

Nways Multiprotocol Switched Services Server



# Interface Configuration and Software User's Guide



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**Note**

Before using this document, read the general information under "Notices" on page xxi.

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This edition applies to Version 2.0 of the IBM Multiprotocol Switched Services (MSS) and to all subsequent releases and modifications until otherwise indicated in new editions or technical newsletters.

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## Preface

This manual contains the information you will need to use the command line interface for configuration and operation of the IBM Nways Multiprotocol Switched Services (MSS) or the A-MSS Server Module, hereafter referred to as “the router,” installed on your IBM Multiprotocol Switched Services (MSS). With the help of this manual, you should be able to perform the following processes and operations:

- Configure, monitor, and use the Multiprotocol Switched Services (MSS) base code on your IBM Nways Multiprotocol Switched Services (MSS) or your A-MSS Server Module
- Configure, monitor, and use the interfaces and Link Layer software supported by your router.

**Who Should Read This Manual:** This manual is intended for persons who install and manage computer networks. Although experience with computer networking hardware and software is helpful, you do not need programming experience to use the protocol software.

---

## Conventions Used in This Manual

The following conventions are used in this manual to show command syntax and program responses:

1. The abbreviated form of a command is shown in the following example:

`restart`

In this example, you can enter either the whole command (restart) or its abbreviation (res).

2. Three periods following an option mean that you enter additional data (for example, a variable) after the option. For example:

`time host ...`

In this example, you enter the IP address of the host in place of the periods, as explained in the description of the command.

3. In information displayed in response to a command, defaults for an option are enclosed in brackets immediately following the option. For example:

`Media (UTP/STP) [UTP]`

In this example, the media defaults to UTP unless you specify STP.

4. Keyboard key combinations are indicated in text in the following ways:

- **Ctrl-P**

**Ctrl** **P**

---

## MSS Server Library

The following hard copy publications are shipped with the product. The manuals in this list are also included in displayable softcopy form on the Multiprotocol Switched Services (MSS) Softcopy Library CD-ROM (SK2T-0378). This CD-ROM is shipped with initial orders for the MSS Server.

The reference cards, the International Program License Agreement, and the safety information booklet are shipped in hard copy only and are not included on the CD-ROM.

- *IBM 8210 Nways Multiprotocol Switched Services (MSS) Server Setup and Problem Determination Guide, GA27-4140*
- *IBM 8210 Nways Multiprotocol Switched Services (MSS) Server Operations Reference Card, GX27-4017*
- *IBM Multiprotocol Switched Services (MSS) Server Configuration and Operations Guide, SC30-3821*
- *CAUTION: Safety Information - Read This First, SD21-0030*
- *International Program License Agreement*
- *IBM Nways Multiprotocol Switched Services (MSS) Server Module Reference Card, GX27-4018*
- *IBM Nways Multiprotocol Switched Services (MSS) Server Module Setup and Problem Determination Guide, GA27-4141*

The following publications are not shipped in hard copy, but are offered in soft copy form on the Multiprotocol Switched Services (MSS) Softcopy Library CD-ROM (SK2T-0378). All of these manuals can be separately ordered in hard copy form through your IBM marketing representative.

- *IBM Multiprotocol Switched Services (MSS) Server Introduction and Planning Guide, GC30-3820*
- *IBM Multiprotocol Switched Services (MSS) Server Interface Configuration and Software User's Guide, SC30-3818*
- *Multiprotocol Switched Services (MSS) Configuring Interfaces and Features, SC30-3819*
- *Event Logging System Messages Guide, SC30-3682*
- *IBM 8210 Nways Multiprotocol Switched Services (MSS) Server Service and Maintenance Manual, GY27-0354*
- *IBM 8210 Multiprotocol Switched Services Server (MSS) Server Module Installation and Initial Configuration Guide GA27-4141*

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## Summary of Changes For Version 2.0

The following are the hardware enhancements for the A-MSS Server Module in this release:

- New 166 Mhz 603EV PowerPC processor
- An embedded 10 Mbps Ethernet port
- 64 MB of DRAM now standard
- New 20 MBPCMCIA flash card

The following are the hardware enhancements for the IBM 8210 in this release:

- 64 MB of DRAM now standard
- New 20 MB PCMCIA flash card

The following are the software enhancements in this release:

- APPN support
- Banyan VINES support
- Extensions to NHRP to support Zero Hop Routing for LAN-attached stations
- Support for the Distributed ARP Server
- SuperELAN for TR
- Support for RFC 1577+

The technical changes and additions are indicated by a vertical line (|) to the left of the change.

## Title Change

The titles of the following books have been changed. The contents are the same with the exception noted:

**SC30–3818** *Multiprotocol Switched Services (MSS) Server Command Line Interface Volume 1 User's Guide and Protocol Reference* is now titled *Multiprotocol Switched Services (MSS) Server Interface Configuration and Software User's Guide*.

The information about configuring and monitoring MAC filtering has been moved *Multiprotocol Switched Services (MSS) Configuring Protocols and Features*.

**SC30–3819** *Multiprotocol Switched Services (MSS) Server Command Line Interface Volume 2 User's Guide and Protocol Reference* is now titled *Multiprotocol Switched Services (MSS) Configuring Protocols and Features*.

The information about configuring and monitoring MAC filtering is now in this book.



---

## Part 1. User's Guide



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## Chapter 1. Getting Started (Introduction to the User Interface)

This chapter shows you how to get started with using the following components related to the IBM Nways Multiprotocol Switched Services (MSS) Server Module (IBM 8210) and the IBM 8210 Multiprotocol Switched Services Server:

- Router console terminals
- Router software (IBM 8210 Multiprotocol Switched Services Server)
- Router software user interface
- Protocol software - configuring and monitoring
- Network interfaces - configuring and monitoring

The information in this chapter is divided into the following sections:

- “Before You Begin”
- “Using Local and Remote Router Consoles” on page 1-2
- “Discussing the User Interface System” on page 1-7
- “Accessing Protocol Configuration and Console Processes” on page 1-11
- “Accessing Feature Configuration and Console Processes” on page 1-15
- “Accessing Network Interface Configuration and Console Processes” on page 1-16
- “Command History for GWCON and CONFIG Command Line” on page 1-18
- “System Security” on page 1-21

---

### Before You Begin

Before you begin, refer to the following checklist to verify that your router is installed correctly.

HAVE YOU...

- Installed all necessary hardware?
- Connected the console terminal (video terminal) to the router?

**Attention:** If you are using a service port-attached terminal to configure or monitor your IBM 8210 and your service terminal is unreadable, you need to change some parameters in your configuration. (See “Service Terminal Display Unreadable” in IBM Nways Multiprotocol Switched Services (MSS) Server Module Service and Maintenance Manual.)

- Connected your router to the network using the correct network interfaces and cables?
- Run all necessary hardware diagnostics?

For more information on any of these procedures, refer to the *IBM Nways Multiprotocol Switched Services (MSS) Server Module Installation and Initial Configuration Guide*

---

### Migrating to Release 2.0

Refer to the *Server and Maintenance Manual* for information about migrating to a new code level.

---

### Using Local and Remote Router Consoles

The router console lets you use the router user interface to monitor and change the function of the router's networking software (IBM 8210 Multiprotocol Switched Services Server). The router supports local and remote consoles.

#### Local Consoles

Local consoles are either directly connected by an EIA 232 (RS-232) cable, or connected via modems to the router. You may need to use a local console during the initial software installation. After the initial setup connection, you can connect via Telnet, as long as IP forwarding has been enabled. (Refer to *Multiprotocol Switched Services (MSS) Configuring Protocols and Features* for more information on enabling IP forwarding.)

When the configured router is started for the first time, a boot message appears on the screen, followed by the OPERator's CONsole or OPCON prompt (\*). The \* prompt indicates that the router is ready to accept OPCON commands.

Your IBM 8210 Multiprotocol Switched Services Server software may have been pre-configured at the factory. If it was, you do not need to use a local console to perform initial configuration. If, however, your IBM 8210 Multiprotocol Switched Services Server was not pre-configured at the factory, you will need to use an ASCII terminal attached to the IBM 8210 service port to initially configure it.

**Important:** Garbage, random characters, reverse question marks, or the inability to connect your terminal to the IBM 8210 service port can have many causes. The following list contains some of those causes:

- The most common cause of garbage or random characters on the service console is that the baud rate is not synchronized with the IBM 8210.

If the IBM 8210 is set to a specific baud rate, the terminal or terminal emulator must be set to the same baud rate.

If the IBM 8210 is set to autobaud (this is the default), press the terminal break key sequence and press **Enter**.

A typical break key sequence for PC terminal emulators is Alt-b (refer to the terminal emulator documentation). Most ASCII terminals have a Break key (often used in conjunction with the Ctrl key).

- Defective terminal or device (ac) grounds.
- Defective, incorrectly shielded, or incorrectly grounded EIA 232 (RS-232) cable between the terminal and the IBM 8210.
- Defective terminal or terminal emulator.
- Defective IBM 8210 system board.
- High ambient electromagnetic interference (EMI) levels.
- Power line disturbances.



(See “Service Terminal Display Unreadable” in the *IBM Nways Multiprotocol Switched Services (MSS) Server Module Service and Maintenance Manual*.)

Once the IBM 8210 is initially configured, you will not need a local console for router operation, as long as IP is enabled.

The router software automatically handles console activity. When upgrading the software, you might have to use the local console. For information on attaching and configuring local consoles, refer to the *IBM Nways Multiprotocol Switched Services (MSS) Server Module Installation and Initial Configuration Guide*.

## Remote Consoles

Remote consoles attach to the router using a standard remote terminal protocol. Remote consoles provide the same function as local consoles, except that a local console must be used for initial configuration if your IBM 8210 was not pre-configured at the factory.

### Telnet Connections

The router supports both Telnet Client and Server. The remote console on the router acts as a Telnet server. The router acts as a Telnet client when connecting from the router to either another router or a host using the **telnet** command in the OPCON (\*) process.

### Remote Login Names and Passwords

During a remote login, the router prompts you for a login name and password. You can display the login name when logged in to the router from a remote console by using a router **status** command.

Use the **set password** command to supply a password for the router. The password, user-configurable for each router, controls access to the router. You may also configure a password for users of a local console.

**Note:** If you do not enter a login name and valid password within one minute of the initial prompt, or if you enter an incorrect password three times in succession, the router drops the Telnet connection.

Multiple users with login permissions may also be added using the **add user** command. See Chapter 6, “The CONFIG Process and Commands” on page 6-1 for more details on the **add user** commands.

## Logging In Remotely or Locally

Logging in to a local console is the same as logging in to a remote console except that you must connect to the router by starting Telnet on your host system. To log in remotely, begin at step 1. To log in locally, begin at step 3 on page 1-4.

To log in from a remote console:

1. Connect to the router by starting Telnet on your host system. Your host system is the system to which remote terminals are connected.
2. Supply the router's name or Internet Protocol (IP) address.

To use router names, your network must have a name server. Issue either the router name or the IP address as shown in the following example:

```
% telnet brandenburg
```

or

```
% telnet 128.185.132.43
```

The router supports both Telnet Client and Server. The remote console on the router acts as a Telnet server. The router acts as a Telnet client when connecting from the router to either another router or a host using the **telnet** command.

At this point, it makes no difference whether you have logged in remotely or locally.

3. If you are prompted, enter your login name and password.

```
login:  
Password:
```

It is possible that there is a login and no password. The password controls access to the router. If a password has not been set, press the **Enter** key at the Password: prompt. Logins are not set automatically. For security, you can set up user names and passwords using the **add user** command in the CONFIG process. Remember to reload or restart to activate any changes.

**Note:** If you do not enter a login name and valid password within one minute of the initial prompt, or if you enter an incorrect password three times in succession, the router drops the Telnet connection.

4. Press the **Enter** key to display the main prompt asterisk (\*).

You may have to press the **Enter** key more than once or press **Ctrl P** to obtain the \* prompt.

Once at this level, you can begin to enter commands from the keyboard. Press the **backspace** key to delete the last character typed in on the command line. Press the **Delete** key or **Ctrl U** to delete the whole command line entry so that you can re-enter a command. See “Command History for GWCON and CONFIG Command Line” on page 1-18 for information on how to access previously entered commands.

Once at the main router prompt, you can begin entering commands from the keyboard. (See “Discussing the User Interface System” on page 1-7 for more information on using the router user interface.) To exit the router, return to the main router prompt (\*) and close the Telnet connection by typing **logout**. For example:

```
IP Config> exit  
Config> Ctrl P  
* logout  
  
%
```

You can also use local Telnet commands on your Telnet client to close the Telnet connection.

### Executing a Command

When typing a command, remember the following:

- Type only enough sequential letters of the command to make it unique among available commands. For example, to execute the **reload** command you must enter **rel** as a minimum.
- Commands are not case-sensitive.

- Sometimes, only the first letter of the command (and subsequent options) is required to execute the command. For example, typing **s** at the \* prompt followed by pressing the **Enter** key causes the **status** command be executed.

**Note:** If you use a VT100 terminal, do not press the **Backspace** key, because it inserts invisible characters. Use the **Delete** key.

## Connecting to a Process

When you start the router, the console displays a boot message. The OPCON prompt (\*) then appears on the screen indicating that you are in the OPCON process and you can begin entering OPCON commands. This is the command prompt from which you communicate with different processes.

To connect your console to a process:

1. Find out the process ID (PID) number of a process by entering the **status** command at the \* prompt.

The **status** command displays information about the router processes, such as the process IDs (PIDs), process names and status of the process. Issuing the **status** command is shown in the following example:

```
* status
Pid  Name      Status TTY  Comments
1    COpCon    RDY   TTY0
2    Monitr    DET   --
3    Tasker    RDY   --
4    MOSDDT    DET   --
5    CGWCon    DET   --
6    Config    DET   --
7    ROpCon    IDL   TTY1 128.185.210.125
8    ROpCon    IDL   TTY2
9    WEBCon    IDL   --
```

2. Use the **talk pid** command, where *pid* is the number of the process to which you want to connect. (For more information about these and other OPCON commands, refer to Chapter 5, “The OPCON Process and Commands” on page 5-1.)

**Note:** All the processes listed do not have a user interface (for example, the **talk 3** process). The **talk 4** command is for use by the software specialist.

## Identifying Prompts

Each process uses a different prompt. You can tell which process your console is connected to by looking at the prompt. (If the prompt does not appear when you enter the **talk pid** command, press the **Return** key a few times.)

The following list shows the prompts for the three main processes:

<u>Process</u>	<u>Prompt</u>
OPCON	*
GWCON	+
CONFIG	Config>

At the prompt level, you can begin to enter commands from the keyboard. Use the **Backspace** key to delete the last character typed in on the command line. Use **Ctrl U** to delete the whole command line entry so that you can re-enter a command. See “Command History for GWCON and CONFIG Command Line” on page 1-18 for information on how to access previously entered commands.

### Getting Help

At any of the prompts just described, you can obtain help in the form of a listing of the commands available at that prompt level. This is done by typing **?** (the **help** command), and then pressing the **Return** key. Use **?** to list the commands that are available from the current prompt level. You can usually enter a **?** after a specific command name to list its options. For example, the following appears if you enter **?** at the **\*** prompt:

```
*?  
  
DIAGS hardware diagnostics  
DIVERT output from process  
FLUSH output from process  
HALT output from process  
INTERCEPT character is  
LOGOUT  
MEMORY statistics  
RELOAD  
STATUS of process(es)  
TALK to process  
TELNET to IP-Address
```

### Getting Back to OPCON

To get back to the OPCON prompt (**\***), press **Ctrl P**. You must always return to OPCON before you can communicate with another process. For example, if you are connected to the GWCON process and you want to connect to the CONFIG process, you must press **Ctrl P** to return to OPCON first. The **Ctrl P** key combination is called the *intercept character*.

When using third-level processes, such as IP Config or IP shown in Figure 1-1 on page 1-7, use the **exit** command to return to the second level.

Use the intercept character (the default intercept character is **Ctrl P**) from a third-level process to return to the **\*** prompt. The next time you use the **talk** command, you will re-enter the third level process. This link goes away when the router is reinitialized.

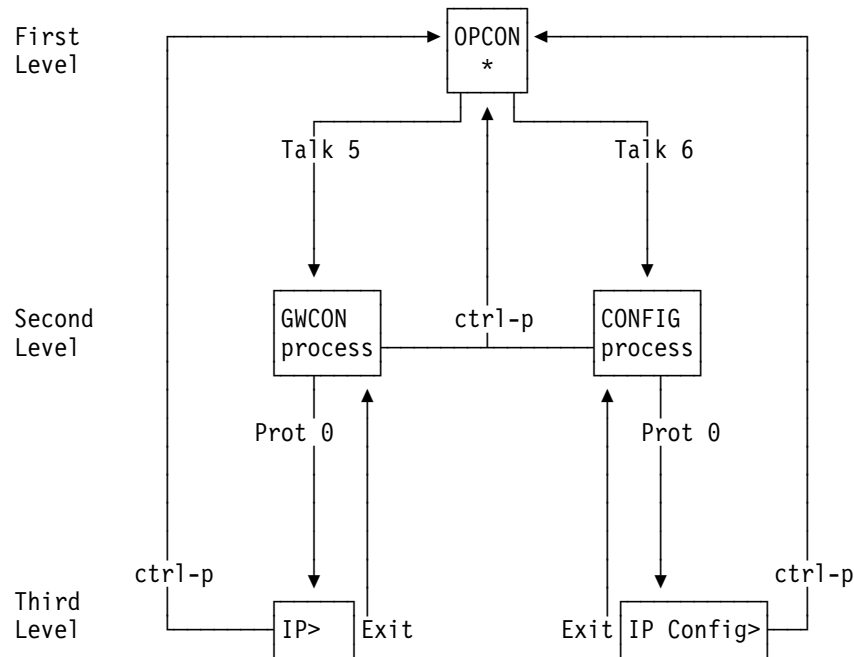


Figure 1-1. Talk and the Intercept Commands

Figure 5-2 on page 5-3 shows the commands in the OPCON structure.

## Exiting the Router

Return to the \* prompt and close the Telnet connection. For example:

```
IP Config> exit
Config> Ctrl P
* logout
%
```

You can also use local Telnet commands on your Telnet client to close the Telnet connection.

## Discussing the User Interface System

The user interface to the router software consists of the main menu (process) and several subsidiary menus (processes). The processes you use most often are OPCON, GWCON, CONFIG, and CONFIG-ONLY. These processes allow you to control and monitor the operations of the router.

There are three levels of processes: first, second, and third as you move down the software tree.

Figure 1-2 on page 1-8 shows the processes and how they fit within the structure of the router software.

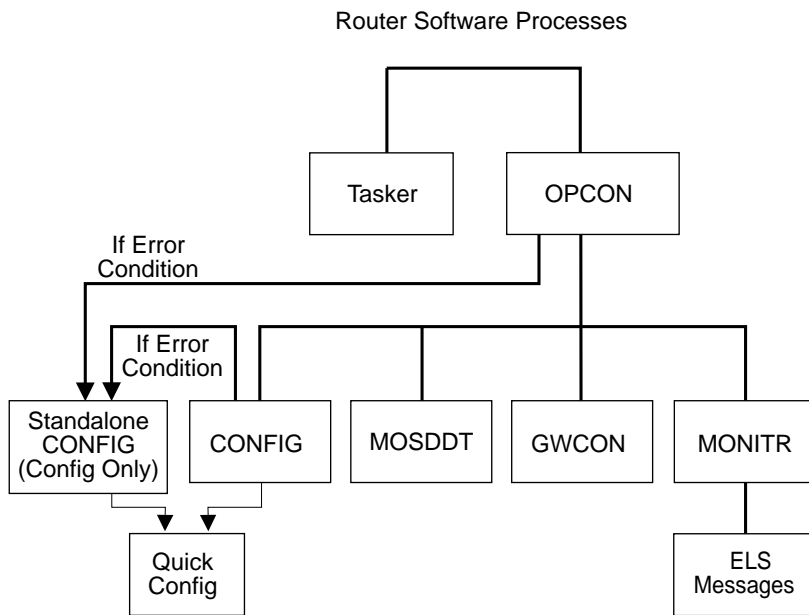


Figure 1-2. IBM 8210 Multiprotocol Switched Services Server

The router software (IBM 8210 Multiprotocol Switched Services Server) is a multi-tasking system that schedules use of the CPU among various processes and hardware devices. The router software:

- Provides timing and memory management, and supports both local and remote operator consoles from which you can view and modify the router's operational parameters.
- Consists of functional modules that include various user interface processes, all network interface drivers, and all protocol forwarders purchased with the router.

Table 1-1 on page 1-9 summarizes the IBM 8210 Multiprotocol Switched Services Server processes and functions on the IBM 8210.

<i>Table 1-1. Router Software Processes</i>		
<b>Process</b>	<b>Definition</b>	<b>Prompt</b>
OPCON	Operates as the main operator control program. It provides service for one directly connected console terminal.	Asterisk (*)
ROPCON	Provides OPCON service for two remotely connected console terminals (not shown). Functionally, OPCON and ROPCON are the same.	Asterisk (*)
GWCON (or CGWCON) (Second Level)	Displays the status and statistics of the router's hardware and software, such as protocols, network interfaces, and event logging.  It is on the second level of the router user interface. It provides access to the third-level process, which allow you to monitor configured protocols and features.	Plus sign (+)
CONFIG (Second Level)	Provides on-line control of various configuration parameters, such as network addresses and event logging.  It is on the second level of the router user interface. It provides access to third-level processes, which allow you to configure various protocols and features.  Quick Config menus are also available under this process.	Config>
MONITR	Receives Event Logging System (ELS) messages and messages from the operating system, and displays them on the monitor, according to user-selected filtering criteria. It is on the second level of the router user interface.	None
TASKER	Runs the router's main networking software and performs the router's internetwork data transfer operations.  This process is part of the operating system and has no user interface.	None
MOSDDT	Serves as the Micro Operating System (MOS) runtime debugging tool (Dynamic Debugging Tool).	Dollar sign (\$)
QUICK CONFIG	Provides a simple, less-detailed way of configuring devices, bridging and routing protocols, and booting records.	None
CONFIG-ONLY (Stand-alone Config)	Provides the same function as the CONFIG process with the addition of the <b>reload</b> command.	Config (only)>
WEBCon	Runs the router's World Wide Web (WWW) interface. This process is part of the operating system and has no user interface.	

### Definition of the First-Level User Interface

The first level of the user interface includes CONFIG-ONLY and OPCON. The CONFIG-ONLY process (which includes Quick Configuration) allows you to configure the router. illustrates how the router enters The OPCON process allows you to set up communication between users and the other router processes. If you are using a remote console, the name of the process handling your console is ROPCON instead of OPCON, but the operation is identical.

#### CONFIG-ONLY Process

Configuration Only, or CONFIG-ONLY, allows you to take the router off line and reconfigure its operating parameters.

The commands available are the same as CONFIG at the `Config>` prompt; however, no other processes are running while the router is in CONFIG-ONLY mode.

The CONFIG-ONLY mode uses commands identical to the CONFIG process, with the addition of the **reload** command.

CONFIG-ONLY mode is provided only for getting a subset of configuration commands when a configuration problem causes the router to crash with a *panic*, *check*, *fatal*, or *bughlt*, particularly those relating to failures of memory allocations. CONFIG-ONLY mode should be used only to adjust parameters affecting memory allocations such as routing table sizes, packet sizes, and receive buffer allocations. It should not be used for general router configuration. In CONFIG-ONLY mode, many of the device-related commands are disabled and some may cause a crash.

There are two ways to enter CONFIG-ONLY mode:

**Operational Failure:** The router encounters a problem during initialization and automatically comes up in CONFIG-ONLY mode. Any of the following situations will cause the router to enter into CONFIG-ONLY mode:

- An unsupported device is in the software load
- One or more of the following configuration errors have occurred during start-up:
  - Static RAM is corrupted
  - All router interface information has been deleted.
  - Incorrect interface configuration information has been entered.

**Deliberate entry into CONFIG-ONLY mode:** To access CONFIG-ONLY mode deliberately, use the **PROM>bc** command when configuring boot options. See Chapter 8, "Using MSS Server Firmware" on page 8-1 for more detail.

#### Quick Configuration Process

Quick Configuration, or Quick Config, allows you to quickly configure portions of the router without dealing with the specific operating system commands. When you initially load, start, or restart the router with no configuration, you enter Config-Only and you can access Quick Config menus from that process. If the router has devices configured and the devices do not have any protocols configured, the router automatically starts Config-Only and then enters Quick Config.

You can also enter Quick Config from the CONFIG process using the **qconfig** command.



## OPCON

The OPCON process handles the communication between users and the other router processes. If you are using a remote console, the name of the process handling your console is ROPCON instead of OPCON, but the operation is identical.

Refer to Chapter 5, “The OPCON Process and Commands” on page 5-1 for complete details.

## Accessing Protocol Configuration and Console Processes

To help you access the configuration and console processes, this section outlines both of these procedures.

All protocols described in the *Multiprotocol Switched Services (MSS) Configuring Protocols and Features* have commands that are executed in one of the following ways:

- Accessing the protocol *configuration* process to initially configure and enable the protocol, as well as perform later configuration changes.
- Accessing the protocol *console* process to monitor information about each protocol or make temporary configuration changes.

The procedure for accessing these processes is basically the same for all protocols. The next sections describe these procedures.

## Accessing the Protocol Configuration Process (CONFIG)

Each protocol configuration process is accessed through the router’s CONFIG process. CONFIG is the second-level process of the router user interface that lets you communicate with third-level processes. Protocol processes are examples of third-level processes.

The CONFIG command interface is made up of levels that are called modes. Protocol configuration command interfaces are modes of the CONFIG interface. Each protocol configuration interface has its own prompt. For example, the prompt for the TCP/IP protocol command interface is `IP config>`.

To access the protocol configuration processes:

1. Enter the CONFIG command process from OPCON and obtain the CONFIG prompt (`Config>`)
2. Enter the desired protocol configuration process (with its own prompt) from the CONFIG prompt using the **protocol** command.

The next sections describe these procedures in more detail.

### Entering the CONFIG Process

To enter the CONFIG command process from OPCON and obtain the CONFIG prompt:

1. At the OPCON prompt, enter the **status** command to find the PID for CONFIG. (See page 1-5 for sample output of the **status** command.)
2. Enter the OPCON **talk** command and the PID for CONFIG. The PID for CONFIG is 6.

```
* talk 6
```

The console displays the CONFIG prompt (Config>). If the prompt does not appear, press the **Return** key again.

**Quick Configuration Process:** Quick Configuration, or Quick Config, allows you to quickly configure portions of the router without dealing with the specific operating system commands. You enter the Quick Config menus from the CONFIG process using the **qconfig** command.

### Entering the Desired Protocol Configuration Process

To enter the desired protocol configuration process from the CONFIG prompt:

1. At the CONFIG prompt, enter the **list configuration** command to see the numbers and names of the protocols purchased in your copy of the software. See 6-17 for sample output of the **list configuration** command.
2. From the Config> prompt, enter the **protocol** command with the number or short name (for example, IP, IPX, and ARP) of the protocol you want to configure. The protocol number and short name is obtained from the **list configuration** command display. In the following example, the command has been entered for accessing the IP protocol configuration process:

```
Config> protocol IP
```

or

```
Config> protocol 0
```

The protocol configuration prompt then displays on the console. The following example shows the IP protocol configuration prompt:

```
IP config>
```

You can now begin entering the protocol's configuration commands. See the corresponding protocol section of the *Multiprotocol Switched Services (MSS) Configuring Protocols and Features* for more information on specific protocol configuration commands.

In summary, the **protocol** command lets you enter the configuration process for the protocol software installed in your router. The **protocol** command enters a protocol's command process. After entering the protocol command, the prompt of the specified protocol appears. From the prompt, you can enter commands specific to that protocol.

### Exiting the Protocol Configuration Process

To exit the protocol configuration process:

1. Return to the CONFIG process by entering the protocol **exit** command. For example:
2. Return to the OPCODE process by entering the OPCODE intercept character (**Ctrl P**). For example:

```
IP config> exit
```

```
Config> Ctrl P
```

## Reloading the Router

Changes that you make to the protocol parameters through CONFIG do not take effect until you reload the router software.

**Note:** You must enter the **write** command to save the changes in the device's flash memory.

## Accessing the Protocol Console (Monitoring) Process, GWCON

To view information about the protocols or to change parameters at the console, you must access and use the protocol console process. Protocol console command interfaces are modes of the GWCON interface. Within the GWCON mode, each protocol console interface has its own prompt. For example, the prompt for the TCP/IP protocol is IP>.

To access the protocol console processes:

1. Enter the GWCON command process from OPCON and obtain the GWCON prompt.
2. Enter the desired protocol console process from the GWCON (+) prompt using the **protocol** command.

For more information on using the **protocol** command, see "Protocol" on page 9-11.

The next sections describe these procedures in more detail.

### Entering the GWCON Command Process

To enter the GWCON process from OPCON and obtain the GWCON prompt:

1. At the OPCON (\*) prompt, enter the **status** command to find the PID for GWCON. (See page 1-5 for sample output of the **status** command.)
2. At the OPCON prompt, enter the OPCON **talk** command and the PID for GWCON. For example:

```
* talk 5
```

The GWCON prompt (+) then displays on the console. If the prompt does not appear, press **Return** again.

### Entering a Protocol Console Process

To enter a protocol console process from the GWCON prompt:

1. At the GWCON prompt, enter the **configuration** command to see the protocols and networks configured for the router. For example:

### +configuration

```
Nways 8210 Multiprotocol Switching Server
Host name: NCE #2
Version: 16.0[R1]
```

```
Num Name Protocol
0 IP DOD-IP
3 ARP Address Resolution
7 IPX Netware IPX
11 SNMP Simple Network Management Protocol
12 OSPF Open SPF-Based Routing Protocol
23 ASRT Adaptive Source Routing Transparent Enhanced Bridge
```

```
Num Name Feature
2 MCF MAC Filtering
6 QOS Quality of Service
```

```
6 Networks:
Net Interface MAC/Data-Link Hardware State
0 ATM/0 ATM CHARM ATM Up
1 ATM/1 ATM CHARM ATM Up
2 TKR/0 Token-Ring/802.5 CHARM ATM Up
3 Eth/0 Ethernet/IEEE 802.3 CHARM ATM Up
4 TKR/1 Token-Ring/802.5 CHARM ATM Up
5 Eth/1 Ethernet/IEEE 802.3 CHARM ATM Down
```

2. Enter the **GWCON protocol** command with the protocol number or short name of the desired protocol displayed in the configuration information.

In the following example, the command has been entered for accessing the IP protocol console process.

```
+ protocol 0
```

*or*

```
+ protocol IP
```

The protocol console prompt then displays on the console. This example shows the IP protocol console prompt:

```
IP>
```

You can now begin entering the protocol's commands. See the corresponding protocol section of the *Multiprotocol Switched Services (MSS) Configuring Protocols and Features* for more information on specific protocol console commands.

## Exiting the Protocol Console Process

To exit the protocol console process and return to the OPCODE process:

1. Return to the GWCON process by entering the protocol **exit** command. For example:

```
IP> exit
```

2. Return to the OPCODE process by entering the OPCODE intercept character (**Ctrl P**). For example:

```
+ Ctrl P
```

## Protocol Names and Numbers

Table 1-2 lists the numbers that you enter with the **protocol** command to access a specific protocol configuration or console process.

Protocol Number	Protocol Short Name	Accesses the following protocol process
0	IP	IP (Internet Protocol)
3	ARP	ARP (Address Resolution Protocol)
7	IPX	IPX (Novell NetWare Internetwork Packet Exchange)
10	BGP	BGP (Border Gateway Protocol)
11	SNMP	SNMP (Simple Network Management Protocol)
12	OSPF	OSPF (Open Shortest Path First)
23	ASRT	Adaptive Source Routing Transparent Bridge
24	HST	TCP/IP Host Services
29	NHRP	Next Hop Resolution Protocol

## Accessing Feature Configuration and Console Processes

To help you access the IBM 8210 Multiprotocol Switched Services Server feature configuration and console processes, this section outlines both of these procedures.

All IBM 8210 Multiprotocol Switched Services Server features described in this guide have commands that are executed in one of the following ways:

- Accessing the *configuration* process to initially configure and enable the feature as well as perform later configuration changes.
- Accessing the *console* process to monitor information about each feature or make temporary configuration changes.

The procedure for accessing these processes is basically the same for all features. The next sections describe these procedures.

## Accessing the Feature Processes

Use the **feature** command from the CONFIG process to access configuration commands for specific IBM 8210 Multiprotocol Switched Services Server features outside of the protocol and network interface configuration processes.

Use the **feature** command from the GWCON process to access console commands for specific features that are outside of the protocol and network interface console processes.

Enter a question mark after the **feature** command to display a listing of the features available for your software release. For example:

```
Config> feature ?

QOS
MCF

Feature name or number [2] ?
```

To access a particular feature's configuration or console prompt, enter the **feature** command at the `Config>` or `+` (GWCON) prompt, respectively, followed by the feature number or short name. For example:

```
Config> feature mcf
MAC filtering user configuration
Filter Config>
```

Table 6-4 on page 6-16 lists the available feature numbers and names.

Once you access the configuration or console prompt for a feature, you can begin entering specific commands for the feature. To return to the previous prompt level, enter the **exit** command at the feature's prompt.

---

## Accessing Network Interface Configuration and Console Processes

This section describes how to get started with accessing the network interface configuration and console processes. Accessing these processes lets you change and monitor software-configurable parameters for network interfaces used in your router.

Although this manual concerns itself primarily with configuration tasks, there might be some point during configuration when you want to display some interface statistics and information. To help you access both the configuration *and* console processes, this manual outlines both procedures. The information presented in the next sections includes:

- “Accessing the Network Interface Configuration Process”
- “Accessing the Network Interface Console Process” on page 1-17

## Accessing the Network Interface Configuration Process

Use the following procedure to access the router's configuration process. This process gives you access to a specific interface's *configuration* process.

1. At the OPCODE prompt (\*), enter the **status** command to find the PID for CONFIG. (See page 1-5 for sample output of the **status** command.)
2. At the OPCODE prompt, enter the OPCODE **talk** command and the PID for CONFIG. (For more detail on this command, refer to Chapter 5, “The OPCODE Process and Commands” on page 5-1.) For example:

```
* talk 6
```

After you enter the `talk 6` command, the CONFIG prompt (`Config>`) displays on the console. If the prompt does not appear when you first enter **CONFIG**, press **Return** again.

Use the **add device** command to create a network interface. The `add device` command automatically assigns the interface number.

Enter **add device ?** to get a list of the supported device types.

3. At the `Config>` prompt, enter the **list devices** command to display the network interface numbers for which the router is currently configured, as follows:

```
Config> list devices
Ifc 0 CHARM ATM Adapter          Slot: 1 Port: 1
```

- Record the interface numbers.
- Enter the CONFIG **network** command and the number of the interface you want to configure. For example:

```
Config> network 1
```

The appropriate configuration prompt (such as ATM Config> for ATM), now displays on the console.

**Note:** Not all network interfaces are user-configurable. For interfaces that cannot be configured, you receive the message:

```
That network is not configurable
```

## Configuring the Network Interface

Refer to the specific chapters in this guide for complete information on configuring your IBM 8210's network interfaces.

The IBM 8210 supports 155 Mbps CHARM ATM interfaces.

## Exiting the Interface Configuration Process

After you have configured the interface information, exit the interface configuration process by using the following procedure:

- Return to the CONFIG process by entering the **exit** command. For example:
- Return to the OPCON process by entering the OPCON intercept character. The default intercept character is **Ctrl P**. (See "Intercept" on page 5-6 for more information.) For example:

```
Config> Ctrl P
```

## Reloading the Router

Whenever you change a user-configurable parameter, you must reload the router for the change to take effect. To do so, enter the OPCON **reload** command. For example:

```
* reload
```

Are you sure you want to reload the gateway? (Yes or No): **yes**

## Accessing the Network Interface Console Process

To monitor information related to a specific interface, access the interface console process by using the following procedure:

- Enter the **status** command to find the PID for GWCON. (See page 1-5 for sample output of the **status** command.)
- At the OPCON prompt, enter the OPCON **talk** command and the PID for GWCON. For example:  
\* talk 5
- The GWCON prompt (+) is displayed on the console. If the prompt does not appear when you first enter GWCON, press **Return** again.
- At the GWCON prompt, enter the **configuration** command to see the protocols and networks for which the router is configured. For example:

### + configuration

```
Nways 8210 Multiprotocol Switching Server
Host name: [not configured]
Version: 1.0
```

```
Num Name Protocol
0 IP DOD-IP
3 ARP Address Resolution
11 SNMP Simple Network Management Protocol
12 OSPF Open SPF-Based Routing Protocol
23 ASRT Adaptive Source Routing Transparent Enhanced Bridge
Num Name Feature
2 MCF MAC Filtering
6 QOS Quality of Service
```

```
3 Networks:
Net Interface MAC/Data-Link Hardware State
0 ATM/0 ATM CHARM ATM Up
```

5. Enter the GWCON **network** command and the number of the interface you want to monitor. For example:

In this example, the ATM console prompt is displayed on the console. You can then view information about the ATM interface by entering the ATM console commands.

```
ATM>
```

### Monitoring the Network Interface

Refer to the specific chapters in this manual for complete information on monitoring your IBM 8210's network interfaces.

### Exiting the Interface Console Process

To exit the interface console process and return to the OPCON process:

1. Return to the GWCON process by entering the **exit** command. For example:
2. Return to the OPCON process by entering the OPCON intercept character. (The default intercept character is **Ctrl P**.) For example:

```
+ Ctrl P
```

---

## Command History for GWCON and CONFIG Command Line

The Command History contains up to the last 50 commands entered by the user in GWCON (Talk 5) or CONFIG (Talk 6) command line menus.

Backward and Forward retrieve keys can be used to recall previously entered commands. In addition, a facility is provided to enable the advanced user to repeat a particular series of commands.



## Repeating a Command in the Command History

By hitting **Ctrl B** (BACKWARD) or **Ctrl F** (FORWARD) at any command line prompt in a GWCON or CONFIG menu, the current command line is replaced by the previous or next command in the Command History. The Command History is common to both GWCON and CONFIG. That is, a command entered while in a GWCON menu can be retrieved from within CONFIG and a command entered while in a CONFIG menu can be retrieved from within GWCON.

The Command History contains the most recently entered commands, up to a maximum of the last 50 commands. If only three commands have been entered since a restart, hitting **Ctrl F** or **Ctrl B** circles through only those three commands. If no commands have been entered thus far, **Ctrl F** or **Ctrl B** results in a "bell," the same bell you see when trying to backspace beyond the beginning of a line of text.

**Note:** A command aborted by entering **Ctrl U** will not be entered into the Command History.

To enter two similar commands:

```
ELS>display sub les
ELS>display sub lec
```

Enter:

```
ELS>display sub les enter
ELS>Enter Ctrl B for BACKWARD, and the current line is
replaced with-
ELS>display sub les
Enter backspace and replace "s" with "c" to get
ELS>display sub lec
then press enter
```

## Repeating a Series of Commands in the Command History

There is an additional feature for advanced users to facilitate repeating a particular series of GWCON or CONFIG commands. C1, C2,...,Cn in the Command History is referred to as a *repeat sequence*. This feature may be more convenient than simply using **Ctrl B** and **Ctrl F** when you must repeat a given task that requires multiple commands. Enter **Ctrl R** (REPEAT) to set the start of the *repeat sequence* at command C1. Enter **Ctrl N** (NEXT) successively to retrieve the next command(s) in the repeat sequence. Commands are not automatically entered, but are placed on the current command line allowing you to modify or enter the command.

To produce the desired behavior of a repeat sequence, the first command retrieved using the first **Ctrl N** (NEXT) depends on the manner in which the start of the repeat sequence was set using **Ctrl R** (REPEAT).

Setting the start of the repeat sequence with **Ctrl R** can be done in two ways:

1. When C1 is initially entered
2. When C1 is retrieved from the Command History with **Ctrl B** or **Ctrl F**.

### Starting a Repeat Sequence As Commands Are Entered

If you enter **Ctrl R** as command C1 is being keyed in, and then enter commands C2, C3... Cn. **Ctrl N** will successively bring commands C1, C2, ... Cn, C1, C2, ... Cn, C1, ... to the command line.

In Example 1, the start of the repeat sequence is set as the first command is keyed in. The user knows ahead of time that the same commands to be entered in GWCON need to be repeated in CONFIG.

#### Example 1

1. As the first command in the sequence is keyed in, use **Ctrl R** (REPEAT) to set the start of the repeat sequence.

```
*talk 5
+event-enter Ctrl R for REPEAT to set the start of the
repeat sequence-
+event enter
```

2. Continue typing the subsequent commands in the sequence:

```
Event Logging System user console
ELS>display sub les
ELS>display sub lec
ELS>exit
+
```

3. To enter these same commands in CONFIG, press **Ctrl P** (the default OPCON intercept character) and go to CONFIG.

```
+press Ctrl P -
*talk 6
Config>-press Ctrl N for NEXT to retrieve the start of
this sequence-
Config>event enter
Event Logging System user configuration
ELS config>-press Ctrl N for NEXT to retrieve the next
command in sequence-
ELS config>display sub les enter
ELS config>-press Ctrl N for NEXT to retrieve the next
command in sequence-
ELS config>display sub lec enter
ELS config>-press Ctrl N for NEXT to retrieve the next
command in sequence-
ELS config>exit enter
Config>
```

### Starting a Repeat Sequence After All Commands Are Entered

On the other hand, if you first enter C1, C2, ... Cn, and retrieve C1 via **Ctrl B** or **Ctrl F**. Entering **Ctrl R**, entering **Ctrl N** successively brings commands C2,..., Cn, C1, C2,..., Cn, C1,...,Cn to the command line (see Example 2). The first occurrence of C1 is bypassed since C1 is already available on the command line at the time it was retrieved, and does not need to be recalled again by the first **Ctrl N**.

In Example 2, all the commands are entered and then the first command in the sequence to be repeated is retrieved. A sequence of commands has been entered in GWCON, and the same sequence needs to be repeated in CONFIG.

**Example 2**

1. Enter the following commands in GWCON:

```
*talk 5
+event
Event Logging System user console
ELS>display sub les
ELS>display sub lec
ELS>exit
+
```

2. To enter these same commands in CONFIG, press **Ctrl P** (the default OPCON intercept character) and go to CONFIG.

```
+-press Ctrl P -
*talk 6
Config>-press Ctrl B four times to retrieve the start of
the four command sequence in this example-
Config>event
Config>event-press Ctrl R for REPEAT to set the start of
the repeat sequence-
Config>event enter
Event Logging System user configuration
ELS config>-press Ctrl N for NEXT to retrieve the next
command in sequence-
ELS config>display sub les enter
ELS config>-press Ctrl N for NEXT to retrieve the next
command in sequence-
ELS config>display sub lec enter
ELS config>-press Ctrl N for NEXT to retrieve the next
command in sequence-
ELS config>exit enter
Config>
```

If the OPCON **intercept** command described in Chapter 5, “The OPCON Process and Commands” on page 5-1 has been used to redefine the OPCON intercept character from the default character **Ctrl P** to one of the Command History control characters, **Ctrl B**, **Ctrl F**, **Ctrl R**, or **Ctrl N**, the OPCON intercept character will take priority. For example, if the intercept character has been changed to **Ctrl F**, then **Ctrl F** will not retrieve Forward in the Command History, but will instead place the user back at the OPCON prompt (\*).

---

## System Security

Multiple users with login permissions can also be added using the **add user** command. See “Configuring User Access” on page 6-4 for details on security issues and for information on the **set password** and **add user** commands.



---

## Chapter 2. Getting Started with the Configuration of the 8210

This chapter explains how to access the 8210 using a workstation and how to manage operational software images and configuration files. It also provides a brief overview of the functions of the 8210.

---

### Physical Access Methods

Before the 8210 has been configured, it cannot yet function in the ATM network. Therefore, you have to access it in one of the following ways:

- Through a null modem cable attached to the EIA 232 service port. This is known as local connection.
- Through one of the PCMCIA modems, or through a modem attached to the EIA 232 service port. The PCMCIA modems are the Voice/Data/Fax Modem and the Data/Fax Modem. These are the forms of remote connection, which rely on the telephone lines.

You can set up both a local and a remote connection to the 8210. However, only one port can be active at any given time. If a workstation is connected locally to the serial port and a call comes in over the Voice/Data/Fax Modem or the Data/Fax Modem, priority is given to the call. After the call, the workstation will have to log back into the 8210.

Before the 8210 has been configured, it cannot yet function in the ATM network. Therefore, you have to access it through a null modem cable attached to the EIA 232 service port. This is known as local connection. You can set up both a local and a remote connection to the 8210. However, only one port can be active at any given time.

With local or remote connection, you can use a teletypewriter (TTY) connection. TTY requires communications software to enable file transfer.

Alternatively, you can use Serial Line Internet Protocol (SLIP) over the local or remote connection. If you use SLIP, you must have Transmission Control Protocol/Internet Protocol (TCP/IP) running on your workstation.

You can continue to use local or remote access to the 8210 after it has been configured. However, after configuration, you can also use Internet Protocol (IP) to access the 8210 through the ATM network. For the IBM 8210 Nways Multiprotocol Switched Services (MSS) Server, the connection is made over optical fiber from one of the ATM connectors. For the IBM Nways Multiprotocol Switched Services (MSS) Server Module, the connection is made through the ATM switch in which the module is installed.

Figures 2-1, 2-2, and 2-3 show local connection, remote connection using the PCMCIA modem, and connection over the network.

