TS-2800 Token Ring Switch Planning and Configuration Guide

MANU0212-02 - Rev. A. - April, 1998

Switch Software Version 3.6.1
ATM UFC Software Version 1.12.3

85H8279

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Legal Notices

FCC CLASS A NOTICE

WARNING: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void this user's authority to operate this equipment.

NOTE: The TS-2800 has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of the equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. FORE is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

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

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This digital apparatus does not exceed Class A limits for radio noise emission for a digital device as set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de la class A prescrites dans le reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.

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This equipment is in the Class 1 category (Information Technology Equipment to be used in commercial and/or industrial areas) and conforms to the standards set by the Voluntary Control Council For Interference by Information Technology Equipment aimed at preventing radio interference in commercial and/or industrial areas.Consequently, when used in a residential area or in an adjacent area thereto, radio interference may be caused to radios and TV receivers, etc. Read the instructions for correct handling.

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This product is in conformity with the protection requirements of EU Council Directives 73/23/EEC and 89/336/EEC on the approximation of the laws of the Member States. FORE cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-FORE option cards.

This product has been tested and found to comply with the limits for Class B Information Technology Equipment according to CISPR 22/European Standard EN 55022:1994. The limits for Class B equipment were derived for residential environments to provide reasonable protection against interference with licensed communication devices.

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Preface

The intent of this manual is to provide the technical information needed to install and operate the FORE Systems TS-2800 Token Ring switch. This manual was created for users with various levels of experience. Please read this manual carefully before attempting to perform any of the procedures contained in it. If you have any questions or problems with the installation or configuration, please contact FORE Systems' Technical Support as described on page iii.

Chapter Summaries

Chapter 1 - Physical Characteristics and Features - Describes the TS-2800 Token-Ring switch. It also provides a brief functional overview.

Chapter 2 - Network Planning and Installation Preparations - Explains how to plan for the installation and configuration of a TS-2800, and provides sample scenarios.

Chapter 3 - Installation - Describes installation and cabling procedures.

Chapter 4 - Configuration - Provides the default configuration parameters, definitions of those parameters, and instructions for changing the settings. This chapter is organized from domain-specific settings to port-specific settings.

Chapter 5 - Managing the TS-2800 - Provides procedures for viewing switch status or statistics. The chapter is arranged from switch-specific parameters, to domain parameters, to port-specific parameters.

Chapter 6 - Managing the ATM UFC - Provides procedures for viewing ATM status or statistics.

Chapter 7 - Resetting the TS-2800` - Explains how to reset the TS-2800 and run diagnostic tests.

Chapter 8 - Troubleshooting and Service - Provides troubleshooting procedures for the TS-2800.

Chapter 9 - Downloading Software - Describes procedures for downloading new code.

Appendix A - Planning Charts and Worksheets - Provides charts and worksheets to record information about your TS-2800 installation.

Appendix B - Advanced Configuration of a LEC - Provides procedures for configuring advanced LEC parameters.

Appendix C - Cable and Pin Information - Provides technical specifications for the cables and pins used by the TS-2800.

Appendix D - Menus and Panels Index - Provides an index to information in this manual organized by menus and panels.

Appendix E - ARI and FCI Bits - Provides a description of how the ARI and FCI bits are set by the TS-2800.

Technical Support

In the U.S.A., customers can reach FORE Systems' Technical Assistance Center (TAC) using any one of the following methods:

1. Select the "Support" link from FORE's World Wide Web page:

   http://www.fore.com/

2. Send questions, via e-mail, to:

   support@fore.com

3. Telephone questions to "support" at:

   800-671-FORE (3673) or **724-742-6999**

4. FAX questions to "support" at:

   724-742-7900

Technical support for customers outside the United States should be handled through the local distributor or via telephone at the following number:

+1 724-742-6999

No matter which method is used to reach the TAC, customers should be ready to provide the following:

- A support contract ID number
- The serial number of each product in question
- All relevant information describing the problem or question

Typographical Styles

Throughout this manual, all specific commands meant to be entered by the user appear on a separate line in bold typeface. In addition, use of the `Enter` or `Return` key is represented as `<ENTER>`. The following example demonstrates this convention:

cd /usr <ENTER>

File names that appear within the text of this manual are represented in the following style: "...the `fore_install` program installs this distribution."

Command names and menu items that appear within the text of this manual are represented in the following style: "...select **Domain Configuration...** to display the Domain Configuration panel."

Any messages that appear on the screen during software installation and network interface administration are shown in `Courier` font to distinguish them from the rest of the text as follows:

SYSREQ: Press any key to return to System Request menu.

Important Information Indicators

To call your attention to safety and otherwise important information that must be reviewed to ensure correct and complete installation, as well as to avoid damage to the FORE Systems product or to your system, FORE Systems utilizes the following *WARNING/CAUTION/NOTE* indicators.

WARNING statements contain information that is critical to the safety of the operator and/or the system. Do not proceed beyond a ***WARNING*** statement until the indicated conditions are fully understood or met. This information could prevent serious injury to the operator, damage to the FORE Systems product, the system, or currently loaded software, and is indicated as follows:

WARNING!

Your FORE Systems product is shipped with a grounding type (3-wire) power cord. To reduce the risk of electric shock, always plug the cord into a grounded power outlet.

CAUTION statements contain information that is important for proper installation/operation. Compliance with **CAUTION** statements can prevent possible equipment damage and/or loss of data and are indicated as follows:

CAUTION

Use care when inserting the power supply into the backplane. Insert the power supply gently and carefully to avoid bending the connector pins. Do not force the connection.

NOTE statements contain information that has been found important enough to be called to the special attention of the operator and is set off from the text as follows:

NOTE

The second power supply can be hot-inserted. If you are installing this power supply in an existing installation, do not disconnect power from the TS-2800 or remove the existing power supply.

Safety Precautions

For your protection, observe the following safety precautions when setting up equipment:

- Follow all warnings and instructions marked on the equipment.
- Ensure that the voltage and frequency of your power source matches the voltage and frequency inscribed on the equipment's electrical rating label.
- Never push objects of any kind through openings in the equipment. Dangerous voltages may be present. Conductive foreign objects could produce a short circuit that could cause fire, electric shock, or damage to your equipment.

Modifications to Equipment

Do not make mechanical or electrical modifications to the equipment. FORE Systems, Inc., is not responsible for regulatory compliance of a modified FORE product.

CAUTION

No user serviceable parts inside product. Refer service to qualified personnel.

Placement of a FORE Systems Product

CAUTION

To ensure reliable operation of your FORE Systems product and to protect it from overheating, openings in the equipment must not be blocked or covered. A FORE Systems product should never be placed near a radiator or heat register.

Power Cord Connection

WARNING!

FORE Systems products are designed to work with single-phase power systems having a grounded neutral conductor. To reduce the risk of electrical shock, do not plug FORE Systems products into any other type of power system. Contact your facilities manager or a qualified electrician if you are not sure what type of power is supplied to your building.

WARNING!

Your FORE Systems product is shipped with a grounding type (3-wire) power cord. To reduce the risk of electric shock, always plug the cord into a grounded power outlet.

WARNING!

To avoid a shock hazard, do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.

WARNING!

When possible, use one hand to connect or disconnect signal cables to prevent a possible shock from touching two surfaces with different electrical potentials.

Required User Guide Statements - UK Installation

In the UK, by law, the telephone cable must be connected after the power cord. The power cord must be disconnected after the telephone line cable.

CHAPTER 1 Physical Characteristics and Features

The FORE Systems TS-2800 Token Ring switch provides high-speed forwarding of Token Ring frames among the shared or dedicated Token Ring segments attached to each of the TS-2800 ports. The TS-2800 creates multiple, concurrent paths among the connected segments, each supporting the full, 16-Mbps Token Ring bandwidth.

The ATM uplink provided with the TS-2800 implements the industry-standard ATM Forum Token Ring LAN Emulation Over ATM, Version 1.0 Specification, generally referred to as *ATM Token Ring LANE 1.0*. ATM Token Ring LANE allows for the seamless flow of Token Ring over an ATM network, independent of higher layer protocols such as SNA, IP, and IPX.

The TS-2800 forwards Token Ring frames among multiple, shared or dedicated Token Ring LAN segments. Using a frame-forwarding technique similar to that of a multiport Token Ring transparent bridge, the TS-2800 uses both Token Ring MAC addresses and source-route descriptors to forward Token Ring frames from one of its ports to another.

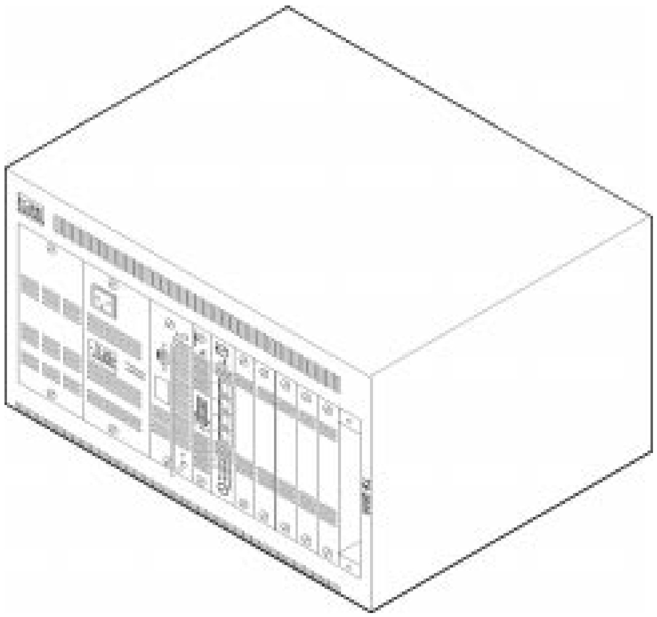


Figure 1.1 - The TS-2800

The TS-2800 is a rack- or surface-mount chassis that provides slots for two power supplies, one Token Ring Processor Card, one or two ATM UFCs (Universal Feature Cards), and six or seven UFCs. The chassis also contains two cooling fans. These fans cool the Token Ring Processor Card and UFCs. The power supplies have their own integrated fans. The TS-2800 can connect to Token Ring and ATM networks. All LAN ports on the TS-2800 are provided by UFCs. At least one UFC must be installed in order to have a functional unit. The following UFCs are included with the TS-2800 starter kit:

- 4-Port Token Ring / Enhanced UTP / STP UFC
- ATM 155-Mbps Multimode SC Fiber / Token Ring UFC

2-Port Token Ring / Enhanced Fiber Multimode ST UFCs are also available.

1.1 Product Features

The TS-2800 comes preset with the appropriate default settings for Plug and Play capability. In a simple network configuration, the TS-2800 can be used with the factory default settings. The TS-2800 includes the following features:

IEEE 802.5 compliance

Full compliance with the IEEE 802.5 Token Ring Standard and the emerging Dedicated Token Ring Standard. Supports priority messaging.

Transparent switching

Plug and Play provides the following advantages:

- Transparent forwarding based on MAC addresses.
- Automatic learning of network configuration.
- Transparency to high-level protocol.

Virtual switching

The virtual switch feature allows you to divide the switch into as many as 16, non-overlapping broadcast domains to help manage traffic and isolate some users from certain network resources. Each domain has its own IP address. Packets are forwarded between ports in the same domain only.

Source-Route Bridging

To further enhance the advantages of Transparent Bridging, the TS-2800 provides a built-in source-route bridge function. Source-Route Bridging switches frames among Token Ring segments with different LAN IDs (also called *ring numbers*). This capability allows any combination of TS-2800 domains to be interconnected internally by a multiport source-route bridge.

In addition, Source-Route Bridging dynamically updates the maximum frame size for each route, eliminating the need to configure the frame size at every work station in the network.

Variable switching modes

The TS-2800 provides the following switching modes:

- *Cut-Through mode*, which provides the benefits of low-latency, high-speed switching when there is no congestion.
- *Store-and-Forward mode*, which provides more error isolation between segments during periods of congestion.
- *Adaptive mode*, which takes advantage of the benefits of the preceding two modes. You can configure the TS-2800 to alternate automatically between Cut-Through and Store-and-Forward modes based on your specified, soft-error thresholds.

MAC addresses

A factory-assigned range of 160 MAC addresses, 96 for the base switch and 32 for each ATM UFC.

10000 filter table entries (MAC addresses and route descriptors)

The TS-2800 supports a maximum of 1790 filter table entries per port, but no more than 10000 for each TS-2800. The filter tables include both MAC address and source-route descriptor entries.

MAC address filtering

MAC address filtering and port security enable the TS-2800 to control traffic on the network by allowing up to 100 source or destination MAC addresses to be selectively filtered at the port of entry into the TS-2800.

User-configurable MAC address aging parameters

The address tables have user-configurable aging parameters that you can set by port or for the entire TS-2800. You can configure the TS-2800 to clear space in the address tables when a configurable threshold is exceeded.

Ease and adaptability

The TS-2800 provides:

- Automatic sensing and port configuration.
- Adaptive switching mode.
- Easy installation.

TokenPipes Feature

You can configure Token Ring ports in connected TS-2800s to create two to four parallel, 16-Mbps links. This increases capacity on a single connection between TS-2800s to support up to 64 Mbps half-duplex (HDX) or 128 Mbps full-duplex (FDX) by using TokenPipes.

Management

Console management via the serial port, connected directly or through a modem, or an in-band TCP/IP session using Telnet or an SNMP manager.

SNMP

Supports standard MIB objects.

Port cost and port priority settings for Spanning Tree

As part of the Spanning Tree function, the TS-2800 allows you to set specific port cost and port priority parameters. When the Spanning Tree reconfigures itself, it selects forwarding ports based on the port cost. For port priority, the port with the lowest priority value will be selected to forward Spanning Tree frames.

Note that the TS-2800 provides two Spanning Tree functions - one for domains not enabled for source-route bridging and one for source-route bridged domains. The parameter settings are independent for each of the two Spanning Tree functions.

Statistics

The TS-2800 keeps statistics by port, by connected station, and for the entire switch.

TokenProbe feature

You can configure any of the Token Ring ports as the TokenProbe port. This port then monitors any of the other Token Ring ports on that switch so that a network analyzer can trace port activity.

Easy software upgrades

You can download software upgrades through the console port or TFTP.

You can initiate a download command from the console menu or the command can result from corrupted flash detection during the POST. When this command is initiated, the TS-2800 accepts the downloaded file using the Xmodem file transfer protocol in a terminal emulator.

Console interface

Provides a console interface through the following media:

- Direct link into serial port.
- Link to serial port using a modem.
- Telnet session.

You can also use SNMP management for a switch interface.

Mounting options

Can be rack or surface mounted. Mounting brackets are included with each TS-2800.

1.2 Physical Characteristics

The TS-2800 faceplate is illustrated in Figure 1.2. The appearance of your TS-2800 will vary depending on the configuration you ordered from FORE. Following the illustration is a description of each of the plug-in modules and UFCs. The connectors, indicators, and switches for each module are also discussed.

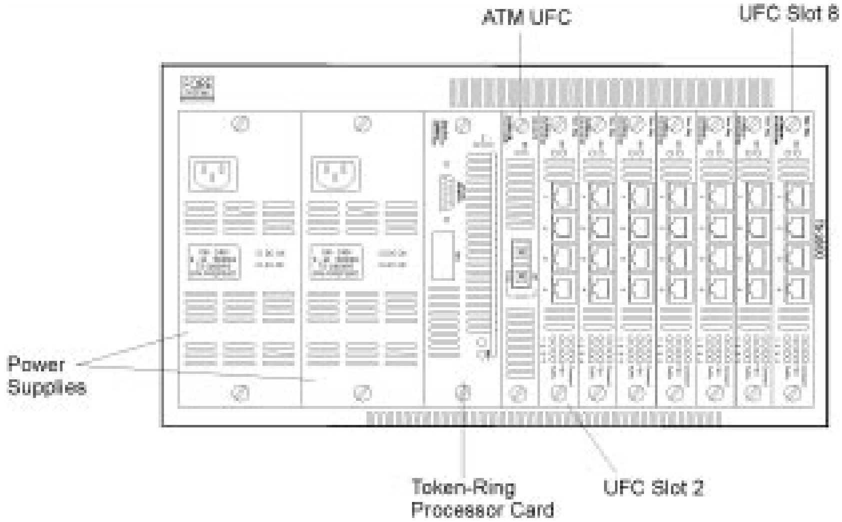


Figure 1.2 - The TS-2800 Faceplate

1.2.1 Power Supply

The TS-2800 provides two slots for power supplies. These are the two leftmost slots in the chassis. (see Figure 1.2). At least one power supply must be installed. The first (left) slot is available for installation of an optional, redundant power supply.

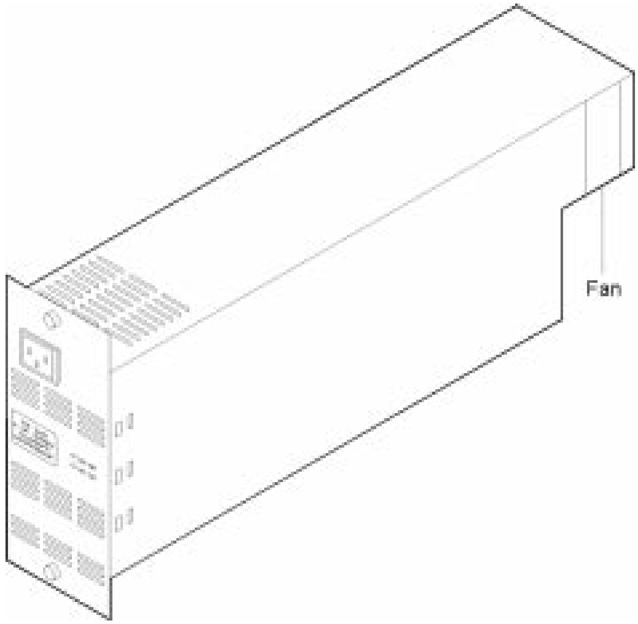


Figure 1.3 - The TS-2800 Power Supply

Figure 1.3 illustrates the TS-2800 power supply. The integrated cooling fan for the power supply is located at the rear of the module. Details of the power supply faceplate are shown in Figure 1.4.

One connector and two LEDs are on the power supply faceplate. The connector is for a standard three-prong power cord that connects to 120/220 V AC at 50/60 Hz line frequency. The LEDs indicate the status of the AC power input (AC OK) and the DC power output (DC OK). See Table 1.1

1.2.1.1 Using Two Power Supplies

If two power supplies are installed, they share the power load. In the event of a failure by either supply, the good power supply automatically maintains power for the entire TS-2800. Operation of the TS-2800 is not disrupted.

NOTE If both power supplies are not plugged in, you will get an error message when you boot up the TS-2800.

1.2.1.2 Power Supplies Are Hot-Swappable

The TS-2800 power supplies are *hot-swappable* They may be removed and installed while the TS-2800 is powered up. When two power supplies are installed, hot-swapping allows a failed power supply to be replaced without disrupting operation of the switch. Both power supplies must have a line cord connected to AC power.

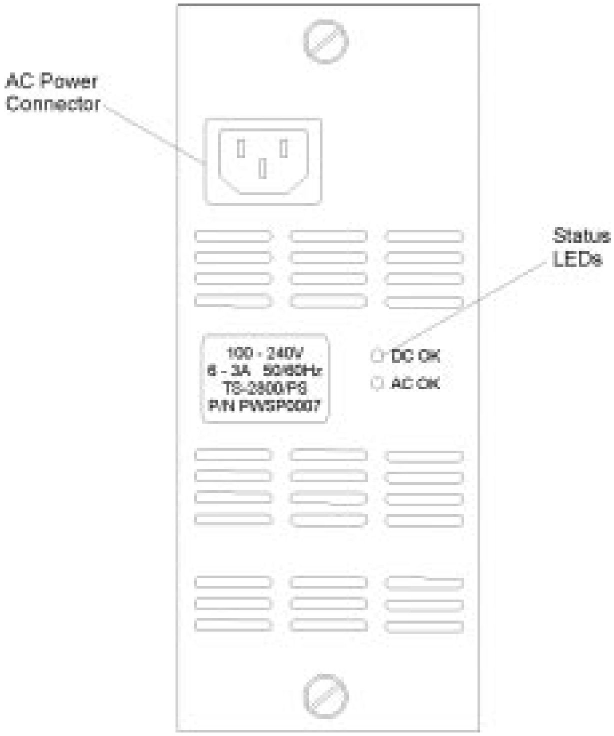


Figure 1.4 - The TS-2800 Power Supply Faceplate

Table 1.1 - Power Supply Status LEDs

LED	State	Meaning
DC OK	On	DC power output is OK.
	Off	DC power output is not OK.
AC OK	On	AC power output is OK.
	Off	AC power output is not OK.

1.2.2 Processor Card

The Token Ring Processor Card is installed in the third slot from the left in the TS-2800 chassis. The Token Ring Processor Card faceplate has three status LEDs, one communication port, one 4-character alphanumeric display and two push buttons. See Figure 1.5. Each of these items is discussed in detail in the following sections.

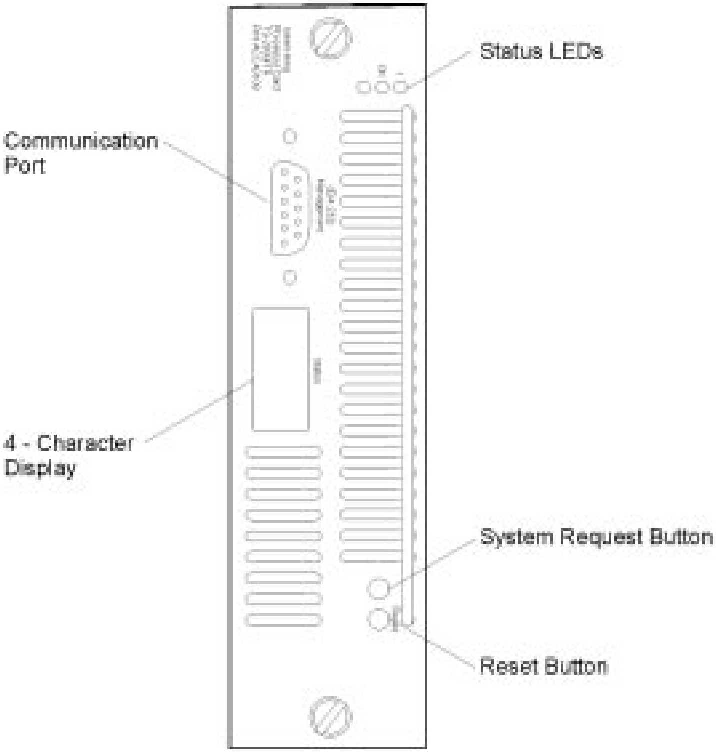


Figure 1.5 - The Token Ring Processor Card Faceplate

1.2.2.1 Status LEDs

The Token Ring Processor Card has three status LEDs. See Table 1.2 for the locations of the LEDs.

Table 1.2 - Status LEDs

Function (color)	Label	State	Meaning
Power (green)	|	On	The Token Ring Processor Card is receiving power from the TS-2800 backplane.
		Off	The Token Ring Processor Card is not receiving power from the TS-2800 backplane.
OK (green)	OK	On	The TS-2800 is working correctly.
		Off	The TS-2800 is not working correctly.
		Blinking	Diagnostics are in progress.
Fault (amber)	unmarked	On	A diagnostic failure has occurred. The Token Ring Processor Card is bad and should be replaced.
		Off	The TS-2800 is working correctly.
		Blinking	Diagnostics are in progress.

1.2.2.2 Status Display

The 4-character alphanumeric display provides additional status information concerning the state of the TS-2800. This includes the power supplies, the Token Ring Processor Card, any installed UFCs, and the chassis fans. The messages are decoded as follows:

- POST (Power-On Self Test) messages

  When POST is running, the first display character is T, followed by a 3-digit numeric code identifying the test in progress. If the test fails, the T character changes to E and the test stops.

- OK

  This message appears for 2 minutes after a successful POST to indicate that the TS-2800 is working correctly.

- Non-test messages
  - The first 2 display characters identify the system component:

    F1 - Fan 1

    F2 - Fan 2

    P1 - Power supply 1

    P2 - Power supply 2

    PC - Processor card

    Sx - UFC in slot x (1 - 8)

    !A - Fuses 3 and 4

    !B - Fuses 1 and 2

    !C - Fuses 7 and 8

    !D - Fuse 6

NOTE

Fuses 3 and 4 control power to the Token Ring Processor Card. If either fuse 3 or fuse 4 fails, the Token Ring Processor Card becomes inoperative and cannot display status messages.

  - The third display character indicates the required action:

    H - Hardware failure. Replace the component identified by the first 2 characters in the message.

NOTE

Replacement of fans and fuses can be done only by qualified service personnel. See “Technical Support” on page iii.

C - Software failure. Download new software from the FORE TACtics web site and reconfigure.

- Boot image
- C2 - Main image

X - UFC is not installed in a valid slot. Move the UFC to a valid slot.

? - The failure cannot be isolated to a specific component. See Chapter 8.

1.2.2.3 EIA 232 Port

This nine-pin, male, management port functions as a DTE port.

With this port you can attach a terminal or terminal emulator to use when customizing the switch's configuration, monitoring switch activity and switch status, testing the switch, or downloading software (see Chapter 9). Console access can be either local, by direct attachment to the EIA 232 port, or remote, through a modem connection.

When enabled, the EIA 232 port automatically detects the baud rate of the terminal to which it is attached.

1.2.2.4 Reset Button

The Reset button resets the hardware and software and clears all tables and memory, including the address tables. Pressing the Reset button does not clear the user-set configuration parameters; those values are stored in nonvolatile random access memory (NVRAM). See Chapter 7 for more information.

1.2.2.5 System Request Button

The System Request button is located next to the Reset button. It is unlabeled and is recessed to prevent unintentional activation. Pressing this button causes the System Request Menu to appear on the console device attached to the EIA 232 port. See "Initiating a Download with the System Request Menu" on page 9-3 for more information.

1.2.3 UFCs

The TS-2800 contains eight UFC slots (see Figure 1.2) that accommodate optional, field-installable UFCs to provide network connections. Currently available UFCs provide the following types of connections:

- Token Ring UTP / STP, four ports (included in TS-2800 starter kit)
- Token Ring optical fiber, two ports
- ATM network, one OC3 port (included in TS-2800 starter kit)

1.2.3.1 Token Ring Ports

Depending upon the type and quantity of UFCs installed, the TS-2800 can provide up to 28 Token Ring ports. This configuration requires seven 4-port UTP/STP UFCs. The 4-port UFC provides shielded RJ-45 connectors for the Token Ring connections.

NOTE

Because slot 1 is considered the default slot for the ATM Uplink UFC, ports 3 and 4 on UFC slot 1 are not available for use in the TS-2800. When a 4-port UFC is installed in slot 1, the invalid slot message (X) appears in the Status display. Even though the invalid slot message is displayed, the 4-port UFC will operate correctly for ports 1 and 2.

These ports allow HDX or FDX connections to other switches, hubs, or end nodes.

You may also use optical fiber Token Ring ports provided by the 2-port Fiber Token Ring UFC. These ports are compatible with RI/RO ports and make connection to the network through ST-compatible optical receptacles and multimode optical fiber cables. Since this UFC has only 2 ports, it is valid for installation in slot 1 of the TS-2800.

The TS-2800 automatically senses what type of Token Ring connection is being used on each of its ports if it is one of the following:

- To a shared-media segment via a Token Ring concentrator
- To another Token Ring switch
- To a 4-Mbps or 16-Mbps Token Ring segment
- To a dedicated- or shared-media segment, directly to a Token Ring LAN station
- Operation in HDX or FDX mode

The TS-2800 will automatically configure (requiring no operator action) each port to operate at the highest level of capability possible. No special crossover cables are required for Token Ring stations on dedicated-media segments or for switch-to-switch connections. These connections use the same cabling used to connect the TS-2800 port to shared-media segments. You can configure the TS-2800 to override this auto-sense and auto-configure capability through the console configurator.

NOTE

If your configuration stops working abruptly, check that an auto-sense or auto-configure setting was not inadvertently set to an inappropriate value.

1.2.3.2 2-Port Fiber UFC

This UFC provides two Token Ring fiber optic ports for the base machine. These ports default to a mode that is compatible with the Ring In/Ring Out (RI/RO) ports of machines such as a multiprotocol switching hub.

The ports support Token Ring fiber optic media vi7a dual ST**-compatible, optical receptacles. Each of these ports provides either shared half-duplex (HDX), 4- or 16-Mbps connections to an RI/RO port or to a full-duplex (FDX) 32-Mbps connection between TS-2800s.

The two ST connectors marked TX send 850 nM infrared light to an attached device. The two ST connectors marked RX detect 850 nM infrared light to an attached device.

In addition to the connectors for the Token Ring ports, there are three operational LEDs for each port and three status LEDs for the UFC overall. See Figure 1.6 for LED locations.

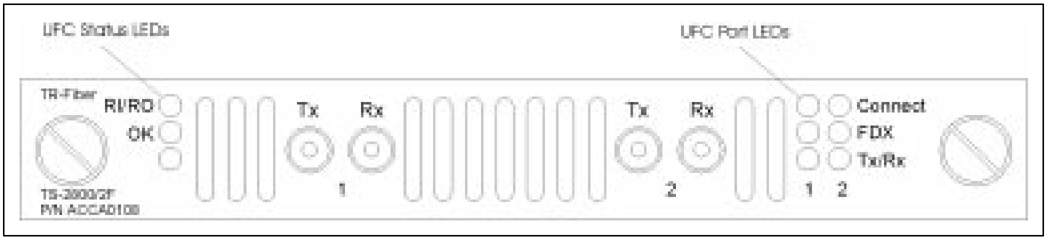


Figure 1.6 - 2-Port Token Ring Fiber UFC Faceplate

1.2.3.3 4-Port Token Ring UTP/STP UFC

This UFC provides four UTP/STP Token Ring ports for the base machine. The functions include operation over twisted-pair (UTP/STP) media via RJ-45 connectors as shared HDX 4- or 16-Mbps connections or dedicated FDX 32-Mbps connections.

In addition to the RJ-45 connectors for the Token Ring ports, there are three operational LEDs for each port and two status LEDs for the UFC overall. See Figure 1.7 for LED locations.

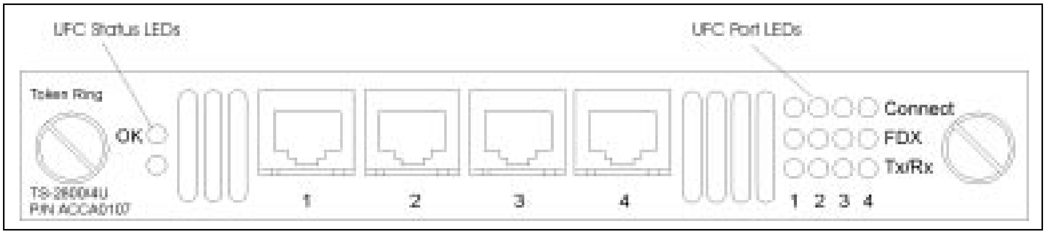


Figure 1.7 - 4-Port Token Ring UTP/STP UFC Faceplate

1.2.3.4 ATM UFC

Refer to "ATM Uplink UFC" on page 1-22 for information about the ATM UFC included with the TS-2800.

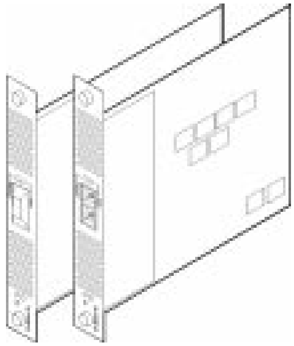


Figure 1.8 - The ATM UFC

Two port status LEDs and two UFC status LEDs indicate the operational status of the UFC and the port. See Figure 1.9 for the LED locations.

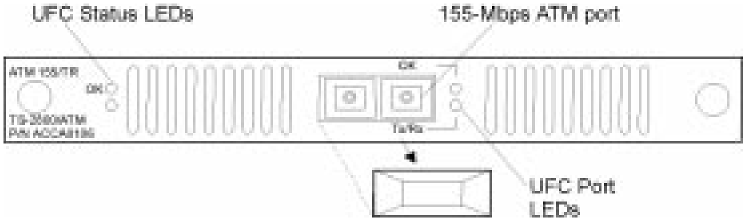


Figure 1.9 - Locations of LEDs and Port for the ATM UFC

1.2.3.4.1 ATM UFC Operating Environment and Physical Dimensions

Table 1.3 - Operating Environment and Physical Dimensions

Measurement	Value
Temperature	10° to 40°C (50° to 104°F)
Relative humidity	8% to 80%
Maximum wet-bulb temperature	27°C (81°F)
Calorific value	7 kcal/hr (27 BTU/hr)
Electrical power	8 watts maximum (at 5 V dc +/- 5%)
Width	170 mm (6.7 in.)
Depth	214 mm (8.4 in.)
Height	25 mm (1 in.)

1.2.3.5 UFC Status LEDs

In most cases, UFCs that can be used in the TS-2800 have OK and Fault (unlabeled) status LEDs. The meaning of these LEDs is similar to those on the Token Ring Processor Card. Refer to Table 1.4 for their meanings.

NOTE

Only the 2-Port UFC has the RI/RO LED.

Table 1.4 - Status LEDs and Their Meanings

LED (color)	Position	State	Meaning
RI/RO (green)	Top	On	The UFC is in RI/RO compatible mode.
		Off	The UFC is not in RI/RO compatible mode.
OK (green)	Middle	On	The UFC is working correctly.
		Off	The UFC is not working correctly.
		Blinking	Diagnostics are in progress when blinking in unison with the Fault LED.

Table 1.4 - Status LEDs and Their Meanings

LED (color)	Position	State	Meaning
Fault (unlabeled (amber)	Bottom	On	An UFC failure has occurred.
		Off	The UFC is working correctly.
		Blinking	Diagnostics are in progress.

1.2.3.6 UFC Port LEDs

In addition to the status indicators, UFCs will have LEDs that show the status of the ports provided by the UFC. Table 1.5 provides the meaning of the port LEDs on the Token Ring UFCs.

Refer to the documentation provided with the UFC for details regarding other port LEDs.

Table 1.5 - Token Ring Port LEDs

LED	Position	State	Meaning
Connect	Top	On	Connected.
		Off	Disabled or faulty port, if the UFC Fault LED is on.
		Blinking	Attempting to connect.
FDX	Middle	On	The port is set to FDX mode.
		Off	The port is set to HDX mode.
Tx/Rx	Bottom	On	Data is being transferred or received by the port.
		Off	Data is not being transferred or received by the port.

1.2.4 Dimensions and Weight

Table 1.6 provides the dimensions and weight of the TS-2800.

Table 1.6 - Dimensions and Weight

Measurement	Value
Width	440 mm (17.32 in.)
Depth	356 mm (14.02 in.)
Height	222 mm (8.74 in.)
Weight (configuration dependent)	17 to 23 kg (37.5 to 50.7 lb.)

1.2.5 Power Requirements

The TS-2800 auto-ranging power supplies operates on line voltage in the range of 100 to 127 or 200 to 265 V AC, and 50 or 60 Hz. Two power cords are shipped with the TS-2800, one for North American use, and one for use in most of Europe, including the United Kingdom.

1.2.6 Operating Environment

Table 1.7 - Operating Environment

Characteristic	Typical Configuration	Maximum Configuration
Temperature	10˚ to 40˚C(50˚ to 104˚F)	Same as typical
Relative Humidity	8% to 80%	Same as typical
Maximum wet-bulb temperature	27˚ C (81˚ F)	Same as typical
Caloric value	180 Kcal/hr (700 BTU/hr)	360 Kcal/hr (1400 BTU/hr)
Electrical Power	0.25 KW	0.6 KW

1.3 Functional Overview

The TS-2800 forwards Token Ring frames at media speeds. With a parallel internal design, the TS-2800 can maintain media-speed frame transfer between each of 15 possible distinct pairs of Token Ring ports simultaneously. This feature provides up to 240 Mbps in HDX mode and up to 480 Mbps if all Token Ring ports are operating in FDX mode. Networks with traffic patterns able to take full advantage of the TS-2800 could sustain throughput equivalent to fifteen 32-Mbps Token Rings.

1.3.1 Maximum Throughput

The flexibility of the TS-2800 allows the system to be configured to meet the requirements of an individual establishment. Any mix of UFCs may be used in the TS-2800, but the potential traffic load must be considered for optimum performance. The maximum continuously sustainable data throughput is **480 Mbps**, regardless of the configuration.

1.3.2 Configuration Guidelines

The following guidelines should be observed when configuring the system:

- Do not install more than two ATM UFC cards. The ATM cards allow traffic to flow to or from the Token Ring ports. The TS-2800 is not designed to provide ATM-to-ATM traffic flow. Refer to “Avoid ATM-to-ATM Switching” on page 1-28.
- Ports operating in FDX mode can utilize more internal bandwidth than ports operating in HDX mode. ATM ports always operate in FDX mode and provide up to 155 Mbps, FDX bandwidth.

The maximum physical configuration of the TS-2800 is 28 Token Ring ports with a single ATM uplink. With a total backplane capacity of 480 Mbps, to create a non-blocking configuration, use the examples shown in Table 1.8 as guidelines. The examples assume that all ports are transferring at full capacity:

- ATM uplink at approximately 125Mbps, allowing for overhead
- HDX = Half-duplex at 16Mbps
- FDX=Full-duplex at 32Mbps:

Table 1.8 - Example Configurations and Throughput

Configuration	Formula	Total Throughput
Five 4-Port UFCs One 2-Port Fiber UFCs One ATM UFCs One free slot (redundant ATM Uplink)	22 HDX ports + 1 ATM port (22*16) + 125 = 477 Mbps	477 Mbps
Five 4-Port UFCs (2 ports configured as FDX) One ATM UFC Two free slots (redundant ATM Uplink)	18 HDX ports + 2 FDX ports + 1 ATM port (18*16) + (2*32) + 125 = 477 Mbps	477 Mbps
Two 4-Port UFCs Two ATM UFCs. (Four ports configured to each ATM UFC.)	8 FDX ports + 2 ATM ports (8*32) + (2*125) = 506 Mbps	506 Mbps (slightly above capacity)

Each port has 512 KB of buffering, fairness algorithms, and split-buffer schemes, to minimize the effects of traffic bursts to or from a single port.

You can connect TS-2800 Token Ring ports to the following devices:

- Another switch
- Shared media
- Dedicated media

1.3.3 Interconnected Switches

Connect any TS-2800 port to another switch in either HDX or FDX mode, or as part of a Token-Pipe connection.

1.3.4 Shared Media

Shared media consists of two or more Token Ring LAN stations that share the 4- or 16-Mbps LAN segment. Connect these ports to Token Ring devices such as multistation access units (MSAUs), Token Ring concentrators, or Token Ring hubs, using the 802.5 Token-Passing Protocol.

1.3.5 Dedicated Media

Create *dedicated media* by directly attaching a single Token Ring LAN station adapter to a switch port without an intervening Token Ring concentrator or hub. You can then operate the LAN station adapter as a dedicated Token Ring device in HDX (4 or 16 Mbps) or FDX (8 or 32 Mbps) mode. FDX requires support by the LAN station adapter.

1.4 ATM Uplink UFC

The 155-Mbps ATM UFC provides an ATM uplink for your FORE Systems TS-2800 Token Ring switch.

This section will answer:

1. How many ports does the ATM UFC support?
2. What protocols does the ATM UFC support?
3. In which network configurations is the ATM UFC ideal?
4. Are there ATM UFC usage recommendations and restrictions?
5. When should one use multiple ATM UFCs?

Additionally, ATM UFC highlights can be found in Table 1.9.

1.4.1 ATM Physical and Logical Ports

The ATM UFC's single physical port provides the following features:

- 155-Mbps data rate (OC-3)
- Multimode fiber (MMF) subscriber connector (SC)
- Constant Bit Rate (CBR), Variable Bit Rate (VBR), and Best Effort Rate (UBR) virtual channel connection (VCC) types
- 1024 VCCs
- ATM User-Network Interface (UNI) Specification, Versions 3.0 and 3.1

The single physical port allows multiplexing of data from multiple logical ports. An ATM UFC logical port is referred to as a *LAN Emulation Client (LEC)*. On one ATM UFC, up to 32 LECs can be configured, with a maximum of 8 LECs enabled at any one time. See "Usage Recommendations and Restrictions" on page 1-26 for important guidelines for assigning LECs to TS-2800 domains.

1.4.2 ATM-Based Protocol Support

The ATM UFC implements the industry-standard ATM-Forum Token Ring LAN Emulation Over ATM, Version 1.0 Specification, generally referred to as *ATM Token Ring LANE 1.0*. ATM Token Ring LANE allows for the seamless flow of Token Ring over an ATM network, independent of higher layer protocols such as SNA, IP, and IPX.

In addition, the ATM UFC supports the ATM-Forum LAN Emulation Client Management, Version 1.0 Specification, as well as other industry-standard network management information bases (MIBs). See Figure 6.1 on page 6-4 for a complete list.

1.4.3 Environments

The ATM UFC is ideal for the following three environments:

1. ATM backbone for legacy LANs

   As a first step in migrating from legacy LANs (Token Ring and Ethernet), many users will deploy ATM in the backbone or as the WAN technology to interconnect geographically dispersed legacy LANs. The TS-2800 with an ATM UFC provides a seamless, switched network between legacy LANs communicating over ATM.

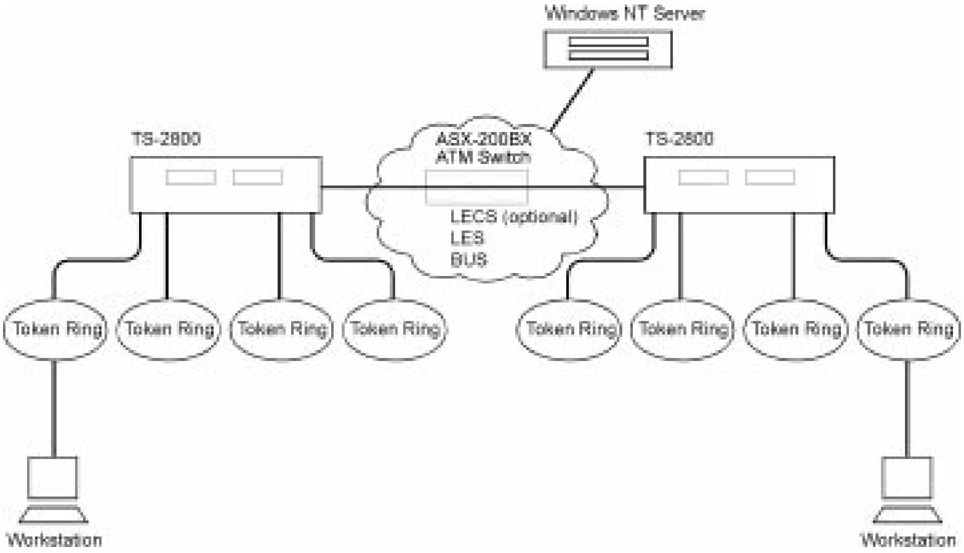


Figure 1.10 - Connection over an ATM Backbone Using Token Ring

2. LAN-to-ATM interoperability

   As the next step of a legacy LAN-to-ATM migration, users will place high-speed or frequently accessed servers or both on the ATM network, to take advantage of ATM's scalability and Quality of Service (QoS) features. By using LANE over ATM, these ATM-based workstations will be able to use existing legacy LAN applications with minimal or no upgrade costs for moving to ATM. Again, a TS-2800 with one or more ATM UFCs helps protect your legacy LAN investment by providing transparent LAN-to-ATM switching.

3. Switched Virtual Networking (SVN)

   For performance and cost reasons, users are moving from router-based networks to switched networks. To provide the performance of switches and the bandwidth management of routers, FORE's partners have made provisions for SVN:

   - Bridging between heterogeneous ELAN types (Token Ring, Ethernet, source-route bridging, transparent bridging, SRTB, and SRT)
   - Sophisticated broadcast management (for instance, discarding redundant NetBIOS broadcasts and converting broadcast packets (ARP) into unicast packets)
   - Routing between heterogeneous ATM encapsulation methods (ATM Forum LAN Emulation over ATM; IPX using Multiprotocol Encapsulation over ATM [MPOA, RFC 1483]; and Classical IP over ATM, [RFC 1577])
   - Automatic protocol-specific and user-defined Virtual Local Area Networks (VLANs)
   - Intra-subnet zero-hop routing and inter-subnet one-hop routing, together with ATM-based and LAN-based Forwarding Engines (FEs)

   The TS-2800 with an ATM UFC provides a low-cost access node for the highly efficient, high-bandwidth SVN architecture.

Table 1.9 - ATM UFC Highlights

Feature	Description
Protocol support	ATM Forum Token Ring LANE over ATM, Version 1.0
Signaling	ATM Forum UNI Versions 3.0 and 3.1 (auto-detectable)
Maximum LECs	32 configurable per ATM UFC. 8 simultaneously enabled per ATM UFC
Maximum VCCs	1024 per ATM UFC (distributed over all active LECs)
Maximum bit rate	155 Mbps (SDH STM-1, SONET STS-3 OC-3)
VCC types	As required by the ATM Forum *LAN Emulation over ATM* specification: Multicast-Send VCC: configurable as CBR, VBR, or UBR All other VCCs: UBR
Management	Console: The TS-2800 console provides configuration and monitoring support for the ATM UFC. This console is accessible via the TS-2800 serial port or Telnet. See “Quick Configuring the ATM UFC” on page 4-81 and Chapter 6 for more details. Telnet: Up to five Telnet sessions are supported. SNMP: supported MIBs include RFCs 1213, 1493, 1573, and 1695. See Table 6.1 for more information. Traps include Link Up and Link Down.
Configuration	Auto-configuration: if a LECS is used (ELAN Name set to NULL) Quick Configuration: if an ELAN Name is required together with an LECS Advanced configuration: full-featured configuration of all ATM Forum parameters
Switching	Port-to-port hardware switching without embedded processor intervention. On-board processor is reserved for VCC establishment and maintenance.
Packaging	Modular, customer-replaceable unit.

1.4.4 Usage Recommendations and Restrictions

Be sure to follow these rules when installing the ATM UFC.

1.4.4.1 One LEC per ATM UFC Assigned to the Same Domain

A TS-2800 switch domain (a grouping of ports) can include only one enabled LEC configured on any single ATM UFC. Although you can define up to 32 LEC configurations per ATM UFC, only a maximum of 8 can be administratively enabled, one for each configured domain. Also, only one enabled LEC can belong to a single domain.

In Figure 1.11, Domain 1 and Domain 2 are correctly configured. However, Domain 3, the grouping for ports 6, 7, and 10 also groups with LEC 103 and LEC 104. The TS-2800 switch generates an error message if a user attempts to enable more than one LEC per domain per ATM UFC and prohibits the action.

1.4.4.2 One LEC per ATM UFC Assigned to the Same ELAN

Always configure your LECs to be in a 1-to-1 relationship between TS-2800 switch domain and ATM ELAN.

Even though the LECs are members of different domains (distinct ring numbers), never assign them to the same ELAN. This would have the effect of having two distinct TR Ring groups sharing the same virtual segment.

The TS-2800 will generate an error message and prohibit this action.

This is not the same as having two separate LECs, members of the same Domain (Port Grouping) over two ATM UFCs joined to the same ELAN. This would be a valid Spanning Tree redundant configuration, and is shown in Figure 1.13.

In Figure 1.11, Domain 4, which includes Token Ring ports 8, 13, and 14, includes LEC 105, which is assigned to `finance`. This configuration would be prohibited because LEC 102 is already assigned to `finance`.

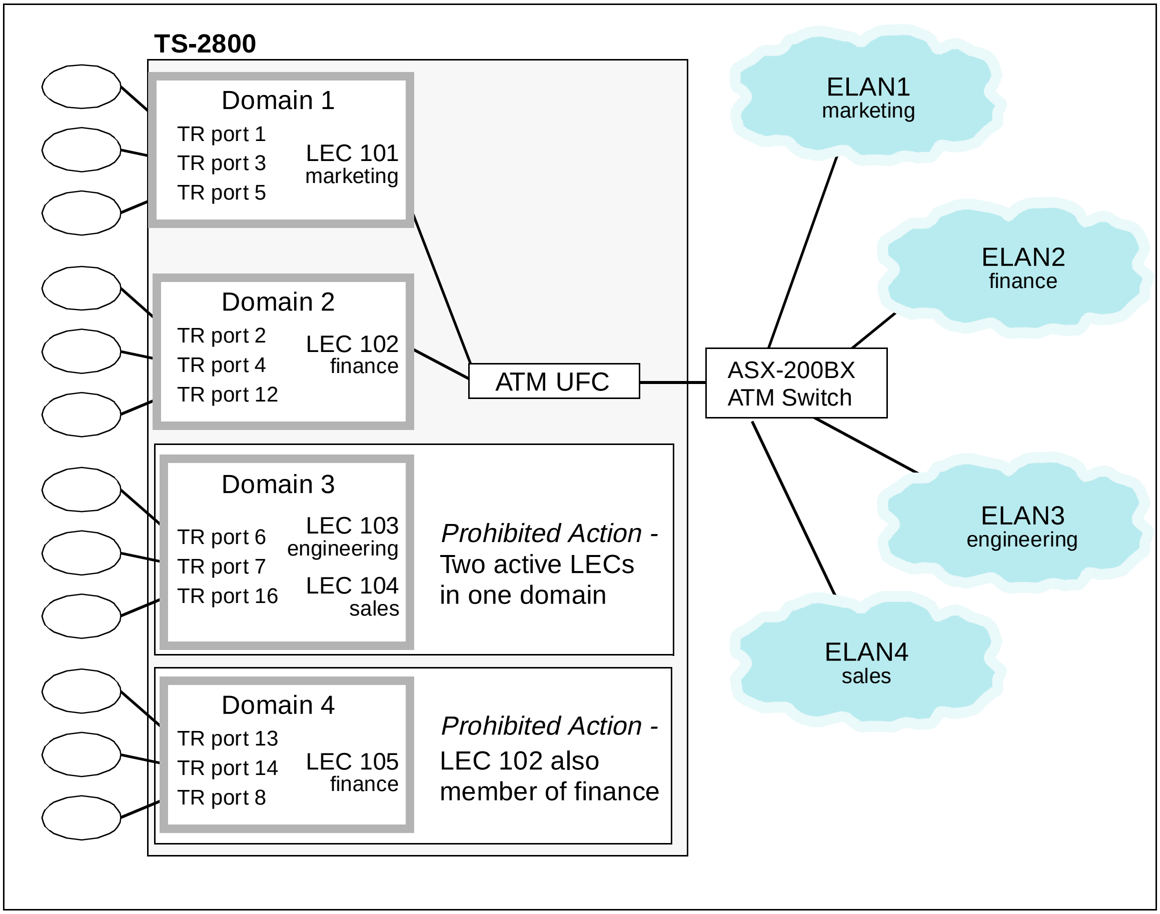


Figure 1.11 - Each Domain Can Include Only One LEC for Each ATM UFC

1.4.4.3 Avoid ATM-to-ATM Switching

Avoid placing two LECs, on different ATM UFCs and joined to different ELANs, in the same TS-2800 domain, as shown in Figure 1.12. Although this is not prohibited by the TS-2800, it may cause ATM-to-ATM traffic, and might severely impact overall switch performance. The TS-2800 is not intended to be an ATM switch.

Note that this is different from placing two different ATM UFC LECs in the same domain and in the same ELAN. If the two LECs share both a domain and an ELAN, then the TS-2800's Spanning Tree operation will automatically place one LEC in the frame-forwarding state and the other LEC in the frame-blocking state. This is a useful backup LEC configuration. See "Rationale for Multiple ATM UFCs" below for more information.

This rule, concerning multiple LECs on different ATM UFCs, is not prohibited by the TS-2800, but violating this guideline might severely impact overall switch performance.

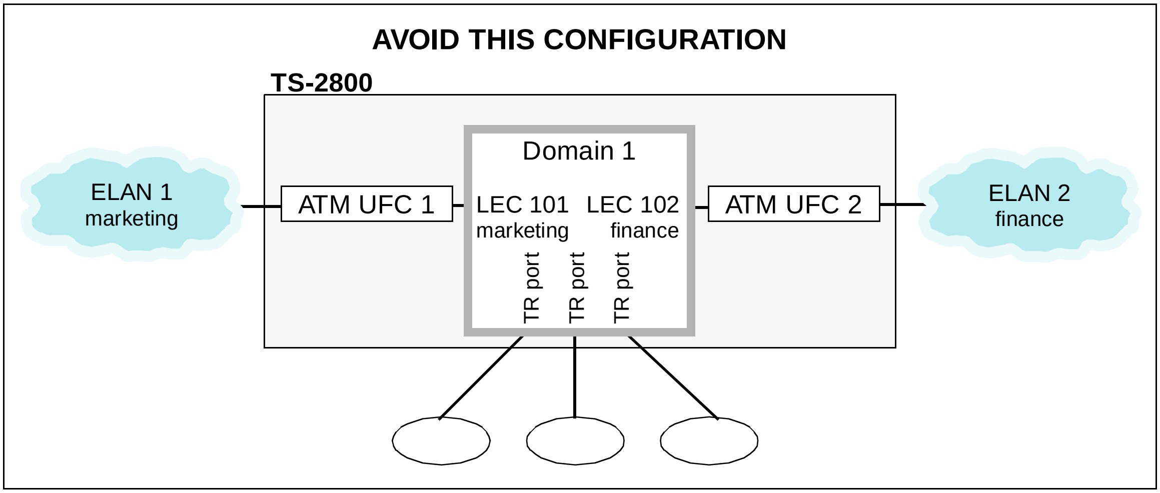


Figure 1.12 - TS-2800 Improperly Configured for ATM-to-ATM Switching

1.4.5 Rationale for Multiple ATM UFCs

Given that one ATM UFC can support as many LECs as there are domains in a TS-2800, the question arises: Why use two ATM UFCs?

1.4.5.1 Redundant ATM Connections

An additional ATM UFC can provide a backup LEC, as shown in Figure 1.13. By enabling two LECs on two different ATM UFCs to be members of both the same domain and the same ELAN, the TS-2800's 802.1D Spanning Tree operation will automatically use one LEC for forwarding frames and the other LEC for blocking frames (active standby). If the first LEC fails, the second one will automatically take over. Note that, in order for the backup LEC configuration to work, Spanning Tree ***must*** be enabled for the related TS-2800 domain. This is a more robust solution than physical cutover available in some ATM edge devices.

