity of all of the PHYs associated with that physical attachment and controlling the optional optical bypass function within the station. There is only one instance of this functionality on a station or concentrator.

### Ethernet order

*See* canonical order.

### FDDI

*See* fiber distributed data interface.

### FDDI order

In the computer world, the term *bit order* is analogous to the order for reading the flow of letters across a page of text. FDDI order is somewhat like reading from left to right, as English speakers normally do. Thus, the characters `TIME WAR` would be read as "time war." To compare FDDI order to a very different ordering, *see* canonical order.

In more technical terminology, FDDI order is a method for representing the 48-bit (6-byte) sequences used for addresses in FDDI. This method considers the first transmitted bit within a byte to be the *most significant* bit, as illustrated in Figure Gl-2. For example, the sequence <1 followed by 0, 0, 0> is represented as 8 decimal. This is FDDI's native ordering and is bit-swapped within each byte with respect to canonical (or Ethernet) order. For the bytes themselves, the first transmitted byte is considered to be the most significant byte (the same as for canonical order).

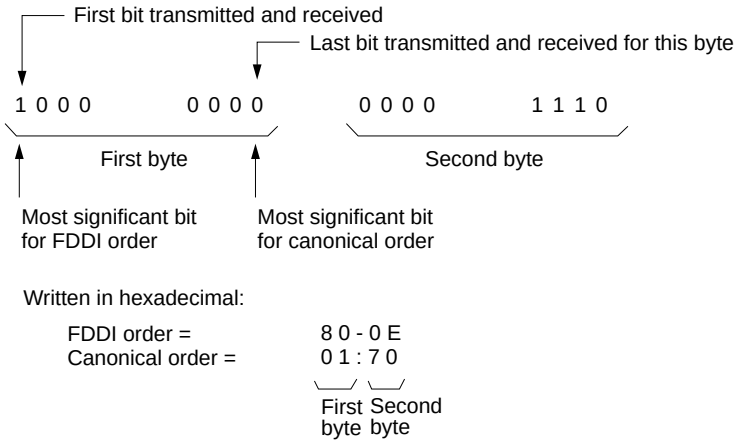



**Figure Gl-2** FDDI Order

The SMT commands represent each byte of an FDDI address in FDDI order as a hexadecimal value (two hexadecimal characters) separated by a dash (-), for example, 10-00-96-25-30-0b. *See also* canonical order.

### fiber distributed data interface (FDDI)

A fiber distributed data interface that is a 100 Mbps standard for fiber optic communications made up of two counter-rotating rings of message traffic.

### fiber optic cable

A type of communications cable constructed of material (for example, glass) that allows an optical signal (light) to travel through it. Fiber optic cable currently is available in two types: multimode and single-mode.

The inside diameter, or pipe, of multimode fiber optic cable is big enough so that light "bounces off the walls" in a number of ways as it proceeds down the fiber. Each of the possible paths is referred to as a mode that takes a slightly different time to travel down the pipe. The existence of the multiple modes causes intersymbol interference.

Single-mode fiber optic cable is narrower than multimode, so the transmitted signal bounces less. Only one mode (straight down the center) maintains its power and is low loss. The other modes quickly dissipate as light moves down the fiber.

The larger, multimode fiber optic cable (typically 62.5 micron internal diameter) is easier to launch a signal into. The interference, rather than the loss of power or spectral purity, limits the distance for a given bit rate, so multimode fibers are most often driven with inexpensive light-emitting diodes (LEDs).

The smaller, single-mode fiber (typically 50 micron internal diameter) is harder to couple power into. However, since there is only one mode, the light can travel much farther without successive bits interfering with each other—or, equivalently, a higher bit rate can be supported at a given distance. To achieve its higher potential, single-mode fiber is usually (but not always) driven with expensive semiconductor lasers rather than LEDs.

### fiber optics

A technology whereby signals are transmitted over an optical waveguide medium through the use of light-generating transmitters and light-detecting receivers.

### frame

A protocol data unit (PDU) transmitted between cooperating MAC entities on a ring. *See also* protocol data unit. The nine fields of the FDDI frame and the number of symbols used by each field are illustrated in Figure Gl-3: I = idle; SD = starting delimiter; FC = frame control; DA = destination MAC address; SA = source MAC address; data = user data; FCS = frame check sequence; ED = ending delimiter; FS = frame status.