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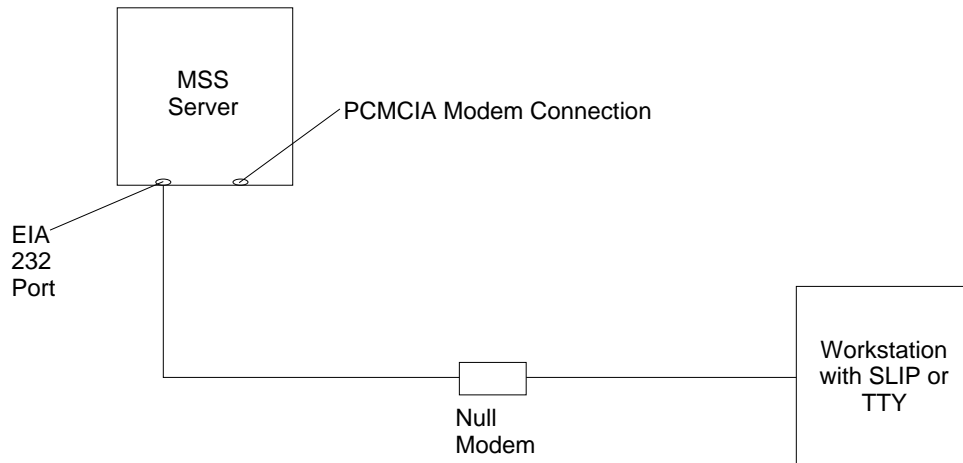


Figure 2-1. Local Serial Connection to the EIA 232 Port

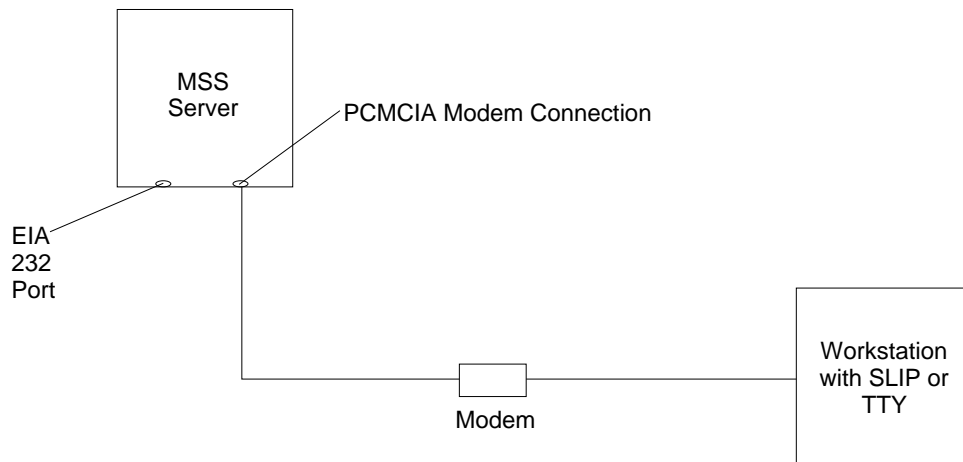


Figure 2-2. Remote Serial Connection to the PCMCIA Modem (Voice/Data/Fax Modem or Data/Fax Modem)

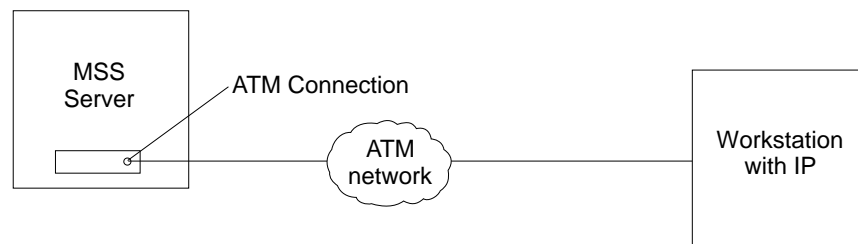


Figure 2-3. Connection Using IP Over the ATM Network. The server must be operational in the network to use this connection.

## SLIP Addresses

To configure SLIP, use these addresses:

**The IP address of the workstation**

10.1.1.3

**The IP address of the 8210**

10.1.1.2

For instructions about installing SLIP on your workstation, refer to the documentation for your version of TCP/IP.

### Serial Port and Data/Fax Modem Default Settings

These are the default settings for the serial port:

**Speed** 19.2 Kbps  
**Parity** None  
**Data Bits** 8  
**Stop Bits** 1

The Data/Fax Modem is a 28.8-Kbps V.32 bis modem. It is set up with a default speed of auto detect. The parity, data bits, and stop bits are the same as those of the serial port: None, 8, and 1.

Once the MSS Server operational code has loaded, the line speed for the serial port is automatically set to 19200 baud.

---

### Configuration and Monitoring Tools

These are the various configuration and monitoring tools that are supported by the physical connections:

#### Multiprotocol Switched Services Configuration Program

This is a standalone program that is installed in a workstation that is connected to the 8210. The workstation must be running TCP/IP. You must use this program differently before and after the initial configuration of the 8210.

##### Before configuration:

Connection to the 8210 must be through the modem or the service port, over a serial link. While the 8210 is in this state, you cannot use the Communications options of the Configuration Program. You can create configuration files and download them to the 8210 over the serial link using TFTP over SLIP. The workstation must be running TCP/IP.

##### After configuration:

The configuration file that you download over a serial link can provide an IP address and subnet mask to the 8210, or establish LAN emulation. After you have configured the 8210 and made it operational in the ATM network, you can access it through the network.

When the 8210 is in this state, you can use the Communications Send option of the Configuration Program to send configuration files from the workstation over the network to the 8210. If you are using the version of the Configuration Program that is supported by AIX, you can also use the Communications Retrieve option of the Configuration Program to retrieve configuration files from the 8210. For more information, see *IBM 8210 Multiprotocol Switched Services Server Configuration Program User's Guide for Nways Multiprotocol Access, Routing, and Switched Services*, GC30-3830.

#### Web browser Hypertext Markup Language (HTML) interface

The Web browser interface is a configurator that is a home page and is accessed by a Web browser from a workstation that is connected to the 8210. You need a Web browser that can display clickable images and tables. The

## Getting Started with 8210 Configuration

Web browser interface can be accessed using SLIP or IP. You must use the serial line connection and SLIP before the 8210 is operational in the network.

If you give the Web browser the SLIP address, one of the configured IP addresses of the 8210, or its name (if you use an IP name server), the Web browser interface will come up.

**Note:** The configured IP addresses of the 8210 include the IP addresses of all the LAN emulation clients and Classical IP clients.

### Command line interface

The command line interface is a teletypewriter (TTY) text interface that requires you to enter commands to use it. The workstation that accesses it must be either an ASCII terminal or a personal computer (PC) or other intelligent programmable workstation emulating an ASCII terminal.

This interface must be reached over a serial link before the 8210 is operational in the network; you can use TTY or SLIP to access it. If you use SLIP, you can Telnet into the 8210.

After the 8210 is operational in the ATM network, you can Telnet into the 8210 over IP to bring up this interface. If one connection to the 8210 is a Telnet session, the 8210 can support two connections at one time.

The command line interface is marked by an asterisk (\*) prompt. Refer to the *IBM Multiprotocol Switched Services (MSS) Server Interface Configuration and Software User's Guide* for a full description of this interface.

**Important:** If you use a serial connection, (either local or remote), you **must press a key** to bring up the asterisk that is the prompt for the command line interface. When you make the connection, the message Please press a key to obtain console appears and reminds you to do this.

### Voice/Data/Fax Modem or Data/Fax Modem

The Voice/Data/Fax Modem is an integrated modem with both voice and fax capabilities that is shipped with the 8210 in the U.S. and Canada. It provides access using touch tone telephone input with automated voice responses. In addition to faxing an alert after the 8210 has had a failure and has restarted, it can fax other reports that monitor the 8210 and it can change a few dynamic parameters that help to maintain the 8210 in the network.

The Data/Fax Modem is an integrated PCMCIA modem that handles data and can fax an alert from the 8210. For example, it can fax an alert from the 8210 if the 8210 has had a failure and has then automatically restarted.

Both of these modems provide full text console access to the command line interface. They provide remote connection that supports either the TTY or SLIP access. The Voice/Data/Fax Modem provides access using the voice interface to several configuration parameters, including enabling or disabling thermal shutdown for the standalone server only.



## Fax Accumulation

If several undeliverable faxes are sent from the Voice/Data/Fax interface, they will not be deleted. They will accumulate as new faxes are added and sent when possible. The most common cause of fax delivery failure is a missing or incorrect fax telephone number.

## Local and Remote Console Access

When accessing the 8210 locally on a null modem cable attached to the EIA service port or remotely through the PCMCIA modem, use VT100 terminal emulation. Because VT100 does not define function keys above F4, edit the keyboard mapping manually as follows: For F6, enter the mapping (ESC)OU. For F9, enter the mapping (ESC)(Left square bracket)009q.

**Note:** (ESC) represents the carat symbol followed by the left square bracket.

Also note that a PING done on the PCMCIA modem may take up to 2 minutes.

## Remote Voice Access

When dialing the number for voice access to the MSS Server, detection of the user is not automatic, as implied in “Voice/Data/Fax Modem Menu Items” on page 4-4. The user will be asked to press the # key. If the user fails to do this, the server assumes the caller is a modem and will subsequently send a carrier signal. If the # key is pressed, operation proceeds as given in “Voice/Data/Fax Modem Menu Items” on page 4-4.

---

## File Transfer

Table 2-1 on page 2-6 defines the ways in which configuration files and operational software files can be transferred to and from the 8210.

## Getting Started with 8210 Configuration

Table 2-1. File Transfer

File Transfer Method	Type of Connection
<p>TFTP Get command from the 8210 to the workstation that has the binary configuration file, to download operational software images and configuration files to the 8210. Files sent using TFTP must be binary, or the 8210 cannot use them. You should use the Create command of the Configuration Program to save configuration files in binary format before downloading them to the 8210.</p> <p>After the 8210 is operational in the network, you can use the TFTP Put command over IP to upload a file from the 8210 to a workstation. The file will be uploaded in binary format. Both operational software and configuration files can be uploaded.</p> <p>You should use the Read router configuration option of the Configuration Program to make an uploaded configuration file usable by the Configuration Program so that you can change some parameter values in it.</p> <p><b>Note:</b> Using TFTP Put is a way to retrieve files from the 8210 if the Retrieve option of the Configuration Program is not available.</p>	<ul style="list-style-type: none"><li>• SLIP connection (using the TFTP Get command to download files to the 8210).</li><li>• IP connection of operational 8210 over functioning network (using the TFTP Get and Put commands to download and upload files).</li></ul>
<p>The Communications Option of the Configuration Program (actually, the protocol for this is SNMP). This method cannot be used until the 8210 is operational in the network. The files are not binary, but are in a format that is internal to the Configuration Program. This function can send configuration files to the 8210 and retrieve them from the server.</p>	<p>IP connection of operational 8210 over functioning network.</p>

---

## Initial Configuration

After the 8210 has passed its hardware diagnostics, it is in a ready state for configuration. These are two examples of ways to complete the first configuration:

### First Example

1. Use the Configuration Program to create a binary configuration file.
2. Download the file to the 8210 using TFTP over SLIP.
3. Restart the 8210 to make the configuration active. If your configuration file included all the necessary parameters, the 8210 should now be completely operational in the network.

### Second Example

1. Use a SLIP or a TTY connection over a serial link to access the IBM 8210.
2. Bring up the Web browser interface or the command line interface.
3. Use quick configuration to do a minimal configuration of the IBM 8210, including IP address and SNMP. See "Quick Configuration" on page 2-7.
4. Restart the IBM 8210 to activate the quick configuration.

5. Next, make and save a configuration file using the Configuration Program. Use either the TFTP Get command over SLIP or IP or use the Communications Options Send command of the Configuration Program to download the configuration file.

If you use TFTP, you must use the Create option of the Configuration Program to create binary files and then TFTP them to the IBM 8210.

6. Restart the IBM 8210 to make the configuration active. If your configuration file included all the necessary parameters, the IBM 8210 should now be completely operational in the network.

---

### Tips for Managing Configuration Problems

**Important:** After the IBM 8210 is configured and operational, *always* back up the active configuration file. Keeping this file enables you to re-establish the IBM 8210 on the network should the active configuration become corrupted.

You can back up the active configuration file by retrieving it and storing it in the workstation. See “File Transfer” on page 2-5 for more information.

### Reconfiguring

You may find it hard to detect problems caused by configuration errors. A configuration error can initially appear to be a hardware problem because the IBM 8210 will not start or data will not flow through a port. In addition, problems with configuration may not result in an error initially; an error may occur only when specific conditions are encountered or when heavy network traffic occurs.

If you cannot resolve a problem after making a few changes to your configuration or after restoring the active configuration file, it is recommended that you generate a new configuration. Too many changes to a configuration often compound the problem, whereas you can usually generate and test a new configuration within a few hours.

---

### Quick Configuration

Quick configuration is a process for initial configuration that is available either from the Web browser interface or from the command line interface. It produces a simple configuration that will enable the IBM 8210 to run in the network. The Web browser interface, which is the more usable of the two interfaces, is recommended. See “Quick Configuration Using the Web Browser Interface” on page 3-5 for a description of quick configuration using the Web interface.

### Completing the Configuration After Quick Configuration

After you have completed quick configuration, you must reload the IBM 8210 to activate the configuration. Then, you can access the IBM 8210 over the network, if you have configured an IP address for it.

The configuration provided by QCONFIG depends upon many default values for parameters, some of which may not be appropriate to your installation. You may need to modify the configuration that you have created using QCONFIG to customize the IBM 8210 to work on your network. You can do this using any of these methods:

## Getting Started with 8210 Configuration

- Configuration Program
- Web browser HTML interface
- Command line interface

However, the Configuration Program is the preferred configuration method for these reasons:

1. It can enable you to keep a number of copies of configuration files on a server for uploading to the appropriate IBM 8210s.
2. It does not alter any configuration parameters dynamically. This feature helps you control changes to the IBM 8210 configurations.
3. It performs more input validation and cross-checking of the configuration parameters than the other methods.

The command line interface and the Web browser interface cause certain parameters to be altered dynamically. The binary files that they create are saved on the hard disk of the IBM 8210, not in the workstation. These characteristics make them more difficult to use for managing the configuration of the IBM 8210. However, they can be used to monitor the operations of the IBM 8210, whereas the Configuration Program cannot. They are also useful when you want to change one of the parameters that can be dynamically altered.

---

## How Software Files Are Managed

To help you manage operational software upgrades and configurations, the IBM 8210 has a software change management feature. This utility enables you to determine which operational software file and which configuration file is active while the IBM 8210 is running. In addition to storing the active operational software and the active configuration file, the IBM 8210 stores two backup images of the operational software and up to 11 configuration files in non-volatile memory.

## How to View the Files

To use the change management tool in the command line interface to view the operational software image and the configuration files, follow these steps:

1. From the prompt for OPCON, which is an asterisk (\*), type **talk 6**. The prompt `Config>` appears.
2. Enter **boot**. You will see the prompt `Boot config>`.
3. Enter **list** to display information about which load images and configuration files are available and active.

See "List" on page 7-8 for sample list output and a description of file statuses.

## How to Reset the IBM 8210

**Note:** A reset interrupts the function of the IBM 8210 for up to 90 seconds. Be sure that the network is prepared for the interruption.

As previously stated, PENDING and LOCAL files are not loaded into active memory until you reset the IBM 8210.

You can reset the IBM 8210 using any one of these methods:

- Press the hardware reset button.

- At the `Config only>` prompt, type **reload**.  
**Note:** The `Config only>` prompt appears when config no file is active. Lack of an active config file indicates that an active configuration has become corrupted or that the IBM 8210 is not configured.
- At the `OPCON` prompt (\*), type **reload**.

### File Transfer Using TFTP

See “TFTP” on page 7-11 for a sequence of commands to transfer a file from a workstation or server to the IBM 8210 using TFTP. You will need to substitute your own values for the IP address and path, which are given as examples.

### Storing Configuration Files Using the Command Line Interface or the Web Browser Interface

To store a configuration file that you have created using the command line interface, type **write** at the `Config>` prompt. If you are using the Web browser interface, select **Write**. The Write command creates a binary configuration file that contains the most current value of each of the configuration parameters.

This file is stored in the ACTIVE bank and is given PENDING status. If the status of the file is not changed by a Set command, it becomes the ACTIVE configuration when the IBM 8210 is reset.

### Changing the Statuses of Files

These are the ways to change the statuses of image and configuration files:

- You can cause the IBM 8210 to perform a reset by using the Send command from the Communications Option of the Configuration Program. When you do this, the file that you send can arrive as a PENDING file or as an AVAIL file. If it is a PENDING file, it becomes the ACTIVE configuration and the previously ACTIVE file becomes AVAIL when the IBM 8210 is reset.  
If it is an AVAIL file, resetting the IBM 8210 does not change its status.
- You can use the Set config (set config) commands from the `Boot config>` prompt manually to change the status of any files except the ACTIVE files. If you set a file to PENDING, it becomes ACTIVE and the ACTIVE file becomes AVAIL when a reset is performed.
- When you use the Write command to store a configuration file that you have created using the command line interface or the Web browser interface, it is stored with a PENDING status.
- If you copy a file from one location to another, the file receives the status of the file that was there before it and that it overwrites. For example, if you copy a file with the status of AVAIL over a file that has the status of PENDING, the new file will keep the status of the original file, which is PENDING.

### Using the Configuration Program to Manage the Configuration Files

For optimal configuration management, it is recommended that you use the Configuration Program and its configuration database to manage all your IBM 8210 configuration files.

## Getting Started with 8210 Configuration

The design of change management facilitates good control of the configuration files. Keeping the ACTIVE file and the file that is stored in the configuration database the same assures that a copy of the ACTIVE file is always available.

When you use the Send option to send a new configuration to the IBM 8210, the new configuration is written to the ACTIVE bank and overwrites the file located in the position just below the currently ACTIVE configuration. The new configuration is PENDING if a time is set for a reset. If the configuration file is sent without a specified time for the reset to occur, it gets AVAIL status.

For example, suppose that CONFIG 2 is ACTIVE. The new configuration file is written to CONFIG 3. It has a status of PENDING if a reset time is associated with it; if not, it has a status of AVAIL.

If the file has a status of PENDING, CONFIG 2 becomes AVAIL and CONFIG 3 becomes ACTIVE when a reset occurs. The next file that is sent from the Configuration Program will be placed in CONFIG 4. If a reset time is associated with the file, it will have the PENDING status and will become ACTIVE when the next reset occurs. If another file is then sent, it is placed in CONFIG 1 because the currently ACTIVE file is now in CONFIG 4. This arrangement results in a circular queue.

If the downloaded file has a status of AVAIL, a reset does not change its status. If another file is sent down, it overwrites that file because the ACTIVE file has not changed and the newly downloaded file always occupies the location just behind the ACTIVE file.

## Using the Set Commands

See "SET" on page 7-10 for information about the **set** command.

## Other Change Management Functions

These are the other change management commands:

- Describe load images
- Describe config images
- Disable dumping
- Enable dumping
- Erase files

### Describe

See "Describe" on page 7-6 for information about the **Describe** function.

### Disable Dumping

The IBM 8210 can be set up to dump the contents of memory to permanent storage in the unlikely event of a complete system failure. If dumping is enabled, using this selection will cause the IBM 8210 *NOT* to dump to disk.

To disable dumping, type **t 6** at the \*, press **Enter** and then type **disable dump** or **dis du** at the Config> prompt. You will see the message:

```
Config> Automatic memory dump disabled
```

### Enable Dumping

This command enables the dumping of memory without intervention from anyone in the event that the IBM 8210 has a catastrophic error. The IBM 8210 will dump memory onto the hard disk. Once a successful dump has been taken, the IBM 8210 attempts to restart. Depending upon the failure of the IBM 8210, it cannot always restart. In this case, you should restart it manually and call a service person, who will dial into the IBM 8210 to determine the nature and the causes of the failure.

To enable dumping, type **t 6** at the \*, press **Enter** and then type **enable dump** or **ena du** at the `Config>` prompt. You will see the message:

```
Config> Automatic memory dump enabled
```

The default state is to have dumping enabled.

### Erase Files

See “Erase” on page 7-6 for information about the **erase** command.

## Using the Copy Command

The Copy command allows you to move a file from one location in the storage area to another. This command allows you to change the status as well. The file that you move always receives the status of the storage area that it is moved to. For example, suppose that you have this scenario:

- The configuration file in BANK A CONFIG 1 is AVAIL. The configuration file in BANK B CONFIG 1 is PENDING.
- You copy the configuration in BANK A CONFIG 1 to BANK B CONFIG 1.

In this case, the original configuration file in BANK A CONFIG 1 remains unchanged and AVAIL. The configuration that was in BANK B CONFIG 1 is overwritten by a copy of the configuration file that is in BANK A CONFIG 1. This copy retains the status of the file that it overwrote, in this case, PENDING.

See “Copy” on page 7-4 for additional information about the **copy** command.

## Using the Lock Command

The **lock** command allows you to prevent the server from overwriting the selected configuration with any other configuration.

See “Lock” on page 7-9 for additional information about the **lock** command.

## Using the Unlock Command

The **unlock** command removes the lock from a configuration allowing the configuration to be updated.

See “Unlock” on page 7-16 for additional information about the **unlock** command.





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## Chapter 3. Using the World Wide Web Interface

The IBM 8210 provides a World Wide Web interface to monitor and configure the product. The Web browser interface performs all of the functionality of the command line interface, but in a graphical, more user-friendly manner.

---

### Connecting to the World Wide Web Interface

There are four mechanisms for accessing the Nways MSS Server using the Web interface:

- Locally, over the service port with a workstation that communicates using Serial Line IP (SLIP).
- Remotely, over an external modem connection to the service port. As with the local connection, the workstation must support SLIP.
- Remotely, using the integrated Voice/Data/Fax Modem or the Data/Fax Modem PCMCIA modem. This connection must also support and be running SLIP.
- Through a LAN emulation (LE) client or Classical IP interface running over the ATM adapter. This connection works over an IBM 8210 that has been configured and is operational in the network.

To use this connection, provide the browser with the IP address of a LE client or Classical IP interface.

You may use any web browser that supports HyperText Markup Language (HTML) tables and clickable images. Examples of browsers that support this feature are WebExplorer Version 1.03 or higher, Netscape Navigator Version 1.1N or higher, and Mosaic Version 2.1.1 or higher.

In order to access the Home Page of the IBM 8210, point your browser to the Universal Resource Locator (URL) `http://<machine>/`, where `<machine>` is either the name or one of the configured IP addresses of the IBM 8210.

You will be shown the Home Page that is described in the next section.

**Note:** Before you can use the Web browser, the IBM 8210 must have been configured with an IP address. This address can either be a network address or a SLIP address. The default SLIP address for the IBM 8210 is:

10.1.1.2

Use this source IP address to identify the workstation:

10.1.1.x

The letter *x* stands for any value.

### Rules for Using the Web Interface

When you perform configuration using the Web browser interface, you should observe the following guidelines:

- Many configuration options require you to enter data on two or more Web pages (or forms). If you fill in and submit the first form in a series, be sure to complete the remaining forms. If you do not fill in and submit all the forms, the configuration parameter could be left in an unknown state.

## Using the World Wide Web Interface

- Two people should not perform configuration at the same time. They can interfere with one another. For example, one person could delete an interface while the other person is in the middle of configuring a protocol on that interface.
- You should disable the caching feature of the browser. If you do not do this, the browser may pull a page out of memory instead of going to the IBM 8210 to get the latest information. You may be shown old data. This problem is more likely to occur when you use the *Back* button on the browser.

---

## Home Page Structure

Figure 3-1 shows the IBM 8210 Home Page.

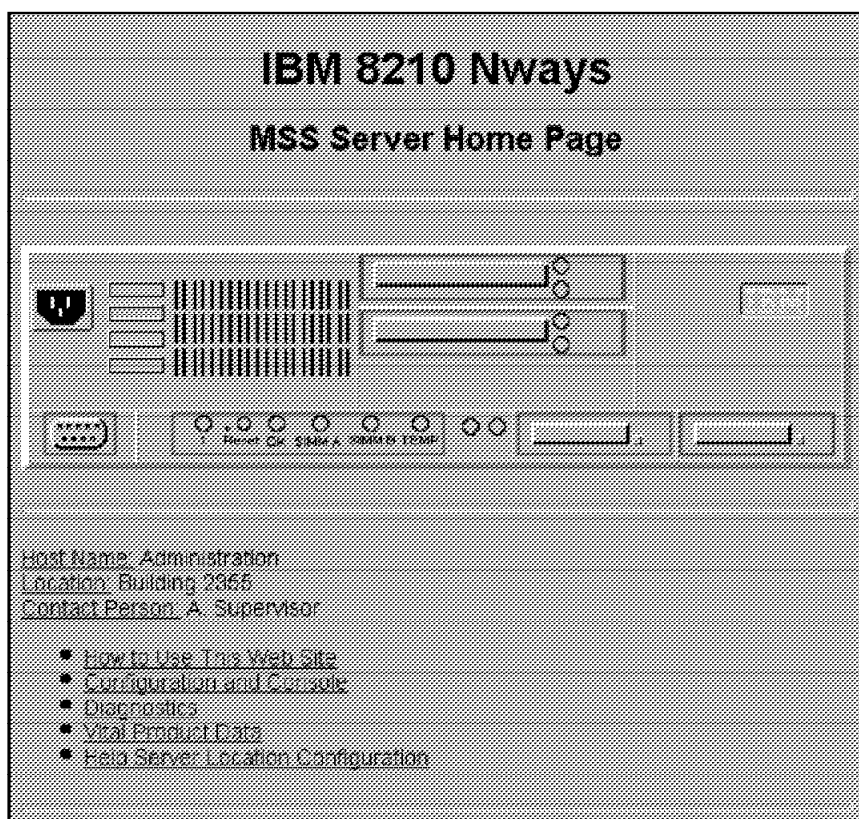


Figure 3-1. IBM 8210 Home Page

This Home Page provides a graphic that shows the status of the IBM 8210. It indicates the current network interfaces installed and shows the status of each port (for example, installed, enabled, or disabled). The current state of each LED is also shown, as well as the indication of the devices that are installed in the two PCMCIA slots. If the Web browser supports dynamic refresh, then this page will automatically refresh itself approximately every 80 seconds. If you click any of these ports or interfaces, a more detailed description of its status will be shown on a separate Web page.

Click **How to use this Web Site** for instructions about using this site.

Click **Configuration and Console** to bring up the menu shown in Figure 3-2 on page 3-3.

Click **Diagnostics** to bring up the menu shown in Figure Figure 3-3 on page 3-3.

Click **Vital Product Data** for information about the hardware and operational software. This panel, which is usually used for diagnostics, is not displayed here.

Click **Help Server Location Configuration** to set the path for the optional Help Server. You will need to set this path if you want to use the optional help files for the Web Browser interface.

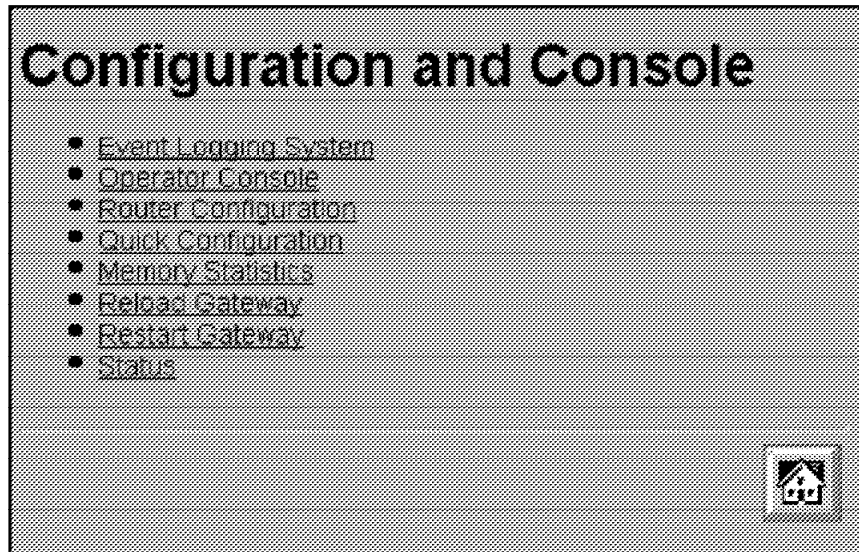


Figure 3-2. Configuration and Console Page 1

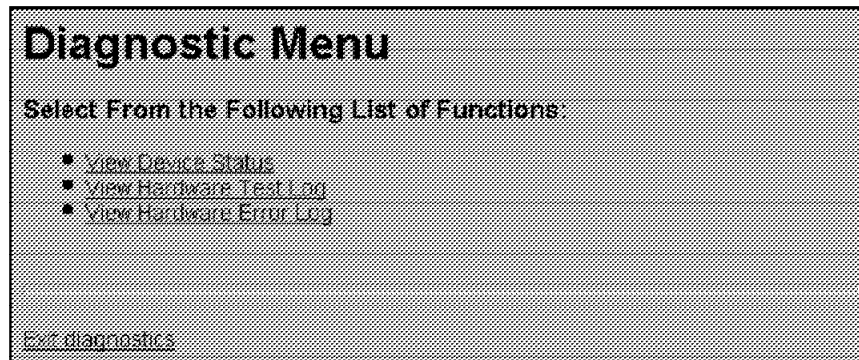


Figure 3-3. Diagnostic Menu

## Configuration and Console Menu

This menu can lead you into various aspects of configuration. If you are starting with quick configuration, click **Quick Configuration**. Figure 3-4 shows the quick configuration menu.

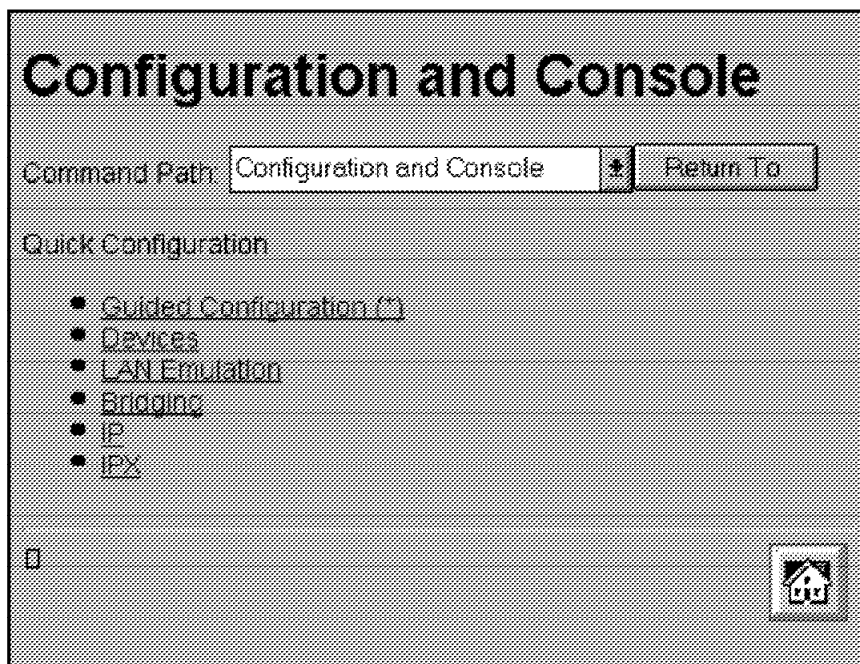


Figure 3-4. Configuration and Console Page 2

See "Quick Configuration Using the Web Browser Interface" on page 3-5 for information about quick configuration and guided configuration.

---

## Event Logging System

One of the links on the Configuration and Console page 1 is to the Event Logging System (ELS). The ELS display is similar to the one provided on the command line interface. On the Web interface, going into the ELS will display the most recent events stored in the system memory. In order to get future updates, press the Reload button on your browser. For more details about the ELS message facility, refer to the *Event Logging System Messages Guide*.

---

## Operator Console

The console monitoring interface provides real-time status information very similar to that offered in the command line interface. The menus from the command line interface are presented as a hierarchy of Web links that can easily be traversed with the click of a mouse button. It is possible to jump back several levels in the hierarchy with a single push of a button.

---

## Router Configuration

**Important:** Exercise caution when you use the Web browser to change configuration parameters. Changes to the configuration that are made using the Web browser are written directly to static random access memory (SRAM). You can make unintentional configuration changes that do not take effect until the IBM 8210 is reset. To check that you have the correct parameters, look over the settings for any parameters that you have configured before submitting them.

The Web interface greatly simplifies the configuration of network and protocol parameters. In many cases where it is necessary to remember the individual network numbers on the command line interface, those options are now all presented as menu options on the Web. Also, the Web interface uses the graphical features available to it, such as pick lists, selection lists, radio buttons, and check boxes.

If a particular configuration option needs to prompt you for answers to several questions, those questions are now presented on a single Web page. After all of the questions are filled in, you should press the *Submit* button to send the data back to the IBM 8210 for validation.

The hierarchy of the Web browser interface is very similar to that of the command line interface.

---

### History Function

The Web Configurator uses a selection list and a *Return to* button to provide an advanced history function. Depending upon your choice of HTML browser, a pick list, choice box or pull-down list box will be displayed. This list of selections contains the names of the pages visited under the current branch of the software structure. To return to a previously visited page within the current command pathway, select that entry from the list and click the *Return To* button.

---

### Help System for the Web Browser Interface

Optional, free-of-charge, help files for the Web Browser interface can be downloaded from the Web. Use of the help button located at the bottom of Web Browser configuration panels requires the installation of these help files.

For download instructions and additional information about the help files, point your browser to URL <http://www.networking.ibm.com/nes/nesswitc.htm>

---

### Quick Configuration Using the Web Browser Interface

**Note:** This section is most helpful when it is used while you are viewing the IBM 8210 Web interface.

Quick Configuration for the IBM 8210 using the Web interface is divided into the following steps:

- Guided configuration
- Devices
- LAN Emulation
- Bridging
- IP
- IPX

### Guided Configuration

To view the individual steps that are required for quick configuration, select **Guided Configuration** from the menu on Configuration and Console page 2, shown in Figure 3-4 on page 3-4. On each step, you will be presented with a link that allows you to skip to the next step. When you submit the form for a step, the results page will contain a link that takes you to the next step in the guided configuration. The results page in the last step of the guided configuration contains a link to take you back to the home page.

If you complete the guided configuration, you will have been through every step of a quick configuration. If you want to change only certain aspects of a quick configuration, use each of the separate steps. For example, to change only LAN emulation parameters, select that step.

### Devices

Selecting **Devices** presents a list of the currently configured devices, which are the ATM adapters. Click on the **Submit** button to add an ATM device using the next available network and slot numbers. A **Submit** button is included on the results page if there is still room to add more devices. Click on it again to add another ATM device. A **Submit** will not be included on the results page once all the available slots have been filled, so it is impossible to attempt to add too many devices.

When you are done with this step, you will have added all physical ATM devices to the configuration.

### LAN Emulation

Selecting **LAN Emulation** presents a form that allows the LAN Emulation Configuration Server (LECS), LAN Emulation Server (LES), Broadcast Manager, and LAN Emulation Client (LEC) to be configured for each ATM device that has been added.

When you add multiple ATM devices, radio buttons are presented that allow you to configure the ATM device that the LECS will use.

For each ATM device that you add, you have the option of adding one emulated token ring, one emulated Ethernet, neither or both. Each emulated LAN (ELAN) is added by selecting its associated check box. For each ELAN that you configure, you must specify the name and selector to be used by the LES. You can also specify which types of broadcast management will be performed by selecting the appropriate check boxes for:

- IP
- IPX
- NetBIOS
- Source Routing (token-ring ELANs only)

When you click on the Submit button, all of the LAN Emulation components are configured based on the input from the form. A LES is added for each ELAN. The LESs are configured to use the burned-in ESI of the ATM device along with the selector byte that you previously specified for the ELAN.

Broadcast management is configured for each ELAN as specified by the check boxes from the form.

An LE client is also added for each ELAN. The clients are configured to request the ELAN name configured from the form and to use the burned-in ESI of the ATM device along with a selector byte automatically generated by the system.

The LECS is configured with policies for the ELAN by name and for the ELAN by type. ELAN by name is given the highest priority. When a LE client joins and specifies one of the configured ELAN names, it will be sent to the appropriate LES. Clients joining an ELAN by type will be sent to the LES of the desired type that is on the ATM device that the LECS is configured to use.

When you submit the form by clicking on the Submit button, LAN emulation is configured according to the submitted data and the results are displayed on a new page. Quick configuration allows you to configure only one ELAN per ATM device. If you need to configure additional ELANs, click on the links that are included on this page to provide links to the more detailed configuration pages for the LECS and each LES and LE client.

When you are done with this step, all ELAN interfaces have been added to the configuration. This step combined with the previous step provides the network interfaces necessary for performing bridging, IP, and IPX configuration in the subsequent steps.

## Bridging

Selecting **Bridging** presents a form that allows bridging to be configured on each network interface that can support bridging. You can also configure the bridge parameters required for source route bridging, which include the bridge number and the virtual segment number. For each emulated token-ring interface capable of bridging, you are given the option to enable source routing and to configure a segment number if source route bridging is enabled.

When the form is submitted by clicking on the Submit button, transparent bridging is automatically enabled for all token-ring and Ethernet LE clients. Source route bridging is enabled on any token-ring LE client with the check box selected. Bridging can be done only on the LE clients and not directly on the ATM devices. The results are displayed on a new page.

## IP

Selecting **IP** presents a form that allows IP to be configured on each network interface. For each interface, you can enable IP by selecting the associated check box. If you enable IP, you must provide an IP address and mask using the dotted decimal format. The IP address and the subnet mask are the only parameters required to enable IP on an ELAN.

If you enable IP on an ATM device, you are actually configuring Classical IP (RFC 1577). In this case, you must select a radio button to choose between a *client-only* configuration or a *client and server* configuration. If you select *client-only*, then you must specify the 20-byte ATM address of the remote ARP server that the client will use. If you select *client and server*, then you must specify the selector. The burned-in ESI and the specified selector make up the portion of the ATM address that can be configured by the user.

**Note:** For quick configuration, the burned-in ESI is the only choice. You are required to set the selector.

When the form is submitted by clicking on the Submit button, IP is configured according to the submitted data and the results are displayed on a new page.

### IPX

Selecting **IPX** presents a form that allows IPX to be configured on each network interface that can support IPX. Each eligible interface can be enabled for IPX by selecting the associated check box. If you enable IPX, you must configure a network number and select the encapsulation type to be used by choosing the appropriate value from the select list presented for each interface.

When you submit the form by clicking the Submit button, IPX is configured according to the submitted data and the results are displayed on a new page.

---

## An Example of Quick Configuration Using the Web Browser Interface

The following procedure shows how to use Quick Configuration to configure LAN emulation using the Web Browser interface:

1. Connect to the IBM 8210 using a SLIP connection. Configure your SLIP stack to use 10.1.1.2 as the IP address of the IBM 8210 and 10.1.1.3 as your IP address.
2. Open the following URL: <http://10.1.1.2/>
3. From the MSS home page, click **Configuration and Console**.
4. From Configuration and Console click **Quick Configuration**.

- a. Click **LAN Emulation**.

Change ELAN names if desired, and then click **Submit**.

LES/BUS, LEC and LECS are now configured for one Token-Ring and one Ethernet ELAN. Either or both ELANs can be omitted if desired.

LEC is now configured for one Token-Ring and one Ethernet ELAN. Either or both ELANs can be omitted if desired.

Select **Quick Configuration** from the Command History and click **Return to**.

- b. Click **IP**.

Enable IP on the desired interfaces. IP must be enabled on at least one interface. The choices are:

- Enabling Classical IP on the ATM adapter interface
- Enabling IP on each of the ELAN interfaces defined in the previous step

Change the IP addresses and masks to appropriate values for your network.

If Classical IP is configured as a client only, the ATM address of the ARP Server must be entered.

Click **Submit**.

IP is now configured on the specified interfaces.

Click the home icon at the bottom of the screen.

5. From the MSS home page, click **Configuration and Console**.



From Configuration and Console click **Router Configuration**

Click **RELOAD**.

Select **Yes** and click the **Submit** button to restart the IBM 8210.

The IBM 8210 will now be accessible from the ATM network using the IP addresses that were specified in step 4b on page 3-8.



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## Chapter 4. MSS Server Voice/Data/Fax Modem Support

A PCMCIA Voice/Data/Fax Modem is shipped with the MSS Server in the U.S. and Canada; in most other countries, the PCMCIA Data/Fax Modem is shipped. Check with your IBM representative if you want to determine whether you will receive the Data/Fax Modem.

If you do not use the Voice/Data/Fax Modem or the Data/Fax Modem, you can purchase a modem and attach it externally to the EIA 232 port for remote access to the MSS Server. Information about the types of modem supported is found in the *IBM Multiprotocol Switched Services (MSS) Server Introduction and Planning Guide*, GC30-3820.

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### Installation of the Voice/Data/Fax Modem

Follow these steps to install the Voice/Data/Fax Modem:

1. Use the eject button to remove the Data/Fax Modem, if it is present.
2. Insert the Voice/Data/Fax Modem in the available PCMCIA slot.

The Voice/Data/Fax Modem is hot-pluggable. It will re-initialize when it is inserted in the PCMCIA slot.

If you use the serial service port at the same time that you use the Voice/Data/Fax Modem or the Data/Fax Modem, you need an analog telephone line for each connection.

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### Data/Fax Modem

This PCMCIA modem allows remote connection of a workstation to the MSS Server over telephone lines to access the command line interface, the Web browser interface, or the Configuration Program. You must use serial line Internet protocol (SLIP) over the telephone line to access the Configuration Program.

In addition, it can be configured to fax a report whenever the MSS Server sends an alert. See "Voice Pager Messages" on page 4-4 for an example of the kinds of alerts that the Data/Fax Modem sends.

Neither the Data/Fax Modem nor the Voice/Data/Fax Modem require any special configuration.

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### MSS Server Voice Access Using the Voice/Data/Fax Modem

When you place a voice call to the Voice/Data/Fax Modem, you will hear a voice menu. Items on this menu will allow you to access the MSS Server and to exercise limited control over it. The four capabilities enabled by the Voice/Data/Fax Modem are:

1. Performance monitoring
2. Remote problem determination
3. Network monitoring
4. Limited configuration

## MSS Server Voice/Data/Fax Modem Support

The Voice/Data/Fax Modem lacks speech synthesis, so verbal output is limited to the capabilities of the prerecorded voice files. The model implemented for the MSS Server uses a fax machine as an output device and the telephone primarily as an input device. You press a touch-tone telephone key to give information to the MSS Voice Response Unit.

As a result, most of the information obtained from the Voice/Data/Fax Modem is in the form of faxed reports. Files containing the report information will be constructed and passed to the fax function.

### Performance Information

A menu option that provides selected performance information and predefined performance and configuration reports is available using the Voice/Data/Fax Modem.

### Remote Service

For remote service, the Voice/Data/Fax Modem provides a menu of activities that the caller can utilize, including:

- Resetting the MSS Server
- Reviewing pager log entries
- Reviewing nonvolatile memory log entries
- Obtaining a report on field replaceable unit (FRU) status

### Network Monitoring

Network monitoring is generally provided using SNMP input that is handled by a network manager. However, the Voice/Data/Fax Modem provides some limited ability to access or retrieve information for the caller. The following menus are offered:

- Network management statistics and information
- Predefined reports available using fax

### Configuration

The Voice/Data/Fax Modem allows you to change a limited number of configuration parameters. See “Option 5—Configuration” on page 4-7 for more information.

**Important:** Exercise caution when you use the voice menu to change configuration parameters. Changes to the configuration that are made using the voice menu cause the current configuration to be written directly to static random access memory (SRAM). When these changes are written to SRAM, any temporary changes that have been made using the Web browser interface or the command line interface are also written to SRAM and become part of the active configuration. Before you use the voice menu to change any parameters, you should make sure that all temporary parameter settings are acceptable.

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## MSS Server Voice Pager Support

The voice pager is included as a way to alert you that there is a problem, for example, that the MSS Server has become overheated or has had to reload due to an unrecoverable error of the software.

The voice pager function can call a telephone number and deliver a voice message describing a problem. The pager attempts to detect that the telephone has been answered before it speaks the message. It can speak its message to a person, a voice mail system, or a voice paging service. It cannot determine which of these methods was used to answer the telephone.

You can configure multiple telephone numbers to receive the pager messages. The pager will try them in sequence until one answers. Whenever one of the numbers is answered, the pager message is considered delivered.

### Voice Pager Configuration Parameters

You can control the sending of outbound telephone call page messages. These are the paging parameters:

- PagerNum character strings

These are the telephone numbers to call for the outbound voice messages generated by problem conditions. The telephone numbers will be called until one answers so that the voice message can be delivered. You can have from zero to 4 numbers. If there are zero telephone numbers, outbound page messages will not be attempted.

- Quantity of telephone numbers
  - Maximum 4
  - Minimum 0
  - Default 0 (no telephone numbers)
- Length of the telephone number
  - Maximum 64
  - Minimum 0
  - Default 0 (no telephone number)
- Content of the telephone number

The telephone numbers can contain digits 0 through 9 and commas. A comma will cause the outbound dialer to pause for 2 seconds. This feature is often used when dialing an outside line or calling a second number.

- Retry Interval integer

High-severity voice page messages will be sent until the machine is called by the receiver of the message and the receipt of the page message is acknowledged. This parameter gives the time in minutes to wait before re-sending the voice page message. This parameter is known as the *nag interval*. If this number is zero, high-severity page messages will be sent only once.