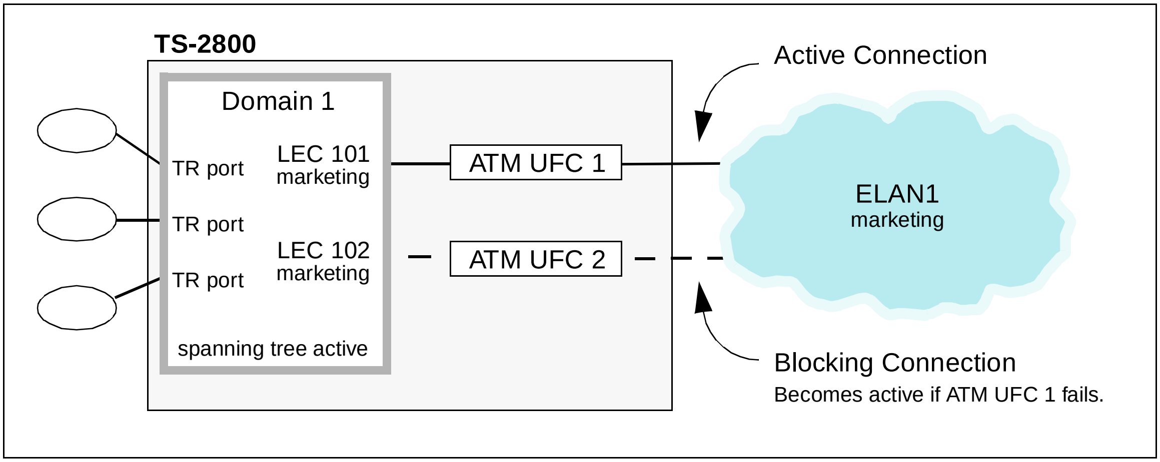


Figure 1.13 - Redundant ATM UFCs Using Spanning Tree

1.4.5.2 Increase System Resources

An additional ATM UFC can significantly increase system resources. In some environments, the resources associated with a single ATM UFC (such as a maximum of 1024 VCCs per ATM UFC and a maximum data rate of 155 Mbps) might affect individual LEC performance. By moving one or more LECs to a second ATM UFC, you can significantly increase the resources available to each LEC.

1.4.5.3 Static Load Sharing

You can statically divide expected traffic load across two ATM UFCs. Each domain must be associated with a ***different*** ELAN. For example, the first domain is associated with the `marketing` ELAN (using one LEC on each of the two physical ATM cards), and the second domain is associated with the `finance` ELAN (using one LEC on each of the same two physical ATM cards).

By default, the ATM UFC 1 card provides the primary link for both domains. ATM UFC 2 provides a secondary (backup) link for both domains. By adjusting the Port Priority Spanning Tree parameter on one of the domains, you can reverse the roles of the two physical ATM cards for that domain. For example, you could adjust the port priority for Domain 2, so that ATM UFC 2 becomes the primary link for the domain and ATM UFC 1 becomes the secondary (backup) link.

This allows you to statically divide the expected traffic load across the two ATM UFCs. (Dynamic load-balancing between the two ATM UFCs is not available.)

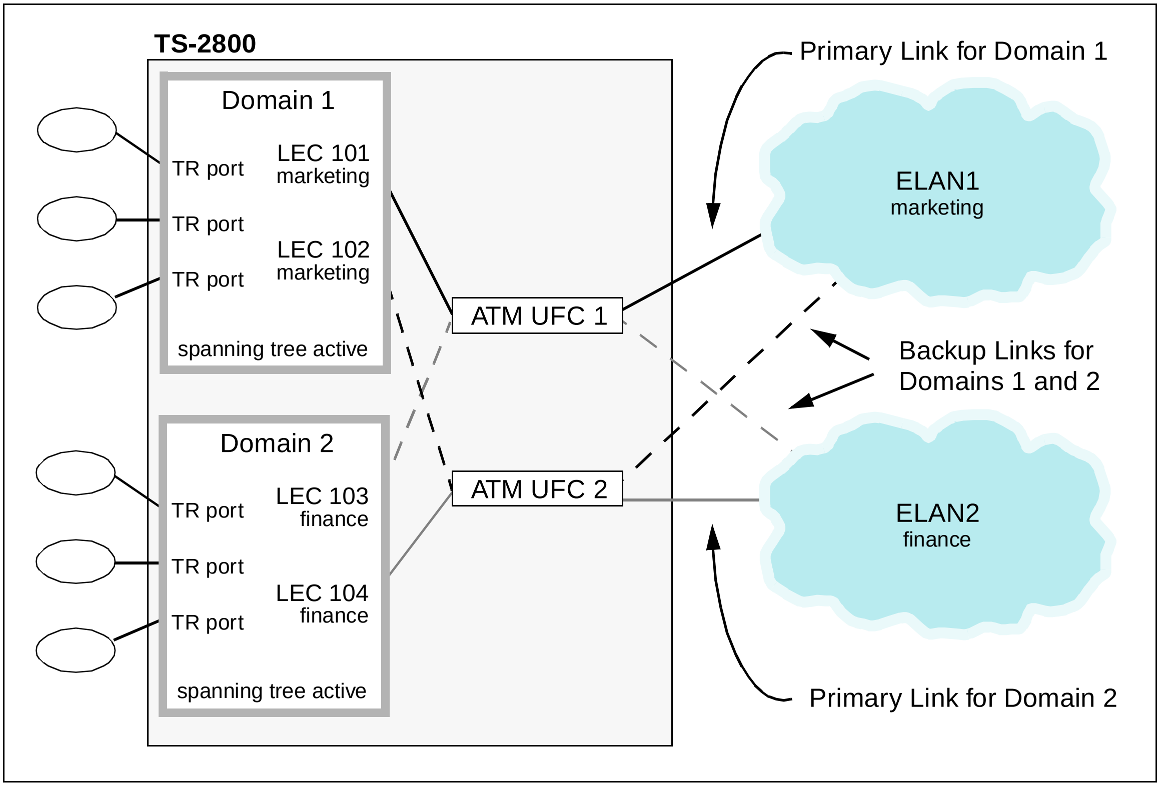


Figure 1.14 - Redundancy and Static Load Sharing Using Spanning Tree

CHAPTER 2 Network Planning and Installation Preparations

2.1 Preparations

The following suggestions will help you prepare for the installation of your TS-2800:

1. Make a sketch of the network to which you will be adding one or more TS-2800s, especially if your institution is a large one. Be sure to include major elements of the network such as hubs and concentrators as well as servers, bridges, and routers.
2. Get connectivity and physical planning information about the network segments to which you will be attaching your TS-2800.
3. If you will be using permanently installed telecommunications wiring, get information about the cabling installation that will allow you to determine the termination points of every cable, the cable type, connector type (if any), and the distance between termination points.
4. Get building floor plans and telecommunications closet layouts.
5. Read the material in this chapter and Chapter 4.
6. Fill out the planning charts and worksheets discussed in “Using Planning Charts and Worksheets” on page 2-11. Retain these sheets for use if it becomes necessary to reconfigure the TS-2800.

2.1.1 Rules to Remember

This section will help you understand the physical configuration restrictions for the TS-2800. In brief, you must remember the following rules when planning to install the TS-2800:

- 4540-byte maximum frame length.
- For shared-media LAN segments, acceptable distances are defined by the hub or concentrator attached to the TS-2800 port.
- Straight-through cables for all Token Ring ports. The UTP/STP ports use auto-configuration and automatically create an internal cross-over if required.
- If you create parallel paths directly between TS-2800s, be sure that you have enabled Spanning Tree. (See “Transparent Bridge Spanning Tree” on page 4-29.) The default setting for Spanning Tree is disabled.
- Star-wired topology for interconnected TS-2800s.

- Read the READ.ME file shipped with this product for any new restrictions or cautions.
- If a 4-port UFC is installed in UFC slot 1, ports 3 and 4 will not operate.

The following paragraphs provide greater detail about the physical restrictions.

2.1.2 Frame Length Limit

The TS-2800 supports a maximum frame length of 4540 bytes (from the Frame Control [FC] to Frame Check Sequence [FCS] characters). Be sure to configure all network software, interconnecting products, workstations, and user applications so that they do not send frames larger than 4540 bytes.

In Cut-Through mode, the TS-2800 truncates frames larger than 4540 bytes and adds an abort sequence at the end. Characteristically, if frames are sent larger than the 4540-byte limit, a network manager will detect abort sequences from the TS-2800.

In Store-and-Forward mode, a switch port rejects larger frames and a soft error will be generated on that port's LAN segment.

2.1.3 Cables and Distances between Devices

The TS-2800 supports attachment to 100-ohm and 120-ohm twisted-pair (STP or UTP), and 150-ohm STP, as defined in the EIA / TIA 568A and ISO / IEC 11801:1995.

The following sections define the distances allowed for different types of connections.

2.1.3.1 Dedicated-Media LAN Segment Rules

Dedicated-media LAN segments are those segments that directly interconnect two TS-2800 ports, or connect a TS-2800 port directly to a Token Ring adapter. A direct connection permits a longer segment length than is normally recommended by the cabling standards. Make sure that you use category 3 or better components when patching cables. See Appendix C for specific cabling information and maximum length limitations.

2.1.3.2 Shared-Media LAN Segment Rules

Shared-media segments are segments that connect a TS-2800 port to a Token Ring access unit or concentrator. For a shared-media LAN segment, the TS-2800 port emulates a Token Ring station; therefore, the applicable wiring rules are those defined by the hub or concentrator to which the port is attached.

2.1.3.3 4-Port Token Ring UTP/STP UFC Cabling Notes

Always use straight-through cables for Token Ring ports. Figure C.1 on page C-2 illustrates the correct wiring of straight-through cables. Figure C.2 on page C-3 illustrates the correct wiring of straight-through, STP cables.

Some devices might require special cabling, and their rules must be met.

2.1.3.4 2-Port Token Ring Fiber UFC Cabling Notes

For fiber cabling, FORE recommends 62.5/125-micron, multimode optical fiber cable that meets the international cable standard (ISO/IEC 11801) or North American cabling standard (EIA/TIA 568A). The recommended maximum cable lobe length is 2000 m (1.2 miles). Each port is terminated in an ST fiber connection.

NOTE

Be sure to check the release notes for any additional planning and configuration considerations for these UFCs.

2.1.4 Sample Applications

The TS-2800 allows you to make incremental changes in your network to address both immediate and long-range performance challenges. For example, a Token Ring LAN of 80 stations including 4 servers might experience performance problems as a result of increased traffic. As it is currently structured, the LAN looks like the one in Figure 2.1.

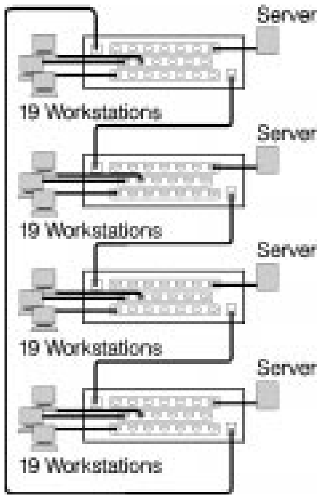


Figure 2.1 - Typical Token Ring LAN Segmentation

All of the stations are attached to access units located in a single wiring closet. You can install a TS-2800 in the same wiring closet and divide the LAN into 4 segments of 20 stations each (as depicted in Figure 2.2). One access-unit port from each segment will be connected to a port on the TS-2800 via a patch cable. Finally, the four servers are removed from the access units to which they have been attached and their cables moved to four ports on the TS-2800.

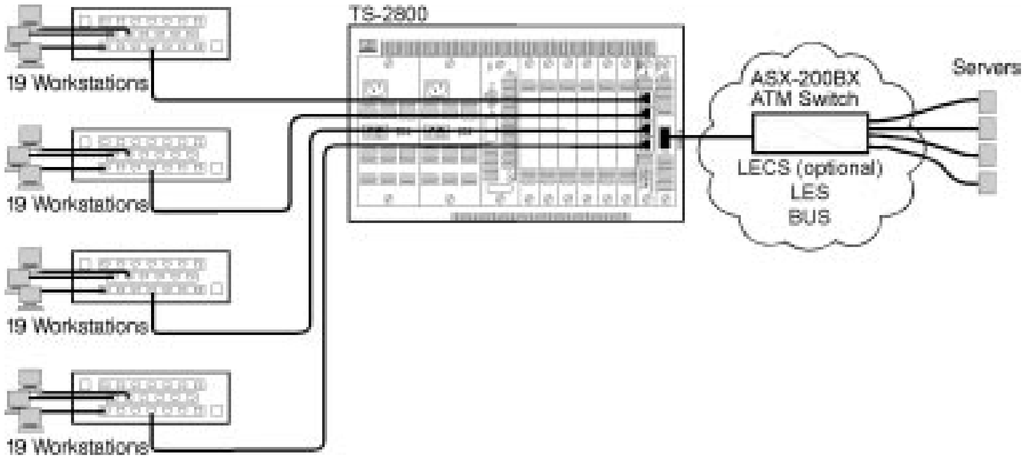


Figure 2.2 - A Simple Application of the TS-2800

Each group of 19 users attached to an access unit now shares a dedicated, 16-Mbps path to the server. Each server has a dedicated, 16-Mbps path upon which to service requests. The overall capacity of this solution is 64 Mbps; network capacity has increased fourfold.

Some large, multisegment, hierarchical Token Ring networks experience congestion at the campus backbone level. Although this congestion can often be relieved by converting the backbone to a higher speed, shared-media protocol or by installing additional bridges or dual backbones to eliminate bottlenecks, the TS-2800 offers dedicated media that might be longer lived or more economical if you eventually need higher demand applications or an ATM WAN. Figure 2.4 and Figure 2.5 offer several alternatives for using TS-2800 switches in the network shown in Figure 2.3. This network is a three-level, hierarchical, campus network.

In Figure 2.4, the congested campus backbone and the source-routing bridges (SRBs) attached to it have been replaced by a TS-2800. LAN segments 4, 5, and 6 in Figure 2.4 have become a single segment (identified as number *5* in the sketch).

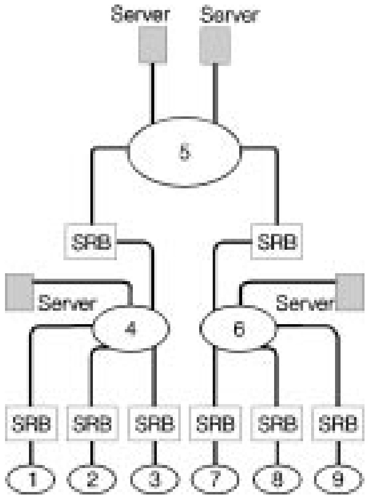


Figure 2.3 - Typical Network without the TS-2800

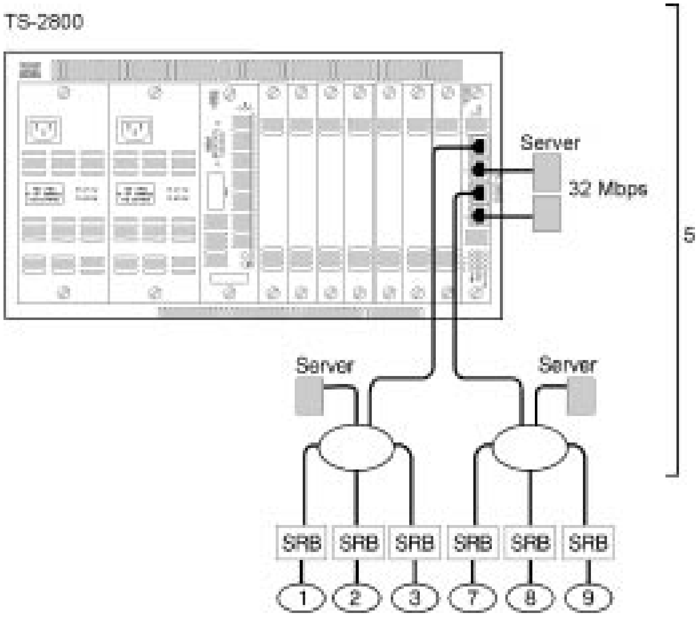


Figure 2.4 - Relieving the Overstressed Backbone

2.1.4.1 The Next Step

Typically, the first point of congestion in this newly configured network would be the servers. Because the usual mode of operation for a Token Ring adapter is HDX, the servers can either send or receive information with one other segment attached to the switch. So, if the servers are equipped with FDX adapters attached as single-station segments as shown in Figure 2.4, they can send and receive data simultaneously. The capacity of each server is now 32 Mbps per port.

However, network congestion is not always at the backbone level. Figure 2.5 shows a network where rings 4 and 6 (shown in Figure 2.3 and Figure 2.4) and all of the bridges around them have been replaced with TS-2800s. All of the stations in the former rings 1 through 9 (shown in Figure 2.3 and Figure 2.4) are now seen as part of a single logical segment. Bottlenecks between users and departmental servers have been markedly decreased.

Finally, when the traffic on the backbone increases, the ATM uplink feature of the TS-2800 allows you to connect to a scalable ATM network through the TS-2800, as shown in Figure 2.6.

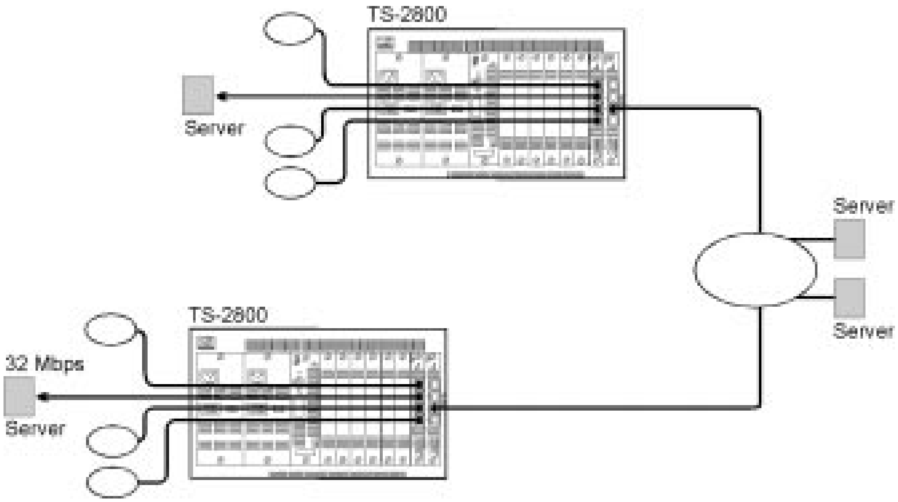


Figure 2.5 - Using Multiple TS-2800s

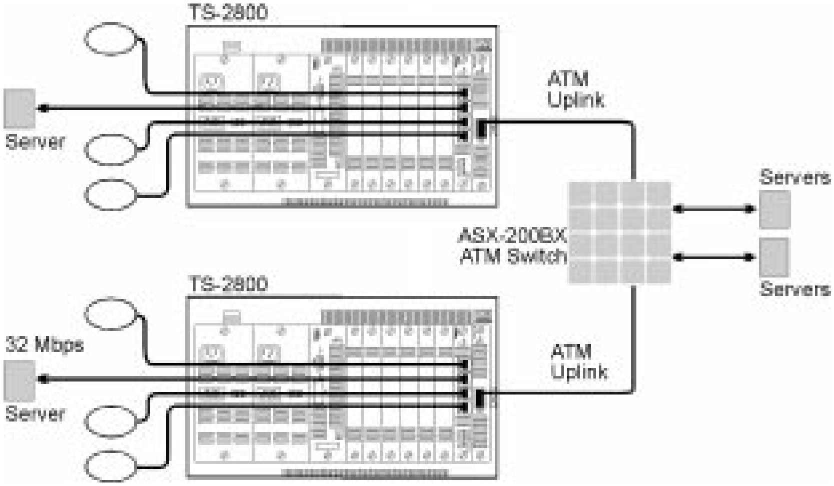


Figure 2.6 - ATM Uplink Feature in a Network

2.1.4.2 Using Source-Route Switching

Figure 2.7 shows an example of using a single TS-2800 configured with virtual domains and Source-Route bridging enabled to eliminate multiple, external source-route bridges. In the example, the TS-2800 is configured with four virtual switch domains, three of which are enabled for Source-Route bridging. Source-Route Switching is used within all of the domains, and Source-Route bridging is used between those domains enabled for Source-Route bridging. Both explorer and specifically routed frames are source-route bridged to other domains. In the example, the internal source-route bridge eliminates the need for up to three external source-route bridges.

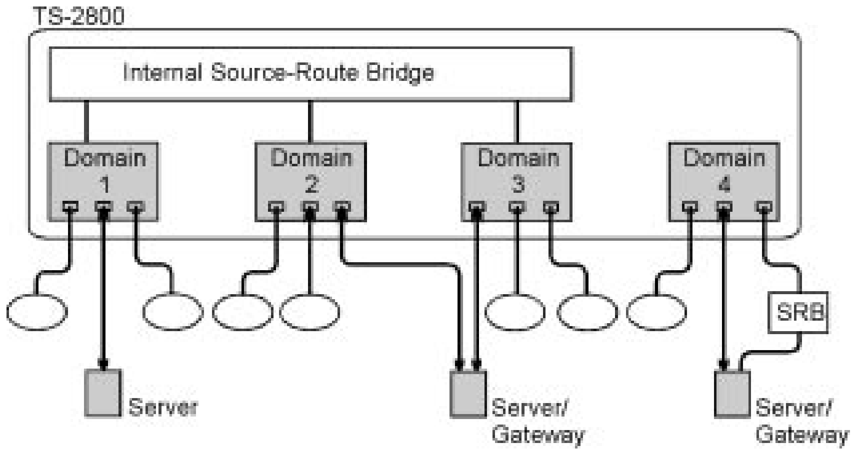


Figure 2.7 - Using the Internal Source-Route Bridge Function

2.1.5 Important Management Considerations

From a performance perspective, a cascaded network topology is recommended when planning your TS-2800 installation.

A star-wired topology (see Figure 2.8) helps achieve maximum bandwidth and helps determine problems in a network because no single cable carries all of the traffic on the network. However, serial connections could reduce network capacity since each connecting cable and TS-2800 could potentially divide the network should a failure occur.

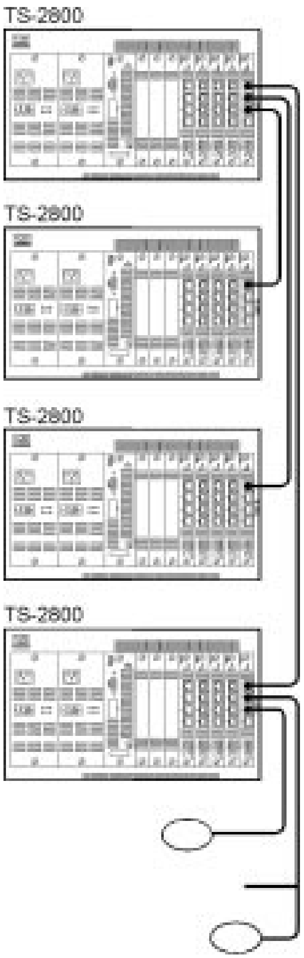


Figure 2.8 - Star-Wired Topology of Interconnected TS-2800s

If you create parallel paths directly between TS-2800s, be sure that you have enabled Spanning Tree (the TS-2800 default setting for Spanning Tree is No or disabled). Parallel paths create endless loops that cause unsatisfactory network operation unless you configure the TS-2800 for Spanning Tree capability. The Spanning Tree algorithm disconnects loops in networks using the IEEE 802.1d standard, and blocks a port of one of the TS-2800s in the parallel paths. If the port in the primary path fails, the port that has been blocked changes automatically to the forwarding state, keeping the network operational.

2.1.6 Using Planning Charts and Worksheets

As part of the planning process, you should complete the charts and worksheets found in Appendix A.

TS-2800 Cabling Chart

The TS-2800 installer uses this chart to place the TS-2800 in its assigned location and to connect the appropriate cables.

TS-2800 Configuration Panel worksheets

Prepare a set of worksheets for each TS-2800 you plan to install. Worksheet parameters match those on the panels that appear on the console attached to the EIA 232 port.

Locator Charts

These charts relate adapter addresses to physical locations and device identification numbers. These charts are useful for problem determination; you should keep them current, especially in large institutions.

In addition to the charts and worksheets discussed above, a Service Information Card is provided. This card is a ready reference for service personnel and contains information about LEDs, the Status display, and cabling. You should fill in the appropriate cabling information in the spaces provided.

All of the documentation discussed above should be retained and updated anytime changes are made. This information is required if it ever becomes necessary to restore the system configuration.

2.2 ATM UFC Configuration

There are three configuration options available: no configuration, quick configuration, and advanced configuration.

2.2.1 No Configuration

The ATM UFC will automatically assign one LEC to the Default domain on the base switch. This LEC will have the following default parameters:

Domain Name	default
ELAN Name	<no ELAN name defined>
LES Address	Get from LECS (Automatic)
LEC End System Identifier (ESI)	<universally administered MAC address>

For this default configuration to work in your ATM network, you must:

1. Have an LECS implemented.
2. The LECS must be configured to accept JOIN requests from LECs that have no ELAN Name defined (NULL), and that match the LAN Type of the base switch (Token Ring).

Otherwise, you must configure the ATM UFC.

2.2.2 Quick Configuration

Because the ATM Forum has standardized parameter defaults, in most environments, you can use Quick Configure exclusively to configure LECs. Quick Configure accepts the default values for all the LEC connection parameters except Domain Name, ELAN Name, LES Address, and LEC ESI. "Quick Configuring the ATM UFC" on page 4-81 describes how to set these parameter values.

2.2.3 Advanced Configuration

In customized LANE environments in which an LECS, LES, and BUS have been configured in non-standard ways, Advanced Configuration might be necessary. You need to consider the information in your LECS, LES, and BUS publications before choosing values for the Advanced Configuration parameters. See Appendix B for descriptions of these parameters and how to set them using the Console.

2.3 Base Switch Enhancements for an ATM UFC

The parameters shown in Table 2.1 apply to the ATM UFC. These parameters are not accessed through the Non-Token-Ring Ports option but through other options on the Main Menu of the TS-2800.

Table 2.1 - Quick Configuration

Configuration Parameters	Explanation
Domain Configuration	LECs are assigned to virtual switch domains to provide connectivity from the switch to the ATM network.
Transparent Bridge Spanning Tree	If two ATM UFCs are installed, and two LECs are assigned to the same domain, Spanning Tree parameter values are used to determine which LEC forwards traffic and which blocks traffic.
N/A	Broadcast suppression can be used to control broadcast storms for the ATM physical port.

NOTE

On base switch configuration panels, the LECs are identified by the LEC index (for example, 201 refers to slot 2, LEC 1). The ATM physical port follows the normal convention for UFC port numbering (for example, 2-1 refers to slot 2, port 1).

CHAPTER 3 Installation

This chapter explains the equipment that you need to install the TS-2800 and describes the installation procedure. Before installing the TS-2800, be sure to read the emission notices found before the table of contents in this manual.

3.1 Installation Summary

Table 3.1 outlines the steps you must complete to install the TS-2800.

Table 3.1 - TS-2800 Installation Procedures

Step	Procedure	Reference
1	Read the safety information in the Preface.	"Safety Precautions" on page vi.
2	Plan for installation.	Chapter 2
3	Unpack the TS-2800.	"Unpacking the TS-2800 Chassis" on page 3-2
4	Gather materials.	"Other Materials You Will Need" on page 3-2
5	Mount the TS-2800 in the rack, if applicable	"Rack-Mounting" on page 3-4
6	Install additional UFCs, if applicable.	"Installing Additional UFCs" on page 3-11
7	Install the redundant (second) power supply, if applicable.	"Installing the Second Power Supply" on page 3-15
8	Connect the TS-2800 to the network.	"Cabling" on page 3-17
9	Verify the operation of the TS-2800.	"Powering On the TS-2800" on page 3-20
Note: Complete the following step only if you will be customizing the configuration of the TS-2800 or monitoring its activity.		
10	Configure the TS-2800.	"Configuration" on page 4-1

3.2 Unpacking the TS-2800 Chassis

1. Open the carton containing the TS-2800 chassis.
2. Remove the *Planning and Configuration Guide* and release notes.
3. Remove the TS-2800 chassis from its protective packaging.
4. Visually inspect the TS-2800 chassis to ensure that it was not damaged during shipment.

   The TS-2800 chassis includes the following boards, already installed:

   - One power supply
   - One Token Ring Processor Card
   - One 4-Port UTP/STP UFC
   - One ATM Uplink UFC
   - Additional UFCs or power supplies depending on the configuration you ordered.
5. The package should also contain:
   - This manual and one Configuration Information Card
   - One cable management bracket
   - One North American power cord
   - One European power cord

If any item is missing or damaged, contact your place of purchase.

3.3 Other Materials You Will Need

To install the TS-2800, you need a cabling chart from your network administrator.

If the TS-2800 is to be rack-mounted, you will also need:

- A rack inventory chart from your network administrator.
- Screws and appropriate tools (screwdriver, etc.) for attaching the cable management bracket and the TS-2800 to the rack.

3.4 Surface Mounting

If the TS-2800 is to be rack-mounted, skip to “Rack-Mounting” on page 3-4.

If the TS-2800 will not be rack-mounted, you might wish to reposition the rack-mount brackets. For surface mounting:

1. Remove the rack-mount brackets from both sides of the chassis by removing the three mounting screws from each bracket. Reinstall the three screws on each side of the chassis.
2. Remove the two screws at the top-rear and bottom-rear corners on both sides of the chassis.
3. Turn a bracket over so that the rack-mount tab points inward, toward the center of the chassis.
4. Position the bracket on the side of the chassis with the tab against the rear of the chassis and reinstall the two screws.
5. Repeat step 3 and step 4 for the other bracket. The brackets are marked “Left” and “Right.”

Continue, if necessary, with “Installing Additional UFCs” on page 3-11. Otherwise, skip to “Cabling” on page 3-17.

Installation

3.5 Rack-Mounting

If you choose to rack-mount, you can use any EIA standard 19-inch rack. The rack can be open or closed. However, if you use a closed rack, special provisions must be made in order to ensure sufficient airflow through the machine. Decorative covers on the front of the rack that impede airflow to the machine must be removed or modified to allow sufficient airflow. Similarly, unvented rear covers that prevent sufficient airflow out of the machine, or cause a back-pressure buildup due to other machines discharging air, are prohibited.

The rack-mounting procedure tells you how to mount both the TS-2800 chassis and the cable management bracket. If the cable management bracket is to be used, it should be mounted first. The TS-2800 occupies five standard EIA rack units. The cable management bracket occupies one standard EIA rack unit. This space requirement and the nature of adjacent equipment should be taken into account when assigning rack space to the TS-2800.

1. FORE recommends that the power supply in the TS-2800 chassis be removed temporarily, while mounting the chassis. This significantly reduces the weight of the chassis to ease the mounting process. To remove the power supply, unscrew the two thumbscrews and pull the module out of the chassis. See Figure 3.1.

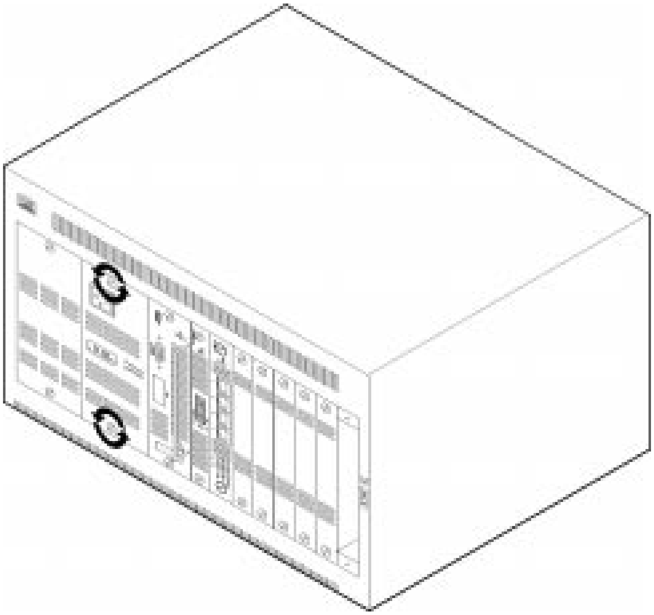


Figure 3.1 - Removing the Power Supply from the TS-2800 (Part 1 of 2)

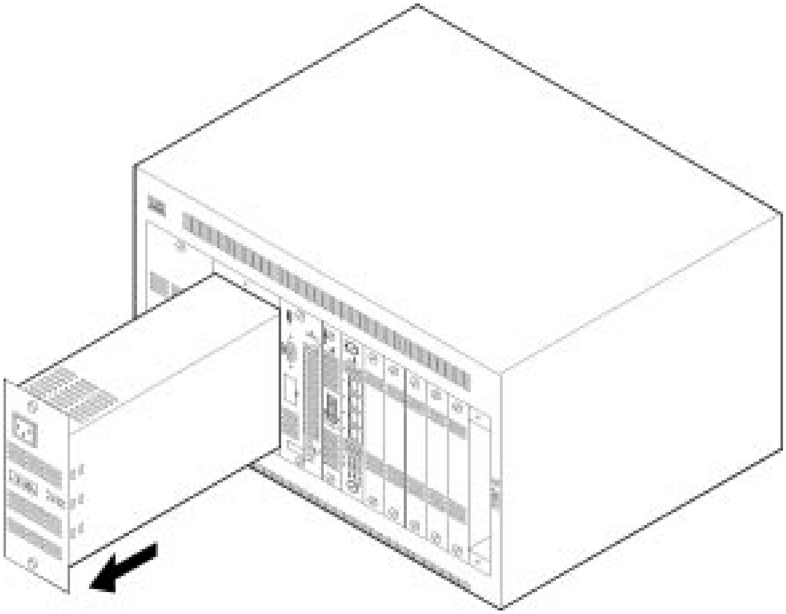


Figure 3.2 - Removing the Power Supply from the TS-2800 (Part 2 of 2)

2. Determine where in the rack the TS-2800 should be mounted and if the cable management bracket is to be mounted.
3. If the cable management bracket is to be used, mount it, using two rack-mounting screws, in the bottom unit of the allocated rack space. See Figure 3.3.

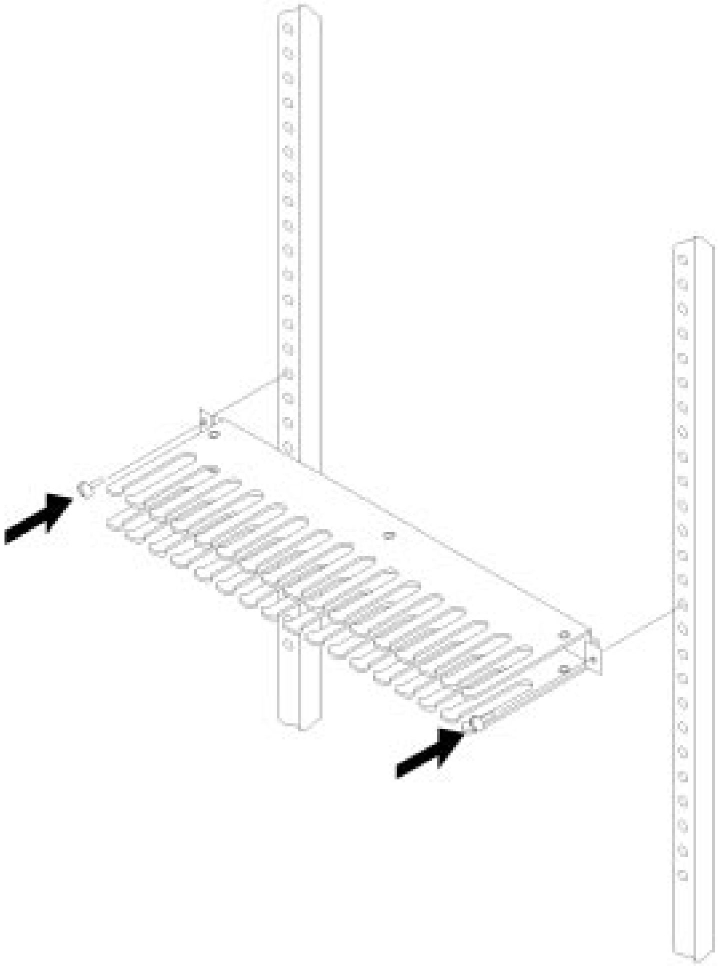


Figure 3.3 - Installing the Cable Management Bracket

CAUTION

When lifting the TS-2800 chassis, grasp the unit on the outside surfaces only. To avoid potential injury due to sharp edges, ***do not*** place your hand inside the unit.

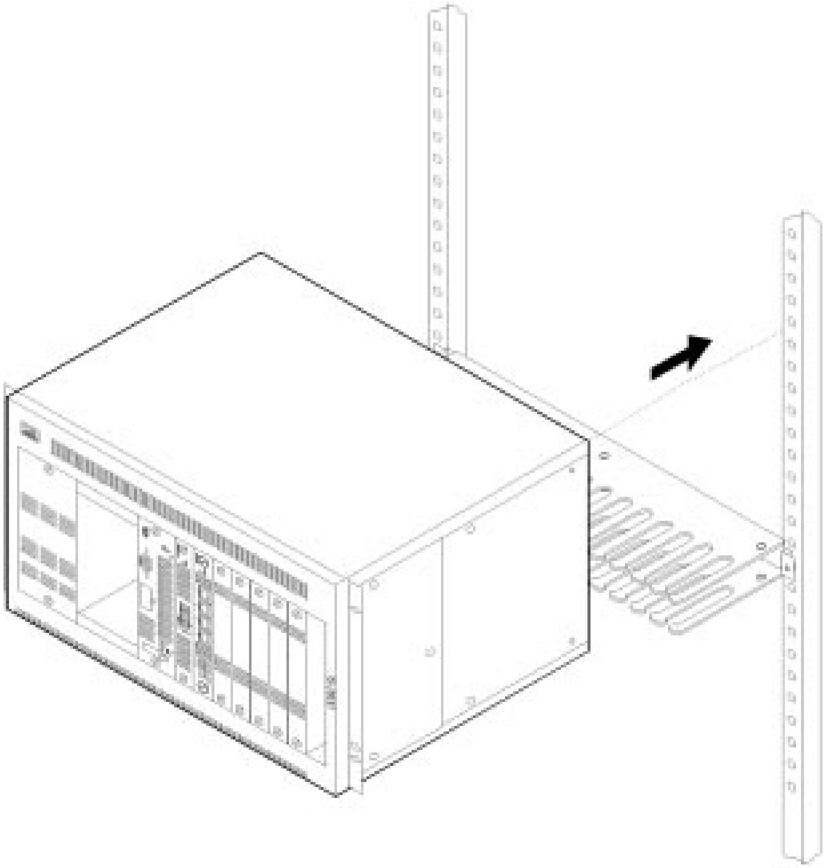


Figure 3.4 - Installing the TS-2800 in the Rack (Part 1 of 2)

4. Using four rack-mount screws, mount the TS-2800 as shown in Figure 3.4. If the cable management bracket is mounted, the TS-2800 occupies the rack space above the cable management bracket. The cable management bracket can also be used to support the TS-2800 chassis while positioning it for mounting.

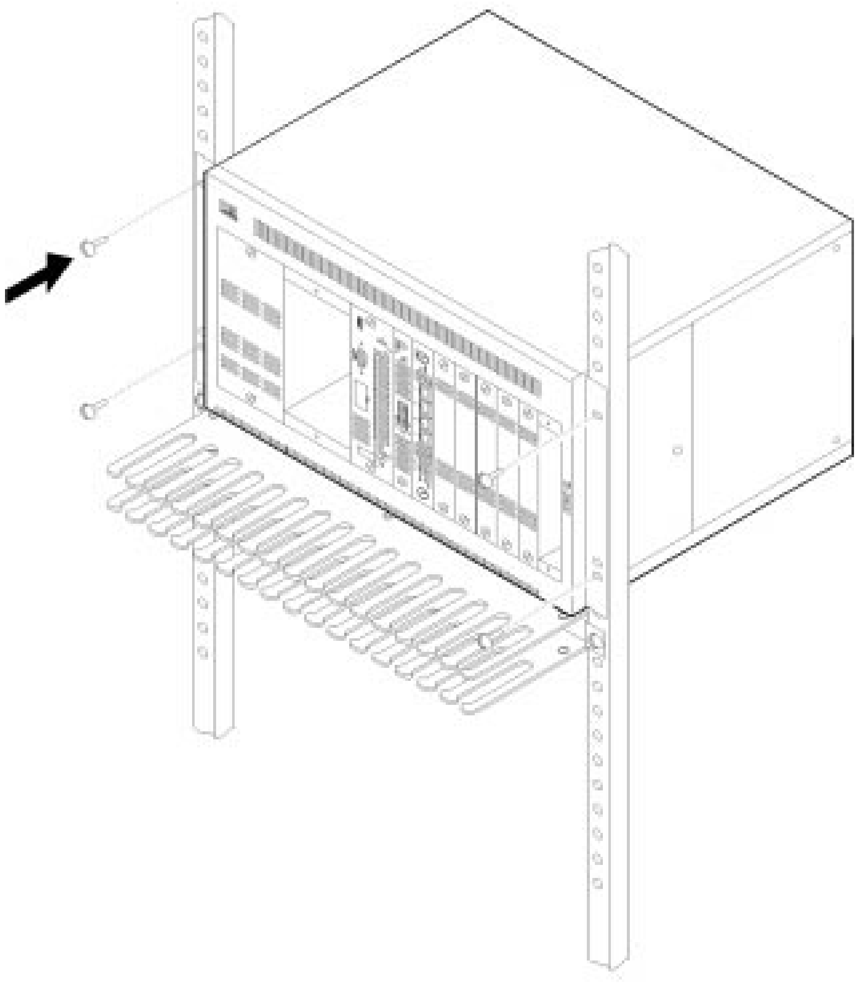


Figure 3.5 - Installing the TS-2800 in the Rack (Part 2 of 2)

5. Reinstall the power supply if it was removed, as shown in Figure 3.6. Tighten the thumbscrews, as shown in Figure 3.7.

CAUTION

Use care when inserting the power supply into the backplane. Insert the power supply gently and carefully to avoid bending the connector pins. Do not force the connection.

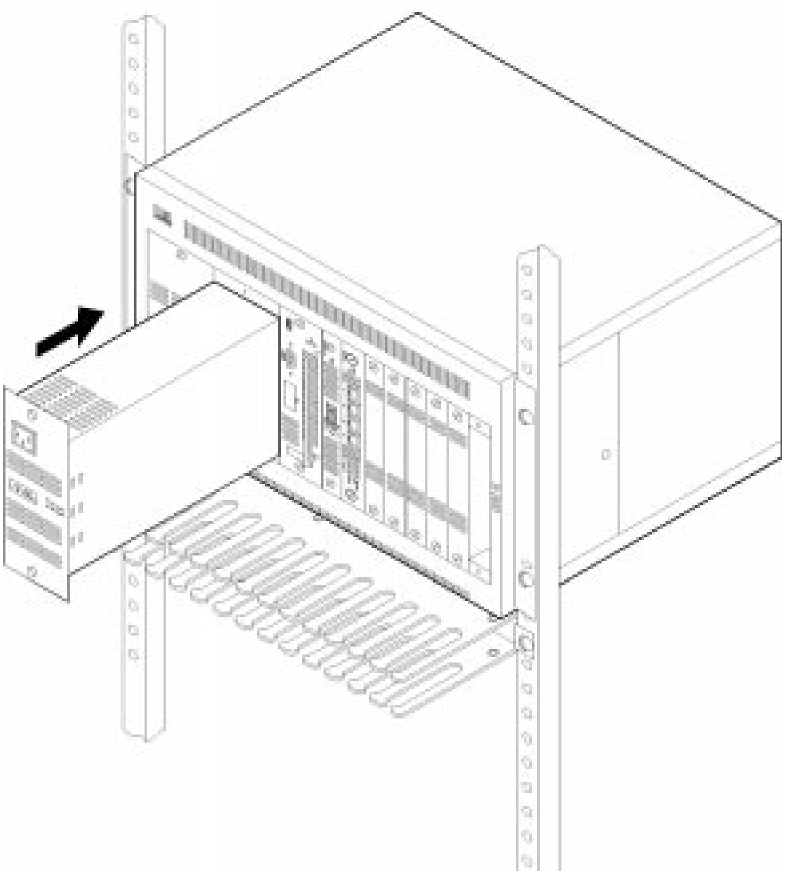


Figure 3.6 - Installing the Power Supply in the TS-2800 (Part 1 of 2)

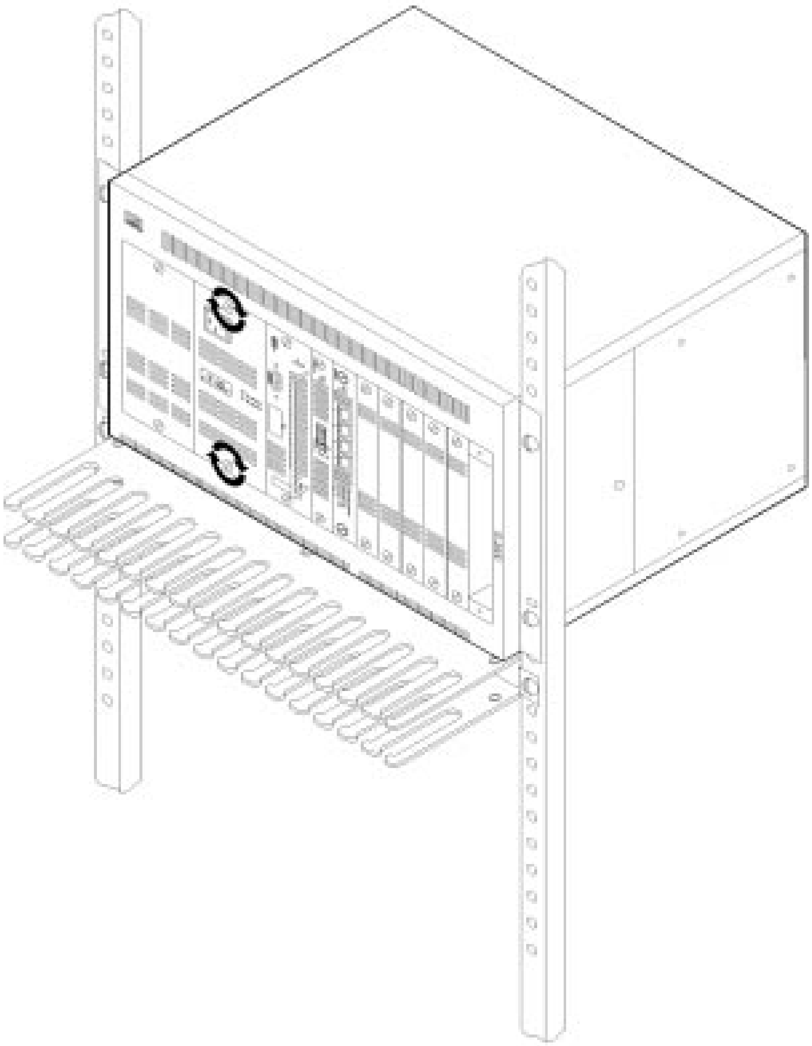


Figure 3.7 - Installing the Power Supply in the TS-2800 (Part 2 of 2)

NOTE

If you want to mount the TS-2800 with the front of the chassis extending out of the rack, you can do so by repositioning the rack-mount brackets on the sides of the chassis. To reposition the brackets, remove the three bracket-mounting screws, rotate the brackets so that the rack-mount tabs are toward the rear of the chassis, and reinstall the three screws.

3.6 Installing Additional UFCs

When you receive the TS-2800 from FORE it will include, already installed, the power supply, the Token Ring Processor card, an ATM Uplink UFC, a 4-Port UFC, and any additional UFCs you may have ordered. The following procedures describe how to install any additional UFCs that you purchase in the TS-2800. If you are installing a UFC in a slot that is currently unoccupied, you might not have to reconfigure the TS-2800. If you are replacing an existing UFC, it must be replaced with one of the same type or reconfiguration will be required. Follow these steps to install UFCs.

1. Remove the UFC and all accompanying documentation from the shipping container.
2. Read all of the documentation provided with the UFC before installing it in the TS-2800.
3. If the TS-2800 is powered on, power it off before installing the UFC.

CAUTION

The UFC can be damaged if you do not power off the TS-2800 prior to installing the UFC.

4. Remove the blank cover from the UFC slot in which the UFC is to be installed from the front of the TS-2800. To remove the cover, remove the two thumbscrews holding it in place, then grasp the edge of the cover and pull it out of the slot. See Figure 3.8. Retain the plate and the thumbscrews for use in the event that the UFC is ever removed.

NOTE

As shipped, the TS-2800 has no cover on UFC slot 8. The first UFC that is installed in the TS-2800 should be placed in slot 8.

If possible, avoid installing a UFC with more than 2 ports in UFC slot 1, which is the default slot for the ATM Uplink UFC. If a 4-port UFC is installed in slot 1, ports 3 and 4 will not operate.

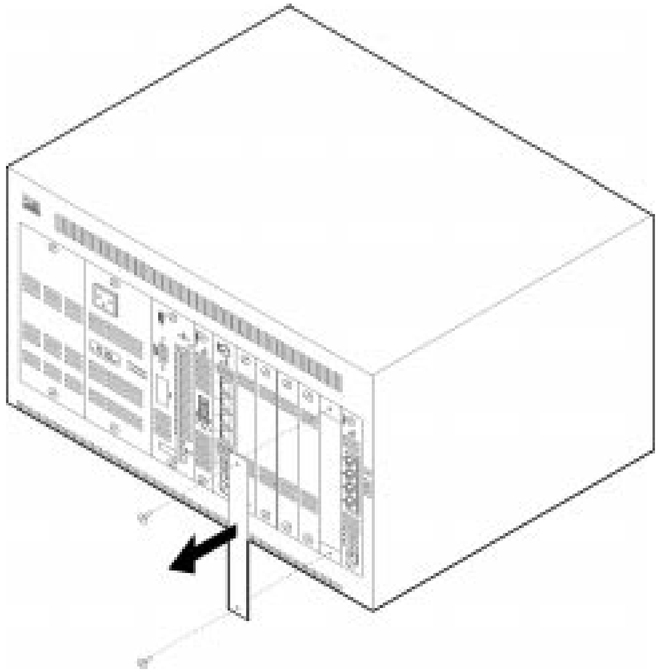


Figure 3.8 - Removing an UFC Slot Cover

5. Carefully insert the card in the UFC slot, fitting each side into the card rails, and making sure that the connector on the card is seated in the connector at the back of the slot. Secure the card with the two thumbscrews attached to it. See Figure 3.9 and Figure 3.10.

CAUTION

Use care when inserting the UFC into the backplane. Insert the UFC gently and carefully to avoid bending the connector pins. Do not force the connection.

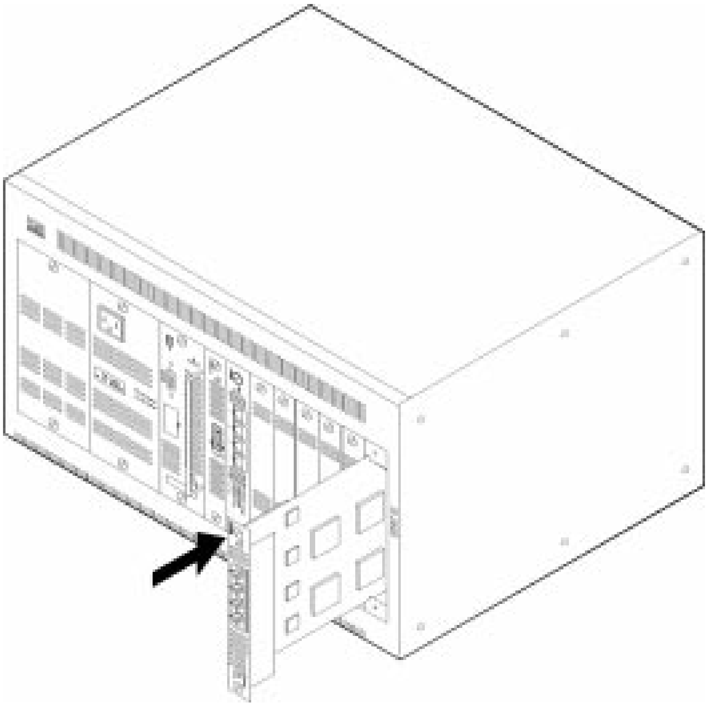


Figure 3.9 - Installing a UFC (Part 1 of 2)

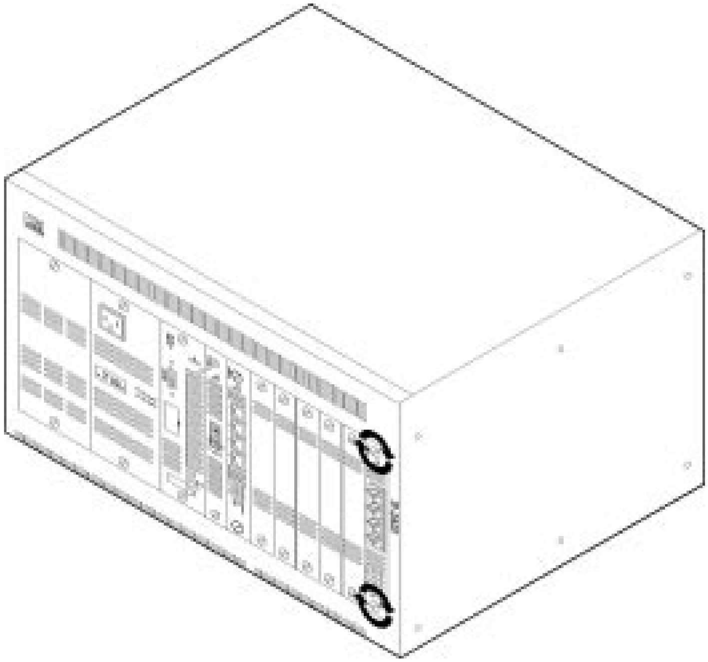


Figure 3.10 - Installing a UFC (Part 2 of 2)

6. If a second power supply is not to be installed skip to “Cabling” on page 3-17. Otherwise, continue with “Installing the Second Power Supply” on page 3-15.

3.7 Installing the Second Power Supply

If you order an optional redundant (second) power supply use the following procedure to install it. If the TS-2800 is rack-mounted, do not attempt to install the power supply when the TS-2800 chassis is not mounted in the rack since the weight of the supply can make the rack-mounting procedure difficult.

1. Remove the power supply and all accompanying documentation from the shipping container.
2. Read all of the documentation provided with the power supply before installing the power supply in the TS-2800.

NOTE

The second power supply can be hot-inserted. If you are installing this power supply in an existing installation, do not disconnect power from the TS-2800 or remove the existing power supply.

3. Remove the blank cover from the power supply slot in which the power supply is to be installed from the front of the TS-2800 by removing the two thumbscrews holding it in place. Retain the plate and the thumbscrews for use in the event that the power supply is ever removed. Insert the power supply module into the open slot until the supply is firmly seated in the connectors at the back of the slot. See Figure 3.11.

CAUTION

Use care when inserting the power supply into the backplane. Insert the power supply gently and carefully to avoid bending the connector pins. Do not force the connection.

4. Secure the supply with the two thumbscrews attached to the faceplate. See Figure 3.12.
5. If you are installing this power supply in an existing installation, skip to "Powering On the TS-2800" on page 3-20. Otherwise, continue with "Cabling" on page 3-17.