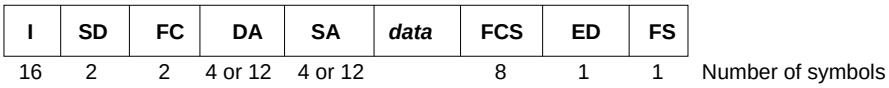



**Figure Gl-3** FDDI Frame

### frame class

Identifies the general function of the frame. SMT defines eight frame classes, listed below:

| | |
|---|---|
| NIF | neighbor information frames |
| SIF | status information frames |
| ECF | echo frames |
| RAF | resource allocation frames |
| RDF | request denied frames |
| SRF | status report frames |
| PMF | parameter management frames |
| ESF | extended service frames |

### frame type

Defines the specific purpose of the frame. SMT frame types are Announcement, Request, and Response. Announcement communicates information; Request asks the targeted (destination) SMT to provide an answer; Response is the answer to a Request frame. Each SMT frame class supports one, two, or three frame types.

### frequency

The number of cycles completed by a signal in 1 second, expressed in hertz (Hz). For example, 5000 cycles per second is expressed as 5000 Hz (or 5 kHz).

### gateway

A computer that, in addition to doing all the tasks that a router performs, supports conversion (translation) from one network's protocols to the other's. For example, an FDDI/Ethernet gateway converts 4500-byte FDDI packets into 1500-byte Ethernet packets whenever packets originate on the FDDI ring and require routing (forwarding) to a destination on the Ethernet network. *See also* router.

### hostname

The user-friendly name assigned to a system. The hostname is specified in the */etc/sys_id* file. A system's hostname can be displayed with the *hostname* command.

### IEEE order

*See* canonical order.

### interchannel isolation

The ability to prevent undesired optical energy from appearing in one signal path as a result of coupling from another signal path, thus eliminating crosstalk.

### International Standards Organization (ISO)

The international standardization body; ANSI represents the United States as a member of ISO.

### Internet address

Also called IP address. A globally unique 4-byte (32-bit) number used by the Internet Protocol (IP or TCP/IP) software to identify computers (or more accurately, computers' network connections). As the well-quoted dictum says: "In the IP world, hosts do not have addresses, network interfaces do." One computer (host) can have one or more IP addresses; each physical network connection for a host must have at least one unique IP address.

Internet addresses come in a number of classes; the major classes are A, B, and C. All IP addresses have three parts: class identifier, network identifier, and host identifier. The number of bits used to represent each part depends on the address' class, as described below:

- Class A addresses use one bit (bit 0) for class identification, 7 bits for network identification, and 24 bits for host identification.
- Class B addresses use 2 bits (bits 0 and 1) for class identification, 14 bits for network, and 16 for host.
- Class C addresses use three bits (bits 0 to 2) for class identification, 21 for network, and 8 for host.

The class plus network identification parts are commonly referred to as the "network address," while the class, network, and host identification parts are referred to as the "host address." For example, the network address for a device with an IP (or host) address of 206.2.71.198 is "net 206.2.71." IP addresses are usually represented in ASCII digits 0 to 9 in dotted decimal notation (for example, 126.13.69.237). Table Gl-1 shows the maximum world-wide number of networks that are possible for IP addresses. Table Gl-1 also shows how many hosts can share any single network address.

**Table Gl-1** Maximum Networks and Hosts Possible for IP Addresses

| Class | Maximum Number of Networks Possible World Wide | Maximum Number of Hosts Possible for Each Network Address |
|---|---|---|
| A | 127 | 16,777,213 |
| B | 16,383 | 65,533 |
| C | 2,097,151 | 253 |

Table Gl-2 summarizes the ranges of valid addresses within these three classes.

**Table Gl-2** Internet Address Ranges

| Class | Bit Usage Within Address (each X represents one byte) | Smallest Non-Broadcast Valid Address | Largest Valid Non-Broadcast Address |
|---|---|---|---|
| A | X. X.X.X<br>classid + netid hostid | 1.0.0.1 | 126.255.255.254<br>(127.x.x.x is reserved) |
| B | X.X. X.X<br>classid + netid hostid | 128.0.0.1 | 191.255.255.254 |
| C | X.X.X X<br>classid + netid hostid | 192.0.0.1 | 223.255.255.254 |

To ensure global uniqueness, network addresses (or blocks of them) are assigned, by the Network Information Center, to requesting organizations. The network administrator for each organization allocates the individual addresses (host addresses within the assigned blocks) to specific devices. Local network administrators are responsible for ensuring that two devices at the same site do not use the same address. *See also* dotted decimal notation.

### IP address

*See* Internet address.