- Length of minutes in the retry interval

This parameter specifies the length of time during which the pager will continue to re-send high-severity voice messages.

- Maximum 840 (24 hours)
- Minimum 0
- Default 60 (1 hour)

### Voice Pager Messages

All page messages start with the same prefix:

```
This is a message from an IBM MSS Server serial number nnnnnnnn
```

The page prefix message will be followed by a unique problem message. Currently, there are three problem messages that the pager will deliver:

1. The MSS Server has rebooted due to an unrecoverable error.
2. The MSS Server is over recommended operating temperature. Further temperature increases may cause the MSS Server to shut down.
3. The MSS Server has exceeded maximum operating temperature and is shutting down.

### Maintenance Log

The maintenance log keeps a record of fax and paging activity. The log entries are time-stamped. The log can be sent to a fax machine for viewing.

### Maintenance Log Configuration Parameter

You can control the size of the maintenance log. This log is a wrap-around file that never changes size. If the file is defined to have 100 entries, it will be created to contain 100 entries. When the log is filled, the oldest log entry will be replaced. Each log file entry takes approximately 250 bytes of disk space.

The configuration parameter is an integer—`MaintenanceLogSize`—that specifies the number of log entries contained in the file.

- Maximum 4096
- Minimum 32
- Default 64 (16 000 bytes disk space)

---

### Voice/Data/Fax Modem Menu Items

When the Voice/Data/Fax Modem receives a call, it requests that the caller press the pound (#) key. If the # is pressed, the Voice/Data/Fax Modem recognizes that this is a voice call. The voice menu takes control and requests the MSS Server personal identification number (PIN).

**Note:** The default value for this PIN is 8210001. Whichever PIN is configured first is the supervisory PIN. If only one PIN is configured, it is the supervisory PIN. If you configure one PIN and delete 8210001, then the PIN that you have configured becomes the supervisory PIN.

Each additional PIN that is configured is placed in a sequence. For example, if you configured three PINs, and then deleted the default PIN and the first PIN, the second PIN would become the supervisory PIN.

**Note:** At this point, the functions offered by the Voice/Data/Fax Modem are the same as certain functions that you can access using the command line interface. Refer to the two volumes of the *Command Line Interface User's Guide and Protocol Reference* for more information about these functions. In the description of the Voice/Data/Fax Modem menu that follows,

keywords from the command line interface are provided to help you find the relevant information in the *Command Line Interface User's Guide and Protocol Reference*.

The main voice menu offers the following options:

<b>Voice Message</b>	<b>Function</b>
Press <b>1</b> to reset	MSS Server Reset
Press <b>2</b> for operational statistics	Status and statistics
Press <b>3</b> for router protocol reports	Reports
Press <b>4</b> for event log reports	Event logs
Press <b>5</b> for configuration options	Configuration
Press <b>6</b> for device presence and status	Device presence and status report
Press <b>7</b> to resend last fax report	Resend fax
Press <b>8</b> for disconnect call	Disconnect
Press <b>9</b> for repeat menu	Repeat menu

The options are repeated approximately every 15 seconds until a valid entry is made or until the call has been terminated.

### Option 1—Reset

When you use the Voice/Data/Fax Modem to perform a reset, you are prompted to confirm that you want to perform the reset. If you do not confirm the reset, the main menu is repeated. If you do confirm the reset, the voice message responds, "The MSS Server will be reset." Your connection to the MSS Server is then broken and the reset occurs.

**Attention:** A reset interrupts the function of the MSS Server for up to 90 seconds. Be sure that the network is prepared for the interruption.

### Option 2—Status and Statistics

Statistics are available from several sources. The following general MSS Server statistics will be packaged as a single report and faxed upon request.

1. Status of Micro Operating System (MOS) processes (as reported by the *STATUS* keyword from the MOS operator console)
2. Memory
  - Number of bytes (as reported by the *MEMORY* keyword from the MOS operator console)
  - Heap and buffer memory (as reported by the *MEMORY* keyword from the configuration gateway [CGW] console)
  - Network interface buffers (as reported by the *BUFFER* keyword from the CGW console)
3. Interface (as reported by the *INTERFACE* keyword from the CGW console)
4. Network (as reported by the *STATISTICS* keyword from the CGW console)
5. Uptime (as reported by the *UPTIME* keyword from the CGW console)
6. Queue length (as reported by the *QUEUE* keyword from the CGW console)
7. Error counts (as reported by the *ERROR* keyword from the CGW console)
8. Event Logging Statistics (as reported by the *STATISTICS* keyword from the *EVENT* keyword from the CGW console)

9. Gateway configuration (as reported by the *CONFIGURATION* keyword from the CGW console)
10. Log level (as reported by the *LOG* keyword from the CGW console)
11. Code image and configuration information (available and active)
12. Thermal status of the hardware

When you request *Status and statistics*, you will hear one of these two messages: "MSS Server statistics will be faxed." or "Statistics not available." If you do not disconnect the call, the voice menu starts again.

### Option 3—Reports

You can also request protocol reports other than statistics from the voice menu.

- IP

The following IP information will be provided in a report:

- Access control list (as reported by the *ACCESS* keyword from IP from PROTOCOL on the CGW console)
  - Address cache (as reported by the *CACHE* keyword from IP from PROTOCOL on the CGW console)
  - Counter values (as reported by the *COUNTERS* keyword from IP from PROTOCOL on the CGW console)
  - Interface addresses (as reported by the *INTERFACE* keyword from IP from PROTOCOL on the CGW console)
  - Table, buffer, cache sizes (as reported by the *SIZES* keyword from IP from PROTOCOL on the CGW console)
  - Static routes (as reported by the *STATIC* keyword from IP from PROTOCOL on the CGW console)
- IPX
    - Interface addresses (as reported by the *CONFIG* keyword from IPX from PROTOCOL on the CGW console)
    - Cache information (as reported by the *CACHE* keyword from IPX from PROTOCOL on the CGW console)
    - Counters (as reported by the *COUNTERS* keyword from IPX from PROTOCOL on the CGW console)
  - LAN emulation (as reported by the *LIST* keyword from LE-SERVICES from ATM from NETWORK on the CGW console)
    - LES/BUS Pairs (as reported by the *LIST* keyword from LE-SERVICES from ATM from NETWORK on the CGW console; an ATM interface must have been selected)
  - Bridging
    - Brief universal summary of the state of the bridge (as reported by the *LIST BRIDGE* keywords from ASRT from PROTOCOL on the CGW console)

When you choose *Reports*, you will be prompted to select the protocol report option. Select IP, IPX, LAN Emulation, or bridging. Then you will hear either "Report not available" or "MSS Server Protocol Report will be faxed." If you do not disconnect the call, the voice menu starts again.



## Option 4—Event Logs

The MSS Server maintains several logs. Information contained there may be of interest to the systems administrator.

- Nonvolatile memory error log (accessed through the firmware log interface)
- Operational diagnostics log (using the Diagnostics Control System interface)
- Pager log entries (new)

**Note:** MSS Server trouble reports (critical problems) can be automatically faxed. These reports are not part of the voice menu structure.

When you choose *Event logs*, you will hear the voice message “MSS Server event logs will be faxed.” or “Event logs not available.” If you do not end the call, the voice menu starts again.

## Option 5—Configuration

The Voice/Data/Fax Modem provides a limited configuration input capability. You can access the following configuration options using the Voice/Data/Fax Modem:

- Fax telephone number (up to 64 digits)
- Thermal shutdown mode (enabled or disabled)—Standalone MSS Server only
- Auto-Fax for trouble reports (On or Off)
- Pager telephone numbers (up to 64 digits)
- Personal identification number (PIN) maintenance

The functions of the Voice/Data/Fax Modem are protected by up to 10 personal identification numbers. Any person with knowledge of the supervisory PIN can add, delete, or modify PINs. The supervisory PIN is the first one in the list of 10 allowed PINs.

**Note:** The Voice/Data/Fax Modem is shipped with a default supervisory PIN of 8210001.

When you choose *Configuration*, you will hear the voice message “Change Voice/Data/Fax Modem PINs.” Then, you are prompted to add, delete, or change the PINs. When you are done, if you do not disconnect the call, the voice menu starts again.

## Option 6—Device Presence and Status Report

Remote service is normally provided over the TTY or SLIP interface. In addition to the reporting and reset capabilities previously described, you can request a report that provides detailed device presence and status (DPS) information. This information can be obtained in a verbal message or in a more detailed fax report.

The verbal message begins with a statement of the number of recognized devices followed by a statement of the number of those that are enabled. If any are disabled, it will then state the number disabled. Finally, if any are out of service for other reasons, it will state the number of devices in non-operational states other than disabled.

## MSS Server Voice/Data/Fax Modem Support

Device presence and status fax reports contain the same information that is accessible when you select the *DIAGS* keyword from the MOS operator control and then select Option 1, Device Status, from the DIAGS menu.

You can also obtain this information from the Web browser interface by selecting *Diagnostics* from the main menu.

### Option 7—Resend Last Fax Report

You should request this option before you select another fax report because the previous fax report file is recreated for each call. If you make this request before you request the next fax report, the file for the previous call is retained and any additional requests will be appended to it.

### Option 8—Disconnect Call

You can request that the modem disconnect the call. When you choose *Disconnect call*, you will hear the voice message “Are you sure you want to disconnect?” and you will be prompted to respond. If you do not disconnect the call, the voice menu starts again.

### Option 9—Repeat Menu

You can request a repetition of the menu.

## Chapter 5. The OPCON Process and Commands

This chapter describes the OPCON process and includes the following sections:

- “What is OPCON?”
- “Accessing the OPCON Process” on page 5-2
- “OPCON Commands” on page 5-2

### What is OPCON?

The Operator Console process (OPCON) is the root-level process of the router software user interface. The main function of OPCON is to control which processes are connected to consoles. OPCON fits into the router software structure as shown in Figure 5-1. Using OPCON commands, you can:

- Manipulate the output from a process
- Change the intercept character
- Display information about router memory usage
- Restart the router software
- Reload the router software (reboot)
- Telnet to other routers or hosts
- Display status information about all router processes
- Communicate with processes at the secondary level
- Escape to the MOS system debugging tool

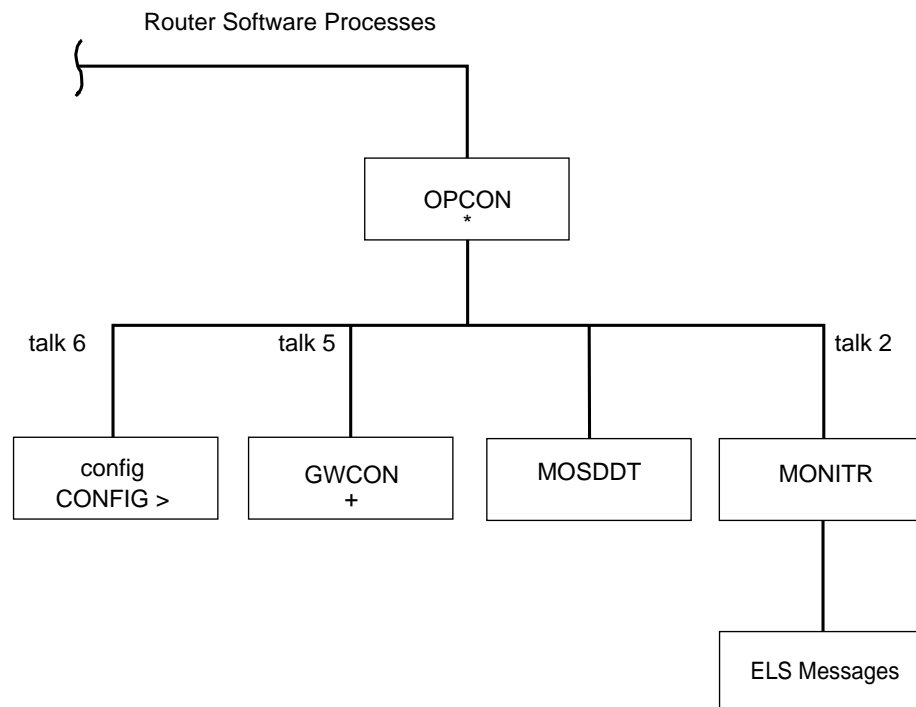


Figure 5-1. OPCON in the Router Software Structure

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### Accessing the OPCON Process

When you start the router for the first time, a boot message appears on the console. Then the OPCON prompt (\*) appears on the console, indicating that you are in the OPCON process and can begin entering OPCON commands.

When you access OPCON from a remote terminal, you access the ROPCON (Remote Operator Console) process. ROPCON and OPCON are functionally the same.

The OPCON process allows you to configure and monitor all of the router's operating parameters. While in the OPCON process, the router is forwarding data traffic. When the router is booted and enters OPCON, a copyright logo and an asterisk (\*) prompt appears on the locally attached console terminal. This is the OPCON (OPerator's CONsole) prompt, the main user interface that allows access to second-level processes.

Some changes to the router's operating parameters made while in OPCON take effect immediately without requiring reinitializing of the router. If the changes do not take effect, use the reload command at the \* prompt.

At the \* prompt, there is an extensive set of commands that you can enter to check the status of various internal software processes, monitor the performance of the router's interfaces and packet forwarders, and configure various operational parameters.

---

### OPCON Commands

This section describes the OPCON commands. Each command includes a description, syntax requirements, and an example. The OPCON commands are summarized in Table 5-1 on page 5-4. To use them, access the OPCON process and enter the appropriate command at the OPCON prompt (\*).

Figure 5-2 on page 5-3 shows the OPCON Command Tree.

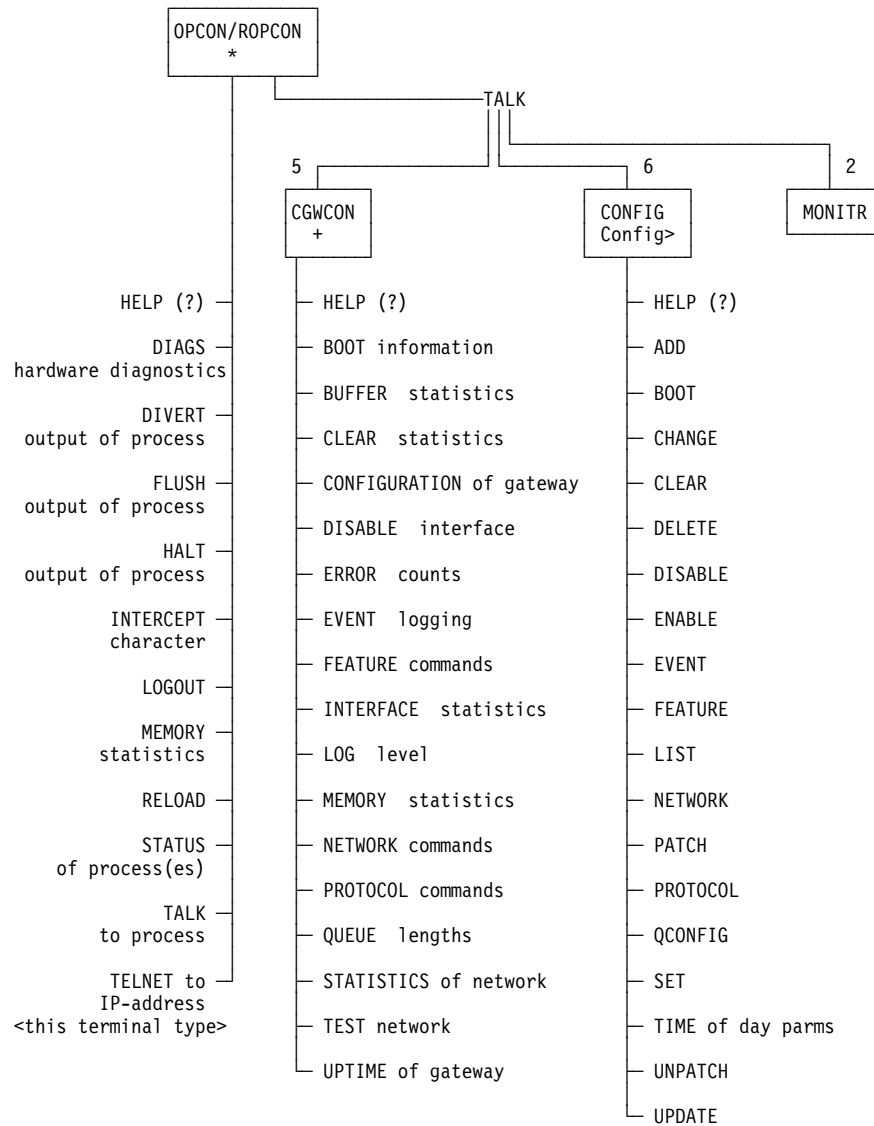


Figure 5-2. OPCON Command Tree

Command	Function
? (Help)	Lists all the OPCON commands.
Diags	Displays device status and the contents of the hardware test log and the hardware error log.
Divert	Sends the output from a process to a console or other terminal.
Flush	Discards the output from a process.
Halt	Suspends the output from a process.
Intercept	Sets the OPCON default intercept character.
Logout	Logs out a remote console.
Memory	Reports the router's memory usage.
Reload	Reloads the router software.
Status	Shows information about all router processes.
Talk	Connects to another router process and enables the use of its commands.
Telnet	Connects to another router.

### ? (Help)

Use the ? (**help**) command to list the commands that are available from the current prompt level. You can also enter a ? after a specific command name to list its options.

**Syntax:** ?

**Example:** ?

```
DIAGS diagnostics
DIVERT output from process
FLUSH output from process
HALT output from process
INTERCEPT character is
LOGOUT
MEMORY statistics
RELOAD
STATUS of process(es)
TALK to process
TELNET to IP Address (this terminal type)
```

### Diags

Use the **Diags** command to display the Diagnostic Main Menu. The diagnostic menus allow you to enable, disable and test hardware adapters or ports. Diagnostic menus have on-screen help for the various options and status information that is available.

You can use the “b” (back) key to return to any previous menu. Use the “e” (exit) key to exit the diagnostics and return to the OPCON command prompt.

**Syntax:** diags

**Example:** diags

## Divert

Use the **divert** command to send the output from a specified process to a specified terminal. This command allows you to divert the output of several processes to the same terminal to simultaneously view the output. The **divert** command is commonly used to redirect MONITR output messages to a specific terminal. The router allows only certain processes to be redirected.

After entering the command, enter the PID and tty# (number of the output terminal). To obtain these values, use the OPCON status command. The terminal number can be the number of either the local console (tty0) or one of the remote consoles (tty1, tty2). The following example shows Event Logging System messages generated by the MONITR process (2) being sent to a remote console *tty1* (1).

Event messages are displayed immediately even though you may be in the middle of typing a command. The display and keyboard have separate buffers to prevent command confusion. The following example shows the MONITR process connected to TTY1 after executing the **divert 2 1** command. If you want to stop the output, enter **halt 2**. The **halt** command is discussed at “Halt” on page 5-6.

**Syntax:** `divert pid tty#`

**Example:** `divert 2 1`

```
* divert 2 1
* status
Pid  Name      Status TTY  Comments
1    COpCon    IOW   TTY0 gzs
2    Monitr    IDL   TTY0
3    Tasker    RDY   --
4    MOSDBG    DET   --
5    CGWCon    DET   --
6    Config    DET   --
7    ROpCon    IDL   TTY1
8    ROpCon    RDY   TTY2 j1g@128.185.40.40
9    WEBCon    IDL   --
```

## Flush

Use the **flush** command to clear the output buffers of the MONITR process. This command is generally used prior to displaying the contents of the MONITR's FIFO buffer to prevent messages from scrolling off the screen. Accumulated messages are discarded.

The router allows only certain processes to be redirected. To obtain the *pid* and *tty#*, use the OPCON **status** command. As you can see in the following example, after executing the **flush 2** command, the output of the MONITR process is sent to the SNK (it has been flushed).

**Syntax:** `flush pid`

**Example:** `flush 2`

## OPCON Commands

```
* status
Pid Name      Status TTY Comments
1   COpCon    IOW  TTY0 gzs
2   Monitr   IDL  SNK
3   Tasker   RDY  --
4   MOSDBG   DET  --
5   CGWCon   DET  --
6   Config   DET  --
7   ROpCon   IDL  TTY1
8   ROpCon   RDY  TTY2 jlg@128.185.40.40
9   WEBCon   IDL  --
```

## Halt

Use the **halt** command to suspend all subsequent output from a specified process until the **divert**, **flush**, or **talk** OPCON command is issued to the process. The router cannot redirect all processes. **Halt** is the default state for output from a process. To obtain the PID for this command, use the OPCON **status** command. As you can see in the following example, after executing the **halt 2** command, the MONITR process is no longer connected to TTY1. Event messages no longer appear.

**Syntax:** halt *pid*

**Example:** halt 2

```
* status
Pid Name      Status TTY Comments
1   COpCon    IOW  TTY0 gzs
2   Monitr   IDL  --
3   Tasker   RDY  --
4   MOSDBG   DET  --
5   CGWCon   DET  --
6   Config   DET  --
7   ROpCon   IDL  TTY1
8   ROpCon   RDY  TTY2 jlg@128.185.40.40
9   WEBCon   IDL  --
```

## Intercept

Use the **intercept** command to change the OPCON intercept character. The intercept character is what you enter from other processes to get back to the OPCON process. The default intercept key combination is **Ctrl P**.

The intercept character **must** be a control character. Enter the ^ (shift 6) character followed by the letter character you want for the intercept character.

**Note:** Do not set the intercept character to the return key or to a printable character. If you change the OPCON intercept character from the default, **Ctrl-P**, to one of the Command History control characters, **Ctrl-B**, **Ctrl-F**, **Ctrl-R**, or **Ctrl-N**, the OPCON intercept character will take priority.

For example, if you change the intercept character to **Ctrl-F**, then **Ctrl-F** will not retrieve Forward in the Command History, but will instead return to the OPCON prompt (\*). See “Command History for GWCON and CONFIG Command Line” on page 1-18 for information on how to access previously entered GWCON or CONFIG commands.

**Syntax:** intercept *character*

**Example:** intercept ^u



From this example, you will have an intercept character of **Ctrl U**.

## Logout

Use the **logout** command to terminate the current session for the user who enters the logout command. If the console login is enabled, this command will require the next user to log in using an authorized userid/password combination. If the console login is not enabled, the OPCON prompt appears again.

**Syntax:** `logout`

**Example:** `logout`

## Memory

Use the **memory** command to obtain and display information about the router's global heap memory usage. The display helps you to determine if the router is being utilized efficiently. For an example of memory utilization, see Figure 5-3.

**Syntax:** `memory`

**Example:** `memory`

Number of bytes: Busy = 319544, Idle = 1936, Free = 1592

*Busy* Specifies the number of bytes currently allocated.

*Idle* Specifies the number of bytes previously allocated but freed and available for reuse.

*Free* Specifies the number of bytes that were never allocated from the initial free storage area.

**Note:** The sum of the Idle and Free memory equals the total available heap memory.

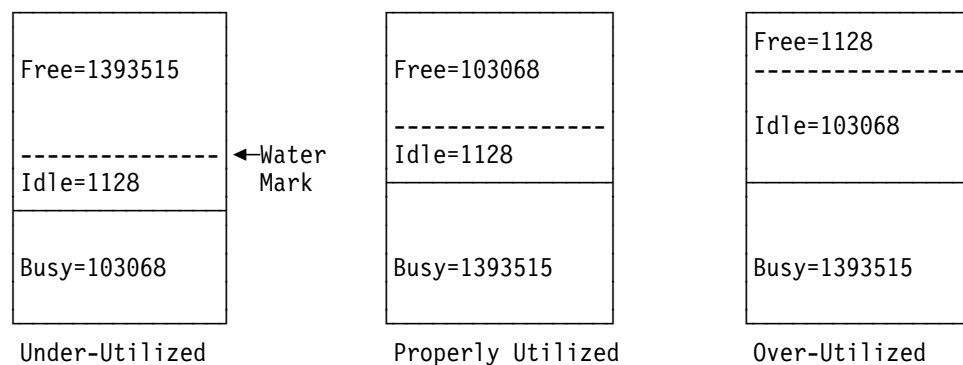


Figure 5-3. Memory Utilization

## Reload

Use the **reload** command to reboot the router by loading in a new copy of the router software. When you use this command from a remote console, you install a new software load without going to the router. This command executes the same functions as pressing the reset button except that the router will not dump (if so configured). Before the reload takes effect, you are prompted to confirm the reload.

**Syntax:** `reload`

### Example: reload

Are you sure you want to reload the gateway (Yes or No)?

## Status

Use the **status** command to display information about all router processes. By entering the PID after the **status** command, you can select to look at the status of only the desired process. The following example shows the total status display.

**Syntax:** `status pid`

### Example: status

Pid	Name	Status	TTY	Comments
1	COpCon	IOW	TTY0	
2	Monitr	IDL	--	
3	Tasker	RDY	--	
4	MOSDDT	DET	--	
5	CGWCon	IOW	--	
6	Config	IOW	TTY1	
7	ROpCon	IOW	TTY1	128.185.46.101
8	ROpCon	RDY	TTY2	128.185.46.104
9	WEBCon	IDL	--	

**Pid** Specifies the PID. This is the process to talk to or from OPCON, or it can be an argument to the STATUS command to request status information about a specific process.

**Name** Specifies the process name. It usually corresponds to the name of the program that is running in the process.

**Status** Specifies one of the following:

**IDL** Specifies that the process is idle and waiting for completion of some external event, such as asynchronous I/O.

**RDY** Specifies that the process is ready to run and is waiting to use the CPU.

**IOW** Specifies that the process is waiting for synchronous I/O, usually its expected standard input, to complete.

**DET** Specifies that the process has output ready to be displayed and it is either waiting to be attached to a display console or waiting to have its output diverted to a specified console.

**FZN** Specifies that the process is frozen due to an error. This usually means the process is trying to use a device which is faulty or incorrectly configured.

**TTYn** Specifies the output terminal, if any, to which the process is currently connected.

TTY0 Local console

TTY1 or TTY2 Telnet consoles.

SNK Process has been flushed.

Two dashes (--) Process has been halted.

**Comments**

Specifies the user's login IP address provided during login when a user is logged in using Telnet (ROpCon).

## Talk

Use the **talk** command to connect to other router processes, such as GWCON, MONITR, or CONFIG. After connecting to a new process, you can send specific commands to and receive output from that process. You cannot talk to the TASKER or OPCON process. See “Command History for GWCON and CONFIG Command Line” on page 1-18 for information on how to access previously entered GWCON or CONFIG commands.

To obtain the PID, use the OPCON **status** command. Once you are connected to the second-level process, such as CONFIG, use the intercept character, **Ctrl P**, to return to the \* prompt.

**Syntax:** `talk pid`

**Example:** `talk 5`

When using third-level processes, such as IP Config or IP, use the **exit** command to return to the second level.

## Telnet

Use the **telnet** command when you want to remotely attach to another router or to a remote host (*ip address*). The only optional parameter is the terminal type that you want to emulate.

A router has a maximum of five Telnet sessions: two servers (inbound to the router), and three clients (outbound from the router).

**Note:** To use Telnet in a pure bridging environment, you must enable Host Services.

**Syntax:** `telnet ip address terminal type`

**Example:** `telnet 128.185.10.30` or `telnet 128.185.10.30 23` or `telnet 128.185.10.30 vt100`

```
Trying 128.185.10.30 ...
Connected to 128.185.10.30
Escape character is '^]
```

If you are Telnetting to a non-existent IP address, the router displays:

```
Trying 128.185.10.30 ...
```

To enter the Telnet command mode, type the escape character-sequence, which is **Ctrl-]**, at any prompt.

```
telnet>
```

If you telnet into a router,

- Press ← **Backspace** to delete the last character typed on the command line.

**Note:** If you use a VT100t terminal, do not press ← **Backspace** because it inserts invisible characters. You must press **Delete** to delete the last character.

- Press **Ctrl U** at the telnet> prompt to delete the whole command line entry so that you can re-enter a command.

## OPCON Commands

The Telnet command mode consists of the following subcommands:

<b>close</b>	Close current connection
<b>display</b>	Display operating parameters
<b>mode</b>	Try to enter line-by-line or character-at-a-time mode
<b>open</b>	Connect to a site
<b>quit</b>	Exit Telnet
<b>send</b>	Transmit special characters ('send ?' for more)
<b>set</b>	Set operating parameters ('set ?' for more)
<b>status</b>	Print status information
<b>toggle</b>	Toggle operating parameters ('toggle ?' for more)
<b>z</b>	Suspend Telnet
<b>?</b>	Print help information

The **status** and **send** subcommands have one of two responses depending on whether or not the user is connected to another host. For example:

Connected to a host:

```
telnet> status
```

Connected to 128.185.10.30 Operating in character-at-a-time mode. Escape character is ^].

```
telnet> send ayt
```

**Note:** The send command currently supports only ayt.

Not connected to a host:

```
telnet> status
```

Need to be connected first.

```
telnet> send ayt
```

Need to be connected first.

Use the **close** subcommand to close a connection to a remote host and terminate the Telnet session. Use the **quit** subcommand to exit the **telnet** command mode, close a connection, and terminate a Telnet session.

```
telnet> close
```

*or*

```
telnet> quit
```

```
logout
```

```
*
```

---

## Chapter 6. The CONFIG Process and Commands

This chapter describes the CONFIG process and includes the following sections:

- “What is CONFIG?”
- “Quick Configuration” on page 6-3
- “Configuring User Access” on page 6-4
- “Entering and Exiting CONFIG” on page 6-7
- “CONFIG Commands” on page 6-7

---

### What is CONFIG?

The Configuration process (CONFIG) is a second-level process of the router user interface. Using CONFIG commands, you can:

- Set or change various configuration parameters
- Add or delete an interface to the hardware configuration
- Enter the Boot CONFIG command mode
- Enter the Quick Configuration mode
- Clear, list, or update configuration information
- Enable or disable console login
- Communicate with third-level processes, including protocol environments

**Note:** Refer to the chapter entitled “Migrating to a New Code Level” in the Maintenance Guide for information about migrating to a new code level.

CONFIG lets you display or change the configuration information stored in the router’s nonvolatile configuration memory. Changes to system and protocol parameters do not take effect until you reload the router software. (For more information, refer to the OPCON **reload** command in Chapter 5, “The OPCON Process and Commands” on page 5-1).

**Note:** You must enter the **write** command to save the changes in the device’s flash memory.

CONFIG fits into the router software structure as shown in Figure 6-1 on page 6-2.

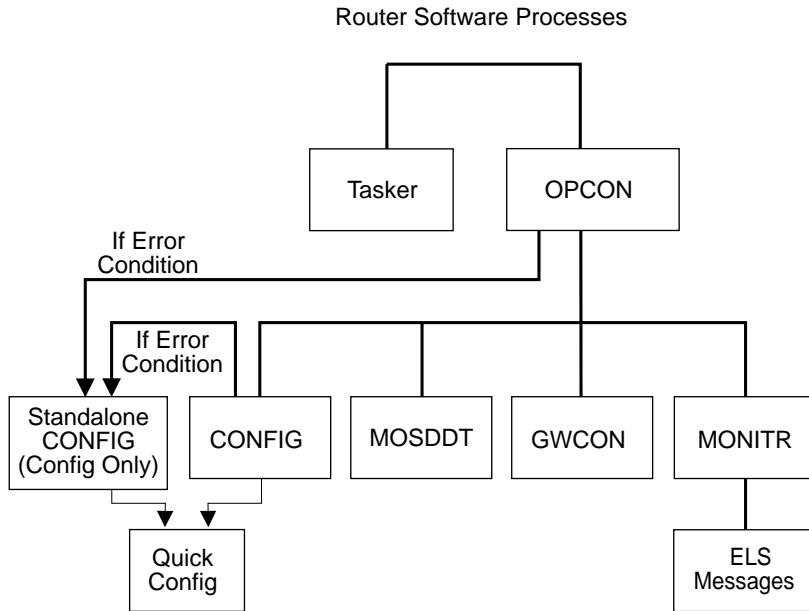


Figure 6-1. CONFIG in the Router Software Structure

The CONFIG command interface is made up of levels that are called modes. Each mode has its own prompt. For example, the prompt for the TCP/IP protocol is IP config>.

If you want to know the process and mode you are communicating with, press **Return** to display the prompt. Some commands in this chapter, such as the **network** and **protocol** commands, allow you to access and exit the various levels in CONFIG. See Table 6-2 on page 6-7 for a list of the commands you can issue from the CONFIG process.

## Config-Only Mode

Config-Only mode is a way to back out of a bad configuration that is causing the router to crash during start-up. Use the Config-Only mode **only** to change devices or data links (that is, for unsupported devices) or to reduce memory use (for *no memory* crashes) such as routing table sizes, packet sizes, and receive buffer allocations.

**Note:** Config-Only is provided only for getting a subset of configuration commands when a config problem causes the router to panic, check, fail, or detect a bug. Do **not** use Config-Only mode for general router configuration; many of the device-related commands are disabled in Config-Only mode and some may cause a crash.

## Automatic Entry Into Config-Only Mode

Config-Only mode is entered when the router detects a problem during operation or during router initialization.

Any of the following situations will cause the router to enter into Config-Only mode:

- The software load does not match the device configuration. More particularly, an attempt is made to configure a device or data link that is unsupported by the software load.

- Deletion of all router interface information.

If the router entered into the configuration-only mode because an unsupported device has been configured:

- Change the device information to match the hardware installed in (and supported by) the router, or change the unsupported device to “null device.”
- Enter the **Reload** command from the `Config (only)>` prompt.
- The router will automatically enter into OPCON (\*).

## Manual Entry Into Config-Only Mode

To enter the Config-Only mode, take any one of the following actions:

- Reload the router with no configuration.
- Reload the router with no interfaces configured.
- Reload the router with no protocols configured.

See Chapter 8, “Using MSS Server Firmware” on page 8-1 for more detail.

During initial start-up, if no devices are configured the router comes up in Config-Only mode. If no protocols are configured the router comes up in Config-Only mode and automatically enters Quick Configuration mode.

---

## Quick Configuration

Quick Configuration (Quick Config) provides a minimal set of commands that allow you to configure bridging protocols and routing protocols present in the router load. You can also configure an SNMP community with `WRITE_READ_TRAP` access. This is useful during initial setup because the configuration program uses SNMP SET commands to transfer the configuration.

**Attention:** At least one network device must be configured before using quick config. To add a device, use the **add device** command at the `config(only)>` or `config>` prompt.

Table 6-1 lists what Quick Config supports.

ATM Protocols	Bridging Protocols	Routing Protocols
LAN Emulation	STB, SRT, SRB, SR/TB	IP, IPX

The Quick Config complements the existing configuration process by offering a shortcut. This shortcut allows you to configure the minimum number of parameters for these bridging protocols and routing protocols without having to exit and enter the different configuration processes. The other parameters are set to selected defaults.

Situations that call for the router to be quickly configured are:

- Blank or corrupted configuration memory, such as when one of the following situations occurs:
  - The router is configured for the first time.
  - Voltage fluctuations resulted in corruption of configuration memory.

- The CPU board, which contains the configuration memory chip, was replaced in the router.
- Demonstration purposes, for which the router needs to be quickly configured to demonstrate its capabilities.
- Bench-marking tests to get the tests going without having to learn the router's operating system commands.

Quick Config operates as follows:

- It asks a series of questions with default values.
- It offers a short-cut to the detailed configuration of the normal mode command set.

Quick Config sets a number of default parameters based upon how you answer the configuration questions. What cannot be configured with Quick Config can be configured using Config after exiting it.

You cannot delete Quick Config information from within Quick Config. However, you can correct information either by exiting and returning to Quick Config, or by entering the **reload** command as a response to some Quick Config questions.

For complete information on using the Quick Config software, see Appendix A, "Quick Configuration Reference" on page A-1.

### Manual Entry Into the Quick Config Mode

You might want to get to Quick Config manually to demonstrate the router's capabilities, reconfiguring on the fly to benchmark tests without having to learn the router's operating system commands.

To enter Quick Config, type **qconfig** at the `Config>` prompt.

### Exiting from Quick Config Mode

To exit Quick Config, restart by entering **r** from any prompt. Follow the queries until you enter **no** and then enter **q** to quit. The router returns to either the `Config (only)>` or the `Config>` prompt.

---

## Configuring User Access

The router configuration process allows for a maximum of 50 user names, passwords, and levels of permission. Each user needs to be assigned a password and level of permission. There are three levels of permission: *Administration*, *Operation*, and *Monitoring*.

For more information, see the **add user** command on page 6-10.

## Technical Support Access

If you are the system administrator, when you add a new user for the first time, you are asked if you want to add Technical Support access. If you answer yes, Technical Support is granted the same access privileges that you have as system administrator.



The password for this account is automatically selected by the software and is known by your service representative. This password can be changed using the **change user** command; however, if you do change the password, customer service cannot provide remote support. For additional information on the use of the **change user** command, see “Change” on page 6-11.

## Configuring Spare Interfaces

Occasionally, you may need to configure a new interface along with its bridging and routing protocols without having to restart the device. You can accomplish this by configuring a number of **spare interfaces** on your device. Spare interfaces are useful when:

- You are adding ATM LAN Emulation clients.

Use spare interfaces to add Token-Ring or Ethernet ATM LAN Emulation clients to an existing ATM interface.

To configure a spare interface:

1. Access the CONFIG process by entering **talk 6**.
2. Configure the number of spare interfaces for the device using the **set spare-interfaces** command.
3. Exit the CONFIG process by pressing **Ctrl-P**.
4. Reload the device.

### Example:

```
* talk 6
Config> set spare 2
Config>
*reload
Are you sure you want to reload the gateway? (Yes or [No]) yes
```

When the device reloads, the spare interfaces are installed as null devices.

To use one of the spare interfaces:

1. Access the CONFIG process by entering **talk 6**.
2. Configure the spare interface by using the **net** command to configure the interface or add ATM LAN Emulation clients.
3. Configure the various protocols and features using the **protocol** and **feature** commands.
4. Exit the CONFIG process by pressing **Ctrl-P**.
5. Access the GWCON process by entering **talk 5**.
6. Bring the new interface online to the network using the **activate** command.

The following example shows how to configure and activate a new ATM LAN Emulation Client on which the IP protocol is enabled. The ATM LAN Emulation Client and IP configurations are not shown.

```
* talk 6
Config> net 0
ATM User Configuration
ATM Config> le-client
ATM LAN Emulation Clients Configuration
LE Client config> add token-ring forum-compliant
Added Emulated LAN as interface 6
LE Client config> config 6
ATM LAN Emulation Client configuration
:
:
(Here you would configure the ATM LAN Emulation Client)
:
:
Token Ring Forum Compliant LEC Config> exit
LE Client config> exit
ATM Config> exit
Config> protocol ip
IP Config>
:
:
(Here you would configure IP on the ATM LAN Emulation Client)
:
:
IP Config> exit
* talk 5
+ activate 6
Interface 6 activated successfully
```

## Restrictions for Spare Interfaces

The activate command cannot be used to bring a new interface online to the network under the following circumstances:

- You have already entered a **delete interface** command. The device must be restarted if **any** interface has been deleted. You cannot delete a spare interface (indicated by **null** in list displays).
- The spare interface is the only interface that enables a protocol or feature. The protocol or feature must already be enabled on an existing interface before it can be used by a spare interface.
- The new spare interface has a header size or trailer size greater than the sizes for other interfaces.
- There is not enough memory to allocate receive buffers for the new interface.

In these cases, you must restart the device to bring the new interface online.

You can configure the following protocols on spare interfaces, but you cannot bring them online to the network using the **activate** command:

- BGP
- MARS

There are also limitations on certain functions. These limitations are:

APPN	To activate these protocols on a spare interface, you must first activate the interface and then configure the protocol on the activated interface.
IPX	When you configure IPX on a spare interface, the device will have to be restarted in the following cases: <ul style="list-style-type: none"><li>• IPX is disabled globally when you activate this interface.</li><li>• IPX is disabled on all other interfaces when you activate this interface.</li><li>• You configure static routes or static services on this interface.</li><li>• You configure interface filters on this interface.</li></ul>

- Bridging
  - Bridging was not already active.
  - NetBIOS filters are defined on the spare interface.
  - The spare interface caused a change to the bridge personality or behavior (for example, adding SR port to pure TB bridge or SR-TB conversion enabled).

## Entering and Exiting CONFIG

To enter CONFIG from OPCON (\*):

1. At the OPCON prompt, enter the **status** command to find the PID of CONFIG. (See page 1-5 for a sample output of the **status** command.)

\* status

2. Enter the OPCON **talk** command and the PID for CONFIG:

\* talk 6

The console displays the CONFIG prompt (Config>). Now, you can enter CONFIG commands. If the prompt does not appear, press the **Return** key again. To exit CONFIG and return to the OPCON prompt (\*), enter the intercept character. (The default is **Ctrl P**.)

## Entering the Desired Protocol Configuration Process

For information on accessing a particular protocol's configuration process, see "Protocol" on page 6-21.

## CONFIG Commands

This section describes each of the CONFIG commands. Each command includes a description, syntax requirements, and an example. The CONFIG commands are summarized in Table 6-2.

After accessing the CONFIG environment, enter the configuration commands at the Config> prompt.

<i>Table 6-2 (Page 1 of 2). CONFIG Command Summary</i>	
Command	Function
? (Help)	Lists the CONFIG commands or lists the options associated with specific commands.
Add	Adds an interface to the router configuration, or a user to the router.
Boot	Enters Boot CONFIG command mode.
Change	Changes a user's password or a user's parameter values associated with this interface. Also changes a slot/port of an interface.
Clear	Clears configuration information.
Delete	Deletes an interface from the router configuration or deletes a configured user.
Disable	Disables login from a remote console, system memory dumping and rebooting, or a specified interface.
Enable	Enables login from a remote console, enables modem use,

## CONFIG Commands

Table 6-2 (Page 2 of 2). CONFIG Command Summary

Command	Function
Event	Enters the Event Logging System configuration environment.
Feature	Provides access to configuration commands for independent router features outside the usual protocol and network interface configuration processes.
List	Displays system parameters, hardware configuration, a complete user list.
Load	Lists, adds, or deletes optional software packages.
Network	Enters the configuration environment of the specified network.
Patch	Modifies the router's global configuration.
Protocol	Enters the command environment of the specified protocol.
Qconfig	Initiates the Quick Config process.
Set	Sets system-wide parameters for buffers, host name, inactivity timer, packet size, prompt level, number of spare interfaces, fast-boot, location, and contact person.
System	Retrieves dumps
Time	Keeps track of system time and displays it on the console.
Unpatch	Restores patch variables to default values.
Update	Updates the current version of the configuration.
Write	Writes the current configuration information to the nonvolatile memory.

## ? (Help)

Use the ? (**help**) command to list the commands that are available from the current prompt level. You can also enter a ? after a specific command name to list its options.

**Syntax:**        ?

**Example:** ?  
 ADD  
 BOOT  
 CHANGE  
 CLEAR  
 DELETE  
 DISABLE  
 ENABLE  
 EVENT  
 FEATURE  
 LIST  
 LOAD  
 NETWORK  
 PATCH  
 PROTOCOL  
 QCONFIG  
 SET  
 SYSTEM  
 TIME OF DAY PARAMS  
 UNPATCH  
 UPDATE  
 WRITE  
 VPD

**Example:** list ?  
 devices  
 configuration  
 patches  
 users  
 v25-bis-address

## Add

Use the **add** command to add an interface to the configuration, or user-access. This command also recreates device records if the configuration is inadvertently lost.

**Syntax:** add device . . .  
user . . .

*device device\_type additional-config-info*

With the **add device** command, you must enter the interface device type (*device\_type*). You are prompted for additional configuration parameters. This additional information varies by device and platform. Refer to “Accessing Network Interface Configuration and Console Processes” on page 1-16 for additional information about device type and configuration parameters.

**Note:** If you are adding more than one interface, the order in which you add them is important because the router assigns a sequential interface number to the device when it is added. This interface number is an index number in the device list; it links the device with other protocol configuration information, such as the IP addresses associated with the device. (For more information, refer to the **list devices** command, “List” on page 6-17.)

All device and protocol configuration information related to network interfaces is stored by interface number. Any changes made to interface numbers will invalidate much of the device configuration information in the protocols.

## CONFIG Commands

**Example:**     **add device atm**

Device Slot x(0-3) 0?  
Adding CHARM ATM Adapter device in slot 0 port 1 as  
interface x  
(where x is the interface number  
assigned)

To determine which devices you can add, use the **add devices ?** command.

When adding interfaces with more than one port, add one port at a time. Use the **add device** command twice to add both ports of a dual-port adapter, for example.

user *user\_name*

Gives a user access to the router. You can authorize up to 50 users to access the router. Each *user\_name* is eight characters and is case-sensitive.

When the first user is added, console login is automatically enabled. Each user added must be assigned one of the permission levels defined in Table 6-3.

Table 6-3. Access Permission

Permission Level	Description
Administrator (A)	Displays configuration and user information, adds/modifies/deletes configuration and user information. The Administrator can access any router function.
Operator (O)	Views router configuration, views statistics, runs potentially disruptive tests, dynamically changes router operation, and restarts the router. Operators cannot modify the permanent router configuration. All actions can be undone with a system restart.
Monitor (M)	Views router configuration and statistics but cannot modify or disrupt the operation of the router.
Tech Support	Allows your service representative to gain access to the router if a password is forgotten. Cannot be assigned to users.

**Note:** To add a user, you must have administrative permission. You do not have to reinitialize the router after adding a user.