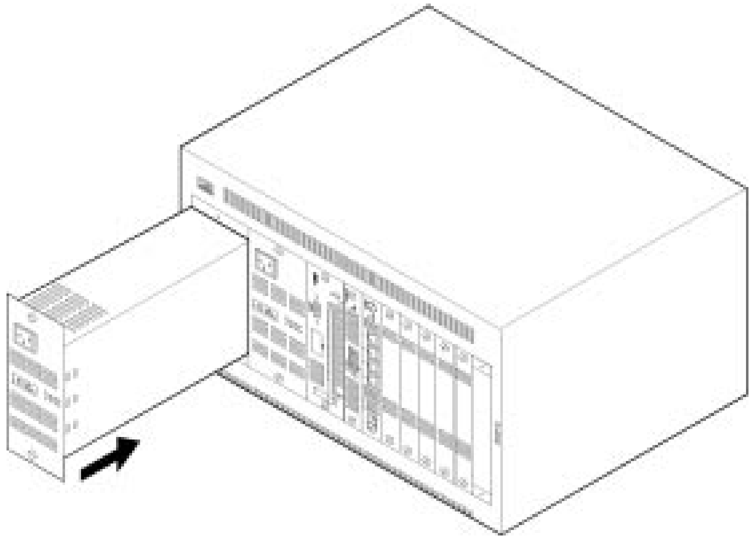


Figure 3.11 - Inserting the Second Power Supply

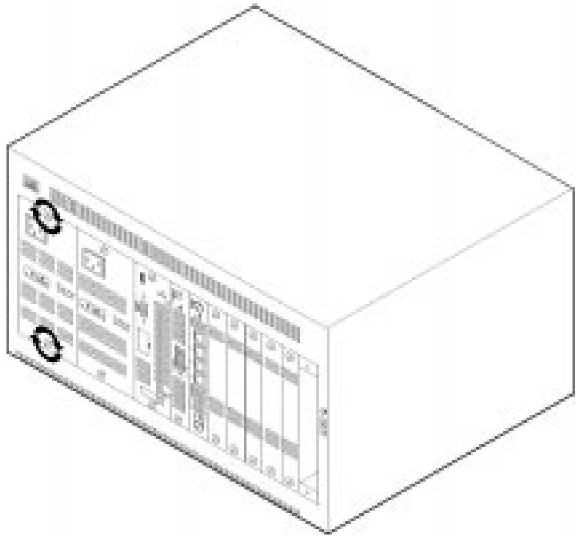


Figure 3.12 - Securing the Second Power Supply

3.8 Cabling

This section provides instructions for connecting devices (such as hubs, servers, personal computers, and workstations) to a TS-2800. Remember these tips when connecting cables:

- Avoid stretching or bending the cables excessively.
- Avoid routing the cables near potential sources of electromagnetic interference, such as motorized devices and fluorescent lights.
- Avoid trip hazards by routing the cables away from aisles and other areas where people walk. If such routes cannot be avoided, use floor cable covers or similar material to secure and protect the cables.
- Be sure that the cables connected to the TS-2800 are supported so that the cable connectors are not excessively strained.
- Use a category 3 or better cable or 150-ohm, STP or STP-A cabling.
- Some attaching devices require impedance-matching baluns at each end. Be sure to use them if the attaching device requires them.

3.8.1 Connecting Devices to the Token Ring Ports

If you ***will*** be using building wiring (in-the-wall cables) to connect devices to the TS-2800, go to “Connecting Devices to the Token Ring Ports Using Building Wiring” on page 3-19.

If you ***will not*** be using building wiring, follow these steps to connect one or more devices to the Token Ring ports on a TS-2800:

1. Connect the cables between the TS-2800 and other devices as illustrated in Figure 3.13. It illustrates an RJ-45 connector on each end. Depending on the cable type you use, the device end of the cable might also have a 9-pin, D-shell or 150-ohm data connector

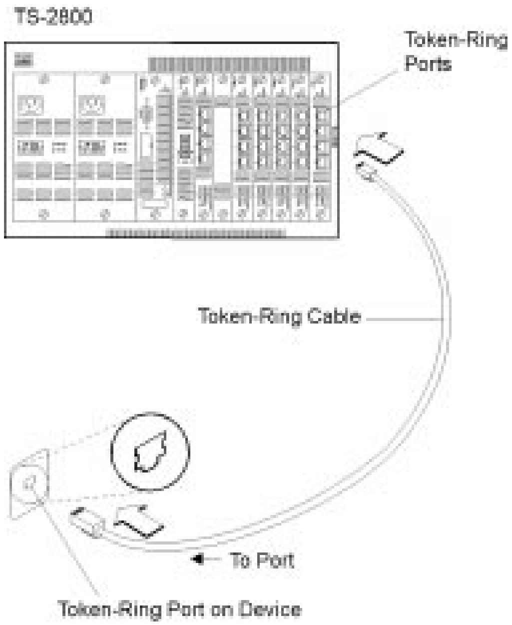


Figure 3.13 - Connecting Devices to Token Ring Ports

2. Label each end of the cables so that it will be easy to find a device if you have to troubleshoot a network problem. You should also put the information on the Cable Destination area of the Configuration Information Card.

   Be sure that the label includes the room location of the device at the other end, a unique cable identification number, the MAC address of the connected device, and the number of the port to which the cable is attached.
3. To continue installing the TS-2800, go to “Powering On the TS-2800” on page 3-20.

3.8.2 Connecting Devices to the Token Ring Ports Using Building Wiring

If you will use building wiring (in-the-wall cables) to connect the device to the TS-2800, perform the following steps:

1. Connect the cables between the devices and the faceplates as illustrated in Figure 3.14.

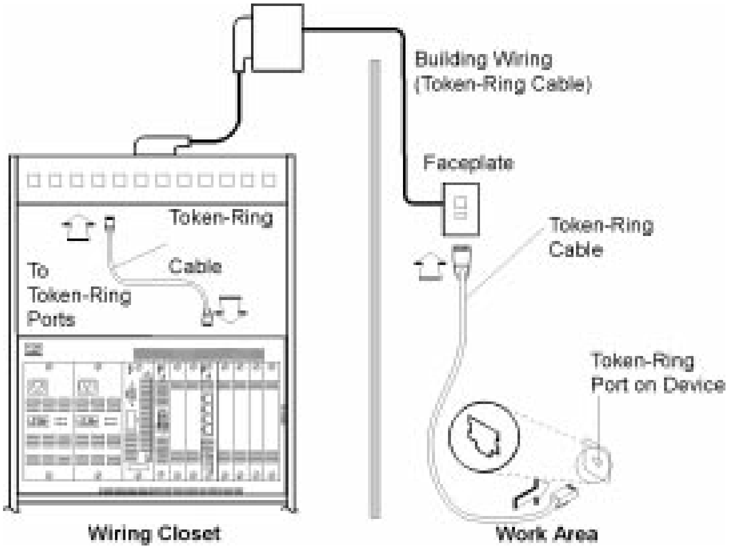


Figure 3.14 - Connecting Devices to Token Ring Ports Using Building Wiring

2. Label the faceplates, so that it will be easier to find the devices if you have to troubleshoot a network problem.
3. In the wiring closet, connect a cable to the Token Ring connector on the patch panel or other equipment where the building wiring terminates.

NOTE

Do not connect these cables to the RI or RO port on a media access unit.

Only the 2-port UFC is designed to be connected to RI/RO ports.

4. Connect the other end of the cable to a Token Ring port on the TS-2800.
5. Label this cable.
6. Dress the TS-2800 end of the cables, through the cable management bracket.
7. To continue installing the TS-2800, continue with “Powering On the TS-2800” below.

3.9 Powering On the TS-2800

To power on the TS-2800 and to verify that it is operating correctly, perform the following steps. (See Figure 1.4 on page 1-8 for the location of the LEDs and connectors on the power supply. See Figure 1.5 on page 1-9 for the location of the LEDs on the processor card.)

1. The TS-2800 does not have a power switch. It is powered on by connecting the line cord to the power supply and then to the AC outlet. See Figure 3.15. Be sure to connect the line cord to the power supply (1) before connecting it to the AC outlet (2).

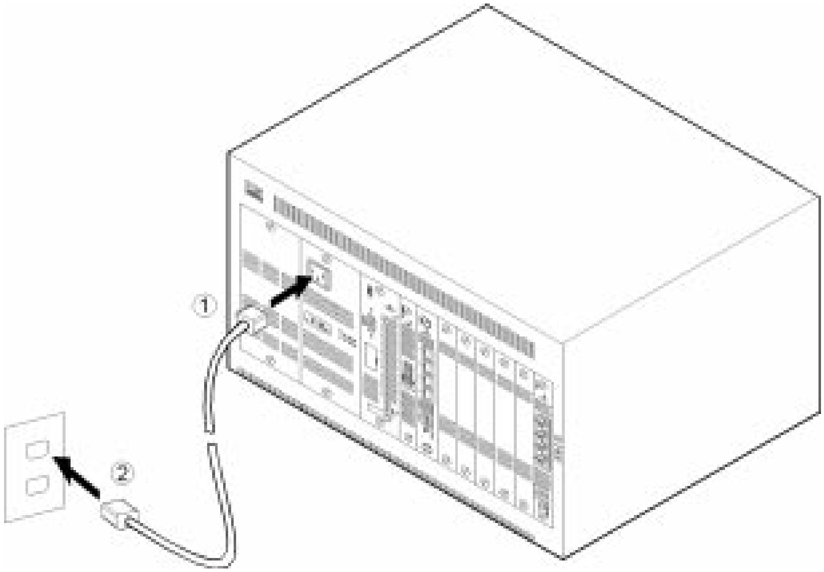


Figure 3.15 - Powering On the TS-2800

2. If the TS-2800 has two power supplies, two line cords must be connected; one for each supply. See Figure 3.16.

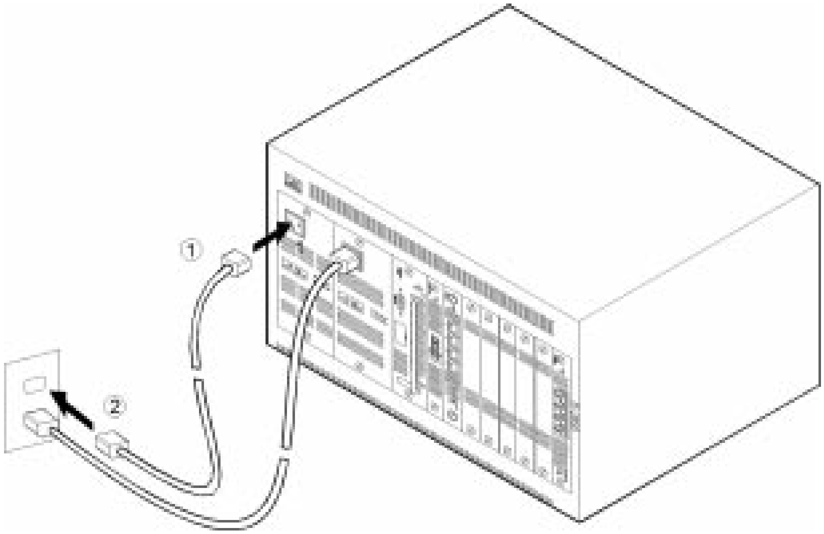


Figure 3.16 - Powering On the TS-2800

3. Verify that the following LEDs are on (both supplies, if two are installed):
   - AC OK on the power supply
   - DC OK on the power supply
   - Power (|) on the Token Ring Processor Card

   If all of the above LEDs are on, go to step 6.
4. If the AC OK LED is *not* on, there is no AC power being supplied to the power supply module. Ensure that the line cord is correctly installed. If that is not the problem, check for power at the AC outlet. If the line cord is correctly installed and the AC outlet is active, the power supply is defective and should be replaced.
5. If the AC OK LED is on but the DC OK LED is *not* on, the power supply is defective and should be replaced. See “Obtaining Service” on page 8-1
6. If both power supply LEDs are on but the Power (|) LED on the processor card is ***not*** on, ensure that both the power supply module and the processor card are correctly seated in the TS-2800 backplane sockets. If this is not the problem, the power supply fuses protecting the processor card might be defective and should be checked. See “Obtaining Service” on page 8-1. If this is not the problem, the processor card is defective and should be replaced. See “Technical Support” on page iii.

7. The TS-2800 automatically performs diagnostics when it is connected to a power supply. Diagnostics can last up to 8 minutes. You can get some idea about the progress of the diagnostics by observing the OK (green) and Fault (unlabeled) LEDs (amber) on the Token Ring Processor Card. During the diagnostic period, the OK LED and the Fault LED will blink in unison. If the diagnostics complete successfully, the Fault LED will be off, and the OK LED will be on. In addition, OK is displayed in the 4-character status display for 2 minutes.

   Verify that the Fault LED (amber) on the processor card is off. If the Fault LED is on, press the **Reset** button. If the Fault LED remains on, the processor card is defective; contact FORE Systems Technical Support, as described in "Technical Support" on page iii.

8. If a UFC has been installed and cabled, there are status LEDs that should be observed and verified on the UFC faceplate. Refer to Table 1.4 for the meanings of the UFC status LEDs.

Table 3.2 summarizes the normal state of the Status LEDs on the power supply, the Token Ring Processor Card, and the UFCs after a successful power-on sequence

Table 3.2 - Normal State of Status LEDs

LED	Normal State
AC OK	On
DC OK	On
Power (|)	On
OK (processor card and all UFCs)	On
Fault (processor card and all UFCs)	Off

If the LEDs are not in the normal state, go to Chapter 8.

NOTE

UFC Slot 1 is intended for use with the ATM UFC and supports only two ports. If a 4-port UFC is intentionally installed in slot 1, ports 3 and 4 will not operate and the LEDs for those ports will not be on. In addition, the message S1X is permanently displayed in the 4-character status display. All other ports will operate correctly.

If diagnostics have been completed successfully and all of the LEDs are in the normal state, physical installation of the TS-2800 is complete.

To continue with the installation, go to Chapter 4.

3.10 Testing the ATM UFC

If you have verified the switch operation using the procedures in the previous section, but the ATM UFC Fault LED is on, take the following actions:

1. Power OFF the base machine.
2. Verify that the UFC has been correctly seated in the slot
3. Power ON the base machine.

If the UFC Fault LED remains on again, you might need a microcode update. See "Check Base Switch Microcode Level" on page 4-79. If you determine that you do not need new microcode, see Chapter 8.

Table 3.3 - UFC Status LEDs and Their Meanings

LED	Position	State	Meaning
OK (green)	Top	On	The UFC is working correctly.
		Off	The UFC is not working correctly.
		Blinking	Diagnostics are in progress when blinking in unison with the Fault LED. Also blinks alone when downloading new code to the flash.
Unlabeled (Fault) (amber)	Bottom	On	An UFC failure has occurred.
		Off	The UFC is working correctly.
		Blinking	Diagnostics are in progress when blinking in unison with the OK LED.

Installation

Table 3.4 - Port Status LEDs and Their Meanings

LED	Position	State	Meaning
OK (green)	Top	On	Optical connection OK
		Off	No optical connection
		Blinking	Administratively disabled
Tx/Rx (green)	Bottom	Blinking	Indicates activity where frequency of blinks correlates to relative traffic rates. (Note: High activity may make this LED appear solid green.)

NOTE All four LEDs will be lit when the TS-2800 reset button is pressed.

CHAPTER 4 Configuration

The TS-2800 is shipped with default configuration settings that allow it to operate satisfactorily in simple networks. In such cases, it is not necessary for you to change the configuration. However, a console interface via the EIA 232 port is provided so that you can customize the TS-2800, monitor its activity, and troubleshoot problems. This chapter tells you how to set up a console session and configure the TS-2800.

4.1 Default Configuration Parameters

Parameter	Default Setting
Port Domain Assignment	All ports are assigned to `domain 0`, which is named `Default`. For further information, see “Configuring Domains” on page 4-16.
IP Address	`0.0.0.0` For further information, see “Setting Up IP Addresses” on page 4-19.
Default Gateway	`0.0.0.0` For further information, see “Setting Up IP Addresses” on page 4-19.
Subnet Mask	`0.0.0.0` For further information, see “Setting Up IP Addresses” on page 4-19.
IP State	`BootP When Needed` For further information, see “IP State for Domains” on page 4-20.
Send Authentication Traps	`Yes` For further information, see “Configuring SNMP” on page 4-24.
Participate in Spanning Tree	`No` For further information, see “Transparent Bridge Spanning Tree” on page 4-29.

Switch Priority	`32768` (if participating in Spanning Tree) For further information, see “Transparent Bridge Spanning Tree” on page 4-29.
Switch Hello Time	`2 seconds` (if participating in Spanning Tree) For further information, see “Transparent Bridge Spanning Tree” on page 4-29.
Switch Maximum Message Age	`20 seconds` (if participating in Spanning Tree) For further information, see “Transparent Bridge Spanning Tree” on page 4-29.
Switch Forward Delay	`15 seconds` (if participating in Spanning Tree) For further information, see “Transparent Bridge Spanning Tree” on page 4-29.
Port Cost	`62` (if participating in Spanning Tree) For further information, see “Port Priority and Port Path Cost” on page 4-33.
Port Priority	`128` (if participating in Spanning Tree) For further information, see “Port Priority and Port Path Cost” on page 4-33.
Port Switching Mode	`Adaptive` For further information, see “Switching Mode” on page 4-36.
Port State	`Enabled` For further information, see “State” on page 4-37.
Port Configuration Type	`Auto` For further information, see “Config Type” on page 4-38.
Configuration Loss Threshold	`8` For further information, see “Config Loss” on page 4-39.
PAT Demand Aging Level	`90%` For further information, see “Port Address Table Aging” on page 4-41.

MAT Demand Aging Level	`90%` For further information, see "Master Address Table Aging" on page 4-42.
LAN Segment Number	`unknown` (switch must learn the LAN segment number or have one assigned) For further information, see "Assigning or Changing LAN Segment Numbers" on page 4-50.
Bridge Number	`1` For further information, see "Internal Source-Route Bridge Configuration" on page 4-52.
Max ARE Frame Xmit Hop Cnt	`7` For further information, see "Changing LAN Segment Bridging Parameters" on page 4-54.
Max ARE Frame Rcv Hop Cnt	`7` For further information, see "Changing LAN Segment Bridging Parameters" on page 4-54.
Max STE Frame Xmit Hop Cnt	`7` For further information, see "Changing LAN Segment Bridging Parameters" on page 4-54.
Max STE Frame Rcv Hop Cnt	`7` For further information, see "Changing LAN Segment Bridging Parameters" on page 4-54.
Maximum Frame Size	`4472` For further information, see "Changing LAN Segment Bridging Parameters" on page 4-54.
SRB Priority	`32768` For further information, see "Source-Route Bridge Spanning Tree Configuration" on page 4-55.
SRB Hello Time	`2 sec` For further information, see "Source-Route Bridge Spanning Tree Configuration" on page 4-55.
SRB Maximum Message Age	`20 sec` For further information, see "Source-Route Bridge Spanning Tree Configuration" on page 4-55.
SRB Forwarding Delay	`15 sec` For further information, see "Source-Route Bridge Spanning Tree Configuration" on page 4-55.

Segment Path Cost
`62`
For further information, see “Source-Route Bridge Spanning Tree Configuration” on page 4-55.

Single-Route Bcast Frame State
`Forward`
For further information, see “SRB Manual Spanning Tree Parameters” on page 4-59.

Port Security Mode
`Normal`
For further information, see “Configuring Port Security Mode” on page 4-63.

Error Rate High Threshold
`10%`
For further information, see “Switching Mode Threshold” on page 4-69.

Error Rate Low Threshold
`1%`
For further information, see “Switching Mode Threshold” on page 4-69.

Error Rate Trend
`1%`
For further information, see “Switching Mode Threshold” on page 4-69.

Set Password
`(none)`
For further information, see “Password” on page 4-71.

Console Timeout
`0 min`
For further information, see “Console Configuration” on page 4-73.

Hardware Flow Control
`Disabled`
For further information, see “Serial Link Configuration” on page 4-74.

Software Flow Control	`Disabled` For further information, see “Serial Link Configuration” on page 4-74.
Autobaud Upon Break	`Enabled` For further information, see “Serial Link Configuration” on page 4-74.
Console Baud Rate	`9600` For further information, see “Serial Link Configuration” on page 4-74.
Number of Telnet Sessions Allowed	`5` For further information, see “Telnet Configuration” on page 4-76.
Disallow New Telnet Sessions	`No` For further information, see “Telnet Configuration” on page 4-76.

Use the Configuration process described in the rest of this chapter to change any of the preceding default parameters.

4.2 Preparing to Configure the TS-2800

Preparations for configuring the TS-2800 involve configuring UFCs and setting up a console session.

4.2.1 Configuring a Token Ring UFC

Review the documentation shipped with any UFCs that are installed in the TS-2800 now, and then return here.

NOTE

If your UFC configuration instructions require you to load new microcode, do so before continuing. If you configure the TS-2800 and then load new microcode, the configuration data might be lost.

4.2.2 Configuring the ATM UFC

If you are configuring the ATM UFC, refer to “ATM UFC Configuration” on page 4-78.

4.2.3 Setting Up a Console Session

You can set up a console session locally by directly connecting a PC or other DTE to the EIA 232 port on the TS-2800. You also can set up a console session remotely by connecting a modem to the EIA 232 port and then dialing in from your remote station. To connect a terminal directly to the TS-2800, continue with “Connecting a Local Terminal” on page 4-6. To use a modem, go to “Connecting a Modem to Allow Remote Terminal Access” on page 4-8.

4.2.3.1 Connecting a Local Terminal

To connect a local terminal to the TS-2800, perform the following steps:

1. Begin running your terminal emulation software on the PC or other DTE to which you will be connecting the TS-2800.
2. Set the terminal as follows:

NOTE

All emulators do not have all the options listed below.

Table 4.1 - Terminal Option Settings

Option	Setting
Baud rate	1200, 2400, 4800, 9600, 19 200, 38 400,57 600 (9600 is the default)
Parity	None
Data bits	8
Stop bits	1
Handshaking	None
Terminal emulation	VT100
Duplex	Full
Software flow control (XON/XOFF)	Off
Hardware flow control (RTS/CTS)	Off
Line wrap	Off
Screen scroll	On
CR translation	CR
Backspace (BS) translation	Destructive
Break length (milliseconds)	350
Enquiry (ENQ)	Off
EGA/VGA true underline	Off
Terminal width	890
ANSI 7- or 8-bit commands	7

3. If you are using Microsoft Windows terminal emulation, disable the “Use Function, Arrow, and Ctrl Keys for Windows“ option in the Terminal Preferences menu under Settings.
4. Connect the EIA 232 port on the TS-2800 to your PC or DTE device using a null-modem cable or straight-through cable and null-modem adapter. The TS-2800 has a 9-pin, male connector. For pinout and cable information, see Appendix C.
5. Press the **Reset** button. The Reset LED comes on. The TS-2800 will then perform a series of self-test diagnostics, which might last between 4 and 7 minutes.
6. When diagnostics are complete (the Reset LED goes off), continue with the steps under “Beginning the Console Session” on page 4-10.

4.2.3.2 Connecting a Modem to Allow Remote Terminal Access

You can monitor the TS-2800 remotely by using any Hayes-compatible modem. To connect a modem to the TS-2800, perform the following steps:

1. Set up your modem according to its instructions. Place it near the TS-2800.
2. Connect the cable from the EIA 232 port on the modem to the EIA 232 port on the TS-2800. (For cable information, see "Cable and Pin Information" on page C-1.)
3. Set the modem as indicated below. If your modem uses settings other than the ones listed, you can cause the TS-2800 to reset when the modem is powered on.

NOTE All modems might not have all these options. Also, some modems use slightly different names for the options.

Table 4.2 - Modem Option Settings

Option	Value
Echo	Off
Result codes	Off
Auto-answer	On first ring
Wait for connection	45 seconds
Pause between calls	6 seconds
Auto baud detect	On
Drop DTR between calls	Yes
Send CR between calls	Yes
Send unit if CD high	Yes
Maximum dial attempts	999

4. Prepare your remote terminal by following step 1 and step 2 under "Connecting a Local Terminal" on page 4-6.
5. Dial in to the TS-2800 modem from your remote site.
6. Continue with "Beginning the Console Session" on page 4-10.

4.3 Navigating the Console Panels

Follow these guidelines during a console session:

- To change a value, perform an action, or display a new panel, select an item using the cursor keys, and press **`<Enter>`**. Selected items are highlighted. You are then prompted to enter data, select from a list of valid choices, or a new panel is displayed. The prompts appear just below the line containing action items (Return, Add, and so on). The third line from the bottom (also highlighted), acts as a *Help* line, providing brief descriptions and explanations of selected items.
- When a menu or panel consists of more than one part, the **`More`** action item is displayed. Selecting More will cause the next part of the current panel to be displayed.
- Selecting the **`Return`** action item returns you to the previously displayed panel.
- To save in NVRAM any changes made on the configuration panels, select **`Return`** on the panel whose settings you want to save.

NOTE

Selecting **`Return`** is the only way to save any changes made on the configuration panels. Changes are not made when if you press **`<Ctrl+N>`**.

- To return to the Main Menu, press **`<Ctrl+N>`**.

CAUTION

Changes made to the current panel will ***not*** be saved if you press **`<Ctrl+N>`** before pressing **`<Enter>`**.

- To refresh the console screen at any time, press **`<Ctrl+L>`**.

4.4 Beginning the Console Session

After you have connected and configured a local or remote terminal, proceed as follows:

1. Press **<Enter>** repeatedly until a panel similar to the one in Figure 4.1 appears on your display. If no panel appears, make sure that you have made all of the correct settings and are using the correct type of cables.

```
            FORE Systems TS-2800 Token Ring LAN Switch
                     (c) Copyright FORE Systems, Inc.
                and others, 1995-1997.  All rights reserved.

         Switch Base MAC Address:   000629 220BA0

         System Contact:


    A later level of TS-2800 microcode may be available electronically.
        Consult the current Release Notes for detailed instructions.


          Type Password, then press <ENTER>:



         -- No password has been set, press <ENTER> to continue. --
```

Figure 4.1 - Copyright Panel

2. Type the password, if one has been configured. If no password has been set, press **<Enter>** to continue.

NOTE

If you have forgotten your password, press the **System Request** button to access the System Request menu, and then select **Clear NVRAM**. This will clear the password and set all configuration parameters to their default values, ***clearing any values you have entered***.

3. Then, press **<Enter>** to advance to the Main Menu as shown in “Main Menu” on page 4-12.

NOTE

To terminate a Telnet session, press **<Ctrl+B>**.

4.5 Main Menu

In the Main Menu, the first selection item, **`Configuration...`**, is covered in the remainder of this chapter. The other three selection items are covered in subsequent chapters.

```
                               Main Menu

                            Configuration...

                            Status/Statistics...

                            Reset/Diagnostics...

                            Non-Token Ring Ports Menu...

                            Download...





      Exit

         Exit local console menus or terminate remote console session
      Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                      Press <CTRL><N> to exit console.
```

Figure 4.2 - Main Menu

Selecting any of the listed items on the Main Menu takes you to the first panel of the indicated function.

4.6 Configuration Menu

From the Main Menu, select **`Configuration...`** to display the Configuration Menu as shown in Figure 4.3.

```
                           Configuration Menu

Switch Information...                        TokenPipe...

Domain Configuration...                      MAC Filter & Port Security...

IP Configuration...                          Address Aging...

SNMP Configuration...                        Switching Mode Threshold...

Spanning Tree                                Password...

Token Ring Port Configuration...             Console Configuration...

TokenProbe Configuration...                  Source Route Configuration...

Return


                           Display the Main Menu
      Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                   Press <CTRL><N> to return to Main Menu.
```

Figure 4.3 - Configuration Menu

Selecting any of the listed items on the Configuration Menu takes you to the first panel of the indicated function.

4.7 Viewing Switch Information

From the Configuration Menu, select **`Switch Information...`**. Use the Switch Information panel to view or change the system description, identification, MAC address, interface description, system name, system location, or system contact. Figure 4.4 shows sample data.

```
                             Switch Information

    System Description       FORE Systems TS-2800 Token Ring LAN Switch
    System ID                1.3.6.1.4.1.326.2.8
    Switch Base MAC Address  000629 220BA0
    Address Format           Noncanonical
    Interface Description    FORE Systems TS-2800 HW Rev 15; SW 3.2.0B      (May
                              7 1997 10:07:30); Port uCODE KS25J1
    System Name              Payroll 1
    System Location          Building 3

    System Contact           Jane Doe



    DRAM Installed           4 MB
    Time of Day              Tue. October 7, 1997  13:16:52

    Return

    Configure the switch, virtual switches. and Token-Ring port parameters.
        Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 4.4 - Switch Information Panel4

The following list describes the information and parameters shown on the Switch Information panel.

System Description
Shows the full name and version identification of the system’s hardware type.

System ID
Shows the unique identification code for this TS-2800 that was assigned at the factory. It serves a purpose similar to that of a serial number.

Switch Base MAC Address

Displays the MAC address of the TS-2800.

Address Format

Allows you to choose to display MAC addresses in canonical or noncanonical format. Canonical format is typically used in Ethernet and is also known as *least significant bit (LSB) first*. Noncanonical is typically used in Token Ring and is also known as *most significant bit (MSB) first*.

Interface Description

Shows the hardware and microcode version of the TS-2800. The port microcode level applies to code related to physical port function.

System Name

Displays and allows you to enter the locally assigned name.

System Location

Displays and allows you to enter the locally assigned location.

System Contact

Displays and allows you to enter the locally assigned contact name.

Enhanced Features

Displays the state of the enhanced feature set.

DRAM Installed

Displays the number of megabytes of memory installed.

Time of Day

Allows the user to set the internal clock of the TS-2800.

4.8 Configuring Domains

From the Configuration Menu, select **`Domain Configuration...`** to display the Domain Configuration panel as shown in Figure 4.5. On the Domain Configuration panel, you can partition a single TS-2800 into a maximum of 16 domains. Except for those domains enabled for Source-Route bridging, each domain acts like a separate switch. A domain can be configured with its own IP address and managed with SNMP. Any domain can participate independently in the Spanning Tree protocol. Once domains have been established, packets are forwarded between ports belonging to the same domain only, if the domain is not enabled for Source-Route bridging.

NOTE

When port numbers are displayed in the following panels, the ports are identified by the UFC slot number and the port number on that slot (for example, port 3 on slot 2 appears as 2-3).

```
                         Domain Configuration

                       Port            Domain
                        1-1            default
                        1-2            default
                        1-3            default
                        2-1            default
                        2-2            default
                        2-3            default
                        2-4            default
                        3-1            default
                        3-2            default
                        3-3            default
                        3-4            default



   Return  More  Change  Change_Domain_Names...

                         Return to previous menu
       Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure 4.5 - Domain Configuration Panel

To see additional ports, select **More**.

The Port column displays the number of the port that you want to assign to a domain (0-7). All ports are initially assigned to domain 0. The **Change** option in the Configuration Menu allows you to change the domain within which a port is configured.

The **Change_Domain_Names...** option brings up the panel shown in Figure 4.6. This panel allows you to change the name of each domain.

For each domain that you establish, you can set up IP parameters (see “Setting Up IP Addresses” on page 4-19), SNMP trap tables (see “SNMP Network Management” on page 4-21), and Spanning Tree parameters (see “Transparent Bridge Spanning Tree” on page 4-29).

4.8.1 Naming Domains

From the Domain Configuration panel, select **Change_Domain_Names...** to display the Domain Names panel. This panel allows you to change the names of each domain from the default name to a name of your choosing.

```
                     Domain Names

                Index           Name
                  0             default
                  1             Domain01
                  2             Domain02
                  3             Domain03
                  4             Domain04
                  5             Domain05
                  6             Domain06
                  7             Domain07
                  8             Domain08
                  9             Domain09
                  10            Domain10
                  11            Domain11
                  12            Domain12
                  13            Domain13
                  14            Domain14
                  15            Domain15

Return   More   Change
                       Return to previous menu
       Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 4.6 - Domain Names Panel

Select **Change** to change the name of a domain from the default value to a name of your choosing. This panel shows the domains that can be created and their default names.

4.9 Setting Up IP Addresses

From the Configuration Menu (see Figure 4.3), select **`IP Configuration...`** to set the IP address, gateway address, subnet mask, and IP state, and to send PINGs. Figure 4.7 shows the IP Configuration for domain “default”.

```
           IP Configuration for Domain: default

Change_Displayed_Domain...

IP Address                        0.0.0.0

Default Gateway                   0.0.0.0

Subnet Mask                       0.0.0.0

IP State                          BootP When Needed

Send PING




Return

                      Display the Configuration Menu
      Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                   Press <CTRL><N> to return to Main Menu.
```

Figure 4.7 - IP Configuration Panel

IP addresses are always entered as a set of 4 decimal numbers from 0 through 255. The numbers must be separated by periods. The default is 0.0.0.0. If the default is used, no SNMP management will be available. The default gateway and default subnet mask are both 0.0.0.0. The settings take effect when you leave this panel by selecting the **`Return`** option.

4.9.1 IP State for Domains

The choices for IP state are IP Disabled, BootP When Needed, and BootP Always. The default is BootP When Needed. The following list explains the meaning of each of these parameters:

IP Disabled

The domain will not process any IP or Address Resolution Protocol (ARP) frames it receives. It will not respond to SNMP, PING, Telnet, or ARP frames that are received.

BootP When Needed

IP is enabled for the domain and will function immediately, if a non-0 IP address has been stored in NVRAM. If the IP address is 0 (0.0.0.0), BootP requests will be broadcast by the TS-2800 in an effort to learn its IP address. Until the TS-2800 receives a reply, this is the only IP function that will work.

BootP Always

IP is enabled for the domain but will not function until a BootP reply has been received. If a non-0 IP address for the domain is stored in NVRAM, it will be cleared to 0 when the TS-2800 is booted.

NOTE

When you select either of the BootP options in the preceding list, the TS-2800 repeats BootP requests at regular intervals, beginning at 1 second and eventually decreasing to every 5 minutes until it has received a valid reply. The BootP requests will also cease if a valid IP address is configured or the IP state is set to IP Disabled.

Once the TS-2800 stops sending BootP requests on a domain, it does not resume sending requests or recognize BootP responses on that domain unless the TS-2800 is reset. The parameters in a BootP response that are recognized and recorded in NVRAM are:

- IP Address
- Default Gateway
- Subnet Mask
- TFTP Bootfile Name
- TFTP Server Address

4.9.2 Send PING

The system prompts you to enter an IP address. The TS-2800 sends a PING to that address when you return to the Configuration panel. To send a PING to the BootP server, enter the IP address for the server you want to PING.

4.10 SNMP Network Management

Each TS-2800 kit has a diskette containing the private MIBs necessary for managing a TS-2800 with an SNMP-based network manager, such as HP OpenView or IBM NetView.

The SNMP agent in a TS-2800 maintains the management information bases (MIBs) listed in Table 4.3. The MIBs consist of objects that contain information about the TS-2800's identity, status, and resources. The SNMP network manager can request that the TS-2800 report information in the MIBs or set values in the MIBs.

MIBs supported by the ATM UFC are listed in Table 6.1.

Table 4.3 - MIBs Implemented in the TS-2800 SNMP Agent

MIB	RFC
TS-2800	N/A
Network Management of TCP/IP-based Internets: MIB-II	1213
Evolution of Interfaces Group of MIB-II	1573
Definition of Managed Objects for Ethernet-like Interface Types	1643
Definitions of Managed Objects for Bridges ***Note:*** Objects returned from RFC 1493 are for the domain from which the request originated.	1493
IEEE 802.5 Token Ring	1231
Source-Route Bridge	1525
HP Discovery	N/A
Dedicated Token Ring MIB	IEEE standard
RMON MIB	1757
RMON Token Ring MIB	1525

Table 4.4 - RMON Groups Implemented in the TS-2800 SNMP Agent

RMON Groups/Tables	RFC
Statistics	1757
tokenRingMLStatsTable	1513
tokenRingPStatsTable	1513
history	1757
tokenRingMLHistoryTable	1513
tokenRingPHistoryTable	1513
alarms	1757
alarmTable	1757
events	1757
eventTable	1757
logTable	1757

Note: Printed copies of RFCs are available for a fee from:

SRI International, Room EJ291
333 Ravenswood Avenue
Menlo Park, CA 94025
(415) 859-3695
(415) 859-6387
FAX (415) 859-6028

Request a softcopy of an RFC through an Internet mail gateway service (ATTMAIL, MCI-MAIL, CompuServe**, BITNET, and so on) as follows:
Address: `SERVICE@NIC.DDN.MIL`
Subject: `RFC` *`number`*
`number` is the number of the RFC you are requesting.

Alternately, RFCs can be accessed at the following URL: `ftp://ds1.internic.net/rfc`

Some of the MIBs are standard MIBs. The TS-2800 SNMP agent implements some elements of each of these MIBs, which are listed in Table 4.3 along with the Internet Requests for Comments (RFCs) that define them. These standard MIBs are included with most SNMP management applications.

1. If your network is SNMP-managed, give this diskette to the network management operator so that it can be compiled into the SNMP-based network manager.
2. If you are not currently using an SNMP manager, store the diskette for future use.

NOTE

If you are using SNMP management, once you have entered the initial IP address and SNMP configuration parameters from the console, you can use either the console or an SNMP managing entity with the MIBs loaded to view or change all parameters or management information except transparent Spanning Tree parameters.

4.10.1 Configuring SNMP

Before configuring SNMP, be sure that you have set IP addresses for the switch and each configured domain.

From the Configuration Menu, select **`SNMP Configuration...`** to set specific attributes related to SNMP.

```
                             SNMP Configuration

              Send Authentication Traps          Yes

              Community Strings...

              Trap Receivers








   Return

                        Display the Configuration Menu
        Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 4.8 - SNMP Configuration Menu

Send Authentication Traps

Indicates whether an authentication trap should be issued to Trap Receivers whenever authentication of an SNMP request fails.

The default entry is `Yes`. Changing it to No blocks all authentication traps from being sent to all trap receivers.

Community Strings Panel

Allows you to display and change the list of community names. Table entries are saved across resets.

Trap Receiver Panel

Displays a table of managers to which to send traps. Entries in the table are saved across resets and power cycles.

4.10.2 Creating Communities

From the SNMP Configuration menu, select **`Community Strings...`**. Use the Community Strings panel to configure the community names for the TS-2800. A *community name* is a name associated with the TS-2800 and a set of SNMP managers allowed to manage it with the specified privilege level. The community strings must be set to match the corresponding SNMP requests. Entries are saved when you leave the menu. Figure 4.9 shows sample data.

```
                             Community Strings

                Index  Community Name                   Mode
                  1    budget                           Read/Write










Return  Add  Delete  Change  Clear_Table

                            Return to previous menu
      Use cursor keys to select action. Press <ENTER> to confirm choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure 4.9 - Community Strings Panel

Mode

If you select R (Read), SNMP managers can only view SNMP information. If you select W (Read / Write), SNMP managers can both view and change SNMP information.

Add

Used to add a community name and access mode.

Delete

Used to delete a community name.

Change

Used to modify a community name or access mode.

Clear Table

Used to delete all community names.

Entries are displayed in the order in which they are entered. There is a limit of 10 community names.

4.10.3 Creating Trap Receivers

From the SNMP Configuration menu, select **`Trap Receivers...`**. Use the Trap Receivers panel to tell the TS-2800 where to send traps. The trap receivers table contains the IP address of each SNMP manager and a corresponding community name. Entries take effect when you return to the SNMP Configuration menu. Figure 4.10 shows sample data.

```
                              Trap Receivers

  Index   IP Address     Community Name                     Domain
  1       9.67.192.113   budget                             Domain01 ...










 Return  Add  Delete  Change  Clear_Table  Zoom

                          Return to previous menu
      Use cursor keys to select action. Press <ENTER> to confirm choice.
                   Press <CTRL><N> to return to Main Menu.
```

Figure 4.10 - Trap Receivers Panel

Use the following tools to set up or change trap receivers entries. The Trap Receivers panel contains a maximum of 13 entries. IP addresses are always entered as a set of 4 decimal numbers, from 0 through 255. The numbers must be separated by periods.

NOTE

Trap Receivers addresses are those of the workstations that receive SNMP errors.

Configuration

Add

Used to add a new entry to the Trap Receivers panel.

Delete

Used to delete an entry from the Trap Receivers panel.

Change

Used to modify an entry in the Trap Receivers panel.

Clear Table

Used to delete all Trap Receivers panel entries.

Zoom

Used to view details about the domain.

NOTE

When specifying domains use the space bar to select or deselect a domain.

4.11 Transparent Bridge Spanning Tree

Enabling the TS-2800 to participate in Spanning Tree lets you configure redundant (backup) paths in the switch topology, and have the switch automatically disable redundant paths to prevent loops. If the active path is broken and a backup path is available, the switch will find the redundant path and enable it. Without Spanning Tree, a path failure means loss of connectivity for the affected part of the network, and you must manually regain connectivity.

There are two sets of Spanning Tree parameters in the TS-2800. The following panels configure Spanning Tree for domains that use transparent bridging. See "Internal Source-Route Bridge Configuration" on page 4-52 for Source-Route Bridge Spanning Tree configuration.

From the Configuration Menu, select **`Spanning Tree...`**. Use the Spanning Tree panel to specify whether the TS-2800 is participating in the Spanning Tree protocol and, if so, to configure Spanning Tree switch and port parameters. These parameters take effect when you exit this menu.

```
                    Spanning Tree for Domain: default

         Change_Displayed_Domain...

         Participate in Spanning Tree                 802.1d

         Switch Priority                              32768

         Switch Hello Time (in Seconds)               2

         Switch Maximum Message Age (in Seconds)      20

         Switch Forward Delay (in Seconds)            15

         Port Priority and Port Path Cost...

  Return

                       Display the Configuration Menu
        Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure 4.11 - Spanning Tree Panel

The following list defines Spanning Tree parameters:

Change_Displayed_Domain
Choose a new domain to display.

Participate in Spanning Tree
Select `802.1d` or `No`. Select `802.1d` to participate in the Spanning Tree protocol. If you select No, the remaining values on the menu will be saved but will have no effect.

The default is No.

Switch Priority

Enter a priority value for this TS-2800 in the range of 0 to 65535 (decimal). The lower the priority value, the higher the priority. The bridge or switch with the lowest priority value in a Spanning Tree becomes the root. (To change individual port priorities, select the Port Priority and Port Path Cost menu option.)

The default is 32768.

Switch Hello Time

When this TS-2800 is the root switch, Switch Hello Time is the time in seconds the switch waits before sending the next configuration message.

The minimum value is 1.

The maximum value is the lower of 10 or:

(Switch Maximum Message Age/2) - 1

The default is 2.

The valid range for this parameter is displayed when you select Switch Hello Time.

Switch Maximum Message Age

Enter the maximum message age used when this TS-2800 is the root switch. This parameter sets the time in seconds at which the configuration message used by the Spanning Tree algorithm should be discarded.

The minimum value is the larger of 6 or:

2 x (Switch Hello Time + 1)

The maximum cannot be more than the smaller of 40 or:

2 x (Switch Forward Delay - 1) The default is 20.

The range limits that appear when you select this parameter are calculated using the values currently selected for Switch Hello Time and Switch Forward Delay.

Switch Forward Delay

Enter the time in seconds the TS-2800 waits between transitions from listening to learning, and from learning to forwarding.

The minimum is the larger of 4 or:

(Switch Maximum Message Age/2) + 1

The maximum is 30.

The default is 15.

The lower range limit that appears when you select this parameter reflects the value currently selected for Switch Maximum Age.

Port Priority and Port Path Cost

This panel displays a list of port priorities and path costs. This panel is active only when the Participate in Spanning Tree option is set to 802.1d. See “Port Priority and Port Path Cost” on page 4-33 for more information.

4.11.1 Port Priority and Port Path Cost

From the Spanning Tree panel, select **`Port Priority and Port Path Cost...`**. Use the Port Priority and Port Path Cost panel to view and change Spanning Tree priorities and path costs for each port. The Spanning Tree uses port path costs to determine which port to select as a forwarding port.

```
                    Port Priority And Port Path Cost

                   Port           Cost          Priority
                    1-1             62              128
                    1-2             62              128
                    1-3             62              128
                    2-1             62              128
                    2-2             62              128
                    2-3             62              128
                    2-4             62              128
                    3-1             62              128
                    3-2             62              128
                    3-3             62              128
                    3-4             62              128




   Return  More  Change

                         Return to previous menu
       Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                   Press <CTRL><N> to return to Main Menu.
```

Figure 4.12 - Port Priority Panel

Additional panels are available when you select the More option.

Cost

Select the port whose cost you want to change, press **<Enter>**, and then enter a new value. When the Spanning Tree reconfigures itself, it selects forwarding ports based on the port cost. Therefore, assign lower numbers to ports attached to faster media (such as FDX or TokenPipe), and higher numbers to ports attached to slower media (such as 2400-baud modem links). The possible range is from 1 to 65535. The default is 62. The recommended path cost is:

Path Cost = 1000/LAN speed in Mbps

Priority

Select the port whose priority value you want to change, press **<Enter>**, and then enter the new value.

NOTE

The port with the lowest priority value will forward the Spanning Tree frames.

The possible range is from 0 to 255 (decimal).

The default is 128. If all ports have the same priority value, the port with the lowest number (see the left-hand column in Figure 4.12) forwards the Spanning Tree frames.

4.12 Configuring Token Ring Ports

From the Configuration Menu, select **`Token Ring Port Configuration...`**. The Token Ring Port Configuration panel is shown in Figure 4.13. You can set any of the following parameters for each port on your TS-2800:

- Switching mode
- State
- Configuration type
  - Auto
  - Fixed
    - Speed
    - Port mode
    - Duplex
- Configuration loss

From the Port Configuration panel, select the **Change** option to set or change port parameters. Figure 4.13 shows sample data for a variety of port configurations.

NOTE

Refer to the READ.ME file shipped with switch microcode (on the MIB Diskette or with TS-2800 microcode upgrades) for the latest information about Token Ring port configuration.

ATM ports are configured using special UFC console panels, described in “ATM UFC Configuration” on page 4-78.

Configuration

```
                        Token Ring Port Configuration

     Switching                          Config                       Config
Port  Mode       Type   State    Link    Type   Speed  Mode  Duplex  Loss
1-1  Adaptive     RJ45  Enabled   Down   Auto   RSA16   ----  ----     8
1-2  Adaptive     RJ45  Enabled   Down   Auto   RSA16   ----  ----     8
2-1  Adaptive     RJ45  Enabled   Down   Auto   RSA16   ----  ----     8
2-2  Adaptive     RJ45  Enabled   Down   Auto   RSA16   ----  ----     8
2-3  Adaptive     RJ45  Enabled   Down   Auto   RSA16   ----  ----     8
2-4  Adaptive     RJ45  Enabled   Down   Auto   RSA16   ----  ----     8
3-1  Adaptive     RJ45  Enabled   Down   Auto   RSA16   ----  ----     8
3-2  Store & Fwd  RJ45  Enabled   Down   Auto   RSA16   ----  ----     8
3-3  Adaptive     RJ45  Enabled   Down   Auto   RSA16   ----  ----     8
3-4  Cut-Through  RJ45  Enabled    Up    Auto   RSA16   Adpt  Full     8



 Return  More  Change

                            Return to previous menu
     Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                  Press <CTRL><N> to return to Main Menu.
```

Figure 4.13 - Token Ring Port Configuration Panel

4.12.1 Switching Mode

On the Port Configuration panel, enter the switching mode for each port. The default switching mode is Adaptive. The following list explains each available mode:

Cut-Through

The highest-speed switching mode (16 Mbps). You cannot select this mode if the port is set at 4 Mbps.

Store-and-Forward

The mode that provides improved error isolation at the expense of some speed for 16-Mbps ports. Store-and-Forward is the only mode that can be selected for 4-Mbps ports.

Adaptive

The TS-2800 automatically alternates between Cut-Through and Store-and-Forward mode based on the specified error threshold. It operates in Cut-Through mode until it reaches the error-rate high threshold set in the Switching Mode Threshold panel (see “Switching Mode Threshold” on page 4-69). Then, the TS-2800 changes to Store-and-Forward mode. It will change back to Cut-Through mode when it falls below the error-rate low threshold.

4.12.2 Type

The Type column displays the port type. In the preceding example, all ports are RJ-45.

4.12.3 State

On the Port Configuration panel, the State column shows and allows you to change port operational status. The default is Enabled. When you disable a port, it will not connect with another switch, access unit, or station. If a port is disabled due to excessive configuration loss (see “Config Loss” on page 4-39), `Cfg Loss` is displayed in this column.

4.12.4 Link

On the Port Configuration panel, the Connect column indicates whether or not the port is connected to a device. Up means that the port is connected (open). Down means that the port is not connected (closed).

CAUTION

If you change configuration parameters of a connected (Up) port, the port will close and all address information and statistics for that port will be cleared.

4.12.5 Config Type

On the Port Configuration panel, the Config Type column displays the type of configuration for each port. Use this column to select Auto or Fixed. The default is Auto.

Auto
Speed, Mode, and Duplex are automatically set by the TS-2800.

Fixed
Allows you to manually set Speed, Mode, and Duplex.

NOTE

You must select Fixed to manually set Speed, Mode, or Duplex.

4.12.6 Speed

The Speed column in the Port Configuration panel shows and allows you to set the port speed at 4 or 16 Mbps. The prefix RSA (Ring Speed Adjust) means that the speed was automatically sensed and set by the TS-2800. The prefix FIX means that the speed was set to a fixed value via configuration.

NOTE

You must select Config Type as Fixed to manually set Speed.

4.12.7 Mode

From the Port Configuration panel, you can select either Port or Adapter mode for each port, using the Mode column. Selecting Port mode means that only a dedicated connection to a station is supported. The Tx/Rx pinouts are the same as those for a concentrator. Selecting Adapter mode means that the port operates like a station. The connection can be either dedicated or shared. The Tx/Rx pinouts are the same as an adapter's.

NOTE

You must select Config Type as Fixed to manually set Mode.

When interconnecting optical fiber ports on different switches, one end of the connection must be configured as Adapter and the other end as Port.

4.12.8 Duplex

The Duplex column in the Port Configuration panel displays and allows you to change the duplex mode for each port. The choices are Half or Full. Changes to the duplex settings are made immediately by the TS-2800.

NOTE You must select Config Type as Fixed to manually set Duplex.

4.12.9 Config Loss

Configuration loss occurs when a port link completes a connection (goes up), data traffic is allowed to flow, and the port link subsequently closes (goes down). Use this threshold to control the number of configuration losses that can occur within one minute. When the threshold is exceeded, the port is disabled (`Cfg Loss` is displayed in the State column) and must be reenabled by using this panel or SNMP. The Config Loss column in the main Port Configuration panel shows and allows you to change the configuration loss parameters. The default is 8. The range is from 1 to 100.

4.13 Configuring Port Address Aging

From the Configuration Menu, select **`Address Aging...`**. Use the Address Aging menu to configure port and master address table aging.

```
                               Address Aging


                     Port Address Table Aging...

                     Master Address Table Aging...










   Return

    Configure the switch, virtual switches. and Token-Ring port parameters.
     Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 4.14 - Address Aging Menu

Selection of either of the above items takes you to the indicated function.

4.13.1 Port Address Table Aging

From the Address Aging Menu, select **`Port Address Table Aging...`**. Use the Port Address Table Aging panel to configure Port address table aging.

```
                         Port Address Table Aging

             Port     Aging Time (min.)   Demand Aging Level
              1-1             5                  90%
              1-2             5                  90%
              1-3             5                  90%
              2-1             5                  90%
              2-2             5                  90%
              2-3             5                  90%
              2-4             5                  90%
              3-1             5                  90%
              3-2             5                  90%
              3-3             5                  90%
              3-4             5                  90%



    Return  More  Change

                           Return to previous menu
        Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 4.15 - Port Address Table Aging Panel

Aging Time

Defines the time an inactive MAC address will remain in the Port Address Table. The default is 5 minutes. A value of 0 will disable the removal of addresses based on age.

Demand Aging Level

When the Port Address Table reaches 100% capacity, a percentage of the addresses equal to:

`100% - Demand Aging Level value`

are cleared from the table based on a random algorithm that is weighted to clear remote addresses first, until the demand aging level is achieved. The default level is 90%. A level of 90% means that 10% of the addresses are deleted. Valid settings are 90%, 80%, 70%, 60%, 50%, and disabled. A value of disabled means that no addresses are cleared. In this case, when the table becomes full (100% capacity), new addresses cannot be learned.