### ISO

*See* International Standards Organization.

### JK

The nondata symbol pair that identifies the start of a frame. *See also* symbol.

### least significant

The item in a sequence that, by its placement within the sequence, makes the least difference in the value. For example, in the decimal number 209, nine is the least significant digit because it represents ones while the other digits represent larger values (tens and hundreds). *See also* most significant.

### line state

One of several characteristic patterns of bits or symbols transmitted on an FDDI fiber. *See also* symbol.

### LLC

*See* logical link control.

### load

The amount of traffic on the ring.

### logical ring

The set of MACs (for example, FDDI stations) serially connected, thus forming a single ring. An unwrapped, fault-free FDDI ring provides two logical rings.

### logical link control (LLC)

Local area network protocols in the lower layers of the OSI model. *See also* Open Systems Interconnection.

### MAC

*See* media access control.

### management information base (MIB)

A database of FDDI station and ring information. Each Station Management (SMT) module manages its own MIB; however, in order to manage the ring, SMTs share much of the MIB information with each other. Each MIB object (item of information) has a set of attributes, including read and write permissions. FDDIXPress provides the */usr/etc/smtstat* command to display MIB information.

### media access control (MAC)

Local area network protocol functions corresponding to the OSI data link layer (layer 2). MACs provide the following:

- on transmission, assemble data into a frame with address and error-detection fields
- on reception, disassemble frame, perform address recognition and error detection
- manage data link layer communication

### media interface connector (MIC)

A type of connector that provides an interface (connection) between FDDI cables. Each MIC contains two fiber optic fiber lines: one for transmit and one for receive.

### MIB

*See* management information base.

### MIC

*See* media interface connector.

### MIC receptacle

The fixed or stationary half of an optical signal transmissions cable connection attached to FDDI. Receptacles mate with plugs. *See also* connector receptacle.

### most significant

The item in a sequence that, by its placement within the sequence, makes the most difference in the value. For example, in the decimal number 209, two is the most significant digit because it represents hundreds while the other digits represent smaller values (tens and ones). *See also* least significant.

### neighbor

A term that refers to the two functioning stations on either side of an FDDI station. A neighbor station is the immediate next station on a logical ring when viewed from the station in question. A neighbor can be either upstream or downstream. *See also* upstream, downstream, logical ring.

### neighborhood information frame (NIF)

The neighborhood information frame is used by a station for periodic announcement of its address and basic station description.

### network address

A unique, nonphysical address that identifies a local area network. The format for this address varies depending on the address family (for example, OSI, Internet). For the Internet (IP or inet) family, the network address is an IP address in which that portion commonly referred to as the *netid* is followed by a *hostid* portion of zero. For example, a Class A address of 125.0.0.0 (dotted decimal notation), a Class B address of 191.252.0.0 (dotted decimal notation), and a Class C address of 203.27.190.0 are all network addresses.

**Note:** In some environments, the definition and usage of the term *network address* is quite different from this definition.

The OSI family's equivalent to the IP address is the NSAP address as defined in *ISO8348*, not the SNPA.

### network connection name

A user-friendly name associated with a specific network interface. Network connection names are specified in the */etc/hosts* file. The network connection name for the primary network interface is the system's hostname. (*See* hostname.) By convention, a system's other network connection names include the system's hostname. For example, a host by the name of *mickey* with two network connections might have its FDDI interface associated with the network connection name *mickey*, while its Ethernet interface is associated with the name *gate-mickey*.

### Network Information Center

The central authority that assigns blocks of Internet Protocol (IP) addresses to worldwide public and private organizations. The current address for this organization is Government Systems, Inc., Attn: Network Information Center, 14200 Park Meadow Drive, Suite 200, Chantilly, VA 22021 (at telephone 1-800-365-3642). *See also* Internet address.

### NIF

*See* neighborhood information frame.

### node

A generic term referring to an active device (station or concentrator) on an FDDI ring. Each node has one (and only one) SMT module managing it. A node can have zero or multiple MACs, PHYs, and PMDs.

### octet

A data unit composed of eight ordered bits; octet is a synonym for byte. A pair of data symbols is represented in one octet.

### Open Systems Interconnection (OSI)

The OSI model is a standard for computer communications protocols and the implementation of these protocols. The model is a product of International Standards Organization (ISO) and specifies a seven-layer architecture.

### optical bypass switch (OBS)

A device that can be connected between a dual-attachment station and the dual ring. If the station fails, is powered off, or is physically removed, the OBS prevents the ring from wrapping by directing the signal back onto the ring, thus bypassing the station. The station's two neighbors will notice that their upstream or downstream neighbor has changed, but the signal continues to loop around the ring, so no wrap occurs.