**Example:**     **add user John**

Enter password:  
Enter password again:  
Enter permission (A)admin, (O)perations, (M)onitor [A]?  
Do you want to add Technical Support access? (Yes or [No]):

*Enter password*

Specifies the access password for the user. Limited to 80 alphanumeric characters and is case-sensitive.

*Enter password again*

Confirms the access password for the user.

*Enter permission*

Specifies the permission level for the user: A, O, or M (see Table 6-3).

**Boot**

Use the **boot** command to enter the Boot CONFIG command environment. For Boot CONFIG information, see Chapter 7, “Performing Change Management Operations” on page 7-1.

**Syntax:** `boot`

**Example:** `boot`  
 TFTP Boot/dump configuration  
 Boot config>

**Change**

Use the **change** command to modify an interface in the configuration, change your own password, or change user information.

**Syntax:** `change device . . .`  
`user`

**Example: change device**

```
Which configured slot would you like to change? (1, 2) [1]? 2
Which slot would you like to change to? (1-2) [1]? 1
Changed slot 2 to slot 1 in 1 intf (port) record...
```

`device device_type`

With the **change device** command you can:

- Change the slot of an existing interface. (Change slot x in interface record n to y where slot y is unoccupied.)
- Swap slots of two existing interfaces. (Swap slot x and slot y in interface records with x or y.)
- Replace the slot in an existing interface with the slot in another. (Interface configuration for slot x will become interface configuration for slot y. Interface records for slot y will be deleted.)

When the target slot is occupied:

1. If you select the “swap” option, the source and target slots are swapped in the interface records in which they appear.
2. If you select the “replace” option is selected, the interface configuration for slot x will become the interface configuration for slot y. Interface records for slot y will be deleted.

**Example:** Change slot 2 on interface 0 to unoccupied slot 1.

```
Config>list dev
Ifc 0 CHARM ATM                               Slot: 2 Port: 1

Config>change device
Which configured slot would you like to change? (2) [2]? 2
Which slot would you like to change to? (1-2) [1]? 1

Changed slot 2 to slot 1 in 1 intf (port) record...

Config>list dev
Ifc 0 CHARM ATM                               Slot: 1 Port: 1
```

**Example:** Change (swap) slot 2 on interface 1 to occupied slot 1.

```
Config>list dev
Ifc 0 CHARM ATM          Slot: 1 Port: 1
Ifc 1 CHARM ATM          Slot: 2 Port: 1

Config>change device
Which configured slot would you like to change? (1, 2) [2]? 2
Which slot would you like to change to? (1-2) [1]? 1

Configuration for slot 1 already exists. You can:
a - abort this operation
r - replace configuration
   (Interface configuration for slot 2 will become interface
   configuration for slot 1. Interface records for slot 1
   will be deleted!)
s - swap configuration (slot 1 will be swapped with slot 2.)
s

Swapped slot 2 with slot 1 in 1 port record...
```

```
Config>list dev
Ifc 0 CHARM ATM          Slot: 2 Port: 1
Ifc 1 CHARM ATM          Slot: 1 Port: 1
```

**Example:** Change (replace) slot 1 on interface 1 to occupied slot 2.

```
Config>list dev
Ifc 0 CHARM ATM          Slot: 2 Port: 1
Ifc 1 CHARM ATM          Slot: 1 Port: 1

Config>change device
Which configured slot would you like to change? (1, 2) [2]? 1
Which slot would you like to change to? (1-2) [1]? 2

Configuration for slot 2 already exists. You can:
a - abort this operation
r - replace configuration
   (Interface configuration for slot 1 will become interface
   configuration for slot 2. Interface records for slot 2
   will be deleted!)
s - swap configuration (slot 1 will be swapped with slot 2.)
r

Moved slot 2 to slot 1 in 1 intf (port) record...
```

```
Config>list dev
Ifc 0 CHARM ATM          Slot: 2 Port: 1
```

### password

Modifies the password of the user who is now logged in.

**Note:** To change a user password, you must have administrative permission.

```
Example: change password
Enter current password:
Enter new password:
Enter new password again:
```

*Enter current password*  
Specifies your current password.

*Enter new password*  
Specifies your new password.

*Enter new password again*  
Specifies your new password again for confirmation. If your confirmation does not match the previous new password, the old password remains in effect.



user

Modifies the user information that was previously configured with the **add user** command.

**Note:** To change a user, you must have administrative permission.

Example: change user  
 User name: []  
 Change password? (Yes or No)  
 Change permission? (Yes or [No])

## Clear

Use the **clear** command to delete the router’s configuration information from non-volatile configuration memory.

**Attention:** Use this command only after calling your service representative.

To clear a process from nonvolatile configuration memory, enter the **clear** command and the process name. To clear all information from configuration memory, except for device information, use the **clear all** command. If you want to clear all information, including the device information, use the **clear all** command and then the **clear device** command.

The **clear user** command clears all user information except the router console login information. This is left as enabled (if it was configured as enabled) even though the default value is “disabled.”

**Notes:**

1. To clear user information, you must have administrative permission.
2. There may be other items in the list, depending upon what is included in the software load.

**Syntax:** clear            all  
                                   ap2 (AppleTalk 2)  
                                   arp (ARP)  
                                   asrt (Adaptive Source Route Protocol)  
                                   appn (Advanced Peer-to-Peer Networking)  
                                   atm (Asynchronous Transfer Mode)  
                                   bgp (Border Gateway Protocol)  
                                   boot  
                                   device  
                                   dn (DECnet)  
                                   els (Event Logging System Information)  
                                   ip (IP)  
                                   ipx (Novell IPX)  
                                   ospf (OSPF routing protocol)  
                                   snmp  
                                   srb (Source Route Bridge)  
                                   srly (SDLC Relay)  
                                   stb (Spanning Tree Bridge)  
                                   tcp/ip-host  
                                   time (Time of day information)  
                                   user  
                                   vines (Banyan VINES)



Example: disable interface 2

### dump-memory

Disables the dumping of system memory to the installed hard disk when a serious error occurs.

Example: Config> **disable dump**  
 Disable system memory dumping? ([No]) **Yes**  
 System memory dump function disabled successfully.

### reboot-system

Disables the rebooting of the system when a serious error occurs. This may be desirable if the network service personnel wish to troubleshoot the error on-line. System rebooting cannot be disabled unless memory dumping is also disabled. If you attempt to disable system rebooting while memory dumping is enabled, system rebooting is aborted and the following message is displayed:

System reboot not disabled: memory dumping must be disabled first

Example:  
 Config> disable reboot  
 Disable system reboot for serious errors? ([No]) **Yes**  
 System reboot function disabled successfully.

## Enable

Use the **enable** command to allow login from a remote console,

**Syntax:** enable            console-login  
                               interface . . .  
                               dump-memory . . .  
                               reboot-system . . .

### console-login

Enables the user to be prompted for a user ID and password on the physical console. This is useful for security situations. If you do not configure any administrative users and you enable this feature, the following message appears:

Warning: Console login is disabled until an administrative user is added.

By disabling the console login, a lock-out situation is prevented.

Example: enable console-login

### interface *interface#*

Causes the interface to be enabled after issuing the **reload** command.

Example: enable interface 2

### dump-memory

Enables the dumping of system memory to the installed hard disk when a serious error occurs. This may be desirable so that the state of the unit at the time of the error can be preserved for troubleshooting later. The dump memory function cannot be enabled unless system rebooting is enabled. If you attempt to enable the dump memory function while system rebooting is disabled, dump memory is aborted and the following message is displayed:

System memory dump function not enabled: rebooting must be enabled first

Example:  
 Config> enable dump  
 Enable system memory dumping? ([No]) **Yes**  
 System memory dump function enabled successfully

## CONFIG Commands

reboot-system

Enables the rebooting of the system when a serious error occurs.

```
Example: enable reboot-system
Enable system rebooting for serious errors? ([No]) Yes
System reboot function enabled successfully.
```

## Event

Use the **event** command to enter the Event Logging System (ELS) environment so that you can define the messages that will appear on the console. Refer to Chapter 11, “Using and Configuring the Event Logging System (ELS)” on page 11-1 for information about ELS.

**Syntax:** `event`

```
Example:  event
          Event Logging System user configuration
          ELS config>
```

## Feature

Use the **feature** command to access configuration commands for specific router features outside of the protocol and network interface configuration processes.

All IBM 8210 features have commands that are executed by:

- Accessing the configuration process to initially configure and enable the feature, as well as perform later configuration changes.
- Accessing the console process to monitor information about each feature, or make temporary configuration changes.

The procedure for accessing these processes is the same for all features. The following information describes the procedure.

Enter a question mark after the **feature** command to obtain a listing of the features available for your software release.

```
Example:  feature ?
          MCF
          CMPRS
          QOS
          Feature name or number [2] ?
```

To access a feature's configuration prompt, enter the **feature** command followed by the feature number or short name. Table 6-4 lists available feature numbers and names.

Feature Number	Feature Short Name	Accesses the following feature configuration process
2	MCF	MAC Filtering
6	QOS	Quality of Service
7	CMPRS	Data Compression

**Example:**     **feature mcf**  
                   MAC filtering user configuration  
                   Filter Config>

Once you access the configuration prompt for a feature, you can begin entering specific configuration commands for the feature. To return to the CONFIG prompt, enter the **exit** command at the feature's configuration prompt.

**Syntax:** *feature feature# OR feature-short-name*

**Example:**     **feature 2**  
                   or  
                   **feature MCF**

## List

Use the **list** command to display configuration information for all network interfaces, or configuration information for the router.

**Syntax:** *list*  
                   devices  
                   configuration  
                   patches  
                   vpd

**devices**

Displays the relationship between an interface number and the hardware interface. You can also use this command to check that a device was added correctly issuing the **add** command.

**Example: list devices**

Ifc 0 CHARM ATM Adapter     Slot: 1 Port: 1

**configuration**

Displays configuration information about the router.

**Example: list configuration**

## CONFIG Commands

```
Hostname: acctg
Maximum packet size: [autoconfigured]
Maximum number of global buffers: [autoconfigured]
Number of spare interfaces: 0
Console baudrate: 9600 (Autobaud)
Console inactivity timer (minutes): 0
Physical console login: disabled
Modem Control Enabled, using CARRIER-WAIT type control
Contact person for this node: [none]
Location of this node: [none]
```

```
Configurable Protocols:
Num Name Protocol
0 IP DOD-IP
3 ARP Address Resolution
7 IPX NetWare IPX
11 SNMP Simple Network Management Protocol
10 BGP Border Gateway Protocol
12 OSPF Open SPF-Based Routing Protocol 23 ASRT
Adaptive Source Routing Transparent Enhanced Bridge
24 HST TCP/IP Host Services
```

```
Configurable Features:
Num Name Feature
2 MCF MAC Filtering
6 QOS Quality of Service
```

27616 bytes of configuration memory free

### patches

Displays the values of patch variables that have been entered using the **patch** command.

```
Example: list patches
Patched variable      Value

ping-size             60
ping-ttl              59
ip-default-ttl        60
ethernet-security     3
rip-static-suppress   3
```

### vpd

Displays the hardware and software vital product data.

## Load

Use the **load** command to list, add, or delete optional software packages (for example, APPN).

The software is divided into multiple load modules. These load modules are grouped into software packages. Some of these software packages are optional because, although they are shipped with the product, they are not automatically loaded.

To load and run optional software packages:

1. Add the package using the **load add** command.
2. Reboot. This action loads the optional software into the device's memory.
3. Configure the optional software.
4. Save the configuration.
5. Reboot the device. This action enables the software with the new configuration.

**Syntax:** **load**      add package

```
delete package
list . . .
```

**add package** *packagename*

Adds a software package to the software. The *packagename* is the name of the package of load modules you want to include in the software.

**Example:** load add appn

**delete package** *packagename*

Removes a software package to the software. The *packagename* is the name of the package of load modules you want to remove from the software.

**Example:** load delete appn

**list** Lists either the packages in the software load that are available but not configured, or the packages that are configured in the software load. You can specify one of the following:

**available**

Lists the software packages in the current software load that are not configured.

**configured**

Lists the software packages in the current software load that are configured.

## Network

Use the **network** command to enter the network interface configuration environment for supported networks. Enter the interface or network number as part of the command. (To obtain the interface number, use the CONFIG **list device** command.) The appropriate configuration prompt (for example, TKR Config>) will be displayed. See the network interface configuration chapters in this book for complete information on configuring your types of network interfaces.

**Note:** Whenever you change a user-configurable parameter, you must **reload** the router for the change to take effect. To do so, enter the **reload** command at the OPCON prompt (\*).

**Syntax:** *network interface#*

**Example:**     **network 0**  
                  TKR config>

**Note:** Not all network interfaces are user-configurable. For interfaces that you cannot configure, you receive the message: That network is not configurable.

## Patch

Use the **patch** command for modifying the router's global configuration. Patch variables are recorded in nonvolatile configuration memory and take effect immediately; you do not have to wait for the next restart of the router. This command should be used only for handling uncommon configurations. Anything that you commonly configure should still be handled by using the specific configuration commands. The following is a list of the current patch variables documented and supported for this release.

## CONFIG Commands

**Syntax:** patch `bgp-subnets`  
`ethernet-security`  
`ip-default-ttl`  
`ip-mtu`  
`more-lines`  
`mosheap-lowmark`  
`ospf-import-rate`  
`ping-size`  
`ping-ttl`  
`rip-static-suppress`

**Example:** `patch ping-size`  
New value [0]?

### *bgp-subnets new value*

If you want the BGP speaker to advertise subnet routes to its neighbors, set *new value* to 1. The default is 0.

*New value*                      The new value for the variable that you are patching.

### *ethernet-security*

When set to a non-zero value, zeros the padding that is applied to Ethernet packets whose data portion is less than the physical minimum of 60 bytes. This may be required for security reasons. Default: 0.

### *ip-default-ttl*

The TTL used in packets that are originated by the router. The default is 64.

**Note:** It is preferable to set this parameter with the **set ttl** IP configuration command. (See the “Set” section of the “Using and Configuring IP” chapter of *Multiprotocol Switched Services (MSS) Interface Configuration and Software User’s Guide*.) This patch variable remains for compatibility with configurations from older releases.

### *ip-mtu*

This parameter limits the IP MTU size to the specified value. When this parameter is set, the IP MTU size on a given network interface is set to the lesser of the *ip-mtu* value and the largest value that network interface’s configured frame size can accommodate.

### *more-lines*

The number of lines to display on the console when listing the IP routing table, which uses a “more pipe” (!).

### *mosheap-lowmark*

This parameter specifies the percentage of free MOS heap memory, at which the device notifies the operator that an out-of-memory error is imminent. This notification allows the operator to take action to free up MOS heap memory before the device receives an error and stops.

When the operator receives notification, the operator can reconfigure the router and then reboot, minimizing the outage to the network. Specifying 0 for this parameter suppresses this warning.

**Valid Values:** 0 to 100

**Default Value:** 10

### *ospf-import-rate*

Number of routes imported per second.



*ping-size*

The size of the data portion (that is, excluding IP and ICMP headers) of the ICMP PING packet that is sent via the IP>**ping** command. Default: 56 bytes. (The size of the PING data can also be entered as a parameter of the **ping** command as described in the “Ping” section of the “Monitoring IP” chapter of *Multiprotocol Switched Services (MSS) Interface Configuration and Software User’s Guide*.)

*ping-ttl*

The TTL (time-to-live) sent in PINGs by the IP>**ping** command. Default: 64. (The TTL can also be entered as a parameter of the **ping** command as described in the “Ping” section of the “Monitoring IP” chapter of *Multiprotocol Switched Services (MSS) Interface Configuration and Software User’s Guide*.)

*rip-static-suppress*

When set to a non-zero value, static routes will not be advertised by RIP over a given interface unless the IP config> **enable send static** command is given for the interface. This changes the semantics of the **enable send static** command. When *rip-static-suppress* is equal to 0 (the default), the list of the routes advertised via RIP is the union of those specified by the interface’s RIP flags.

**Note:** You must specify the complete name of the patch variable that you want to change. You cannot use an abbreviated syntax for the patch name.

## Protocol

Use the **protocol** command at the Config> prompt to enter the configuration environment for the protocol software installed in the router. The **protocol** command followed by the desired protocol number *or* short name lets you enter a protocol’s command environment. After you enter this command, the prompt of the specified protocol appears. From the prompt, you can enter commands specific to that protocol. Table 1-2 on page 1-15 lists examples of protocol numbers and names. To return to Config>, enter the **exit** command.

**Notes:**

1. To see the names and numbers of the protocols in your software load, at the Config> prompt, enter **list configuration**.
2. When you change a user-configurable parameter, you must restart the router for the change to take effect. To do so, enter the **reload** command at the OPRON prompt (\*).

The changes you make through CONFIG are kept in a configuration database in nonvolatile memory and are recalled when you restart the router.

**Syntax:** protocol *prot#*

Example:  
 protocol 7  
or  
 protocol ipx  
 IPX config>

### Qconfig

Use the **qconfig** command to initiate Quick Config. Quick Config allows you to configure parameters for bridging and routing protocols without entering separate configuration environments.

**Syntax:** `qconfig`

**Note:** For complete information on using the Quick Config software provided with your router, refer to the *IBM Nways Multiprotocol Switched Services (MSS) Server Module Installation and Initial Configuration Guide*

### Set

Use the **set** command to configure various system-wide parameters.

**Syntax:** `set` contact-person .  
down-notify . . .  
global-buffers  
hostname  
inactivity-timer  
input-low-water  
location . . .  
logging level  
packet-size  
prompt-level  
receive-buffers  
  
fast-boot

`contact-person` *sysContact*

Sets the name or identification of the contact person for this managed SNMP node. There is a limit of 80 characters for the *sysContact* name length.

This variable is for information purposes only and has no effect on router operation. It is useful for SNMP management identification of the system.

Example: `set contact-person nautilus`

`down-notify` *interface# # of seconds*

Allows the user to specify the number of seconds before declaring an interface as being down. The normal maintenance packet interval is 3 seconds, and it takes four maintenance failures to declare the interface as down.

The **set down-notify** command is used primarily when tunneling LLC traffic over an IP network using OSPF. If an interface goes down, OSPF cannot detect it fast enough because of the length of time that it takes for an interface to be declared down. Therefore, LLC sessions would begin to timeout. You can set the down-notify timer to a lower value, allowing OSPF to sense that an interface is down quicker. This enables an alternate route to be chosen more quickly, which will prevent the LLC sessions from timing out.

**Note:** If the **set down-notify** command is executed on one end of a serial link, the same command must be performed at the other end of the link or the link may not come up and stay up.

*Interface#*

The number of the interface you are configuring.

*# of seconds*

The down notification time value that specifies the maximum time that will elapse before a down interface is marked as such. Large values will cause the router to ignore transient connection problems, and smaller values will cause the router to react more quickly. The range of values is 1 to 300 seconds and the default is 0, which sets the 3-second period. Setting the down notification time to 0 will restore the default time for that interface.

The **list devices** command will show the down notification time setting for any interface that has the default value overridden.

Example: `set down-notify 4 3`

global-buffers *max#*

Sets the maximum number of global packet buffers, which are the packet buffers used for locally originated packets. The default is to autoconfigure for the maximum number of buffers (up to 1000). To restore the default, set the value to 0. To display the setting for global-buffers, use the **list configuration** command.

Example: `set global-buffers 30`

## hostname

Adds or changes the router name. The router name is for identification only; it does not affect any router addresses. The name must be less than 78 characters and is case sensitive.

Example: `set hostname sales`

inactivity-timer *# of min*

Changes the setting of the Inactivity Timer. The Inactivity Timer logs out a user if the remote or physical console is inactive for the period of time specified in this command. This command affects only consoles that require login. The default setting of 0 turns the inactivity timer off, indicating that no logoff is performed, no matter how long a console remains inactive.

Example: `set inactivity-timer 3`

input-low-water *interface # low # of receive buffers*

Allows you to configure the value of the low number of receive buffers, or packets, on a per-interface basis, thus overriding the default values.

The memory allocation strategy changes to conserve buffers when the number of free buffers is equal to or less than the low or low-water mark value. When a packet is received, and the current value of the interface is less than the low water value, then that packet is eligible for flow control (dropping).

The range of values is 1 to 255. The default is both platform and device specific. Setting the value to 0 restores the autoconfigured default.

*Interface #* is the number of the interface you are configuring. *Low # of receive buffers* is the low water value.

Lowering the value will make it less likely that packets from this interface will be dropped when sent on congested networks. However, lowering the value may negatively affect performance if it drops packets to the extent that the receive queue is frequently empty. Raising the value has the opposite effect.

Type the **QUEUE** or **BUFFER** command at the GWCON prompt (+) to show the low setting.

## CONFIG Commands

Example: set input-low-water 4 7

### location *sysLocation*

Sets the physical location of an SNMP node. There is a limit of 80 characters for the *sysLocation* name length. This variable is for information purposes only and has no effect on router operation. It is useful for SNMP management identification of the system.

Example: set location atlanta

### packet-size *max packet size in bytes*

Establishes or changes the maximum size for global buffers and receive buffers. If you specify a value of 0 as the maximum packet size, the size of receive buffers for an interface is based on that interface's configured packet size and the packet size of global buffers are autoconfigured. If you specify a non-zero value, the configured value is used as the global buffer packet size and any interfaces that have a configured packet size that is larger than the maximum packet size will use the maximum packet size for their receive buffers. A value of 0 (for autoconfigure) is the default.

**Attention:** Use this command only under direct instructions from your service representative. **Never** use it to reduce packet size – **only** to increase it.

Example:  
set packet-size  
What is the maximum packet size (in bytes) [0]?  
Packet size updated successfully

### prompt-level *user-defined-name*

Adds a user-defined name as a prefix to all operator prompts, replacing the hostname.

The user-defined-name can be any combination of characters, numbers, and spaces up to 80 characters. Special characters may be used to request additional functions as described in Table 6-5 on page 6-25.

Example:  
set prompt  
What is the new MOS prompt [y]? **AnyHost 99**  
AnyHost 99 Config>

*Table 6-5. Additional Functions Provided by the Set Prompt Level Command*

Special Characters	Function Provided by the Set Prompt Level Command
\$n	Displays the hostname. This is useful when you want the hostname included in the prompt. For example:  Config> <b>set prompt</b> What is the new MOS prompt [y]? \$n hostname:: Config>
\$t	Displays the time. For example:  Config> <b>set prompt.</b> What is the new MOS prompt [y]? \$t 02:51:08[GMT-300] Config>
\$d	Displays the current date-month-year. For example:  Config> <b>set prompt.</b> What is the new MOS prompt [y]? \$d 26-Feb-1997 Config>
\$v	Displays the software VPD information in the following format: program-product-number Feature xxxx Vx.x PTFx RPQx
\$e	Erases one character <i>after</i> this combination within the user-defined prompt.
\$h	Erases one character <i>before</i> this combination within the user-defined prompt.
\$_	Adds a carriage return to the user-defined prompt.
\$\$	Displays the \$.
<b>Note:</b> You can combine these commands. For example:  Config> <b>set prompt.</b> What is the new MOS prompt [y]? \$n::\$d hostname::26-Feb-1997 Config>	

receive-buffers *interface # max #*

Adjusts the number of private receive buffers for most interfaces. The range is 5 to 255.

Example: set receive-buffers 4 30

*Table 6-6. Default and Maximum Settings for Interfaces*

Interface	Default	Maximum
ATM	80	80
ETH	40	100
TKR	40	100

spare-interfaces *n*

Defines *n*, the number of spare interfaces, for this device. See “Configuring Spare Interfaces” on page 6-5 for additional information.

**Example:** set spare 5

## CONFIG Commands

### fast-boot

Setting **fast-boot** *yes* will bypass system diagnostics. Setting **fast-boot** *no* will cause the device to perform various diagnostics on the hardware before the system comes up to the Config> operational code prompt.

**Valid values:** Yes or No

**Default value:** No

## System Memory Dump

Use the **system memory dump** command to retrieve the memory image file from the installed hard disk after a serious error has occurred.

**Syntax:** `system retrieve`

**retrieve** Uses TFTP to send the memory image to a remote location, with a destination TFTP file address, path, and file name supplied by the user.

If memory dumping is disabled, the function is aborted and the following message is displayed:

```
Image file transfer aborted: function disabled
```

If the memory file is not present on the hard disk, or if the hard disk has been removed, the function is aborted and the following message is displayed.

```
Image file transfer aborted: image file not found
```

```
Example: system retrieve
Destination IP address (0.0.0.0) 2.2.2.2
Fully qualified destination path/file name (tmp/dump.dat)
The memory image file is nnnnn bytes long.
Proceed? (Y/[N])
```

## Time

Use the **time** command to set the IBM 8210 system clock and date, and to display the values on the user console. These values can then be used to time-stamp ELS messages.

**Note:** The IBM 8210 has a hardware clock that maintains the date and time after router reinitialization.

**Syntax:** `time`     `host . . .`  
                  `list`  
                  `offset`  
                  `set . . .`  
                  `sync . . .`

`host` *IP\_address*

Sets the IP address of the RFC 868-compliant host that will be used as the time source. This is the address of a host which will respond to an empty datagram on UDP port 37 with a datagram containing the current time.

```
Example: time host 131.210.1.4
```

`list`

Displays all configured time-related parameters. This includes the current time (if set) and the source of the time (operator or IP address from which time was last received).

```
Example: time list
05:20:27 Wednesday December 7, 1994
Set by: operator
Time Host: 131.210.4.1
Sync Interval: 10 seconds GMT
Offset: -300 minutes
```

**offset** *minutes*

Defines the time zone, in minutes, offset from GMT (Greenwich Mean Time). Note that values west of GMT are negative. For example, EST is 5 hours earlier than GMT, so the command would be **time offset -300**.

```
Example: time offset
minutes from GMT (-720 to 720) [0]? -300
```

**set** <*year month date hour minute second*>

Prompts you to set the current time. If you do not specify the entire time in the command, you are prompted for the remaining values. You can change the date as shown in the following example.

```
Example: time set
year [1996] 1997
month [12]?
date [6]? 7
hour [11]? 12
minute [3]?
second [2]?
```

**sync** *seconds*

Sets the period, in seconds, at which the router will poll the time host for the current time.

```
Example: time sync 300
```

## Unpatch

Use the **unpatch** command to restore the values of the patch variables entered with the **patch** command to their default values. See the **patch** command in “Patch” on page 6-19.

**Note:** You *must* specify the long name of the patch variable to be restored.

**Syntax:** unpatch *variable\_name*

**Example:** unpatch ethernet-security

## Update

Use the **update** command to update the configuration memory when you receive a new software load. Follow the instructions on the release notice sent with the software. The **update** command is the last command that you enter when loading new software. After you enter this command, the console displays a message indicating configuration memory is being updated.

**Syntax:** update *version-of-SRAM*

**Example:** update version-of-SRAM

```
Updating configuration memory to V15.2 [X104]
```

### Write

Use the **write** command to save a configuration to the device before reloading. If you fail to issue the write command and try to reload the device, you will be asked if you want to save the configuration. The configuration is saved in the next CONFIG on the hard disk in the bank you are currently using.

**Syntax:** `write`

**Example:** `write`

```
Config> write
```



---

## Chapter 7. Performing Change Management Operations

This chapter describes the Boot/Dump Configuration process. This chapter includes the following sections:

- “Understanding Change Management”
- “Using the Trivial File Transfer Protocol (TFTP)”
- “Entering and Exiting Change Management Configuration Environment” on page 7-2
- “Change Management Configuration Commands” on page 7-2

---

### Understanding Change Management

Change management refers to the handling of software and configuration data for an IBM 8210. This involves:

1. Moving code and configuration data to and from the IBM 8210
2. Moving code and configuration data on the IBM 8210 persistent storage device, which is currently a disk drive and flash memory
3. Selecting and Activating specific combinations of software and configuration.

The change management functions are available through the `Boot config>` environment (available through talk 6), or the firmware should the box be in a condition where the hard drive does not contain viable software (that is, you cannot access talk 6). During normal operations, access the change management functions through the `Boot config>` prompt.

The IBM 8210 code and configuration data storage resource is divided into areas called “system banks” (banks for short), each containing a single version of the operational code and any other ancillary files pertinent to that release of the code. Up to four configuration files are associated with each bank’s software.

The general change management model of the IBM 8210 is to introduce new code and or configuration data to the system while the system runs at its present level and then activate the changed code or configuration data set later. If for some reason the new code or configuration does not function as expected, you have the ability to revert to the previous version of the configuration.

---

### Using the Trivial File Transfer Protocol (TFTP)

TFTP is a file transfer protocol that runs over the Internet UDP protocol. This implementation provides multiple, simultaneous TFTP file transfers between an IBM 8210’s nonvolatile configuration memory, image bank, and remote hosts.

TFTP allows you to:

- Get a configuration file from a server to an IBM 8210
- Put a configuration file from an IBM 8210 to a server

TFTP transfers involve a *client* node and a *server* node. The client node generates a TFTP Get or Put request onto the network. The IBM 8210 acts as a client node by generating TFTP requests from the IBM 8210 console using the `Boot config>` process **tftp** command.

## Change Management Commands

The client can transfer a copy of a configuration file or image file stored in an image bank of a server.

The server is any device (for example, a personal computer or workstation) that receives and services the TFTP requests. Use the ELS subsystem TFTP message log to view the transfer in progress.

---

### Loading an Image at a Specific Time

There may be occasions when you may want to load a device on a specific day and time when you will be unavailable. You can configure the device to perform a timed load using the **timeload activate command**. Other commands allow you to view a device's scheduled load information or cancel a scheduled load. See "Change Management Configuration Commands" for information on these commands.

---

### Entering and Exiting Change Management Configuration Environment

To enter the change management configuration command environment, use the **CONFIG boot** command. When the router's software is initially loaded, it is running in the **OPCON** process, signified by the **\*** prompt. From the **\*** prompt:

1. Enter **talk 6**.
2. At the **Config>** prompt, type **boot**.
3. At the **Boot config>** prompt, type **?**. The following appears:

```
ADD description
COPY software
DESCRIBE software
ERASE software
LIST software
LOCK Config file
SET boot information
TFTP software
TIMEDLOAD
UNLOCK Config file
EXIT
```

To return to the **CONFIG** process, type **exit**.

---

### Change Management Configuration Commands

This section describes the Change Management Configuration commands. Each command includes a description, syntax requirements, and an example. Table 7-1 on page 7-3 summarizes the Change Management Configuration commands.

After accessing the Change Management Configuration environment, enter the configuration commands at the **Boot config>** prompt.

Table 7-1. Change Management Configuration Commands

Command	Function
? (Help)	Displays a list of the commands available from that prompt level.
Add	Adds an optional description to a configuration file.
Copy	Copies boot files and configuration files to or from banks.
Describe	Displays information about the stored loadfile images.
Erase	Erases a stored image or a configuration file.
List	Displays information about configuration files and scheduled load information.
Lock	Prevents the device from overwriting the selected configuration with any other configuration.
Set	Selects code bank and configuration to be used.
TFTP	Initiates TFTP file transfers between IBM 8210 remote servers.
Timedload	Schedules a load into the device on a specific day and time, cancels a scheduled load, or displays scheduled load information.
Unlock	Removes the lock from a configuration allowing the configuration to be updated by the device.
Exit	Leaves the Change Management Configuration environment and returns to the CONFIG process.

## ? (Help)

Use the ? (**help**) command to list the commands that are available from the current prompt level. You can also enter a ? after a specific command name to list its options.

**Syntax:** ?

**Example:** Boot config>?

```
ADD description
COPY software
DESCRIBE software VPD
ERASE software
LIST software status
LOCK Config File
SET boot information
TFTP software
TIMEDLOAD
UNLOCK Config File
EXIT
```

## Add

Use the **add** command to add an optional description to a configuration file.

**Syntax:** *add* configuration file load image description

**Example:** Boot config> add

## Change Management Commands

```
+----- BankA -----+----- Description -----+----- Date -----+
| IMAGE - NONE                |                               | 01 Jan 1970 00:01 |
| CONFIG 1 - AVAIL            | test config for pubs         | 01 Jan 1970 01:26 |
| CONFIG 2 - AVAIL *          | test config for pubs         | 01 Jan 1970 01:13 |
| CONFIG 3 - AVAIL            |                               | 01 Jan 1970 01:39 |
| CONFIG 4 - AVAIL            |                               | 01 Jan 1970 01:52 |
+----- BankB -----+----- Description -----+----- Date -----+
| IMAGE - ACTIVE              |                               | 01 Jan 1970 00:30 |
| CONFIG 1 - AVAIL            | test config for pubs         | 01 Jan 1970 00:54 |
| CONFIG 2 - AVAIL            |                               | 01 Jan 1970 00:01 |
| CONFIG 3 - AVAIL            |                               | 01 Jan 1970 00:14 |
| CONFIG 4 - ACTIVE *         |                               | 01 Jan 1970 00:24 |
+----- BankF -----+----- Description -----+----- Date -----+
| IMAGE - AVAIL                |                               | 01 Jan 1970 00:30 |
| CONFIG 1 - AVAIL            | test config for pubs         | 01 Jan 1970 00:54 |
| CONFIG 2 - AVAIL            |                               | 01 Jan 1970 00:01 |
| CONFIG 3 - AVAIL            |                               | 01 Jan 1970 00:14 |
| CONFIG 4 - AVAIL            |                               | 01 Jan 1970 00:24 |
+-----+-----+-----+
* - Last Used Config      L - Config File is Locked
```

```
Select the source bank: (A, B, F): [A]
Select the source configuration: (1, 2, 3, 4): [1] 3
Enter the description of the file: () New config for today
```

Attempting to set description for bank A configuration 3.

Operation completed successfully.

```
Boot config>list
```

```
+----- BankA -----+----- Description -----+----- Date -----+
| IMAGE - NONE                |                               | 01 Jan 1970       |
| CONFIG 1 - AVAIL            | test config for pubs         | 01 Jan 1970 00:58 |
| CONFIG 2 - AVAIL *          | test config for pubs         | 01 Jan 1970 01:13 |
| CONFIG 3 - NONE             | New config for today         | 09 Jan 1970 00:58 |
| CONFIG 4 - AVAIL            |                               | 01 Jan 1970 01:05 |
+----- BankB -----+----- Description -----+----- Date -----+
| IMAGE - ACTIVE              |                               | 01 Jan 1970       |
| CONFIG 1 - AVAIL            | test config for pubs         | 01 Jan 1970 00:54 |
| CONFIG 2 - AVAIL            |                               | 01 Jan 1970 00:01 |
| CONFIG 3 - AVAIL            |                               | 01 Jan 1970 00:14 |
| CONFIG 4 - ACTIVE *         |                               | 01 Jan 1970 00:24 |
+----- BankF -----+----- Description -----+----- Date -----+
| IMAGE - AVAIL                |                               | 01 Jan 1970       |
| CONFIG 1 - AVAIL            | test config for pubs         | 01 Jan 1970 00:54 |
| CONFIG 2 - AVAIL            |                               | 01 Jan 1970 00:01 |
| CONFIG 3 - AVAIL            |                               | 01 Jan 1970 00:14 |
| CONFIG 4 - AVAIL            |                               | 01 Jan 1970 00:24 |
+-----+-----+-----+
* - Last Used Config      L - Config File is Locked
```

## Copy

Use the **copy** command to copy configuration files and load images to and from banks.

**Syntax:** `copy` configuration [file]  
load [image]

**Example:** Boot config>copy load

BankA	Description	Date
IMAGE - AVAIL		01 Jan 1970 00:01
CONFIG 1 - AVAIL	test config for pubs	01 Jan 1970 01:26
CONFIG 2 - AVAIL *	test config for pubs	01 Jan 1970 01:13
CONFIG 3 - AVAIL		01 Jan 1970 01:39
CONFIG 4 - AVAIL		01 Jan 1970 01:52
BankB	Description	Date
IMAGE - ACTIVE		01 Jan 1970 00:01
CONFIG 1 - AVAIL		01 Jan 1970 00:14
CONFIG 2 - AVAIL		01 Jan 1970 00:01
CONFIG 3 - AVAIL		01 Jan 1970 00:37
CONFIG 4 - ACTIVE *		01 Jan 1970 00:24
BankF	Description	Date
IMAGE - AVAIL		01 Jan 1970 00:01
CONFIG 1 - AVAIL		01 Jan 1970 00:14
CONFIG 2 - AVAIL		01 Jan 1970 00:01
CONFIG 3 - AVAIL		01 Jan 1970 00:37
CONFIG 4 - ACTIVE *		01 Jan 1970 00:24

\* - Last Used Config      L - Config File is Locked

```
Select the source bank: (A, B, F): [A] b
Select the destination bank: (A, B): [B] a
Copy SW load image from: bank B
                        to: bank A.
```

Operation completed successfully.

### Example: Boot config>copy configuration

BankA	Description	Date
IMAGE - CORRUPT		01 Jan 1970 00:01
CONFIG 1 - AVAIL	test config for pubs	01 Jan 1970 01:26
CONFIG 2 - AVAIL *	test config for pubs	01 Jan 1970 01:13
CONFIG 3 - AVAIL		01 Jan 1970 01:39
CONFIG 4 - AVAIL		01 Jan 1970 01:52
BankB	Description	Date
IMAGE - ACTIVE		01 Jan 1970 00:01
CONFIG 1 - AVAIL		01 Jan 1970 00:14
CONFIG 2 - AVAIL		01 Jan 1970 00:01
CONFIG 3 - AVAIL		01 Jan 1970 00:37
CONFIG 4 - ACTIVE *		01 Jan 1970 00:24
BankF	Description	Date
IMAGE - AVAIL		01 Jan 1970 00:01
CONFIG 1 - AVAIL		01 Jan 1970 00:14
CONFIG 2 - AVAIL		01 Jan 1970 00:01
CONFIG 3 - AVAIL		01 Jan 1970 00:37
CONFIG 4 - AVAIL		01 Jan 1970 00:24

\* - Last Used Config      L - Config File is Locked

```
Select the source bank: (A, B, F): [A]
Select the source configuration: (1, 2, 3, 4): [1]
Select the destination bank: (A, B, F): [B]
Select the destination configuration: (1, 2, 3, 4): [1]
Copy SW configuration from: bank A, configuration 1
                        to: bank B, configuration 1.
/hd0/sys0/CONFIG0 --> /hd0/sys1/CONFIG0
```

Operation completed successfully.

If the copy fails you may receive one of the following messages:

#### **Error: Active bank cannot be overwritten or erased.**

You attempted to copy a configuration into the bank currently in use by the IBM 8210.

## Change Management Commands

### Error: File copy failed.

This condition occurs when the copy operation fails for reasons other than copying to the active configuration. The most common cause is specifying the same source and destination configurations. When you list (see "List" on page 7-8) the configurations, CORRUPT appears next to the bank that is damaged.

## Describe

Use the **describe** command to display information about a stored image.

**Syntax:** `describe`

**Example:** `Boot config>describe`

BANK A		BANK B		BANK F	
Product ID -	8210-MSS	Product ID -	8210-MSS	Product ID -	8210-MSS
Version	2.0	Version	2.0	Version	2.0
Maint.	0 PTF 0	Maint.	0 PTF 0	Maint.	0 PTF 0
Feat.	8707 RPQ 0	Feat.	8707 RPQ 0	Feat.	8707 RPQ 0
Date	31 Dec 1996	Date	31 Dec 1996	Date	31 Dec 1996

## Erase

Use the **erase** command to erase a stored image or a configuration file.

**Syntax:** `erase configuration [file]`  
`load [image]`

`config` or `load`

Erases a configuration file or a load image. Enter the config number to be erased after the **erase** command.

**Example:** `Boot config>erase load`

## Change Management Commands

```

+----- BankA -----+----- Description -----+----- Date -----+
| IMAGE - CORRUPT      |      |      |      |      |      |
| CONFIG 1 - AVAIL    | test  |      |      |      |      |
| CONFIG 2 - AVAIL    | *     | test  |      |      |      |
| CONFIG 3 - NONE     |      |      |      |      |      |
| CONFIG 4 - AVAIL    |      |      |      |      |      |
+----- BankB -----+----- Description -----+----- Date -----+
| IMAGE - ACTIVE      |      |      |      |      |      |
| CONFIG 1 - AVAIL    | test  |      |      |      |      |
| CONFIG 2 - AVAIL    |      |      |      |      |      |
| CONFIG 3 - AVAIL    |      |      |      |      |      |
| CONFIG 4 - ACTIVE   | *     |      |      |      |      |
+----- BankF -----+----- Description -----+----- Date -----+
| IMAGE - AVAIL       |      |      |      |      |      |
| CONFIG 1 - AVAIL    | test  |      |      |      |      |
| CONFIG 2 - AVAIL    |      |      |      |      |      |
| CONFIG 3 - AVAIL    |      |      |      |      |      |
| CONFIG 4 - AVAIL    |      |      |      |      |      |
+-----+-----+-----+
* - Last Used Config      L - Config File is Locked

```

Select the bank to erase: (A, B, F): [A] a  
Erase SW load image from bank A.

Operation completed successfully.

Boot config>list

```

+----- BankA -----+----- Description -----+----- Date -----+
| IMAGE - NONE        |      |      |      |      |      |
| CONFIG 1 - AVAIL    | test  |      |      |      |      |
| CONFIG 2 - AVAIL    | *     | test  |      |      |      |
| CONFIG 3 - AVAIL    |      |      |      |      |      |
| CONFIG 4 - AVAIL    |      |      |      |      |      |
+----- BankB -----+----- Description -----+----- Date -----+
| IMAGE - ACTIVE      |      |      |      |      |      |
| CONFIG 1 - AVAIL    | test  |      |      |      |      |
| CONFIG 2 - AVAIL    |      |      |      |      |      |
| CONFIG 3 - AVAIL    |      |      |      |      |      |
| CONFIG 4 - ACTIVE   | *     |      |      |      |      |
+----- BankF -----+----- Description -----+----- Date -----+
| IMAGE - AVAIL       |      |      |      |      |      |
| CONFIG 1 - AVAIL    | test  |      |      |      |      |
| CONFIG 2 - AVAIL    |      |      |      |      |      |
| CONFIG 3 - AVAIL    |      |      |      |      |      |
| CONFIG 4 - AVAIL    |      |      |      |      |      |
+-----+-----+-----+
* - Last Used Config      L - Config File is Locked

```

**Example:** Boot config>erase configuration

## Change Management Commands

```
+----- BankA -----+----- Description -----+----- Date -----+
| IMAGE - NONE                |                               | 01 Jan 1970 00:01 |
| CONFIG 1 - AVAIL            | test config for pubs         | 01 Jan 1970 00:26 |
| CONFIG 2 - AVAIL *          | test config for pubs         | 01 Jan 1970 01:13 |
| CONFIG 3 - AVAIL            |                               | 01 Jan 1970 01:26 |
| CONFIG 4 - AVAIL            |                               | 01 Jan 1970 01:39 |
+----- BankB -----+----- Description -----+----- Date -----+
| IMAGE - ACTIVE              |                               | 01 Jan 1970 00:01 |
| CONFIG 1 - AVAIL            | test config for pubs         | 01 Jan 1970 00:54 |
| CONFIG 2 - AVAIL            |                               | 01 Jan 1970 00:01 |
| CONFIG 3 - AVAIL            |                               | 01 Jan 1970 00:14 |
| CONFIG 4 - ACTIVE *         |                               | 01 Jan 1970 00:24 |
+----- BankF -----+----- Description -----+----- Date -----+
| IMAGE - AVAIL                |                               | 01 Jan 1970 00:01 |
| CONFIG 1 - AVAIL            | test config for pubs         | 01 Jan 1970 00:54 |
| CONFIG 2 - AVAIL            |                               | 01 Jan 1970 00:01 |
| CONFIG 3 - AVAIL            |                               | 01 Jan 1970 00:14 |
| CONFIG 4 - AVAIL            |                               | 01 Jan 1970 00:24 |
+-----+-----+-----+
* - Last Used Config      L - Config File is Locked
```

```
Select the source bank: (A, B, F): [A]
Select the configuration to erase: (1, 2, 3, 4): [1] 3
Erase SW configuration file from bank A, configuration 3.
```

Operation completed successfully.

```
Boot config>list
+----- BankA -----+----- Description -----+----- Date -----+
| IMAGE - NONE                |                               | 01 Jan 1970 00:14 |
| CONFIG 1 - AVAIL            | test config for pubs         | 01 Jan 1970 01:13 |
| CONFIG 2 - AVAIL *          | test config for pubs         | 01 Jan 1970 00:58 |
| CONFIG 3 - NONE            |                               | 01 Jan 1970 00:26 |
| CONFIG 4 - AVAIL            |                               |                               |
+----- BankB -----+----- Description -----+----- Date -----+
| IMAGE - ACTIVE              |                               | 01 Jan 1970      |
| CONFIG 1 - AVAIL            | test config for pubs         | 01 Jan 1970 00:54 |
| CONFIG 2 - AVAIL            |                               | 01 Jan 1970 00:01 |
| CONFIG 3 - AVAIL            |                               | 01 Jan 1970 00:14 |
| CONFIG 4 - ACTIVE *         |                               | 01 Jan 1970 00:24 |
+----- BankF -----+----- Description -----+----- Date -----+
| IMAGE - AVAIL                |                               | 01 Jan 1970      |
| CONFIG 1 - AVAIL            | test config for pubs         | 01 Jan 1970 00:54 |
| CONFIG 2 - AVAIL            |                               | 01 Jan 1970 00:01 |
| CONFIG 3 - AVAIL            |                               | 01 Jan 1970 00:14 |
| CONFIG 4 - AVAIL            |                               | 01 Jan 1970 00:24 |
+-----+-----+-----+
* - Last Used Config      L - Config File is Locked
```

Notice that the list command displays *NONE* by bank A, config 3.