4.13.2 Master Address Table Aging

From the Address Aging Menu, select **`Master Address Table Aging...`**. Use the Master Address Table Aging Panel to configure Master Address Table aging.

```
                       Master Address Table Aging



                  Aging Time              5

                  Demand Aging Level      90%






   Return




                           Return to previous menu
       Use cursor keys to select action. Press <ENTER> to confirm choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure 4.16 - Master Address Table Aging Panel

Aging Time

Defines the time an inactive MAC address will remain in the Master Address Table. The default is 5 minutes. A value of 0 will disable the removal of addresses based on age.

Demand Aging Level

When the Master Address Table reaches 100% capacity, a percentage of the addresses equal to:

`100% - Demand Aging Level value`

are cleared from the table based on a random algorithm that is weighted to clear remote addresses first, until the demand aging level is achieved. The default level is 90%. A level of 90% means that 10% of the addresses are deleted. Valid settings are 90%, 80%, 70%, 60%, 50%, and disabled. A value of disabled means that no addresses will be cleared. In this case, when the table becomes full (100% capacity), new addresses cannot be learned.

4.14 Configuring for Source-Route Bridged Environments

4.14.1 Terminology

In connection with source-routing and the TS-2800, several equivalent terms are used in the LAN industry in general. For the purposes of this manual, the following terms are used interchangeably as indicated:

- LAN ID = LAN segment number = ring number
- LAN segment = Domain

4.14.2 Source-Route Switching and Source-Route Bridging

There are two forms of source-routing in the TS-2800, Source-Route Switching and Source-Route Bridging.

- Source-Route Switching switches frames within a domain (LAN segment). In Source-Route Switching, because all ports connected to a specific domain must have the same LAN segment number (also known as a *Ring Number*), all Source-Route Bridges connected to the ports of a specific domain of the TS-2800 must be configured with the same LAN segment number.

  Source-Route switching is an automatic capability of the TS-2800 that allows it to easily integrate into a network containing external Source-Route Bridges.
- Source-Route Bridging switches frames among segments with different LAN segment numbers. The internal Source-Route Bridge allows the TS-2800 to act as a Source-Route Bridge itself, and with proper network configuration can replace external source-route Bridges.

On the TS-2800, the same LAN segment number is used by every port within a domain. By grouping ports together into domains, an administrator can control and limit traffic between domains. If the administrator wants to permit a workstation in one domain to communicate with a workstation in another domain, he can enable Source-Route Bridging between those two domains. This will permit source-routed frames which originate in one domain, but have a target destination in another domain, to flow across the TS-2800. Source-routed frames which have a source and destination within the same domain will not be switched across the Source-Route Bridge.

In Figure 4.17, source-routed frames can travel from any domain attached to the internal Source-Route Bridge to any other domain attached to the internal Source-Route Bridge. For example, a source-routed frame may pass from Domain 1 across the internal Source-Route Bridge to Domain 3. However, in this example, Domain 4 is Source-Route Switched, but is not attached to the internal Source-Route Bridge. Source-routed frames originating in Domain 4 cannot pass into domains 1, 2, or 3.

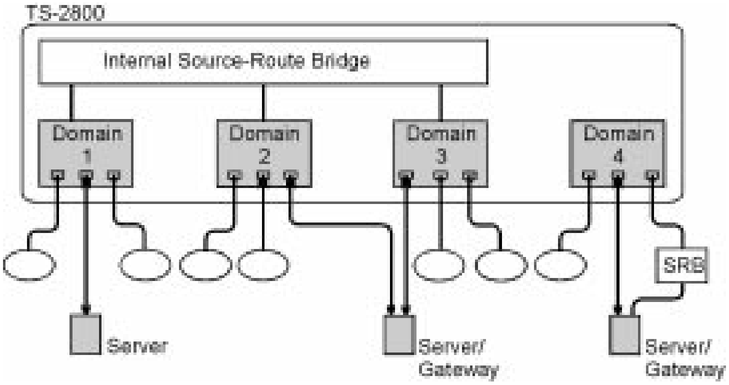


Figure 4.17 - Internal Source-Route Bridging and Source-Route Switching

4.14.3 ELANs and Source-Route Bridging

The internal Source-Route Bridge does ***not*** bridge between ATM ELANs. Although the ATM UFC may contain multiple LECs attached to different ELANs, these ELANs cannot communicate to each other through the internal Source-Route Bridge of the TS-2800. Traffic from Token-Ring ports can flow through the internal Source-Route Bridge to a domain with an ELAN connection on the ATM UFC.

4.14.4 Configuring LAN Segment Numbers for a Domain

The TS-2800 can learn the local LAN segment number when it sees a Source-Routed explorer frame from a bridge on any port in the domain; however, FORE recommends that you set the LAN segment number to ensure the TS-2800 has the current and correct information (see “Assigning or Changing LAN Segment Numbers” on page 4-50). Figure 4.18 depicts a small network. The local LAN segment number is 367. (The TS-2800 in this example is not using the internal Source-Route Bridge capability.)

NOTE

The TS-2800 does not *relearn* its local LAN segment number, so if the LAN segment number changes (due to network reconfiguration), you must use the Source-Route Configuration utility to either clear the learned LAN segment number so a new one can be learned, or to assign a specific LAN segment number.

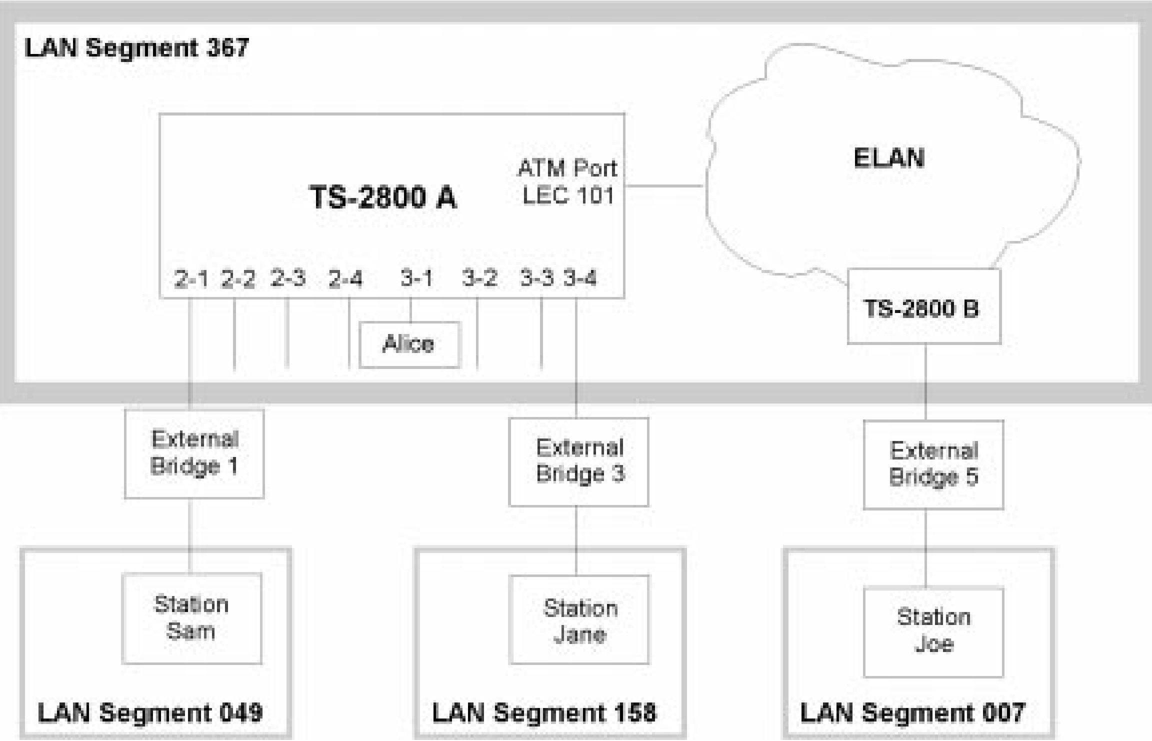


Figure 4.18 - Simple External Source-Route Bridged Network (No Internal Source-Route Bridge)

4.14.5 Source-Routing Switching Examples

4.14.5.1 Destination in Local Domain

If the TS-2800 receives a frame with an RIF that indicates that the destination is in the local domain, it will send it to the appropriate port based on its MAC-to-Port Number table. For example, if workstation Jane sends a frame to workstation Alice, the frame will have the following RIF:

`0630:158:3:367:0`

The terminating LAN segment number, `367`, matches that of the TS-2800, so the destination must be in the same domain as the port that received the frame. The TS-2800 looks up the destination MAC address (which is contained in the frame's header) in its MAC-to-Port Number table. In this table the MAC address for workstation Alice is mapped to port 3-1. The TS-2800 sends the frame out port 3-1.

Additionally, the TS-2800 will learn the route `367:3:158` and map it to port 3-1 in its Route Descriptor Table for future use.

4.14.5.2 Destination in Different Domain

If the TS-2800 receives a frame with an RIF that indicates that the destination is in a different domain, it will send it to the appropriate port based on its Route Descriptor Table. For example, if workstation Jane sends a frame to workstation Sam, it will have the following RIF:

`0830:158:3:367:1:049:0`

The terminating LAN segment number, `049`, is not that of the local domain. The TS-2800 will check its Route Descriptor Table for the route `367:1:049` and find port 2-1 associated with that route. The TS-2800 sends the frame out port 2-1.

If the route `367:1:049` was not in the Route Descriptor Table, the TS-2800 will flood the frame on all ports that are members of the domain.

4.14.5.3 Destinations in an ATM ELAN

If the TS-2800 receives a frame with an RIF that indicates a destination reached via the ATM uplink, the LEC operating on the ATM uplink will work with components of the ELAN (the LES and BUS) to resolve the destination address. The LEC acts as a proxy for destinations within the ELAN. For example, if workstation Jane sends a frame to workstation Joe, it will have the following RIF:

`0830:158:3:367:5:007:0`

The terminating LAN segment number, `007`, is not that of the local domain. The TS-2800 will check its Route Descriptor Table for the route `367:050:007` and find LEC 101 associated with that route. LEC 101 determines that the LEC on TS-2800 B is the appropriate destination, opens a connection and sends the frame out the ATM uplink. TS-2800 B will pass the frame out the appropriate port to reach workstation Joe.

4.14.6 Internal Source-Route Bridge Example

Figure 4.19 shows the same network as that in Figure 4.18, however, the external Source-Route Bridges have been replaced by the internal Source-Route Bridges of TS-2800s A and B.

- Stations Sam is now directly connected to TS-2800 A and Station Joe is now directly connected to TS-2800 B.
- The ports on TS-2800 A have been grouped into two domains, LAN Segment 049 and 367.
- The ports on TS-2800 B have been grouped into two domains, 367 and 007. LEC 101 on TS-2800 A has been configured as a member of LAN Segment 367.
- The internal Source-Route Bridge on TS-2800 A is bridging between domains 049, 367.
- The internal Source-Route Bridge on TS-2800 B is bridging between domains 367 and 007.
- Station Jane is still connected via External Bridge 3. Although the internal Source-Route Bridge is being used, the TS-2800 can still perform source-route switching with frames that have passed through external Source-Route Bridges.

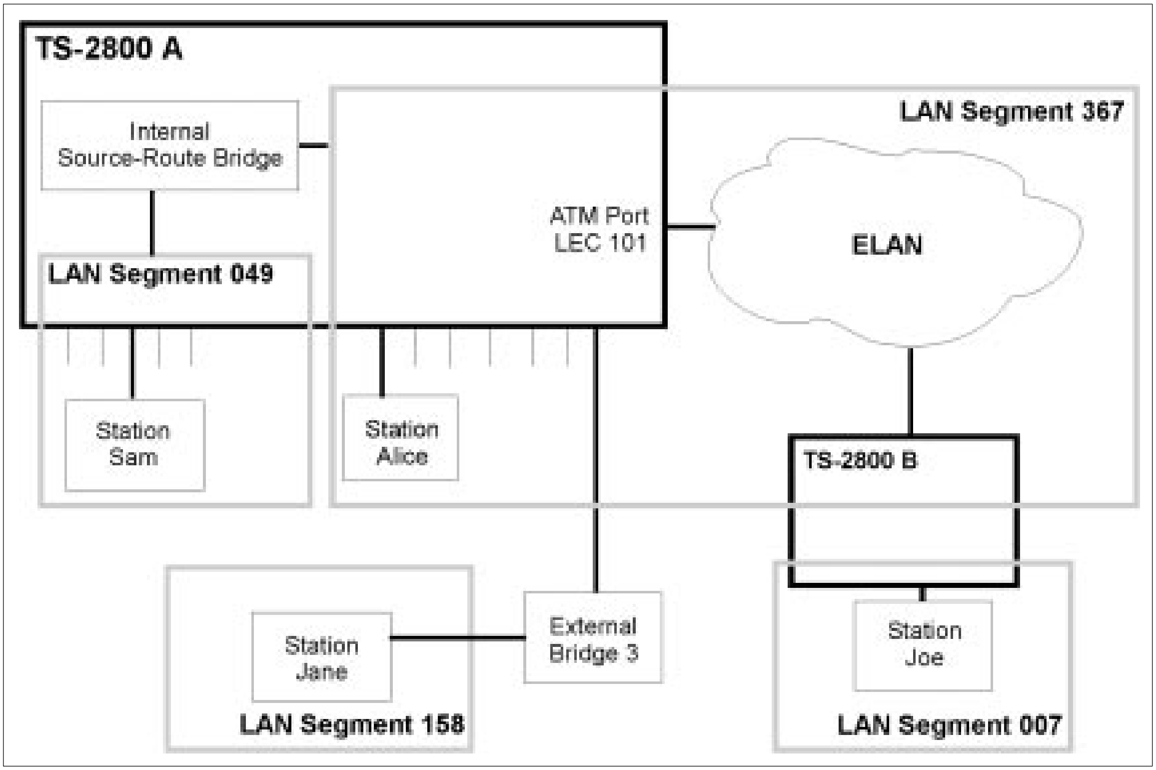


Figure 4.19 - Network Using Internal Source-Route Bridge

4.14.7 Assigning or Changing LAN Segment Numbers

To assign or change the LAN segment numbers associated with each domain, select **`Source Route Configuration...`** from the Configuration Menu. The Source-Route Configuration panel will resemble the one shown in Figure 4.20.

```
                      Source-Route (SR) Configuration

                               Ports:
                  LAN Segment  Slot1  Slot2  Slot3  Slot4  Slot5  Slot6  Slot7  Slot8
Index  Domain     Number       12     1234   1234   1234   1234   1234   1234   1234
  1    default      unknown    X      ..XX   XXXX   XXX.   XXXX   XX     XX     XX
  2    Domain01     001        .      XX..   ....   ...X   ....   ..     ..     ..
  3    Domain02   * 222        .      XX..   ....   ...X   ....   ..     ..     ..
  4    Domain03     002        .      XX..   ....   ...X   ....   ..     ..     ..
  5    Domain04   * 123        .      XX..   ....   ...X   ....   ..     ..     ..


  * = Learned LAN Segment Number
  # = LAN Segment enabled for SR Bridging
   Return  More  Assign_LAN_Segment_Number  Configure_Internal_SR_Bridge



                            Return to previous menu
       Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure 4.20 - Source-Route Configuration Panel

Select **`Assign LAN Segment Number`** to assign or change the LAN Segment Number (sometimes referred to as the *Ring Number*) or to reset the number to an *unknown* state. In an unknown state, the TS-2800 learns the segment number from source-routed explorer frames. If the segment is enabled for Source-Route bridging, this value cannot be changed or removed. A domain must have a segment number in order to be enabled for Source-Route bridging.

Select **`Configure Internal SR Bridge`** to bring up the internal Source-Route Bridge (SRB) configuration menu. If the number of learned or assigned segments is less than two, an error is displayed since you cannot Source-Route Bridge with less than two segments. You must have two or more segments with known segment numbers to get to the Source-Route

Bridge menu.

The default for `LAN Segment Number` is unknown.

Use the **`Return`** option to return to the Configuration Menu.

Entries and changes take effect immediately.

Port columns for which no port exists contain blanks.

Ports that exist but do not have the indicated LAN segment number in their table contain a period (.).

Ports that exist and have the indicated LAN segment number in their table contain an X.

4.14.8 Internal Source-Route Bridge Configuration

To set global parameters for the internal Source-Route Bridge function, select **`Configure_Internal_SR_Bridge`** from the Source-Route (SR) Configuration panel.

```
                Internal Source-Route Bridge (SRB) Configuration


             Bridge Number (hex)                     1

             LAN Segment Bridging Parameters...

             SRB Spanning Tree Configuration ...

             Internal Bridge Enabled?                Disabled




     Return





                            Return to previous menu
   Use cursor keys to choose an item.  Press <ENTER> to confirm your choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure 4.21 - Internal Source-Route Bridge Configuration Menu

Bridge Number

Specify the internal bridge number to be used in Source-Route descriptors. The range is from 0 to F, with a default of 1. Changes to this parameter take effect immediately, so a confirmation message is issued when the bridge number is changed and the Source-Route Bridge is enabled.

LAN Segment Bridging Parameters

Change the internal bridging parameters for individual LAN segments. Selecting this option leads to a new panel.

SRB Spanning Tree Configuration

Configure the Source-Route Bridge to use automatic or manual Spanning Tree. Selecting this option leads to a new panel.

Internal Bridge Enabled

Enable or Disable the internal Source-Route Bridge function. Changes to this parameter take effect immediately, so a confirmation message is issued when the Source-Route Bridge state is changed. If there are fewer than two segments enabled for bridging, an error message is displayed, and the change does not take effect.

4.14.9 Displaying LAN Segment Bridging Parameters

To set Source-Route Bridge parameters for individual LAN segments, select **`LAN Segment Bridging Parameters...`** from the Internal Source-Route Bridge (SRB) Configuration menu. On this panel, all LAN segments with learned or assigned segment numbers are displayed.

```
                       LAN Segment Bridging Parameters

                                              --ARE Frames--  --STE Frames--   Max
       Segment                       Bridged  Tx Hop  Rx Hop  Tx Hop  Rx Hop  Frame
Index  Number  Domain Name           Segment  Count   Count   Count   Count   Size
  1     001    domain01              disabled   7       7       7       7      4472
  2     002    domain03              disabled   7       7       7       7      4472
  3     123    domain04              disabled   7       7       7       7      4472
  4     222    domain02              disabled   7       7       7       7      4472






  Return    More    Change



                                Return to previous menu
  Use cursor keys to choose an item.  Press <ENTER> to confirm your choice.
                   Press <CTRL><N> to return to Main Menu.
```

Figure 4.22 - LAN Segment Bridging Parameters Panel

Change

Change the internal bridging parameters for a LAN segment. Selecting this option leads to a new panel.

4.14.10 Changing LAN Segment Bridging Parameters

To change LAN segment bridging parameters, select **Change** from the LAN Segment Bridging Parameters panel.

```
      Change LAN Segment Bridging Parameters - Segment 001 - domain01



     Enable/Disable Bridged Segment                  Disabled

     Max ARE Frame Transmit Hop Count                7
     Max ARE Frame Receive Hop Count                 7

     Max STE Frame Transmit Hop Count                7
     Max STE Frame Receive Hop Count                 7

     Maximum Frame Size (bytes)                      4472



   Return




                            Return to previous menu
  Use cursor keys to choose an item.  Press <ENTER> to confirm your choice.
                 Press <CTRL><N> to return to Main Menu.
```

Figure 4.23 - Change LAN Segment Bridging Parameters Panel

Enable/Disable Bridged Segment

Enable or disable frame forwarding for this segment over the internal bridge.

Max ARE Frame Transmit Hop Count

Change the All-Routes Explorer (ARE) transmit hop count for this segment. The range is from 1 to 13, with a default of 7.

Max ARE Frame Receive Hop Count

Change the All-routes Explorer (ARE) receive hop count for this segment. The range is from 1 to 13, with a default of 7.

Max STE Frame Transmit Hop Count

Change the Spanning Tree Explorer (STE) transmit hop count for this segment. The range is from 1 to 13, with a default of 7.

Max STE Frame Receive Hop Count

Change the Spanning Tree Explorer (STE) receive hop count for this segment. The range is from 1 to 13, with a default of 7.

Maximum Frame Size

Change the maximum frame size for frames forwarded on this segment. Values that may be selected are 4472, 2052, 1500, or 516. The default is 4472.

NOTE

The maximum frame size values allowed in the 1525 MIB are the IEEE values of 4399, 2052, 1470, and 516 -- two of which are different from the FORE values defined above. The TS-2800 always uses the larger FORE values. When retrieving this setting using SNMP, the smaller IEEE value is returned even if the larger FORE value was set through the console. This is not an error.

4.14.11 Source-Route Bridge Spanning Tree Configuration

To change the Spanning Tree parameters for Source-Route bridging, select **`SRB Spanning Tree Configuration...`** from the Internal Source-Route Bridge (SRB) Configuration menu.

NOTE

The Source-Route Bridge Spanning Tree parameters are in addition to and independent of the Spanning Tree parameters for transparent domains found in “Transparent Bridge Spanning Tree” on page 4-29.

```
     Source-Route Bridge (SRB) Spanning Tree Configuration


          SRB Spanning Tree Mode                  Manual

          SRB Priority                            32768
          SRB Hello Time (in seconds)             2
          SRB Maximum Message Age (in seconds)    6
          SRB Forwarding Delay (in seconds)       4
          SRB Segment Path Cost...

          Manual Spanning Tree Parameters...

  Return









                           Return to previous menu
  Use cursor keys to choose an item.  Press <ENTER> to confirm your choice.
```

Figure 4.24 - Source-Route Bridge Spanning Tree Configuration Panel

SRB Spanning Tree Mode

Set the mode to Automatic or Manual. Automatic mode allows the internal Source-Route Bridge to participate in the Source-Route spanning tree algorithm with other Source-Route Bridges to determine a single route through the source routing network for Spanning Tree explorer (STE) frames. Manual mode allows the user to specify which logical bridge ports are forwarding the STE frames. The default mode is manual.

SRB Priority

This option can be changed only when the Spanning Tree Mode is Automatic. The SRB priority becomes part of the Bridge ID for the spanning tree algorithm. The lower the priority value, the higher the priority. The Source-Route bridge with the highest priority in a Spanning Tree becomes the root. The range is from 0 to 65535, with a default of 32768.

SRB Hello Time

This option can be changed only when the Spanning Tree Mode is Automatic. This parameter determines the time in seconds between Source-Route Spanning Tree configuration messages when this bridge is the root. The minimum is 1. The maximum is the lower of 10 or

(SRB Maximum Message Age/2) - 1.

The default is 2.

SRB Maximum Message Age

This option can be changed only when the Spanning Tree Mode is Automatic. This parameter sets the time in seconds at which the configuration message used by the Source-Route Spanning Tree algorithm should be discarded when this bridge is the root. The minimum value is the higher of 6 or

2 x (Bridge Hello Time + 1).

The maximum value is the lower of 40 or

2 x (Switch Forward Delay - 1).

The default is 20.

SRB Forwarding Delay

This option can be changed only when the Spanning Tree Mode is Automatic. This parameter controls the time in seconds that a bridge spends in the listening state when this bridge is the root. The minimum is the larger of 4 or

(Switch Maximum Message Age/2) + 1.

The maximum is 30. The default is 15.

SRB Segment Path Cost...

This option can be selected only when the Spanning Tree Mode is Automatic. Selecting this option leads to a new panel.

Manual Spanning Tree Parameters...

This is the only option that can be selected on this panel when Spanning Tree mode is manual. Selecting this option leads to another panel.

4.14.12 Source-Route Bridge Path Cost

To change the path cost for a Source-Route Bridge segment, select **SRB Segment Path Cost...** from the Source-Route Bridge (SRB) Spanning Tree Configuration panel.

```
                    Source-Route Bridge (SRB) Path Cost



                    Segment                          Segment
           Index    Number  Domain Name             Path Cost
           1      001     domain01                    62
           2      002     domain03                    62
           3      222     domain02                    62








  Return    More    Change Segment Path Cost




                           Return to previous menu
  Use cursor keys to choose an item.  Press <ENTER> to confirm your choice.
                   Press <CTRL><N> to return to Main Menu.
```

Figure 4.25 - Source-Route Bridge Path Cost Panel

Change Segment Path Cost

Path cost is used by the Source-Route Spanning Tree algorithm to determine which logical bridge ports are in forwarding state for STE frames. The range is from 1 to 65535, with a default of 62.

4.14.13 SRB Manual Spanning Tree Parameters

To manually change the forwarding state for a Source-Route Bridge segment, select **`Manual Spanning Tree Parameters...`** from the Source-Route Bridge (SRB) Spanning Tree Configuration panel.

NOTE Changes made to this panel are not effective if the SRB Spanning Tree Mode is set to Automatic.

```
        Source-Route Bridge (SRB) Manual Spanning Tree Parameters


                Segment                  Single-route
        Index   Number  Domain Name      Bcast Frames
          1     001     domain01           Forward
          2     002     domain03           Forward
          3     222     domain02           Forward







Return     More     Change Single-Route Bcast Frame State




                         Return to previous menu
Use cursor keys to choose an item.  Press <ENTER> to confirm your choice.
                 Press <CTRL><N> to return to Main Menu.
```

Figure 4.26 - Source-Route Bridge Manual Spanning Tree Parameters Panel

Change Single-Route Bcast Frame State

Each segment is set to Forward or Block STE frames. The default is Forward.

4.15 Changing Address Filters and Port Security

From the Configuration Menu, select **MAC Filter & Port Security...**. Use the MAC Filter & Port Security menu shown in Figure 4.27 to configure MAC address filters, configure port security attributes, or view port filters. A filter for a particular MAC address can be applied to only one domain.

```
                        MAC Filter & Port Security

                        Configure Filters...
                        Configure Port Security Mode...











    Return
                        Configure MAC address filters
        Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 4.27 - MAC Filter & Port Security Menu

NOTE

Filters are applicable only to segments that begin and end at the TS-2800.

4.15.1 Configuring Filters

From the MAC Filter & Port Security menu, select **`Configure Filters...`**. Use the Configure Filters panel to restrict certain users from communicating with other users by specifying up to 100 source or destination MAC addresses to be filtered at the port of entry into the TS-2800. MAC addresses can be unicast, multicast (group), or broadcast. All 100 addresses can be associated with one port or divided among the ports. Figure 4.28 shows the filter choices offered when the **Add** option is selected.

Note that a large number of active MAC address filters will degrade switch performance.

```
                            Configure Filters

   Index   MAC Address      Type      Entry Ports      Exit Ports
     1    10005A 4315CF    Block src    2-1 2-2 2-3 ...
     2    10005A 4975AC    Block dst    4-1
     3    10005C 4315CF    Allow src    4-1             6-1
     4    10005A 431525    Force dst    4-1             6-1


Filter Type:
   Block any packet with Source Address from ports....
   Block any packet with Destination Address from ports....
   Allow any packet with the designated Source Address to port(s)....
   Force any packet with the designated Destination Address to port(s)....


Return  More  Add  Delete  Change  Clear_Table  Zoom

                          Return to previous menu
     Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure 4.28 - Filter Configuration Panel

The following list describes functions available on the Configure Filters panel:

Add

Used to specify the filter type, the MAC address you want to filter, and the entry ports to which this filter will be applied. Leaving entry port parameters empty causes a filter to be applied to all ports. A filter for a particular MAC address can be applied to only one domain.

Delete

Used to specify a filter you want to remove.

Clear_Table

Clears the address table.

Zoom

Displays the complete list of Entry and Exit ports for the filter.

Filter Type:

- Block any packet with Source Address from ports....
  Listed as `Block src` in the Type field.
- Block any packet with Destination Address from ports....
  Listed as `Block dst` in the Type field.
- Allow any packet with the designated Source Address to port(s)....
  Listed as `Allow src` in the Type field.
- Force any packet with the designated Destination Address to port(s)....

Listed as Force dst in the Type field.

When you choose any of the filter Type options, you are prompted to enter the port to which the filter applies. This is the port where the filtering takes place. After you have entered it, this port number appears in the Applied Ports column.

When you choose Allow any packet with the designated Source address to port(s) or Force any packet with the designated Destination Address to port(s), you are also prompted to enter the port that is to receive the filtered data. This port appears in the Exit Ports column.

NOTE

If you set up a filter for broadcast packets, hosts on the other side of the TS-2800 will not see the ARP broadcast packets. To prevent this, let the TS-2800 learn the host addresses before implementing the filter. Some hosts might time out their local address entries and attempt to relearn them with a broadcast ARP packet.

If a filter is set up with the TokenPipe option, filters must be created for all ports in the TokenPipe.

The Allow and Force type filters should be used in conjunction with port security configuration.

4.15.2 Configuring Port Security Mode

From the MAC Filter & Port Security menu, select **`Configure Port Security Mode...`**. Use the Configure Port Security Mode panel to define the security attributes of each Token Ring port. This function totally blocks (secures) all addresses at selected ports unless a MAC filter allows them. Addresses that have been allowed or forced by a configured filter are not blocked. Figure 4.29 shows sample data.

```
                        Configure Port Security Mode

           Port       Security Mode
            1-1       Normal
            1-2       Normal
            2-1       Normal
            2-2       Normal
            2-3       Normal
            2-4       Normal
            3-1       Normal
            3-2       Normal
            3-3       Normal
            3-4       Normal
            4-1       Normal



    Return  More  Change

                            Return to previous menu
        Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 4.29 - Configure Port Security Mode Panel

The following list describes functions available on the Configure Port Security Mode panel:

Normal
No security mode is defined for a port. This is the default.

Secure source addresses
Block all source addresses, except those allowed by a configured filter.

Secure destination addresses
Block all destination addresses, except those forced by a configured filter.

Secure both source and destination addresses
Block all source and destination addresses, except those allowed or forced by a configured filter.

4.16 Configuring TokenProbe

You can configure any one of the Token Ring ports as the TokenProbe port. By attaching a network analyzer to the TokenProbe port, you can then monitor the switched traffic of a selected port.

To use TokenProbe, select **`TokenProbe Configuration...`** from the Configuration Menu. Enter the number of the port you want to configure as the TokenProbe port, and also the number of the port you want to monitor.

```
                          TokenProbe Configuration



         TokenProbe Port Number                         2-2

         Port to Monitor                                2-1

         Monitor Local Traffic                          No







    Return

                        Display the Configuration Menu
        Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 4.30 - TokenProbe Configuration Panel

TokenProbe is helpful when analyzing traffic on adapters or devices attached directly to a switch port, and there is no LAN hub or concentrator port to help with tracing the segment.

With a trace tool attached to the configured TokenProbe port, you can monitor switch port traffic.

The following list provides definitions for items appearing on the TokenProbe Configuration panel:

TokenProbe Port Number

Allows you to select the port to which the network analyzer will be attached. Select port 0 to disable the TokenProbe function.

Port to Monitor

Allows you to select the port that will be monitored by the TokenProbe port.

Monitor Local Traffic

This parameter determines the type of frames monitored on the port. When set to Yes, all non-MAC frames are monitored whether or not they pass through the TS-2800. When set to No, only frames that pass through the TS-2800 to and from the monitored port are monitored.

4.17 Configuring TokenPipe

You can configure two to four ports connected between TS-2800s to create TokenPipe 16-Mbps links. This increases the capacity of the connection between TS-2800s to support up to 64-Mbps HDX or 128-Mbps FDX.

To use TokenPipe, select **`TokenPipe Configuration...`** from the Configuration Menu.

```
                          TokenPipe Configuration

                TokenPipe         State         Ports
                     1            Down          2-1 2-2
                     2            N/A           Not Defined
                     3            N/A           Not Defined
                     4            N/A           Not Defined










   Return  Add  Delete  Change  Clear_Table

                            Return to previous menu
       Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure 4.31 - TokenPipe Configuration Panel

State

- N / A **-** Ports have not been defined for a TokenPipe.
- Down **-** A TokenPipe has been defined but physical cable connections have not yet been established.
- Up **-** A TokenPipe is defined and operational.

Ports

Defines the ports participating in the TokenPipe.

NOTE

Create TokenPipe port connections between TS-2800s in consecutive, numeric order from lowest to highest numbered port. The lowest-numbered port becomes the primary port and all broadcast frames flow through this port as TokenPipe connections are created and then assigned to the other TokenPipe ports.

NOTE

If any strand in the TokenPipe fails, the entire TokenPipe becomes inoperative.

4.18 Switching Mode Threshold

From the Configuration Menu, select **`Switching Mode Threshold...`**. Use the Switching Mode Threshold panel to change the error-rate thresholds, trend, and sample period.

NOTE Switching Mode Threshold only applies when the port is in Adaptive mode.

```
                            Switching Mode Threshold


                     Error rate high threshold     10

                     Error rate low threshold      1

                     Error rate trend              5

                     Error rate sample             10








    Return

                            Return to previous menu
        Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 4.32 - Switching Mode Threshold Panel

The following list defines functions available on the Switching Mode Threshold panel:

Error rate high threshold

When the port is set to Adaptive mode, the error-rate high threshold is one of two criteria used to automatically force the port from Cut-Through mode to Store-and-Forward mode. If the percentage of errors detected in a sampling period exceeds the high threshold, the port is forced from Cut-Through mode to Store-and-Forward mode. The range of the high threshold is 1-100% The default is 10%.

Error rate low threshold

When the port is set to Adaptive mode, the error-rate low threshold is one of two criteria used to automatically return the port from Store-and-Forward mode to Cut-Through mode. If the percentage of errors detected in a sampling period falls below the low threshold, then the port is returned from Store-and-Forward mode to Cut-Through mode. The low threshold ranges from 1-100%. The default is 1%.

Error rate trend

When the port is set to Adaptive mode, the error-rate trend is one of two criteria used to force the port from Cut-Through to Store-and-Forward. It is also one of two criteria used to return the port from Store-and-Forward to Cut-Through mode. The error-rate trend, which is the difference between two successive sampling periods, is compared to the trend threshold. If the percentage of errors has increased between two sampling periods, and the trend exceeds the trend threshold, then the port is forced from Cut-Through mode to Store-and-Forward mode. However, if the percentage of errors has decreased between two sampling periods, and the trend exceeds the trend threshold, then the port is returned from Store-and-Forward mode to Cut-Through mode. The error-rate trend algorithm is active only when the error rate is between the error rate high threshold and the error rate low threshold. The error-rate trend threshold ranges from 1% to 100%. The default is 5%.

Error rate sample period

The amount of time in which the error-rate trend is sampled. The error rate sample period ranges from five to 120 minutes. The default is ten minutes.

4.19 Password

From the Configuration Menu, select **`Password...`**. Use the Password panel to add, change, or delete a password. If you establish a password, users must enter it to obtain access to the Main Menu.

```
                                  Password

                             Set Password

                             Delete Password










   Return

    Configure the switch, virtual switches. and Token-Ring port parameters.
        Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 4.33 - Password Panel

The following list describes functions available through the Password panel:

Set Password

Used to establish or change the password. The default is no password.

Delete Password

Used to delete the password.

The system prompts you to enter the password before it allows you to change or delete the password. If you are establishing a new password, press **`<Enter>`** at the Old Password prompt.

The password is saved across resets and power cycles in NVRAM.

NOTE

If you have forgotten your password, press the **`System Request`** button (shown in Figure 1.5 on page 1-9) to access the System Request Menu, and then select **`Clear NVRAM`**. This will clear the password but also set all configuration parameters to their default values, clearing any values you have entered.

4.20 Console Configuration

From the Configuration Menu, select **`Console Configuration`**. Use the Console Configuration menu to configure for a serial link or Telnet console session and to set the console time-out value.

```
                           Console Configuration


                        Serial Link Configuration...

                        Telnet Configuration...

                        Console Time-Out         0









   Return

    Configure the switch, virtual switches. and Token-Ring port parameters.
        Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 4.34 - Console Configuration Menu

The following list describes functions available from the Console Configuration menu:

Serial Link Configuration
Used to configure a console session with a device attached to the EIA 232 port.

Telnet Configuration
Used to configure a console session via Telnet.

Console Time-Out

Used to set the number of minutes a console session will remain idle before timing out. Unsaved screen entries are lost when the console times out. The default is 0, meaning that no timeout will occur.

4.20.1 Serial Link Configuration

From the Console Configuration menu, select **`Serial Link Configuration...`**. Use the Serial Link Configuration panel to change the default parameters of the EIA 232 port and, if necessary, to set up a console session with an attached device.

```
                      Serial Link Configuration

         Hardware Flow Control                              Disabled

         Software Flow Control                              Disabled

         Autobaud Upon Break                                Enabled

         Console Baud Rate                                  9600







   Return

                          Return to previous menu
        Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 4.35 - Serial Link Configuration Panel

The following list defines functions available on the Serial Link Configuration panel:

Hardware Flow Control

Used to enable or disable hardware flow control. The default is Disabled.

Software Flow Control

Used to enable or disable software flow control. The default is Disabled.

Autobaud Upon Break

Used to enable or disable autobaud upon break. The default is Enabled. When set to enabled, a baud rate change can be accomplished by changing the baud rate of the terminal emulator, disconnecting and reconnecting the EIA 232 cable, and then pressing **`<Enter>`** until a panel appears.

Console Baud Rate

Used to display and change the TS-2800 EIA 232 port baud rate.

Acceptable values are 1200, 2400, 4800, 9600, 19 200, 38 400, and 57 600.,

The default value is 9600.

Make sure that your terminal emulator baud rate matches the console baud rate you set.

CAUTION

Setting the console baud rate higher than your terminal emulator or modem rate causes firmware alterations that require qualified service personnel to correct.

4.20.2 Telnet Configuration

From the Console Configuration menu, select **`Telnet Configuration...`**. Use the Telnet Configuration panel to configure the TS-2800 for a Telnet console session.

```
                            Telnet Configuration

         Number of Telnet Sessions Allowed       5

         Disallow New Telnet Session             No

         Terminate All Active Telnet Sessions

         Telnet Sessions...





   Return



                           Return to previous menu
        Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 4.36 - Telnet Configuration Panel

The following list describes functions available on the Telnet Configuration panel:

Number of Telnet Sessions Allowed
Defines the number of Telnet sessions allowed. The default is 5.

Disallow New Telnet Sessions
Disallows new Telnet sessions. The default is No.

Terminate All Active Telnet Sessions
Stops all active Telnet sessions.

Telnet Sessions

Displays any active Telnet sessions.

4.20.3 Telnet Sessions

From the Telnet Configuration panel, select **`Telnet Sessions...`**. Use the Telnet Sessions panel to display or close any active Telnet sessions.

```
                              Telnet Sessions

                      --- Remote ---            --- Local ---
Index   Box         IP          Port          IP          Port    Status
    1      1     98.68.214.153   1493      9.70.199.118    23       Open











    Return    Close_Session


                            Return to previous menu
        Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 4.37 - Telnet Sessions Panel

The Remote column indicates the IP address and port number at which the Telnet session is originating. The Local column indicates the IP address of the TS-2800 and the port number the Telnet session is using.

4.21 ATM UFC Configuration

4.21.1 Obtain Configuration Parameters Worksheets

The following worksheets are available in Appendix A:

Table 4.5 - Configuration Worksheets

Worksheet	For configuration procedures see
Quick Config Parameters Worksheet (required)	This chapter
Advanced Config Parameters Worksheet (optional)	Appendix B
Spanning Tree - Port (LEC) Priority and Path Cost Worksheet	"Port Priority and Port Path Cost" on page 4-33
Port Address Table Aging Worksheet (optional)	"Port Address Table Aging" on page 4-41

NOTE

If the configuration parameters worksheets have not been filled out, you should be able to accomplish a simple quick configuration without worksheets using the procedure in this chapter.

NOTE

We recommend that you use the worksheets. Keep them for your records in case the ATM UFC needs to be reconfigured.

4.21.2 Establish an ATM Console Session

To change the ATM UFC parameters, you can gain access to the UFC console in any of the following ways:

- Direct console session through the EIA 232 management port
- Modem connection to the EIA 232 management port
- Telnet console session if the base switch is IP enabled

To set up a console session, refer to *Setting Up a Console Session* in your base switch manual.

4.21.3 Check Base Switch Microcode Level

You might need to update your base switch microcode to support the UFC before you configure the UFC port. To ensure that your base switch microcode supports the ATM UFC, complete the following procedure to download the level 3.2.0B main image of the base switch microcode.

1. Start a console session using the procedure in “Console Configuration” on page 4-73.
2. Go to the Switch Information panel, one of the selections on the Configuration panel.
3. Make sure that the value of the Interface Description entry for software is `SW 3.2.0B` or higher.
4. If the software level is `SW 3.2.0B` or higher, you do not need to update the base machine microcode.

If the software level is not `SW 3.2.0B` or higher, you must update the base machine microcode. To do so, see “Downloading Software” on page 9-1.

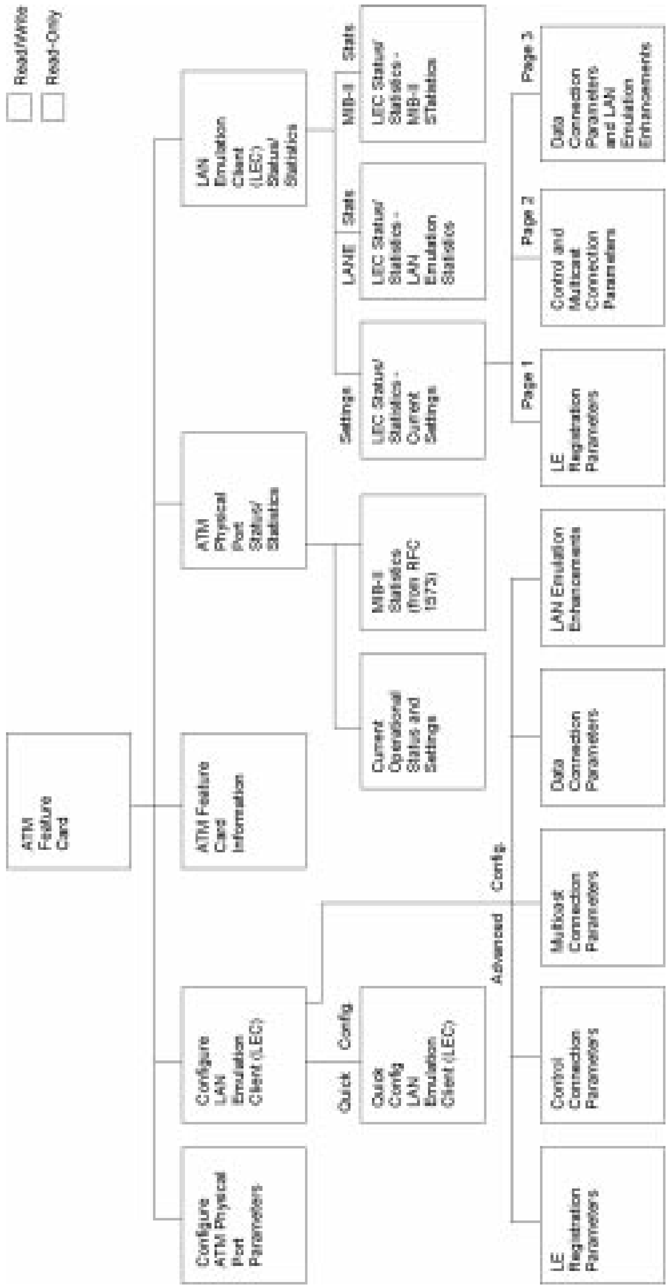


Figure 4.38 - ATM UFC Menu Hierarchy

4.22 Quick Configuring the ATM UFC

Quick configuring the ATM UFC requires four steps:

1. Select **`Non-Token-Ring Ports`** option from the Main menu.

```
                              ATM Feature Card                          Slot 1


                  ATM Feature Card Configuration
                    Configure ATM Physical Port Parameters...

                    Configure LAN Emulation Client (LEC)...



                  ATM Feature Card Status/Statistics
                    ATM Feature Card Information...

                    ATM Physical Port Status/Statistics...

                    LAN Emulation Client (LEC) Status/Statistics...



    Return To Previous Menu

                           HELP MESSAGES APPEAR HERE
        Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 4.39 - ATM Feature Card Panel

2. Choose the **`Select UFC`** option and enter the port number of the ATM Feature Card that you want to configure. The ATM Feature Card menu appears, as shown in Figure 4.39.
3. Select **`Configure ATM Physical Port Parameters...`**. See “Configuring ATM Physical Port Parameters” on page 4-82.

4. Select **`Configure LAN Emulation Client (LEC)...`**. Configure a LEC for each domain that you want to connect to the ATM network. See “Configuring LAN Emulation Clients” on page 4-84.
5. Reset the ATM UFC. The ATM physical port and any LECs configured will be reset automatically when you exit the ATM UFC console. However, you can reset them individually using the ATM UFC console.

NOTE Resetting the ATM physical port will reset all LECs.

NOTE Resetting a LEC will also reset all of the base switch ports in the domain to which the LEC is assigned.

4.23 Configuring ATM Physical Port Parameters

You do not need to configure the port for it to work in your network. Two physical port parameters can be changed. One is the UNI level (3.0, 3.1, or Auto-detect); the other is the Control Plane VCC Peak Rate for the port.

1. To change these parameters, go to the ATM UFC main menu, select **`Configure ATM Physical Port Parameters...`**, and press **`<Enter>`**.

```
                 Configure ATM Physical Port Parameters               Slot 1



User-Network Interface (UNI) Level
           Default Value:      Auto-detect
           Configured Value:   Auto-detect


Control Plane VCC Peak Rate
           Default Value:      8000 Kbps ( 5% of port's bandwidth)
           Configured Value:   8000


Save and Return     Cancel and Return     Reset     Enable      Disable
                                          Port      Port        Port
For Quick Config, use the default values
for UNI Level and Control Plane VCC Rate.



                         HELP MESSAGES APPEAR HERE
      Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                   Press <CTRL><N> to return to Main Menu.
```

Figure 4.40 - Configure ATM Physical Port Parameters Panel

2. Configure the following parameters as necessary.
   a. UNI level
      - Auto-detect (default); monitors ATM traffic to determine UNI level 3.0 or 3.1
      - UNI 3.0
      - UNI 3.1

   b. Control Plane VCC Peak Rate

      Defines the maximum bandwidth available for control, signaling, and Interim Local Management Interface (ILMI) connections. The range is 0-155 000 Kbps. The default is 8000 Kbps (5% of the total ATM UFC bandwidth).

4.24 Configuring LAN Emulation Clients

1. To configure your LECs, go to the ATM Feature Card main menu, select **Configure LAN Emulation Client (LEC)...**, and press **<Enter>**.

```
                    Configure LAN Emulation Client (LEC)                Slot 1

 LEC
Index Domain Name      Domain Ports    Emulated LAN Name                  Status
101   default          1 3 4 5 7 8     <no ELAN name defined>              down
102   default                                                       Adm. Disabled
103   default                                                       Adm. Disabled
104   default                                                       Adm. Disabled
105   default                                                       Adm. Disabled
106   default                                                       Adm. Disabled
107   default                                                       Adm. Disabled
108   default                                                       Adm. Disabled
109   default                                                       Adm. Disabled
110   default                                                       Adm. Disabled
111   default                                                       Adm. Disabled
112   default                                                       Adm. Disabled
113   default                                                       Adm. Disabled


Return   More   Quick Config   Advanced Config   Reset   Enable   Disable

                          HELP MESSAGES APPEAR HERE
       Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 4.41 - Configure LAN Emulation Client (LEC) Panel

2. Select **Quick Config** at the bottom of the **Configure LAN Emulation Client (LEC)** panel. At the prompt, type the LEC index as it appears in the table, and press **<Enter>**.

```
            Quick Config LAN Emulation Client (LEC)            Slot 1
                         LEC Index 101                    Port is DOWN

          Domain Name        default

          ELAN Name          <no ELAN name defined>

          LES Address        Get from LECS (Automatic)

          ESI                006094ca2ec0  (universally administered)

For Quick Config, specify the Domain Name that the LEC is
assigned to. Optionally, configure the other parameters as
necessary for your LECS/LES/BUS implementation.

Save and Return    Cancel and Return

                         HELP MESSAGES APPEAR HERE
     Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                  Press <CTRL><N> to return to Main Menu.
```

Figure 4.42 - Quick Config LAN Emulation Client (LEC) Panel

3. Configure the following parameters as needed.

   a. Domain name

      The LEC must be assigned to the domain that you configured on the base switch console to provide connectivity from the domain ports to the ATM network.

      To assign the LEC to a domain, select **`Domain Name`** and press **`<Enter>`**. Then, select the desired domain name and press **`<Enter>`**.

NOTE You might see an informational message that all physical ports in the old and new domains will be reset. Press **`<Esc>`** to clear the message.

b. ELAN Name

The name of the ATM ELAN to which the LEC will connect. The ELAN name can be up to 32 characters. No ELAN name specified is correct for certain LECS, LES, and BUS configurations.

To specify the ELAN Name, select **ELAN Name** and press **<Enter>**. Then, type the name at the prompt and press **<Enter>**. This parameter is case-sensitive.

c. LES address

If your ATM network implements an ATM Forum-compliant LECS, you do not need to configure the LES address (choose the default, Get From LECS- Automatic).

If your ATM network does not implement LECS, then select **LES address** and press **<Enter>**. Select **User-defined** and press **<Enter>**. Type the LES ATM address at the prompt and press **<Enter>**. The ATM address must be entered with hyphens separating the switch prefix, the end station identifier and the selector byte, as shown on the panel.

d. End System Identifier (ESI)

The ESI is the MAC address portion of the LEC's ATM address. You can use the default, universally administered MAC address as the ESI or configure a locally administered ESI. To configure the ESI, select **ESI** and press **<Enter>**. Select **Locally administered MAC address** and press **<Enter>**. Type the ESI at the prompt and press **<Enter>**.

When you have finished configuring the necessary parameters, select **Save and Return** and press **<Enter>**.

NOTE

You might see an informational message that the LEC must be reset for changes to take effect. Press **<Esc>** to clear the message.

4. Enable the LEC.

By default, all LECs except LEC 101 are administratively disabled. To enable a LEC, select **Enable** from the Configure LAN Emulation Client (LEC) panel and press **<Enter>**. Type the LEC index as you see it in the table, and press **<Enter>**. Type **Y** at the confirmation prompt and press **<Enter>**. You might see an informational message that the LEC you are enabling is in the same domain as another enabled LEC. Two enabled LECs on the same ATM UFC are not permitted in one domain. You can disable the other LEC, or select a new domain for this LEC. Press **<Esc>** to clear the message.

See Appendix B for Advanced Configuration instructions.

CHAPTER 5 Managing the TS-2800

This chapter provides information about monitoring TS-2800 activity using a console interface. Before proceeding with the information in this chapter, make sure that you have attached a PC or other DTE device to the EIA 232 port on the TS-2800 by following the steps under "Connecting a Local Terminal" on page 4-6 or "Connecting a Modem to Allow Remote Terminal Access" on page 4-8.

Should you need to reconfigure parameters for the TS-2800, go to Chapter 4 for specific instructions.

To view status or statistics, select **`Status/Statistics...`** from the Main Menu (see Figure 4.2).

```
                    Status/Statistics Menu

     Module Information...        View Port N Filters...
     Port Status...               Transparent Bridge Spanning Tree...
     TokenPipe Status...          Message Log Information...

     Master Address Table...      Master Route Descriptor Table...
     Domain Address Table...      Domain Route Descriptor Table...
     Port N Address Table...      Port N Route Descriptor Table...

     Switch Statistics...         SRB Spanning Tree Status...
     Domain Statistics...         LAN Segment N SRB Statistics...
     Port N Statistics...




 Return

                        Display the Main Menu
      Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                Press <CTRL><N> to return to Main Menu.
```

Figure 5.1 - Status/Statistics Menu

5.1 Viewing Module Information

From Status/Statistics Menu, select **`Module Information...`**. Use the Module Information panel to display information about installed UFCs.

```
                         Module Information

Module     Status      Type         Revision      Ports       Up Time
   0         up        Processor       15           0         17:50:36
   1         up        ATM155          0           1,32       17:50:36
   2         up        ATM155          0           1,32       17:50:36
   3         up        TR UTP/STP      1           4          17:50:36
   4         up        TR UTP/STP      1           4          17:50:36
   5         up        TR Fiber        1           2          17:50:36
   6         empty
   7         empty
   8         empty





Return

                        Return to previous menu
    Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                 Press <CTRL><N> to return to Main Menu.
```

Figure 5.2 - Module Information Panel

The following list describes information available on the Module Information panel:

Module
Displays a module number. Installed UFCs will appear as 1 through 8.

Status
Indicates whether the module is up or down.

Type
Indicates the type of module or UFC.

Revision

Displays the revision level of the module.

Ports

Indicates the number of ports on the module.

Up Time

Displays time since the TS-2800 was last reset.

5.2 Viewing the Master Address Table

From the Status/Statistics Menu, select **Master Address Table...**. Use the Master Address Table shown in Figure 5.3 to view the station addresses of all ports known to the TS-2800. The table can contain up to 10000 entries.

```
                           Master Address Table

                                   Ports - Filtered Ports High-Lighted
               Local               Slot1 Slot2 Slot3 Slot4 Slot5 Slot7
MAC Address    Port                12    1234  1234  1234  1234  1234
0004AC 281320  Swtch Base          X     XXXX  XX..  XXXX  XXXX  XXXX
0004AC 281340  default             X     XXXX  XX..  XXXX  XXXX  XXXX
0004AC 3438DE   2-1                .     X...  ....  ....  ....  ....
002000 0344B4   2-1                .     X...  ....  ....  ....  ....
080020 790F48   2-1                .     X...  ....  ....  XXXX  ....
08005A 0C025D   2-1                .     X...  ....  ....  XXXX  ....
08005A 226395   2-1                .     X...  ....  ....  ....  ....
08005A 22FCF5   2-1                .     X...  ....  ....  ....  ....
08005A A40179   2-1                .     X...  ....  ....  ....  ....
08005A A401FF   2-1                .     X...  ....  ....  ....  ....
08005A D40160   2-1                .     X...  ....  ....  ....  ....


Return   More   Search   Scroll   View Logical Ports...

                                    Return
    Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                 Press <CTRL><N> to return to Main Menu.
```

Figure 5.3 - Master Address Table Panel

The following list describes information shown on the Master Address Table:

MAC Address
Displays the MAC address of a node.

Local Port
Describes the type of address or association of the address with the listed port.

Ports

Displays the ports whose address tables include this MAC address.

- Port columns for which no port exists contain blanks.
- Ports that exist but do not have the indicated MAC address in their address table contain a period (.).
- Ports that exist and have the indicated MAC address in their address table contain an X.

5.3 Viewing the Master Route Descriptor Table

From the Status/Statistics Menu, select **`Master Route Descriptor Table...`**. Use the Master Route Descriptor Table to view the route descriptors that have been learned by the TS-2800 and the associated ports. These descriptors are contained within the 10000 entries allowed for the Master Address Table. They appear on this menu sorted by route descriptor (as if it were one large number).

```
                      Master Route Descriptor Table

                                Ports:
    Route          Local        Slot1 Slot2 Slot3 Slot4 Slot5
    Descriptor     Port         123   1234  1234  1234  1234
    D29:1:016      2-3          ...   ..X.  ....  ....  ....
    D29:1:017      2-3          ...   ..X.  ....  ....  ....
    D29:1:018      2-3          ...   ..X.  ....  ....  ....
    D29:1:200      2-3          ...   ..X.  ....  ....  ....
    D29:1:320      2-3          ...   ..X.  ....  ....  ....
    D29:2:016      2-3          ...   ..X.  ....  ....  ....
    D29:2:017      2-3          ...   ..X.  ....  ....  ....
    D29:2:018      2-3          ...   ..X.  ....  ....  ....
    D29:2:200      2-3          ...   ..X.  ....  ....  ....
    D29:2:220      2-3          ...   ..X.  ....  ....  ....
    D29:3:200      2-3          ...   ..X.  ....  ....  ....


    Return   More   View Logical Ports

                                    Return
        Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 5.4 - Master Route Descriptor Table Panel

The following list describes information available on the Master Route Descriptor Table:

Route Descriptor

Displays the route descriptor associated with a port. Route descriptors represent paths through external source-route bridges, specifying ring-number, bridge-number, and ring-number. For example the route descriptor `D29:1:016` indicates that the route has passed from ring `016` through bridge `1` into ring `D29`.

Local Port

The port that is connected to the bridge designated in the route descriptor.

Ports

All ports whose tables include this route descriptor.

- Port columns for which no port exists contain blanks.
- Ports that exist but do not have the indicated route descriptor in their table contain a period (.).
- Ports that exist and have the indicated route descriptor in their table contain an X

5.4 Viewing Switch Statistics

From the Status/Statistics Menu, select **`Switch Statistics...`**. Use the Switch Statistics panel shown in Figure 5.5 to view information about stations connected to the TS-2800.

```
                             Switch Statistics

            System Up Time               2 Hr,  1 Min, 47 Sec
            Board Temperature            Normal
            Currently Active Addresses           58
            Largest Number of Addresses          58
            Maximum Number of Addresses       10000
            Frames Transmitted                  543
            Frames Received                     969
            Error Frames Received                18
            Frames Lost                           0
            Pending Send Requests                 0
            Frame Transmit Errors                 2
            Maximum Address Chain                 3
            Address Table Full                    0

Return  Reset_Statistics



                            Return to previous menu
                          Press <ENTER> to exit menu.
                    Press <CTRL><N> to return to Main Menu.
```

Figure 5.5 - Switch Statistics Panel

The following list defines information available on the Switch Statistics panel:

System Up Time
Displays the length of time since the last reset or power cycle.

Board Temperature
Indicates the board temperature as either Normal or Abnormal.

Currently Active Addresses
Displays the number of entries in the address table, representing the number of currently active stations, or nodes, on all ports of the TS-2800.

Largest Number of Addresses
Displays the largest number of addresses in the address table at any one time since the last reset or power cycle.

Maximum Number of Addresses
Displays the maximum number of stations that the TS-2800 can support simultaneously.

Frames Transmitted
Displays the number of frames transmitted from the TS-2800 processor to its ports.

Frames Received
Displays the number of frames received by the TS-2800 processor.

Error Frames Received
Displays the number of frames not successfully received.

Frames Lost
Displays the number of frames lost because software processing queues were full.

Pending Send Requests
Displays the number of frames in the Send Queue.

Frame Transmit Errors
Displays the number of frames not transmitted because of transmit errors.

Maximum Address Chain
Displays the maximum number of addresses having the same index.

Address Table Full
Displays the number of times the address table has been full.

5.5 Viewing the Message Log Information

From Status/Statistics Menu, select **`Message Log Information...`**. Use the Message Log Information panel to view the message log.