### OSI

*See* Open Systems Interconnection.

### path test

A self-test performed by an FDDI node's own CMT to verify that its connection to the ring is performing correctly. The path test is one part of the trace function.

The path test includes the following items:

- verification that the MAC can resolve the beacon and claim process
- loopback verification of the PHY's functionality
- verification of accessibility of all data paths at the node
- confirmation of the parameters given to the MAC

**PCM**

*See* physical connection management.

**PDU**

*See* protocol data unit.

**PHY**

*See* physical layer protocol.

**physical connection management (PCM)**

The portion of connection management (CMT) that manages a physical connection between the PHY being managed and another PHY, likely an adjacent (neighbor) station on the ring.

**physical layer protocol (PHY)**

The layer that performs the clock recovery and serial-to-parallel (receive) or parallel-to-serial (transmit) conversion of data between the transmission medium and the MAC entity.

**physical layer medium dependent protocol (PMD)**

The medium that specifies the optical-to-electrical conversion mechanism to conform to FDDI.

**PMD**

*See* physical layer medium dependent.

**port**

The physical location where a computer's signals pass through to a peripheral device or a communications network medium (cable). In FDDI, there are four types of ports: A, B, S, and M. Ports A and B are both used for a dual-attachment configuration; port S is used for a single-attachment configuration; M ports are found only on concentrators. Each port has both an incoming (reception) line and an outgoing (transmission) line; however, in some configurations, only one line is in use.

**primary ring**

The main transmission ring within a dual ring. *See also* DAS, ring, secondary ring.

**protocol data unit (PDU)**

The unit of data transfer between communicating peer layer entities. It may contain control information, address information, data, or any combination of the three. The FDDI PHY PDUs are code groups such as frames and tokens. *See also* frame.

**receive**

The action of a station accepting a token, frame, or other symbol sequence from the incoming medium.

**receiver**

An electronic circuit that converts an optical signal to an electric logic signal.

**repeat**

The action of a station in receiving a token or frame from the adjacent upstream station and simultaneously sending it to the adjacent downstream station.

**ring**

Two or more stations that pass information sequentially through a physical medium (cable). Each station examines all information on the physical medium, copies information sent to it, and returns the information to the cable where the originating station can read it.

**ring management (RMT)**

The portion of connection management that monitors the MAC. It provides a trace mechanism to handle beaconing and also detects duplicate addresses on the ring.

**RMT**

*See* ring management.

**router**

A computer that routes (forwards) packets between two or more networks and is capable of discovering (or maintaining) routes to distant network destinations. In the simplest situation, a router with two network connections moves from network 1 to network 2 all of the packets that have been transmitted on network 1, but are destined for a host on network 2, and vice versa. In cases in which the destination host is located on a network to which the router is not physically attached, the router sends the packet to the next router along the route; and that router passes the packet to another router, until the packet can be delivered directly to the specified destination host. In OSI terminology, a router is an Intermediate System supporting network layer forwarding.

**SA**

*See* source address.

**secondary ring**

The backup ring used when a fault occurs on the primary ring. *See also* primary ring.

**SIF**

*See* status information frame.

**single-attachment station (SAS)**

A station that offers a single connection (attachment) to the FDDI network.

**SMT**

*See* station management.

**source address (SA)**

The address of the station that sends a frame. The address consists of 4 symbols (16-bit address) or 12 symbols (48-bit address).

**station**

An addressable node on an FDDI network capable of transmitting, repeating, and receiving information. A station has exactly one SMT, at least one MAC, at least one PHY, and at least one PMD.

**station management (SMT)**

One of the FDDI standards. The entity within a station that monitors station activity, exercises overall control of station activity, and manages the FDDI ring. The SMT module controls and manages the station's processes at the various FDDI layers. It also works cooperatively with other SMT modules to manage the ring. SMT provides services such as fault isolation and recovery for the ring, maintenance of the local station's MIB, control over station insertion and removal from the ring, and configuration management.

**station ID**

An 8-byte (64-bit), site-configurable number used by SMT modules to identify and reference FDDI stations. This number is used only for reporting status information. The FDDIXPress SMT daemon, by default, creates the station ID from the station's MAC address. The six bytes of the MAC address (in canonical order) occupy the lower six bytes of the station ID and the upper two bytes are set to zero.