If the erasure fails, a message indicating the failure appears on the console along with the banks that failed.

## List

Use the **list** command to display information about which load images and configuration files are available and active. This command may also be used to display scheduled load information.

**Syntax:** `list`

**Example:** `Boot config>list`



```

boot config>list
+----- BankA -----+----- Description -----+----- Date -----+
| IMAGE - AVAIL          |                               | 01 Jan 1970 00:01 |
| CONFIG 1 - AVAIL      | test config for pubs         | 01 Jan 1970 01:26 |
| CONFIG 2 - AVAIL *    | test config for pubs         | 01 Jan 1970 01:13 |
| CONFIG 3 - NONE       |                               | 01 Jan 1970 00:58 |
| CONFIG 4 - AVAIL      |                               | 01 Jan 1970 00:39 |
+----- BankB -----+----- Description -----+----- Date -----+
| IMAGE - ACTIVE        |                               | 01 Jan 1970 00:01 |
| CONFIG 1 - AVAIL      | test config for pubs         | 01 Jan 1970 00:54 |
| CONFIG 2 - AVAIL      |                               | 01 Jan 1970 00:01 |
| CONFIG 3 - AVAIL      |                               | 01 Jan 1970 00:14 |
| CONFIG 4 - ACTIVE *   |                               | 01 Jan 1970 00:24 |
+----- BankF -----+----- Description -----+----- Date -----+
| IMAGE - AVAIL          |                               | 01 Jan 1970 00:01 |
| CONFIG 1 - AVAIL      | test config for pubs         | 01 Jan 1970 00:54 |
| CONFIG 2 - AVAIL      |                               | 01 Jan 1970 00:01 |
| CONFIG 3 - AVAIL      |                               | 01 Jan 1970 00:14 |
| CONFIG 4 - AVAIL      |                               | 01 Jan 1970 00:24 |
+-----+-----+-----+
* - Last Used Config      L - Config File is Locked
Time Activated Load Schedule Information...

```

The router is scheduled to reload as follows.

```

Date: June 26, 1997
Time: 16:30
The load modules are in bank A.
The configuration is CONFIG 1 in bank A.
Boot config>

```

The following are the possible file status descriptors:

### ACTIVE

The file is currently loaded and is running on the 8210

### AVAIL

This is a valid file that can be made ACTIVE.

### CORRUPT

The file was damaged or not loaded into the 8210 completely. The file must be replaced.

### LOCAL

The file will be used only on the next reload or reset. After the file is used, it will be placed in AVAIL state.

### PENDING

This file will be loaded on the next reload, reset, or power-up of the 8210.

## Lock

Use the **lock** command to prevent the device from overwriting the selected configuration with any other configuration.

**Syntax:** `lock`

**Example:** `Boot config>lock`

## Change Management Commands

```
+----- BankA -----+----- Description -----+----- Date -----+
| IMAGE - NONE                |                               | 01 Jan 1970 01:03 |
| CONFIG 1 - AVAIL            | test config for pubs         | 01 Jan 1970 00:26 |
| CONFIG 2 - AVAIL *          | test config for pubs         | 01 Jan 1970 01:13 |
| CONFIG 3 - NONE             |                               | 01 Jan 1970 00:58 |
| CONFIG 4 - AVAIL            |                               | 01 Jan 1970 00:26 |
+----- BankB -----+----- Description -----+----- Date -----+
| IMAGE - ACTIVE              |                               | 01 Jan 1970 00:01 |
| CONFIG 1 - AVAIL            | test config for pubs         | 01 Jan 1970 00:54 |
| CONFIG 2 - AVAIL            |                               | 01 Jan 1970 00:01 |
| CONFIG 3 - AVAIL            |                               | 01 Jan 1970 00:14 |
| CONFIG 4 - ACTIVE *         |                               | 01 Jan 1970 00:24 |
+----- BankF -----+----- Description -----+----- Date -----+
| IMAGE - AVAIL                |                               | 01 Jan 1970 00:01 |
| CONFIG 1 - AVAIL            | test config for pubs         | 01 Jan 1970 00:54 |
| CONFIG 2 - AVAIL            |                               | 01 Jan 1970 00:01 |
| CONFIG 3 - AVAIL            |                               | 01 Jan 1970 00:14 |
| CONFIG 4 - AVAIL            |                               | 01 Jan 1970 00:24 |
+-----+-----+-----+
* - Last Used Config      L - Config File is Locked
```

```
Select the source bank: (A, B, F): [A]
Select the source configuration: (1, 2, 3, 4): [1] 4
Attempting to lock bank A and configuration 4.
```

Operation completed successfully.

```
Boot config>list
+----- BankA -----+----- Description -----+----- Date -----+
| IMAGE - NONE                |                               | 01 Jan 1970       |
| CONFIG 1 - AVAIL            | test config for pubs         | 01 Jan 1970 00:13 |
| CONFIG 2 - AVAIL *          | test config for pubs         | 01 Jan 1970 01:13 |
| CONFIG 3 - NONE             |                               | 01 Jan 1970 00:58 |
| CONFIG 4 - AVAIL L          |                               | 01 Jan 1970 00:26 |
+----- BankB -----+----- Description -----+----- Date -----+
| IMAGE - ACTIVE              |                               | 01 Jan 1970 00:54 |
| CONFIG 1 - AVAIL            | test config for pubs         | 01 Jan 1970 00:01 |
| CONFIG 2 - AVAIL            |                               | 01 Jan 1970 00:14 |
| CONFIG 3 - AVAIL            |                               | 01 Jan 1970 00:24 |
| CONFIG 4 - ACTIVE *         |                               | 01 Jan 1970 00:24 |
+----- BankB -----+----- Description -----+----- Date -----+
| IMAGE - AVAIL                |                               | 01 Jan 1970 00:54 |
| CONFIG 1 - AVAIL            | test config for pubs         | 01 Jan 1970 00:01 |
| CONFIG 2 - AVAIL            |                               | 01 Jan 1970 00:14 |
| CONFIG 3 - AVAIL            |                               | 01 Jan 1970 00:24 |
| CONFIG 4 - AVAIL            |                               | 01 Jan 1970 00:24 |
+-----+-----+-----+
* - Last Used Config      L - Config File is Locked
```

## SET

Use the **set** command to select the code bank, the configuration to use, and the duration of use. The valid durations are:

**once** The configuration is active for the next boot only.

**always** The configuration is active for all subsequent boots until changed again.

**Syntax:** `set`

**Example:** `Boot config>set`

BankA	Description	Date
IMAGE - NONE		01 Jan 1970 01:03
CONFIG 1 - AVAIL	test config for pubs	01 Jan 1970 00:13
CONFIG 2 - AVAIL *	test config for pubs	01 Jan 1970 01:13
CONFIG 3 - NONE		01 Jan 1970 00:58
CONFIG 4 - AVAIL		01 Jan 1970 00:26
BankB	Description	Date
IMAGE - ACTIVE		01 Jan 1970 00:01
CONFIG 1 - AVAIL	test config for pubs	01 Jan 1970 00:54
CONFIG 2 - AVAIL		01 Jan 1970 00:01
CONFIG 3 - AVAIL		01 Jan 1970 00:14
CONFIG 4 - ACTIVE *		01 Jan 1970 00:24
BankF	Description	Date
IMAGE - AVAIL		01 Jan 1970 00:01
CONFIG 1 - AVAIL	test config for pubs	01 Jan 1970 00:54
CONFIG 2 - AVAIL		01 Jan 1970 00:01
CONFIG 3 - AVAIL		01 Jan 1970 00:14
CONFIG 4 - AVAIL		01 Jan 1970 00:24

\* - Last Used Config      L - Config File is Locked

```
Select the source bank: (A, B, F): [A] b
Select the source configuration: (1, 2, 3, 4): [1] 4
Select the duration to use for booting: (once, always): [always]
Set SW to boot using bank B and configuration 4, always.
```

Operation completed successfully.

Boot config>list

BankA	Description	Date
IMAGE - NONE		01 Jan 1970
CONFIG 1 - AVAIL	test config for pubs	01 Jan 1970 00:13
CONFIG 2 - AVAIL *	test config for pubs	01 Jan 1970 01:13
CONFIG 3 - NONE		01 Jan 1970 00:58
CONFIG 4 - AVAIL		01 Jan 1970 00:26
BankB	Description	Date
IMAGE - ACTIVE		01 Jan 1970
CONFIG 1 - AVAIL	test config for pubs	01 Jan 1970 00:54
CONFIG 2 - AVAIL		01 Jan 1970 00:01
CONFIG 3 - AVAIL		01 Jan 1970 00:14
CONFIG 4 - ACTIVE *		01 Jan 1970 00:24
BankF	Description	Date
IMAGE - AVAIL		01 Jan 1970
CONFIG 1 - AVAIL	test config for pubs	01 Jan 1970 00:54
CONFIG 2 - AVAIL		01 Jan 1970 00:01
CONFIG 3 - AVAIL		01 Jan 1970 00:14
CONFIG 4 - AVAIL		01 Jan 1970 00:24

\* - Last Used Config      L - Config File is Locked

## TFTP

Use the **tftp** command to initiate TFTP file transfers between 8210 remote servers.

**Note:** When you unzip a Release 2 image, you will see multiple files ending in ".ld." Use the **tftp get load modules** command to get multiple load modules.

### Syntax:

```
tftp get config
      load single [image]
      load modules

      put config
      load single [image]
      load modules
```

## Change Management Commands

### Example: Boot config>tftp get load single

```
+----- BankA -----+----- Description -----+----- Date -----+
| IMAGE - NONE          |                               | 01 Jan 1970 01:03 |
| CONFIG 1 - AVAIL     | test config for pubs         | 01 Jan 1970 00:01 |
| CONFIG 2 - AVAIL     | * test config for pubs       | 01 Jan 1970 01:13 |
| CONFIG 3 - NONE      |                               | 01 Jan 1970 00:58 |
| CONFIG 4 - AVAIL     |                               | 01 Jan 1970 00:14 |
+----- BankB -----+----- Description -----+----- Date -----+
| IMAGE - ACTIVE       |                               | 01 Jan 1970 00:01 |
| CONFIG 1 - AVAIL     | test config for pubs         | 01 Jan 1970 00:54 |
| CONFIG 2 - AVAIL     |                               | 01 Jan 1970 00:01 |
| CONFIG 3 - AVAIL     |                               | 01 Jan 1970 00:14 |
| CONFIG 4 - ACTIVE    | *                               | 01 Jan 1970 00:24 |
+----- BankF -----+----- Description -----+----- Date -----+
| IMAGE - AVAIL        |                               | 01 Jan 1970 00:01 |
| CONFIG 1 - AVAIL     | test config for pubs         | 01 Jan 1970 00:54 |
| CONFIG 2 - AVAIL     |                               | 01 Jan 1970 00:01 |
| CONFIG 3 - AVAIL     |                               | 01 Jan 1970 00:14 |
| CONFIG 4 - ACTIVE    | *                               | 01 Jan 1970 00:24 |
+-----+-----+-----+
* - Last Used Config      L - Config File is Locked
```

Specify the server IP address (dotted decimal): : [1.2.3.4] **192.9.200.1**

Specify the remote file name: : (/u/bin) **/usr/8210load/nce.img**

Select the destination bank: (A, B, F): [A] **a**

```
TFTP SW load image
get: /usr/8210load/nce.img
from: 192.9.200.1
to: bank A.
```

Operation completed successfully.

**Note for Dynamic Loading of Software:** All of the load modules in the specified directory will be retrieved as part of the load going into the bank. For loads for releases prior to Version 1, Release 2, this will be a single load module. For Version 1, Release 2 loads and later, this may be multiple load modules.

### Example: Boot config>tftp get load modules

BankA	Description	Date
IMAGE - NONE		01 Jan 1970 01:03
CONFIG 1 - AVAIL	test config for pubs	01 Jan 1970 00:01
CONFIG 2 - AVAIL *	test config for pubs	01 Jan 1970 01:13
CONFIG 3 - NONE		01 Jan 1970 00:58
CONFIG 4 - AVAIL		01 Jan 1970 00:14
BankB	Description	Date
IMAGE - ACTIVE		01 Jan 1970 00:01
CONFIG 1 - AVAIL	test config for pubs	01 Jan 1970 00:54
CONFIG 2 - AVAIL		01 Jan 1970 00:01
CONFIG 3 - AVAIL		01 Jan 1970 00:14
CONFIG 4 - ACTIVE *		01 Jan 1970 00:24
BankF	Description	Date
IMAGE - AVAIL		01 Jan 1970 00:01
CONFIG 1 - AVAIL	test config for pubs	01 Jan 1970 00:54
CONFIG 2 - AVAIL		01 Jan 1970 00:01
CONFIG 3 - AVAIL		01 Jan 1970 00:14
CONFIG 4 - ACTIVE *		01 Jan 1970 00:24

\* - Last Used Config      L - Config File is Locked

```
Specify the server IP address (dotted decimal): : [1.2.3.4] 192.9.200.1
Specify the remote modules directory: : (/u/bin/) /usr/8210load/
Select the destination bank: (A, B, F): [A] a
TFTP SW load image
get: /usr/8210load/LML.ld
from: 192.9.200.1
to: bank A.
```

Operation completed successfully.

## Notes:

When putting files to a server:

1. Make sure that the files on the target server have the appropriate permissions that would allow anyone to write to those files. If not, the put operation will fail.
2. You must be aware of the files you are putting to the target server. To determine whether the image in the bank is a single module or multiple modules, use the **describe** command. A load prior to Version 1, Release 2 is a single module. Loads at Version 1, Release 2 or after are multiple modules.

## Timedload

Use the **timedload** command to schedule a load on a device, cancel a scheduled load, or view scheduled load information.

This command allows you to load the device outside peak network traffic periods when support personnel may not be present.

**Syntax:** **timedload**    activate  
                                   deactivate  
                                   view

**activate**    Schedules a load on the device. You will be prompted for information for a time-activated load similar to the **tftp get load** and **tftp get config** commands. See "TFTP" on page 7-11 for information about the parameters.

### Time of day to load the device

Specifies the date and time to load the device. Specify the value as YYYYMMDDHHMM, where:

## Change Management Commands

YYYY is the four-digit year

**Note:** If the current month on the device is December, the year data must be the current year or the following year. Otherwise, if the current month on the device is January through November, the year data must be the current year.

MM is the two digit month.

**MM Valid Values:** 01 to 12 with 01 representing January.

DD is the two-digit day of the month.

**DD Valid Values:** 01 to 31, depending on the value of MM.

HH is the two-digit hour in 24-hour time.

**HH Valid Values:** 00 to 23

MM is the two-digit minute of the hour.

**MM Valid Values:** 00 to 59

The following are examples of scheduling a load from different sources.

**Example 1. Load modules and configuration source is a remote host:**

## Change Management Commands

Boot config>timedload activate

```
+----- BankA -----+----- Description -----+----- Date -----+
| IMAGE - AVAIL          |                               | 01 Jan 1970 00:01 |
| CONFIG 1 - AVAIL      | test config for pubs         | 01 Jan 1970 01:26 |
| CONFIG 2 - AVAIL      | * test config for pubs       | 01 Jan 1970 01:13 |
| CONFIG 3 - NONE       |                               | 01 Jan 1970 00:58 |
| CONFIG 4 - AVAIL      |                               | 01 Jan 1970 00:39 |
+----- BankB -----+----- Description -----+----- Date -----+
| IMAGE - ACTIVE        |                               | 01 Jan 1970 00:01 |
| CONFIG 1 - AVAIL      | test config for pubs         | 01 Jan 1970 00:54 |
| CONFIG 2 - AVAIL      |                               | 01 Jan 1970 00:01 |
| CONFIG 3 - AVAIL      |                               | 01 Jan 1970 00:14 |
| CONFIG 4 - ACTIVE     | *                             | 01 Jan 1970 00:24 |
+----- BankF -----+----- Description -----+----- Date -----+
| IMAGE - AVAIL          |                               | 01 Jan 1970 00:01 |
| CONFIG 1 - AVAIL      | test config for pubs         | 01 Jan 1970 00:54 |
| CONFIG 2 - AVAIL      |                               | 01 Jan 1970 00:01 |
| CONFIG 3 - AVAIL      |                               | 01 Jan 1970 00:14 |
| CONFIG 4 - AVAIL      |                               | 01 Jan 1970 00:24 |
+-----+-----+-----+
* - Last Used Config      L - Config File is Locked
```

Time Activated Load Processing...

Select the bank to use: (A, B): [A] **a**

Do you want to put load modules into the bank? (Yes, No, Quit): [Yes] **yes**

Do you want to retrieve a SINGLE image or a set of MODULES? [MODULES]? **modules**

Specify the server IP address (dotted decimal): : [1.2.3.4] **192.9.200.1**

Specify the remote modules directory: : (/u/bin) /usr/601bin/205img

The destination bank is bank A

TFTP SW load image

get: /usr/601bin/205img/

from: 192.9.200.1

to: bank A.

tftp: connect to '192.9.200.1'

tftp: connect to '192.9.200.1'

tftp: connect to '192.9.200.1'

tftp: connect to '192.9.200.1'

tftp: connect to '192.9.200.1'

tftp: connect to '192.9.200.1'

tftp: connect to '192.9.200.1'

tftp: connect to '192.9.200.1'

tftp: connect to '192.9.200.1'

tftp: connect to '192.9.200.1'

tftp: connect to '192.9.200.1'

tftp: connect to '192.9.200.1'

tftp: connect to '192.9.200.1'

Operation completed successfully.

Do you want to put a configuration into the bank? (Yes, No, Quit): [Yes] **yes**

Specify the server IP address (dotted decimal): : [1.2.3.4] **192.9.200.1**

Specify the remote file name: : (config.dat) /tftpboot/192.9.200.6.config

The destination bank is bank A

Select the destination configuration: (1, 2, 3, 4): [1] **1**

TFTP SW configuration file

get: /tftpboot/192.9.200.6.config

from: 192.9.200.1

to: bank A, configuration 1.

tftp: connect to '192.9.200.1'

Operation completed successfully.

Time of day to load the router (YYYYMMDDHHMM) []? **199706261630**

The load timer has been activated.

Boot config>

## Change Management Commands

### Example 2. Load modules and configuration source is a bank:

```
Boot config>timedload activate
```

```
+----- BankA -----+----- Description -----+----- Date -----+
| IMAGE - AVAIL          |                               | 01 Jan 1970 00:01 |
| CONFIG 1 - AVAIL      | test config for pubs         | 01 Jan 1970 01:26 |
| CONFIG 2 - AVAIL      | test config for pubs         | 01 Jan 1970 01:13 |
| CONFIG 3 - NONE       |                               | 01 Jan 1970 00:58 |
| CONFIG 4 - AVAIL      |                               | 01 Jan 1970 00:39 |
+----- BankB -----+----- Description -----+----- Date -----+
| IMAGE - ACTIVE        |                               | 01 Jan 1970 00:01 |
| CONFIG 1 - AVAIL      | test config for pubs         | 01 Jan 1970 00:54 |
| CONFIG 2 - AVAIL      |                               | 01 Jan 1970 00:01 |
| CONFIG 3 - AVAIL      |                               | 01 Jan 1970 00:14 |
| CONFIG 4 - ACTIVE *   |                               | 01 Jan 1970 00:24 |
+----- BankF -----+----- Description -----+----- Date -----+
| IMAGE - AVAIL          |                               | 01 Jan 1970 00:01 |
| CONFIG 1 - AVAIL      | test config for pubs         | 01 Jan 1970 00:54 |
| CONFIG 2 - AVAIL      |                               | 01 Jan 1970 00:01 |
| CONFIG 3 - AVAIL      |                               | 01 Jan 1970 00:14 |
| CONFIG 4 - AVAIL      |                               | 01 Jan 1970 00:24 |
+-----+-----+-----+
* - Last Used Config      L - Config File is Locked
```

```
Time Activated Load Processing...
```

```
Select the bank to use: (A, B): [A] a
```

```
Do you want to put load modules into the bank? (Yes, No, Quit): [Yes] no
```

```
Do you want to put a configuration into the bank? (Yes, No, Quit): [Yes] no
```

```
Select the configuration to use: (1, 2, 3, 4): [1] 1
```

```
Time of day to load the router (YYYYMMDDHHMM) []? 199706261630
```

```
The load timer has been activated.
```

```
Boot config>
```

### deactivate

Cancels a scheduled load.

### Example 1: Deactivate the time activated load

```
Boot config>timedload deactivate
```

```
Deactivate Load Timer Processing...
```

```
Do you want to deactivate the load timer? (Yes, No, Quit): [No] yes
```

```
The load timer has been deactivated.
```

```
Boot config>
```

### view

Displays scheduled load information.

```
Boot Config> timedload view
```

```
Time Activated Load Schedule Information...
```

```
The router is scheduled to reload as follows.
```

```
Date: June 26, 1997
```

```
Time: 16:30
```

```
The load modules are in bank A.
```

```
The configuration is CONFIG 1 in bank A.
```

```
Boot config>
```

## Unlock

Use the **unlock** command to allow the device to overwrite the selected configuration that was previously locked.

**Syntax:** unlock

**Example:** Boot config>**unlock**



BankA	Description	Date
IMAGE - NONE		01 Jan 1970 01:03
CONFIG 1 - AVAIL	test config for pubs	01 Jan 1970 00:13
CONFIG 2 - AVAIL *	test config for pubs	01 Jan 1970 01:13
CONFIG 3 - NONE		01 Jan 1970 00:58
CONFIG 4 - AVAIL L		01 Jan 1970 00:26
BankB	Description	Date
IMAGE - ACTIVE		01 Jan 1970 00:01
CONFIG 1 - AVAIL	test config for pubs	01 Jan 1970 00:54
CONFIG 2 - AVAIL		01 Jan 1970 00:01
CONFIG 3 - AVAIL		01 Jan 1970 00:14
CONFIG 4 - ACTIVE *		01 Jan 1970 00:24
BankF	Description	Date
IMAGE - AVAIL		01 Jan 1970 00:01
CONFIG 1 - AVAIL	test config for pubs	01 Jan 1970 00:54
CONFIG 2 - AVAIL		01 Jan 1970 00:01
CONFIG 3 - AVAIL		01 Jan 1970 00:14
CONFIG 4 - AVAIL		01 Jan 1970 00:24

\* - Last Used Config      L - Config File is Locked

Select the source bank: (A, B, F): [A]  
 Select the source configuration: (1, 2, 3, 4): [1] 4  
 Attempting to unlock bank A and configuration 4.

Operation completed successfully.

Boot config>list

BankA	Description	Date
IMAGE - NONE		
CONFIG 1 - AVAIL	test config for pubs	01 Jan 1970 00:01
CONFIG 2 - AVAIL *	test config for pubs	01 Jan 1970 01:13
CONFIG 3 - NONE		01 Jan 1970 00:58
CONFIG 4 - AVAIL		01 Jan 1970 00:14
BankB	Description	Date
IMAGE - ACTIVE		01 Jan 1970
CONFIG 1 - AVAIL	test config for pubs	01 Jan 1970 00:54
CONFIG 2 - AVAIL		01 Jan 1970 00:01
CONFIG 3 - AVAIL		01 Jan 1970 00:14
CONFIG 4 - ACTIVE *		01 Jan 1970 00:24
BankF	Description	Date
IMAGE - AVAIL		01 Jan 1970
CONFIG 1 - AVAIL	test config for pubs	01 Jan 1970 00:54
CONFIG 2 - AVAIL		01 Jan 1970 00:01
CONFIG 3 - AVAIL		01 Jan 1970 00:14
CONFIG 4 - ACTIVE *		01 Jan 1970 00:24

\* - Last Used Config      L - Config File is Locked

## Exit

Use the **exit** command to leave the current process command level and return to the previous process level.

**Syntax:** exit

**Example:** exit

## Change Management Commands

---

## Chapter 8. Using MSS Server Firmware

The MSS Server contains firmware that tests the hardware each time the MSS Server is powered on. If the MSS Server has not loaded its operational code, the firmware should be running.

One of the functions is to perform hardware checking after a power-on, and decide which version of the operational code will be loaded. It also allows you to change some of the hardware-related parameters, and manage the operational code and your configuration files.

The System Management Services menu appears when the MSS Server: is set up to boot up in “Attended Mode.”

### Important:

1. You can also access the firmware by stopping the boot process. To do this, you must have a TTY console directly attached to the EIA 232 service serial port. When the server starts its boot process, press and hold **Ctrl-C** or **F1** at the terminal keyboard.
2. If the firmware panels do not appear after you complete the above step:
  - a. Be sure that your workstation is connected to the EIA 232 service serial port on the server.
  - b. Reset or power down and power up the server.
3. You can use the up(↑) and down arrow (↓) keys or the Tab key to move around the firmware panels.

---

### Accessing the Firmware Prompt

Before booting the 8210, note that:

- You will need a terminal or IP workstation connected to the 8210. This can be a VT100 TTY device connected directly through the serial port. You can connect an IP workstation using SLIP to connect into the 8210. The default 8210 IP address is 10.1.1.2 and the workstation address should be 10.1.1.3.
- The 8210 is shipped with code loaded in flash memory and on the hard drive.

**Important:** To access the Firmware prompt, you can stop the 8210 boot; to stop it, you must have a TTY console directly attached to the serial port. When the 8210 starts its boot sequence, press **Ctrl C** from the console to interrupt the boot sequence.

Another way to control booting is to configure the 8210 to come up in Attended mode. Attended mode can be configured from the Firmware command set.

---

### Boot Options Available for the 8210

The 8210 can be configured for Unattended mode. In Unattended mode, you must have chosen which load image and which configuration to load. You are provided with three banks to choose among. The structure of the image banks is as follows:

- IMAGE - Status of image
- CONFIG 1 - Status of Config
- CONFIG 2 - Status of Config
- CONFIG 3 - Status of Config
- CONFIG 4 - Status of Config

See “List” on page 7-8 for a description of file statuses.

### Attended Mode

When the server is configured to come up in attended mode, you have access to the Firmware System Management Services.

Connection in attended mode is via a TTY connection. You can transfer files using the Xmodem protocol for TTY or TFTP for IP connections.

In attended mode, you can start booting the server by pressing **F9** or by pressing **Ctrl+A**, then **9**, and then **Enter** to start the operating system. The system will prompt you to enter the supervisory password.

### Unattended Mode

This is the normal mode for the 8210. It will come up on the Active, Local, or Pending image and config based on your choice.

A password is not required to boot up in unattended mode.

---

### Starting the MSS Server Firmware

You can begin using the information in this section after you have prepared your service terminal and have established connection with the server.

From the Main Menu panel (as shown in Figure 8-1 on page 8-3), you can select one of four services. The following sections explain these services and provide instructions for going through the associated panels:

- “Managing the Configuration” on page 8-3
- “Selecting the Boot Sequence” on page 8-4
- “Selecting a Device To Test” on page 8-4
- “Using the Utilities” on page 8-6

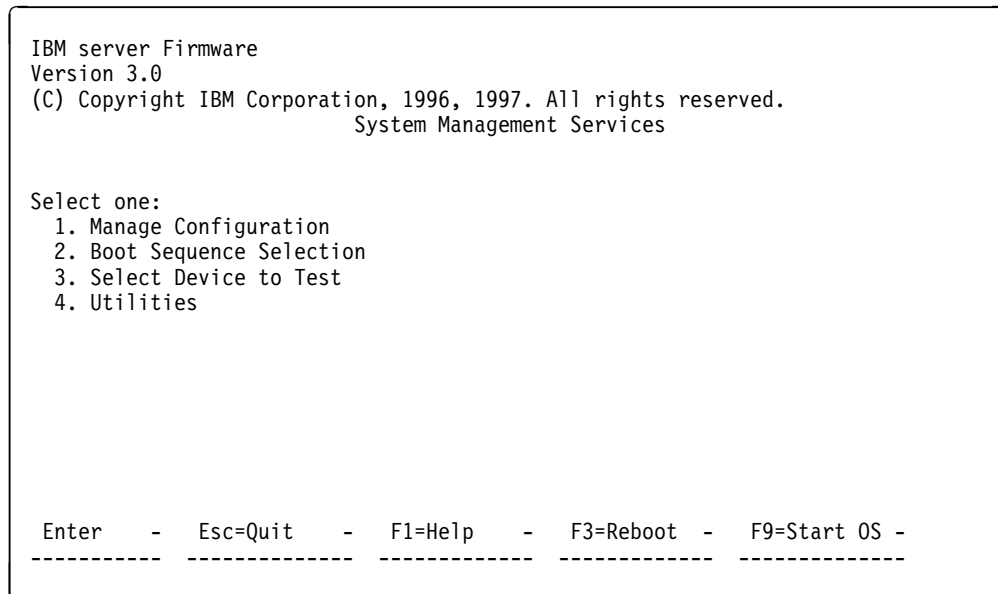


Figure 8-1. Main Menu Panel

## The Function Keys

As seen in Figure 8-1, various function keys appear at bottom of the panels. These keys are common among the MSS Server Firmware panels. On other panels the functions keys are stacked at the right of the panel. Use the F1 Help key to get descriptions for the function keys associated with the MSS Server Firmware.

## Obtaining Help

Online helps are available for panels whenever the F1 key appears at the lower portion of the panel. Pressing F1 presents a pop-up help window with information relating to the currently active panel.

## Managing the Configuration

Managing the configuration involves defining and modifying some configuration values. You can change the operational parameters for the EIA 232 service serial port and the PCMCIA modem by pressing the F6 Modify key.

**Note:** Although you can modify the speed, parity, data bits, and so on, of either the EIA 232 service serial port or the PCMCIA modem, it is recommended that you modify only the PCMCIA modem and not the EIA 232 service serial port.

1. Select **1. Manage Configuration** from the main menu as shown in Figure 8-1.
2. The *System Configuration Information* panel appears as shown in Figure 8-2 on page 8-4.

**Note:** Only the fields under Serial Ports can be changed (modified). To change the specifications for a port, move the cursor to the field, press **F6**, and type in the new value.

Use the down arrow (↓) key to scroll to the next panel.

3. Press **Enter** to make the change effective.
4. To display serial ports, press **F6** after selecting the processor type.

```
IBM server Firmware
Version 3.0
(C) Copyright IBM Corporation, 1996, 1997. All rights reserved.
      System Management Services
+-----System Configuration Information-----+
Select one  Processor Type      166MHz 603EV
 1. Manag  Memory                64 Megabytes      >
 2. Boot
 3. Selec
 4. Utili  PCI Slots
          Name of adapter   Slot #      Device ID    Revision ID
          8260 ATM Interface  1          1410        03
          L2 Cache          512KB Installed
          Serial Ports
          COM1 (x' 8c0')    Serial Port
          COM2 (x' 2f8')    PCMCIA Modem
Enter      Enter  -  Esc=Quit  -  F1=Help  -  F6=Modify  -
-----
```

Figure 8-2. System Configuration Information

## Selecting the Boot Sequence

This function enables you to select a sequence for the various boot devices, display the current boot device settings, restore the default setting, and boot from other boot devices.

**Attention:** It is not recommended that you use this function. Use the Change Management option under the Utilities menu instead. See Chapter 7, “Performing Change Management Operations” on page 7-1 for more information about change management.

## Selecting a Device To Test

The firmware performs hardware tests when the MSS Server boots up. But there may be times when you have removed and replaced a failing part and you want to run an individual test before a full boot up or reset. The firmware allows you to run these individual tests:

- Test All Subsystems: This test runs all the subsystem tests that are listed on this panel.

**Note:** This list is a variable list and the entries are based on diagnostic files.

- Test Memory: This test searches all available memory regions, tests the regions, and presents a consolidated list of test results.
- Test System Board: This tests the PowerPC CPU, the System Board interrupts, the PCMCIA controller, the system board temperature sensor and its interrupt

mechanism, and turns the LEDs on and off (you must visually confirm that the LEDs are indeed on or off).

- Test 8260 Mailbox: This tests the Mailbox communications interface with the 8260 or 8265.
- Test IDE Devices: This tests the IDE hard drive devices
  - Device self test
  - Read/Seek test
  - Buffer test

It also allows low-level formatting of the hard drive.

**Note:** Perform low-level formatting only under the guidance of service support personnel.

- ATM Interface to Hub: This tests the ATM subsystem in the A-MSS Server Module.
- 155-Mbps ATM Adapter: This tests the ATM adapter and allows the testing of the physical interface in the MSS Server when used with an optical wrap plug.
- FDDI Adapter: This tests the FDDI adapter in the MSS Server.

To test a device:

- Select **3. Select Device to Test** from the main menu.

The *Select Device to Test* panel appears (Figure 8-3).

**Note:** The *Select Device to Test* panel is created dynamically, depending on what diagnostics have been loaded. What items appear depend on whether you have an MSS Server or an A-MSS Server Module.

```

IBM server Firmware
Version 3.0
(C) Copyright IBM Corporation, 1996, 1997. All rights reserved.
      System Management Services

Select one:
  1. Manage Configuration
  2. Boot Sequence +-----Select Device to Test-----+
  3. Select Device |                                     | Esc=Quit - |
  4. Utilities     |                                     | ----- |
                  |                                     | F1=Help - |
                  |                                     | ----- |
                  | {>} Test All Subsystems | Spacebar=Choose - |
                  | { } Test Memory | ----- |
                  | { } Test System Board | F4=Parm Setup - |
                  | { } Test 8260 Mailbox | ----- |
                  | { } Test IDE Devices | F6=Execute - |
                  | { } ATM Interface to Hub | ----- |
                  |                                     | F9=Display Error Log - |
                  |                                     | ----- |
Enter -          |                                     |
-----+-----+-----+-----+-----+-----+-----+

```

Figure 8-3. Test Selection Panel

- Use the spacebar and up arrow and down arrow keys to select the test that you want to run.

## Using Firmware

- Move the cursor to a selection and press **F4** to define additional test parameters.
  - **Note:** Errors encountered during diagnostics are logged in the hardware error log.
  - The *Test Parameters* panel appears. From this panel you can select:
    - Run Interactive Test
    - Run Wrap Tests
    - Stop On Error
    - Loop Tests
    - Loop Count
- Press **Esc** to return to the *Select Device Test* panel.
- Press **F6** to start a test.
  - After the test is complete, press **Esc** to return to the main menu panel.

---

## Using the Utilities

To use the utilities:

1. Select **4. Utilities** from the main menu.

A panel listing the available utilities appears (Figure 8-4 ).

```
IBM server Firmware
Version 3.0
(C) Copyright IBM Corporation, 1996, 1997. All rights reserved.
      System Management Services

Select one:
1. Set Supervisory Password
2. Enable Unattended Start Mode
3. Disable Unattended Start Mode
4. Remove Supervisory Password
5. Update System Firmware
6. Display Event / Error Log
7. View or Set Vital Product Data
8. Copy Remote Files
9. Remote Initial Program Load Setup
10. Manipulate Dead Man Timer
11. Verify Hard Disk Format
12. Change Management
13. Prepare Hard Disk

Enter   -   Esc=Quit   -   F1=Help   -
-----
```

Figure 8-4. Utilities Selection Panel

2. Make your selection. Additional panels appear to prompt you for additional information, and messages appear to indicate that the task is completed.



## Setting the Supervisory Password

If a password is set and the server is configured to come up in unattended mode, you must enter the password before you can access the firmware System Management Services. The MSS Server is initially shipped with a password of **mss**. This utility allows you to set and change the password.

**Note:** You can perform this function only if you do it immediately after you perform a power-on reset.

1. Select **1. Set Supervisory Password** from the utilities panel.

The *Set Supervisory Password* panel appears (Figure 8-5).

2. Type your new password and press **Enter**. The system prompts you to enter your new password again.

**Note:** The supervisory password can consist of from 1 to 8 characters with no restrictions on which characters can be used.

```

IBM server Firmware
Version 3.0
(C) Copyright IBM Corporation, 1996, 1997. All rights reserved.
      System Management Services

Select one:
 1. Set Supervisor+-----Set Supervisory Password-----+
 2. Enable Unatten|
 3. Disable Unatte|   Type your new password, and then
 4. Remove Supervi|   press Enter.
 5. Update System  |
 6. Display Event  |
 7. View or Set Vi |   Enter -   Esc=Quit -   F1=Help -
 8. Copy Remote Fi |-----|
 9. Remote Initial+-----+
10. Manipulate Dead Man Timer
11. Verify Hard Disk Format
12. Change Management
13. Prepare Hard Disk

Enter   -   Esc=Quit   -   F1=Help   -
-----|-----|-----|

```

Figure 8-5. Set Supervisory Password Panel

3. Type the password again and press **Enter**.
4. The *Password Saved* panel appears with the message that your supervisory password has been saved.

## Enabling Unattended Start Mode

The default is that the unattended start mode is enabled, which causes the MSS Server to load operational code automatically.

**Note:** You can perform this function only if you do it immediately after you perform a power-on reset.

1. Select **2. Enable Unattended Start Mode** from the utilities panel.

The *Unattended Start Mode Changed* panel appears (Figure 8-6 on page 8-8).

```
IBM server Firmware
Version 3.0
(C) Copyright IBM Corporation, 1996, 1997. All rights reserved.
      System Management Services

Select one:
 1. Set Supervisory Password
 2. Enable Unatten+-----Unattended Start Mode Changed-----+
 3. Disable Unatte|
 4. Remove Supervi|      Unattended Start mode has been
 5. Update System  |      enabled.
 6. Display Event
 7. View or Set Vi
 8. Copy Remote Fi
 9. Remove Initial+-----+
10. Manipulate Dead Man Timer
11. Verify Hard Disk Format
12. Change Management
13. Prepare Hard Disk

Enter   -   Esc=Quit   -   F1=Help   -
-----  -----  -----
```

Figure 8-6. Unattended Start Mode Changed (Enabled) Panel

**Note:** Once unattended start mode has been enabled, you can enter the firmware by pressing and holding **Ctrl-C** or pressing **F1** at the terminal keyboard when the boot process begins.

### Disabling Unattended Start Mode

The default for the MSS Server firmware is that the unattended start mode is enabled. You disable Unattended Start Mode using this utility.

**Note:** You can perform this function only if you do it immediately after you perform a power-on reset.

1. Select **3. Disable Unattended Start Mode** from the utilities panel.

The *Unattended Start Mode Changed* panel appears (Figure 8-7 on page 8-9).

```

IBM server Firmware
Version 3.0
(C) Copyright IBM Corporation, 1996, 1997. All rights reserved.
      System Management Services

Select one:
  1. Set Supervisor Password
  2. Enable Unattended Start Mode
  3. Disable Unattended Start Mode Changed
  4. Remove Supervisory Password
  5. Update System
  6. Display Event
  7. View or Set Variables
  8. Copy Remote File
  9. Remote Initial
 10. Manipulate Deadlocks
 11. Verify Hard Disk Format
 12. Change Management
 13. Prepare Hard Disk

Enter - Esc=Quit - F1=Help -
-----

```

Figure 8-7. Unattended Start Mode Changed (Disabled) Panel

## Removing Supervisory Password

The use of a supervisory password allows you a degree of security by preventing unauthorized access to the MSS Server. Removing the enforcement of a password, however, could be a convenience while servicing the MSS Server.

**Note:** You can perform this function only if you do it immediately after you perform a power-on reset.

1. Select **4. Remove Supervisory Password** from the utilities panel.

The *Remove Supervisory Password* panel appears (Figure 8-8 on page 8-10 ).

```
IBM server Firmware
Version 3.0
(C) Copyright IBM Corporation, 1996, 1997. All rights reserved.
      System Management Services

Select one:
 1. Set Supervisory Password
 2. Enable Unattended Start Mode
 3. Disable Unattended Start Mode-----Remove Supervisory Password-----+
 4. Remove Supervisory Password
 5. Update System
 6. Display Event
 7. View or Set Variables
 8. Copy Remote Firmware
 9. Remote Initial
10. Manipulate Deadlocks-----+
11. Verify Hard Disk Format
12. Change Management
13. Prepare Hard Disk

Do you want to remove the
Supervisory password?
  Yes (Y) -   No (N) -
-----

Enter - Esc=Quit - F1=Help -
-----
```

Figure 8-8. Remove Supervisory Password Panel

2. Type **Y** if you want to remove the supervisory password.
3. The *Password Removed* panel appears. This panel informs you that the supervisory password has been removed.

## Updating System Firmware

Use this utility to update the MSS Server firmware.

**Note:** Do not power off or reset the MSS Server during the process of updating the firmware. If the update fails, the MSS Server will boot a backup firmware image. If this happens, repeat the update procedure to reload the onboard firmware image.

1. Select **5. Update System Firmware** from the utilities panel.

The *System Firmware Update* panel appears (Figure 8-9 on page 8-11 ).

```

IBM server Firmware
Version 3.0
(C) Copyright server Corporation, 1996, 1997. All rights reserved.
      System Management Services

Select one:
  1. Set Supervisory Password
  2. Enable Unattended Start Mode
  3. Disable Unattended Start Mode
  4. Remove Supervisory Password
  5. Update System +-----F/W Update Options-----+
  6. Display Event |
  7. View or Set Vi | 1. TFTP a Remote Image File
  8. Copy Remote Fi | 2. XMODEM a Remote Image File
  9. Remote Initial | 3. Use a Local Image File
 10. Manipulate Dea |
 11. Verify Hard Di | Enter - Esc=Quit - F-1=Help
 12. Change Managem |-----
 13. Prepare Hard D+-----

Enter - Esc=Quit - F1=Help -
-----

```

Figure 8-9. Update System Firmware Panel

2. Select the option that you want to use from those listed. For TFTP, the system prompts you for the local (the “to”) and the remote (the “from”) file name that you want to use and the name of the server that can be reached by the server. It also prompts you to create a recovery image and a file name from which to update the firmware.

For Xmodem, the system prompts you for the received file name and tells you when to begin the transfer.

The firmware update process begins. It informs you that the system firmware has been updated.

## Displaying the Event/Error Log

See *IBM Nways Multiprotocol Switched Services (MSS) Server Module Service and Maintenance Manual* to interpret the data that appears in the Error Code field. To display the Event/Error Log:

1. Select **6. Display Event / Error Log** from the utilities panel.

The *Event / Error Log* panel appears (Figure 8-10 on page 8-12 ).

```
IBM server Firmware
Version 3.0
(C) Copyright IBM Corporation, 1996, 1997. All rights reserved.
      System Management Services

Select one:
1. Set Supervisory Password
2. Enable Unattended Start Mode
3. Disable Unattended Start Mode
4. Remove Supervisory Password
5. Update System Firmware
+-----Event Log-----+
|
| 1. Src      1 08/src/arp/sysex/c200/io_int.c:324      00000005,012B
| 2. Bootup  0*****                                00-01, 21 01/03/96 16:23:27
| 3. Src      1 08/src/arp/sysex/c200/io_int.c:324      00000005,012B
|
|   Enter    -   Esc=Quit  -   F1=Help  -   F2=Clear Log -
| -----
|
+-----+
Enter - Esc=Quit - F1=Help -
-----
```

Figure 8-10. Event/Error Log Panel

If the log is too large to appear on one panel, you can move through the log by using the up and down arrow keys or the PgUp/PgDn keys.

2. Press **F2** to clear the log.

## Viewing Vital Product Data

This utility allows you to view vital product data (VPD) for the MSS Server

1. Create a flat (ASCII) text file with a complete list of all VPD keywords. Make sure that you list *all* keywords, not just those that you want to change, because the ASCII file completely overwrites the existing list of keywords.
2. Transfer the ASCII file to the server by using the Copy Remote Files utility (see “Copying Remote Files” on page 8-14), which allows you to use either TFTP or Xmodem.

```

IBM server Firmware
Version 3.0
(C) Copyright IBM Corporation, 1996, 1997. All rights reserved.
      System Management Services

Select one:
  1. Set Supervisory Password
  2. Enable Unattended Start Mode
  3. Disable Unattended Start Mode
  4. Remove Supervisory Password
  5. Update System Firmware
  6. Display Event / Error Log
  7. View or Set Vital Product Data-----View or Set Vital Product Data-----+
  8. Copy Remote Files
  9. Remote Initial Program L
 10. Manipulate Dead Man Time | Firmware Part Number
 11. Verify Hard Disk Format  | Hardware Vital Product Data
 12. Change Management
 13. Prepare Hard Disk

Enter - Esc=Quit -          Enter - Esc=Quit - F1=Help -
-----+-----+-----+

```

Figure 8-11. View of Set Vital Product Data

3. Select **7. View or Set Vital Product Data** from the utilities panel.

The *View or Set Vital Product Data* panel appears (Figure 8-11 ). From this panel you can select the type of vital product data you want to view.

4. For each selection, a *View Part Number* panel appears that contains the part number you selected. Version number and dates are provided for the firmware and System Management Services.
5. Select **Hardware Vital Product Data** if you want to view vital product data. VPD is stored in keyword format. The following is a list of the keywords and their meanings. Depending on the configuration of your system, all of the keywords listed may not be present or have meaningful values.

Vital product data fields are:

- AT - Main logic card type
- DS - Text description of card
- FN - FRU number
- PN - Manufacturing part number
- ML - Maintenance level
- MF - Manufacturing location
- SN - Serial number
- BF - Boot flash level and ID
- NA - Burned in MAC Address in ASCII Format
- ZB - Burned in MAC Address in Hex Canonical Format
- TM - Machine type and model
- F# - Feature Number
- BS - Box serial number

RC - Recycle count

Z0 - Vendor ID

6. Press **Esc** when you are through.

7. Repeat the procedure, if you wish to view the new VPD.

## Copying Remote Files

This utility allows you to copy remote files from another machine into the hard file. There are two methods of file transfer, TFTP from a server using the Ethernet port, or Xmodem over the active serial port.