```
                      Message Log Information

Log   Type    Message Content
  1    W      Fri. September 8, 1995 14:18:12
              TS-2800 failed to find bootp server on one or more
              domains (still trying...)

 Return   More   Clear_Logs

                            Return to previous menu
      Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                   Press <CTRL><N> to return to Main Menu.
```

Figure 5.6 - Message Log Information Panel

The data on this panel is intended for use by technical experts when solving complex problems. An explanation of all the messages that can appear in this log is beyond the scope of this manual.

5.6 Viewing the Domain Address Table

From the Status/Statistics Menu, select **Domain Address Table...**. Use the Domain Address Table to view the station addresses of all ports known to the selected domain.

```
                Domain Address Table for Domain: default


                                Ports - Filtered Ports High-Lighted
               Local            Slot1 Slot2 Slot3 Slot4 Slot5 Slot7
MAC Address    Port             123   1234  1234  1234  1234  1234
0004AC 281320  Swtch Base       X     XXXX  XX..  XXXX  XXXX  XXXX
0004AC 281340  default          X     XXXX  XX..  XXXX  XXXX  XXXX
0004AC 3438DE   2-1             .     X...  ....  ....  ....  ....
002000 0344B4   2-1             .     X...  ....  ....  ....  ....
080020 790F48   2-1             .     X...  ....  ....  XXXX  ....
08005A 0C025D   2-1             .     X...  ....  ....  XXXX  ....
08005A 226395   2-1             .     X...  ....  ....  ....  ....
08005A 22FCF5   2-1             .     X...  ....  ....  ....  ....
08005A A40179   2-1             .     X...  ....  ....  ....  ....
08005A A401FF   2-1             .     X...  ....  ....  ....  ....
08005A D40160   2-1             .     X...  ....  ....  ....  ....



Return  More  Search  Change_Displayed_Domain... View_Logical_Ports...

                                 Return
    Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                 Press <CTRL><N> to return to Main Menu.
```

Figure 5.7 - Domain Address Table Panel

The following list describes the information shown on the Domain Address Table:

MAC Address
Displays the MAC address of a node.

Local Port
Describes the type of address or association of the address with the listed port.

Ports
Displays the ports whose address tables include this MAC address.

- Port columns for which no port exists contain blanks.
- Ports that exist but do not have the indicated MAC address in their address table contain a period (.).
- Ports that exist and have the indicated MAC address in their address table contain an X.

5.7 Viewing the Domain Route Descriptor Table

From the Status/Statistics Menu, select **Domain Route Descriptor Table...**. Use the Domain Route Descriptor Table to view the route descriptors of all ports known to the selected domain. Entries are sorted by route descriptor, treating it as one large number.

```
          Domain Route Descriptor Table for Domain: default

                              Ports:
   Route          Local          Slot1 Slot2 Slot3 Slot4 Slot5
   Descriptor     Port           123   1234  1234  1234  1234
   D29:1:016      2-3            ...   ..X.  ....  ....  ....
   D29:1:017      2-3            ...   ..X.  ....  ....  ....
   D29:1:018      2-3            ...   ..X.  ....  ....  ....
   D29:1:200      2-3            ...   ..X.  ....  ....  ....
   D29:1:320      2-3            ...   ..X.  ....  ....  ....
   D29:2:016      2-3            ...   ..X.  ....  ....  ....
   D29:2:017      2-3            ...   ..X.  ....  ....  ....
   D29:2:018      2-3            ...   ..X.  ....  ....  ....
   D29:2:200      2-3            ...   ..X.  ....  ....  ....
   D29:2:220      2-3            ...   ..X.  ....  ....  ....
   D29:3:200      2-3            ...   ..X.  ....  ....  ....


   Return  More  Change_Displayed_Domain...  View_Logical_Ports...

                                  Return
       Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure 5.8 - Domain Route Descriptor Table Panel

The following list describes information available on the Domain Route Descriptor Table:

Route Descriptor

Displays the route descriptor associated with a port. Route descriptors represent paths through external source-route bridges, specifying ring-number, bridge-number, and ring-number. For example the route descriptor D29:1:016 indicates that the route has passed from ring 016 through bridge 1 into ring D29.

Local Port

The port that is connected to the bridge designated in the route descriptor.

Ports

All ports whose tables include this route descriptor.

- Port columns for which no port exists contain blanks.
- Ports that exist but do not have the indicated route descriptor in their table contain a period (.).
- Ports that exist and have the indicated route descriptor in their table contain an X.

5.8 Viewing Domain Statistics

From the Status/Statistics Menu, select **`Domain Statistics...`**. Use the Domain Statistics panel to view the current number of addresses and the largest number of addresses in the master address table for the selected domain.

```
                 Domain Statistics for Domain: default

              Change_Displayed_Domain...

              Currently Active Addresses              143

              Largest Number of Addresses             1434

              Maximum Number of Addresses             10000






      Return

                            Return to previous menu
                           Press <ENTER> to exit menu.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 5.9 - Domain Statistics Panel

The following list describes the information available on the Domain Statistics panel.

Currently Active Addresses
Displays the number of addresses currently in the master address table that are recognized by ports belonging to this domain.

Largest Number of Addresses
Displays the largest number of addresses in the master address table since the last reset or power cycle that are recognized by ports belonging to this domain.

Maximum Number of Addresses
Displays the maximum number of addresses allowed on the domain.

5.9 Viewing Transparent Bridge Spanning Tree Statistics

From the Status/Statistics Menu, select **Transparent Bridge Spanning Tree....** This panel provides a summary of all Spanning Tree information for each port. You cannot change information using this panel.

NOTE

When the TS-2800 is configured with TokenPipes, Spanning Tree packets use the primary (lowest-numbered) port of the TokenPipe.

```
          Transparent Bridge Spanning Tree for domain: default

       Hello Time: 20,   Max Message Age: 20,   Forward Delay: 15
       Root: 30000.FFFF0000001F,     Root Port: This Bridge is Root

    Port    Port Port  Desig   Designated      Desig   #Topo  Time Since
     ID     Cost STS   Cost  Switch/Bridge ID  PortID   Chgs  Last Change
   128.2-1   0 FWD      0 30000.FFFF0000001F 128.01     1     0:27:45

    Return  More  Change_Displayed_Domain...

                                  Return
       Use cursor keys to select action. Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 5.10 - Transparent Bridge Spanning Tree Information Panel

The following list defines each of the parameters displayed on the Transparent Bridge Spanning Tree Information panel:

Hello Time
Displays the Hello Time, in seconds, that is advertised by the root and used by all devices and switches in the active topology of the Spanning Tree network.

Max Message Age
Displays the Maximum Message Age, in seconds, that is advertised by the root and used by all devices and switches in the Spanning Tree network.

Forward Delay
Displays the Forward Delay time, in seconds, that is advertised by the root and used by all devices and switches in the Spanning Tree network.

Root
Displays the priority and MAC address of the device in the Spanning Tree that this switch has accepted as the root device.

Root Port
Displays the number of the port on this switch that is closest to the root. This switch communicates with the root through this port. If there is no root port, this switch has been accepted as the root of the Spanning Tree network.

Port ID
Displays the port ID that is used to determine the role of the port in the Spanning Tree. The port ID is expressed in the form: `port priority.port number`.

Port Cost
Displays the Port Path Cost for each port on the switch. The Port Path Cost helps determine the role of the port in the Spanning Tree.

Port STS (status)
Displays the current status of this port within the spanning tree:

- `DSB` - Disabled.
- `BLK` - Blocked.
- `LSN` - Listening.
- `LRN` - Learning.
- `FWD` - Forwarding.

The rules that define the state of the port are as follows:

- A port on a network segment with no other switch or bridge is always forwarding.

- If two ports of the TS-2800 are connected to the same network segment and there is no other bridge or switch, the port with the smaller ID is forwarded and the other is blocked.
- When the switch is booted, all ports are blocked initially, and then some of them change to a different state: listening, learning, or forwarding, in that order. To see the change in states you must repeatedly exit from this menu, and then select it again. This screen is not interactive. All ports that are going to change states from blocking to forwarding will have done so after two to three times the value of:

  Switch Maximum Message Age + (2 x Switch Forward Delay)

Designated Cost

Displays the cost for a packet to travel from this port to the root in the current Spanning Tree configuration. The slower the media, the higher the cost.

Designated Switch/Bridge ID

Displays the Priority and Station address of the device through which this port has determined it must communicate with the root of the Spanning Tree.

Designated Port ID

Displays the port on the designated bridge through which this switch will communicate with the root of the Spanning Tree. This information is useful if the TS-2800 is the designated bridge on one or more network segments.

 # Topo Changes

Displays the number of topology changes, that is, the number of times the port has entered the forwarding state plus the number of times the port has made the transition from forwarding to blocking. The counter is reset when the TS-2800 is reset or the Spanning Tree is turned on.

Time Since Last Change

Displays the time since the last time that the port entered the forwarding state or made the transition from forwarding to blocking.

5.10 Viewing Port Status

From the Status/Statistics Menu, select **Port Status...**. to view the status of the ports.

```
                               Port Status

      Switching                                  Config                      Config
Port  Mode          Type  State     Link   Type    Speed    Mode  Duplex  Loss
 1-1  Adaptive      RJ45  Enabled   Down   Auto    RSA16    ----  ----      8
 1-2  Adaptive      RJ45  Enabled   Down   Auto    RSA16    ----  ----      8
 1-3  Adaptive      RJ45  Enabled   Down   Auto    RSA16    ----  ----      8
 2-1  Adaptive      RJ45  Enabled   Down   Auto    RSA16    ----  ----      8
 2-2  Adaptive      RJ45  Enabled   Down   Auto    RSA16    ----  ----      8
 2-3  Adaptive      RJ45  Enabled   Down   Auto    RSA16    ----  ----      8
 2-4  Adaptive      RJ45  Enabled   Down   Auto    RSA16    ----  ----      8
 3-1  Adaptive      RJ45  Enabled   Down   Auto    RSA16    ----  ----      8
 3-2  Adaptive      RJ45  Enabled   Down   Auto    RSA16    ----  ----      8
 3-3  Cut-Through   RJ45  Enabled    Up    Auto    RSA16    Adpt  Full      8
 3-4  Adaptive      RJ45  Enabled   Down   Auto    RSA16    ----  ----      8

  Return  More

                           Return to previous menu
      Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                   Press <CTRL><N> to return to Main Menu.
                               Port Status
```

Figure 5.11 - Port Status Panel (1 of 2)

```
      Switching                            Config                      Config
Port  Mode          Type  State      Link  Type   Speed   Mode  Duplex Loss
 4-1  Adaptive      RJ45  Enabled    Down  Auto   RSA16   ----  ----    8
 4-2  Adaptive      RJ45  Enabled    Down  Auto   RSA16   ----  ----    8
 4-3  Adaptive      RJ45  Enabled    Down  Auto   RSA16   ----  ----    8
 4-4  Cut-Through   RJ45  Enabled     Up   Auto   RSA16   Adpt  Half    8
 5-1  Adaptive      RJ45  Enabled    Down  Auto   RSA16   ----  ----    8
 5-2  Adaptive      RJ45  Enabled    Down  Auto   RSA16   ----  ----    8
 5-3  Adaptive      RJ45  Enabled    Down  Auto   RSA16   ----  ----    8
 5-4  Adaptive      RJ45  Enabled    Down  Auto   RSA16   ----  ----    8
 6-1  Adaptive      RJ45  Enabled    Down  Auto   RSA16   ----  ----    8
 6-2  Adaptive      RJ45  Enabled    Down  Auto   RSA16   ----  ----    8
 6-3  Adaptive      RJ45  Enabled    Down  Auto   RSA16   ----  ----    8
 6-4  Adaptive      RJ45  Enabled    Down  Auto   RSA16   ----  ----    8

  Return  More

             Display the next page of port configuration table
      Use cursor keys to select action. Press <ENTER> to confirm choice.
                   Press <CTRL><N> to return to Main Menu.
```

Figure 5.12 - Port Status Panel (2 of 2)

The following list defines parameters displayed on this panel:

Switching Mode

Displays one of the three available switching modes, Cut-Through, Store-and-Forward, or Adaptive mode.

Cut-Through: The highest-speed switching mode (16 Mbps). You cannot select this mode if the port is set at 4 Mbps.

Store-and-Forward: This mode provides improved error isolation at the expense of some speed for 16-Mbps ports. Store-and-Forward is the only mode that can selected for 4-Mbps ports.

Adaptive Mode: The TS-2800 automatically alternates between Cut-Through and Store-and-Forward mode based on the specified error threshold. It operates in Cut-Through mode until it reaches the error-rate high threshold set in the Switching Mode Threshold panel (see “Switching Mode Threshold” on page 4-69). Then, the TS-2800 changes to Store-and-Forward mode. It changes back to Cut-Through mode when it falls below the error-rate low threshold.

The default switching mode is Adaptive.

Type

Displays the port type. In this example, all ports are RJ-45. If a UFC is installed, each of its ports and port types will be listed here.

State

Displays the operational status of the ports. Possible values are Enabled, Disabled, and Cfg Loss. The default is Enabled.

Link

Indicates whether the port is up (open) or down (closed).

Config Type

Display the Config Type, either Auto or Fixed. The default is Auto.

Auto: Speed, Mode, and Duplex are automatically set by the TS-2800.

Fixed: The Speed, Mode, and Duplex have been manually set.

Speed

Displays the speed of the port in Mbps. The prefix RSA (Ring Speed Adjust) means that the speed was automatically sensed and set by the TS-2800. The prefix FIX means that the speed was set to a fixed value via configuration.

Mode

Displays either Port mode or Adapter mode:

- `Port` - In Port mode, only a dedicated connection to a station is supported. The Tx/Rx pinouts are the same as a concentrator's.
- `Adpt` - In adapter mode, the port operates like a station. The connection can be either dedicated or shared. The Tx/Rx pinouts are the same as an adapter's.

Duplex

Displays the current setting of Duplex mode for this port. Changes to the duplex settings are made immediately by the TS-2800.

Config Loss

Configuration loss occurs when a port link completes a connection (goes up), data traffic is allowed to flow, and the port link subsequently closes (goes down). Use this threshold to control the number of configuration losses that can occur within a specified time. When the threshold is exceeded, the port is disabled and must be enabled by using this panel or SNMP. The default is 8. The range is 1 - 100.

5.11 Viewing TokenPipe Status

From the Status/Statistics Menu, select **`TokenPipe Status...`**. to view the status of TokenPipes.

```
                        TokenPipe Status

      TokenPipe                State            Ports
          1                  Up               2-1 2-2
          2                  N/A              Not Defined
          3                  N/A              Not Defined
          4                  N/A              Not Defined











  Return


                   Return to previous menu
     Use cursor keys to select action. Press <ENTER> to confirm choice.
                Press <CTRL><N> to return to Main Menu.
```

Figure 5.13 - TokenPipe Status Panel

The following list describes information available on the TokenPipe status panel:

State

Indicates that a TokenPipe is either

Up (enabled and connected)

Down (enabled and not connected)

N / A (not enabled).

Ports

Indicates ports included in the TokenPipe.

NOTE

Create TokenPipe port connections between TS-2800s in consecutive, numeric order from lowest-to-highest numbered port. The lowest-numbered port becomes the primary port and all broadcast frames flow through this port as TokenPipe connections are created and then assigned to the other TokenPipe ports.

NOTE

If any strand in the TokenPipe fails, the entire TokenPipe becomes inoperative.

5.12 Viewing the Port N Address Table

From the Status/Statistics Menu, select **`Port N Address Table...`**. You are prompted to specify a port number, after which the Address Table for that port is displayed. Use the Port N Address Table to view the MAC addresses of nodes connected to a specific port, and to view the Spanning Tree status of this port. This table includes MAC addresses from which this port has received packets or to which it has sent packets. It can contain up to 1790 entries.

```
                        Port  1-1   Address Table

   MAC Address      Local Port      SrcPkts    DstPkts   SrcBytes   DstBytes
   0004AC A300C0    Swtch Base            0          0          0          0
   0004AC A300E1    Domain01              0       4397          0     478084
   10005A 895667      1-1                 1          0         60          0
   800143 000000    STP Mcast             0          0          0          0
   800143 000010    Multicast             0          0          0          0
   800143 000020    Multicast             0          0          0          0
   800143 000030    Multicast             0          0          0          0
   800143 000040    Multicast             0          0          0          0
   800143 000050    Multicast             0          0          0          0
   800143 000060    Multicast             0          0          0          0
   800143 000070    Multicast             0          0          0          0
   800143 000080    Multicast             0          0          0          0
   800143 000090    Multicast             0          0          0          0

    Return  More  Search

                                          Return
       Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure 5.14 - Port N Address Table Panel

The following list describes information available on the Port N Address Table:

Address

Displays the MAC address of a node. Ports that belong to a TokenPipe are designated as primary or secondary. The lowest switch port number participating in the TokenPipe is the primary port; this port is used for all broadcast traffic.

Local Port

Displays the port to which the node is attached.

5.13 Viewing the Port N Route Descriptor Table

From the Status/Statistics Menu, select **Port N Route Descriptor Table...**. You are prompted to specify a port number, after which the Route Descriptor Table for that port is displayed. Use the Port N Route Descriptor Table to view the route descriptors of nodes connected to a specific port. This table includes route descriptors from which this port has received packets or to which it has sent packets. These descriptors are contained within the 1790 entries allowed for learned MAC addresses on a port. Entries are sorted by route descriptor, treating it as one large number.

```
                       Port 2-4 Route Descriptor Table

Route Descriptor  Local Port       SrcPkts    DstPkts   SrcBytes   DstBytes
222:B:444            2-4                 0          0          0          0












Return   More    Search




                           Return to Previous Menu
     Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                  Press <CTRL><N> to return to Main Menu.
```

Figure 5.15 - Port N Route Descriptor Table Panel

The following list defines information available on the Port N Route Descriptor Table:

Route Descriptor

Displays the route descriptor associated with a port. Route descriptors represent paths through external source-route bridges. "Viewing the Master Route Descriptor Table" on page 5-6 for a description of this route descriptor.

Local Port

The port that is connected to the bridge designated in the route descriptor.

5.14 Viewing Port N Statistics

From the Status/Statistics Menu, select **`Port N Statistics...`**. You are prompted to specify a port number, after which the Statistics panel for that port is displayed. Use the Port N Statistics panel to view detailed information about a particular port.

```
                           Port 1-1 Statistics

      Frames Received                                  0
      Octets Received                                  0
      Frames Transmitted                               0
      Octets Transmitted                               0
      Multicast/Broadcast Frames Received             15
      Frames Local to Port (not forwarded)             0
      Frames Switched by Hardware                      0
      Frames Delivered to Processor                    0
      All Frames Forwarded                             0
      Number of Learned Stations                       0
      Currently Active Addresses                      20
      Local Address Entries                            1
      Remote Address Entries                          19
      Largest Number of Addresses                      9
      Address Table Overflows                          0
      Time Since Last Reset        0 Hr, 28 Min, 41 Sec
  Return  More  Reset_Statistics

                            Return to previous menu
        Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 5.16 - Port N Statistics Panel (1 of 2)

The following list describes information available from the Port N Statistics panel:

Frames Received
Displays the number of frames received by the port.

Octets Received
Displays the bytes received.

Frames Transmitted

Displays the number of frames transmitted by the port.

Octets Transmitted

Displays the bytes transmitted.

Multicast/Broadcast Frames Received

Displays the number of frames received that have the multicast bit set or are broadcast frames.

Frames Local to Port (not forwarded)

Displays the number of frames that are confined to this segment and are not forwarded by the switch.

Frames Switched by Hardware

Displays the number of frames received on this port and forwarded by the TS-2800 hardware to another port without being sent to the processor.

Frames Delivered to Processor

Displays the number of frames received on this port and forwarded to the processor for any reason.

All Forwarded Frames

Displays the number of frames received on this port and forwarded by the TS-2800 hardware or software.

Number of Learned Stations

Displays the number of frames sent to the processor for learning.

Currently Active Addresses

Displays the sum of local and remote addresses.

Local Address Entries

Displays the number of addresses on this port that belong to the local segment.

Remote Address Entries

Displays the number of addresses on this port that belong to another segment.

Largest Number of Addresses

Displays the largest number of addresses active since the last reset of the TS-2800.

Address Table Overflows

Displays the number of times the address table has reached maximum entries.

Time Since Last Reset

Displays the hours, minutes, and seconds since the port traffic counters were last reset.

```
                   Port  1-1   Statistics
        Unicast Frames Received                         4961
        Non-Unicast Frames Received                       12
        Hi Port Bytes Transmitted                          0
        Low Port Bytes Transmitted
        Hi Port Unicast Frames Xmt                         0
        Low Port Unicast Frames Xmt                   117098
        Hi Port Non-Unicast Frames Xmt                     0
        Low Port Non-Unicast Frames Xmt               516744
        Receive Buffer Queue Full                          0
        Receive Internal Packet Errors                     0
        Receive Frames too Long                            0
        Hi Port Internal Packet Errors                     0
        Low Port Internal Packet Errors                    0
        Hi Port Packets in Queues                          0
        Low Port Packets in Queues                         0
        Transmit Buffer Queue Full                         0
        Port DATA Bus Timeout Errors                       0

    Return    More   Reset_Statistics

                         Display more port statistics
        Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure 5.17 - Port N Statistics Panel (2 of 2)

The statistics shown in Figure 5.17 provide additional granularity for analyzing traffic and switch performance statistics. Some error events will occur periodically and are captured for possible fault analysis. The following list defines statistics available on the Figure 5.17:

Unicast Frames Received
The number of frames received by this port designated for a single destination address.

Non-Unicast Frames Received
The number of frames that are received by this port that are designated for a general broadcast or multicast address.

Hi Port Bytes Transmitted
The number of bytes transmitted from the high-priority transmit queue.

Low Port Bytes Transmitted
The number of bytes transmitted from the low-priority transmit queue.

Hi Port Unicast Frames Xmt
The number of unicast frames transmitted from the high-priority transmit queue.

Low Port Unicast Frames Xmt
The number of unicast frames transmitted from the low-priority transmit queue.

Hi Port Non-Unicast Frames Xmt
The number of general broadcast or multicast frames transmitted from the high-priority transmit queue.

Low Port Non-Unicast Frames Xmt
The number of general broadcast or multicast frames transmitted from the low-priority transmit queue.

Receive Buffer Queue Full
The number of instances in which a packet arrived on the input link and there were no available receive buffers.

Receive Internal Packet Errors
The number of times that a packet was received with an error (CRC, incomplete frame, and so forth) that resulted in an abnormal termination of a Cut-Through operation.

Receive Frames Too Long
The number of frames received that exceed the maximum frame length limit of 4540 bytes.

Hi Port Internal Packet Errors
The number of transmits from the high-priority transmit queue in which an abnormal frame termination occurred.

Low Port Internal Packet Errors
The number of transmits from the low-priority transmit queue in which an abnormal frame termination occurred.

Hi Port Packets in Queues
The current number of packets in the high-priority transmit queue awaiting transmission.

Low Port Packets in Queues
The current number of packets in the low-priority transmit queue awaiting transmission.

Transmit Buffer Queue Full
The number of packets lost due to the inability of the transmit queue to accept a packet from another port.

Port DATA Bus Timeout Errors
The number of receive packets discarded due to failure of the target port to accept the packet.

5.15 Viewing Port N Filters

From the Status/Statistics Menu, select **`Port N Filters...`**. You are prompted to specify a port number after which the filters panel for that port is displayed. Use the Port N Filters panel to display the defined filters and security mode for the specified port.

```
            Port  1-1   Filters - Security Mode is Normal

Index   MAC Address     Description
  1     10005A 4315CF   This address is blocked















Return    More

                        Return to previous menu
    Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                Press <CTRL><N> to return to Main Menu.
```

Figure 5.18 - Port N Filters Panel

5.16 Viewing Source-Route Bridge Spanning Tree Status

From the Status/Statistics Menu, select **`Source-Route Bridge Spanning Tree Status...`**. This panel shows the current status of the source-route Spanning Tree.

```
          Source-Route Bridge (SRB) Spanning Tree Status
  ________________________________________________________________________
  Bridge Number       1                 Mode         Automatic
  SRB Hello Time      20                Root Device  xxxxxx.xxxxxxxxxxxx
  SRB Max Message Age 20                Root Segment xxx
  SRB Forward Delay   15
  ________________________________________________________________________
                               ______Designated Path to the Root_______
  Segment  Segment  Segment
 ____ID_____Cost_____Status_______Segment ID____Cost________Bridge ID______
   001.1     62       FWD           xxx.x        xx      xxxxxx.xxxxxxxxxxxx
   002.1     62       FWD           xxx.x        xx      xxxxxx.xxxxxxxxxxxx
   222.1     62       FWD           xxx.x        xx      xxxxxx.xxxxxxxxxxxx





 Return     More


                    Return to previous menu
 Use cursor keys to choose an item.  Press <ENTER> to confirm your choice.
                Press <CTRL><N> to return to Main Menu.
```

Figure 5.19 - Source-Route Bridge Spanning Tree Status Panel

NOTE

When Spanning Tree mode is Manual, the only fields displayed are:
Bridge Number
Mode (shown as Manual)
Segment ID
Segment Status
All of the other fields appear only when the Mode is Automatic.

Bridge Number

The number of the bridge located on this switch.

SRB Hello Time

The Hello Time, in seconds, that is advertised by the root and used by all devices and switches in the active topology of the Source-Route Bridge Spanning Tree network.

SRB Maximum Message Age

The Maximum Message Age, in seconds, that is advertised by the root and used by all devices and switches in the Source-Route Bridge Spanning Tree network.

SRB Forward Delay

The Forward Delay time, in seconds, that is advertised by the root and used by all devices and switches in the Source-Route Bridge Spanning Tree network.

Mode

Automatic indicates that the ports are automatically set to Forwarding or Blocked if there are parallel paths. Manual indicates that the user must configure these settings manually.

Root Device

Displays the priority and MAC address of the device in the Source-Route Bridge Spanning Tree that this switch has accepted as the root device.

Root Segment

Displays the segment number of the segment on this switch that is closest to the root. The switch communicates with the root through this segment.

Segment ID

Segment ID of a domain which is participating in the Source-Route Bridge. The Segment ID is expressed in the form of
segment number.bridge number

Segment Cost

Displays the Segment Path Cost for each segment which is a member of the Source-Route Bridge. The Segment Path Cost helps determine the role of the segment in the Source-Route Bridge Spanning Tree.

Segment Status

Displays the current status of this segment within the Source-Route Bridge Spanning Tree as follows:

- `BLK` - Blocked
- `LSN` - Listening
- `FWD` - Forwarding

Designated Path to the Root - Segment ID

Displays the segment ID to the designated bridge through which this switch will communicate with the root of the Source-Route Bridge Spanning Tree. The Segment ID is expressed in the form:

```
segment number.bridge number
```

Designated Path to the Root - Cost

Displays the cost for a packet to travel from this segment to the root of the current Source-Route Internal Bridge spanning tree configuration.

Designated Path to the Root - Bridge ID

Displays the priority and station address of the device through which this segment has determined it must communicate with the root of the Source-Route Bridge Spanning Tree.

5.17 LAN Segment Selection List for SRB Statistics

From the Status/Statistics Menu, select **`LAN Segment N SRB Statistics...`**. This panel allows you to select the domain for which you want to view Source-Route Bridge statistics.

```
                             Choose a LAN Segment

      001  domain01  enabled for SRB
      002  domain03  enabled for SRB
      222  domain02  disabled for SRB

                   Source-route bridge (SRB) is enabled.
  Use cursor keys to choose an item.  Press <ENTER> to confirm your choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure 5.20 - Source-Route Bridge LAN Segment Selection Panel

Selecting a segment and pressing **`Enter`** takes you to the Source-Route Bridge (SRB) Statistics panel.

5.18 Viewing Source-Route Bridge Statistics

This panel allows you to reset the Source-Route Bridge statistics for the domain selected in the Choose a LAN Segment and Domain Name panel.

```
       Segment 001 - domain01 - Source-Route Bridging (SRB) Statistics
               Time Since Last Reset       0 Hr.  0 Min.  0 Sec.

     Traffic Counters                                Frames In         Frames Out
     Specifically routed frames...........                   0                  0
     All-routes explorer (ARE) frames.....                   0                  0
     Spanning Tree Explorer (STE) frames..                   0                  0

     Hop Count (RIF Length) Discards       Recv Hop Count     Xmit Hop Count
     ARE hop count exceeded...............                   0                  0
     STE hop count exceeded...............                   0                  0

     Other Discarded Frame Counters
     Segment mismatch...........................             0
     Duplicate segment..........................             0
     Duplicate LAN ID or Tree Error.............             0
     Input queue overflow.......................             0
     Output queue overflow......................             0

   Return  Change_Displayed_Segment  Reset Statistics

                        Return to previous menu
   Use cursor keys to choose an item.  Press <ENTER> to confirm your choice.
                   Press <CTRL><N> to return to Main Menu.
```

Figure 5.21 - Source-Route Bridge Statistics Panel

Specifically routed frames - Frames In

The number of specifically routed frames which have entered this domain from the network and then traversed the Source-Route Bridge.

Specifically routed frames - Frames Out

The number of specifically routed frames which have traversed the Source-Route Bridge and then been put on the network from this domain.

All-routes explorer (ARE) frames - Frames In

The number of All-routes explorer frames which have entered this domain from the network and then traversed the Source-Route Bridge.

All-routes explorer (ARE) frames - Frames Out

The number of All-routes explorer frames which have traversed the Source-Route Bridge and then been put on the network from this domain.

Spanning Tree explorer (STE) frames - Frames In

The number of Spanning Tree explorer frames which have entered this domain from the network and then traversed the Source-Route Bridge.

Spanning Tree explorer (STE) frames - Frames Out

The number of Spanning Tree explorer frames which traversed the Source-Route Bridge and then been put on the network from this domain.

ARE hop count exceeded - Recv Hop Count

The number of All-routes explorer frames which have been discarded because the receive hop count was exceeded.

ARE hop count exceeded - Xmit Hop Count

The number of All-routes explorer frames which have been discarded because the transmit hop count was exceeded.

STE hop count exceeded - Recv Hop Count

The number of Spanning Tree explorer frames which have been discarded because the receive hop count was exceeded.

STE hop count exceeded - Xmit Hop Count

The number of Spanning Tree explorer frames which have been discarded because the transmit hop count was exceeded.

Segment Mismatch

The number of explorer frames which have been discarded by this port because the routing descriptor field contained an invalid segment value.

Duplicate segment

The number of frames which have been discarded because the routing descriptor field contained a duplicate segment identifier.

Duplicate LAN ID or Tree Error

The number of Spanning Tree explorer frames which have been discarded because they appeared at the bridge more than once.

Input queue overflow

The number of frames which have been discarded because there were insufficient input buffers to forward them across the Source-Route Bridge.

Output queue overflow

The number of frames which have been discarded because there were insufficient output buffers to forward them across the Source-Route Bridge.

Change Displayed Segment

Scroll to the next LAN segment’s statistics.

Reset Statistics

Set the statistics to 0.

CHAPTER 6 Managing the ATM UFC

Managing the ATM UFC involves interpreting status and statistics information and changing configuration parameters when needed. Statistics gathering and reconfiguration can be accomplished in two ways: SNMP-based tools, and through the ATM UFC and base switch console.

This chapter describes the resources provided with the ATM UFC to enable SNMP management. Also, this chapter describes the statistics and information available from the ATM UFC console. Chapter 4 and Appendix B describe how to change configuration parameters.

6.1 Management Using an SNMP-Based Manager

Each ATM UFC kit has a diskette containing the private MIBs necessary for managing an ATM UFC with an SNMP-based network manager, such as *ForeView*.

Four of the five MIBs are standard MIBs. The ATM UFC SNMP agent implements some elements of each of these five MIBs, which are listed in Table 6.1 along with the Internet RFCs that define them. These standard MIBs are included with most SNMP management applications.

Table 6.1 - MIBs Related to the ATM UFC

MIB	RFC
Management Information Base for Network Management of TCP/IP-based Internets: MIB-II	1213
Evolution of Interfaces Group of MIB-II	1573
Definitions of Managed Objects for ATM Management (aka. AToM MIB)	1695
Definitions of Managed Objects for Bridges	1493
LAN Emulation Client MIB	ATM Forum standard

Printed copies of RFCs are available for a fee from:

SRI International, Room EJ291
333 Ravenswood Avenue
Menlo Park, CA 94025
(415) 859-3695
(415) 859-6387
Fax (415) 859-6028

Request a softcopy of an RFC through an Internet mail gateway service (ATTMAIL, MCI-MAIL, CompuServe, BITNET, and so on) as follows:

Address: `SERVICE@NIC.DDN.MIL`

Subject: `RFC` *`number`*

`number` is the number of the RFC you are requesting.

Alternately, RFCs can be accessed at the following URL: ftp://ds1.internic.net/rfc

If your network is SNMP managed, give this diskette to the network management operator so that it can be compiled into the SNMP-based network manager.

NOTE If you are using SNMP management, once you have entered the initial IP address and SNMP configuration parameters from the console, you can use either the console or an SNMP managing entity with the MIBs loaded to view or change all parameters or management information except Spanning Tree parameters.

If you are not currently using an SNMP manager, store the diskette for future use.

6.2 ATM UFC Status and Statistics

This section describes the status and statistics information accessible from the main menu.

6.2.1 Viewing Physical Port Current Status and Settings

This panel includes information regarding setting up network characteristics for normal operation, finding current operational parameters, and keeping track of inventories and network topologies.

1. Select the **`Non-Token-Ring Ports Menu...`** option from the Main menu.
2. Choose the **`Select UFC`** option and enter the port number of the ATM Feature Card that you want to configure. The ATM Feature Card menu appears.
3. Select **`ATM Physical Port Status/Statistics...`**,
4. Select **`Current Operational Status and Settings...`**.

The ATM Physical Port Status panel is displayed, as shown in Figure 6.1.

```
 ATM Physical Port Status - Current Operational Status and Settings Slot 1


 Port Status
 Port Operational Status             Down
 Port Administrative Status          Disabled


 ATM Switch Connected to this port
 IP Address of ATM Switch            0.0.0.0
 ATM Network Prefix of ATM Switch    00000000000000000000000000


 Current Values for ATM Physical Port Parameters
 Base MAC Address (Base ESI)         112233445566
 User-Network Interface Level        Auto Detect
 Control Plane VCC Peak Rate         8000 Kbps (5% of port's bandwidth)


Return

                      HELP MESSAGES APPEAR HERE
    Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                 Press <CTRL><N> to return to Main Menu.
```

Figure 6.1 - ATM Port Status - Operational Status Panel

Port Operational Status

up=port has successfully connected to the upstream ATM switch;
down=port has not successfully connected to the upstream ATM switch.

Port Administrative Status

enabled=administratively enabled; disabled=administratively disabled. You can enable or disable the port by selecting **`Configure ATM Physical Port Parameters`** from the ATM UFC main menu.

IP Address of ATM Switch

IP address of the upstream ATM switch, if the ATM switch is enabled for IP.

ATM Network Prefix of ATM Switch

The 26-character (13-byte) network prefix for the upstream ATM switch. This prefix, combined with a LECS ESI, is the LEC ATM address.

Base MAC Address (Base ESI)

The base MAC address of the ATM UFC in canonical format. All universally administered LEC ESIs (MAC addresses) are derived from this base address.

User-Network Interface Level

The current setting for UNI level.

Control Plane VCC Peak Rate

The current setting for control plane VCC peak rate. Control plane VCC peak rate is the maximum amount of bandwidth available for control, signaling, and ILMI connections.

6.2.2 Viewing MIB-II Statistics (from RFC 1573)

This section includes statistics listed in RFC 1573.

From the ATM Feature Card menu, select **LAN Emulation Client (LEC) Status/Statistics...** and then **MIB-II Statistics...**. Press **Enter**.

```
   ATM Physical Port Statistics - MIB-II Statistics (from RFC 1573)  Slot 1


                               Received or            Transmitted or
                             Inbound Packets         Outbound Packets
  Total Octets (bytes)           10204036              10210200

  Unicast Packets                9030105               9010301
  Non-unicast Packets            932100                928041

  Discarded Packets              432                   221
  Error Packets                  72                    102

  Unknown Protocol Packets       408                   220

  Multicast Packets              4210                  3819
  Broadcast Packets              8910                  10201


 Return     Reset Statistics

                          HELP MESSAGES APPEAR HERE
    Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                 Press <CTRL><N> to return to Main Menu.
```

Figure 6.2 - ATM Port Status - MIB-II Statistics Panel

This panel represents the sum of status counters for all enabled LECs that communicate through the ATM physical port connection. A similar panel is available for each LEC individually.

Total Octets (bytes)

The total number of protocol data unit (PDU) octets (received, transmitted) on all of the VCCs associated with this emulated network interface. This includes octets from circuits that have been torn down since this LEC joined the ELAN.

Unicast Packets

The number of data packets delivered by this LEC to a higher layer, which were not addressed to a multicast or broadcast LAN destination.

Non-unicast Packets

The sum of all multicast and broadcast packets.

Discarded Packets

The number of inbound or outbound LANE PDU packets that were chosen to be discarded even though no errors had been detected, to prevent their being delivered to a higher layer protocol or to the control entity in the LEC. One possible reason for discarding such a packet could be to free buffer space. This count also includes packets discarded for echo-suppression reasons, which might limit its utility for detecting data-loss problems.

Error Packets

The number of inbound or outbound LANE PDU packets that contained errors preventing them from being deliverable to a higher layer protocol or to the control entity in the LEC.

Unknown Protocol Packets

The number of LANE PDU packets this client received from the LAN UNI (LUNI) that were discarded because of an unknown or unsupported LAN Emulation Control, IEEE 802.3, Ethernet or IEEE 802.5 protocol.

Multicast Packets

The total number of data packets that higher-level protocols asked the LEC to transmit, and which were addressed to a multicast LAN Destination, including those that were discarded or not sent. This includes both Group and Functional MAC addresses.

Broadcast Packets

The total number of data packets that higher-level protocols asked the LEC to transmit, and which were addressed to the broadcast MAC address, including those that were discarded or not sent.

6.3 Viewing LEC Status and Statistics

From the ATM Feature Card menu, select **LAN Emulation Client (LEC) Status/Statistics**.

```
              LAN Emulation Client (LEC) Status/Statistics           Slot 1

 LEC
Index Domain Name      Domain Ports    Emulated LAN Name                  Status
101   default          2-1 2-1 2-3 2-4 <no ELAN name defined>             down
102   default                                                      Adm. Disabled
103   default                                                      Adm. Disabled
104   default                                                      Adm. Disabled
105   default                                                      Adm. Disabled
106   default                                                      Adm. Disabled
107   default                                                      Adm. Disabled
108   default                                                      Adm. Disabled
109   default                                                      Adm. Disabled
110   default                                                      Adm. Disabled
111   default                                                      Adm. Disabled
112   default                                                      Adm. Disabled
113   default                                                      Adm. Disabled


   Return     More      Settings     LANE Stats     MIB-II Stats

                         HELP MESSAGES APPEAR HERE
       Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure 6.3 - LEC Status / Statistics Panel

The table on this panel provides the following information for each LEC:

- LEC Index

  The LEC index is the logical port number for a LEC. The first number refers to the slot in the base switch that the ATM UFC is in. The second two numbers (01-32) are the LEC numbers.

- Domain Name

  The name of the domain to which the LEC is assigned.

- Domain Ports

  The base switch physical ports that are assigned to the domain.

- Emulated LAN Name

  The name of the ELAN that the LEC joins to provide connection to the ATM network.

- Status
  - up-The LEC is administratively enabled and successfully connected to the LES/BUS.
  - down-The LEC is administratively enabled but has not successfully connected to the LES/BUS.
  - Adm. Disabled-The LEC is administratively disabled. To enable the LEC, selecting **`Configure LAN Emulation Client (LEC)`** from the ATM UFC main menu.

Additional statistics are available for each LEC by selecting the items at the bottom of the table:

- More

  Choose this to view additional LECs not displayed on the panel

- Settings

  Choose this and type the LEC index to display the operational status and current parameter settings for the LEC. The parameters listed on the three panels are described in Appendix B.

NOTE

From the settings panel, you can choose to view the three pages of the LEC settings. Also, you can select Next LEC to see the settings for the next LEC (for example, choose **`Next LEC`** to display LEC 102 if you are currently viewing LEC 101).

- LANE Stats-select **`LANE Stats`** and then type the LEC index to view the statistics shown in Figure 6.4.

```
            LEC Status/Statistics - LAN Emulation Statistics         Slot 1
                             LEC Index 101                     Port is DOWN

   LE Address Resolution Frames     Received        Transmitted
   Total LE_ARP Requests                    0               0
   Total LE_ARP Replies                     0               0
   Total Control Frames                     0               0
   ____________________________________________________________
   Total Switched Virtual Connection (SVC) Failures         0

   Last Failure State               Initial State
   Last Failure Reason              None



  Return     Reset Statistics     Next LEC
                        HELP MESSAGES APPEAR HERE
      Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                   Press <CTRL><N> to return to Main Menu.
```

Figure 6.4 - LEC Status/Statistics - LAN Emulation Panel

Total LE_ARP Requests

The number of LE_ARP requests transmitted to the LES from the LEC since last reset. LE_ARP requests are required to learn new addresses in the ATM network.

Total LE_ARP Replies

The number of replies received from the LES or from other LECs in response to LE_ARP requests since the last reset.

Total Control Frames

The total number of control frames transmitted by the LEC and received by the LEC since the last reset. Control frames include

- configuration direct VCC frames
- control direct VCC frames
- control distribute VCC frames (received only)

Total Switch Virtual Connection (SVC) Failures

The number of SVCs that have failed since the last reset. These include control and data VCCs.

6.4 Switch Panel Changes for the ATM UFC

There are a number of enhancements to the statistics panels on your base switch to accommodate the logical ports (or LECs) of the ATM UFC. Also, there are other statistics panels that you can view for the ATM physical port. Refer to Chapter 5 for more information about these statistics panels.

Table 6.2 - How to Access Statistics Panels

Panel	Logical Port (LEC)	Physical Port	How to Access
Module Information	YES	NO	Select Module Information from the Status/Statistics Menu.
Port Status	YES	NO	Select Port Status from the Status/Statistics Menu, then type the ATM physical port number.
Transparent Bridge Spanning Tree	NO	YES	Select Transparent Bridge Spanning Tree from the Status/Statistics Menu.
Master Address Table	YES	YES	Select Master Address Table from the Status/Statistics Menu. To view logical ports (LECs), select View logical ports, then select the ATM UFC from the list.
Master Route Descriptor Table	YES	YES	Select Master Route Descriptor Table from the Status/Statistics Menu. To view logical ports (LECs), select View logical ports, then select the ATM UFC from the list.
Domain Address Table	YES	YES	Select Domain Address Table from the Status/Statistics Menu. To view logical ports (LECs), select View logical ports, then select the ATM UFC from the list.
Domain Route Descriptor Table	YES	YES	Select Domain Route Descriptor Table from the Status/Statistics Menu. To view logical ports (LECs), select View logical ports, then select the ATM UFC from the list.

Table 6.2 - How to Access Statistics Panels

Panel	Logical Port (LEC)	Physical Port	How to Access
Port N Address Table	YES	YES	Select Port N Address Table from the Status/Statistics Menu. To view logical ports (LECs), select View logical ports, then select the ATM UFC from the list.
Port N Route Descriptor Table	YES	YES	Select Port N Route Descriptor Table from the Status/Statistics Menu. To view logical ports (LECs), select View logical ports, then select the ATM UFC from the list.
Port N Statistics	YES	YES	Select Port N Statistics from the Status/Statistics Menu. To view logical ports (LECs), select View logical ports, then select the ATM UFC from the list.

6.4.1 LEC Port Numbering

On the base switch, LECs are generically referred to as logical ports. Logical ports on the base switch console use the same numbering as LECs (the LEC index). The LEC index is *xyy*, where *x* refers to the UFC slot number, and *yy* refers to the LEC number (for example, 212 is a LEC 12 on an ATM UFC in UFC slot 2) .

6.4.2 ATM Physical Port Numbering

The ATM physical port is numbered like any other UFC port. The ATM physical port number is x-1, where x refers to the UFC slot number (for example, 3-1 is an ATM physical port in UFC slot 3).

6.5 Logical Port Address and Route Descriptor Tables

Most of the statistics panels mentioned in the previous tables are displayed and described in Chapter 5. However, the View logical port option on the Master Address, Domain Address, Master Route Descriptor, and Domain Route Descriptor tables is explained here.

```
                            Master Address Table

                      Slot 1               Logical Ports
                   Local            0        1         2         3
MAC Address        Port             12345678901234567890123456789012
0004AC 1AE2D3      1-1              X.
0004AC 2AD43C      201              XX
0004AC 2AE2F5      3-2              X.
0004AC 3AD443      201              XX
0004AC 4A22AF      4-4              X.
800143 1AD43C      201              XX
800143 2AE2D3      202              X.
800143 5AD43C      201              XX




Return   More   Search


                           HELP MESSAGES APPEAR HERE
    Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                 Press <CTRL><N> to return to Main Menu.
```

Figure 6.5 - Master Address Table Panel

This is an example of the layout of an address/route descriptor table for logical ports (LECs). In the first column is the MAC address (or route descriptor). In the second column is the Local Port (or port of exit) where traffic to the MAC address (or route descriptor) should go. The third column is a list of all of the logical ports (LECs) that are configured on an ATM UFC. An X indicates that the logical port is holding the MAC address (or route descriptor) in its MAC address (or route descriptor) table. You can also select the Search item below the table to search for a specific MAC address (or route descriptor).

NOTE

The Address and Route Descriptor tables for logical ports (LECs) will not display any information until actual traffic is forwarded on the switch.

CHAPTER 7 Resetting the TS-2800

CAUTION

Resetting the TS-2800 will interrupt all network traffic through the TS-2800.

Two kinds of reset operations can be performed by the TS-2800. You can reset the TS-2800 and run internal diagnostics (cold boot) or you can reset the TS-2800 and not run internal diagnostics (warm boot).

NOTE

LED indications that show the result of diagnostic tests are not given in real time. You must reset the switch with diagnostics (cold boot) in order to determine whether the LEDs are alerting you to a problem with the TS-2800.

7.1 Resetting with Diagnostics (Cold Boot)

There are two ways to cold-boot the TS-2800. You can initiate a cold boot using the Reset Menu (see “Reset/Diagnostics” on page 7-2) or you can temporarily interrupt AC power input.

Since there is no power switch on the TS-2800, AC power is interrupted by unplugging the line cord at the AC outlet.

7.2 Resetting without Diagnostics (Warm Boot)

There are two ways to warm-boot the TS-2800. You can initiate a warm boot using the Reset/Diagnostics menu (see “Reset/Diagnostics” on page 7-2) or you can press the **`Reset`** button on the Token Ring Processor Card.

7.3 Reset/Diagnostics

From the Main Menu, select **Reset/Diagnostics...** Use the Reset / Diagnostics panel to reset the TS-2800 and run diagnostics.

```
                           Reset/Diagnostics

              Number of Resets Since Diagnostics      0

              Reset Switch with Diagnostics

              Reset Switch without Diagnostics

              Reset Port Address Table

              Clear Non-Volatile RAM

              Power-On Diagnostics                    Enabled

              Diagnostic Test Results...


     Return

                       Display the Configuration Menu
        Use cursor keys to choose item. Press <ENTER> to confirm choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure 7.1 - Reset / Diagnostics Panel

Number of Resets Since Diagnostics

Displays the number of times the unit has been reset since the unit was powered on or ran power-on diagnostics. This number is not reset to 0 when you reset the address table for the port.

Reset Switch with Diagnostics

Resets the TS-2800 hardware, runs diagnostic tests, clears all counters including address tables, and starts the TS-2800. This does not clear any user-configured parameters. When the TS-2800 restarts, parameters from NVRAM are used to initiate the operational parameters.

Reset Switch without Diagnostics

Resets the switch hardware, clears all counters including address tables, and starts the TS-2800. This does not clear any user-configured parameters. When the TS-2800 restarts, parameters from NVRAM are used to initiate operational parameters.

Reset Port Address Table

Clears all table entries for a selected port, sets all port traffic counters to 0, and sets Time since Last Reset to 0.

Clear Non-Volatile RAM

Deletes all user-configured parameters, such as IP address and baud rate information, and resets the TS-2800.

NOTE

Clearing NVRAM erases all configuration parameters. If you are using the TokenPipe feature, be sure to disconnect the affected ports or disable them on the Port Configuration panel and reset the switch ***before*** clearing NVRAM. If you are using the Spanning Tree option, it will be turned off and port costs and priorities will be lost, which can result in loops. Use the Spanning Tree panels to reestablish port costs and priorities. If you are using an SNMP manager, reconfigure all IP and SNMP parameters.

Power-On Diagnostics

Enables or disables the running of power-on diagnostics when the TS-2800 is powered on. The default is Enabled. It is recommended that you do not change this option. (However, disabling the power-on diagnostics could greatly reduce recovery time from unexpected power outages.)

Diagnostic Test Results

Show the results of the most recent running of power-on diagnostics. See Figure 7.2.

Resetting the TS-2800

```
                          Diagnostic Test Results

    Diagnostic Test               Result
    Number of Test Loops          1
    Serial Port                   Passed
    Real-Time Clock               Passed
    CPU Transmit Buffers          Passed
    CPU Receive Buffers           Passed
    CPU Loopback Test             Passed
    Port Memory                   Passed
    Port Registers                Passed
    T/R Port Loopback Test        Passed
    T/R Cross Port Test           Passed
    T/R Port Broadcast Test       Passed
    CPU Broadcast Test            Passed

    Return

                            Return to previous menu
        Use cursor keys to select action. Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 7.2 - Diagnostic Test Results Panel

If the TS-2800 is connected to a terminal via the EIA 232 port, a series of diagnostic messages should appear after you reset the TS-2800 with diagnostics. A list of these messages is shown in Figure 7.3. An abbreviated version of this set of messages will appear if you reset the TS-2800 without diagnostics.

```
FORE TS-2800 Switch Boot Firmware P/N 11152-00 Rev A, Copyright 1995
- Initiating bootstrapping sequence.
- Boot image integrity check...Passed.
- Control transferred to boot process.