### status information frame (SIF)

Status information frames are used to request and provide, in response, a station's configuration and operating information.

### straight-tip (ST®)connector

An optical fiber connector used to join single fibers together.

### symbol

The smallest signaling element used by the data link layer. The FDDI symbol set consists of 16 data symbols and 8 control symbols. Each symbol corresponds to a specific sequence of 5 bits transmitted by the physical layer on the optic cable that is seen by software as a 4-bit sequence. (The 4-bit to 5-bit conversion, and vice-versa, is done by hardware.)

### target token rotation time (TTRT)

The amount of time a station bids in the claim process. The station whose claim indicates that it has the lowest TTRT wins the claim process. This TTRT value is then used by all stations on the network for setting TTRT.

### token

A packet that is the explicit indication of the right to transmit on a shared medium. On a token ring, the token circulates sequentially through the stations on the ring. At any time, it may be held by zero or one station. The format for the FDDI token is illustrated in Figure Gl-4. The FDDI token has four fields: I = idle; SD = starting delimiter; FC = frame control; ED = ending delimiter. The illustration indicates the number of symbols used for each field.

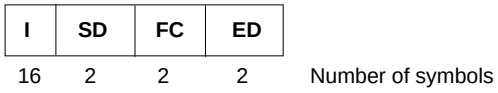



**Figure Gl-4** FDDI Token

### token ring

A set of stations serially connected by a transmission medium (cable) to form a closed loop.

### token rotation time (TRT)

The maximum time that a token needs to make a complete circuit around the ring.

### trace

An RMT function that attempts to provide ring recovery when there is a stuck (continuous) beacon condition on the ring. The trace causes all stations and concentrators upstream from the tracing SMT to leave the ring and perform a Path Test. When the stuck device is isolated, the ring is wrapped so as to exclude the stuck device.

### transmit

The action of a station generating a frame, token, or control sequence and placing it on the medium to the next station.

### transmitter (optical)

An opto-electronic circuit that converts an electrical logic signal to an optical signal.

### tree

A physical topology consisting of a hierarchy of master-slave connections between a concentrator and other FDDI nodes (including subordinate concentrators) as illustrated by the dotted enclosure in Figure Gl-5.

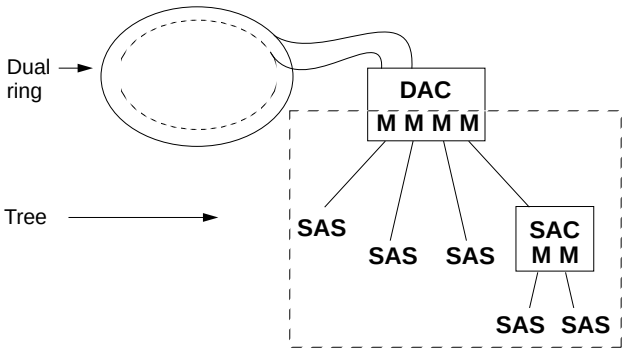



**Figure Gl-5** Tree Topology

### TRT

*See* token rotation time.

### trunk

A physical loop topology, either open or closed, employing two optical fiber signal paths, one in each direction (that is, counter-rotating), forming a sequence of peer connections between FDDI nodes. When the trunk forms a closed loop, it is sometimes called a trunk ring.

### TTRT

*See* target token rotation time.

### upstream

Opposite from the direction of the optical signal's flow within a ring.

### wrap

A condition in which the primary ring loops to (is connected to) the secondary ring. Wraps occur when there is a fault on the primary ring, as illustrated in Figure Gl-6. The fault or break in the primary ring prevents the optical signal from completing the loop around the ring, thus stopping all communication. Wrapping reestablishes the loop and allows communication to continue. When a ring is wrapped, one or more ports have been left out of the ring.

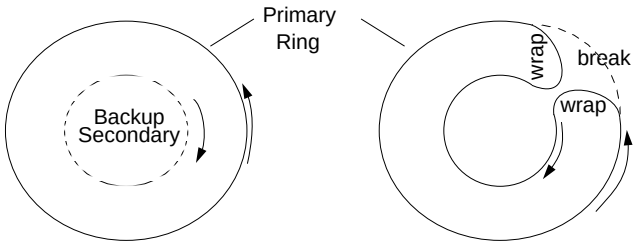



**Figure Gl-6** Wrap

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## E



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**M**



**N**



**O**



**P**

## R



## S

## Tell Us About This Manual

As a user of Silicon Graphics products, you can help us to better understand your needs and to improve the quality of our documentation.

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