1. Select **8. Copy Remote Files** from the utilities panel.

The *Copy Remote Files* panel appears (Figure 8-12 ). From this panel you select the method of file transfer. Subsequent panels allow you to enter the names of the files that you want to copy.

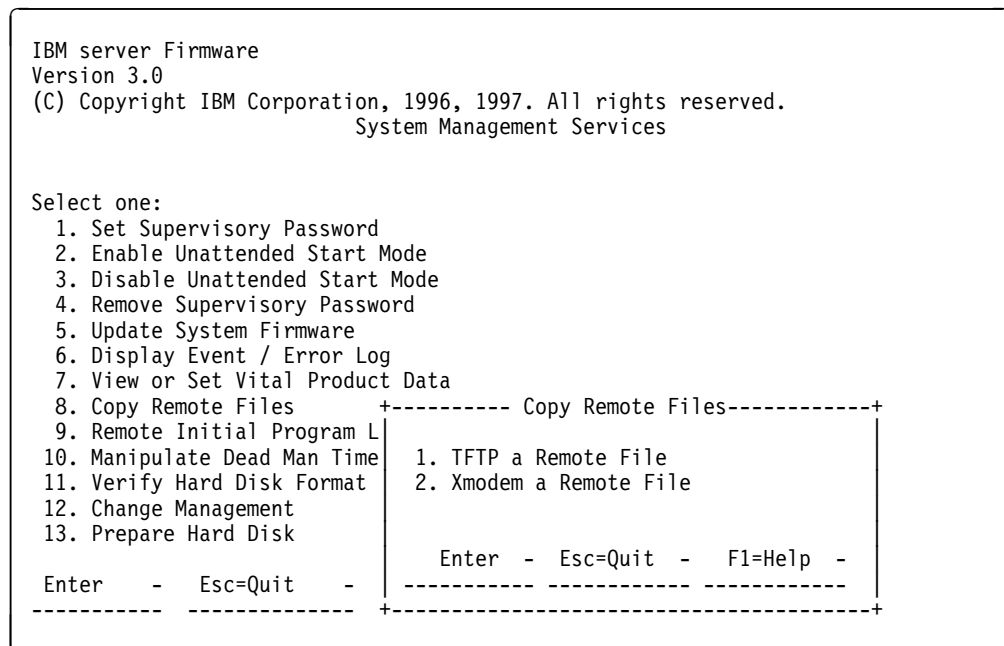


Figure 8-12. Copy Remote Files Panel

## Setting Up Remote Initial Program Load

Before you can configure an MSS Server in the network, it must have an IP address that is recognized within your network and it must have the addresses of your ATM adapters.

This utility allows you to load this minimum information to install this device in your network so that you can send it a configuration file, or otherwise communicate with it. This utility allows you to Ping the MSS Server, after loading its minimum network parameters, to see if you can communicate with it.

1. Select **9. Remote Initial Program Load Setup** from the utilities panel.



The *Network Parameters* panel appears (Figure 8-13 on page 8-15 ). From this panel you can select to enter the IP address of the MSS Server and the host, input adapter parameters, or Ping from the MSS Server to the host.

```

IBM server Firmware
Version 3.0
(C) Copyright IBM Corporation, 1996, 1997. All rights reserved.
      System Management Services

Select one:
 1. Set Supervisory Password+----- Network Parameters -----+
 2. Enable Unattended Start |
 3. Disable Unattended Start |           1. IP Parameters
 4. Remove Supervisory Passw |           2. Adapter Parameters
 5. Update System Firmware   |           3. Ping
 6. Display Event / Error Lo |
 7. View or Set Vital Produc |
 8. Copy Remote Files        |           Enter - Esc=Quit - F1=Help -
 9. Remote Initial Program L |-----+
10. Manipulate Dead Man Time+-----+
11. Verify Hard Disk Format
12. Change Management
13. Prepare Hard Disk

Enter - Esc=Quit - F1=Help -
-----

```

Figure 8-13. Setup Remote Initial Program Load Panel

- If you select **IP Parameters**, a panel appears on which you can enter:
  - Client IP Address (the IP address of the MSS Server)
  - Server IP Address
  - Gateway IP Address
  - Subnet Mask

An MSS Server comes from the factory with the following default IP addresses:

```

Client          10.1.1.2
Server          10.1.1.1
Gateway        10.1.1.1
Subnet Mask    255.255.255.0

```

An A-MSS Server Module comes from the factory with the following default IP addresses:

```

Client          10.1.2.2
Server          10.1.2.3
Gateway        10.1.2.3
Subnet Mask    255.255.255.0

```

2. If you select **Adapter Parameters**, a panel appears with the MAC address of the Ethernet port or a list of any configurable adapters.
3. The **Ping** option allows you to test connectivity.

**Note:** Do not Ping your current terminal connection via SLIP.

## Manipulating the Dead Man Timer

This utility allows you to selectively enable or disable the dead man timer. The default is disabled.

1. Select **10. Manipulate Dead Man Timer** from the utilities panel.

A *Dead Man Timer Options* panel appears. From this panel you can enable or disable the timer.

```
IBM server Firmware
Version 3.0
(C) Copyright IBM Corporation, 1996, 1997. All rights reserved.
                        System Management Services

Select one:
 1. Set Supervisory Password
 2. Enable Unattended Start Mode
 3. Disable Unattended Start Mode
 4. Remove Supervisory Password
 5. Update System Firmware
 6. Display Event / Error Log
 7. View or Set Vital Product Data
 8. Copy Remote Files
 9. Remote Initial Program L
10. Manipulate Dead Man Timer+-----Dead Man Timer Options-----+
11. Verify Hard Disk Format |           1. Enable Dead Man Timer           |
12. Change Management      |           2. Disable Dead Man Timer          |
13. Prepare Hard Disk      |-----+-----+-----+-----+-----+-----+-----+
Enter - Esc=Quit -        |           Enter - Esc=Quit - F1=Help -           |
-----+-----+-----+-----+-----+-----+-----+-----+
+-----+-----+-----+-----+-----+-----+-----+-----+

```

Figure 8-14. Manipulate Dead Man Timer Panel

If you have enabled the timer and the server locks up, the timer automatically resets the hardware after the time expires.

## Verifying Hard Disk Format

This utility allows you to verify whether the hard disk is correctly formatted so that code images, configuration files, and dump data can be written to the hard disk as needed.

1. Select **11. Verify Hard Disk Format** from the utilities panel.

A *Hard Disk Format* panel appears, informing you whether or not the hard disk is correctly formatted.

```

IBM server Firmware
Version 3.0
(C) Copyright IBM Corporation, 1996, 1997. All rights reserved.
      System Management Services

Select one:
  1. Set Supervisory Password
  2. Enable Unattended Start Mode
  3. Disable Unattended Start Mode
  4. Remove Supervisory Password
  5. Update System Firmware
  6. Display Event / Error Log
  7. View or Set Vital Product Data
  8. Copy Remote Files
  9. Remote Initial Program L
 10. Manipulate Dead Man Timer
 11. Verify Hard Disk Format Correct-----+
 12. Change Man |
 13. Prepare Ha |           The hard disk is correctly formatted.
Enter   - E   |           Enter   -
-----+-----+

```

Figure 8-15. Verify Hard Disk Format Panel

## Change Management

Change Management enables you to manipulate the server level of software code that will run on the server. See Chapter 7, “Performing Change Management Operations” on page 7-1 for detailed information about change management.

### Xmodem Software Selection

Xmodem is supported only from the Firmware prompt. To access the Firmware prompt, you must either interrupt the boot-up sequence or bring up the server in attended mode. The Change Management command is available from the Utilities option of the Main Menu. From that point, the server directs you as to what to transfer in and where to put the image.

#### Notes:

1. When the server is in firmware mode, there is no Active configuration or image. Therefore, you should use caution when specifying where to write new images or configurations.
2. When using Xmodem to transfer a multiple load module image (used in Version 2.0 in the form of several files ending in .ld), **you must** transfer each of the modules (.ld files) one by one to get the entire load module image.

When an entire load image has transferred, the status of the bank will change from CORRUPT to AVAIL. Transfer file LML.ld first. Unless you see an information message ERROR WRITING FILE appear, assume each individual transfer has been successful.

When you are finished with file transfer, select **List software** on the Change Management menu. The status will have changed to AVAIL for that bank that has the new load image.

The following sample menus are associated with Xmodem download. These menus show the text that is displayed when you choose Change Management.

### Examples:

```
IBM server Firmware
Version 3.0
(C) Copyright IBM Corporation, 1996, 1997. All rights reserved.

                Change Management Software Control

Select one:
1. Add Description Data
2. Describe Software
3. Control Rebooting of Router
4. Control Dumping of Router
5. Copy Software
6. Erase Software
7. List Software
8. Lock Config File
9. Set Boot Information
10. TFTP Software
11. Unlock Config File
12. XMODEM Software

Enter - Esc=Quit - F1=Help -
-----
```

#### 1. Select **5. Copy Software**.

```
IBM server Firmware
Version 3.0
(C) Copyright IBM Corporation, 1996, 1997. All rights reserved.

                Change Management Software Control

1. Add Description Data
2. Describe Software
3. Control Rebooting of Router
4. Control Dumping of Router +-----Select Type-----+
5. Copy Software |
6. Erase Software |                1. Config
7. List Software |                2. Load Image
8. Lock Config File |
9. Set Boot Informa |
10. TFTP Software |                Enter - Esc=Quit - F1=Help -
11. Unlock Config Fi+-----+
12. XMODEM Software

Enter - Esc=Quit - F1=Help -
-----
```

#### 2. Select either **Config** (for configuration file) or **Load Image** (for the operational software file).

The following figure is an example of the Load Image selection.

```

IBM server Firmware
Version 3.0
(C) Copyright IBM Corporation, 1996, 1997. All rights reserved.

+----- BANK A -----+-----Description-----+-----Date-----+
| IMAGE - AVAIL          |                               | -14256 Jan 1970 - |
| CONFIG 1 - PENDING    |                               | -14256 Jan 1970 - |
| CONFIG 2 - NONE       |                               | -14256 Jan 1970 - |
| CONFIG 3 - NONE       |                               | -14256 Jan 1970 - |
| CONFIG 4 - NONE       |                               | -14256 Jan 1970 - |
+----- BANK B -----+-----Description-----+-----Date-----+
| IMAGE - PENDING        |                               | -14256 Jan 1970 - |
| CONFIG 1 - NONE       |                               | 02 Jan 1994 20:39 |
| CONFIG 2 - NONE       |                               | 02 Jan 1994 20:41 |
| CONFIG 3 - NONE       |                               | 1994 20:43        |
| CONFIG 4 - NONE       |                               | 1994 20:45        |
+-----+-----+-----+
* - Last Used Config      L - Config F      Enter
XMODEM Software          1. Bank A      -----
                          2. Bank B      Esc=Quit
                          F1=Help      F1=Help
Enter - Esc=Quit - F1=Help -
-----

```

The following figure is an example of the Config selection.

```

IBM server Firmware
Version 3.0
(C) Copyright IBM Corporation, 1996, 1997. All rights reserved.

+-----+-----+
|          BANK A          |          BANK B          |
| IMAGE - PENDING         | IMAGE - AVAIL            |
| CONFIG 1 - PENDING     | CONFIG 1 - NONE         |
| CONFIG 2 - NONE        | CONFIG 2 - NONE         |
| CONFIG 3 - NONE        | CONFIG 3 - NONE         |
| CONFIG 4 - NONE        | CONFIG 4 - NONE         |
+-----+-----+
XMODEM Software          +Select Destination Config+
                          Config 1      Enter -
                          Config 2      -----
                          Config 3      -----
                          Config 4      -----
Enter - Esc=Quit - F1=Help -
-----

```

## Preparing the Hard Disk

This utility allows you to verify whether the hard disk is correctly formatted so that code images, configuration files, and dump data can be written to the hard disk as needed.

**Note:** This procedure takes approximately 45 minutes on the PCMCIA IDE hard file and approximately 10 minutes on the internal IDE hard file.

1. Select **13. Prepare Hard Disk** from the utilities panel.

A *Prepare Hard Disk* panel appears, warning you that your user data on the hard disk will be destroyed if you continue.

```
IBM server Firmware
Version 3.0
(C) Copyright IBM Corporation, 1996, 1997. All rights reserved.
+-----Attention-----+
Select one:
1. Set Supervisor
2. Enable Unatten
3. Disable Unatte
4. Remove Supervi
5. Update System
6. Display Event
7. View or Set Vi
8. Copy Remote Fi
9. Remote Initial
10. Manipulate Dea+
11. Verify Hard Disk Format
12. Change Management
13. Prepare Hard Disk

All user data on the drive shown
below will be destroyed if you
continue.
IBM-DDLA-21620 1626 MB Disk ID
0, Controller 0
Are you sure you want to continue?
Yes (Y) - No (N) -
-----

Enter - Esc=Quit - F1=Help -
-----
```

Figure 8-16. Prepare Hard Disk Panel

2. Type **Y** and press **Enter**, if you want to reformat the hard disk.

The *Hard Disk Formatted* panel appears. This panel informs you that the hard disk has been reformatted.

3. Type **N** and press **Enter** if you do not want to reformat the hard disk.

## Chapter 9. The GWCON (Monitoring) Process and Commands

This chapter describes the GWCON process and includes the following sections:

- “What is GWCON?”
- “Entering and Exiting GWCON” on page 9-2
- “GWCON Commands” on page 9-2

### What is GWCON?

The Gateway Console (monitoring) process, GWCON (also referred to as CGWCON), is a second-level process of the router user interface.

Using GWCON commands, you can:

- List the protocols and interfaces currently configured in the router.
- Display memory and network statistics.
- Set current Event Logging System (ELS) parameters.
- Test a specified network interface.
- Communicate with third-level processes, including protocol environments.
- Enable and disable interfaces.

GWCON fits into the router software structure as shown in Figure 9-1.

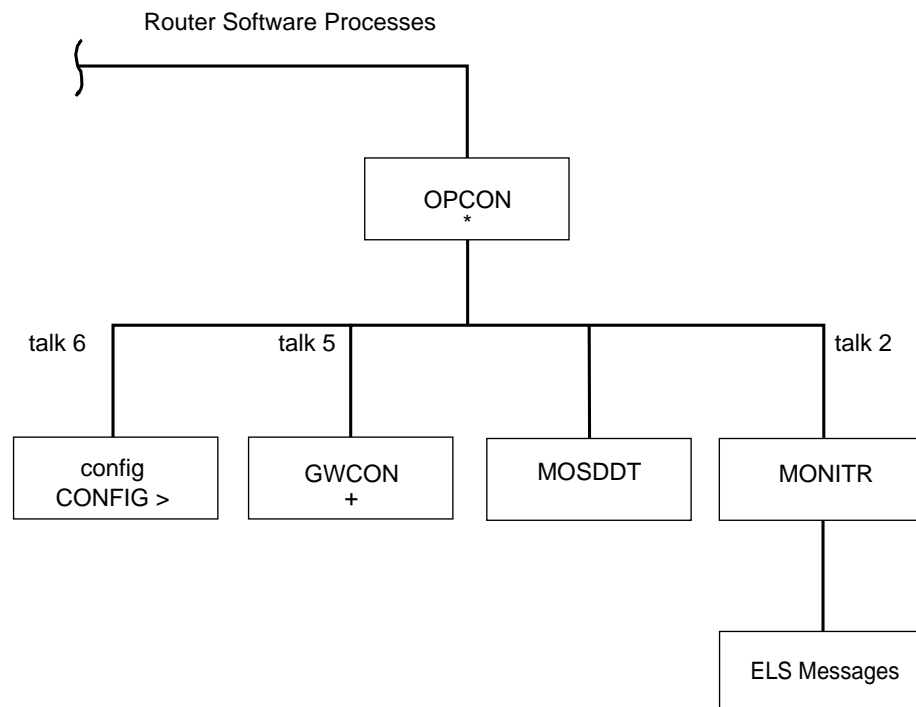


Figure 9-1. GWCON in the Router Software Structure

The GWCON command interface is made up of levels called modes. Each mode has its own prompt. For example, the prompt for the IP protocol is IP>.

If you want to know the process and mode you are communicating with, press **Return** to display the prompt. Some commands in this chapter, such as the

## GWCON (Monitoring) Process and Commands

**network** and **protocol** commands, allow you to access the various modes in GWCON.

---

### Entering and Exiting GWCON

To enter the GWCON command environment from OPCON and obtain the GWCON prompt:

1. At the OPCON prompt, enter the **status** command to find the process ID (PID) of GWCON.

\* **status**

For sample output of the status command see "Status" on page 5-8.

2. Enter the **talk** command and the PID for GWCON to get to the GWCON prompt.

\* **talk 5**

The console displays the GWCON prompt (+). If the prompt does not appear, press **Return**. Now, you can enter GWCON commands.

To return to OPCON, enter the OPCON intercept character. (The default is **Ctrl P**.)

---

### GWCON Commands

This section contains the GWCON commands. Each command includes a description, syntax requirements, and an example. The GWCON commands are summarized in Table 9-1.

To use the GWCON commands, access the GWCON process by entering **talk 5** and enter the GWCON commands at the (+) prompt.

*Table 9-1 (Page 1 of 2). GWCON Command Summary*

Command	Function
? (Help)	Lists the GWCON commands.
Activate	Enables a newly configured spare interface.
Buffer	Displays information about packet buffers assigned to each interface.
Clear	Clears network statistics.
Configuration	Lists status of the current protocols and interfaces.
Disable	Takes the specified interface off line.
Error	Displays error counts.
Event	Enters the Event Logging System environment.
Feature	Provides access to console commands for independent router features outside the usual protocol and network interface console processes.
Interface	Displays network hardware statistics or statistics for the specified interface.
Memory	Displays memory, buffer, and packet data.





### Buffer

Use the **buffer** command to display information about packet buffers assigned to each interface.

**Note:** Each buffer on a device is the same size and is dynamically built. Buffers vary in size from one device to another.

To display information about one interface only, enter the interface or network number as part of the command. To obtain the interface number, use the GWCON **configuration** command.

**Syntax:** `buffer network#`

#### Example: buffer

```
          Input Buffers:      Buffer sizes:
Nt Interface Req Alloc Low Curr Hdr Wrap Data Trail Total Bytes Alloc

0  ATM/0      20   20   7   0 109  92  2052   7  2260  45200
```

*Nt* Network interface number associated with the software.

*Interface* Type of interface.

#### **Input Buffers:**

*Req* Number of buffers requested.

*Alloc* Number of buffers allocated.

*Low* Low water mark (flow control).

*Curr* Current number of buffers on this device. The value will be 0 if the device is disabled. When a packet is received, if the value of *Curr* is below *Low*, then the packet is eligible for flow control. (See the **queue** command for conditions.)

#### **Buffer Sizes:**

*Hdr* Sum of the maximum hardware, MAC, and data link headers.

*Wrap* Allowance given for MAC, LLC, or Network layer headers due to protocol wrapping.

*Data* Maximum data link layer packet size.

*Trail* Sum of the largest MAC and hardware trailers.

*Total* Overall size of each packet buffer.

*Bytes Alloc* Amount of buffer memory for this device. This value is determined by multiplying the values of *Alloc* x *Total*.

### Clear

Use the **clear** command to delete statistical information about one or all of the router's network interfaces. This command is useful when tracking changes in large counters. Using this command does not save space or speed up the router.

Enter the interface (or net) number as part of the command. To get the interface number, use the GWCON **configuration** command.

**Syntax:** `clear interface#`

**Example:**     `clear 1`  
                   Clear network statistics? (Yes or No):

## Configuration

Use the **configuration** command to display information about the protocols and network interfaces. The output is displayed in three sections, the first section lists the router identification, software version, boot ROM version, and the state of the auto-boot switch. The second and third sections list the protocol and interface information.

**Syntax:** `configuration`

**Example:**     `configuration`

```
Nways 8210 Multiprotocol Switching Server

Host name: [not configured]
Version: 2.0

Num Name Protocol
0 IP DOD-IP
3 ARP Address Resolution
11 SNMP Simple Network Management Protocol
12 OSPF Open SPF-Based Routing Protocol
23 ASRT Adaptive Source Routing Transparent Enhanced Bridge
Num Name Feature
2 MCF MAC Filtering
6 QOS Quality of Service

1 Networks:
Net Interface MAC/Data-Link Hardware State
0 ATM/0 ATM CHARM ATM Up
```

- The first line gives the product name.
- The second line indicates whether a host name is configured.
- The third line lists the program/product number, Feature Number, Version, Release, PTF and RPQ information.
- The remaining lines list the configured protocols, followed by the configured features.

### **Protocols:**

*Num*  
       Number that is associated with the protocol.

*Name*  
       Abbreviated name of the protocol.

*Protocol*  
       Full name of the protocol.

### **Features:**

*Num*  
       Number associated with the feature.

## GWCON (Monitoring) Process and Commands

### *Name*

Abbreviated name of the feature.

### *Feature*

Full name of the feature.

### **Networks:**

*Net* Network number that the software assigns to the interface. Networks are numbered starting at 0. These numbers correspond to the interface numbers discussed under the CONFIG process.

### *Interface*

Name of the interface and instance of this type of interface.

### *MAC/Data Link*

Type of MAC/Data link configured for the interface.

### *Hardware*

Specific kind of interface by hardware type.

### *State*

Current state of the network interface.

**Testing** Indicates that the interface is undergoing a self-test. Occurs when the router is first started, when a problem is detected on the interface, or when the **test command** is used.

When an interface is operational, the interface periodically sends out maintenance packets and/or checks the physical state of the port or line to ensure that the interface is still functioning correctly. If the maintenance fails, the interface is declared down and a self-test is scheduled to run in 5 seconds. If a self-test fails, the interface transitions to the down state and the interval until the next self-test is increased up to a maximum of 2 minutes. If the self-test is successful, the network is declared up.

**Up** Indicates the interface is operational.

**Down** Indicates that the interface is not operational and has failed a self-test. The network will periodically transition to the testing state to determine if the interface can become operational again.

### **Disabled**

Indicates that the interface is disabled. An interface can be disabled by the following methods:

- An interface can be configured as disabled using the CONFIG **disable** command. Each time the router is reinitialized, the interface's initial state will be disabled. It will remain in the disabled state until an action is taken to enable it.
- An interface can be disabled using the GWCON **disable** command. This method is temporary because the interface will revert to its configured state (enabled or disabled) when the router is reinitialized.
- The network manager can disable the interface through SNMP. This method is temporary because the interface will revert to its configured state (enabled or disabled) when the router is reinitialized.

When an interface is disabled, it remains disabled until one of the following methods is used to enable it:

- The GWCON **test** command is used to start a self-test of the interface.
- The network manager initiates a self-test of the interface through SNMP.

### Not Present

Indicates that the interface's adapter is not plugged in.

Not Present is also used as the state for a null device. Spare interfaces are displayed as null devices until they are activated.

### HW Mismatch

Indicates that the configured adapter type does not match the adapter type that is actually present in the slot.

## Disable

Use the **disable** command to take a network interface off-line, making the interface unavailable. This command immediately disables the interface. You are not prompted to confirm, and no verification message displays. If you disable an interface with this command, it remains disabled until you use the GWCON **test** command or an OPCON **restart** or **reload** command to enable it.

Enter the interface, or net number as part of the command. To obtain the interface number, use the GWCON **configuration** command.

**Syntax:** `disable interface#`

**Example:** `disable interface 1`

## Error

Use the **error** command to display error statistics for the network. This command provides a group of error counters.

**Syntax:** `error`

**Example:** `error`

Nt	Interface	Input Discards	Input Errors	Input Unk Proto	Input Flow Drop	Output Discards	Output Errors
0	ATM/0	0	0	0	0	0	0

*Nt* Network interface number associated with the software.

*Interface* Type of interface.

*Input Discards* Number of inbound packets which were discarded even though no errors were detected to prevent their being deliverable to a higher-layer protocol. The packets may have been discarded to free buffer space.

*Input Errors* Number of packets that were found to be defective at the data link.

*Input Unk Proto* Number of packets received for an unknown protocol.

*Input Flow Drop* Number of packets received that are flow controlled on output.

## GWCON (Monitoring) Process and Commands

*Output Discards* Number of packets that the router chose to discard rather than transmit due to flow control.

*Output Errors* Number of output errors, such as attempts to send over a network that is down or over a network that went down during transmission.

**Note:** The sum of the discarded output packets is not the same as input flow drops over all networks. Discarded output may indicate locally originated packets.

## Event

Use the **event** command to access the Event Logging System (ELS) console environment. This environment is used to set up temporary message filters for troubleshooting purposes. All changes made in the ELS console environment will take effect immediately, but will go away when the router is reinitialized. See Chapter 11, "Using and Configuring the Event Logging System (ELS)" on page 11-1 for information about the Event Logging System and its commands. Use the **exit** command to return to the GWCON process.

**Syntax:** `event`

**Example:** `event`

## Feature

Use the **feature** command to access console commands for specific IBM 8210 features outside of the protocol and network interface console processes.

Enter a question mark after the **feature** command to obtain a listing of the features available for your software release. For example:

```
feature ?
```

To access that feature's console prompt, enter the **feature** command at the GWCON prompt followed by the feature number or short name. Table 6-4 on page 6-16 lists available feature numbers and names.

Once you access the prompt for that feature, you can begin entering specific commands to monitor that feature. To return to the GWCON prompt, enter the **exit** command at the feature's console prompt.

**Syntax:** `feature feature# OR feature-short-name`

**Example:**

```
feature mcf
feature 1
```

## Interface

Use the **interface** command to display statistical information about the network interfaces (for example, Ethernet or Token-Ring). This command can be used without a qualifier to provide a summary of all the interfaces (shown in the following output) or with a qualifier to reveal detailed information about one specific interface.

Descriptions of detailed output for each type of interface are provided in the specific interface *Monitoring* chapters found in this guide. To obtain the interface number, use the GWCON **configuration** command.

**Syntax:** `interface interface#`

**Example:** `interface`

Nt	Interface	Slot-Port	Port Name	Self-Test		Maintenance
				Passed	Failed	Failed
0	ATM/0	Slot:1	Port:1	1	0	0

**Note:** The display varies depending on the device.

*Nt* Global interface number.

*Interface* Interface name.

*Slot-Port* Slot number and port number of the interface.

*Port Name*

Port number, if applicable on the slot.

*Self-Test Passed*

Number of times self-test succeeded (state of interface changes from down to up).

*Self-Test Failed*

Number of times self-test failed (state of interface changes from up to down).

*Maintenance Failed*

Number of maintenance failures.

## Memory

Use the **memory** command to display the current CPU memory usage in bytes, the number of buffers, and the packet sizes.

To use this command, free memory must be available. The number of free packet buffers may drop to zero, resulting in the loss of some incoming packets; however, this does not adversely affect router operations. The number of free buffers should remain constant when the router is idle. If it does not, contact your service representative.

**Syntax:** `memory`

**Example:** `memory`

	Total	Reserve	Never Alloc	Perm Alloc	Temp Alloc	Prev Alloc
Heap memory	5463895	201824	5065383	328344	375856	22656

Number of global buffers: Total = 294, Free = 287, Fair = 57, Low = 58  
 Global buff size: Data = 4478, Header = 128, Wrap = 92, Trailer = 19  
 Total = 4700

**Heap memory:** Amount of memory used to dynamically allocate data structures.

**Total** Total amount of space available for allocation for memory.

**Reserve** Minimum amount of memory needed by the currently configured protocols and features.

**Never Alloc** Memory that has never been allocated.

**Perm Alloc** Memory requested permanently by router tasks.

## GWCON (Monitoring) Process and Commands

Temp Alloc	Memory allocated temporarily to router tasks.
Prev Alloc	Memory allocated temporarily and returned.
Number of global buffers:	
Total	Total number of global buffers in the system.
Free	Number of global buffers available.
Fair	Fair number of buffers for each interface. (See "Low.")
Low	The number of free buffers at which the allocation strategy changes to conserve buffers. If the value of <i>Free</i> is less than <i>Low</i> , then buffers will not be placed on any queue that has more than the <i>Fair</i> number of buffers in it.
Global buff size:	
Data	Maximum data link packet size of any interface.
Header	Sum of the maximum hardware, MAC, and data link headers.
Wrap	Allowance given for MAC, LLC, or Network layer headers due to protocol wrapping.
Trailer	Sum of the largest MAC and hardware trailers.
Total	Overall size of each packet buffer

## Network

Use the **network** command to enter the console environment for supported networks, such as ATM networks. This command obtains the console prompt for the specified interface. From the prompt, you can display statistical information, such as the LAN Emulation Clients for ATM networks.

At the GWCON prompt (+), enter the **configuration** command to see the protocols and networks for which the router is configured. See "Configuration" on page 9-5 for more information on the configuration command.

Enter **interface** at the + prompt for a display of the networks for which the router is configured.

Enter the GWCON **network** command and the number of the interface you want to monitor. For example:

```
+network 0
ATM+
```

In the example, the ATM+ prompt is displayed. You can then view information about the ATM interface by entering the ATM monitoring commands.

### Exiting the Interface Console Process

To exit the interface console process and return to the OPCON process:

1. Return to the GWCON process by entering the **exit** command. For example:  
ATM+ **exit**
2. Return to the OPCON process by entering the OPCON intercept character. (**Ctrl P** is the default intercept character.)

After identifying the interface number of the interface you want to monitor, for interface-specific information, see the monitoring chapter in this manual for the



specified network or link-layer interface. Console support is offered for the following network and link-layer interfaces:

- ATM
- Token Ring LECs
- Ethernet LECs
- ISDN

**Syntax:**     network interface#

**Example:**    **network 0**  
                  ATM+

## Protocol

Use the **protocol** command to communicate with the router software that implements the network protocols installed in your router. The **protocol** command accesses a protocol's command environment. After you enter this command, the prompt of the specified protocol appears. From the prompt, you can enter commands that are specific to that protocol.

Enter the protocol number or short name as part of the command. To obtain the protocol number or short name, enter the CONFIG command environment (Config>), and then enter the **list configuration** command. See "Entering and Exiting CONFIG" on page 6-7 for instructions on accessing Config>. To return to GWCON, enter **exit**.

See the corresponding monitoring chapter in this manual or in the *Multiprotocol Switched Services (MSS) Configuring Protocols and Features* for information on a specific protocol's console commands.

**Syntax:**     protocol prot#

**Example:**    **protocol 7**  
                  IPX>

The following table lists examples of protocol numbers and names.

Pro- tocol Number	Protocol Short Name	Accesses the following protocol process
0	IP	IP (Internet Protocol)
3	ARP	ARP (Address Resolution Protocol)
7	IPX	IPX (Novell NetWare Internetwork Packet Exchange)
11	SNMP	SNMP (Simple Network Management Protocol)
12	OSPF	OSPF (Open Shortest Path First)
22	AP2	AppleTalk Phase 2
23	ASRT	Adaptive Source Routing Transparent Bridge
24	HST	TCP/IP Host Services

### Queue

Use the **queue** command to display statistics about the length of input and output queues on the specified interfaces. Information about input and output queues provided by the queue command includes:

- The total number of buffers allocated
- The low-level buffer value
- The number of buffers currently active on the interface.

To display information about one interface only, enter the interface or network number as part of the command. To obtain the interface number, use the **GWCON configuration** command.

**Syntax:** `queue interface#`

**Example:**

Nt	Interface	Input Queue			Output Queue	
		Alloc	Low	Curr	Fair	Curr
0	ATM/0	30	10	30	30	1

Nt Network interface number associated with the software.

Interface Type of interface.

Input  
Queue:

Alloc Number of buffers allocated to this device.

Low Low water mark for flow control on this device.

Curr Current number of buffers on this device. The value will be 0 if the device is disabled.

Output  
Queue:

Fair Fair level for the length of the output queue on this device.

Curr Number of packets currently waiting to be transmitted on this device. For locally originated packets, the eligibility discard depends on the global low water mark described in the **memory** command.

The router attempts to keep at least the Low value packets available for receiving over an interface. If a packet is received and the value of Curr is less than Low, then the packet will be subject to flow control. If a buffer subject to flow control is to be queued on this device and the Curr level is greater than Fair, then the buffer is dropped instead of queued. The dropped buffer is displayed in the Output Discards column of the **error** command. It will also generate ELS event GW.036 or GW.057.

Due to the scheduling algorithms of the router, the dynamic numbers of Curr (particularly the Input Queue Curr) may not be fully representative of typical values during packet forwarding. The console code runs only when the input queues have been drained. Thus, Input Queue Curr will generally be nonzero only when those packets are waiting on slow transmit queues.

## Statistics

Use the **statistics** command to display statistical information about the network software, such as the configuration of the networks in the router.

To display information about one interface only, enter the interface or network number as part of the command. To obtain the interface number, use the GWCON **configuration** command.

**Syntax:** `statistics interface#`

**Example:** `statistics`

Nt	Interface	Unicast Pkts Rcv	Multicast Pkts Rcv	Bytes Received	Packets Trans	Bytes Trans
0	ATM/0	479	0	19730	479	20292

*Nt* Network interface number associated with the software.

*Interface* Type of interface.

*Unicast Pkts Rcv*

Number of non-multicast, non-broadcast specifically-addressed packets at the MAC layer.

*Multicast Pkts Rcv*

Number of multicast or broadcast packets received.

*Bytes Received*

Number of bytes received at this interface at the MAC layer.

*Packets Trans*

Number of packets of unicast, multicast, or broadcast type transmitted.

*Bytes Trans*

Number of bytes transmitted at the MAC layer.

## Test

Use the **test** command to verify the state of an interface or to enable an interface that was previously disabled with the **disable** command. If the interface is enabled and passing traffic, the **test** command will remove the interface from the network and run self-diagnostic tests on the interface.

Enter the interface or network number as part of the command. To obtain the interface number, use the GWCON **configuration** command. When testing starts, the console displays the following message:

```
Testing net 0 ATM/0...
```

When testing completes or fails, or when GWCON times out (after 30 seconds), the following possible messages are displayed:

```
Testing net 0 ATM/0 ...successful      Testing net 0 ATM/0 ...failed
Testing net 0 ATM/0 ...still testing
Network is already undergoing test, attempting restart
```

Some interfaces may take more than 30 seconds before testing is done.

**Syntax:** `test interface#`

**Example:** `test 0`

## GWCON (Monitoring) Process and Commands

**Note:** For this command to work, you must enter the **complete** name of the command followed by the interface number.

### Uptime

Use the **uptime** command to display time statistics about the router, including the following:

- Number of restarts.
- Number of known crashes.
- Whether the router was last reloaded or restarted.
- Time elapsed since the last reload.
- Time elapsed since the last restart.

**Syntax:**     uptime

**Example:**   **u**pt **i**ne

```
1 start, (0 known crashes) Last: Reloaded
```

```
Last Reload: 4 hours, 46 minutes ago
```

```
Last Restart: 4 hours, 46 minutes ago
```

## Chapter 10. The MONITR Process

This chapter explains how to use the MONITR process and how to control the way MONITR collects and displays messages. (Refer to Chapter 11, "Using and Configuring the Event Logging System (ELS)" on page 11-1 for information about ELS and message formats. Refer also to the *IBM 8210 Multiprotocol Switched Services Server Event Logging System Messages Guide* for a description of each message. This chapter includes the following sections:

- "What is MONITR?"
- "Commands Affecting MONITR"
- "Entering and Exiting MONITR" on page 10-2
- "Receiving MONITR Messages" on page 10-2

### What is MONITR?

The MONITR process provides a view of activity inside the router and the networks. MONITR also displays logging messages from software that still uses the old logging system. MONITR fits into the router software structure as shown in 10-1.

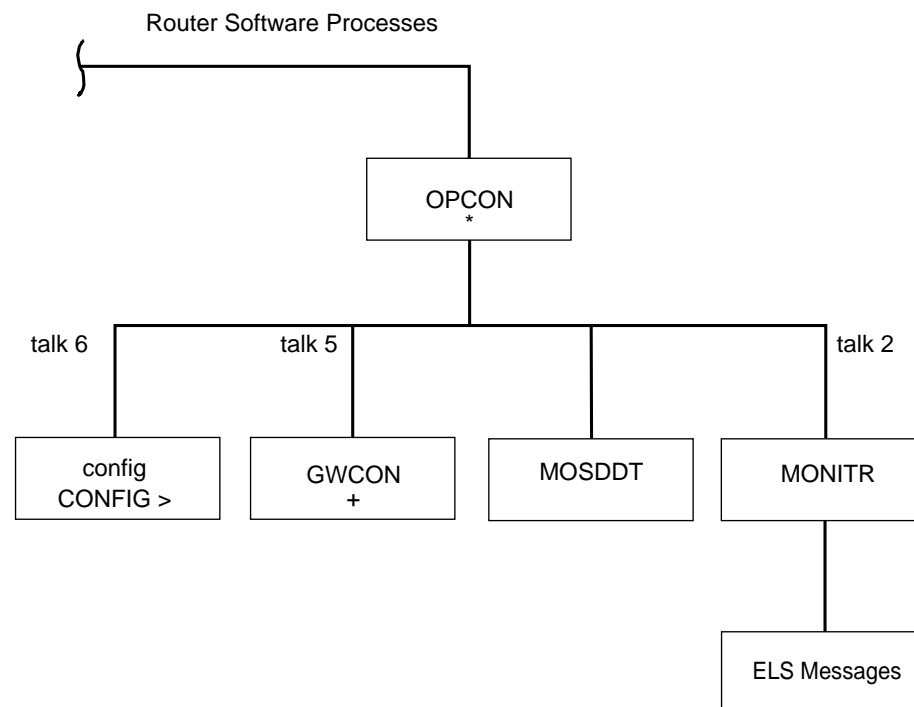


Figure 10-1. MONITR in the Router Software Structure

### Commands Affecting MONITR

The following commands affect the MONITR process:

- OPCON commands:
  - **divert** temporarily diverts output to a different device.
  - **flush** causes MONITR to discard the messages it collects.

## MONITR Process

- **halt** reverses the action of the divert command.
- **talk** causes MONITR to display its output.
- CONFIG **set logging disposition** command sets the initial device to which MONITR sends its output.

---

## Entering and Exiting MONITR

To enter the MONITR process from OPCODE:

1. At the OPCODE prompt, enter the status command to find the PID (process ID) of MONITR.

```
* status
```

2. Enter the **talk** command and the PID number to enter the MONITR environment.

```
* talk 2
```

MONITR does not display any prompt and you cannot enter any commands; however, the console begins to display the messages MONITR has accumulated.

To exit MONITR and return to OPCODE, enter the OPCODE intercept character (the default is **Ctrl P**).

---

## Receiving MONITR Messages

To receive MONITR messages at your console, contact MONITR as described in the previous section. Then MONITR displays all the messages it has recorded since it was last invoked. While you are connected to MONITR, it displays all messages as they arrive.

You can use the OPCODE **divert** and **halt** commands to view MONITR messages while you are doing something else with the router. Permitted devices divert output to TTY0 (the local console), TTY1, or TTY2 (the remote consoles).

---

## Chapter 11. Using and Configuring the Event Logging System (ELS)

This chapter describes the Event Logging System (ELS) and its configuration. The ELS continually logs all events, filtering them according to parameters that you select. A combination of the GWCON counters and the ELS provides information for monitoring the health and activity of the system. The information is divided into the following sections:

- “What is ELS?”
- “Entering and Exiting the ELS Configuration Environment” on page 11-2
- “Event Logging Concepts” on page 11-3
- “ELS Configuration Commands” on page 11-7

---

### What is ELS?

ELS is a monitoring system and an integral part of the router operating system. ELS manages the messages logged as a result of router activity. Using ELS commands, you can set up a configuration that sorts out only those messages that are important to you. You can display the messages on the console terminal screen or send the messages to a network management station using Simple Network Management Protocol (SNMP) traps.

The ELS system and the GWCON counters are the best troubleshooting tools you have to isolate problems in the router. A quick scan of the event messages will tell you whether or not the router has a problem and basically where to start looking for it.

In the ELS configuration environment, the commands are used to establish a default configuration. This default configuration does not take effect until you reinitialize the router.

Occasionally, it is necessary to temporarily view messages other than what was set up in the ELS configuration environment without having to reinitialize the router. The ELS console environment is used to:

- Temporarily change the default ELS display settings
  - Changes made in the ELS console environment take effect immediately
  - Changes made using console commands are not stored in nonvolatile configuration storage.
- View statistical information regarding ELS uses of dynamic RAM

**Note:** Specific ELS messages are described in the *IBM 8210 Multiprotocol Switched Services Server Event Logging System Messages Guide*

ELS is a subprocess that you access from the

OPCON process. ELS fits into the router software structure as shown in Figure 11-1 on page 11-2.

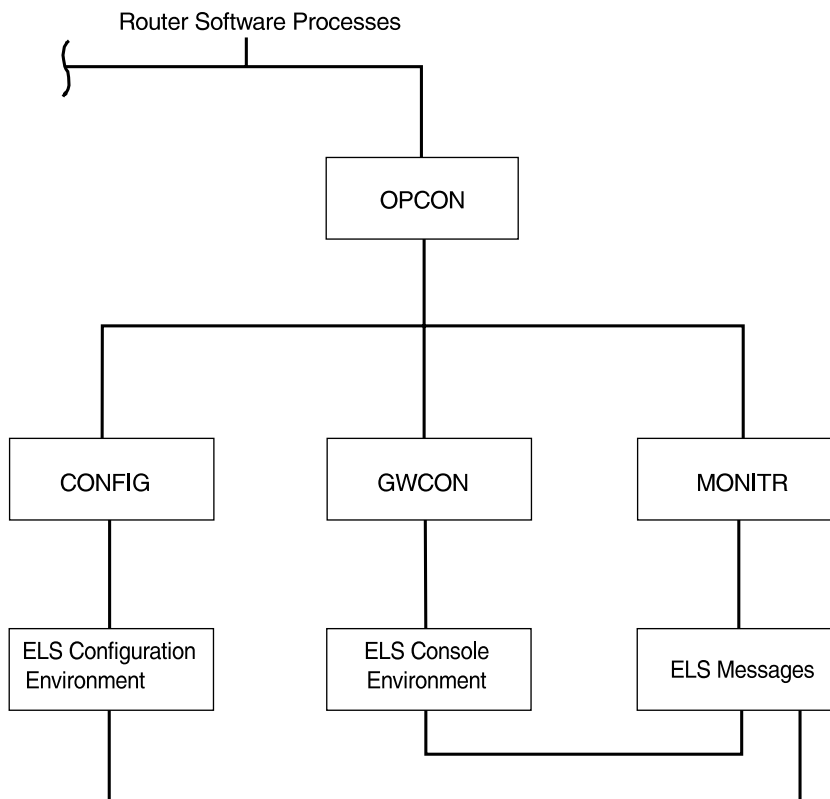


Figure 11-1. ELS in the Router Software Structure

---

## Entering and Exiting the ELS Configuration Environment

The ELS configuration environment (available from the CONFIG process) is characterized by the ELS `Config>` prompt. Commands entered at this prompt create the ELS default state that takes effect after you restart the router. These commands are described in greater detail later in this chapter.

Configuration commands that have subsystem, group, or event as a parameter are executed in the following order:

- Subsystem
- Group
- Event

To set a basic ELS configuration, enter the **display subsystem all standard** command at the ELS `Config>` prompt. This command configures the ELS to display messages from all subsystems with the STANDARD logging level (that is, all errors and unusual informational comments).

**Note:** The router does not have a default ELS configuration. You must enter the ELS configuration environment and set the default state.

This section describes how to enter and exit the ELS configuration and console environments.



## ELS Configuration Environment

To enter the ELS configuration environment from OPCON:

1. At the OPCON prompt, enter the **status** command to find the PID (process ID) of CONFIG.

```
* status
```

2. Enter the **talk** command and the PID for CONFIG.

```
* talk 6
```

The console displays the CONFIG prompt (Config>). If the prompt does not appear when you first enter CONFIG, press **Return**.

3. At the CONFIG prompt, enter the following command to access ELS:

```
Config> eve
```

The console displays the ELS configuration prompt (ELS config>). Now, you can enter ELS configuration commands.

To leave the ELS configuration environment, enter the **exit** command. This command is described in this chapter.

---

## Event Logging Concepts

This section describes how events are logged and how to interpret messages. Also described are the concepts of subsystem, event number, and logging level. A large part of ELS function is based on commands that take the subsystem, event number, and logging level as parameters.

## Causes of Events

Events occur continuously while the router is operating. They can be caused by any of the following reasons:

- System activity
- Status changes
- Service requests
- Data transmission and reception
- Data and internal errors

When an event occurs, ELS receives data from the system that identifies the source and nature of the event. Then ELS generates a message that uses the data received as part of the message.

## Interpreting a Message

This section describes how to interpret a message generated by ELS. Figure 11-2 shows the message contents.

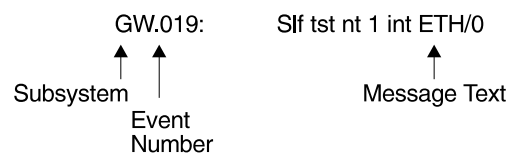


Figure 11-2. Message Generated by an Event

The information illustrated in Figure 11-2 as well as the ELS logging level information displayed with the **list subsystem** command is as follows:

### Subsystem

*Subsystem* is a predefined short name for a router component, such as a protocol or interface. In Figure 11-2 on page 11-3, **GW** identifies the subsystem through which this event occurred.

Other examples of subsystems include IP, TKR, and X25. On a particular router, the actual subsystems present depend on the hardware and software configured for that router. You can use the **list subsystem** command described in this chapter to see a list of the subsystems on your router.