- Relocating main image to DRAM........Done.
- Main image integrity...succeeded.
- Control transferred to main process.
TS-2800 System started on Fri. July 11, 1997  12:58:07
4 Megabytes System memory
2 Megabytes Network memory
- Initialization started
- File system initialized
- System temperature is within safe operating levels
- Warmboot initialization started
- LAN ports detected:
  - Token Ring Ports: 1-1 1-2 2-1 2-2 2-3 2-4 3-1 3-2 3-3 3-4
- Initializing Ports: 1-1 1-2 2-1 2-2 2-3 2-4 3-1 3-2 3-3 3-4
- Initializing system address table
- No existing diagnostic information, forcing diagnostic mode
- Starting Power Up Diagnostics test
  - UART loopback test on diagnostic port...Passed
  - UART loopback test on console port...Passed
  - RTC memory test...Passed
  - Real Time Clock test...Passed
  - CPU loopback test.............Passed
  - Token Ring Port loopback test..........Passed
  - Token Ring Port cross port loopback test..........Passed
  - Token Ring Port broadcast test..........Passed
  - CPU broadcast test...Passed
- Completing Power Up Diagnostic
- Activating Ports: 1-1 1-2 2-1 2-2 2-3 2-4 3-1 3-2 3-3 3-4
- Activating IP
- TS-2800 initiating bootp requests on one or more domains
- System initialization complete
```

Figure 7.3 - Messages during Diagnostics

CHAPTER 8 Troubleshooting and Service

This chapter contains procedures that help you troubleshoot problems with a TS-2800 and its connections to other devices.

Be sure to read “Safety Precautions” on page vi of the Preface before proceeding.

8.1 Obtaining Service

There are no user serviceable parts in the TS-2800 chassis. Refer all internal service requirements to FORE Technical Support, as described in “Technical Support” on page iii of the Preface. The power supplies, the processor card, and the UFCs are individually replaceable by the user, if they become defective.

If you need assistance in troubleshooting your TS-2800, contact FORE as described in “Technical Support” on page iii of the Preface.

8.2 Troubleshooting in a Network

The TS-2800 console and SNMP management agent give you access to important statistics and other information about the network, as seen by the TS-2800 (see Chapter 5).

The “Viewing Port N Statistics” on page 5-28 can be helpful in isolating network level problems.

The TokenProbe feature allows a network analyzer to be attached to a port on the TS-2800 to monitor, in real time, switch activity of another port. See “Configuring TokenProbe” on page 4-65 for information on configuring TokenProbe.

8.3 Start of Troubleshooting Process

If one or more devices (such as PCs) connected to a TS-2800 are unable to communicate with other devices in the network, use the following steps to start the troubleshooting process:

1. Locate the TS-2800 to which the device is connected. Use the network sketch, the label on the cable connected to the device, or other network records to help you locate the TS-2800.
2. You should also have available any documentation associated with the UFCs that are installed in the TS-2800.
3. If you have set up a console session (see “Setting Up a Console Session” on page 4-6), you can use it to determine whether diagnostics have been completed correctly. A list of normal diagnostic messages is shown in Figure 7.3 on page 7-5.
4. Observe the LEDs and the 4-character display on the TS-2800 front panel. Ignore the UFC LEDs at this time. Figure 1.4 on page 1-8 and Figure 1.5 on page 1-9 illustrate the location of these indicators.
   - For explanations of the LEDs, see Table 1.1 on page 1-8 and Table 1.2 on page 1-10.
   - For explanations of the messages in the 4-character display, see “Status Display” on page 1-10.

   Review these sections before proceeding with the troubleshooting process.
5. If the 4-character display message indicates a fan (Fx) or fuse (!x) failure contact FORE Technical Support, as described in “Technical Support” on page iii of the Preface.

NOTE

Fuses 3 and 4 control power to the Token Ring Processor Card. If either fuse 3 or fuse 4 fails, the Token Ring Processor Card becomes inoperative and cannot display status messages. The symptom of failure of fuse 3 or 4 is that the Power (|) LED on the Token Ring Processor Card is not on, while the AC OK and DC OK LEDs on the power supply are on.

6. Otherwise, in Figure 8.1, locate the symptom that best describes the communication problem and the LED pattern you observed. Then, go to the section that contains the recommended actions for resolving the problem and follow that procedure.

8.4 Choosing a Troubleshooting Procedure

Use Table 8.1 below to determine which troubleshooting procedure you should use. Unless otherwise stated, references to the OK and Fault LEDs are those on the Token Ring Processor Card.

Table 8.1 - Symptom, LED State, and Recommended Procedure

Symptom and LED State	Action:
Both the AC OK and DC OK LEDs are off (applies to either or both power supplies if the second power supply is installed).	Go to "Procedure A" on page 8-4
The AC OK LED is on and the DC OK LED is off (applies to either or both power supplies if the second power supply is installed).	The power supply is defective. See "Obtaining Service" on page 8-1.
The Fault (unlabeled) LED (amber) is on or the OK LED is off.	Go to "Procedure B" on page 8-4
None of the devices connected to the TS-2800 can communicate, the Fault (unlabeled) LED (amber) is off, and the Power (|) LED is on.	Go to "Procedure C" on page 8-5
A single device connected to the TS-2800 is having trouble communicating.	Go to "Procedure D" on page 8-5
A UFC's Fault (unlabeled) LED (amber) is on or a device connected to a UFC is experiencing problems.	Refer to service and troubleshooting information in the UFC documentation.
All LEDs are on.	The +5V-A fuses are open. See "Obtaining Service" on page 8-1.
The I (green) LED on the Token Ring Processor card is on and the console displays the message `Invalid port access`.	The +5V-B or +5V-C fuses are open. See "Obtaining Service" on page 8-1.

NOTE

Throughout this manual, *segment* refers to a single cable or interconnected cables between a TS-2800 Token Ring port and the device at the other end.

8.4.1 Procedure A

Use this procedure if all of the LEDs are off:

1. Verify that the AC power outlet to which the TS-2800 power supply is connected is active. If an uninterruptible power supply (UPS) is being used to provide AC power to one or both supplies, ensure that the UPS is working correctly.
2. Verify that the line cord is correctly installed.
3. Verify that the power supply is correctly installed in the chassis.
4. If all of the preceding conditions are satisfied, the power supply is defective. See “Obtaining Service” on page 8-1.

8.4.2 Procedure B

Use this procedure if the Fault (unlabeled) LED (amber) is on:

1. Reset the TS-2800 by disconnecting the line cord from the AC outlet, waiting 10 seconds, and reconnecting the line cord to the AC outlet. If the problem is corrected, resume using the TS-2800.
2. If you have just downloaded new microcode, clear NVRAM and reset the TS-2800 using the instructions in “Reset/Diagnostics” on page 7-2.

   Clearing NVRAM erases all configuration parameters.

   - If you are using the TokenPipe feature, be sure to disconnect the affected ports or disable them on the Port Configuration panel and reset the switch ***before*** clearing NVRAM. This is to prevent improperly configured bridge loops.
   - If you are using the Spanning Tree option, it will be turned off and port costs and priorities will be lost, which can result in loops. Temporarily disconnect the parallel ports, and then use the Spanning Tree panels to reestablish port costs and priorities. This is to prevent improperly configured bridge loops.
   - If you are using an SNMP manager, reconfigure all IP and SNMP parameters. If in doubt, disconnect all ports then reconnect them one at a time. If the problem is corrected, resume using the TS-2800.

3. One or more bad ports can cause this symptom, and the remaining ports might continue to operate.
   a. Reset the TS-2800 and monitor the diagnostic messages shown in Figure 7.3 for port failures. Try to correct any individual port problems that are detected.
   b. For failing ATM UFC ports, refer to "Troubleshooting the ATM UFC" on page 8-8.
   c. If the problem is corrected, resume using the TS-2800.
4. If the problem is not corrected, the TS-2800 is defective. See "Obtaining Service" on page 8-1.

8.4.3 Procedure C

Use this procedure if all devices connected to the TS-2800 are having communication problems, the Fault (unlabeled) LED is off, and the OK LED is on:

1. Reset the TS-2800 by disconnecting the line cord from the AC outlet, waiting 10 seconds, and reconnecting the line cord to the AC outlet.
   a. If the problem has corrected itself, resume using the TS-2800.
   b. If the status LEDs indicate a failure, go to "Procedure B" on page 8-4.
   c. If the problem persists, check all the configuration parameters.
   d. If the problem has still not been resolved, go to "Procedure D" on page 8-5 and try to get individual ports working.

8.4.4 Procedure D

Use this procedure if one device connected to the TS-2800 is having a communication problem, the Fault (unlabeled) LED is off, the OK LED is on and other attached devices can communicate through the TS-2800:

1. Check the port (UFC) LEDs.
   a. If the Connect LED is on, the problem is probably external to the TS-2800. Go to step 2.
   b. If the Connect LED is off, the port is probably disabled. Check that the port configuration matches that of the attached device, and then go to step 3.
   c. If the Connect LED is blinking, go to step 4.

2. If the Connect LED on the failing port is on, and the attached device still cannot communicate:
   a. If the attached device is directly connected, it might be set up incorrectly. Go to step step 4.
   b. In a shared environment, check the segment cabling and the media access unit.
   c. Go to step 5.
3. Perform the following steps when the Connect LED is off:
   a. Using the local console on the console of the SNMP manager, check to see whether the failing port is disabled. If it is, enable it. A port will disable itself when the Config Loss parameter is exceeded. This can be caused by poor cables, a faulty station connected to the TS-2800, or a bad port on the TS-2800.
   b. If the port is not disabled, disconnect the port cable. If the LED does not start flashing within a few seconds, the port is bad and the TS-2800 needs service. Try moving the cable to another port with a flashing Connect LED until service can be arranged. If the TS-2800 can be temporarily removed from service, connect a console and reset the TS-2800 with diagnostics to see whether the port passes diagnostics and initializes. If it does not, the problem is in the TS-2800. See “Obtaining Service” on page 8-1.
4. Restart the communications program on the failed connected device.
   a. If the communications program appears to start without errors, observe the Connect LED on the TS-2800 port. If it is on, the problem might have gone away. Check the Config Loss parameter in the Port Configuration Menu for possible causes of the failure.
   b. If the problem persists, try another identically configured port on the TS-2800. If the new port works, there is a problem with the failed port. See “Obtaining Service” on page 8-1.
5. If the TS-2800 is connected to a Token Ring concentrator, perform the following steps:
   a. Verify that the TS-2800 duplex setting matches that of the attached device.
   b. Verify that the concentrator is operating correctly.
   c. Verify that only one cable interconnects the two devices. In other words, only one port on the TS-2800 should be connected to a port on the concentrator. (If Spanning Tree is operational, it will not allow this configuration. It will disable traffic through the port, but the port will remain open.

6. For each device that is having a communication problem, connect its segment to another Token Ring port on the TS-2800. Try each of the remaining ports to determine whether the problem will go away.
   a. If the problem goes away, the problem might be in the TS-2800. See "Obtaining Service" on page 8-1.
   b. If the problem persists, continue with step 7.
7. The problem does not appear to be in the TS-2800 and the cables and devices connected to the TS-2800. The problem might be in the network applications or other software running on the devices that are having the communication problem. Refer to the software documentation for software problem determination procedures, or consult your network administrator for assistance.

8.5 Troubleshooting the ATM UFC

There are no serviceable parts on the TS-2800 ATM UFCs. All UFCs are individually replaceable, if they become defective. See “Technical Support” on page iii of the Preface for information concerning service for the product.

8.5.1 Trouble Indicators

This section focuses on analyzing and responding to potential problems associated with the introduction of the ATM UFC in your network.

In general, ATM-UFC-associated problems can be detected in four different ways:

1. TS-2800 ATM-UFC LED patterns.
2. End-station connectivity problems.
3. TS-2800 console messages, status, and counters.
4. SNMP traps, status, and counters.

Table 8.2 defines the indicators more specifically.

8.5.2 Responding to a Problem

Once a problem has been detected, use Table 8.3 to assess how best to proceed. The table allows you to use LED, console, and SNMP information to categorize the trouble and select a troubleshooting procedure.

Use Figure 8.1 to help with configuration or topology errors. If these methods fail, contact FORE Technical Support, as described in “Technical Support” on page iii of the Preface.

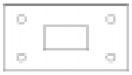
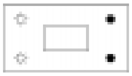
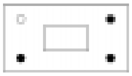
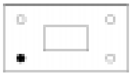
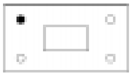
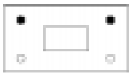
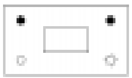
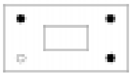
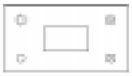
Table 8.2 - Trouble Indicators

Group	Specific area of problem
LED patterns (see Table 8.3 for details)	Card LEDs (OK and Fault) Port LEDs (Connect and Activity)
Connectivity problems	Session failures and link time-outs PING / APING failures WAN and LAN protocol analyzer traces
TS-2800 console (accessed via a TS-2800 serial port or Telnet), see Figure 4.38	UFC Configuration and Statistics submenus ATM Physical Port Status / Statistics LEC Status / Statistics Statistics submenus Port Statistics Diagnostic Test Results Message Log Information
SNMP-based information	Traps Link Down Absence of Link Up MIB objects ifOperStatus, ifIn and ifOut counts atmInterface counts lecLastFailure objects, lecSvcFailures, lecServerVccTable

NOTE

As part of the ATM UFC's normal startup procedure, it will pass through each of the states shown in Table 8.3 from all LEDs off to the Activity LED blinking. This procedure takes approximately 30 seconds.

Table 8.3 - Troubleshooting Overview: Indicators, Descriptions, and Procedures

LEDs	ATM UFC LEDs	ATM PORT LEDs	Alternate Trouble Indicators	Trouble Type	Troubleshooting Procedures
	OK=off Fault=off	Connect=off Activity=off	Switch LEDs: fault (lowest) LED on or both LEDs off Console: POST failed	Box fault	See Chapter 7.
	OK=blinking Fault=blink-ing	Connect=on Activity=on	Not an error state. Card microcode load and diagnostics are in progress.	Card load (non-error)	If after 30 seconds the LEDs do not change to another pattern, replace the UFC. See Chapter 3.
	OK=off Fault=on	Connect=on Activity=on	No code/code loaded; not running.	Card load error	Reload the microcode. See "Downloading ATM Microcode" on page 9-8.
	OK=off Fault=on	Connect=off Activity=off	UFC LEDs: fault LED on Console: ATM UFC Diagnostic Test failed	Card fault	Replace the UFC. Unplug the base box and see Chapter 3.
	OK=on Fault=off	Connect=off Activity=off	UFC LEDs: OK on and Connect off	Optical error	1. Swap cable, card, and check the remote port, one at a time. 2. If (1) fails, replace the UFC. Unplug the base box and see Chapter 3.
	OK=on Fault=off	Connect=on Activity=off	UFC LEDs: OK on and Connect on solid; Activity off	ILMI error	1. Swap cable, card, and check the remote port, one at a time. 2. Check remote station's ILMI activity (if possible). 3. If (1) and (2) fail, replace the UFC. Unplug the base box and see Chapter 3.
 	OK=on Fault=off	Connect=on Activity= blinking or solid	Not an error state. If trouble check: Connectivity problem Console messages, sta-tus, or counts SNMP traps, status, or counts	Configura-tion or topology error	Refer to the alternate trouble indicators: Connectivity problem Console messages, status, or counts SNMP traps, status, or counts
	OK=blinking Fault=off	Connect=on or off Activity=on or off or blinking	Not an error state. Card microcode is being updated.	Card update (non-error)	If after 10 minutes the LEDs do not change to another pattern, replace the UFC. See Chapter 3.

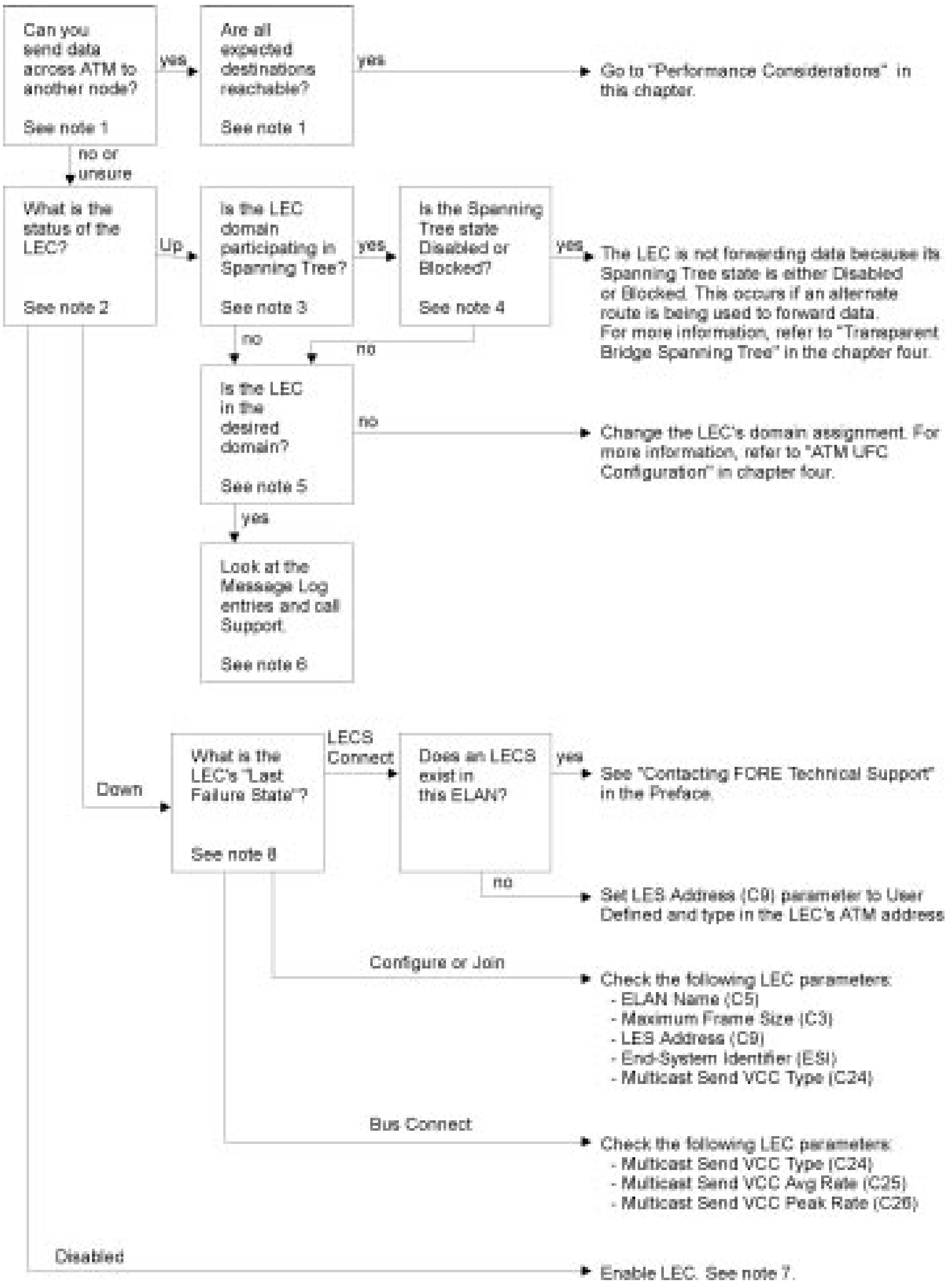


Figure 8.1 - Troubleshooting Configuration or Topology Errors

8.5.2.1 Note 1: Validating source-to-destination connectivity

There are many applications to assess source-to-destination connectivity. The most popular include TCP/IP PING, SNA APING, and a WAN or LAN protocol analyzer.

8.5.2.2 Note 2: Determining LEC status

A LEC can have one of three states: disabled, down, or up.

Using the TS-2800 console: Access LEC status through the following menus:
Main -> Non-Token Ring Ports Menu -> Select UFC -> LEC Status/Statistics.

The fifth column displays the LEC Status information.

Using SNMP-based management: Access LEC status by retrieving the following MIB object: RFC 1573 ifOperStatus, which has the values up (1), down (2), testing (3), unknown (4), and dormant (5).

8.5.2.3 Note 3: Determining Spanning Tree participation

Either the entire domain is or is not participating in Spanning Tree.

Using the TS-2800 console: Determine Spanning Tree participation through the following menus:

Main -> Configuration -> Spanning Tree.

The first item is called Participate in Spanning Tree and can be set to Yes or No.

Using SNMP-based management: Use the following switch-dependent object: tsDmnInfoStp, where 1=on and 2=off.

8.5.2.4 Note 4: Determining a LEC's Spanning Tree state

A LEC's Spanning Tree state can have one of the following values: disabled (DSB), blocked (BLK), listening (LSN), learning (LRN), and forwarding (FWD).

Using the TS-2800 console: Access a LEC Spanning Tree's state through the following menus:

Main -> Status/Statistics -> Transparent Bridge Spanning Tree

The third column, Port STS, displays the LEC Spanning Tree state.

Using SNMP-based management: Access a LEC Spanning Tree's state through RFC 1493's dot1dStpPortState, which has the values disabled (1), blocking (2), listening (3), learning (4), forwarding (5), and broken (5).

8.5.2.5 Note 5: Determining the LEC domain

In order to forward traffic from another port, a LEC has to share the same domain as the other ports.

Using the TS-2800 console: Access a LEC domain assignment through the following menus:

Main -> Non-Token Ring Ports Menu -> Select UFC -> Configure LEC.

Using SNMP-based management: Access a LEC domain assignment through tsDmnPorts.

Both of these are bit-encoded fields, with the most-significant bit representing port 1 and a binary 1 indicating that the port is in this domain.

8.5.2.6 Note 6: Accessing the Message Log

The Message Log entries contain significant events, warnings, and error information.

Using the TS-2800 console: Access the Message Log through the following menus:

Main -> Statistics -> Message Log Information.

Using SNMP-based Management: Message Log information is not accessible via SNMP. Look for traps originating from the TS-2800.

8.5.2.7 Note 7: Enabling a LEC

Using the TS-2800 console: Use the following menus:

Main -> Non-Token Ring Ports Menu -> Select UFC -> Configure LEC.

Move to the Enable action to select and enable a LEC. Note that only a certain number of LECs can be enabled at one time; thus, you might have to disable one LEC before enabling another.

Using SNMP-based management: Use SNMP MIB-II (RFC 1573), set ifAdminStatus to up (1).

8.5.2.8 Note 8: Accessing a LEC Last Failure State

The Last Failure State describes in which LEC state an error occurred. On the TS-2800 ATM UFC, a LEC Last Failure State can be set to lecsConnect, configure, join, or busConnect.

Using the TS-2800 console: Access a LEC Last Failure State through the following menus:

Main -> Non-Token Ring Ports Menu -> Select UFC -> LEC Status/Statistics -> LANE Stats.

The Last Failure State is the second-to-last variable.

Using SNMP-based management: Access a LEC Last Failure State through the ATM LAN-EMULATION-CLIENT-MIB lecLastFailureState object.

8.6 Performance Considerations

Most possible performance bottlenecks in a LAN-to-ATM environment (such as that which uses the TS-2800 ATM UFC) are outside the ATM UFC itself and prevent the UFC from achieving the maximum throughput allowed by the physical medium. With this in mind, this section gives a structured approach for analyzing problems within the UFC's environment.

UFC-related LAN-to-ATM performance bottlenecks can usually be isolated in one of four areas:

- End-station protocols and applications
- Emulated and VLAN topology and characteristics
- TS-2800 configuration
- ATM UFC configuration

Remember each of these areas when thinking about performance issues, since a bottleneck in one area might prevent another area from achieving its ideal throughput or latency. For instance, if you use IPX with Burst Mode set off, trying to perfect the performance related to LE_FLUSH time-outs might be misguided.

CHAPTER 9 Downloading Software

This chapter provides information on download procedures that send software upgrades to the TS-2800 flash EEPROM and the ATM Uplink UFC. The TS-2800 software consists of four files that can be upgraded via download as required:

- The main switch software image (TRSxxxxx.GZ)
- The main switch boot image (TRSxxxxx.BT)
- The SOLO Token Ring processor card microcode image (TRSxxxxx.SOL)
- The ATM Feature Card code (ATM_xxxx.UFC)

This chapter also describes how to use BOOTP with the TS-2800.

NOTE The TS-2800 is not operational during a reset. Before starting this procedure, make sure that the network will not be affected.

9.1 Contents of the TS-2800 Microcode Diskettes

Table 9.1 lists typical files found on the TS-2800 Microcode upgrade shipped with the TS-2800 on the MIB diskette. Additional microcode is included on the ATM Microcode diskette, described in Table 9.2.

Table 9.1 - Files on the TS-2800 Microcode Diskette

Item	File name	Contents
a.	TRSxxxxx.GZ	Main image
b.	TRSxxxxx.BT	Boot image
c.	TRSxxxxx.SOL	Token Ring microcode image
d.	TRSxxxxx.DEF	MIB tree definitions
e.	TRSxxxxx.MIB	MIB definitions for private MIB
f.	TRSxxxxx.TRP	MIB definitions for traps
g.	DTRCxxxx.MIB	MIB definitions for source-routing
h.	READ.ME	Release Notes
Note - xxxxx or xxxx refers to the Machine Type and Release Number		

Table 9.2 - Files on the ATM Uplink UFC Microcode Diskette

Item	File name	Contents
i.	ATM_xxxx.UFC	ATM UFC Code
j.	RFC1695.MBI	ATM MIB
k.	RFC1695.DEF	ATM MIB Compiler Object Definition
l.	LECMIB.MIB	LAN Emulation Client MIB
m.	LECMIB.DEF	LEC MIB Compiler Object Definition
n.	README.TR	Release Notes
Note **-** xxxx refers to the Machine Type and Release Number		

1. You should refer to the READ.ME file shipped with a microcode diskette for the latest information about the TS-2800 software and download procedures.
2. Items a through c are software modules that reside in the switch. Items d through g and j through m are network management files that should be given to your network administrator. Item i is the microcode for the ATM Uplink UFC.
3. If your switch contains back-level code (such as Release 1.xx or 2.xx), or if directed in the READ.ME file, download all four code modules to the TS-2800. Otherwise, download only the Main Image (TRSxxxxx.GZ).
4. Download the code using the System Request menu as discussed in “Initiating a Download with the System Request Menu” on page 9-3.
5. ***Important:*** Before beginning System Request Menu or Serial Port download, make sure that the baud rate of the terminal session and the TS-2800 are both set to 9600. Although this rate is slow, it helps prevent potential problems.
6. Reset the switch after each module is loaded; this helps ensure error-free downloads.

If you must load all four modules, load them in the following order:

1. The BOOT image (module has extension of .BT), using System Request Menu option 1.
2. The SOLO image (module has extension of .SOL), using System Request Menu option 3.
3. The MAIN code (module has extension of .GZ), using System Request Menu option 2.
4. The ATM UFC code (module has extension of .UFC), using the Download option from the Main Menu.

9.2 Initiating a Download with the System Request Menu

This section provides information on initiating the download procedure with the System Request Menu.

Follow these steps to begin a software upgrade:

1. If you have not already done so, start a console session as described in "Beginning the Console Session" on page 4-10, and advance to the Copyright panel, if possible.
2. Press and release the **`System Request`** button, the unmarked button on the Token Ring Processor Card. The console will display the System Request menu.

```
                   System Request Menu

             1. Xmodem download of boot image
             2. Xmodem download of main image
             3. Xmodem download of Token Ring microcode image

             4. Clear Non-Volatile RAM
             5. Reset the system


             0. Exit and continue



          Choice=>
```

Figure 9.1 - System Request Menu

3. Select your download option from the console and continue with the procedure.

4. The following messages appear:

```
SYSREQ:  Beginning Xmodem download of main(or boot) image
SYSREQ:  Waiting for binary file....
```

5. Use a terminal emulator program on your PC to download the binary file using Xmodem protocol.

   The download takes approximately 12 minutes at 9600 baud.

   When the download is complete, the following messages appear:

```
SYSREQ:  Beginning Xmodem download of main image
SYSREQ:  Waiting for binary file.... Done
SYSREQ:  Preparing Flash....Done.
SYSREQ:  Saving Main Image into Flash...Done


SYSREQ:  Press any key to return to System Request menu.
```

6. Select option 5 to reset the system.

9.3 Serial Port or TFTP Downloading with the Download Menu

This section provides information on initiating the download procedure with the Download menu.

Follow these steps to begin a software upgrade:

1. If you are downloading via the serial port, insert the upgrade disk in your terminal drive. Make sure that your terminal emulator supports Xmodem protocol.
2. If you are downloading via TFTP, copy the binary file `TRSxxxxx.GZ` from the diskette provided by FORE to the TFTP server and prepare the TFTP server.
3. If you have not already done so, start a console session as described in “Beginning the Console Session” on page 4-10, and advance to the Main Menu.
4. Select **`Download`** on the Main Menu as shown in Figure 4.2.

```
                                  Download


                           Serial Link Download

                           TFTP Download...











 Return



                           Return to previous menu
      Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                  Press <CTRL><N> to return to Main Menu.
```

Figure 9.2 - Download Menu

5. When the Download menu appears (see Figure 9.2), select **Serial Link Download** or **TFTP Download...**.
6. If you chose Serial Link Download, go to step 8.
7. If you chose TFTP Download, go to “TFTP Download” on page 9-7.
8. Select **Main Image**, **Boot Code**, or **UFC Image**. If you select UFC Image, you will be prompted to select the UFC for which you are downloading code.
9. Confirm the download when you are prompted to do so by the following message:

```
Please confirm new code download via serial port (Y or N):
```

10. The following messages appear:

```
Console:  Beginning Xmodem download of main image
Console:  Waiting for binary file....
```

11. Use the file transfer function of your terminal emulator program to download the binary file using Xmodem protocol.

    The download takes approximately 12 minutes at 9600 baud.

CAUTION

Do not interrupt the download or the boot image will be corrupted and need to be reloaded. During the download, the TS-2800 OK LED will blink.

When the download is complete, the following messages appear:

```
Console:  Beginning Xmodem download of main image
Console:  Waiting for binary file.... Done
Console:  Preparing Flash....Done.
Console:  Saving Main Image into Flash...Done


Please confirm switch reset (Y or N):
```

12. Confirm the reset. The procedure is complete.

9.3.1 TFTP Download

Continue here from step 7 on page 9-6 when performing a download via TFTP.

1. When the TFTP Download panel appears (see Figure 9.3), fill in the fields and then select **`Execute Network Download`**.
2. Confirm the download when you see the message:

`Please confirm new code download via network (Y or N):`

CAUTION

Do not interrupt the download or the boot image will be corrupted and need to be reloaded. During the download, the TS-2800 OK LED will be blinking.

```
                              TFTP Download


             TFTP Server Address     0.0.0.0

             Download Domain         default

             Download Image          main image

             Download Filename

             Execute Network Download




 Return

                       Return to previous menu
       Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure 9.3 - TFTP Download Panel

Downloading Software

3. Press **`Enter`** when you see the message:

```
Download  complete - reset switch to activate new software.
Press <Enter> to continue......
```

4. Reset the TS-2800, as instructed, to activate the new code.

9.4 Downloading ATM Microcode

The TS-2800 Token Ring switch has intelligent processors both inside the base box and on the ATM UFC. ATM software runs on both of these processors. This section explains how to download software on the ATM UFC.

This section provides information on the download procedure that sends software upgrades to the base switch flash EEPROM using TFTP, or via the serial port.

9.4.1 Serial Port/TFTP Downloading with the Download Menu

This section provides information on initiating the download procedure with the Download Menu.

Follow these steps to begin a software upgrade:

1. If you are downloading via the serial port, insert the upgrade diskette in your workstation drive. Make sure that your terminal supports Xmodem protocol.
2. If you are downloading via TFTP, copy the binary file `afcflash.elf` from the disk provided to the TFTP server and prepare the TFTP server.
3. If you have not already done so, start a console session and advance to the Main Menu.
4. Select **`Download`** on the Main Menu.

```
                                   Download

                            Return to Previous Menu

                            Serial Link Download

                            TFTP Download...




                         Display the Configuration Menu
        Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                     Press <CTRL><N> to return to Main Menu.
```

Figure 9.4 - Download Menu

When the Download Menu appears (see Figure 9.4), select **`Serial Link Download`** or **`TFTP Download...`**.

5. If you chose Serial Link Download, go to step 8.
6. If you chose TFTP Download, go to “TFTP Download” on page 9-10.
7. Select **`Main Image`** or **`UFC Image`**.
8. Confirm the download when you are prompted to do so by the following message:

`Please confirm new code download via serial port (Y or N):`

9. The following messages appear:

`Console:  Beginning Xmodem download of UFC image`
`Console:  Waiting for a binary image file....`

10. Use a terminal emulator program on your PC to download the binary file using Xmodem protocol.

The download takes approximately 5 minutes at 19200 baud.

When the download is complete, the following messages appear:

```
Console:  Beginning Xmodem download of main image
Console:  Waiting for binary file.... Done
Console:  Preparing Flash....Done.
Console:  Saving Main Image into Flash...Done

Please confirm switch reset (Y or N):
```

11. Confirm the reset; the procedure is complete.

9.4.1.1 TFTP Download

1. Select **Download Image**, then select **UFC Image** and enter the port number for the UFC when prompted. Fill in the other fields on this menu and then select **Execute Network Download**.
2. Confirm the download when you see the message:

```
Please confirm new code download via network (Y or N):
```

```
                              TFTP Download

                 Return to Previous Menu

                 TFTP Server Address     0.0.0.0

                 Download Domain         default

                 Download Image          main image

                 Download Filename

                 Execute Network Download



                        Display the Configuration Menu
       Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure 9.5 - TFTP Download Menu

3. Press **Enter** when you see the message:

```
Network download to UFC complete.  Reset ports to activate new soft-
ware. Press <Enter> to continue......
```

4. Reset the port, as instructed, to activate the new code.

9.4.1.2 Additional Information

New code does not take effect when loaded onto the ATM UFC until the ATM UFC is reset.

The image transfer can be terminated before it is completed, either by pressing a key on the console or disconnecting your console connection or your TFTP connection. If you do this, however, it is very likely that the code image in the ATM UFC will be destroyed. The ATM UFC must have a code image stored in flash to become operational.

If the TFTP server which contains the ATM UFC image is on the ATM network, you can download code through the ATM adapter. This is possible even if you are loading new code onto the same ATM UFC that supports your ATM device (server). It will not be possible, however, if the code image on the ATM UFC has been corrupted, preventing the ATM UFC from being operational. If the latter occurs, you can still load new code onto the ATM UFC either over the console connection (serial download) or through a LAN port (TFTP download).

For both serial and TFTP download, you might experience several apparent pauses during the image file transfer for reasons not related to network congestion or file server workload. These are due to the time needed to prepare the ATM UFC flash for new code (erasing the old image) or writing the new image to flash.

9.5 BootP

The Bootstrap Protocol (referred to as *BootP*) function allows the TS-2800 to participate in RFC 951-compliant environments. BootP uses User Datagram Protocol (UDP) to formulate a network request to allow a device to configure its IP address for a given logical TS-2800.

9.5.1 BootP Procedure

1. Edit the BOOTPTAB file on the BootP server (see “Editing the BOOTPTAB File” on page 9-13).
2. Initiate the BootP daemon (`BOOTPD`) on the BootP server.
3. Make sure that the IP State in the IP Configuration Menu is set to BootP When Needed or BootP Always.
4. Initiate the BootP transfer by resetting the TS-2800. A BootP is automatically initiated after diagnostics have been completed.

NOTE Do not configure multiple BootP servers on a single subnet.

The BootP sequence consists of IP address determination, if configured, using BootP request and reply. The TS-2800 does not perform a network boot using BootP, but can only determine its IP address.

In order for you to utilize the BootP function, a BootP server must be configured on the network. This BootP server must reside on the same subnet as the TS-2800. A typical implementation might consist of a BootP daemon (`BOOTPD` or `IN.BOOTPD`) or something similar. BOOTPD reads a startup file called `BOOTPTAB`. This file contains various strings that describe how BootP clients are configured. An entry is made in the BOOTPTAB file for each BootP client (in this case, the TS-2800) on the network. Figure 9.6 displays an example of a BOOTPTAB file for configuring two TS-2800s.

9.5.2 Editing the BOOTPTAB File

Figure 9.6 shows an example of a BOOTPTAB file.

```
#Blank lines and lines beginning with '#' are ignored.
#Legend:
#       first field--hostname (may be full domain name)
#       bf--bootfile
#       bs--bootfile size
#       cs--cookie servers
#       ds--domain name servers
#       gw--gateway address list
#       ha--host hardware address
#       hd--bootfile home directory
#       hn--send hostname
#       ht--hardware type
#       im--impress servers
#       ip--host IP address
#       lg--log servers
#       lp--LPR servers
#       ns--IEN-116 name servers
#       rl--resource location protocol servers
#       sm--subnet mask
#       tc--template host (points to similar host entry)
#       to--time offset (seconds)
#       ts--time servers
#       vm--vendor magic cookie selector

#Be certain to include backslashes where they are needed.
#Define different master entries for each TS-2800 (or domain).

TS28001:
       hn:
       ht=Token Ring:
       vm=rfc1084:
       ha=0004AC281340:
       ip=134.177.169.111:
       sm=255.255.0.0:
       gw=134.177.169.201:
       bf=\etc\2800_XX.gz:
TS28002:
       hn:
       ht=Token Ring:
       vm=rfc1048:
       ha=0004AC 281352:
       ip=134.177.169.48:
       sm=255.255.0.0:
        gw=134.177.169.201:
       bf=\etc\2800_XX.gz:
```

Figure 9.6 - Example of a BOOTPTAB File

Configure the BOOTPTAB file for the TS-2800 to which the BootP server is attached. To do this, in the BOOTPTAB file, associate the MAC address for Domain 0 (listed as the default local port in the Master Address Table, Figure 5.3 on page 5-4) with the IP address.

NOTE Do not use the MAC address in the Switch Information panel.

The Master Address Table in Figure 5.3 on page 5-4 displays the address for Domain 0 (default) as `0004AC 281340`. The address that is loaded for Domain 0 in the BOOTPTAB file should be `0004AC 281340`.

If another TS-2800 is configured (or another domain within a single TS-2800), the address associated with that TS-2800 (or domain) is entered in the BOOTPTAB file in the BootP server associated with that TS-2800 (or domain). (In this example, the second TS-2800 has the address `0004AC 281352`.)

9.5.2.1 TS-2800 MAC Address Assignment for Multiple Domains

If the TS-2800 has multiple domains configured, a BootP server should be attached to each configured domain. The BOOTPTAB file must contains the MAC address for that specific domain. To determine the MAC address for each domain in a single TS-2800, use the following procedure:

1. Determine your unit's Token Ring base MAC address. This is the MAC address which appears on a label on the front of the Token Ring processor card (main CPU). This base MAC address also appears on the console user-interface's initial welcome screen.
2. Add 0x20 hexadecimal (32 decimal).
3. Add the domain number ("default" domain == 0x00).

In other words, you can use the following formula to determine the domain MAC address:

`Domain-specific MAC address = Base MAC Address + 0x20 + Domain Number`

NOTE The addition is done directly to the Non-Canonical form of the address.

An example of MAC addressing for a TS-2800 with the base MAC address 00 04 12 0C 07 E0 (non-canonical) is shown in Figure 9.3.

Table 9.3 - Domain MAC Address for Base Address 00 04 12 0C 07 E0

Domain	Specific MAC Address
default	00 04 12 0C 08 00
Domain01	00 04 12 0C 08 01
Domain02	00 04 12 0C 08 02
Domain03	00 04 12 0C 08 03
Domain04	00 04 12 0C 08 04
Domain05	00 04 12 0C 08 05
Domain06	00 04 12 0C 08 06
Domain07	00 04 12 0C 08 07
Domain08	00 04 12 0C 08 08
Domain09	00 04 12 0C 08 09
Domain10	00 04 12 0C 08 0A
Domain11	00 04 12 0C 08 0B
Domain12	00 04 12 0C 08 0C
Domain13	00 04 12 0C 08 0D
Domain14	00 04 12 0C 08 0E
Domain15	00 04 12 0C 08 0F

An example of MAC addressing for a TS-2800 with the base MAC address 00 04 12 8C 6A 20 (non-canonical) is shown in Figure 9.3.

Table 9.4 - Domain MAC Address for Base Address 00 04 12 0C 07 E0

Domain	Specific MAC Address
default	00 04 12 8C 6A 40
Domain01	00 04 12 8C 6A 41
Domain02	00 04 12 8C 6A 42
Domain03	00 04 12 8C 6A 43
Domain04	00 04 12 8C 6A 44
Domain05	00 04 12 8C 6A 45
Domain06	00 04 12 8C 6A 46
Domain07	00 04 12 8C 6A 47
Domain08	00 04 12 8C 6A 48
Domain09	00 04 12 8C 6A 49
Domain10	00 04 12 8C 6A 4A
Domain11	00 04 12 8C 6A 4B
Domain12	00 04 12 8C 6A 4C
Domain13	00 04 12 8C 6A 4D
Domain14	00 04 12 8C 6A 4E
Domain15	00 04 12 8C 6A 4F

You can display the MAC address for each domain through the user interface:

1. Select **`Status/Statistics...`** from the Main Menu.
2. Select **`Domain Address Table...`** from the Status/Statistics Menu.
3. Select **`Change_Displayed_Domain`** and select the domain for which you want to determine the MAC address.
4. Find the symbolic name for the domain in the `Local Port` column. The corresponding MAC address is that of the domain. This is the MAC address used by the TS-2800 for IP communication over the domain.

NOTE

The TS-2800 has a limitation with respect to the gateway entry. The server device IP address is written into the “gw” gateway address filed when the configuration is downloaded. Thus, you must configure the gateway address on the TS-2800 at the end of the download sequence. Refer to your UNIX operating system environment manual for further information.

9.5.2.2 BootP and TFTP Limitations

- Do not configure multiple TFTP servers to download code updates using TFTP to a single TS-2800 (or to multiple domains).
- If the download is interrupted or corrupted, you must download a new image using the serial port download (see “Serial Port or TFTP Downloading with the Download Menu” on page 9-5).
- If the network broadcast traffic is 200 packets per second or more, the TFTP request might not be initiated by the TS-2800. You must reduce network traffic or reset the TS-2800 and download a new image using the serial port download (see “Serial Port or TFTP Downloading with the Download Menu” on page 9-5).
- The BootP function might not work if BootP request and reply frames must cross Token Ring segments.

9.5.3 Error Messages

During the BootP download procedure, the TS-2800 might encounter certain error conditions. When this occurs, the TS-2800 sends error messages to the console.

APPENDIX A Planning Charts and Worksheets

The planning charts and worksheets on the following pages can be photocopied and used for planning the installation and configuration of the TS-2800s in your network.

A.1 TS-2800 Charts and Worksheets

A.1.1 TS-2800 Cabling Chart (1 of 2)

Table A.1 - Switch Information

Date:	**Mounting:** ❏ **Rack** ❏ **Surface**
Segment:	**Building:**
Unit No.:	**Location:**

Table A.2 - Option Card Information (1 of 2)

UFC 1 Type:				
UFC Port (Base Port)	**1 (1-1)**	**2(1-2)**	**N/A**	**N/A**
Cable Type				
Connect to:				
UFC 2 Type:				
UFC Port (Base Port)	**1 (2-1)**	**2(2-2)**	**3 (2-3)**	**4 (2-4)**
Cable Type				
Connect to:				
UFC 3 Type:				
UFC Port (Base Port)	**1 (3-1)**	**2(3-2)**	**3 (3-3)**	**4 (3-4)**
Cable Type				
Connect to:				
UFC 4 Type:				
UFC Port (Base Port)	**1 (4-1)**	**2(4-2)**	**3 (4-3)**	**4 (4-4)**
Cable Type				
Connect to:				

A.1.2 TS-2800 Cabling Chart (2 of 2)

Table A.3 - Option Card Information (2 of 2)

UFC 5 Type:				
UFC Port (Base Port)	**1 (5-1)**	**2(5-2)**	**3 (5-3)**	**4 (5-4)**
Cable Type				
Connect to:				
UFC 6 Type:				
UFC Port (Base Port)	**1 (6-1)**	**2 (6-2)**	**3 (6-3)**	**4 (6-4)**
Cable Type				
Connect to:				
UFC 7 Type:				
UFC Port (Base Port)	**1 (7-1)**	**2 (7-2)**	**3 (7-3)**	**4 (7-4)**
Cable Type				
Connect to:				
UFC 8 Type:				
UFC Port (Base Port)	**1 (8-1)**	**2 (8-2)**	**3 (8-3)**	**4 (8-4)**
Cable Type				
Connect to:				

A.1.3 Switch Information Panel

"Viewing Switch Information" on page 4-14

Record the indicated information in the table.

Table A.4 - Switch Information

System Name	
System Location	
System Contact	

A.1.4 Domain Name Panel and Source-Route Configuration

"Naming Domains" on page 4-18 and "Assigning or Changing LAN Segment Numbers" on page 4-50

Record in the table the name assigned to each domain.

Table A.5 - Domain Name Information

Index	Domain Name	LAN Segment Number
0		
1		
2		
3		
4		
5		
6		
7		

A.1.5 Domain Configuration Panel

"Configuring Domains" on page 4-16

Record in the table the name of the domain associated with each port.

Table A.6 - Domain Configuration Information

Port	Domain Name
1-1	
1-2	
2-1	
2-2	
2-3	
2-4	
3-1	
3-2	
3-3	
3-4	
4-1	
4-2	
4-3	
4-4	
5-1	
5-2	
5-3	
5-4	
6-1	
6-2	
6-3	
6-4	
7-1	

Table A.6 - Domain Configuration Information

Port	Domain Name
7-2	
7-3	
7-4	
8-1	
8-2	
8-3	
8-4	

A.1.6 IP Configuration Panel

“Setting Up IP Addresses” on page 4-19[1]

Table A.7 - IP Configuration Information

Domain Name	Parameter	Value
	IP Address (Default: 0.0.0.0)	________,________,________,________
	Default Gateway (Default: 0.0.0.0)	________,________,________,________
	Subnet Mask (Default: 0.0.0.0)	________,________,________,________
	IP State (Default: BOOTP When Needed)	________,________,________,________
	IP Address (Default: 0.0.0.0)	________,________,________,________
	Default Gateway (Default: 0.0.0.0)	________,________,________,________
	Subnet Mask (Default: 0.0.0.0)	________,________,________,________
	IP State (Default: BOOTP When Needed)	________,________,________,________
	IP Address (Default: 0.0.0.0)	________,________,________,________
	Default Gateway (Default: 0.0.0.0)	________,________,________,________
	Subnet Mask (Default: 0.0.0.0)	________,________,________,________
	IP State (Default: BOOTP When Needed)	________,________,________,________
	IP Address (Default: 0.0.0.0)	________,________,________,________
	Default Gateway (Default: 0.0.0.0)	________,________,________,________
	Subnet Mask (Default: 0.0.0.0)	________,________,________,________
	IP State (Default: BOOTP When Needed)	________,________,________,________

1. Make additional copies of this page if you have more than four domains.

A.1.7 SNMP Configuration Menu

"SNMP Network Management" on page 4-21

Table A.8 - SNMP Configuration Information

Send Authentication-Failure Traps	Yes	No
Set to:		

A.1.8 SNMP - Community Strings Panel

"Creating Communities" on page 4-25

Table A.9 - Community Strings Information

Index	Community Name	Mode	
		R	W
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

- R=Read
- W=Read / Write

A.1.9 SNMP--Trap Receivers Panel (1 of 2)

"Creating Trap Receivers" on page 4-27

Table A.10 - Trap Receivers Information (1 of 2)

Domain	Index	IP Address	Trap Community Name
	1	_______,_______,_______,_______	
	2	_______,_______,_______,_______	
	3	_______,_______,_______,_______	
	4	_______,_______,_______,_______	
	5	_______,_______,_______,_______	
	6	_______,_______,_______,_______	
	7	_______,_______,_______,_______	
	8	_______,_______,_______,_______	
	9	_______,_______,_______,_______	
	10	_______,_______,_______,_______	
	11	_______,_______,_______,_______	
	12	_______,_______,_______,_______	
	13	_______,_______,_______,_______	
	1	_______,_______,_______,_______	
	2	_______,_______,_______,_______	
	3	_______,_______,_______,_______	
	4	_______,_______,_______,_______	
	5	_______,_______,_______,_______	
	6	_______,_______,_______,_______	
	7	_______,_______,_______,_______	
	8	_______,_______,_______,_______	
	9	_______,_______,_______,_______	
	10	_______,_______,_______,_______	
	11	_______,_______,_______,_______	
	12	_______,_______,_______,_______	
	13	_______,_______,_______,_______	

A.1.10 SNMP--Trap Receivers Panel (2 of 2)

“Creating Trap Receivers” on page 4-27

Table A.11 - Trap Receivers Information (2 of 2)

Domain	Index	IP Address	Trap Community Name
	1	_______,_______,_______,_______	
	2	_______,_______,_______,_______	
	3	_______,_______,_______,_______	
	4	_______,_______,_______,_______	
	5	_______,_______,_______,_______	
	6	_______,_______,_______,_______	
	7	_______,_______,_______,_______	
	8	_______,_______,_______,_______	
	9	_______,_______,_______,_______	
	10	_______,_______,_______,_______	
	11	_______,_______,_______,_______	
	12	_______,_______,_______,_______	
	13	_______,_______,_______,_______	
	1	_______,_______,_______,_______	
	2	_______,_______,_______,_______	
	3	_______,_______,_______,_______	
	4	_______,_______,_______,_______	
	5	_______,_______,_______,_______	
	6	_______,_______,_______,_______	
	7	_______,_______,_______,_______	
	8	_______,_______,_______,_______	
	9	_______,_______,_______,_______	
	10	_______,_______,_______,_______	
	11	_______,_______,_______,_______	
	12	_______,_______,_______,_______	
	13	_______,_______,_______,_______	

A.1.11 Spanning Tree Panel

“Transparent Bridge Spanning Tree” on page 4-29

Table A.12 - Spanning Tree Information

Domain	Parameter	Value
	Participate in Spanning Tree Default: No	❑ 802.1d ❑ No
	Switch Priority Range 0 to 65 535 Default: 32 768	
	Switch Hello Time Range (in seconds) 1 to 10 Default: 2	
	Switch Maximum Message Age Range (in seconds) 6 to 40 Default: 20	
	Switch Forward Delay Range (in seconds) 4 to 30 Default: 15	
	Participate in Spanning Tree Default: No	❑ 802.1d ❑ No
	Switch Priority Range 0 to 65 535 Default: 32 768	
	Switch Hello Time Range (in seconds) 1 to 10 Default: 2	
	Switch Maximum Message Age Range (in seconds) 6 to 40 Default: 20	
	Switch Forward Delay Range (in seconds) 4 to 30 Default: 15	
	Participate in Spanning Tree Default: No	❑ 802.1d ❑ No
	Switch Priority Range 0 to 65 535 Default: 32 768	
	Switch Hello Time Range (in seconds) 1 to 10 Default: 2	
	Switch Maximum Message Age Range (in seconds) 6 to 40 Default: 20	
	Switch Forward Delay Range (in seconds) 4 to 30 Default: 15	

A.1.12 Spanning Tree - Port Priority and Path Cost Panel

"Port Priority and Port Path Cost" on page 4-33

Record in the table the cost of each port.
Range: 1 to 65 535
Default: 62

Record in the table the priority for each port.
Range: 0 to 255
Default: 128

Table A.13 - Port Priority and Path Cost Information

Port	1-1	1-2	N/A	N/A	2-1	2-2	2-3	2-4
Cost:								
Priority:								
Port	**3-1**	**3-2**	**3-3**	**3-4**	**4-1**	**4-2**	**4-3**	**4-4**
Cost:								
Priority:								
Port	**5-1**	**5-2**	**5-3**	**5-4**	**6-1**	**6-2**	**6-3**	**6-4**
Cost:								
Priority:								
Port	**7-1**	**7-2**	**7-3**	**7-4**	**8-1**	**8-2**	**8-3**	**8-4**
Cost:								
Priority:								

Path Cost=1000/LAN speed in Mbps

A.1.13 Port Configuration Panel (1 of 2)

"Configuring Token Ring Ports" on page 4-35

Fill in the appropriate boxes to define the characteristics of

Table A.14 - Port Configuration Information (1 of 2)

Port	1-1	1-2	N/A	N/A	2-1	2-2	2-3	2-4
Switching Mode								
Type								
State								
Config Type[1]								
Speed								
Mode								
Duplex								
Config Loss								
Port	**3-1**	**3-2**	**3-3**	**3-4**	**4-1**	**4-2**	**4-3**	**4-4**
Switching Mode								
Type								
State								
Config Type[1]								
Speed								
Mode								
Duplex								
Config Loss								

1. The port Config Type must be Fixed if you want to change port Speed, Mode, or Duplex.

A.1.14 Port Configuration Panel (2 of 2)

“Configuring Token Ring Ports” on page 4-35

Fill in the appropriate boxes to define the characteristics of each port.

Table A.15 - Port Configuration Information (2 of 2)

Port	**5-1**	**5-2**	**5-3**	**5-4**	**6-1**	**6-2**	**6-3**	**6-4**
Switching Mode								
Type								
State								
Config Type[1]								
Speed								
Mode								
Duplex								
Config Loss								
Port	**7-1**	**7-2**	**7-3**	**7-4**	**8-1**	**8-2**	**8-3**	**8-4**
Switching Mode								
Type								
State								
Config Type[1]								
Speed								
Mode								
Duplex								
Config Loss								

1. The port Config Type must be `Fixed` if you want to change port Speed, Mode, or Duplex.

A.1.15 Internal Source-Route Bridge Connection Configuration Menu

"Internal Source-Route Bridge Configuration" on page 4-52

Record the internal bridge number and mark the box corresponding to the state of the bridge.

Table A.16 - Internal Source-Route Bridge Connection Information

Bridge Number(0 - F)	State
	❏ Enabled ❏ Disabled

A.1.16 LAN Segment Bridging Parameters Panel

"Displaying LAN Segment Bridging Parameters" on page 4-53

Record the bridging parameters for each LAN segment.

Table A.17 - LAN Segment Bridging Parameters Information

Segment Number	Domain Name	Bridged Segment Fowarding	ARE Tx Hop Cnt	ARE Rx Hop Cnt	STE Tx Hop Cnt	STE Rx Hop Cnt	Maximum FrameSize
		❏ Enabled ❏ Disabled					
		❏ Enabled ❏ Disabled					
		❏ Enabled ❏ Disabled					
		❏ Enabled ❏ Disabled					
		❏ Enabled ❏ Disabled					
		❏ Enabled ❏ Disabled					
		❏ Enabled ❏ Disabled					
		❏ Enabled ❏ Disabled					

A.1.17 Source-Route Bridge Spanning Tree Configuration Panel

"Source-Route Bridge Spanning Tree Configuration" on page 4-55

Record the Spanning Tree parameters for the internal source-route bridge.

Table A.18 - Source-Route Bridge Spanning Tree Configuration Information

Parameter	Value
SRB Spanning Tree Mode	❑ Manual ❑ Automatic
SRB Priority Range: 0 to 65 535 Default: 32 768	
SRB Hello Time Range: 0 to 10 sec Default: 2 sec	
SRB Maximum Message Age Range: 6 to 40 sec Default: 6 sec	
SRB Forwarding Delay Range: 4 to 30 sec Default: 4 sec	
SRB Maximum Message Age Range: 6 to 40 sec Default: 6 sec	

A.1.18 Source-Route Bridge Path Cost Panel

"Source-Route Bridge Path Cost" on page 4-58

Record the path cost for each LAN segment. This is applicable only if the SRB Spanning Tree mode is Automatic.

Table A.19 - Source-Route Bridge Path Cost Information

Segment Number	Domain Name	Segment Path Cost Range: 0 to 65535 Default: 62

A.1.19 Source-Route Bridge Manual Spanning Tree Parameters Panel

"SRB Manual Spanning Tree Parameters" on page 4-59

Record the forwarding state of each source-route bridge segment. This is applicable only if the SRB Spanning Tree mode is Manual.

Table A.20 - Source-Route Bridge Manual Spanning Tree Parameters Information

Index	Segment Number	Domain Name	Single-route Bcast Frames
1			❑ Forward ❑ Block
2			❑ Forward ❑ Block
3			❑ Forward ❑ Block
4			❑ Forward ❑ Block
5			❑ Forward ❑ Block
6			❑ Forward ❑ Block
7			❑ Forward ❑ Block
8			❑ Forward ❑ Block

A.1.20 TokenProbe Configuration Panel

"Configuring TokenProbe" on page 4-65

TokenProbe Port: ______

NOTE

You can configure any of the Token Ring ports as the TokenProbe port. However, this port will then be a dedicated TokenProbe port. Do not select a heavily used port as the TokenProbe port.

A.1.21 TokenPipe Configuration Panel

“Configuring TokenPipe” on page 4-67

Write the port numbers in each TokenPipe in the table.

Table A.21 - TokenPipe Information

TokenPipe	Ports
1	
2	
3	
4	

NOTE

Create TokenPipe port connections between TS-2800s in consecutive, numeric order from lowest-to-highest numbered port. The lowest-numbered port becomes the primary port and all broadcast frames flow through this port as TokenPipe connections are created and then assigned to the other TokenPipe ports.

NOTE

If any strand in the TokenPipe fails, the entire TokenPipe becomes inoperative.

A.1.22 Configure Filters Panel

"Configuring Filters" on page 4-61[1]

Table A.22 - Filters Information

Filter Number	MAC Address	Filter Type	Entry Ports	Exit Ports
1		❏ Block src ❏ Allow src ❏ Block dst ❏ Force dst		
2		❏ Block src ❏ Allow src ❏ Block dst ❏ Force dst		
3		❏ Block src ❏ Allow src ❏ Block dst ❏ Force dst		
4		❏ Block src ❏ Allow src ❏ Block dst ❏ Force dst		
5		❏ Block src ❏ Allow src ❏ Block dst ❏ Force dst		
6		❏ Block src ❏ Allow src ❏ Block dst ❏ Force dst		
7		❏ Block src ❏ Allow src ❏ Block dst ❏ Force dst		
8		❏ Block src ❏ Allow src ❏ Block dst ❏ Force dst		
9		❏ Block src ❏ Allow src ❏ Block dst ❏ Force dst		
10		❏ Block src ❏ Allow src ❏ Block dst ❏ Force dst		
11		❏ Block src ❏ Allow src ❏ Block dst ❏ Force dst		
12		❏ Block src ❏ Allow src ❏ Block dst ❏ Force dst		
13		❏ Block src ❏ Allow src ❏ Block dst ❏ Force dst		

1. Make additional copies of this page if you have more than 13 filters.

A.1.23 Configure Port Security Mode Panel

"Configuring Port Security Mode" on page 4-63

Table A.23 - Port Security Mode Information

Port	Security Mode
1-1	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
1-2	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
2-1	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
2-2	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
2-3	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
2-4	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
3-1	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
3-2	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
3-3	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
3-4	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
4-1	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
4-2	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
4-3	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
4-4	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
5-1	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
5-2	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
5-3	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
5-4	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
6-1	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
6-2	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
6-3	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
6-4	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
7-1	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
7-2	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination

Table A.23 - Port Security Mode Information

Port	Security Mode
7-3	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
7-4	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
8-1	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
8-2	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
8-3	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination
8-4	❏ Normal ❏ Secure Source ❏ Secure Destination ❏ Secure Source and Destination

A.1.24 Port Address Table Aging Panel

"Configuring Port Address Aging" on page 4-40.

Table A.24 - Port Address Table Aging Information

Port	Aging Time	Demand Aging Level
1-1		
1-2		
2-1		
2-2		
2-3		
2-4		
3-1		
3-2		
3-3		
3-4		
4-1		
4-2		
4-3		
4-4		
5-1		

Table A.24 - Port Address Table Aging Information

Port	Aging Time	Demand Aging Level
5-2		
5-3		
5-4		
6-1		
6-2		
7-3		
6-4		
7-1		
7-2		
7-3		
7-4		
8-1		
8-2		
8-3		
8-4		

A.1.25 Master Address Table Aging Panel

"Master Address Table Aging" on page 4-42.

Table A.25 - Master Address Table Aging Information

Parameter	Value
Address Aging TimeRange: 0 to 9999 min Default: 5 min.	
Demand Aging Level Range: 50%, 60%, 70%, 80%, 90%, or disable Default: 90%	

A.1.26 Switching Mode Threshold

"Switching Mode Threshold" on page 4-69

Table A.26 - Switching Mode Threshold Information

Parameter	Value
Error-rate high threshold Range: 0% to 100% Default: 10%	
Error-rate low threshold Range: 0% to 100% Default: 1%	
Error-rate trend Range: 0% to 100% Default: 1%	
Error-rate sample Range: 0 to 120 min Default: 10 min	

A.1.27 Password Panel

"Password" on page 4-71

Table A.27 - Password Information

Current Password	New Password

A.1.28 Serial Configuration Panel

"Serial Link Configuration" on page 4-74

Table A.28 - Serial Link Information

Function	Selected Option
Hardware Flow Control	❏ Enabled ❏ Disabled
Software Flow Control	❏ Enabled ❏ Disabled
Autobaud upon Break (Default 9600)	❏ Enabled ❏ Disabled
Baud Rate (if Autobaud is disabled)	❏ 1200 ❏ 2400 ❏ 4800 ❏ 9600 ❏ 19200 ❏ 38400 ❏ 57600

A.1.29 Telnet Configuration Panel

"Telnet Configuration" on page 4-76

Write in the number of sessions allowed.

Table A.29 - Telnet Sessions Allowed

Function	Selected Option
Number of Telnet Sessions Allowed (default 5)	
Disallow New Telnet Sessions	❏ Yes ❏ No

A.1.30 Adapter Address to Physical Location

Table A.30 - Adapter Address to Physical Location Mappings[1]

Adapter Address	Physical Location	Device ID	Segment Number	Hub/Switch Unit Number

1. Make additional copies of this page if necessary.

A.1.31 Physical Location to Adapter Address

Table A.31 - Physical Location to Adapter Address Mappings[1]

Physical Location	Adapter Address	Device ID	Segment Number	Hub/Switch Unit Number

1. Make additional copies of this page if necessary.

A.2 ATM Planning Charts

The planning charts on the following pages can be photocopied and used for planning the installation and configuration of your ATM UFC. You should fill out one table for each switch you are planning.

Table A.32 - Physical Port Configuration

Port	(slot) ___ - 1 (port)
UNI Level	Circle one: AUTO DETECT UNI 3.0 UNI 3.1
Control Plane VCC Peak Rate	Range: 0-155000 Default: 8000

A.2.1 Quick Configuration Parameters Worksheet

NOTE

The LES ATM Address fields are optional. You must specify the address if your LECS is not ATM Forum-compliant, or if you are not using a LECS. You can use the default value (from ILMI) when using an ATM Forum-compliant LECS.

Table A.33 - Quick Configuration of LAN Emulation Client (LEC)

LEC Index	LEC Parameter	Value
_01	LAN Switch Domain (16 char.)	
	ELAN Name (32 char.)	
	LES ATM Address 26 char. Network Prefix 12 char. ESI 2 char. Selector Byte	
	LEC ESI (12 char.)	

Table A.33 - Quick Configuration of LAN Emulation Client (LEC)

LEC Index	LEC Parameter	Value
_02	LAN Switch Domain (16 char.)	
	ELAN Name (32 char.)	
	LES ATM Address 26 char. Network Prefix 12 char. ESI 2 char. Selector Byte	
	LEC ESI (12 char.)	
_03	LAN Switch Domain (16 char.)	
	ELAN Name (32 char.)	
	LES ATM Address 26 char. Network Prefix 12 char. ESI 2 char. Selector Byte	
	LEC ESI (12 char.)	
_04	LAN Switch Domain (16 char.)	
	ELAN Name (32 char.)	
	LES ATM Address 26 char. Network Prefix 12 char. ESI 2 char. Selector Byte	
	LEC ESI (12 char.)	

Table A.33 - Quick Configuration of LAN Emulation Client (LEC)

LEC Index	LEC Parameter	Value
_05	LAN Switch Domain (16 char.)	
	ELAN Name (32 char.)	
	LES ATM Address 26 char. Network Prefix 12 char. ESI 2 char. Selector Byte	
	LEC ESI (12 char.)	
_06	LAN Switch Domain (16 char.)	
	ELAN Name (32 char.)	
	LES ATM Address 26 char. Network Prefix 12 char. ESI 2 char. Selector Byte	
	LEC ESI (12 char.)	
_07	LAN Switch Domain (16 char.)	
	ELAN Name (32 char.)	
	LES ATM Address 26 char. Network Prefix 12 char. ESI 2 char. Selector Byte	
	LEC ESI (12 char.)	

Table A.33 - Quick Configuration of LAN Emulation Client (LEC)

LEC Index	LEC Parameter	Value
_08	LAN Switch Domain (16 char.)	
	ELAN Name (32 char.)	
	LES ATM Address 26 char. Network Prefix 12 char. ESI 2 char. Selector Byte	
	LEC ESI (12 char.)	

A.2.2 Advanced Configuration Parameters Worksheet

"Advanced Configuration" on page B-1

Table A.34 - Advanced Configuration (Name and Address Parameters)

Parameter	LEC _ _ _	LEC _ _ _
Domain Name		
ELAN Name (C5)		
Maximum Frame Size (C3)		
LES Address		
End-System Identifier (ESI)		
Parameter	**LEC _ _ _**	**LEC _ _ _**
Domain Name		
ELAN Name (C5)		
Maximum Frame Size (C3)		
LES Address		
End-System Identifier (ESI)		

Table A.35 - Advanced Configuration (Miscellaneous Parameters)

Parameter	LEC _ _ _	LEC _ _ _	LEC _ _ _	LEC _ _ _
Control Time-Out (C7)				
Maximum LE_ARP Retry Count (C13)				
LE_ARP Entry Aging Time (C17)				
LE_ARP Entry Forward Delay Time (C18)				
Expected LE_ARP Response Time (C20)				
Maximum Unknown Frame Count (C10)				
Maximum Unknown Frame Time (C11)				
Multicast Send VCC Type (C24)				
Multicast Send VCC Avg Rate (C25)				
Multicast Send VCC Peak Rate (C26)				
Flush Response Time-Out (C21)				
Maximum Path Switching Delay (C22)				
Idle VCC Time-Out (C12)				
Connection Completion Timer (C28)				
Data Direct VCC after BUS Failure				

NOTE

If advanced configuration is used, you can choose not to use Table A-2 of the Quick Configuration parameters worksheet.

A.2.3 Spanning Tree - Port (LEC) Priority and Path Cost Worksheet

Refer to Chapter 4.

Record in the table the cost of each port.
Range: 1 to 65,535
Default: 6

Record in the table the priority for each port.
Range: 0 to 255
Default: 128

Table A.36 - Port (LEC) Cost and Priority

Port (LEC)	**_01**	**_02**	**_03**	**_04**	**_05**	**_06**	**_07**	**_08**
Cost:								
Priority:								
Port (LEC)	**_09**	**_10**	**_11**	**_12**	**_13**	**_14**	**_15**	**_16**
Cost:								
Priority:								
Port (LEC)	**_17**	**_18**	**_19**	**_20**	**_21**	**_22**	**_23**	**_24**
Cost:								
Priority:								
Port (LEC)	**_25**	**_26**	**_27**	**_28**	**_29**	**_30**	**_31**	**_32**
Cost:								
Priority:								

Path Cost = 1000/LAN speed in Mbps

APPENDIX B Advanced Configuration of a LEC

Because the ATM Forum has standardized parameter defaults, in most environments, you can use Quick Configure exclusively to configure LECs. Quick Configure accepts the default values for all the LEC connection parameters except Domain Name, ELAN Name, LES Address, and LEC End System Identifier (ESI). Chapter 4 describes how to set these parameter values.

B.1 Advanced Configuration

In customized LANE environments in which an LECS, LES, and BUS have been configured in non-standard ways, Advanced Configuration might be necessary. You need to consider the information in your LECS/LES/BUS publications before choosing values for the Advanced Configuration parameters.

1. Select the **`Non-Token-Ring Ports Menu...`** option from the Main menu.
2. Choose the **`Select UFC`** option and enter the port number of the ATM Feature Card that you want to configure. The ATM Feature Card menu.
3. Select **`Configure LAN Emulation Client (LEC)...`** and then select **`Advanced Config`** at the bottom of the panel.
4. Specify the index number of the LEC you want to configure.