Enter the subsystem as a parameter to an ELS command when you want the command to affect the entire subsystem. For example, the ELS command **display subsystem GW** causes all events (except the events with 'debug' logging level) that occur through the GW subsystem to be displayed.

### Event Number

*Event Number* is a predefined, unique, arbitrary number assigned to each message within a subsystem. In Figure 11-2 on page 11-3, **19** is the event number within the GW subsystem. You can see a list of all the events within a subsystem by using the **list subsystem** command, where *subsystem* is the short name for the subsystem.

The event number always appears with a subsystem, separated by a period. For example: **GW.019**. The subsystem and event number together identify an *individual* event. They are entered as a parameter to certain ELS commands. When you want a command to affect only the specified event, enter the subsystem and event number as a parameter for the ELS command.

### Logging Level

*Logging level* is a predefined setting that classifies each message by the type of event that generated it. This setting is displayed whenever you use the **list subsystem** ELS console command. Table 11-1 on page 11-5 lists the logging levels and types.

Table 11-1. Logging Levels

Logging Level	Type
UI ERROR	Unusual internal errors
CI ERROR	Common internal errors
UE ERROR	Unusual external errors
CE ERROR	Common external errors
ERROR	Includes all error levels above
UINFO	Unusual informational comment
CINFO	Common informational comment
INFO	Includes all comment levels above
STANDARD	Includes all error levels and all informational comment levels (default)
PTRACE	Per packet trace
UTRACE	Unusual operation Trace message
CTRACE	Common operation Trace message
TRACE	Includes all trace levels above
DEBUG	Message for debugging
ALL	Includes all logging levels

In Table 11-1, ERROR, INFO, TRACE, STANDARD, and ALL are aggregates of other logging level types. STANDARD is the recommended default.

The logging level setting affects the operation of the following commands:

- **Display subsystem**
- **Nodisplay subsystem**
- **Trap subsystem**
- **Notrap subsystem**

The logging level is set for a particular command when you specify it as a parameter to one of the above commands. For example:

```
display subsystem TKR ERROR
```

Including the logging level on the command line modifies the **display** command so that whenever an event with a logging level of either UI-ERROR or CI-ERROR occurs through subsystem TKR, the console displays the resulting message.

You cannot specify the logging level for operations affecting groups or events.

### Message Text

*Message Text* appears in short form. In Figure 11-2 on page 11-3, S1f tst nt 1 int ETH/0 is the message generated by this event. Variables, such as *source\_address* or *network*, are replaced with actual data when the message displays on the console.

The variable *error\_code* is referred to by some of the Event Logging System message descriptions (usually preceded by *rsn* or *reason*). They indicate the type of packet error detected. Table 11-2 on page 11-6 describes the error or packet

completion codes. Packet completion codes indicate the disposition of the packets that arrive at the router.

Code	Meaning
0	Packet successfully queued for output
1	Random, unidentified error
2	Packet not queued for output due to flow control reasons
3	Packet not queued because network is down
4	Packet not queued to avoid looping or bad broadcast
5	Packet not queued because destination host is down (only on networks where this can be detected)

ELS displays network information as follows:

```
nt 1 int Eth/0 (or ) network 1, interface Eth/0,
```

where:

- 1 is the network number (each network on the router is numbered sequentially from zero).
- 0 is the unit number (the interfaces of each hardware type are numbered sequentially from zero).

Ethernet and 802.5 hardware addresses appear as a long hexadecimal number.

IP (Internet Protocol) addresses are printed as 4 decimal bytes separated by periods, such as 18.123.0.16.

### Groups

*Groups* are user-defined collections of events that are given a name, the group name. Like the subsystem, subsystem and event number, and logging level, you can use the group name as a parameter to ELS commands. However, there are no predefined group names. You must create a group before you can specify its name on the command line.

To create a group, use the **add** configuration command described in this chapter, specify the name you want to call the group, and then specify the events you want to be part of the group. The events you add to the group can be from different subsystems and have different logging levels.

After creating a group, you can use the group name to manipulate the events in the group as a whole. For example, to turn off display of all messages from events that have been added to a group named `grouptwo`, include the group name on the command line, as follows:

```
nodisplay group grouptwo
```

To delete a group, use the **delete** command.

## ELS Configuration Commands

Table 11-3 summarizes the ELS configuration commands. The remainder of this section describes each one in detail. After accessing the ELS configuration environment, you can enter ELS Configuration commands at the ELS Config> prompt.

Command	Function
? (Help)	Lists the ELS configuration commands or lists the options associated with specific commands.
Add	Adds an event to an existing group or creates a new group.
Clear	Clears all ELS configuration information.
Default	Resets the display or trap setting of an event, group, or subsystem.
Delete	Deletes an event number from an existing group or deletes an entire group.
Display	Enables message display on the console monitor.
Exit	Exits the ELS configuration process and returns you to the CONFIG process.
List	Lists information on ELS settings and messages.
Nodisplay	Disables message display on the console.
Notrace	Controls disablement of packet trace events.
Notrap	Keeps messages from being sent out in SNMP traps.
Set	Sets the pin parameter, the timestamp feature, and ATM packet tracing options.
Trace	Controls enablement of packet trace events.
Trap	Allows messages to be sent to a network management workstation in SNMP traps.
View	Allows viewing of traced packets.

### ? (Help)

Use the ? (**help**) command to list the commands that are available from the current prompt level. You can also enter a ? after a specific command name to list its options.

**Syntax:** ?

**Example:** ?

```
ADD
CLEAR
DEFAULT
DELETE
DISPLAY
LIST
NODISPLAY
NOTRACE
NOTRAP
SET
TRACE
TRAP
VIEW
EXIT
```

**Example:** list ?

ALL  
GROUPS  
PIN  
STATUS  
SUBSYSTEM

## Add

Use the **add** command to add an individual event to an existing group or to create a new group. Group names must start with a letter and are case sensitive. You cannot append an entire subsystem to a group.

**Syntax:** `add group_name subsystem.event_number`

**Example:** `add MyGroup gw.019`

**Note:** If the specified group does not exist, the following prompt asks you to confirm the creation of a new group:

Group not found. Create new group? (yes or no)

## Clear

Use the **clear** command to clear all of the ELS configuration information.

**Syntax:** `clear`

**Example:** `clear`

You are about to clear all ELS configuration information  
Are you sure you want to do this (Yes or No):

## Default

Resets the display or trap setting of an event, group, or subsystem back to a disabled state.

**Syntax:** `default display  
trap`

`display event OR group OR subsystem`

Controls the output of the display of messages to the console.

**Example:** `default display event snmp.016`

`trap event OR group OR subsystem`

Controls the generation of traps to the network management station.

**Example:** `default trap subsystem ip`

## Delete

Use the **delete** command to delete an event number from an existing group or to delete the entire group. If the specified event is the last event to be deleted in a group, you will be notified. If *all* is specified instead of *subsystem.event\_number*, a prompt asks you to confirm the deletion of the entire group.

**Syntax:** `delete group_name subsystem.event_number`

**Example:** `delete groupa gw.019`

## Display

Use the **display** command to enable message displaying on the console monitor for specific events, a range of events for a subsystem, groups, or subsystems.

**Syntax:** `display` event . . .  
range . . .  
group . . .  
subsystem . . .

`event` *subsystem.event#*

Displays messages of the specified event (*subsystem.event#*).

**Example:** `display event gw.019`

`range` *subsystemname first\_event\_number last\_event\_number*

Where *first\_event\_number* is the number of the first event in the specified event range, and *last\_event\_number* is the number of the last event in the specified event range.

Displays a range of messages for the specified subsystem.

**Example:** `display range gw 19 22`

Displays events gw.19, gw.20, gw.21, and gw.22.

`group` *groupname*

Displays messages of a specified group (*groupname*).

**Example:** `display group groupb`

`subsystem` *subsystemname*

Displays messages associated with the specified subsystem. The following is a list of subsystems that are supported on the router. To find out which subsystems are on your router, type **list subsystems**.

**Note:** Although ELS supports all of these subsystems, not all devices support all subsystems. See *ELS Messages* for the most current list of supported subsystems.

<u>Subsystem</u>	<u>Description</u>
------------------	--------------------

AI	Auto-device Install
All	All subsystems

**Note:** Do not display all subsystems for extended periods of time when the router is forwarding live protocol traffic because this causes the router to spend an excessive amount of time communicating with the console. Never display all subsystems when you are communicating with the router via a remote console. This causes the router to spend most of its time communicating with the remote console.

AP2	AppleTalk Phase 2
ARP	Address Resolution Protocol
APPN	Advanced Peer-to-Peer Networking
ATM	Asynchronous Transfer Mode
BAN	Boundary Access Node
BGP	Border Gateway Protocol
BR	Bridging/Routing

BRS	Bandwidth Reservation
BTP	BOOTP relay agent
CLNP	ISO 8473 - CLNP
COMP	Data Compression
DLS	Data Link Switching
DNAV	DNA Phase V
DVM	DVMRP Multicast Routing Protocol
ENCR	Data Encryption
ESIS	ISO 9542 - ESIS Protocol
ETH	Ethernet handler
EZ	EasyStart
FLT	Filter library
FRL	Frame Relay
GW	Router base and network library
ICMP	Internet Control Message Protocol
ILMI	Interim Local Management Interface
IP	Internet Protocol
IPPN	IP Protocol Net
IPX	Internetwork Packet Exchange Protocol
ISDN	Integrated-services Digital Network
ISIS	ISO 10589 - ISIS Protocol
ILEC	ATM IBM LAN Emulation Client
ILMI	ATM Interim Local Management Interface
LCS	Logical Channel Station
LEC	ATM LAN Emulation Client
LECS	LAN Emulation Configuration Server
LES	LAN Emulation Server
LLC	Logical Link Control
LSA	Link Services Architecture
LNM	LAN Network Manager
MCF	MAC Filtering
MPC	Multi-Path Channel
MSPF	OSPF Multicast extensions
NBS	NetBIOS Support Subsystem
NOT	Non-supported Protocol Forwarder
OSPF	Open SPF-based Routing Protocol
PPP	Point-to-Point Protocol
RIP	IP Routing Information Protocol
R2MP	AppleTalk Phase 2 Routing Table Management Protocol
SAAL	Signaling ATM Adaptation Layer
SDLC	IBM SDLC
SL	Serial Line Handler
SNMP	Simple Network Management Protocol
SRLY	SDLC Relay
SRT	Source Routing Transparent Bridge
STP	Spanning Tree Protocol
SVC	Switched Virtual Connection
TCP	Transport Control Protocol
TFTP	Trivial File Transfer Protocol
TKR	Token Ring Handler
UDP	User Datagram Protocol
VIN	Banyan VINES
V25B	CCITT/ITU V.25bis
WRS	WAN Restoral/Reroute



XN	XNS/IPX/DDS common processing
XNS	Xerox Networking Systems Protocol
X25	X.25 Protocols
X251	X.25 Physical Layer
X252	X.25 Frame Layer
X253	X.25 Packet Layer
XTP	X.25 Transport Protocol
ZIP2	AppleTalk Phase 2 Zone Information Protocol
<b>Example:</b>	<b>display subsystem tkr</b>

## List

Use the **list** command to get updated information regarding ELS settings and listings of selected messages.

**Syntax:** `list`    all  
                           groups  
                           pin  
                           status  
                           subsystem  
                           subsystem . . .  
                           subsystems all  
                           trace-status

all

Lists information from all the **list** categories.

**Example:**    `list all`

groups

Lists the user-defined group names and contents.

**Example:**    `list groups`

```
Group: test
GW.019
```

pin

Lists the current number of ELS event messages sent in SNMP traps (per second).

**Example:**    `list pin`

```
Pin: 100 events/second
```

status

Lists the subsystems, groups, and events that have been modified by the **display**, **nodisplay**, **trap**, and **notrap** commands.

**Example:**    `list status`

subsystem

Lists names, events, and descriptions of all subsystems.

**Example:**    `list subsystem`

(Example output from a **list subsystem** command can be found beginning on page 12-9.)

subsystem *subsystem*

Lists all events in a specified subsystem.

**Example:**    `list subsystem gw`

Event	Level	Message
GW.001	ALWAYS	Copyright 1984 Mass Institute of Technology
GW.002	ALWAYS	Portable CGW %s Rel %s strtd
GW.003	ALWAYS	Unus pkt len %d nt %d int %s/%d
GW.004	ALWAYS	Sys %s q adv alloc %d excd %d
GW.005	ALWAYS	Bffrs: %d avail %d idle fair %d low %d
GW.006	C-INFO	Pkt frm nt %d int %s/%d for uninit prt, disc
GW.007	C-INFO	Ip err %x nt %d int %s/%d
GW.008	U-INFO	Ip ovfl nt %d int %s/%d, disc
GW.009	UI-ERROR	Nt dwn ip rstrt nt %d int %s/%d
GW.010	UI-ERROR	Ip q len %d no ip buf nt %d int %s/%d
GW.011	U-INFO	Op err %x hst %wo nt %d int %s/%d
GW.012	U-INFO	Op err cnt excd hst %wo nt %d int %s/%d
GW.013	U-INFO	Rtrns cnt excd hst %wo nt %d int %s/%d
GW.014	UI-ERROR	Nt dwn op rstrt nt %d int %s/%d
GW.015	UI-ERROR	Nt dwn to hst %wo nt %d int %s/%d
GW.016	U-INFO	Op ovfl to hst %wo nt %d int %s/%d
GW.017	UE-ERROR	Intfc hdw mssng nt %d int %s/%d
GW.018	U-TRACE	Strt nt slf tst nt %d int %s/%d
GW.019	C-INFO	Slf tst nt %d int %s/%d
GW.020	U-TRACE	Nt pss slf tst nt %d int %s/%d
GW.021	UE-ERROR	Nt up nt %d int %s/%d
GW.022	U-TRACE	Nt fld slf tst nt %d int %s/%d

### subsystems all

Lists all events in all subsystems.

**Example:** `list subsystems all`

### trace-status

Displays information on the status of packet tracing, including configuration and run-time information.

**Example:** `list trace-status`

```

----- Configuration -----
Trace Status:ON Wrap Mode:ON Decode Packets:ON HD Shadowing:ON
RAM Trace Buffer Size:100000 Maximum Trace Buffer File Size:10000000
Max Packet Bytes Trace:256 Default Packet Bytes Traced:100
Trace File Record Size:2048 Stop Trace Event: TCP.013
Maximum Hours to HD Shadow: 1

```

## Nodisplay

Use the **nodisplay** command to select and turn off messages displaying on the console monitor.

**Syntax:** `nodisplay` event . . .  
range . . .  
group . . .  
subsystem . . .

`event` *subsystem.event#*

Suppresses the displaying of a specified event (*subsystem.event#*).

**Example:** `nodisplay event gw.019`

`range` *subsystemname first\_event\_number last\_event\_number*

Where *first\_event\_number* is the number of the first event in the specified event range, and *last\_event\_number* is the number of the last event of the specified event range.

Suppresses the displaying of a range of messages for the specified subsystem.

**Example:** `nodisplay range gw 19 22`

Suppresses the display of events gw.19, gw.20, gw.21, and gw.22.

group *groupname*

Suppresses the displaying of messages that were previously added to the specified group (*groupname*).

**Example:** `nodisplay group groupb`

subsystem *subsystemname*

Suppresses the displaying of messages associated with the specified subsystem.

**Example:** `nodisplay subsystem tkr`

## Notrace

Disables packet trace for the specified event/range/subsystem/group.

**Syntax:** `notrace` event . . .  
range . . .  
group . . .  
subsystem . . .

event *subsystem.event#*

Suppresses the sending of packet trace data for the specified event#

**Example:** `notrace event atm.088`

range *subsystemname first\_event\_number last\_event\_number*

Where *first\_event\_number* is the number of the first event in the specified event range, and *last\_event\_number* is the number of the last event of the specified event range.

Disables the sending of packet trace data for a range of messages for the specified subsystem.

**Example:** `notrace range gw 19 22`

Suppresses the sending of packet trace data for events gw.19, gw.20, gw.21, and gw.22.

group *groupname*

Suppresses the sending of packet trace data that was previously added to the specified group (*groupname*).

**Example:** `notrace group groupb`

subsystem *subsystemname*

Suppresses the sending of packet trace data for the specified subsystem (*subsystemname*).

**Example:** `notrace subsystem atm`

## Notrap

Use the **notrap** command to select and turn off messages so that they are no longer sent to a network management workstation in SNMP traps.

**Syntax:** `notrap` event . . .  
range . . .  
group . . .  
subsystem . . .

event *subsystem.event#*

Suppresses the sending of the specified message in an SNMP trap (*subsystem.event#*).

**Example:** `notrap event gw.019`

range *subsystemname first\_event\_number last\_event\_number*

Where *first\_event\_number* is the number of the first event in the specified event range, and *last\_event\_number* is the number of the last event of the specified event range.

Suppresses the sending of messages for the events in the specified range for the specified subsystem in SNMP traps.

**Example:** `notrap range gw 19 22`

Suppresses the sending of messages for events gw.19, gw.20, gw.21, and gw.22 in SNMP traps.

group *groupname*

Suppresses the sending of messages in SNMP traps that were previously added to the specified group (*groupname*).

**Example:** `notrap group groupb`

subsystem *subsystemname*

Suppresses the sending of messages in SNMP traps that are associated with the specified subsystem.

**Example:** `notrap subsystem tkr error`

## Set

Use the **set** command to set the maximum number of traps per second, to set the timestamp feature, or to set tracing options for ATM devices.

**Syntax:** `set pin . . .  
timestamp . . .  
trace . . .`

pin *max\_traps*

Use the **set pin** command to set the pin parameter to the maximum number of traps that can be sent on a per-second basis. Internally, the pin resets every tenth of a second. (One tenth of the number (*max\_traps*) is sent every tenth of a second.)

**Example:** `set pin 100`

timestamp *timeofday* OR *uptime* OR *off*

Allows you to turn on message timestamping so that either the time of day or uptime (number of hours, minutes, and seconds, but no date, since the router was last initialized) appears next to each message. Set timestamp can also be turned off.

Use the **set timestamp** command to enable one of the following timestamp options.

**Example:** `set timestamp timeofday`

*timeofday*

Adds an HH:MM:SS prefix to each ELS message indicating the time of the occurrence during a 24-hour day.

*uptime*

Adds an HH:MM:SS prefix to each ELS message indicating the time of the occurrence during a 100-hour cycle. After 100 hours of uptime, the uptime counter returns to zero to begin another 100-hour cycle.

*off*

Turns off the ELS timestamp prefix.

trace

Use the **set trace** command to configure tracing options for ATM devices. When tracing options are configured from the monitoring console, the changes take effect immediately, and return to their previously configured settings when the device is rebooted.

**Note:** Tracing should be used only under the direction of trained support personnel. Tracing, especially when used with disk-shadowing enabled, uses device resources and can impact overall performance and throughput.

**Syntax:** `set trace`            decode  
                                  default-bytes-per-port  
                                  disk-shadowing  
                                  max-bytes-per-port  
                                  memory-trace-buffer-size  
                                  off  
                                  on  
                                  reset  
                                  stop-event  
                                  wrap-mode

*decode off/on*

Turns packet decoding on or off. Packet decoding is not supported by all components.

*default-bytes-per-pkt bytes*

Sets the default number of bytes traced. This value is used if a value is not specified by the component doing the tracing.

*disk-shadowing off / on OR record-size OR time-limit OR delete-file OR max-file-size*

Turns disk shadowing on or off, sets the maximum trace file size, or sets the maximum time for disk-shadowing traces.

*off / on*    Turns disk shadowing on or off. If disk shadowing is enabled, trace records are copied to the hard disk. Once a traced record is copied to the hard disk, it can no longer be viewed from the console.

**Note:** Disk shadowing should be set to OFF whenever the WRITE, TFTP software, RETRIEVE system dump, or COPY software commands are issued.

**Example:** `set trace off`

*delete-file*    Deletes the trace file.

**Example:** `set trace disk-shadowing delete-file`

max-file-size Sets the maximum file size for the trace file.

**Valid Values:** 1 Mbyte to 16 Mbytes

**Default Value:** 10 Mbytes

**Example:** set trace disk-shadowing max-file-size 12000000

record-size Sets the record size for trace file records:

**Valid Values** 1024, 2048, or 4096 bytes

**Default** 2048 bytes

**Notes:**

1. If a trace file already exists, "Cannot change Record Size without first deleting the existing Trace File" is displayed and record size is not changed.
2. If you configure a record size and a trace file already exists, the trace will use the record size of the existing file.

**Example:** set trace disk-shadowing record-size 4096

time-limit Sets the maximum time for disk-shadowing of traces:

**Valid Values** 1 - 72 hours

**Default** 24 hours

**Note:** Disk shadowing stops (tracing continues) after this time has elapsed. The actual time is reset to 0 when disk shadowing is turned on again.

**Example:** set trace disk-shadowing time 36

max-bytes-per-pkt *bytes*

Sets the maximum number of bytes traced for each packet.

memory-trace-buffer-size *bytes*

Sets the size, in bytes, of the RAM trace buffer.

off Disables packet tracing.

on Enables packet tracing.

reset Clears the trace buffer and resets all associated counters.

stop-event *event id*

Stops tracing when an event (event id) occurs. Enter either an ELS event id (for example: TCP.013) or "None." "None" is the default. Tracing stops only if the display of the particular ELS event is enabled.

When a stop-event occurs, an entry is written to the trace buffer. The **view** command for this trace entry will display "Tracing stopped due to ELS Event Id: TCP.013."

After tracing stops due to a stop-event, you must re-enable tracing with the **set trace on** command. (A restart will also re-enable tracing if enabled from the ELS Config> prompt.)

**Example: set trace stop-event TCP.013**

wrap-mode *off/on*

Turns the trace buffer wrap mode on or off. If wrap mode is on and the trace buffer is full, previous trace records will be overwritten by new trace records as necessary to continue tracing.

**Example 1: set trace decode on**

**Example 2: set trace default-bytes-per-packet 64**

**Example 3: set trace off**

## Trace

Enables packet trace for the specified event/range/subsystem/group. When the **trace** command is used from the ELS Config> prompt, the changes become part of the configuration, and a reboot is required to activate the changes.

**Syntax:** `trace` event . . .  
range . . .  
group . . .  
subsystem . . .

event *subsystem.event#*

Causes the specified trace event (*subsystem.event#*) to be displayed on the system console.

**Example: trace event gw.019**

range *subsystemname first\_event\_number last\_event\_number*

Where *first\_event\_number* is the number of the first event in the specified event range, and *last\_event\_number* is the number of the last event of the specified event range.

Causes the trace events in the specified range for the specified subsystem to be displayed on the system console.

**Example: trace range gw 19 22**

Causes the trace events gw.19, gw.20, gw.21, and gw.22 to be displayed on the system console.

group *groupname*

Allows trace events that were previously added to the specified group to be displayed on the router console.

**Example: trace group groupb**

subsystem *subsystemname*

Allows trace events associated with the specified subsystem to be displayed on the router console.

**Example: trace subsystem gw**

## Trap

Use the **trap** command to select the message to be sent to the remote SNMP network management workstation. A remote SNMP network management workstation is an IP host in the network acting as an SNMP manager.

**Syntax:** `trap` event . . .  
range . . .  
group . . .  
subsystem . . .

`event` *subsystem.event#*

Causes the specified message (*subsystem.event#*) to be sent to a network management workstation in an SNMP trap.

**Example:** `trap event gw.019`

`range` *subsystemname first\_event\_number last\_event\_number*

Where *first\_event\_number* is the number of the first event in the specified event range, and *last\_event\_number* is the number of the last event of the specified event range.

Causes the messages that are in the specified range for the specified subsystem to be sent to a network management workstation in an SNMP trap.

**Example:** `trap range gw 19 22`

Causes the messages in events gw.19, gw.20, gw.21, and gw.22 to be sent to a network management workstation in an SNMP trap.

`group` *groupname*

Allows messages that were previously added to the specified group to be sent to a network management workstation in an SNMP trap.

**Example:** `trap group groupb`

`subsystem` *subsystemname*

Allows messages associated with the specified subsystem to be sent to a management station in an SNMP trap.

**Example:** `trap subsystem gw`

**Note:** Messages for the IP, ICMP, ARP and UDP subsystems cannot be sent in SNMP traps because these areas are or may be used in the process of sending the SNMP trap. This could lead to an infinite loop of traffic putting an undue strain on the router.

## Exit

Use the **exit** command to return to the CONFIG prompt.

**Syntax:** `exit`

**Example:** `exit`



## Chapter 12. Monitoring the Event Logging System (ELS)

This chapter describes how to monitor events logged by ELS and how to use the ELS console commands. The information includes the following sections:

- “Using ELS”
- “Using ELS to Troubleshoot a Problem” on page 12-3
- “Entering and Exiting the ELS Console Environment” on page 12-5
- “ELS Console Commands” on page 12-5

If you need more information on the Event Logging System and how to interpret ELS event messages, refer to Chapter 11, “Using and Configuring the Event Logging System (ELS)” on page 11-1.

### Using ELS

To use ELS effectively, it is recommended you take the following steps:

- Know what you want to see before using the ELS system. Clearly define the problem or events that you want to see before using the MONITR process.
- Execute the command **nodisplay subsystem all all** to turn off all ELS messages.
- Turn on only those messages that relate to the problem you are experiencing.
- Use the *IBM 8210 Multiprotocol Switched Services Server Event Logging System Messages Guide* to determine which messages you are seeing are normal.

When you initially view ELS from the MONITR process, you will see a considerable amount of information. Because the router cannot buffer and display every packet under moderate to heavy loads the buffers are flushed. When this occurs the following message is displayed:

```
xx messages flushed
```

The router does not save these messages. When this message appears, you may want to tailor the ELS output to display only that information that is important to the current task you are monitoring.

### Managing ELS Message Rotation

It is also important to note that the ELS messages continually rotate through the router's buffers. To stop and restart the displaying of ELS messages, use the following key combinations:

<b>Ctrl</b>	<b>S</b>	to pause scrolling
<b>Ctrl</b>	<b>Q</b>	to resume scrolling
<b>Ctrl</b>	<b>P</b>	to go back to the last process

You may also want to capture the ELS output to a file. You can do this by starting a script file or log file from your location when Telneting to a router. You can also do this by attaching a PC to the router's console port and starting a log file from within the terminal emulation package. This information is needed to help Customer Service diagnose a problem.

### Capturing ELS Output Using a Telnet Connection on a UNIX Host

You can use a Telnet connection on an AIX or UNIX host to capture the ELS messages on your screen to a file on the host. Before beginning, make sure you have set up ELS for the messages you want to capture by using the ELS console commands in this chapter.

To capture the ELS output to a file on an AIX or UNIX host, follow these steps:

1. From the host, enter **telnet router\_ip\_addr | tee local\_file\_name**

*router\_ip\_addr* is the IP address of the router

*local\_file\_name* is the name of the file on the host where you want the ELS messages to be saved.

The **tee** command displays the ELS messages on your screen and, at the same time, copies them to the local file.

2. From the OPCON prompt (\*), enter **t 2**. This accesses the MONITR process, which is the process that displays ELS messages on your screen. Depending on which ELS messages you configured, you should see ELS messages appearing on the screen.

As long as you are in the MONITR process, all ELS messages will be written to the local file. When you exit the MONITR process (by entering **Ctrl P**) or terminate the Telnet session, the logging of messages to the local file will stop.

### Configuring ELS So Event Messages Are Sent In SNMP Traps

ELS can be configured so that event messages are sent to a network management workstation in an SNMP enterprise-specific trap. These traps are useful for reporting status and diagnostic results, and are often used for remote monitoring of a IBM 8210. When ELS is configured appropriately, an SNMP trap will be generated each time the selected event occurs. For more information about SNMP, see *Multiprotocol Switched Services (MSS) Configuring Protocols and Features*.

To tell ELS that a specific event should be activated to be sent as an SNMP trap, at the ELS `config>` prompt or at the ELS> prompt, using IP as an example, type:

```
trap event ip.007
```

**Note:** If you are at the ELS `config>` prompt, you will need to reboot.

To enable the ELS enterprise-specific trap, follow these steps:

1. At the SNMP `config>` prompt, using **public** as an example, type:

```
SNMP config> add address public <network manager IP address>
```

```
SNMP config> enable trap enterprise public
```

```
SNMP config> set community access read_trap public
```

**Note:** You will need to reboot to activate these changes.

2. Enable your network management station to receive and properly display the enterprise-specific traps.

You can follow the steps above for trapping groups, subsystems, and events.

## Using ELS to Troubleshoot a Problem

Events occur continuously while the router is operating. They can be caused by any of the following reasons:

- System activity
- Status changes
- Service requests
- Data transmission and reception
- Data and internal errors

When an event occurs, ELS receives data from the system that identifies the source and nature of the event. Then ELS generates a message that uses the data received as part of the message.

When trying to troubleshoot a particular problem, display those messages that relate to the problem. For example, if you are experiencing a problem with bridging, turn on the bridging messages:

```
display subsystem srt all
display subsystem br all
```

Initially, because of the rapid pace of messages scrolling across the screen, you may want to record the numbers you see and look those up in the manual. Once you become familiar with different types of messages being displayed for a particular protocol, you can turn on and turn off only those messages that contain the information that you require to troubleshoot a problem. The following sections list specific ELS examples. Keep in mind that different problems may require different steps.

### ELS Example 1

You are interested in looking at the frequency of polling on a Token-Ring interface, and finding out whether the polls are successful.

```
ELS> nodisplay subsystem all all
```

```
ELS> display subsystem tkr all
```

```
Ctrl P
```

```
* t 2
```

As the messages begin to scroll by, look for ELS message tkr.031.

### ELS Example 2

SRTB bridging is not working.

1. Check the configuration.
2. Use the GWCON bridging console to verify that the bridging interfaces are enabled.
3. Enter:

## Using ELS in Monitoring

```
* t 6  
config> event  
ELS config> nodisplay subsystem all all  
ELS config> display subsystem srt all  
ELS config> exit  
config> Ctrl P
```

- Restart the routing subsystem. When the subsystem has restarted, enter the following:

```
* t 2
```

As the messages begin to scroll by, look for messages srt.071 through srt.075. If you see one of these messages, you are not licensed to use one or more of the bridging features.

### ELS Example 3

Router cannot communicate with an IPX server on an Ethernet.

- At the OPCODE prompt, enter the **status** command to find the PID (process ID) of GWCON. (See step 1 on page 11-3 in “ELS Configuration Environment” on page 11-3 for a sample output of the **status** command.)

```
* status
```

- Enter the **talk** command and the PID for GWCON.

```
* talk 5
```

The console displays the GWCON prompt (+). If the prompt does not appear when you first enter GWCON, press **Return**.

- At the GWCON prompt (+), enter **IPX** to access the IPX console prompt (IPX>).
- At the IPX console prompt, enter the **slist** command to verify that the server is listed. (See the section on monitoring IPX in the *Multiprotocol Switched Services (MSS) Configuring Protocols and Features* for information on the slist command.)

- Check the IPX configuration.

- Enter the following:

```
* t 5  
+ event  
ELS> nodisplay subsystem all all  
ELS> display subsystem IPX all  
ELS> display subsystem eth all  
ELS> Ctrl P  
* t 2
```

As the messages begin to scroll by, look for ELS message eth.001. This indicates that the server has a bad Ethernet type field.

---

## Entering and Exiting the ELS Console Environment

The ELS console environment (available from the GWCON process) is characterized by the ELS> prompt. Commands entered at this prompt modify the current ELS parameter settings. These commands are described Chapter 12, “Monitoring the Event Logging System (ELS)” on page 12-1.

To enter the ELS console environment from OPCON:

1. At the OPCON prompt, enter the **status** command to find the PID (process ID) of GWCON. (See step 1 on page 11-3 in “ELS Configuration Environment” on page 11-3 for a sample output of the **status** command.)

\* **status**

2. Enter the **talk** command and the PID for GWCON.

\* **talk 5**

The console displays the GWCON prompt (+). If the prompt does not appear when you first enter GWCON, press **Return**.

3. At the GWCON prompt, enter the following command to access ELS:

+ **event**

The console displays the ELS console prompt (ELS>). Now, you can enter ELS console commands.

To leave the ELS console environment, enter the **exit** command.

---

## ELS Console Commands

This section summarizes and then explains all the ELS console commands. After accessing the ELS Console environment, you can enter ELS console commands at the ELS> prompt.

Table 12-1. ELS Console Command Summary

Command	Function
? (Help)	Lists the ELS console commands or lists the options associated with specific commands.
Clear	Clears messages associated with specific events, groups, or sub-systems.
Display	Enables message display on the console.
Exit	Exits the ELS console process and returns the user to GWCON.
List	Lists information on ELS settings and messages.
Nodisplay	Disables message display on the console.
Notrace	Disables trace event display on the console.
Notrap	Keeps messages from being sent out in SNMP traps to the network management workstation.
Packet-trace	Provides an enhanced central environment for setting and listing active packet tracing parameters.
Remove	Frees up memory by erasing stored information.
Restore	Clears current settings and reloads initial ELS configuration.
Retrieve	Reloads the saved ELS configuration.
Save	Stores the current configuration.
Set	Sets the pin parameter and the timestamp feature.
Statistics	Displays available subsystems and pertinent statistics.
Trace	Enables trace event display on the console.
Trap	Allows messages to be sent to a network management workstation in SNMP traps.
View	Allows viewing of traced packets.

## ? (Help)

Use the **? (help)** command to list the commands that are available from the current prompt level. You can also enter a **?** after a specific command name to list its options.

**Syntax:** ?

**Example:** ?

```
CLEAR
DISPLAY
LIST
NODISPLAY
NOTRACE
NOTRAP
PACKET-TRACE
REMOVE saved state
RESTORE initial state
RETRIEVE saved state
SAVE current state
SET
STATISTICS
TRACE
TRAP
VIEW
EXIT
```

**Example:** `list ?`

```

ALL
ACTIVE
EVENT
GROUPS
PIN
SUBSYSTEMS
TRACE

```

## Clear

Use the clear command to disable both the display and trap commands as they relate to specific events, groups, or subsystems.

**Syntax:** `clear`      event . . .  
                           group . . .  
                           subsystem . . .

`event subsystem.event#`

Disables the displaying or trapping of messages for the specified event (*subsystem.event#*).

**Example:**    `clear event gw.019`

`group group.name`

Disables the displaying or trapping of messages for the specified group (*group.name*). specified group (*groupname*).

**Example:**    `clear group groupb`

`subsystem subsystem.name`

Disables the displaying or trapping of messages associated with the specified subsystem (*logging level*). If you do not specify a logging level, all messages for that subsystem are disabled.

**Example:**    `clear subsystem gw`

## Display

Use the display command to enable the message display on the console monitor for specific events.

**Syntax:** `display`    event . . .  
                           range . . .  
                           group . . .  
                           subsystem . . .

`event subsystem.event#`

Displays messages for the specified event (*subsystem.event#*).

**Example:**    `display event gw.019`

`range subsystemname first_event_number last_event_number`

Where *first\_event\_number* is the number of the first event in the specified event range, and *last\_event\_number* is the number of the last event in the specified event range.

Displays a range of messages for the specified subsystem.

**Example:**    `display range gw 19 22`

Displays events gw.19, gw.20, gw.21, and gw.22.

## Monitoring ELS

group *groupname*

Displays messages of a specified group (*groupname*).

**Example:** `display group groupb`

subsystem *subsystem.name*

Displays any messages associated with the specified subsystem (*logging level*). If you do not specify a logging level, all messages for that subsystem are turned on.

**Example:** `display subsystem tkr`

## Files Trace TFTP

Use the **files trace tftp** command to retrieve trace files from the subdirectory associated with:

- The currently active bank (bank A or bank B on the hard disk)
- Bank A on the hard disk
- Bank B on the hard disk
- The trace file stored in the Network Subdirectory (if there is no active bank)

**Syntax:** `files trace tftp`      active-bank ...  
   bank-a ...  
   bank-b ...  
   net-subdir ...

You are prompted for the *remote server IP address* and the *remote path/file name*.

active-bank      Retrieves the traces file from the currently active bank

bank-a            Retrieves the trace file from bank A.

bank-b            Retrieves the trace file from bank B.

net-subdir        Retrieves the trace file stored in the Network Subdirectory (if there is no active bank).

**Example:** `files trace tftp active-bank 9.67.240.163 trace1.log`

## Files

Use the **files** command to transfer trace files to another host on the network using TFTP.

**Syntax:** `files trace tftp host_IP_addr filename`

*host\_IP\_addr*

Is the IP address of the host to which you are transferring the files.

*filename*

Is the target file name. For TFTP, the file name must be fully path specified, and the file name must already exist on the target host.

**Example:** `files trace tftp 9.67.240.163 trace1.log`



## List

Use the list command to get updated information regarding ELS settings and to get listings of selected messages.

**Syntax:** `list`      all  
                           active . . .  
                           event . . .  
                           groups . . .  
                           pin  
                           subsystems . . .  
                           trace-status

`all`

Lists all subsystems, defined groups, enabled subsystems, enabled events, and pins.

**Example:**    `list all`

`active` *subsystem.name*

Displays the events that are active for a specific subsystem and the count of the occurrence of the messages.

**Example:**    `list active ip`

```
EventActiveCount
IP.00789354
ETH.009D10
Subsystem X25: no event active
```

`event` *subsystem.event#*

Displays the logging level, the message, and the count of the specified event.

**Example:**    `list event ip.007`

```
Level: p-TRACE
Message: source_ip_address -> destination_ip_address
Active: Count: 84182
```

`groups` *group.name*

Displays the user-defined group names.

**Example:**    `list groups`

`pin`

Lists the current number of ELS event messages sent per second in SNMP traps. This is a threshold value that can be used to reduce the amount of SNMP trap traffic.

**Example:**    `list pin`

```
Pin: 100 events/second
```

`subsystem` *subsystem.name*

Lists event names, the total number of events that have occurred, and their descriptions.

**Note:** Although ELS supports all of these subsystems, not all devices support all subsystems. See *ELS Messages* for the most current list of supported subsystems.

**Example:**    `list subsystem`

## Monitoring ELS

Name	Events	Description
ALL		All subsystems
GW	101	Router base and network library
FLT	7	Filter Library
BRS	5	Bandwidth Reservation
ARP	142	Address Resolution Protocol
IP	100	Internet Protocol
ICMP	21	Internet Control Message Protocol
TCP	57	TCP
UDP	6	User Datagram Protocol
BTP	13	BOOTP relay agent
RIP	22	IP Routing Information Protocol
OSPF	73	Open SPF-Based Routing Protocol
MSPF	17	OSPF Multicast extensions
TFTP	29	TFTP Protocol
SNMP	28	Simple Network Management Protocol
DVM	21	DVMRP Multicast Routing Protocol
XN	21	XNS/IPX/DDS common processing
IPX	110	Internetwork Packet Exchange Protocol
CLNP	58	ISO 8473 - CLNP
ESIS	24	ISO 9542 - ESIS Protocol
ISIS	58	ISO 10589 - ISIS Protocol
AP2	70	AppleTalk Phase 2
ZIP2	51	AppleTalk Phase 2 Zone Information Protocol
R2MP	38	AppleTalk Phase 2 Routing Table Management Protocol
VIN	79	Banyan VINES
SRT	94	Source Routing Transparent Bridge
STP	32	Spanning Tree Protocol
BR	30	Bridge/Routing
SRLY	28	SDLC Relay
ETH	47	Ethernet Handler
SL	35	Serial Line Handler
TKR	45	Token Ring Handler
X25	53	X.25 Protocols
FDDI	27	FDDI Handler
SDLC	95	IBM SDLC
FRL	97	Frame Relay
PPP	186	Point-to-Point
X251	16	X.25-Physical-Layer
X252	34	X.25-Frame-Layer
X253	42	X.25-Packet-Layer
ISDN	43	Integrated Services Digital Network
IPPN	4	IP Protocol Net
WRS	33	WAN Restoral
LNM	60	LNM
LLC	168	Logical Link Control
BGP	74	Border Gateway Protocol
MCF	9	MAC Filtering
V25B	28	CCITT/ITU V.25bis
COMP	26	Data Compression Engines
NBS	50	NetBIOS Support Subsystem
ATM	216	Asynchronous Transfer Mode
LEC	174	ATM LAN Emulation Client
APPN	28	Advanced Peer-to-Peer Networking
ILMI	23	ATM Interim Local Management Interface
SAAL	26	ATM Signalling ATM Adaptation Layer
SVC	26	ATM Signalling
LES	361	LAN Emulation Services
LECS	145	LAN Emulation Configuration Server
EVLOG	1	EventLog() error logging system
NOT	15	Forwarder messages not loaded
NHRP	211	Next Hop Resolution Protocol
XTP	58	X.25 Transport

LCS	22	LCS Handler
LSA	61	LSA Handler
MPC	30	MPC Handler
SCSP	34	Server Cache Synchronization Protocol
ALLC	36	ATM LLC (RFC1483)
NDR	38	Network Dispatcher Router Feature
MLP	93	Multilink-PPP
SEC	30	Security Protocols
ENCR	4	Data Encryption Engines
PM	6	Presence Manager
DGW	9	Default Gateway
QLLC	54	QLLC-Packet-LayerName Events Description
VLAN	20	Virtual LAN

**subsystem *subsystem.name***

Lists all events, logging levels, and messages for the specified subsystem.

**Example: list subsystem eth**

```

Event      Level      Message
ETH.001    P-TRACE    brd rcv unkwn type packet_type source_Ethernet_address ->
            destination_Ethernet_address nt network
ETH.002    UE-ERROR    rcv unkwn typ packet_type source_Ethernet_address ->
            destination_Ethernet_address nt network
ETH.010    C-INFO     LLC unk SAP_DSAP source_Ethernet_address ->
            destination_Ethernet_address nt network

```

**subsystems all**

Lists all events, logging levels, and messages for every event that has occurred on the router.

**Example: list subsystems all****trace-status**

Displays information on the status of ATM packet tracing, including configuration and run-time information.

**Example: list trace-status**

```

----- Configuration -----
Trace Status:ON  Wrap Mode:ON  Decode Packets:ON  HD Shadowing:ON
RAM Trace Buffer Size:100000  Maximum Trace Buffer File Size:10000000
Max Packet Bytes Trace:256  Default Packet Bytes Traced:100
Trace File Record Size:2048  Stop Trace Event: TCP.013
Maximum Hours to HD Shadow: 1
----- Run-time Status -----
Packets in RAM Trace Buffer:1  Free Trace Buffer Memory:99958
Trace Errors:0  First Packet:1  Last Packet:1
Trace Records Stored on HD:8  Trace Buffer File Size:16560
HD-Shadowing Time Exceeded? NO  Elapsed Time: 0 hr, 0 min, 10 sec
Has Stop Trace Event Occurred? NO

```

- “Trace Status” in the LIST TRACE-STATUS display will indicate OFF when STOP-ON-EVENT action occurs.
- “HD Shadowing” in the LIST TRACE-STATUS display will indicate OFF when STOP-ON-EVENT action occurs or when Time Limit is exceeded.
- “Trace Buffer File Size” will display “<wrapped>” when a wraparound has occurred in the trace file.
- If disk-shadowing time limit is exceeded, but there has not been a trace record written since the time expired, then “HD-Shadowing Time Exceeded? NO <Next trace will turn it OFF>” will be displayed. When the next trace record has been written, then “HD-Shadowing Time Exceeded? YES” will be displayed.

## Monitoring ELS

ELS Config>**LIST TRACE** command under Talk-6 displays information similar to the following:

```
----- Configuration -----  
Trace Status:ON  Wrap Mode:ON  Decode Packets:ON  HD Shadowing:ON  
RAM Trace Buffer Size:100000  Maximum Trace Buffer File Size:10000000  
Max Packet Bytes Trace:256  Default Packet Bytes Traced:100  
Trace File Record Size:2048  Stop Trace Event: TCP.013  
Maximum Hours to HD Shadow: 1
```

## Nodisplay

Use the **nodisplay** command to select and turn off messages displaying on the console monitor.

**Syntax:** **nodisplay** event . . .  
range . . .  
group . . .  
subsystem . . .

*event subsystem.event#*

Suppresses the displaying of messages for the specified event.

**Example:** **nodisplay event gw.019**

*range subsystemname first\_event\_number last\_event\_number*

Where *first\_event\_number* is the number of the first event in the specified event range, and *last\_event\_number* is the number of the last event of the specified event range.

Suppresses the displaying of a range of messages for the specified subsystem.

**Example:** **nodisplay range gw 19 22**

Suppresses the display of events gw.19, gw.20, gw.21, and gw.22.

*group group.name*

Suppresses the displaying of messages that were previously added to the specified group (*group.name*).

**Example:** **nodisplay group groupb**

*subsystem subsystem.name*

Suppresses the displaying of messages associated with the specified subsystem (*logging level*).

**Example:** **nodisplay subsystem tkr**

## Notrace

Use the **notrace** command to stop display of selected trace events at the console.

**Syntax:** **notrace** event . . .  
range . . .  
group . . .  
subsystem . . .

*event subsystem.event#*

Suppresses the display of the specified tracing event.

**Example:** **notrace event gw.019**

range *subsystemname first\_event\_number last\_event\_number*

Where *first\_event\_number* is the number of the first event in the specified event range, and *last\_event\_number* is the number of the last event of the specified event range.

Disables the sending of packet trace data for a range of messages for the specified subsystem.

**Example:** `notrace range gw 19 22`

Suppresses the sending of packet trace data for events gw.19, gw.20, gw.21, and gw.22.

group *groupname*

Suppresses the display of tracing events related to the specified group (*groupname*).