```
         Advanced Configuration of a LAN Emulation Client (LEC)      Slot 1
                            LEC Index 101

 NOTE: Changes made to configured LEC parameters are saved to non-volatile
       RAM using the Save and Return command on the following panels.
       However, LECs must be Reset before the changes take effect.

                  LE Registration Parameters...

                  Control Connection Parameters...

                  Multicast Connection Parameters...

                  Data Connection Parameters...

                  IBM LAN Emulation Enhancements...

 Return

                         HELP MESSAGES APPEAR HERE
      Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                   Press <CTRL><N> to return to Main Menu.
```

Figure B.1 - Advanced LEC Configuration Menu

The following list provides specific information about these advanced configuration options.

LE Registration Parameters

The LANE registration parameters define LEC information to the LES. A LEC must register all LAN destinations for which it is responsible, or join as a proxy to other MAC addresses.

Control Connection Parameters

These parameters apply to Control VCCs, which link LECs to LECSs, and carry control frames and LE_ARP traffic.

Multicast Connection Parameters

These parameters determine connections for sending data to the BUS and for distributing data from the BUS. The LEC must maintains these connections in order to participate in the ELAN.

Data Connection Parameters

These connections carry data frames and refer to the connection of LECs to each other and to the BUSs.

IBM LAN Emulation Enhancements

Provides for data direct VCC after BUS failure.

B.1.1 LAN Emulation Registration Parameters

Select **`LE Registration Parameters...`** from the Advanced Configuration menu. The panel shown in Figure B.2 appears.

```
Advanced Configuration of a LEC - Control Connection Parameters   Slot 1
                              LEC Index 101


 Domain Name                  default

 ELAN Name (C5)               <no ELAN name defined>

 Maximum Frame Size (C3)      1516

 LES Address (C9)             Get from LECS (Automatic)

 End-System Identifier (ESI) 112233445566  (universally administered)

 Save and Return           Cancel and Return

NOTE: The "(Cxx)" notation above is an ATM Forum LEC variable designation.



           HELP MESSAGES APPEAR HERE
       Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure B.2 - Advanced LEC Configuration - LANE Registration Parameters

Domain Name

Refers to the name assigned to each LEC.

Emulated LAN Name

Refers to the name of the ELAN to which the LEC belongs. The name is automatically provided when the LEC connects with the ELAN.

Maximum Frame Size

The maximum frame size the LEC will send or receive on the Multicast VCC or Multicast Forward VCC. This parameter must be set to either 1516 or 4544 (Token Ring only) octets. Do not change this parameter without terminating the LEC and returning it to its original configuration. The default value is 1516 octets.

LES Address

ATM address for the LES that is assigned to the LEC. This address is determined when the LEC starts up.

End-System Identifier (ESI)

The ESI is the MAC address portion of the LEC's ATM address. You can use the default, universally administered MAC address as the ESI or configure a locally administered ESI. To configure the ESI, select **`End System Identifier (ESI)`** and press **`Enter`**. Select **`Locally administered MAC address`** and press **`Enter`**. Type the ESI at the prompt and press **`Enter`**.

B.1.2 LEC Control Connection Advanced Parameters

Select **Control Connection Parameters...** from the Advanced Configuration menu. The panel shown in Figure B.3 appears.

```
Advanced Configuration of a LEC - LE Registration Parameters    Slot 1
                              LEC Index 101



                                                 Current          Default
 Control Connection Parameter                     Value            Value
 Control Timeout (C7)                            120              120 sec.

 Maximum LE_ARP Retry Count (C13)                1                1 retry
 LE_ARP Entry Aging Time (C17)                   300              300 sec.
 LE_ARP Entry Forward Delay Time (C18)           15               15 sec.
 Expected LE_ARP Response Time (C20)             1                1 sec.


 Save and Return    Cancel and Return    Restore Defaults

NOTE: The "(Cxx)" notation above is an ATM Forum LEC variable designation.




                          HELP MESSAGES APPEAR HERE
       Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure B.3 - Advanced LEC Configuration - Control Connection Parameters

Control Timeout

This parameter determines the time period for most request / response control frame interactions.

- Minimum=10 seconds
- Maximum=300 seconds
- Default=120 seconds

Maximum LE_ARP Retry Count (C13)

A LEC must not retry an LE_ARP_REQUEST for a given frame's LAN destination more than Maximum Retry Count times, after the first LE_ARP REQUEST for the same frame's LAN destination.

- Minimum=0
- Maximum=2
- Default=1

LE_ARP Entry Aging Time (C17)

The maximum time that a LEC will maintain an entry for a local MAC address in its LE_ARP cache.

- Minimum=10 seconds
- Maximum=300 seconds
- Default=300 seconds

LE_ARP Entry Forward Delay Time (C18)

The maximum time that a LEC will maintain an entry for a non-local MAC address in its LE-ARP cache.

- Minimum=4 seconds
- Maximum=30 seconds
- Default=15 seconds

Expected LE_ARP Response Time (C20)

The maximum time that the LEC expects a LE_ARP_REQUEST or LE_ARP_RESPONSE cycle to take. This parameter is used for retries and verifies.

- Minimum=1 second
- Maximum=30 seconds
- Default=1 second

B.1.3 LEC Advanced Multicast Connection Parameters

Select **`Multicast Connection Parameters...`** from the Advanced Configuration menu. The panel shown in Figure B.4 appears.

```
   Advanced Configuration of a LEC - Multicast Connection Parameters  Slot 1
                            LEC Index 101



                                                Current          Default
 Multicast Connection Parameters                 Value            Value
 Maximum Unknown Frame Count (C10)              1                1 frame
 Maximum Unknown Frame Time (C11)               1                1 sec.

 Multicast Send VCC Type (C24)                  Best Effort      Best Effort
 Multicast Send VCC Avg Rate (C25)              5000             5000 kbps
 Multicast Send VCC Peak Rate (C26)             25000            25000 kbps

 Save and Return    Cancel and Return    Restore Defaults

NOTE: The "(Cxx)" notation above is an ATM Forum LEC variable designation.




                           HELP MESSAGES APPEAR HERE
      Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                   Press <CTRL><N> to return to Main Menu.
```

Figure B.4 - Advanced LEC Configuration - Multicast Connection Parameters

Maximum Unknown Frame Count (C10)

See the definition for *Maximum Unknown Frame Time.*

- Minimum=1
- Maximum=10
- Default=1

Maximum Unknown Frame Time (C11)

Within the period of time defined by the Maximum Unknown Frame Time, a LEC will send no more than Maximum Unknown Frame Count frames to the BUS for a given unicast LAN Destination.

- Minimum=1 second
- Maximum=60 seconds
- Default=1 second

Multicast Send VCC Type (C24)

The signaling parameter that should be used by the LEC when establishing a Multicast Send VCC. This is the method to be used by the LEC when specifying traffic parameters when it sets up the Multicast Send VCC for this ELAN.

Generally, this parameter must be set to whatever the BUS supports. If the BUS supports more than one option, then selecting VBR or CBR instead of Best Effort might improve performance with regard to the guaranteed forwarding of broadcast frames and frames whose destinations are unknown.

Multicast Send VCC Avg Rate (C25)

Signaling parameter that should be used by the LEC when establishing the Multicast Send VCC. Forward and Backward Sustained Cell Rate to be requested by LEC when setting up Multicast Send VCC, if using VBR codings.

Multicast Send VCC Peak Rate (C26)

Signaling parameter that should be used by the LEC when establishing the Multicast Send VCC. Forward and Backward Peak Cell Rate to be requested by the LEC when setting up the Multicast Send VCC when using either VBR or CBR.

B.1.4 LEC Advanced Data Connection Parameters

Select **`Data Connection Parameters...`** from the Advanced Configuration menu. The panel shown in Figure B.5 appears.

```
Advanced Configuration of a LEC - Data Connection Parameters    Slot 1
                              LEC Index 101



                                              Current       Default
 Path Switching Parameters                     Value         Value
 Flush Response Timeout (C21)                 4             4 sec.
 Maximum Path Switching Delay (C22)           6             6 sec.


 Data Direct VCC (DD_VCC) Parameters
 Idle VCC Timeout (C12)                       1200          1200 sec.
 Connection Completion Timer (C28)            4             4 sec.

 Save and Return    Cancel and Return    Restore Defaults

NOTE: The "(Cxx)" notation above is an ATM Forum LEC variable designation.




                          HELP MESSAGES APPEAR HERE
       Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                    Press <CTRL><N> to return to Main Menu.
```

Figure B.5 - Advanced LEC Configuration - Data Connection Parameters

Flush Response Timeout (C21)

The time limit to wait to receive an LE_FLUSH_RESPONSE after the LE_FLUSH_REQUEST has been sent before taking recovery action.

- Minimum=1 second
- Maximum=4 seconds
- Default=4 seconds.

Maximum Path Switching Delay (C22)

The time since sending a frame to the BUS after which the LEC can assume that the frame has been either discarded or delivered to the recipient. This may be used to bypass the Flush protocol.

- Maximum=1 second
- Minimum=8 seconds
- Default=6 seconds.

Idle VCC Timeout (C12)

This value is the VCC inactivity timer; that is, after this period of time expires, if the VCC has not had activity on it, the VCC is torn down. The range of values is 0 minutes to unlimited time, with a default of 20 minutes. In practice, many users will find that 20 minutes is excessive and uses up more VCCs than necessary, potentially exhausting the VCC-related resources of either their LAN switch ATM UFC or the attached ATM switch. For this reason, for environments where a large number of VCCs are used (that is, hundreds of ATM-attached destinations will be communicated with), it is recommended that this value be set to between 1 and 10 minutes.

Nonetheless, one must be sensitive to the environment. If a quick setup time (the amount of time needed to establish a VCC) is more critical than freeing little-used VCCs, then defining this value at 20 minutes or more might be necessary.

A LEC should release any Data Direct VCC that has not been used to transmit or receive any data frames for the length of the Idle VCC Time out Period. This parameter is meaningful for only SVC Data Direct VCCs.

- Maximum=Unlimited
- Minimum=Unspecified
- Default=20 minutes

Connection Completion Timer (C28)

In Connection Establishment this is the time period in which data or a READY_IND message is expected from a Calling Party.

- Minimum=1 second
- Maximum=10 seconds
- Default=4 seconds

B.1.5 LEC Advanced LAN Emulation Enhancements

Select **`IBM LAN Emulation Enhancements...`** from the Advanced Configuration menu. The panel shown in Figure B.6 appears.

```
      Advanced Configuration of a LEC - LAN Emulation Enhancements   Slot 1
                       LEC Index 101                     Port is DOWN

                                                Current       Default
LAN Emulation Enhancements                       Value         Value
Data Direct VCC Keep Alive Timeout              1             34 sec.









Save and Return    Cancel and Return    Restore Defaults





    Cancel changes made to this panel and return to the previous panel.
      Use cursor keys to choose item.  Press <ENTER> to confirm choice.
                   Press <CTRL><N> to return to Main Menu.
```

Figure B.6 - Advanced LEC Configuration - Data Connection Parameters

The data direct VCC keep alive timeout allows a user to configure how long the ATM UFC will maintain its data direct VCCs to other LAN Emulation Clients, after it has detected unavailability of the LES/BUS. If a data direct connection existed prior to a disruption, and the ATM address of the station was learned prior to the LES/BUS connection disruption, then traffic to and from the station continues to flow during the temporary disruption of the LES/BUS connection.

The ATM Forum specifies that data direct VCCs should be taken down immediately upon detection of LES/BUS unavailability. Enter 0 seconds for 100% ATM Forum Compliant operation. If your network contains an alternate path to any of the destinations that are reachable through the ATM network, (for example, an Ethernet, Token-Ring, or alternate ATM path), you must set the data direct keep alive timeout small enough to avoid loops in your network. The data direct keep alive timeout plus the time that it takes the LEC to discover the absence of the LES/BUS must be smaller than the 802.1D spanning tree parameters Max Age plus Forward Delay for your network.

NOTE

Data direct keep alive timeout plus LES/BUS failure detection time must be set less than or equal to 802.1d max age plus 802.1d forward delay.

The time required to detect a LES/BUS failure depends on the type of failure and the UNI version. The ATM/UFC detects LES/BUS failures when any of the control or multicast VCCs are taken down. In many cases, the loss of one of these VCCs is detected very quickly. However, in some cases it takes a long time to detect the loss of a control or multicast VCC. These VCC failures are detected by the expiration of QSAAL poll timer and the T309 UNI signalling timer. This takes from 17 to 32 seconds for UNI 3.1 or from 97 to 112 seconds for UNI 3.0. Failure of the 8260 CPSW or executing the command 'Set module isolated' on the 8260 port that is attached to the ATM UFC are examples of this class of failure.

Spanning tree loops can be created if the above recommendation is not followed. Figure B.7 shows a network that has two paths between the ATM network and the Token Ring network. The backup path is blocked by the 802.1D spanning tree protocol.

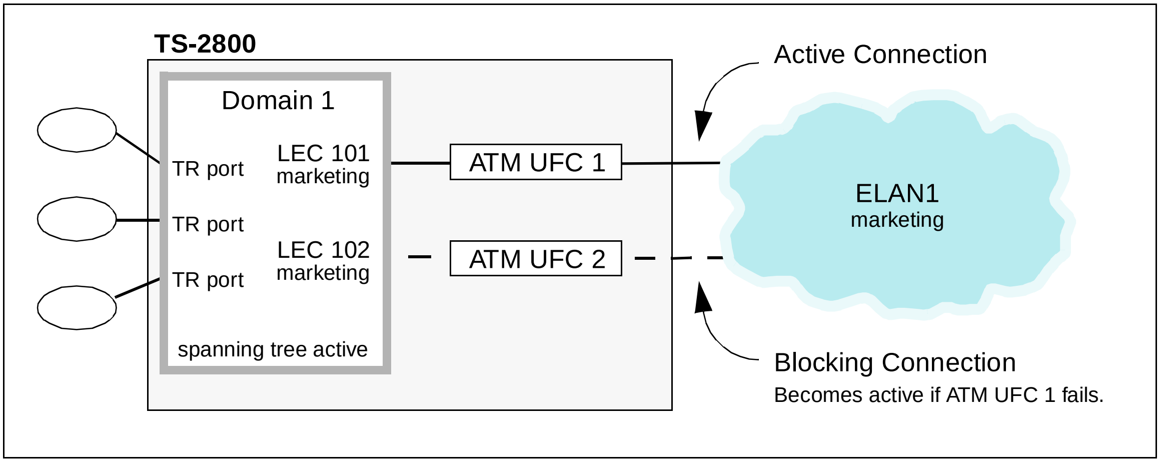


Figure B.7 - Redundant ATM UFCs Using Spanning Tree

Assume that the ATM port is blocked by the 802.1D spanning tree. It will remain in blocked state as long as BPDUs are received on that port. If the LES/BUS fails and no BPDUs are received for the MAX AGE time, the port will transition to the LISTENING state followed by the LEARNING state and then the FORWARDING state. The port will stay in LISTENING state for one forward delay time and in LEARNING state for one forwarding delay time. So, if the port fails to receive BPDUs for MAX AGE plus two times the FORWARD DELAY time, it will transition to the FORWARDING state.

If the LES/BUS outage is short enough so that the Data Direct VCC Keep Alive Timeout timer is still running, the ATM UFC will not signal a LINK DOWN state to the Spanning Tree code when the LES/BUS VCCs are re-established. The ports are re-attached to the ELAN as if there was no interruption. If the Data Direct VCC Keep Alive Timeout is set too long, both ports could be reattached to the ELAN in FORWARDING state causing a spanning tree loop. Frames can endlessly circulate in a loop causing extreme network congestion.

Recommended settings for 802.1D spanning tree and Data Direct VCC Keep Alive Timeout are shown in Figure B.1.

Table B.1 - Recommended Timeout Settings

	UNI 3.1	**UNI 3.0**
MAX AGE	20 sec	20 sec
FORWARD DELAY	15 sec	15 sec
Data Direct VCC Keep Alive Timeout	3 sec	0 sec

NOTE

If you have lowered the spanning tree times (MAX AGE = 6 and FORWARD DELAY = 4) to avoid problems with directly attached servers, you must set the Data Direct VCC Keep Alive Timeout to zero.

2.2 Management of the ATM UFC

The ATM UFC is primarily managed using SNMP. The standard bridge, LAN media, and emerging ATM MIBs are supported. Any TCP/IP-based communication with the ATM UFC needs to be in the context of LAN Emulation, rather than RFC 1577, Classical IP over ATM.

APPENDIX C Cable and Pin Information

This appendix provides information on cables that can be used with the TS-2800. It also provides minimum pinout information so that you can verify that the cables that you are using are correctly wired.

C.1 Connecting to the Management (EIA 232) Port

Table C.1 lists the type of cables that are used when connecting to the EIA 232 port on the TS-2800.

Table C.1 - Connecting to the EIA 232 Port

Cable Function	Cable Type or Cable Solution
Connect a modem to the EIA 232 port	Connect one end of a straight-through, EIA 232 modem cable to the EIA 232 port and the other to the modem.
Connect a PC or other DTE device to the EIA 232 port	Connect one end of a crossover, EIA 232 cable to the EIA 232 port and the other end to the PC or DTE device. Attach a null-modem adapter to the EIA 232 port. Then, attach a straight-through modem cable to the null-modem adapter.

C.2 Twisted-Pair Cable Pinouts

When connecting devices to the Token Ring ports on the TS-2800, you must use a straight-through cable. Diagrams of these cables follow.

C.2.1 Straight-Through 100-Ohm and 120-Ohm Cable

The TS-2800 RJ-45 connector makes ground available on the shield and on pins 1, 2, 7, and 8. Shielded cables will provide continuity for ground to any shielded connector on the other end of the cable.

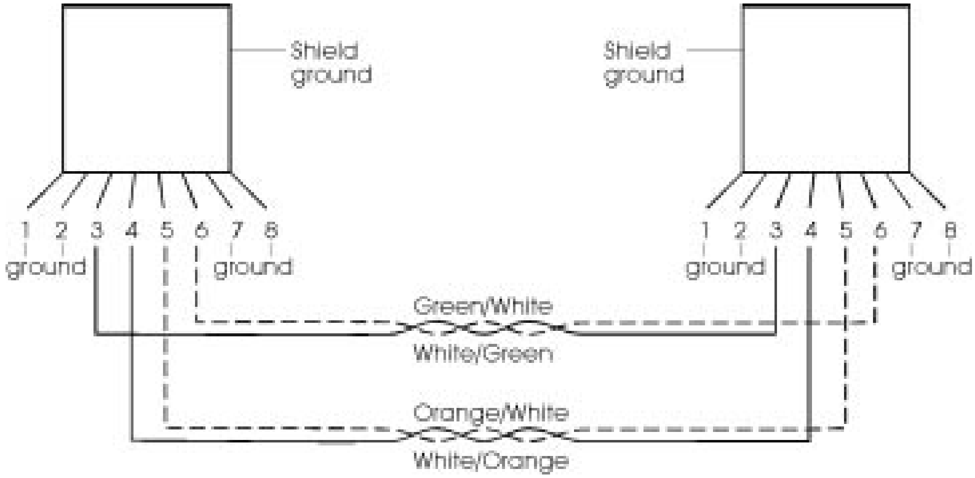


Figure C.1 - Straight-Through Cable

C.2.2 150-Ohm Data Connector-to-RJ-45 Straight-Through Cable

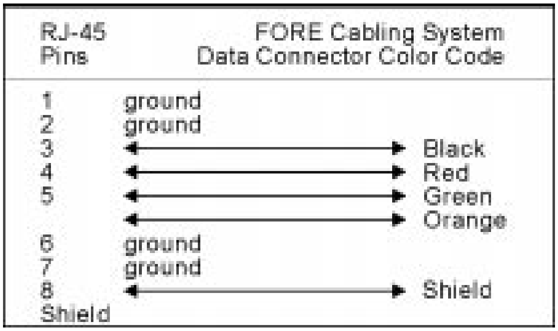


Figure C.2 - 150-Ohm Data Connector-to-RJ-45 Straight-Through Cable

C.3 EIA 232 Port and Cable Pinouts

The TS-2800 has an EIA 232 port wired as a DTE. For this reason, you cannot use a straight-through modem cable to directly connect a terminal to the EIA 232 port.

For a terminal connection, you can use either a null-modem cable or a modem cable with a null-modem adapter attached. For a modem connection, you can use a standard modem cable (i.e. straight through).

This section provides pinout information for the cables you can use to connect to the EIA 232 port.

C.3.1 EIA 232 Port Pinout

Pin	Signal Name
Shell	CHS GND
3	TXD
2	RXD
7	RTS
8	CTS
6	DSR
5	SIG GND
1	CD
4	DTR
9	RI

Figure C.3 - Pinout of the EIA 232 Port

C.3.2 EIA 232 Modem Cable Connections

Use a straight-through modem cable to connect the EIA 232 port of the TS-2800 to a modem.

Signal Name	Terminal /PC End 25-Pin Male		Switch End 9-Pin Female
TXD	2	←	3
RXD	3	→	2
RTS	4	←	7
CTS	5	→	8
DSR	6	→	6
GND	7	—	5
DCD	8	→	1
DTR	20	←	4
RI	22	→	9

Figure C.4 - EIA 232 Modem Cable for Terminal with 25-Pin Connector

C.3.3 EIA 232 Null-Modem Connections

Use a null-modem (crossover) cable as shown in Figure C.5 to connect the EIA 232 port to a terminal (DTE) with a 25-pin connector. Alternatively, you can use a modem cable and a null-modem adapter. DTR (pin 20) and RTS (pin 4) must be on, or high, on your terminal or in your terminal emulation program.

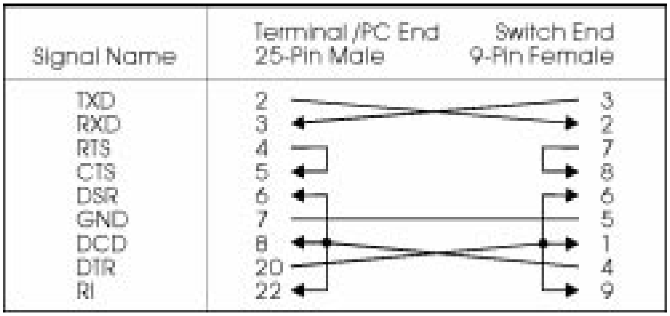


Figure C.5 - EIA 232 Null-Modem Cable for Terminal with 25-Pin Connector

Use a null-modem (crossover) cable as shown in Table C.6 to connect the EIA 232 port to a terminal (DTE) with a 9-pin connector. Alternatively, you can use a modem cable and a null-modem adapter. DTR (pin 4) and RTS (pin 7) must be on, or high, on your terminal or in your terminal emulation program.

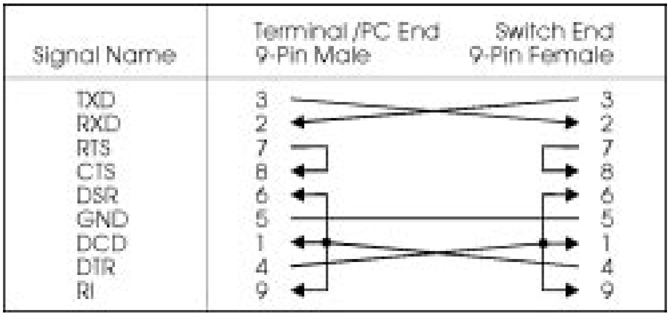


Figure C.6 - EIA 232 Null-Modem Cable for Terminal with 9-Pin Connector

C.4 Cabling Recommendations

Table C.2 and Table C.3 list the supported cable types.

Table C.2 - Copper Cable Types

Cable Type	Impedance
Type 1 and 1A	150 ohms
Type 2 and 2A	150 ohms
Type 8	150 ohms
Type 9	150 ohms
Type 3	100 ohms
Category 3	100 and 120 ohms
Category 4	100 and 120 ohms
Category 5	100 and 120 ohms

Table C.3 - Multimode Optical Fiber Cable Types

Cable Type
65.5 / 125-micron fiber
50 / 125-micron fiber
100 / 140-micron fiber

If you are installing new cabling for data applications, FORE recommends that you use the following types of cable:

- For lobe cabling from the telecommunications closet to the wall outlet, FORE recommends 150-ohm, STP or four-pair category 5 cable that meets the international cable standard (ISO / IEC 11801) or the North American cabling standard (EIA / TIA 568A).
- For backbone cabling, FORE recommends 62.5 / 125-micron, multimode, optical fiber cable that meets the international cable standard (ISO / IEC 11801) or the North American cabling standard (EIA / TIA 568A).

C.4.1 Length Recommendations for Dedicated-Media LAN Segments

The Token Ring Network dedicated-media connections support only one attached entity (workstation or TS-2800) per connection.

For all supported cable types except optical fiber, the recommended maximum cable lobe length is 190 m (624 ft) plus a 10-m (33-ft) total allowance for the patch cords in the office and telecommunications closets.

In the Token Ring Network, the section of cable that attaches a device to an access unit is called a *lobe.*

C.4.2 Lobe Wiring Rules for Dedicated-Media LAN Segments

Table C.4, Table C.5, and Table C.6 specify the maximum supported lobe lengths for the indicated types of cables. An additional 10 m (33 ft) per lobe length is allowed to accommodate patch cables, unless otherwise specified.

The maximum lengths reflect the longest lengths supported by the transmission characteristics of IEEE 802.5-compliant adapters. The recommended distances for the various cable types are set by North American and international commercial building wiring standards. These standards state that standards-compliant horizontal copper cabling shall not exceed 90 m (295 ft), leaving 10 m (33 ft) total for required patch cabling in both the office and telecommunications closet. For optical fiber, the recommended maximum cable lobe length is 2000 m (1.2 miles). It is good practice to follow the cabling standards guidelines when installing building cabling to help ensure a longer useful life for your cabling infrastructure, migration to new technologies, and maximum flexibility for your network configuration.

Table C.4 - Lobe Lengths for 150-Ohm, Shielded Media

Ring Speed	Types 1 and 1A Types 2 and 2A	Type 8	Type 9
4 Mbps	750 m (2460 ft)	376 m (1234 ft)	500 m (1640 ft)
16 Mbps	290 m (951 ft)	146 m (479 ft)	200 m (656 ft)
Note - Subtract 10 m (33 ft) from the allowed Type 1 or 2 distance each time a 2.4-m (8-ft) patch cable is replaced by a Type 6, 9-m (30-ft) patch cable on that lobe.			

Table C.5 - Lobe Lengths for 100- / 120-Ohm, Shielded or Unshielded Cable

Ring Speed	Type 3	Category 3
4 Mbps	100 m (328 ft)	250 m (820 ft)
16 Mbps	Not Supported	100 m (328 ft)
***Note* -** Unshielded media requires appropriate filtering.		

Table C.6 - Lobe Lengths for 100- / 120-Ohm, Shielded or Unshielded Cable

RingSpeed	Category 4	Category 5
4 Mbps	350 m (1148 ft)	350 m (1148 ft)
16 Mbps	200 m (656 ft)	200 m (656 ft)
***Note* -** Unshielded media requires appropriate filtering.		

C.4.3 Cable Length and Lobe Wiring Rules for Shared-Media LAN Segments

The types of cables that can be used are the same as those described in "Lobe Wiring Rules for Dedicated-Media LAN Segments" on page C-7 for dedicated-media segments. The acceptable distances are defined by the hub or concentrator attached to the TS-2800 port.

C.4.4 Number of Attaching Devices

The Token Ring Network supports up to 260 attaching devices or nodes on a single network when using 150-ohm shielded media (type 1, 1A, 2, or 2A). When cable segments in the network are 100 or 120 ohm, this number is decreased to 132 (72 if using any 4-Mbps-only adapters or filters).

APPENDIX D Menus and Panels Index

The following lists provides the names of all the menus and panels available on the TS-2800 management and configuration tool. The page numbers appearing after each title refer to the page in the manual where that menu or panel is described.

D.1 Configuration Menus

D.2 Management and Statistics Panels

APPENDIX E ARI and FCI Bits

To prevent possible problems in adapter drivers in client and servers attached to the network, the TS-2800 allows you to control whether the TS-2800 sets the Address Recognized Indicator (ARI) and Frame Copied Indicator (FCI) bits in the Frame Status byte of the Token Ring frame. You can set the TS-2800 to either always set the bits or to never set the bits in frames that it has forwarded. The TS-2800 sets or does not set the bits in frames circulating on the segment on which the frames originated. On the destination segment to which the TS-2800 forwards the frame, it clears the ARI and FCI bits.

E.1 Usage of the ARI and FCI Bits

These bits have the following meanings:

- The ARI is set to one by a destination station if the destination station recognized the frame.
- The FCI is set to one if the destination station was able to copy the frame into the local adapter buffer memory.

IEEE 802.5 specifies that these bits should not be used by application logic. However, some vendors have used these bits in driver and application logic. In some drivers, if the bits aren't correctly set, errors can occur and traffic can fail.

When the TS-2800 forwards a frame onto another segment, it normally sets the bits depending on the presence of the Routing Information Field (RIF) in the frame. The TS-2800 sets the bits in frames circulating on the segment on which the frames originated. On the destination segment to which the TS-2800 forwards the frame, it clears the ARI and FCI bits.

- If an RIF ***is not*** present in the frame, the TS-2800 will set the ARI and FCI bits. See Figure E.1.
- If an RIF ***is*** present in the frame, the TS-2800 will not set the bits. It will rely on Source-Route Bridges (SRBs) in the network to set the bits. An SRB will act as a proxy and set the bits for destinations on the other side of the bridge. See Figure E.2.

If the TS-2800 is not forwarding the frame, it ignores the ARI and FCI bits unless the destination is itself.

In some network configurations the bits might not be set when they should be. If you have such a configuration and your network includes older drivers which rely on the ARI and FCI bits, traffic from the older drivers might fail. Drivers might:

- Re-send traffic if the bits are not set.
- Lose sessions if the bits are not set.
- Produce increased soft-errors if the bits are always set.

To deal with these problems you can override the normal operation of the TS-2800 and set it to either:

- Set the bits for non-routed traffic only.
- Always set the ARI and FCI bits.
- Never set the ARI and FCI bits.

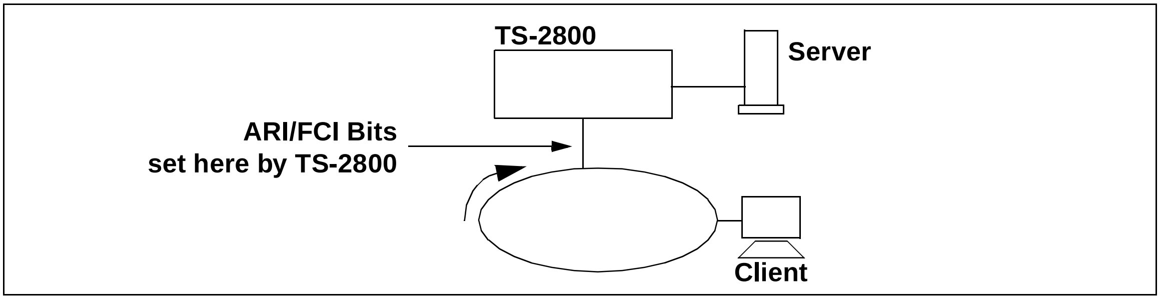


Figure E.1 - TS-2800 Sets Bits When Source-Routing Not Used

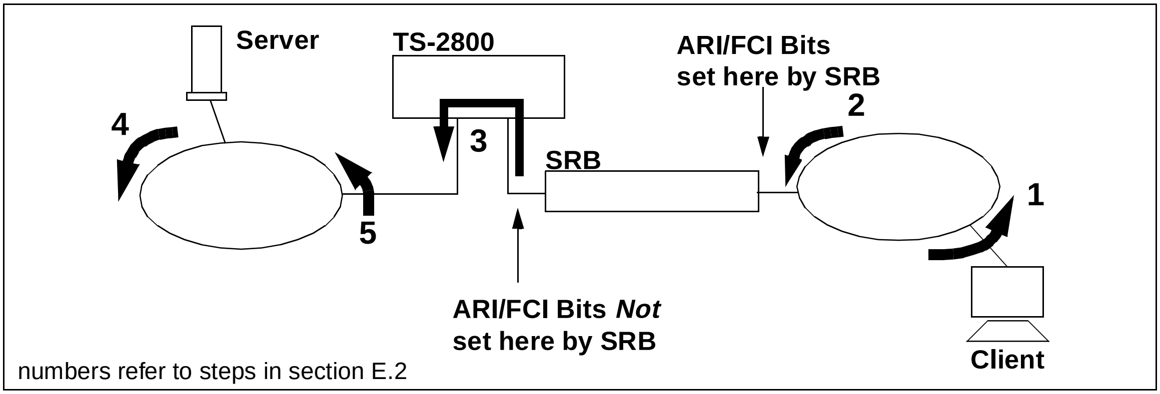


Figure E.2 - SRB Sets Bits When Source-Routing is Used

E.2 Back Frame Errors

The following process takes place as traffic moves in the network shown in Figure E.2. Numbers in Figure E.2 refer to the following steps:

1. The client sends frame to the server.
2. The SRB sets the ARI and FCI bits, acting as a proxy for the destination server.
3. The TS-2800 detects RIF in the frame and does not set the ARI and FCI bits.
4. The server responds and sends a data frame to the client.
5. The TS-2800 detects RIF in the frame and does not set the ARI and FCI bits.
6. Because the bits were not set, the server receives the frame as a back frame without the ARI and FCI bits being set. The server erroneously registers an error, as if the frame never made it to its destination, when in fact it has been forwarded on the network by the TS-2800.

E.3 SRB Configuration Examples

The following sections show various configurations that might cause problems. In these configurations are the following workstations and servers:

- Workstations **A**, **B**, and **C** have older drivers which improperly use the ARI and FCI bits.
- Workstations **D**, **E**, **F**, **G**, and **H** have new drivers which do not use the ARI and FCI bits.
- Server **I** has an older driver which improperly relies on the ARI and FCI bits.
- Servers **J** and **K** are FDX servers which do not use the ARI and FCI bits.

E.3.1 Example One: No SRBs

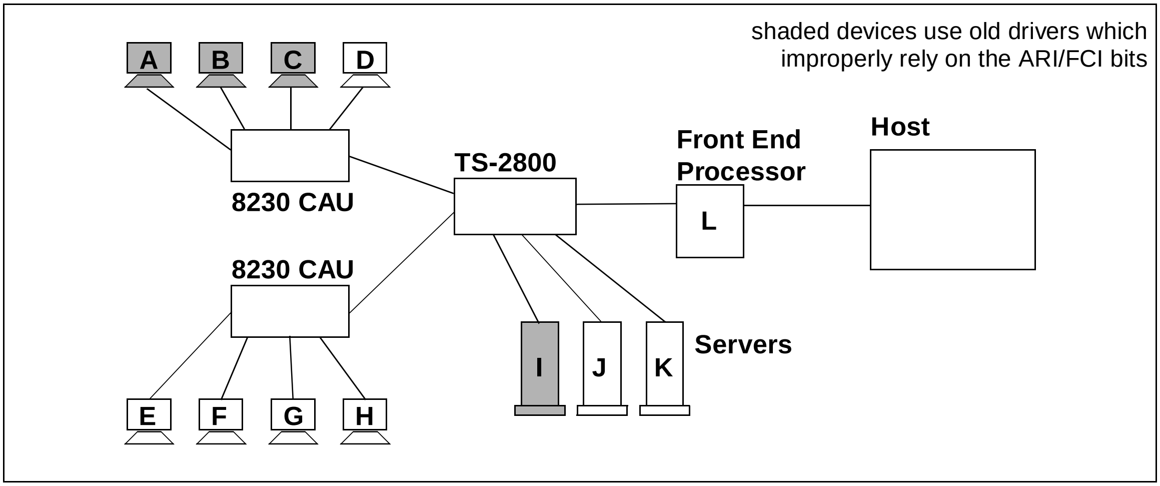


Figure E.3 - Example Configuration Without SRBs

In the configuration in Figure E.3 the TS-2800 always sets the bits when needed because there is no SRB in the network. All communications work except:

- IBM TCP/IP might report false errors.
- Windows NT Remote Program Load (only) fails.

E.3.2 Example Two: Two SRBs

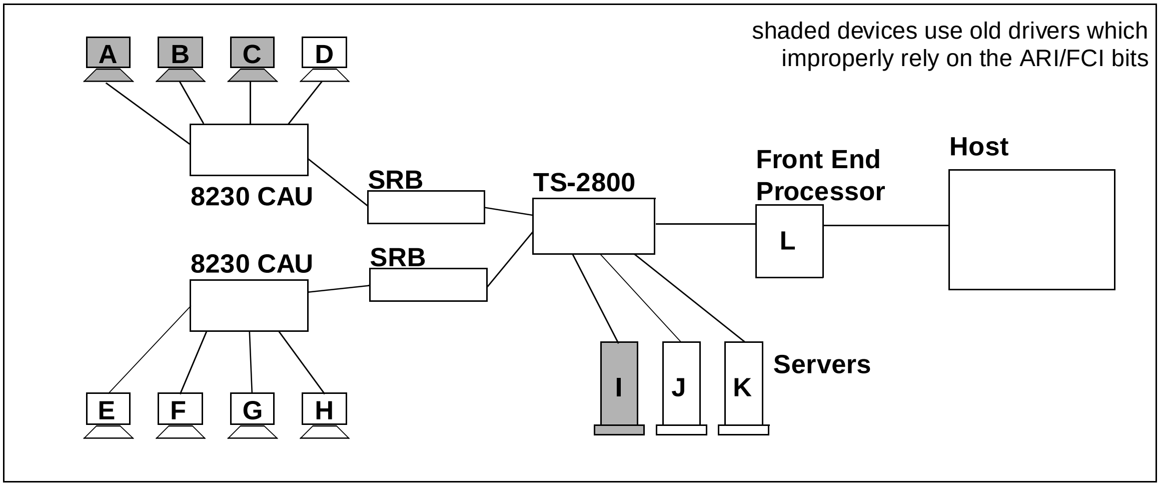


Figure E.4 - Example Configuration With Two SRBs

Table E.1 - Driver Considerations for Example Two

Source	Destination	Successful?	Comments
A, B, C, D	Anywhere except I	Yes	Traffic passes through the SRB, which sets the ARI and FCI bits.
E, F, G, H	Anywhere	Yes	These workstations have new drivers that do not use ARI and FCI bits.
I	A - H	***No***	This server has an old driver that improperly relies on the ARI and FCI bits. Update the driver.
I	J - L	Yes	Traffic does not go through the SRB so no RIF is present. The bits are never set.
J	Anywhere	Yes	FDX servers are unaffected by the ARI and FCI bit issue.
L	Anywhere	Yes	The Front End Processor is unaffected by the ARI and FCI bit issue.

E.3.3 Example Three: One SRB Bridging ARI/FCI Reliant Drivers

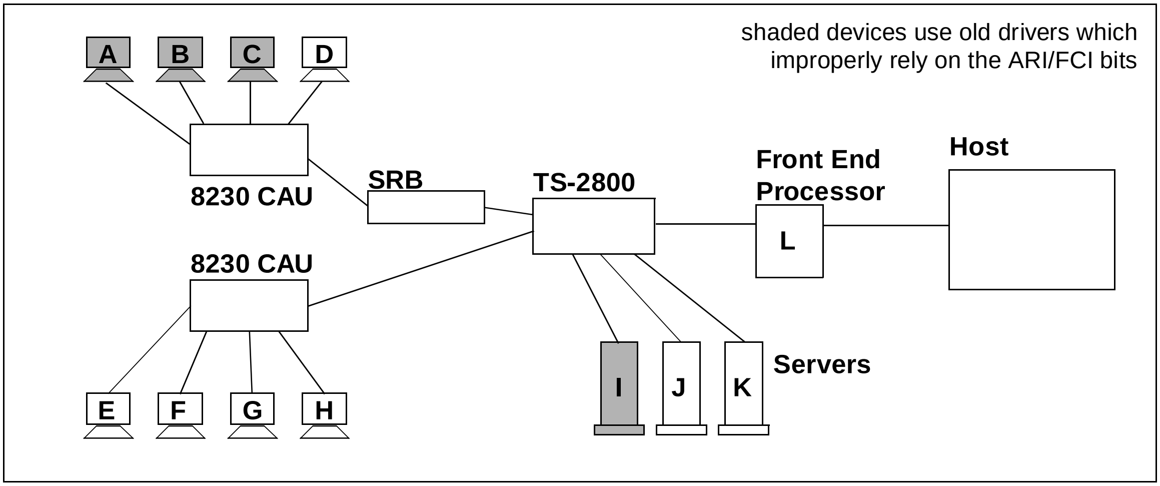


Figure E.5 - Example Configuration With One SRB

Table E.2 - Driver Considerations for Example Three

Source	Destination	Successful?	Comments
A, B, C, D	Anywhere except I	Yes	Traffic passes through the SRB, which sets the ARI and FCI bits.
E, F, G, H	Anywhere	Yes	These workstations have new drivers that do not use the ARI and FCI bits.
I	A - D	***No***	This server has an old driver that improperly relies on the ARI and FCI bits. Update the driver.
I	E-L	Yes	Traffic does not go through the SRB so no RIF is present. The bits are never set.
J, K	Anywhere	Yes	FDX servers are unaffected by the ARI and FCI bit issue.
L	Anywhere	Yes	The Front End Processor is unaffected by the ARI and FCI bit issue.

E.3.4 Example Four: One SRB Bridging Updated Drivers

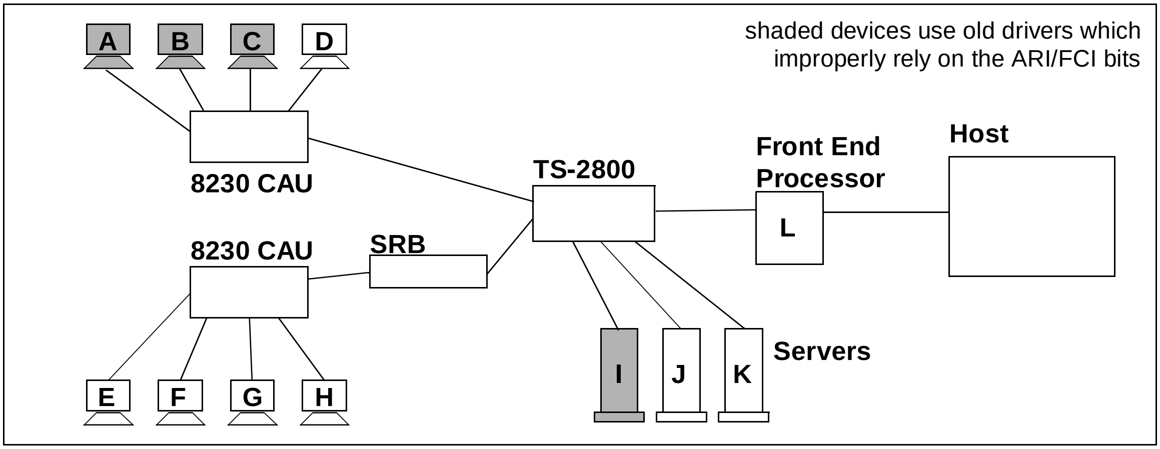


Figure E.6 - Example Configuration With Single SRB

Table E.3 - Driver Considerations for Example Four

Source	Destination	Successful?	Comments
A, B, C, D	A - D, I - L	Yes	Traffic does not go through the SRB so no RIF is present. The bits are never set.
A, B, C	E - H	***No***	These workstations have old drivers that improperly use the ARI and FCI bits. Need new drivers in A - C.
D	E - H	Yes	Will log false errors at D because TS-2800 never set the ARI and FCI bits.
E, F, G, H	Anywhere	Yes	These workstations have new drivers that do not use ARI and FCI bits.
I	E, F, G, H	***No***	This server has an old driver that improperly relies on the ARI and FCI bits. Update the driver.
I	A - D, I - L	Yes	Traffic does not go through the SRB so no RIF is present. The bits are never set.
J, K	Anywhere	Yes	FDX servers are unaffected by the ARI and FCI bit issue.
L	Anywhere	Yes	The Front End Processor is unaffected by the ARI and FCI bit issue.

ARI and FCI Bits

E.4 Setting the TS-2800

To prevent possible problems FORE recommends that you use the latest drivers in devices attached to your network. However, if you are encountering problems described in the previous examples, you can set the TS-2800 to either always set or never set the ARI and FCI bits on forwarded frames, as appropriate for the problems encounter at your site.

To control the way the TS-2800 sets the bits:

1. Select the **Configuration...** option on the Main Menu.
2. Select the **Token Ring Port Configuration...** option on the Configuration Menu.
3. Press **<Ctrl+F>**. The ARI / FCI Bits Options panel appears, as shown in Figure E.7.

```
                            ARI/FCI Bit Options
            MPC
Port     Chip Level    Current Setting             Default Setting
3-1         3.1        Always set                  Always set
3-2         3.1        Always set                  Always set
3-3         3.1        Always set                  Always set
3-4         3.1        Always set                  Always set
5-1         3.1        Always set                  Always set
5-2         3.1        Always set                  Always set
5-3         3.1        Always set                  Always set
5-4         3.1        Always set                  Always set
6-1         3.1        Always set                  Always set
6-2         3.1        Always set                  Always set
6-3         3.1        Always set                  Always set
6-4         3.1        Always set                  Always set
  Return      More     Change Port Setting     Change All Ports
                  Set non-routed only  Never set  Always set
              Change the ARI/FCI bit options for a single port
           Press <ESC> to cancel.  Press <ENTER> to confirm choice.
                   Press <CTRL><N> to return to Main Menu.
```

Figure E.7 - ARI / FCI Bit Options Panel

4. Select the **Change Port Setting** option. (If you want to change the bit setting option for all ports, select **Change All Ports**.)

5. Specify the port number of the port for which you want to modify the setting (if you did not select **`Change All Ports`**.)
6. Select the option for the port: **`Set non-routed only`**, **`Never set`**, or **`Always set`**.
7. Press **`<ENTER>`** to confirm the action and proceed.

After you confirm the changes, you can return to the Greeting panel by choosing the **`Return`** option.

Glossary

This glossary includes terms and definitions from the *IBM Dictionary of Computing* (New York; McGraw-Hill, Inc., 1994).

- The symbol (A) identifies definitions from the *American National Standard Dictionary for Information Systems*, ANSI X3.172-1990, copyright 1990 by the American National Standards Institute (ANSI). Copies can be purchased from the American National Standards Institute, 1430 Broadway, New York, New York 10018.
- The symbol (E) identifies definitions from the ANSI/EIA Standard-440-A, *Fiber Optic Terminology.*
- The symbol (I) identifies definitions from published parts of the *Information Technology Vocabulary,* developed by Subcommittee 1, Joint Technical Committee 1, of the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC JTC1/SC1).
- The symbol (T) identifies definitions from draft international standards, committee drafts, and working papers being developed by ISO/IEC JTC1/SC1.

The following cross-references are used in this glossary:

Contrast with:	This refers to a term that has an opposed or substantively different meaning.
Synonym for:	This indicates that the term has the same meaning as a preferred term, which was defined in its correct place in the glossary.
Synonymous with:	This is a backward reference from a defined term to all other terms that have the same meaning.
See:	This refers the reader to multiple-word terms that have the same last word.
See also:	This refers the reader to related terms that have a related, but not synonymous, meaning.

access unit - A unit that allows multiple attaching devices access to a Token Ring network at a central point such as a wiring closet or in an open work area. See *multistation access unit*.

active - (1) Able to communicate on the network. (2) Operational. (3) Pertaining to a node or device that is connected or is available for connection to another node or device. (4) Currently transmitting or receiving.

adapter - In a communicating device, a circuit card that, with its associated software and/or microcode, enables the device to communicate over the network.

adaptive switching mode - In a LAN switch, the capability to alternate automatically between Cut-Through switching mode and Store-and-Forward switching mode, based on user-specified soft-error thresholds. See also *Cut-Through switching mode* and *Store-and-Forward switching mode*.

address - In data communication, the unique code assigned to each device or workstation connected to a network.

address resolution - A method for mapping network layer addresses onto media-specific addresses. See also *Address Resolution Protocol (ARP).*

Address Resolution Protocol (ARP) - A protocol that dynamically maps between Internet addresses, baseband adapter addresses, X.25 addresses, and Token Ring adapter addresses on a local area network.

agent - In the client-server model, the part of the system that performs information preparation and exchange on behalf of a client or server application. See also *client-server model* and *network management station (NMS).*

AIX operating system - IBM's implementation of the UNIX operating system. See *UNIX operating system*.

American National Standards Institute (ANSI) - An organization consisting of producers, consumers, and general interest groups, that establishes the procedures by which accredited organizations create and maintain voluntary industry standards in the United States. (A)

ANSI - American National Standards Institute.

ARP - Address resolution protocol.

Asynchronous - Pertaining to two or more processes that do not depend upon the occurrence of a specific event such as a common timing signal. (T)

ATM - Asynchronous transfer mode.

attaching device - Any device that is physically connected to a network and can communicate over the network. See *ring attaching device.*

backbone - (1) In a local area network multiple-bridge ring configuration, a high-speed link to which the rings are connected by means of bridges or routers. A backbone can be configured as a bus or as a ring. (2) In a wide area network, a high-speed link to which nodes or data switching exchanges (DSEs) are connected.

backup path - In an Token Ring Network, an alternative path for signal flow through access units and their main ring path cabling. The backup path allows recovery of the operational portion of the network while problem determination procedures are being performed.

bandwidth - (1) The difference, expressed in hertz, between the highest and the lowest frequencies of a range of frequencies. For example, analog transmission by recognizable voice telephone requires a bandwidth of about 3000 hertz (3 kHz). (2) The bandwidth of an optical link designates the information-carrying capacity of the link and is related to the maximum bit rate that a fiber link can support.

Basic Input/Output System (BIOS) - Code that controls basic hardware operations, such as interactions with diskette drives, hard disk drives, and the keyboard.

baud - (1) A unit of signaling speed equal to the number of discrete conditions or signal events per second; for example, one baud equals one-half dot cycle per second in Morse code, one bit per second in a train of binary signals, and one 3-bit value per second in a train of signals each of which can assume one of eight different states. (A) (2) In asynchronous transmission, the unit of modulation rate corresponding to one unit interval per second; that is, if the duration of the unit interval is 20 milliseconds, the modulation rate is 50 baud. (A)

best-effort delivery - Unreliable connectionless delivery of datagrams in a network. Reliability at link levels is not provided.

BIOS - Basic Input / Output System.

BootP - Bootstrap Protocol.

bootstrap - (1) A sequence of instructions whose execution causes additional instructions to be loaded and executed until the complete computer program is in storage. (T) (2) A technique or device designed to bring itself into a desired state by means of its own action, for example, a machine routine whose first few instructions are sufficient to bring the rest of itself into the computer from an input device. (A)

bridge - (1) An attaching device that connects two LAN segments to allow the transfer of information from one LAN segment to the other. A bridge can connect the LAN segments directly by network adapters and software in a single device, or it can connect network adapters in two separate devices through software and use of a telecommunications link between the two adapters. (2) A functional unit that connects two LANs that use the same logical link control (LLC) procedures but may use the same or different medium access control (MAC) procedures. (T) Contrast with *gateway* and *router*.

A bridge connects networks or systems of the same or similar architectures, whereas a gateway connects networks or systems of different architectures.

bridge ID - The bridge label combined with the adapter address of the adapter connecting the bridge to the LAN segment with the lowest LAN segment number; it is used by the automatic single-route broadcast function in bridge programs.

bridge number - The bridge identifier that the user specifies in the bridge program configuration file. The bridge number distinguishes among parallel bridges. See also *parallel bridge*.

bridging - The forwarding of a frame from one local area network segment to another. The destination is based upon the medium access control (MAC) sublayer address encoded in the destination address field of the frame header.

broadband local area network (LAN) - A local area network (LAN) in which information is encoded, multiplexed, and transmitted through modulation of carriers. (T)

broadcast - (1) Transmission of the same data to all destinations. (T) (2) Simultaneous transmission of the same data to more than one destination. (3) A packet delivery system where a copy of a given packet is given to all hosts attached to the network. Broadcast can be implemented in hardware (Ethernet, for example) or software. Contrast with *multicast.*

BTU - British thermal unit.

buffer - (1) A portion of storage used to hold input or output data temporarily. (2) A routine or storage used to compensate for a difference in data rate or time of occurrence of events, when transferring data from one device to another. (A)

byte - (1) A string that consists of a number of bits, treated as a unit, and representing a character. (T) (2) A binary character operated upon as a unit and usually shorter than a computer word. (A) (3) A group of 8 adjacent binary digits that represent one EBCDIC character. (4) See *n-bit byte*. See also *bit*.

C - Celsius.

cable segment - A section of cable between components or devices on a network. A segment can consist of a single patch cable, multiple patch cables connected together, or a combination of building cable and patch cables connected together. See *LAN segment*, *ring segment*.

channel-attached - (1) Pertaining to the connection of devices directly by data channels (I/O channels) to a computer. (2) Pertaining to devices connected to a controlling unit by cables rather than by telecommunication lines. See also *local*. Contrast with *telecommunication-attached*.

client - (1) A user. (2) A functional unit that receives shared services from a server. (T)

client-server model - A common way to describe network services and the model user processes (programs) of those services.

command - (1) A request for performance of an operation or execution of a program. (2) A character string from a source external to a system that represents a request for system action.

community - An administrative relationship between Simple Network Management Protocol (SNMP) entities.

community name - An opaque string of octets identifying a community.

configuration - (1) The manner in which the hardware and software of an information processing system are organized and interconnected. (T) (2) The devices and programs that make up a system, subsystem, or network. (3) The task of defining the hardware and software characteristics of a system or subsystem. (4) See also *system configuration*.

configuration management - The monitoring and control of information required to identify physical and logical network resources, their states, and their interdependencies. Services include customization, network resource inventory, and assistance to other network management disciplines.

configuration parameters - Variables in a configuration definition, the values of which characterize the relationship of a product, such as a bridge, to other products in the same network.

congestion - See *network congestion*.

connect - In a LAN, to physically join a cable from a station to an access unit or network connection point. Contrast with *attach*.

connection - (1) In TCP/IP, the path between two protocol applications that provides reliable data stream delivery service. In Internet, a connection extends from a TCP application on one system to a TCP application on another system. (2) The path between two protocol functions, usually located in different machines, that provides reliable data delivery service.

connectivity - (1) The capability of a system or device to be attached to other systems or devices without modification. (T) (2) The capability to attach a variety of functional units without modifying them.

connector - A means of establishing electrical flow.

controller - A unit that controls input/output operations for one or more devices.

CRC - Cyclic redundancy check.

cursor - (1) A movable, visible mark used to indicate the position at which the next operation will occur on a display surface. (2) A unique symbol that identifies a character position in a screen display, usually the character position at which the next character to be entered from the keyboard will be displayed.

customize - Defining and activating a configuration, and changing system parameters to meet user requirements.

Cut-Through switching mode - In LAN switches, an architecture that allows a switch to transmit a frame out of the destination port after it has received the destination address header. The switch does not have to wait for the whole frame to be received in order to begin transmission. This cuts down drastically on latency. Contrast with *Store-and- Forward switching mode*.

data terminal equipment (DTE) - (1) That part of a data station that serves as a data source, data sink, or both. (I) (A) (2) Equipment that sends or receives data, or both.

data terminal ready (DTR) - A signal to the modem used with the EIA 232 protocol.

data transfer rate - The average number of bits, characters, or blocks, per unit time passing between corresponding equipment in a data transmission system. (I) See *actual data transfer rate*, *effective transfer rate*. The rate is expressed in bits, characters, or blocks per second, minute, or hour.

database - A collection of data with a given structure for accepting, storing, and providing, on demand, data for multiple users. (T)

datagram - (1) In packet switching, a self-contained packet, independent of other packets, that carries information sufficient for routing from the originating data terminal equipment (DTE) to the destination DTE without relying on earlier exchanges between the Dates and the network. (I) (2) In TCP/IP, the basic unit of information passed across the Internet environment. A datagram contains a source and destination address along with the data. An Internet Protocol (IP) datagram consists of an IP header followed by the transport layer data. See also *packet* and *segment*. (3) A particular type of information encapsulation, at the network layer of the adapter protocol. No explicit acknowledgment for the information is sent by the receiver. Transmission relies on the best effort of the link layer. See also *best-effort delivery*.

default - Pertaining to an attribute, value, or option that is assumed when none is explicitly specified. (I)

default value - A value assumed when no value has been specified.

destination - Any point or location, such as a node, station, or particular terminal, to which information is to be sent.

destination address - A field in the medium access control (MAC) frame that identifies the physical location to which information is to be sent. Contrast with *source address*.

device - (1) An input/output unit such as a terminal, display, printer, or telephone. See also *attaching device*. (2) A physical entity attached to the network that requires data transportation service.

device identifier (ID) - An 8-bit identifier that uniquely identifies a physical I/O device.

diagnostics - The process of investigating the cause or the nature of a condition or problem in a product or system.

digital - (1) Pertaining to data in the form of digits. (A) Contrast with *analog*. (2) Pertaining to data consisting of numerical values or discrete units.

directory - A table of identifiers and references to the corresponding items of data. (I) (A)

directory service (DS) - An application service element that translates the symbolic names used by application processes into the complete network addresses used in an OSI environment. (T)

directory services (DS) - A control point component of an APPN node that maintains a directory and provides the location of network resources.

disable - To make nonfunctional.

disabled - (1) Pertaining to a state of a processing unit that prevents the occurrence of certain types of interruptions. (2) Pertaining to the state in which a transmission control unit or audio response unit cannot accept incoming calls on a line. (2) Nonoperational or nonfunctional.

domain - That part of a computer network in which the data processing resources are under common control. (T)

DOS - Disk Operating System.

DRAM - Dynamic random access memory.

DTE - Data terminal equipment. (A)

DTR - Data terminal ready.

duplex - Pertaining to communication in which data can be sent and received at the same time. Synonymous with *full-duplex*. Contrast with *half-duplex*.

EEPROM - Electrically erasable programmable read-only memory.

EIA - Electronic Industries Association.

EIA-232 - In data communications, a specification of the Electronic Industries Association (EIA) that defines the interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE), using serial binary data interchange.

electromagnetic interference - A disturbance in the transmission of data on a network resulting from the magnetism created by a current of electricity.

EIA unit - A unit of measure equal to 4.45 cm (1.75 in.).

EMC - Electromagnetic compatibility.

emulation - (1) The use of a data processing system to imitate another data processing system, so that the imitating system accepts the same data, executes the same programs, and achieves the same results as the imitated system. Emulation is usually achieved by means of hardware or firmware. (T) (2) The use of programming techniques and special machine features to permit a computing system to execute programs written for another system.

enable - To make functional.

enabled - (1) On a LAN, pertaining to an adapter or device that is active, operational, and able to receive frames from the network. (2) Pertaining to the state in which a transmission control unit or an audio response unit can accept incoming calls on a line.

end node - (1) In SNA, a node in a APPN network that can be a source or target node but does not provide any routing or session services to any other node. (2) A type 2.1 node that does not provide any intermediate routing or session services to any other node.

equipment rack - Synonym for *rack*.

error - A discrepancy between a computed, observed, or measured value or condition and the true, specified, or theoretically correct value or condition. (I) (A) Contrast with *failure* and *fault*.

Ethernet - (1) A 10-Mbps baseband local area network that allows multiple stations to access the transmission medium at will without prior coordination, avoids contention by using carrier sense and deference, and resolves contention by collision detection and transmission. Ethernet uses carrier sense multiple access with collision detection (CSMA/CD). (2) A passive coaxial cable whose interconnections contain devices or components, or both, that are all active. It uses CSMA/CD technology to provide a best-effort delivery system.

explorer frame - See *explorer packet*.

explorer packet - A packet, generated by the source host that traverses the entire Token Ring network gathering information on the possible paths the host might use.

F - Fahrenheit.

failure - The termination of the ability of a functional unit to perform its required function. (I) (A) - An uncorrected hardware error. Failures are either recoverable or not recoverable by the software or the operator. The operator is always notified when failures occur. Contrast with *error*.

fault - An accidental condition that causes a functional unit to fail to perform its required function. (I) (A)

FC - See *frame control character*.

FCS - See *frame check sequence*.

FDX - See *full-duplex*.

fiber - (1) Dielectric material that guides light; waveguide (see *multimode* and *single-mode optical fiber*). See *optical fiber.*

fiber optics - The branch of optical technology concerned with the transmission of radiant power through fibers made of transparent materials such as glass, fused silica, and plastic. (E)

Telecommunication applications of fiber optics use optical fibers. Either a single discrete fiber or a nonspatially aligned fiber bundle can be used for each information channel. Such fibers are often called optical fibers to differentiate them from fibers used in noncommunication applications.

field - On a data medium or a storage, a specified area used for a particular class of data; for example, a group of character positions used to enter or display wage rates on a screen. (T)

file - A named set of records stored or processed as a unit. (T)

file name - (1) A name assigned or declared for a file. (2) The name used by a program to identify a file.

File Transfer Protocol (FTP) - The Internet protocol (and program) used to transfer files between hosts. It is an application layer protocol in TCP/IP that uses Telnet and TCP protocols to transfer bulk-data files between machines or hosts.

filter - A device or program that separates data, signals, or material in accordance with specified criteria. (A)

flow control - In SNA, the process of managing the rate at which data traffic passes between components of the network. The purpose of flow control is to optimize the flow rate of message units with minimum congestion in the network, that is, to neither overflow the buffers at the receiver or at intermediate routing nodes, nor leave the receiver waiting for more message units.

forward - A switch feature that temporarily redirects incoming calls. The incoming calls are redirected from the originally dialed phoneset to another destination. The other destination has previously been defined to the switch by the party associated with the phoneset.

frame - (1) In Open Systems Interconnection architecture, a data structure pertaining to a particular area of knowledge and consisting of slots that can accept the values of specific attributes and from which inferences can be drawn by appropriate procedural attachments. Synonymous with *schema*. (T) (2) A data structure that consists of fields, predetermined by a protocol, for the transmission of user data and control data. The composition of a frame, especially the number and types of fields, may vary according to the type of protocol. Synonymous with *transmission frame*. (T) (3) The unit of transmission in some local area networks, including the Token Ring Network; it includes delimiters, control characters, information, and checking characters. (4) In SDLC, the vehicle for every command, every response, and all information that is transmitted using SDLC procedures. (5) A packet that is transmitted over a serial line or LANs. See also *packet*.

frame check sequence - (1) A character determined by the data present within the transmission frame and appended to the transmission frame to allow detection of transmission errors. (T) (2) A field immediately preceding the closing flag sequence of a frame that contains a bit sequence checked by the receiver to detect transmission errors.

frame control character - A data control character that defines the type of transmission frame and certain control functions.

FTP - File Transfer Protocol.

full-duplex - Synonym for *duplex*.

gateway - (1) A functional unit that interconnects two computer networks with different network architectures. A gateway connects networks or systems of different architectures. A bridge interconnects networks or systems with the same or similar architectures. (T) (2) A computer that attaches two or more networks and routes data packets to their destination through those networks. Contrast with *bridge* and *router.* (3) The original Internet term for router or IP router.

group - (1) A set of related records that have the same value for a particular field in all records. (2) A collection of users who can share access authorities for protected resources. (3) A list of names that are known together by a single name.

half-duplex - In data communication, pertaining to transmission in only one direction at a time. Contrast with *duplex*.

hardware - All or part of the physical components of an information processing system, such as computers or peripheral devices. (T) (A)

HDX - See *half-duplex*.

header - (1) System-defined control information that precedes user data. (2) The portion of a message that contains control information for the message such as one or more destination fields, name of the originating station, input sequence number, character string indicating the type of message, and priority level for the message.

hello - An internet protocol used by a group of cooperative, trusting routers to allow them to discover minimal delay routes.

host - (1) In Internet terminology, an end system. (2) In interpretive execution mode, the real machine as opposed to the virtual or interpreted machine (the guest).

host system - (1) A data processing system used to prepare programs and operating environments for use on another computer or controller. (2) The data processing system to which a network is connected and with which the system can communicate. (3) The controlling or highest-level system in a data communication configuration.

hr - Hour, 60 minutes.

Hz - A unit of frequency equal to one cycle per second.

IBM Disk Operating System (DOS) - A disk operating system based on MS-DOS** that operates with all IBM-compatible personal computers.

IBM Token Ring Network - A baseband local area network with a ring topology that passes tokens from Token Ring adapter to Token Ring adapter.

identifier (ID) - (1) One or more characters used to identify or name a data element and possibly to indicate certain properties of that data element. (A) (2) A sequence of bits or characters that identifies a program, device, or system to another program, device, or system.

IEC - International Electrotechnical Commission

IEEE - Institute of Electrical and Electronics Engineers.

in - Inch, inches.

inactive - (1) Not operational. (2) Pertaining to a node or device not connected or not available for connection to another node or device. (3) Pertaining to a station that is only repeating frames or tokens, or both.

initialization - (1) The operations required for setting a device to a starting state, before the use of a data medium, or before implementation of a process. (T) (2) Preparation of a system, device, or program for operation. (3) To set counters, switches, addresses, latches, or storage contents to 0 or to other starting values at the beginning of, or at the prescribed points in, a computer program or process.

insert - To make an attaching device an active part of a LAN.

interface - (1) A shared boundary between two functional units, defined by functional characteristics, signal characteristics, or other characteristics, as appropriate. The concept includes the specification of the connection of two devices having different functions. (T) (2) Hardware, software, or both, that links systems, programs, or devices.

International Organization for Standardization - An organization of national standards bodies from various countries established to promote development of standards to facilitate international exchange of goods and services, and develop cooperation in intellectual, scientific, technological, and economic activity.

Internet Engineering Task Force (IETF) - One of the task forces of the Internet Architecture Board (IAB) responsible for solving short-term engineering needs of the Internet.

Internet Packet Exchange (IPX) - The routing protocol used to connect Novell's servers or any workstation or router that implements IPX with other workstations. Although similar to TCP / IP, it uses different packet formats and terminology. See also *TCP/IP* and *Xerox Network Services (XNS)*.

Internet Protocol - (1) A protocol that routes data through a network or interconnected networks. IP acts as an interface between the higher logical layers and the physical network. However, this protocol does not provide error recovery, flow control, or guarantee the reliability of the physical network. IP is a connectionless protocol. (2) A protocol used to route data from its source to its destination in an Internet environment.

IP - See *Internet Protocol*.

IPX - Internet Packet Exchange.

IP address - A 32-bit address assigned to devices or hosts in an IP internet that maps to a physical address. The IP address is composed of a network and host portion.

ISO - See *International Organization for Standardization*.

jack - A connecting device to which a wire or wires of a circuit can be attached and that is arranged for insertion of a plug.

jumper cable - Synonym for *patch cable*.

KB - (1) Kilobyte. (2) For processor storage and real and virtual memory, 1024 bytes. (3) For disk storage capacity and transmission rates, 1000 bytes.

Kb - Kilobit, 1000 bits.

Kcal - Kilocalorie, 1000 calories.

Kg - Kilogram, 1000 grams.

KVA - Kilovolt-ampere, 1000 volt-amperes.

KW - Kilowatt, 1000 watts.

LAN - See *local area network*

LAN segment - (1) Any portion of a LAN (for example, a single bus or ring) that can operate independently but is connected to other parts of the establishment network via bridges. (2) An entire ring or bus network without bridges. See *cable segment, ring segment*.

LAN Segment Number - The identifier that uniquely distinguishes a LAN segment in a multi-segment LAN.

latency - The time interval between the instant at which an instruction control unit initiates a call for data and the instant at which the actual transfer of data begins. Synonymous with *waiting time*. (T) See also *ring latency.*

lb - Pound, pounds.

LBP - Logical bridge port.

link connection - (1) All physical components and protocol machines that lie between the communicating link stations of a link. (2) The physical equipment providing two-way communication between one link station and one or more other link stations; for example, a telecommunication line and data circuit-terminating equipment (DCE). Synonymous with *data circuit*. (3) In SNA, the physical equipment providing two-way communication and error correction and detection between one link station and one or more other link stations.

link-attached - Pertaining to devices that are physically connected by a telecommunication line. Synonymous with *remote.*

LLC - See *logical link control*.

lobe - (1) In a star/ring network configuration, two pairs of conductors that provide separate send and receive paths between a wiring concentrator and a network port, such as a wall outlet. (2) In the Token Ring Network, the section of cable that attaches a device to an access unit. The cable can consist of several segments.

local - Pertaining to a device accessed directly without use of a telecommunication line. Synonym for *channel-attached*. Contrast with *remote*.

local area network - (1) Physical network technology that transfers data at high speed over short distances. (2) A network in which a set of devices are connected to one another for communication and that can be connected to a larger network. See also *Token Ring* and *Ethernet.* (3) A computer network located on a user's premises within a limited geographical area. Communication within a local area network is not subject to external regulations; however, communication across the LAN boundary may be subject to some form of regulation. (T) Contrast with *wide area network (WAN).*

local directory database - That set of resources (LUs) in the network known at a particular node. The resources included are all those in the node's domain as well as any cache entries.

log - (1) To record; for example, to log all messages on the system printer. (2) A record of events that have occurred.

logical link control - (1) The data link control (DLC) LAN sublayer that provides two types of (DLC) operation. The first type is connectionless service, which allows information to be sent and received without establishing a link. The LLC sublayer does not perform error recovery or flow control for connectionless service. The second type is connection-oriented service, which requires the establishment of a link prior to the exchange of information. Connection-oriented service provides sequenced information transfer, flow control, and error recovery. (2) A sublayer of the OSI link layer that defines formats and protocols for exchanging frames between LLC sublayers attached to a local area network. It has provisions that ensure that error-free, nonduplicated, properly ordered frames are delivered to the appropriate data-link user. See also *bridge* and *medium access control (MAC).*

logical link control protocol - In a local area network, the protocol that governs the exchange of transmission frames between data stations independently of how the transmission medium is shared. (T) The LLC protocol was developed by the IEEE 802 committee and is common to all LAN standards.

logical link control protocol data unit - A unit of information exchanged between link stations in different nodes. The LLC protocol data unit contains a destination service access point (DSAP) address, a source service access point (SSAP), a control field, and user data. See *logical link control (LLC).*

logical link control sublayer - One of two sublayers of the ISO Open Systems Interconnection data link layer (which corresponds to the SNA data link control layer), proposed for LANs by the IEEE Project 802 Committee on Local Area Networks and the European Computer Manufacturers Association (ECMA). It includes those functions unique to the particular link control procedures that are associated with the attached node and are independent of the medium; this allows different logical link protocols to coexist on the same network without interfering with each other. The LLC sublayer uses services provided by the medium access control (MAC) sublayer and provides services to the network layer.

LSB - Least significant bit.

mA - Milliampere, .001 amperes.

MAC - See *medium access control*.

MAC protocol - See *medium access control (MAC) protocol*.

management information base - A collection of objects that can be accessed by means of a network management protocol.

management station - The system responsible for managing all, or a portion of, a network. The management station talks to network management agents that reside in the managed node by means of a network management protocol such as Simple Network Management Protocol (SNMP). Synonymous with *network management station (NMS)*.

MB - (1) Megabyte (2) For processor storage and real and virtual memory, 1048576 bytes. (3) For disk storage capacity and transmission rates, 1000000 bytes.

Mb - Megabit. One million bits.

Mbps - One million bits per second.

medium access control - (1) The sublayer of the data link control layer that supports media-dependent functions and uses the services of the physical layer to provide services to the logical link control sublayer. The MAC sublayer includes the medium-access port. See *logical link control*. (2) For local area networks, the method of determining which device has access to the transmission medium at any time.

medium access control frame - In the Token Ring Network: (1) An address resolution request frame that has the unique part of a destination address and an “all rings” address. A sender issues this request to determine the ring where the destination station is located and whether the node is active. (2) Response from an active destination node to the requesting source node, providing the source node with the complete address and ring number of the destination node.

medium access control procedure - In a local area network, the part of the protocol that governs access to the transmission medium independently of the physical characteristics of the medium, but takes into account the topological aspects of the network, in order to enable the exchange of data between data stations.

medium access control protocol - (1) In a local area network, the protocol that governs access to the transmission medium, taking into account the topological aspects of the network, in order to enable the exchange of data between data stations. (T) See also *logical link control protocol*. (2) The LAN protocol sublayer of data link control (DLC) protocol that includes functions for adapter address recognition, copying of message units from the physical network, and message unit format recognition, error detection, and routing within the processor.

medium access control segment - An individual LAN communicating through the medium access control layer within this network.

medium access control service data unit - In a medium access control frame, the logical link control protocol data unit (LPDU) and the routing information field (if the destination station is located on a different ring).

medium access control sublayer - In a local area network, the part of the data link layer that applies a medium access method. The MAC sublayer supports topology-dependent functions and uses the services of the physical layer to provide services to the logical link control sublayer. (T)

medium access control subvector - A group of related fields within a medium access control (MAC) major vector.

medium access control vector - The medium access control frame information field.

memory - All of the addressable storage space in a processing unit and other internal storages that is used to execute instructions. (T)

MIB - (1) Management information base. (2) MIB module.

microcode - (1) One or more microinstructions. (2) A code, representing the instructions of an instruction set, that is implemented in a part of storage that is not program-addressable. (3) To design, write, and also test one or more microinstructions.

The term microcode represents microinstructions used in a product as an alternative to hard-wired circuitry to implement functions of a processor or other system component. The term microprogram means a dynamic arrangement of one or more groups of microinstruction for execution to perform a certain function.

mm - Millimeter, millimeters.

modem (modulator/demodulator) - (1) A functional unit that modulates and demodulates signals. One of the functions of a modem is to enable digital data to be transmitted over analog transmission facilities. (T) (A) (2) A device that converts digital data from a computer to an analog signal that can be transmitted in a telecommunication line, and converts the analog signal received to data for the computer.

monitor - (1) A device that observes and records selected activities within a data processing system for analysis. Possible uses are to indicate significant departure from the norm, or to determine levels of utilization of particular functional units. (T) (2) Software or hardware that observes, supervises, controls, or verifies operations of a system. (A) (3) In a Token Ring network, the function required to initiate the transmission of a token on the ring and to provide soft-error recovery in case of lost tokens, circulating frames, or other difficulties. The capability is present in all ring stations.

MS - Management services.

MSAU - Multistation access unit.

MSDU - See *medium access control services data unit*.

MSB - Most significant bit.

MTU - Maximum transmission unit.

multicast - (1) Transmission of the same data to a selected group of destinations. (T) (2) A special form of broadcast where copies of the packet are delivered to only a subset of all possible destinations. Contrast with *broadcast*.

multimode optical fiber - A graded-index or step-index optical fiber that allows more than one bound mode to propagate. (E) Contrast with *single-mode optical fiber.*

multistation access unit - In the Token Ring Network, a wiring concentrator that can connect up to eight lobes to a ring.

NetBIOS - Network Basic Input/Output System. An operating system interface for application programs used on personal computers that are attached to the Token Ring Network. See also *BIOS*.

NetView - A host-based IBM licensed program that provides communication network management (CNM) or communications and systems management (C&SM) services.

network - (1) An arrangement of nodes and connecting branches. (T) (2) A configuration of data processing devices and software connected for information interchange. (3) A signal path connecting input/output devices to a system. A network can consist of multiple LAN segments connected together with bridging products. See ring (network). (4) The interconnection of two or more subnets.

network administrator - A person who manages the use and maintenance of a network.

network congestion - An undesirable overload condition caused by traffic in excess of what a network can handle.

network identifier - A 1- to 8-byte customer-selected name or an 8-byte registered name that uniquely identifies a specific subnetwork.

network management - The process of planning, organizing, and controlling a communications-oriented system.

network management station - The system responsible for managing a network or a portion of a network. The NMS talks to network management agents, that reside in the managed nodes, by means of a network management protocol. See also *agent*.

network manager - A program or group of programs that is used to monitor, manage, and diagnose the problems of a network.

network operator - (1) A person or program responsible for controlling the operation of all or part of a network. (2) In a multiple-domain network, a person or program responsible for controlling all domains.

network wiring closet - See *wiring closet*.

NIC - Network Information Center.

NMS - See *network management station*.

node - (1) In a network, a point at which one or more functional units connect channels or data circuits. (I) (2) In network topology, the point at an end of a branch. (T) (3) The representation of a state or an event by means of a point on a diagram. (A) (4) In a tree structure, a point at which subordinate items of data originate. (A) (5) An end point of a link or a junction common to two or more links in a network. Nodes can be processors, communication controllers, cluster controllers, or terminals. Nodes can vary in routing and other functional capabilities.

NVRAM - Nonvolatile random access memory.

OC3 - Optical Carrier 3, where 3 means 3 times the basic STS-1 (51.84 Mbps) building block rate.

offline - (1) Pertaining to the operation of a functional unit that takes place either independently of, or in parallel with, the main operation of a computer. (T) (2) Neither controlled by, nor communicating with, a computer. Contrast with *online*.

online - (1) Pertaining to the operation of a functional unit when under the direct control of the computer. (T) (2) Pertaining to a user's ability to interact with a computer. (A) (3) Pertaining to a user's access to a computer via a terminal. (A) (4) Controlled by, or communicating with, a computer. Contrast with *offline*.

open - (1) To make an adapter ready for use. (2) A break in an electrical circuit. (3) To prepare a file for processing.

operating system - Software that controls the execution of programs and that may provide services such as resource allocation, scheduling, input/output control, and data management. Although operating systems are predominantly software, partial hardware implementations are possible. (T)

operation - (1) A defined action, namely, the act of obtaining a result from one or more operands in accordance with a rule that completely specifies the result for any permissible combination of operands. (A) (2) A program step undertaken or executed by a computer; for example, addition, multiplication, extraction, comparison, shift, transfer. The operation is usually specified by the operator part of an instruction. (A) (3) An action performed on one or more data items, such as adding, multiplying, comparing, or moving.

optical cable - A fiber, multiple fibers, or a fiber bundle in a structure built to meet optical, mechanical, and environmental specifications. (E)

optical fiber - Any filament made of dielectric materials that guides light, regardless of its ability to send signals. (E) See also *fiber optics*.

option - (1) A specification in a statement that can be used to influence the execution of the statement. (2) A hardware or software function that can be selected or enabled as part of a configuration process. (3) A piece of hardware (such as a network adapter) that can be installed in a device to modify or enhance device function.

OS - See *operating system*.

packet - (1) In data communication, a sequence of binary digits, including data and control signals, that is transmitted and switched as a composite whole. (I) (2) Synonymous with *data frame*. Contrast with *frame*.

packet internet groper - A program used in TCP/IP networks to test the ability to reach destinations by sending the destinations an Internet Control Message Protocol (ICMP) echo request and waiting for a reply. The term, PING, is used as a verb.

panel - A formatted display of information that appears on a display screen.

parallel - (1) Pertaining to a process in which all events occur within the same interval of time, each handled by a separate but similar functional unit; for example, the parallel transmission of the bits of a computer word along the lines of an internal bus. (T) (2) Pertaining to concurrent or simultaneous operation of two or more devices or to concurrent performance of two or more activities in a single device. (A) (3) Pertaining to concurrent or simultaneous occurrence of two or more related activities in multiple devices or channels. (4) Pertaining to the simultaneity of two or more processes. (5) Pertaining to the simultaneous processing of the individual parts of a whole, such as the bits of a character and the characters of a word, using separate facilities for the various parts. (A) (6) Contrast with *serial*.

parallel bridge - One of the two or more bridges that connect the same two LAN segments in a network.

parameter - (1) A variable that is given a constant value for a specified application and that may denote the application. (I) (A) (2) An item in a menu or for which the user specifies a value or for which the system provides a value when the menu is interpreted. (3) Data passed between programs or procedures.

parity - (1) A transmission error-checking scheme in which an extra bit is added to some unit of data, usually a byte, in order to make the total number of one bits even or odd. For the AEA feature, odd, even, mark, space, or no-parity coding is supported. No-parity means that no parity bit is sent or expected. Mark and space mean that the parity position is always set to one or zero, respectively, and that received parity is not checked. (2) The state of being either even-numbered or odd-numbered.

parity (even) - A condition when the sum of all of the digits in an array of binary digits is even.

parity (odd) - A condition when the sum of all of the digits in an array of binary digits is odd.

password - In computer security, a string of characters known to the computer system and a user, who must specify it to gain full or limited access to a system and to the data stored within it.

patch cable - A length of cable with data connectors at both ends that is normally used to interconnect two sections of building cable at a patch panel or to connect a product to the building cable. Synonymous with *jumper cable*.

patch panel - An organized concentration of cable terminations, usually mounted in a flat panel, that facilitates the interconnection of communication cables.

path - (1) In a network, any route between any two nodes. A path may include more than one branch. (T) (2) The route traversed by the information exchanged between two attaching devices in a network. (3) The series of transport network components (path control and data link control) that are traversed by the information exchanged between two network accessible units (NAUs). A path consists of a virtual route and its route extension, if any.

path control - The function that routes message units between network accessible units in the network and provides the paths between them. It converts the basic information units (BIUs) from transmission control (possibly segmenting them) into path information units (PIUs) and exchanges basic transmission units containing one or more PIUs with data link control. Path control differs by node type: some nodes (APPN nodes, for example) use locally generated addresses or session identifiers for routing, and others (subarea nodes) use network addresses for routing.

path cost - A value, maintained by each bridge program that uses the automatic single-route bridge function, that indicates to the automatic single-route bridge function the relative length of the path between the root bridge and a designated or standby bridge.

PC - (1) See *path control*. (2) See *personal computer.*

personal computer - (1) A microcomputer primarily intended for stand-alone use by an individual. (T) (2) A desk-top, floor-standing, or portable microcomputer that usually consists of a system unit, a display monitor, a keyboard, one or more diskette drives, internal fixed-disk storage, and an optional printer. PCs are designed primarily to give independent computing power to a single user and are inexpensively priced for purchase by individuals or small businesses.

physical - (1) Pertaining to actual implementation or location as opposed to conceptual content or meaning. (A) (2) Pertaining to the representation and storage of data on a medium such as magnetic disk, or to a description of data that depends on physical factors such as length of data elements, records, or pointers. (A) (3) Contrast with *logical.* (A)

physical circuit - A circuit established without multiplexing. See also *data circuit*. Contrast with *virtual circuit*.

PING - See *packet internet groper.*

plug - (1) A connector designed to insert into a receptacle or socket. (2) To insert a connector into a receptacle or socket.

pointer - (1) An identifier that indicates the location of an item of data. (A) (2) A data element that indicates the location of another data element. (T) (3) A physical or symbolic identifier of a unique target.

port - (1) An access point for data entry or exit. (2) A connector on a device to which cables for other devices such as display stations and printers are attached. Synonymous with *socket*. (3) The representation of a physical connection to the link hardware. A port is sometimes referred to as an adapter, however, there can be more than one port on an adapter. A single DLC process can control one or more ports. (4) An abstraction used by transport protocols to distinguish among multiple destinations within a host machine.

port number - The identification of an application entity to the transport service in IP.

POST - See *power-on self-test*.

power-on self-test - A series of diagnostic tests that are run automatically by a device when the power is switched on.

primary path - The channel an operation first uses.

problem determination - The process of determining the source of a problem; for example, a program component, a machine failure, telecommunication facilities, user or contractor-installed programs or equipment, an environment failure such as a power loss, or user error.

processor - In a computer, a functional unit that interprets and executes instructions. A processor consists of at least an instruction control unit and an arithmetic and logic unit. (T)

protocol - (1) A set of semantic and syntactic rules that determines the behavior of functional units in achieving communication. (I) (2) In Open Systems Interconnection architecture, a set of semantic and syntactic rules that determine the behavior of entities in the same layer in performing communication functions. (T) (3) In SNA, the meanings of, and the sequencing rules for, requests and responses used for managing the network, transferring data, and synchronizing the states of network components.

protocol data unit (PDU) - (1) A unit of data specified in a protocol of a given layer and consisting of protocol control information of this layer, and possibly user data of this layer. (T) (2) A unit of data specified in a protocol of a given layer and consisting of protocol control information of this layer, and possibly user data of this layer. (T)

queue - A list constructed and maintained so that the next data element to be retrieved is the one stored first. (T)

rack - A free-standing framework that holds equipment.

rack inventory chart - An Token Ring Network planning chart indicating the location of the components installed in an equipment rack.

random access memory (RAM) - (1) A storage device in which data can be written and read. (2) A storage device into which data is entered and from which data is retrieved in a non-sequential manner. (3) Deprecated term for *direct access storage device*. (T)

read-only memory (ROM) - (1) A storage device in which data, under normal conditions, can only be read. (T) (2) Memory in which stored data cannot be modified by the user except under special conditions.

reduced instruction-set computer - A computer that uses a small simplified set of frequently used instructions for rapid execution.

remote - Pertaining to a system, program, or device that is accessed through a telecommunication line. Contrast with *local*. Synonym for *link-attached*.

remove - (1) To take an attaching device off a network. (2) To stop an adapter from participating in data passing on a network.

Request for Comments - Documents that describe the Internet suite of protocols and related experiments. All Internet standards are written as RFCs.

reset - On a virtual circuit, re-initialization of data flow control. At reset, all data in transit are eliminated.

RFC - See *Request for Comments*.

ring - (1) Two or more stations in which information is passed sequentially between active stations, each station in turn examining or copying the information, finally returning it to the originating station. (2) See also *ring network*.

ring attaching device - In a ring network, any device equipped with an adapter that is physically attached to the ring.

ring latency - In a Token Ring network, the time, measured in bit times at the data transmission rate, required for a signal to propagate once around the ring. Ring latency includes the signal propagation delay through the ring medium, including drop cables, plus the sum of propagation delays through each data station connected to the Token Ring network. (T)

ring network - (1) A network configuration in which devices are connected by unidirectional transmission links to form a closed path. (2) A network in which every node has exactly two branches connected to it and in which there are exactly two paths between any two nodes. (T) See also *star/ring network, Token Ring network*.

ring segment - A ring segment is any section of a ring that can be isolated (by unplugging connectors) from the rest of the ring. A segment can consist of a single lobe, the cable between access units, or a combination of cables, lobes, and / or access units. See *cable segment, LAN segment*.

ring station - The functions necessary for connecting to the local area network and for operating with the Token Ring protocols. These include token handling, transferring copied frames from the ring to the using node's storage, maintaining error counters, observing Medium Access Control (MAC) sublayer protocols (for address acquisition, error reporting, or other duties), and (in the full-function native mode) directing frames to the correct Data Link Control link station. A ring station is an instance of a MAC sublayer in a node attached to a ring.

RISC - See *reduced instruction-set computer.*

root bridge - In a LAN containing bridges that use automatic single-route broadcast, the bridge that sends the "hello" message on the network every 2 seconds. Automatic single-route broadcast uses the message to detect when bridges enter and leave the network, and to change single-route broadcast parameters accordingly. See also *designated bridge, standby bridge*.

ROM - Read-only memory. (A)

route - (1) The path that network traffic uses to get from source to destination. (2) An ordered sequence of nodes and transmission groups (TGs) that represent a path from an origin node to a destination node traversed by the traffic exchanged between them.

route bridge - A function of an bridge program that allows two bridge computers to use a telecommunications link to connect two LANs. Each bridge computer is connected directly to one of the LANs, and the telecommunication link connects the two bridge computers.

router - (1) A computer that determines that path of network traffic flow. The path selection is made from several paths based on information obtained from specific protocols, algorithms that attempt to identify the shortest or best path, and other criteria such as metrics or protocol-specific destination addresses. (2) An attaching device that connects two LAN segments, which use similar or different architectures, at the reference model network layer. Contrast with *bridge* and *gateway.* (3) In OSI terminology, a router is a network layer intermediate system.

routing - (1) The assignment of the path by which a message is to reach its destination. (2) In SNA, the forwarding of a message unit along a particular path through a network, as determined by parameters carried in the message unit, such as the destination network address in a transmission header.

RSA - Remote systems access.

Rx - Receive.

schema - Synonym for *frame*. (T)

scroll - To move a display image vertically or horizontally to view data that otherwise cannot be observed within the boundaries of the display screen. See also *page (2).*

segment - (1) In the Token Ring Network, a section of cable between components or devices. A segment can consist of a single patch cable, several patch cables that are connected, or a combination of building cable and patch cables that are connected. (2) The unit of transfer between TCP functions in different machines. Each segment contains control and data fields whereby the current byte stream position and actual data bytes are identified along with a checksum to validate received data. (3) In an OS/2 program, a variable-length area of contiguous storage addresses not exceeding 64 KB. See also *data segment*, *cable segment*, *LAN segment*, *ring segment*.

select - The process of choosing a single symbol or menu item by placing the cursor on it and clicking the mouse button. To select multiple symbols simultaneously, press and hold the Shift key down while clicking on the symbols you want to select.

serial - (1) Pertaining to a process in which all events occur one after the other; for example, serial transmission of the bits of a character according to V24 CCITT protocol. (T) (2) Pertaining to the sequential or consecutive occurrence of two or more related activities in a single device or channel. (A) (3) Pertaining to the sequential processing of the individual parts of a whole, such as the bits of a character or the characters of a word, using the same facilities for successive parts. (A) (4) Contrast with *parallel*.

serial port - On personal computers, a port used to attach devices such as display devices, letter-quality printers, modems, plotters, and pointing devices such as light pens and mice; it transmits data 1 bit at a time. Contrast with *parallel port*.

server - (1) A functional unit that provides shared services to workstations over a network; for example, a file server, a print server, a mail server. (T) (2) In a network, a data station that provides facilities to other stations; for example, a file server, a print server, a mail server. (A) (3) A class of adapter in a network node that performs local processing and does not have any physical connections to other devices (as do port adapters and trunk adapters). (4) A device, program, or code module on a network dedicated to providing a specific service to a network.

session - (1) In network architecture, for the purpose of data communication between functional units, all the activities which take place during the establishment, maintenance, and release of the connection. (T) (2) A logical connection between two network accessible units (NAUs) that can be activated, tailored to provide various protocols, and deactivated, as requested. Each session is uniquely identified in a transmission header (TH) accompanying any transmissions exchanged during the session. (3) The period of time during which a user of a terminal can communicate with an interactive system, usually, elapsed time between logon and logoff.

Simple Network Management Protocol - (1) An IP network management protocol that is used to monitor routers and attached networks. (2) A TCP/IP-based protocol for exchanging network management information and outlining the structure for communications among network devices. SNMP is an application layer protocol. Information on devices managed is defined and stored in the application's Management Information Base (MIB).

single-mode optical fiber - An optical fiber in which only the lowest-order bound mode (which can consist of a pair of orthogonally polarized fields) can propagate at the wavelength of interest. (E) Contrast with *multimode optical fiber.*

SNMP - See *Simple Network Management Protocol.*

SNMP agent - As defined in the SNMP architecture, an agent, or an SNMP server, is responsible for performing the network management functions requested by the network management stations.

soft error - (1) An error that occurs sporadically and that may not appear on successive attempts to read data. Synonymous with *transient error.* (T) (2) An intermittent error on a network that requires retransmission. Contrast with *hard error.*

A soft error by itself does not affect overall reliability of a network, but reliability can be affected if the number of soft errors reaches the ring error limit.

source address - A field in the medium access control (MAC) frame that identifies the location from which information is sent. Contrast with *destination address.*

Source-Route Bridging - A bridging method that uses the routing information field in the IEEE 802.5 medium access control (MAC) header of a frame to determine which rings or Token Ring segments the frame must transit. The RI field is inserted into the MAC header by the originating (source) node. The information in the routing information field is derived from explorer packets generated by the source host. See *explorer packet*.

source routing - A method by which the sending station determines the route the frame will follow and includes the routing information with the frame. Bridges then read the routing information to determine if they should forward the frame. Also known as source-route bridging.

spanning tree - The method by which bridges automatically develop a routing table and update that table in response to changing topography to ensure that there is only one route between any two LANs in the bridged LAN. This method prevents packet looping, where a packet returns in a circuitous route back to the sending router.

SRB - Source-route bridging. See *source routing.*

SRS - Source-route switching. See *source routing*.

standby bridge - In a LAN using automatic single-route broadcast, a bridge that does not forward single-route broadcast frames. A standby bridge is a parallel bridge or is in a parallel path between two LAN segments. See also *designated bridge, root bridge*.

star - A wiring arrangement in which an individual cable runs from each work area to a concentration point.

star/ring network - A ring network with unidirectional transmission, laid out in such a way that several data stations are grouped and interconnected to the network by means of lobe attaching units. This configuration allows attachment and removal of data stations without disrupting network operations. (A)

station - (1) An input or output point of a system that uses telecommunication facilities; for example, one or more systems, computers, terminals, devices, and associated programs at a particular location that can send or receive data over a telecommunication line. (2) A location in a device at which an operation is performed; for example, a read station.

Store-and-Forward switching mode - In LAN switches, a switching architecture which requires that a whole frame must be received by a destination port before transmission out of the destination port can begin. Contrast with *Cut-Through switching mode.*

STP - Shielded twisted pair.

subnet - Shortened form of *subnetwork.* See *subnetwork.*

subnet mask - A bit template that identifies to the TCP/IP protocol code the bits of the host address that are to be used for routing for specific subnets.

subnetwork - Any group of nodes that have a set of common characteristics, such as the same network ID.

switch - On an adapter, a mechanism used to select a value for, enable, or disable a configurable option or feature.

system - In data processing, a collection of people, machines, and methods organized to accomplish a set of specific functions. (I) (A)

system configuration - A process that specifies the devices and programs that form a particular data processing system. an element of a network.

TCP - See *Transmission Control Protocol*.

TCP/IP - See *Transmission Control Protocol/Internet Protocol*.

telephone twisted pair - One or more twisted pairs of copper wire in the unshielded voice-grade cable commonly used to connect a telephone to its wall jack. Also referred to as *unshielded twisted pair* (UTP).

Telnet - In TCP/IP, an application protocol that allows a user at one site to access a remote system as if the user's display station were locally attached. Telnet uses the Transmission Control Protocol as the underlying protocol.

terminal - In data communication, a device, usually equipped with a keyboard and display device, capable of sending and receiving information.

terminal emulation - The capability of a microcomputer or personal computer to operate as if it were a particular type of terminal linked to a processing unit and to access data.

TFTP - Trivial File Transfer Protocol. See *File Transfer Protocol*.

threshold - (1) A level, point, or value above which something is true or will take place and below which it is not true or will not take place. (2) In bridge programs, a value set for the maximum number of frames that are not forwarded across a bridge due to errors, before a *threshold exceeded* occurrence is counted and indicated to network management programs. (3) An initial value from which a counter is decremented to zero, or a value to which a counter is incremented or decremented from an initial value. When the counter reaches zero or the threshold value, a decision is made and/or an event occurs.

throughput - (1) A measure of the amount of work performed by a computer system over a given period of time, for example, number of jobs per day. (I) (A) (2) A measure of the amount of information transmitted over a network in a given period of time. For example, a network's data transfer rate is usually measured in bits per second.

TIA - Telecommunications Industries Association.

time-out - (1) An event that occurs at the end of a predetermined period of time that began at the occurrence of another specified event. (I) (2) A time interval allotted for certain operations to occur: for example, response to polling or addressing before system operation is interrupted and restarted. (3) A parameter related to an enforced event designed to occur at the conclusion of a predetermined elapsed time. A time-out condition can be canceled by the receipt of an appropriate time-out cancellation signal.

token - (1) In a local area network, the symbol of authority passed successively from one data station to another to indicate the station temporarily in control of the transmission medium. Each data station has an opportunity to acquire and use the token to control the medium. A token is a particular message or bit pattern that signifies permission to transmit. (T) (2) A sequence of bits passed from one device to another along the token ring. When the token has data appended to it, it becomes a frame.

token passing - In a Token Ring network, the process by which a node captures a token; inserts a message, addresses, and control information; changes the bit pattern of the token to the bit pattern of a frame; transmits the frame; removes the frame from the ring when it has made a complete circuit; generates another token; and transmits the token on the ring where it can be captured by the next node that is ready to transmit.

Token Ring - (1) A network with a ring topology that passes tokens from one attaching device to another; for example, the Token Ring Network. See also *local area network (LAN)*. (2) A group of interconnected Token Rings.

Token Ring network - (1) A ring network that allows unidirectional data transmission between data stations, by a token passing procedure, such that the transmitted data return to the transmitting station. (T) (2) A network that uses a ring topology, in which tokens are passed in a sequence from node to node. A node that is ready to send can capture the token and insert data for transmission. (3) A group of interconnected Token Rings.

topology - The physical or logical arrangement of nodes in a computer network. Examples are ring topology and bus topology.

trace - (1) A record of the execution of a computer program. It exhibits the sequences in which the instructions were executed. (A) (2) A record of the frames and bytes transmitted on a network.

transient error - (1) Synonym for *soft error.* (T) (2) An error that occurs once or at unpredictable intervals.

Transmission Control Protocol (TCP) - (1) A communications protocol used in Internet and in any network that follows the U.S. Department of Defense standards for inter-network protocol. TCP provides a reliable host-to-host protocol between hosts in packet-switched communications networks and in interconnected systems of such networks. It assumes that the Internet protocol is the underlying protocol. (2) A transport protocol in the Internet suite of protocols that provides reliable, connection-oriented, full-duplex data stream service.

Transmission Control Protocol/Internet Protocol - (1) A set of protocols that allow cooperating computers to share resources across a heterogeneous network. (2) A set of communication protocols that support peer-to-peer connectivity functions for both local and wide area networks.

transmission frame - (1) In data transmission, data transported from one node to another in a particular format that can be recognized by the receiving node. In addition to a data or information field, a frame has some kind of delimiter that marks its beginning and end and usually control fields, address information that identifies the source and destination, and one or more check bits that allow the receiver to detect any errors that occur after the sender has transmitted the frame. (2) In synchronous data link control (SDLC), the vehicle for every command, every response, and all information that is transmitted using SDLC procedures. Each frame begins and ends with a flag. (3) In high level data link control (HDLC), the sequence of contiguous bits bracketed by and including opening and closing flag (01111110) sequences. (4) In a Token Ring network, a bit pattern containing data that a station has inserted for transmission after capturing a token.

transmit - To send information from one place for reception elsewhere. (A)

transmitter - (1) A circuit used in data communication applications to send information from one place for reception elsewhere. (2) The device in which the transmission circuits are housed. (3) In fiber optics, see *optical transmitter.*

transparency - See *transparent*.

transparent - (1) Pertaining to operations or data that are of no significance to the user. (2) In data transmission, pertaining to information not recognized by the receiving program or device as transmission control characters.

transparent bridging - A method for tying individual local area networks (LANs) together through the medium access control (MAC) level. A transparent bridge keeps the tables that hold MAC addresses so that frames seen by the bridge can be forwarded to another LAN if the tables indicate to do so.

trap - A vital part of the Simple Network Management Protocol (SNMP). A trap is specified data that is sent by a managed node (agent function) to a management station to report an exception condition.

tree network - A network in which there is exactly one path between any two nodes. (T)

twisted pair - A transmission medium that consists of two insulated electrical conductors twisted together to reduce noise. (T)

UDP - See *User Datagram Protocol*.

UFC - Universal feature card.

UNIX operating system - An operating system developed by Bell Laboratories that features multiprogramming in a multiuser environment. The UNIX operating system was originally developed for use on minicomputers, but has been adapted for mainframes and microcomputers.

The AIX operating system is IBM’s implementation of the UNIX operating system.

unshielded twisted pair - See *telephone twisted pair.*

User Datagram Protocol - (1) In TCP/IP, a packet-level protocol built directly on the Internet Protocol layer. UDP is used for application-to-application programs between TCP/IP host systems. (2) A transport protocol in the Internet suite of protocols that provides unreliable, connectionless datagram service. (3) The Internet Protocol that enables an application programmer on one machine or process to send a datagram to an application program on another machine or process. UDP uses the internet protocol (IP) to deliver datagrams.

UTP - See *unshielded twisted pair.*

V - Volt, a unit of electrical potential.

variable - (1) In computer programming, a character or group of characters that refers to a value and, in the execution of a computer program, corresponds to an address. (2) A quantity that can assume any of a given set of values. (A) (3) In SNMP, a match of an object instance name with an associated value.

version - A separately licensed program, based on an existing licensed program, that usually has significant new code or new function.

virtual circuit - (1) A logical connection established between two DTEs. (2) In packet switching, the facilities provided by a network that give the appearance to the user of an actual connection. (T) See also *data circuit*. Contrast with *physical circuit*. (3) In a packet-switching data network, a logical end-to-end transmission channel - as opposed to a physical connection - that connects X.25 users. Virtual circuits allow physical transmission facilities to be shared by many users simultaneously. (4) Synonym for *virtual connection*.

virtual connection - (1) A connection between two nodes on the network that is established using the transport layer and that provides reliable data between nodes. (2) A logical connection established between two data terminal equipment (DTE) devices. Synonymous with *virtual circuit*.

virtual machine - (1) A virtual data processing system that appears to be at the exclusive disposal of a particular user, but whose functions are accomplished by sharing the resources of a real data processing system. (T) (2) A functional simulation of a computer and its associated devices. Each virtual machine is controlled by a suitable operating system; for example, the conversational monitor system. VM/370 controls concurrent execution of multiple virtual machines on a single System/370 computing system.

VM - See *virtual machine*.

waiting time - Synonym for *latency*.

WAN - See *wide area network*.

wide area network - (1) A network that provides communication services to a geographic area larger than that served by a local area network or a metropolitan area network, and that may use or provide public communication facilities. (T) (2) A data communications network designed to serve an area of hundreds or thousands of miles; for example, public and private packet-switching networks and national telephone networks. Contrast with *local area network (LAN)*.

wiring closet - A room that contains one or more distribution panels and equipment racks that are used to interconnect cables. Sometimes called a *network wiring closet* to distinguish it from a telephone wiring closet.

workstation - (1) A functional unit at which a user works. A workstation often has some processing capability. (T) (2) Personal desktop computer consisting of a monitor, keyboard, and central processing unit. Workstations can have voice/data application program software enabled by CallPath for Workstations.

write - To make a permanent or transient recording of data in a storage device or on a data medium. (I) (A)

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