**Example:** `notrace group groupb`

subsystem *subsystemname*

Suppresses the display of tracing events that are associated with the specified subsystem.

**Example:** `notrace subsystem atm error`

`notrace subsystem atm`

## Notrap

Use the **notrap** command to select and turn off messages so that they are no longer sent to a network management workstation in SNMP traps.

**Syntax:** `notrap` event . . .  
range . . .  
group . . .  
subsystem . . .

event *subsystem.event#*

Suppresses the sending of the specified message in an SNMP trap (*subsystem.event#*).

**Example:** `notrap event gw.019`

range *subsystemname first\_event\_number last\_event\_number*

Where *first\_event\_number* is the number of the first event in the specified event range, and *last\_event\_number* is the number of the last event of the specified event range.

Suppresses the sending of messages for the events in the specified range for the specified subsystem in SNMP traps.

**Example:** `notrap range gw 19 22`

Suppresses the sending of messages for events gw.19, gw.20, gw.21, and gw.22 in SNMP traps.

group *groupname*

Suppresses the sending of messages in SNMP traps that were previously added to the specified group (*groupname*).

**Example:** `notrap group groupb`

## Monitoring ELS

subsystem *subsystemname*

Suppresses the sending of messages in SNMP traps that are associated with the specified subsystem.

**Example:** `notrap subsystem tkr error`

## Packet Trace

Use the **packet-trace** command to display/enable/disable packet tracing information for various subsystems. This command provides function similar to the **Trace** command.

To enter the Packet-Trace Console from the ELS Console, type **packet-trace** under the ELS> prompt:

```
ELS>packet-trace
Packet Trace Console
ELS Packet Trace>
```

Use the **Exit** command when you are finished using Packet Trace.

For complete command descriptions, see “Packet-trace Console Commands” on page 12-22

## Remove

Use the **remove** command to free up memory by erasing stored information. If you have previously saved the current configuration with the **save** command, **remove** allows you to erase the saved configuration.

**Syntax:** `remove`

**Example:** `remove`

## Restore

Use the **restore** command to clear all current settings (except counters) and reload the initial ELS configuration. To retain the current settings, use the **save** command before restoring the initial configuration.

**Syntax:** `restore`

**Example:** `restore`

## Retrieve

Use the **retrieve** command to reload the saved ELS configuration. If you have previously saved the current configuration with the **save** command, use **retrieve** to reload it. **Retrieve** does not erase the saved configuration after it executes. To erase the saved configuration, use the **remove** command.

**Syntax:** `retrieve`

**Example:** `retrieve`

## Save

Use the **save** command to store the current configuration (except counters). **Save** does not affect the default configuration (the one you set with the configuration commands). Use **save** after modifying the configuration with the console commands with the intention of saving this configuration over a restart. There can be

only one saved configuration at a time. To reload the saved configuration, use the **retrieve** command.

**Syntax:** `save`

**Example:** `save`

## Set

Use the **set** command to set the maximum number of traps per second, to set the timestamp feature, or to set the tracing options.

**pin**

Use the **set pin** command to set the pin parameter to the maximum number of traps that can be sent on a per-second basis. Internally, the pin resets every tenth of a second. (One tenth of the number *max\_traps* is sent every tenth of a second.)

**Syntax:** `set pin max_traps`

**Example:** `set pin 100`

**timestamp**

Allows you to turn on message timestamping so that either the time of day or uptime (number of hours, minutes, and seconds, but no date, since the router was last initialized) appears next to each message, or to turn off message timestamping.

**Note:** If you turn on timestamping, you must remember to go back into the CONFIG process and set the router's date and time using the `time` command. Otherwise, all messages will come out with 00:00:00, or negative numbers in the hours, minutes, and/or seconds, for example 00:-4:-5.

Use the **set timestamp** command to enable one of the following timestamp options:

*timeofday* Adds an HH:MM:SS prefix to each ELS message indicating the time of the occurrence during a 24-hour day.

*uptime* Adds an HH:MM:SS prefix to each ELS message indicating the time of the occurrence during a 100-hour cycle of uptime for the router. After 100 hours of uptime, the uptime counter returns to zero to begin another 100-hour cycle.

*off* Turns off the ELS timestamp prefix.

**Syntax:** `set timestamp timeofday OR uptime OR off`

**Example:** `set timestamp timeofday`

**trace**

Use the **set trace** command to configure tracing options. When tracing options are configured from the monitoring console, the changes take effect immediately, and return to their previously configured settings when the device is rebooted.

**Syntax:** `set trace decode . . .  
default-bytes-per-port . . .  
disk-shadowing . . .  
max-bytes-per-port . . .  
memory-trace-buffer-size . . .`

	<ul style="list-style-type: none"> <li>off</li> <li>on</li> <li>reset</li> <li>stop-event . . .</li> <li>wrap-mode . . .</li> </ul>
decode <i>off / on</i>	Turns packet decoding on or off. Packet decoding is not supported by all components.
default-bytes-per-pkt <i>bytes</i>	Sets the default number of bytes traced. This value is used if a value is not specified by the component doing the tracing.
disk-shadowing <i>off / on OR record-size OR time-limit</i>	Turns disk shadowing on or off, sets the maximum trace file size, or sets the maximum time for disk-shadowing traces.
off / on	<p>Turns disk shadowing on or off. If disk shadowing is enabled, trace records are copied to the hard disk. Once a traced record is copied to the hard disk, it can no longer be viewed from the console.</p> <p><b>Note:</b> Disk shadowing should be set to OFF whenever the WRITE, TFTP software, RETRIEVE system dump, or COPY software commands are issued.</p> <p><b>Example:</b> <code>set trace off</code></p> <p>Turns disk shadowing on or off and sets the maximum trace file size. If disk shadowing is enabled, trace records are copied to the hard disk. Once a traced record is copied to the hard disk, it is no longer viewable through the console.</p>
record-size	<p>Sets the record size for trace file records:</p> <p><b>Valid Values:</b> 1024, 2048, or 4096 bytes</p> <p><b>Default:</b> 2048 bytes</p> <p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. If a trace file already exists, "Cannot change Record Size without first deleting the existing Trace File" is displayed and record size is not changed.</li> <li>2. If you configure a record size and a trace file already exists, the trace will use the record size of the existing file.</li> </ol> <p><b>Example:</b> <code>set trace record-size 4096</code></p>
delete-file	<p>Deletes the trace file (in the subdirectory associated with the active bank only).</p> <p><b>Note:</b> If disk shadowing is ON when the command is issued, "Disk-shadowing must be set to OFF before trace file can be deleted" is displayed and the file is not deleted.</p>
time-limit	<p>Sets the maximum time for disk-shadowing of traces:</p> <p><b>Valid Values:</b> 1 - 72 hours:</p>



**Default** 24 hours

**Note:** Disk shadowing stops (tracing continues) after this time has elapsed. The actual time is reset to 0 when disk shadowing is turned on again.

**Example:** `set trace disk-shadowing time 36`

`max-bytes-per-pkt` *bytes*

Sets the maximum number of bytes traced for each packet.

`memory-trace-buffer-size` *bytes*

Sets the size, in bytes, of the RAM trace buffer.

`off`

Disables packet tracing.

`on`

Enables packet tracing.

`reset`

Clears the trace buffer and resets all associated counters.

`stop-event` *event id*

Stops tracing when an event (event id) occurs. Enter either an ELS event id (for example: TCP.013) or "None." "None" is the default. Tracing stops only if the display of the particular ELS event is enabled.

When a stop-event occurs, an entry is written to the trace buffer. The **view** command for this trace entry will display "Tracing stopped due to ELS Event Id: TCP.013."

After tracing stops due to a stop-event, you must re-enable tracing with the **set trace on** command. (A restart will also re-enable tracing if enabled from the ELS Config> prompt.)

**Example:** `set trace stop-event TCP.013`

`wrap-mode` *off/on*

Turns the trace buffer wrap mode on or off. When wrap mode is enabled and the trace buffer is full, previous trace records will be overwritten by new trace records as necessary to continue tracing.

**Example 1:** `set trace decode on`

**Example 2:** `set trace default-bytes-per-packet 64`

**Example 3:** `set trace off`

## Statistics

Use the **statistics** command to display a list of all of the available subsystems and their statistics.

**Note:** The following example may not match your display exactly. The output of the command depends on the version and release of the installed software.

**Syntax:** `statistics`

**Example:** `statistics`

## Monitoring ELS

Subsys	Vector	Exist	String	Active	Heap
GW	105	101	3411	0	0
FLT	20	7	184	0	0
BRS	50	5	201	0	0
ARP	150	142	7030	0	0
IP	100	100	2463	2	20
ICMP	30	21	529	0	0
TCP	60	57	2420	0	0
UDP	10	6	179	0	0
BTP	40	13	695	0	0
RIP	30	22	474	0	0
OSPF	80	73	2859	0	0
MSPF	40	17	593	0	0
TFTP	35	29	819	0	0
SNMP	30	28	821	0	0
DVM	30	21	589	0	0
DN	140	115	5842	0	0
XN	35	21	780	0	0
IPX	110	110	4705	0	0
CLNP	80	58	1763	0	0
ESIS	40	24	716	0	0
ISIS	80	58	2422	0	0
DNAV	50	26	1314	0	0
AP2	80	70	1755	0	0
ZIP2	60	51	1859	0	0
R2MP	50	38	1185	0	0
VIN	90	79	3159	0	0
SRT	120	94	5040	0	0
STP	60	32	1590	0	0
BR	50	30	1616	0	0
SRLY	30	28	1409	0	0
ETH	60	47	1098	0	0
SL	50	35	584	0	0
TKR	60	45	2031	0	0
X25	70	53	1909	0	0
FDDI	30	27	1155	0	0
SDLC	100	95	4263	0	0
FRL	130	97	6068	0	0
PPP	190	186	6394	0	0
X251	50	16	546	0	0
X252	50	34	996	0	0
X253	50	42	1649	0	0
ISDN	50	43	1994	0	0
IPPN	20	4	132	0	0
WRS	40	33	1938	0	0
LNМ	70	60	3137	0	0
LLC	170	168	9840	0	0
BGP	80	74	2477	0	0
MCF	15	9	244	0	0
V25B	30	28	1058	0	0
COMP	80	26	1050	0	0
NBS	100	50	3029	0	0
ATM	300	216	10808	0	0
LEC	200	174	7258	0	0
APPN	100	28	467	0	0

ILMI	150	23	487	0	0
SAAL	30	26	621	0	0
SVC	30	26	465	0	0
LES	400	361	22333	0	0
LECS	150	145	5666	0	0
EVLOG	1	1	105	0	0
NOT	25	15	508	0	0
NHRP	250	211	8193	0	0
XTP	64	58	2271	0	0
ESC	150	67	3122	0	0
LCS	40	22	858	0	0
LSA	70	61	3506	0	0
MPC	130	30	1677	3	44
SCSP	40	34	1234	0	0
ALLC	50	36	1842	0	0
NDR	50	38	1150	0	0
MLP	100	93	4006	0	0
SEC	50	30	688	0	0
ENCR	100	4	194	0	0
PM	25	6	120	0	0
DGW	20	9	238	0	0
QLLC	55	54	2411	0	0
Total	6490	4942	215805	5	64

Maximum:7976 vector, 155 subsystem

Memory:71784/620 vector+ 81256/217714 data+ 64 heap=371438Subsys

Subsys	Name of subsystem
Vector	Maximum size of subsystem
Exist	Number of events defined in this subsystem
String	Number of bytes used for message storage in this subsystem
Active	Number of active (displayed, trapped, or counted) events in the subsystem
Heap	Dynamic memory in use by subsystem

## Trace

Use the **trace** command to select the trace events to be displayed on the system console. This command provides function that is similar to the **packet trace** command described in “Packet-trace Console Commands” on page 12-22.

**Syntax:** `trace` event . . .  
range . . .  
group . . .  
subsystem . . .

`event subsystem.event#`

Causes the specified trace event (`subsystem.event#`) to be displayed on the system console.

**Example:** `trace event gw.019`

`range subsystemname first_event_number last_event_number`

Where `first_event_number` is the number of the first event in the specified event range, and `last_event_number` is the number of the last event of the specified event range.

Causes the trace events in the specified range for the specified subsystem to be displayed on the system console.

**Example:** `trace range gw 19 22`

Causes the trace events gw.19, gw.20, gw.21, and gw.22 to be displayed on the system console.

`group groupname`

Allows trace events that were previously added to the specified group to be displayed on the router console.

**Example:** `trace group groupb`

`subsystem subsystemname`

Allows trace events associated with the specified subsystem to be displayed on the router console.

**Example:** `trace subsystem gw`

## Trap

Use the **trap** command to select the message to be sent to the remote SNMP network management workstation. A remote SNMP network management workstation is an IP host in the network acting as an SNMP manager.

**Syntax:** `trap`     `event` . . .  
                  `range` . . .  
                  `group` . . .  
                  `subsystem` . . .

`event subsystem.event#`

Causes the specified message (`subsystem.event#`) to be sent to a network management workstation in an SNMP trap.

**Example:** `trap event gw.019`

`range subsystemname first_event_number last_event_number`

Where `first_event_number` is the number of the first event in the specified event range, and `last_event_number` is the number of the last event of the specified event range.

Causes the messages that are in the specified range for the specified subsystem to be sent to a network management workstation in an SNMP trap.

**Example:** `trap range gw 19 22`

Causes the messages in events gw.19, gw.20, gw.21, and gw.22 to be sent to a network management workstation in an SNMP trap.

`group groupname`

Allows messages that were previously added to the specified group to be sent to a network management workstation in an SNMP trap.

**Example:** `trap group groupb`

subsystem *subsystemname*

Allows messages associated with the specified subsystem to be sent to a management station in an SNMP trap.

**Example:** trap subsystem gw

**Note:** Messages for the IP, ICMP, ARP and UDP subsystems cannot be sent in SNMP traps because these areas are or may be used in the process of sending the SNMP trap. This could lead to an infinite loop of traffic putting an undue strain on the router.

## View

Use the **view** command to view traced packets.

**Syntax:** view    current  
                           first  
                           jump  
                           last  
                           next  
                           prev  
                           search ...

current

Displays the current trace packet. If the current packet is not valid, the first packet in the trace buffer is displayed.

first

Displays the first traced packet in the trace buffer.

jump *n*

Displays the traced packet *n* packets ahead of or behind the current packet.

last

Displays the last traced packet in the trace buffer.

next

Displays the next traced packet.

prev

Displays the previous traced packet.

search *hexstring*

Displays the next traced packet that contains the specified hex string.

**Example:** view current

## Exit

Use the **exit** command to return to the previous prompt level.

**Syntax:**    exit

**Example:** exit

## Packet-trace Console Commands

This section describes the Packet-trace Console commands. After accessing the Packet-trace Console environment, you can enter Packet-trace Console commands at the ELS Packet Trace> prompt.

Table 12-2. Packet Trace Console Command Summary

Command	Function
? (Help)	Lists the Packet Trace console commands or lists the options associated with specific commands.
Off	Disables packet tracing.
On	Enables packet tracing. Prompts for memory trace buffer size if not previously set.
Reset	Clears the trace buffer and resets all associated counters.
Set	Configures tracing options.
Subsystems	Activates tracing for the ATM subsystems, or displays a summary.
Trace-status	Displays information on the status of ATM packet tracing, including configuration and run-time.
View	Provides View Captured Packet Trace Buffers Console
Exit	Exits the Packet Trace Console process and returns you to the ELS console.

### ? (Help)

Use the ? (**help**) command to list the commands that are available from the current prompt level. You can also enter a ? after a specific command name to list its specific options.

**Syntax:** ?

**Example:** ?

```
OFF
ON
RESET
SET
SUBSYSTEMS
TRACE-STATUS
VIEW
EXIT
```

### Off

Use the **off** command to disable packet tracing.

**Syntax:** off

**Example:** off

## On

Use the **on** command to enable packet tracing.

**Syntax:** on

**Example:**           on

## Reset

Use the **reset** command to clear the trace buffer and reset all associated counters.

**Syntax:** reset

**Example:**           reset

## Set

Use the **set** command to configure tracing options.

**Syntax:** Set           decode  
                          default-bytes-per-pkt  
                          disk-shadowing  
                          max-bytes-per-pkt  
                          memory-trace-buffer-size  
                          stop-event  
                          wrap-mode  
                          exit

**Example:**           set memory-trace-buffer-size

**Example:**           set decode

For an explanation of the set command, see “Set” on page 12-15.

## Subsystems

Use the **subsystems** command to activate tracing for the ATM subsystems or display a summary.

**Syntax:** subsystems atm  
                          lec  
                          ilec  
                          lecs  
                          les-bus  
                          summary

**Example:**

```
subsystems atm
Network number? 0
ATM Interface is selected
on | off | list [list]? on
Note that SVC uses VPI = 0, VCI = 5
and ILMI uses VPI = 0, VCI = 16
Beginning of VPI range [0]?
End of VPI range [0]?
Beginning of VCI range [0]? 16
End of VCI range [0]? 16
Tracing event ATM.88: ATM frames
```

**Example:**

```

subsystems lec
Network number? 1
ATM Emulated LAN is selected
on | off | list [list]? on
Trace which types of frames (data, control, both) [both]?
Tracing event LEC.11: data frames over ATM Forum LEC: interface 1
Tracing event LEC.12: control frames over ATM Forum LEC: interface 1
Note that if the user DISABLEs and TESTs this LEC interface,
the LEC trace settings from Talk 6 Config will take effect.

```

**Example:**

```

subsystems lecs
LECS Environment
on | off | list [list]? on
LECS modified
LECS modified
Tracing event LECS.128: control frames
(To trace a subset of LEC's, use the SET TRACE VALUE and
SET TRACE MASK commands while using the LECS console.)

```

**Example:**

```

subsystems les-bus
LES-BUS Environment
( 1) ELAN0
( 2) ELANE
Choice of LES/BUS [1]? 2
on | off | list [list]? on
LES/BUS: 'ELANE' : parameter successfully set
LES/BUS: 'ELANE' : parameter successfully set
Trace which types of frames (data, control, both) [both]? data
Tracing event LES.257: data frames
(To trace a subset of LEC's, use the SET TRACE VALUE and
SET TRACE MASK commands while WORK'ing with the LES-BUS.)

```

**Example:**

```

subsystems les-bus
LES-BUS Environment
( 1) ELAN0
( 2) ELANE
Choice of LES/BUS [1]? 2
on | off | list [list]?
Packet trace is ON for ALL LEC's using this LES
LES DATA tracing is on

```

**Example:**

```

subsystems les-bus
LES-BUS Environment
( 1) ELAN0
( 2) ELANE
Choice of LES/BUS [1]?
on | off | list [list]? on
LES/BUS: 'ELANE' : parameter successfully set
LES/BUS: 'ELANE' : parameter successfully set
Trace which types of frames (data, control, both) [both]? control
Tracing event LES.256: control frames
(To trace a subset of LEC's, use the SET TRACE VALUE and
SET TRACE MASK commands while WORK'ing with the LES-BUS.)

```

**Example:**



```

subsystem summary
Subsystems Being Traced

ATM      net number = 0, VPI Range:    0 -    0
          VCI Range:    16 -    16
LEC      net number = 1
LECS
LESBUS   e|an name = ELAN0
LESBUS   e|an name = ELANE

```

#### Example:

```

subsystem les-bus
LES-BUS Environment
  ( 1) ELAN0
  ( 2) ELANE
Choice of LES/BUS [1]?
on | off | list [list]? off
LES/BUS: 'ELAN0' : parameter successfully set
LES/BUS: 'ELAN0' : parameter successfully set

```

#### Example:

```

subsystem les-bus
LES-BUS Environment
  ( 1) ELAN0
  ( 2) ELANE
Choice of LES/BUS [1]?
on | off | list [list]? off
LES/BUS: 'ELAN0' : parameter successfully set
LES/BUS: 'ELANE' : parameter successfully set
notracing event LES.256: control frames
notracing event LES.257: data frames

```

## Trace-Status

Use the **trace-status** command to get updated information regarding packet trace.

**Syntax:** trace-status

#### Example:

```

trace-status
----- Configuration -----
Trace Status:OFF Wrap Mode:OFF Decode Packets:OFF HD Shadowing:OFF
RAM Trace Buffer Size:0 Maximum Trace Buffer File Size:10000000
Max Packet Bytes Trace:256 Default Packet Bytes Traced:100
Trace File Record Size:2048 Stop Trace Event: None
Maximum Hours to HD Shadow: 24
----- Run-time Status -----
Packets in RAM Trace Buffer:0 Free Trace Buffer Memory:0
Trace Errors:0 First Packet:0 Last Packet:0
Trace Records Stored on HD:0 Trace Buffer File Size:0
HD-Shadowing Time Exceeded? NO
Has Stop Trace Event Occurred? NO

```

## View

Use the **view** command to enter the View Captured Packet Trace Buffers Console.

**Syntax:** view

```

View Captured Packet Trace Buffers Console
ELS Packet Trace View>?
CURRENT
FIRST
JUMP
LAST

```

NEXT  
PREV  
SEARCH hexstring  
EXIT

**Example:** ELS PACKET TRACE View>current

For an explanation of the **view** commands, see “View” on page 12-21.

---

## Chapter 13. Using, Configuring and Monitoring FDDI

This chapter describes how to set software-configurable information for the Fiber Distributed Data Interface (FDDI) in the router.

This chapter contains the following sections:

- “Accessing the FDDI Configuration Process” on page 13-3
- “Fiber Distributed Data Interface (FDDI) Overview”
- “FDDI Configuration Commands” on page 13-4
- “Accessing the FDDI Console Process” on page 13-7
- “FDDI Console Commands” on page 13-7

---

### Fiber Distributed Data Interface (FDDI) Overview

Fiber Distributed Data Interface (FDDI) is described by the ANSI X3T9.5 and ISO 9314 committees as a dual counter-rotating ring that operates at a defined speed of 100 Mbps.

In many ways, FDDI is similar to the IEEE 802.5 token-ring, although there are differences, some of which are described in “Differences Between FDDI and Token-Ring” on page 13-2.

The IPX protocol has a **frame** command that allows you to set the FDDI encapsulation type as follows:

**fdi** Sets the encapsulation type to FDDI IEEE 802.2.

**fdi\_snap** Sets the encapsulation type to FDDI SNAP.

For further information about these protocols, refer to *Multiprotocol Switched Services (MSS) Configuring Protocols and Features*

### Token-Passing Ring Network

FDDI is defined as a token-passing protocol. Each station has the chance to transmit data when a token passes. A station can decide how many frames it will transmit using an algorithm that permits “bandwidth” allocating.

FDDI also allows a station to transmit many frames without releasing the token in a way that is similar to the IEEE 802.5 token-ring standard.

An FDDI ring network consists of a set of stations/devices connected as a serial string of stations/devices and transmission media to form a physically closed loop. Information is transmitted sequentially as a stream of suitably encoded signals from one active station/device to the next active one.

Each station/device generally regenerates and repeats each token and can serve as the means of attaching one or more stations/devices to the network.

### Primary and Secondary Rings

FDDI defines two rings:

- The *primary ring*, which is similar to the main ring path in a token-ring network.
- The *secondary ring*, which is similar to the backup ring path in a token-ring network.

Each ring path consists of two fibers, each fiber transmitting one signal; one is pushed and one is pulled in a device. Each fiber is equivalent to a pair of copper conductors. The physical approach in terms of fiber optics is similar to physical fiber optic token-ring paths.

### Attachment of Devices

FDDI permits many attachment units:

- Stations or devices
- Concentrators
- Bridges

These units can be attached to FDDI networks in various ways, similar to those for token-ring networks.

### Differences Between FDDI and Token-Ring

The main differences between FDDI and token-ring techniques are:

- A device can be attached directly to rings without a concentrator, such as a multi-station access unit (MSAU) on a token ring.
- A device can be attached to either or both of the primary and secondary rings.

FDDI defines two device classes, A and B, to differentiate between devices that attach to one ring or both rings, as described in the next section.

### Device Classes A and B

FDDI defines two device classes:

A **Class A** device attaches to both rings directly.

It can be a station, called a *Class A station* or *Dual Access Station (DAS)*, or it can be a Concentrator, called a *Dual Access Concentrator (DAC)*

A **Class B** device attaches to only one of the rings directly or through a concentrator.

It can be a station, called a *Class B station* or *Single Access Station (SAS)*, or it can be a Concentrator, called a *Single Access Concentrator (SAC)*

### FDDI Network Diagram

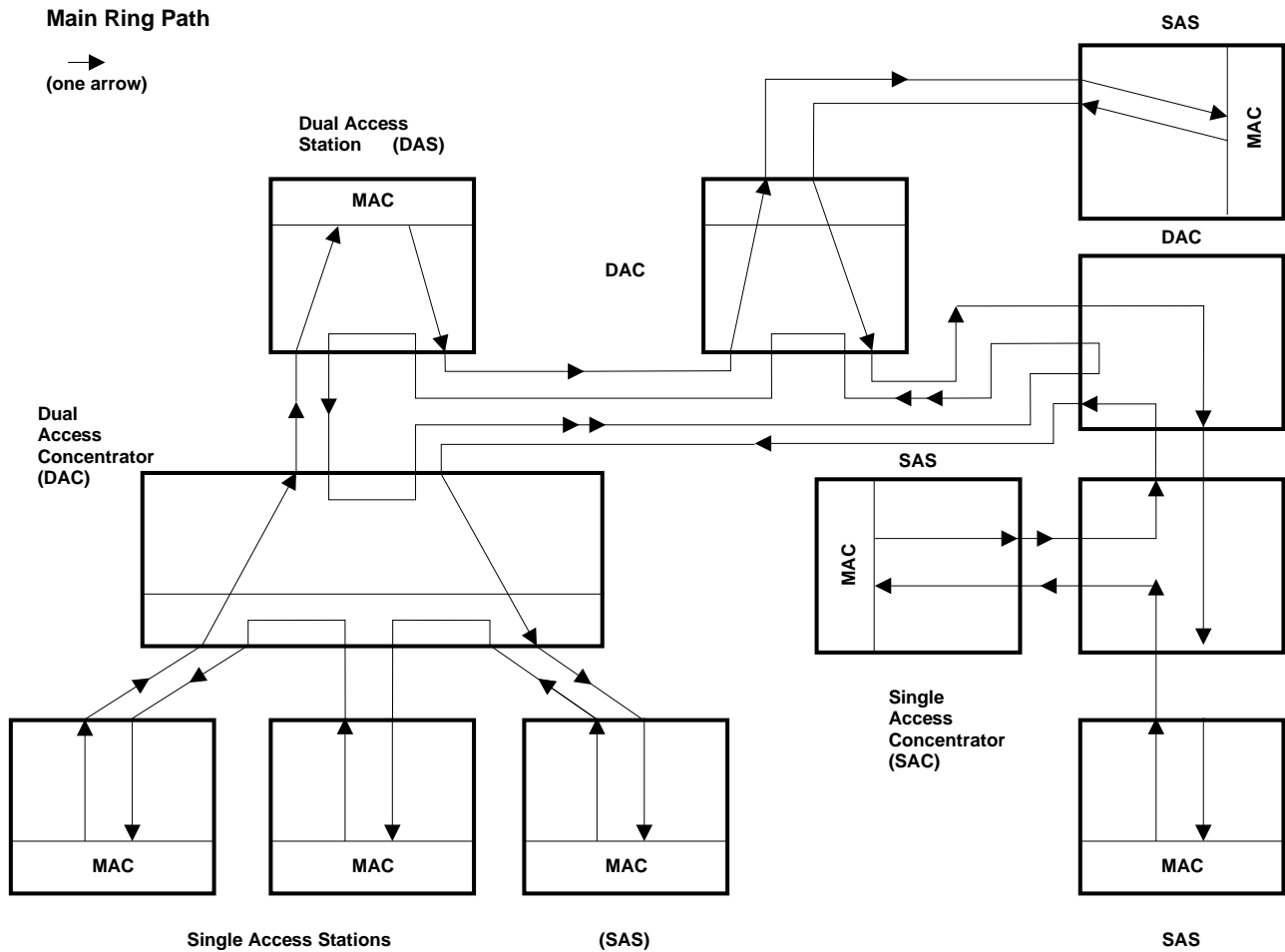


Figure 13-1. FDDI Network Diagram. This diagram shows Single Access Stations (SAS), Dual Access Stations (DAS), Single Access Concentrators (SAC), and Dual Access Concentrators (DAC) in one Main Ring Path of an FDDI network.

## Accessing the FDDI Configuration Process

You can access FDDI configuration from Talk 6. To do so, enter the **add device** command to add an FDDI interface to the network and assign an interface number to it, and then use the **network** command to access the FDDI interface as shown in the following example:

## Configuring FDDI

```
800 Config> add device fddi  
SK-NET FDDI device in slot 0 port 1 as interface #2  
Use "net 2" to configure SK-NET FDDI parameters
```

```
800 Config> network ?  
0 :CHARM ATM Adapter  
1 :ATM Token Ring LAN Emulation: elan1  
2 :SK-NET FDDI
```

```
800 Config> network 2  
FDDI Interface Configuration  
FDD Config>
```

This will get you to the FDDI Config> prompt.

When you are finished, enter **Exit** to return to the previous prompt level.

---

## FDDI Configuration Commands

This section summarizes and then explains all of the FDDI configuration commands as shown in Table 13-1. Enter the commands from the FDDI Config> prompt.

Command	Function
? (Help)	Displays all the FDDI commands or lists subcommand options for specific commands.
Frame	Sets IPX encapsulation values.
LLC	Provides access to the LLC configuration environment.
List	Displays the selected FDDI configuration.
Set	Sets FDDI parameters.
Exit	Exits the FDDI configuration process.

### ? (Help)

Use the ? (**help**) command to list the commands that are available from the current prompt level. You can also enter a ? after a specific command name to list its options.

**Syntax:** ?

**Example:** ?

```
frame
```

```
list
```

```
set
```

```
exit
```

### Frame

Use the **frame** command to set the IPX encapsulation.

**Syntax:** frame fddi

```
fddi_snap
```

```
fddi
```

Sets the IPX encapsulation to FDDI IEEE 802.2.

```
fddi_snap
    Sets the IPX encapsulation to FDDI SNAP.
```

**Example:**

```
frame
    FDDI Config> frame fddi
```

**List**

Use the **list** command to display the current configuration for the FDDI.

**Syntax:** `list all`

`ler`

`pmf`

`tmax`

`tmin`

`treq`

`tvx`

`userdata`

`all`

Lists all of the output for the various parameter that follow.

`ler`

Lists the link error rate alarms and cutoff values for port A and port B.

`a` -- lists the link error rate alarms and cutoff values for port A.

`b` -- lists the link error rate alarms and cutoff values for port B.

`pmf`

Displays the PMF Password (maximum of 8 characters).

`tmax`

Lists the Maximum Token Rotation Time (in milliseconds).

`tmin`

Lists the Minimum Token Rotation Time (in milliseconds).

`treq`

Lists the Requested Target Token Rotation Time (in milliseconds).

`tvx`

Lists the Valid transmission timer expiration (in microseconds)

`userdata`

Displays the user data (maximum of 32 characters).

**Example:**

```
list all
FDDI> list all
```

## Set

Use the **set** command to configure FDDI.

**Syntax:** set        ler  
                           pmf  
                           tmax  
                           tmin  
                           treq  
                           tvx  
                           userdata

ler port# type

Sets the alarm and cutoff values for port A and port B as follows:

**ler a alarm** Sets the alarm values for port A.

**ler a cutoff** Sets the cutoff values for port A.

**ler b alarm** Sets the alarm values for port B.

**ler b cutoff** Sets the cutoff values for port B.

**Valid values and defaults**

Alarm or Cutoff	Valid Values	Default
Alarm	4 to 15	8
Cutoff	4 to 15	7

pmf

Sets the PMF Password (maximum of 8 characters).

tmax

Sets the Maximum Token Rotation Time (in milliseconds) that this station can accept. Commonly referred to in FDDI specifications as T\_Max.

**Valid values:** 5 to 165 milliseconds

**Default:** 165 milliseconds

tmin

Sets the Minimum Token Rotation Time (in milliseconds) that this station can accept. If the negotiated TTRT is less than this value, then the adapter will not provide proper service to the layers above it. Commonly referred to in FDDI specifications as T\_Min.

**Valid values:** 5 to 165 milliseconds

**Default:** 5 milliseconds

treq

Sets the Requested Target Token Rotation Time (in milliseconds) that this station will bid during initialization. Commonly referred to in FDDI specifications as T\_Req.

**Valid values:** 5 to 165 milliseconds

**Default:** 165 milliseconds

tvx

Sets the Valid transmission timer expiration (in microseconds). This timer is reset every time a valid frame or nonrestricted token is seen by the station. If



the timer expires, it indicates that traffic is not circulating properly on the ring and therefore the claim process is started. Commonly referred to in FDDI specifications as TVX.

**Valid values:** 2500 to 10 000 microseconds

**Default:** 2500 microseconds.

userdata

Sets the User data (maximum of 32 characters).

## Exit

Use the **exit** command to return to the previous prompt level.

**Syntax:**     `exit`

**Example:**   `exit`

---

## Accessing the FDDI Console Process

You can access FDDI configuration from Talk 5 by entering the **network** command to access the FDDI interface as shown in the following example:

```
800+ network ?
0 :CHARM ATM Adapter
1 :ATM Token Ring LAN Emulation: elan1
2 :SK-NET FDDI
```

```
800 + network 2
FDDI Interface
FDDI+
```

This will get you to the FDDI+ prompt.

When you are finished, enter **Exit** to return to the previous prompt level.

---

## FDDI Console Commands

The console commands for FDDI are:

```
? (Help)
List
Exit
```

### ? (Help)

Use the **? (help)** command to list the commands that are available from the current prompt level. You can also enter a ? after a specific command name to list its options.

**Syntax:**     ?

**Example:**   ?

```
list
exit
```

## Monitoring FDDI

### List

Use the **list** command to display the current FDDI configuration parameters.

**Example:**

```
FDDI+ list
MAC Address: 00:00:5A:00:00:01
```

### Exit

Use the **exit** command to return to the previous prompt level.

**Syntax:** exit

**Example:** **exit**

---

## Chapter 14. Using and Configuring Quality of Service (QoS)

This chapter describes how to configure the Quality of Service (QoS) feature in the device.

---

### Quality of Service Overview

The QoS feature leverages the benefits of ATM QoS capabilities for LAN Emulation Data Direct VCCs. This support is referred to as “Configurable QoS for LAN Emulation.” The key attributes and the benefits of this feature are as follows:

- An LE Client makes use of configured QoS parameters for its Data Direct VCCs.
- QoS parameters can be configured for:
  - LE Client
  - Emulated LAN
  - ATM Interface
- The set of QoS parameters configured are for use with ATM Forum UNI 3.0/3.1 signaling. The parameters include the desired Peak Cell Rate, Sustained Cell Rate, QoS Class and Maximum Burst Size.
- Maximum Reserved Bandwidth per VCC can be configured to protect an LE Client from accepting/establishing VCCs whose traffic parameters it cannot support.
- The QoS Negotiation mechanism enables the participating LE Clients to be aware of each other’s QoS parameters. A data-direct VCC is set up using the negotiated parameters.

### Benefits of QoS

- Using QoS for the LE Client, ATM Interface, or Emulated LAN provides the following benefits for LANE Data Direct VCCs.
  - An LE Client can be configured with QoS if the QoS required by the client is different from the QoS required by other clients on the ELAN. For example, if an LE Client serves a file server, then the user may want to configure appropriate QoS parameters for all traffic to and from the file server.
  - An Emulated LAN can be configured with QoS if the user wishes to provide QoS for all traffic in that ELAN. For example, an ELAN carrying SNA traffic can be given priority by configuring QoS parameters for that ELAN.
  - An ATM Interface can be configured with QoS if a user wants all LE Clients on that ATM interface to use the same set of parameters. For example, if an ATM Interface is connected at 25 Mbps, the user can configure appropriate parameters that are different from those at a 155-Mbps interface.

### QoS Configuration Parameters

This section describes nine parameters that are used for QoS configuration. The following six parameters can be configured for an LE Client, ATM Interface, and an Emulated LAN:

1. max-reserved-bandwidth
2. traffic-type
3. peak-cell-rate
4. sustained-cell-rate
5. max-burst-size
6. qos-class

The following two parameters can be configured for an Emulated LAN and an LE Client:

1. validate-pcr-of-best-effort-vccs
2. negotiate-qos

The following parameter can be configured only for an LE Client:

accept-qos-parms-from-lecs

The first six parameters control the traffic characteristics of Data Direct VCCs established by the LE Client while the first parameter also applies to the calls received by the LE Client. The following characteristics are associated with all the Data Direct VCCs established by the LE Client:

- Bandwidth is not reserved for best-effort traffic,
- Traffic parameters apply to both forward and backward directions,
- When a reserved bandwidth connection is rejected due to the traffic parameters or QoS Class, the call is retried as a best-effort connection with the configured peak cell rate (cause codes on release or release-complete messages are used to determine why a VCC was released).
- When a best-effort connection is rejected due to the Peak Cell Rate (PCR), the call may be automatically retried with a lower PCR. Retries are performed under the following conditions:
  1. If the rejected PCR is greater than 100 Mbps, the call is retried with a PCR of 100 Mbps.
  2. Otherwise, if the rejected PCR is greater than 25 Mbps, the call is retried with a PCR of 25 Mbps.

#### **Maximum Reserved Bandwidth (max-reserved-bandwidth)**

The maximum reserved bandwidth acceptable for a Data Direct VCC. This parameter applies to both Data Direct VCC calls received by the LE Client and Data Direct VCC calls placed by the LE Client. For incoming calls, this parameter defines the maximum acceptable SCR for a Data Direct VCC. If SCR is not specified on the incoming call, then this parameter defines the maximum acceptable PCR for a Data Direct VCC with reserved bandwidth.

Calls received with traffic parameters specifying higher rates will be released. If SCR is specified on the incoming call, the call will not be rejected due to the PCR or Maximum Burst Size. The constraint imposed by this parameter is not applicable to BEST\_EFFORT connections. For outgoing calls, this parameter sets an upper bound on the amount of reserved bandwidth that can be requested for a Data Direct VCC. Therefore the traffic-type and sustained-cell-rate parameters are dependent upon this parameter.

**Valid Values:** Integer in the range 0 to the line speed of ATM device in Kbps  
**Default Value:** 0

### Traffic Type (traffic-type)

The desired traffic type for Data Direct VCCs. If QoS parameters are not negotiated, then this parameter specifies the type of calls placed by the LE Client. Otherwise, if QoS parameters are negotiated, this parameter specifies the desired type of traffic characteristics for Data Direct VCCs. When QoS parameters are negotiated, if either the source or target LEC desires a reserved bandwidth connection and both LECs support reserved bandwidth connections (that is, max-reserved-bandwidth > 0), then an attempt will be made to establish a reserved bandwidth Data Direct VCC between the two LECs. Otherwise, the Data Direct VCC will be a best-effort connection. Dependencies: max-reserved-bandwidth

**Valid Values:** BEST\_EFFORT or RESERVED\_BANDWIDTH  
**Default:** BEST EFFORT.

### Peak Cell Rate (peak-cell-rate)

The desired peak cell rate for Data Direct VCCs. If QoS parameters are not negotiated, then this parameter specifies the PCR traffic parameter for Data Direct VCC calls placed by the LE Client. Otherwise, if QoS parameters are negotiated, this parameter specifies the desired PCR traffic parameter for Data Direct VCCs. The minimum of the desired PCRs of the two LECs is used for negotiated best-effort VCCs.

When a reserved bandwidth VCC is negotiated and only one of the LE Clients requests a reserved bandwidth connection, then the desired PCR of that LEC is used for the Data Direct VCC subject to the upper bound imposed by the line rate of the local ATM device. If both LECs request a reserved bandwidth connection, then the maximum of the desired PCRs of the LE Clients is used for the Data Direct VCC subject to the upper bound imposed the line rate of the local ATM device.

**Valid Values:** An integer value in the range 0 to the line speed of ATM device in Kbps  
**Default Value:** Line speed of LEC ATM Device in Kbps.

### Sustained Cell Rate (sustained-cell-rate)

The desired sustained cell rate for Data Direct VCCs. If QoS parameters are not negotiated, then this parameter specifies the SCR traffic parameter for Data Direct VCC calls placed by the LE Client. Otherwise, if QoS parameters are negotiated, this parameter specifies the desired SCR traffic parameter for Data Direct VCCs.

When a reserved bandwidth VCC is negotiated and only one of the LE Clients requests a reserved bandwidth connection, then the desired SCR of that LEC is used for the Data Direct VCC (subject to the upper bound imposed by the max-reserved-bandwidth parameter of the other LEC). If both LECs request a reserved

## Using and Configuring Quality of Service (QoS)

bandwidth connection, then the maximum of the desired SCRs of the LE Clients is used for the Data Direct VCC (subject to the upper bound imposed by the max-reserved-bandwidth parameters of both LECs). In any case (negotiation or not), if the SCR that is to be signaled equals the PCR that is to be signaled, then the call is signaled with PCR only.

Dependencies: max-reserved-bandwidth, traffic-type and peak-cell-rate. This parameter is applicable only when traffic-type is RESERVED\_BANDWIDTH.

**Valid Values:** An integer value in the range 0 to the minimum of max-reserved-bandwidth and peak-cell-rate, specified in Kbps

**Default Value** None

### Maximum Burst Size (max-burst-size)

The desired maximum burst size for Data Direct VCCs. If QoS parameters are not negotiated, then this parameter specifies the Maximum Burst Size traffic parameter for Data Direct VCC calls placed by the LE Client. Otherwise, if QoS parameters are negotiated, this parameter specifies the desired Maximum Burst Size traffic parameter for Data Direct VCCs.

When a reserved bandwidth VCC is negotiated and only one of the LE Clients requests a reserved bandwidth connection, then the desired Maximum Burst Size of that LEC is used for the Data Direct VCC. If both LECs request a reserved bandwidth connection, then the maximum of the desired Maximum Burst Sizes of the LE Clients is used for the Data Direct VCC.

In any case (negotiation or not), the Maximum Burst Size is signaled only when SCR is signaled. Although this parameter is expressed in units of cells, it is configured as an integer multiple of the Maximum Data Frame Size (specified in LEC's C3 parameter) with a lower bound of 1.

Dependencies: This parameter is applicable only when traffic-type is RESERVED\_BANDWIDTH.

**Valid Values:** An integer number of frames; must be greater than 0

**Default:** 1 frame

### QoS Class (qos-class)

The desired QoS class for reserved bandwidth calls. If QoS parameters are not negotiated, then this parameter specifies the QoS Class to be used for reserved bandwidth Data Direct VCC calls placed by the LE Client. Otherwise, if QoS parameters are negotiated, this parameter specifies the QoS Class that is desired for Data Direct VCCs. Unspecified QoS Class is always used on best-effort calls. Specified QoS Classes define objective values for ATM performance. Specified QoS Classes define objective values for ATM performance parameters such as cell loss ratio and cell transfer delay.

The UNI Specification states that:

*Specified QoS Class 1* should yield performance comparable to current digital private line performance.

*Specified QoS Class 2* is intended for packetized video and audio in teleconferencing and multimedia applications.

- Specified QoS Class 3* is intended for interoperation of connection oriented protocols, such as frame relay.
- Specified QoS Class 4* is intended for interoperation of connectionless protocols, such as IP or SMDS.

LECs must be able to accept calls with any of the above QoS Classes. When QoS parameters are negotiated, the configured QoS Classes of the two LECs are compared, and the QoS Class with the more stringent requirements is used.

- Valid Values:** 0: for Unspecified QoS Class  
1: for Specified QoS Class 1  
2: for Specified QoS Class 2  
3: for Specified QoS Class 3  
4: for Specified QoS Class 4
- Default Value:** 0 (Unspecified QoS Class)

### **Validate PCR of Best-Effort VCCs (validate-pcr-of-best-effort-vccs)**

To validate Peak Cell Rate of Best-Effort VCCs. When FALSE, best-effort VCCs will be accepted without regard to the signaled forward PCR. When TRUE, best-effort VCCs will be rejected if the signaled forward PCR exceeds the line rate of the LE Client ATM device. Calls will not be rejected due to the backward PCR. The signaled backward PCR will be honored if it does not exceed the line rate; otherwise, transmissions to the caller will be at line rate.

#### **Notes:**

1. Accepting best-effort VCCs with forward PCRs that exceed the line rate can result in poor performance due to excessive retransmissions; however, rejecting these VCCs can result in interoperability problems.
2. The YES setting is useful when callers will retry with a lower PCR following call rejection due to unavailable cell rate.

- Valid Values:** YES,NO  
**Default Value:** NO

### **Negotiate QoS (negotiate-qos)**

Enable QoS parameter negotiation for Data Direct VCCs. This parameter should be enabled only when connecting to an IBM MSS LES. When this parameter is YES, the LE Client will include an IBM Traffic Parameter TLV in LE\_JOIN\_REQUEST and LE\_ARP\_RESPONSE frames sent to the LES. This TLV will include the values of max-reserved-bandwidth, traffic-type, peak-cell-rate, sustained-cell-rate, max-burst-size and qos-class. An IBM Traffic Parameter TLV may also be included in a LE\_ARP\_RESPONSE returned to the LE Client by the LES.

If there is no TLV in a LE\_ARP\_RESPONSE received by the LE Client, then the local configuration parameters must be used to setup the Data Direct VCC. If a TLV is included in a LE\_ARP\_RESPONSE, the LE Client must compare the contents of the TLV with the corresponding local values to determine the “negotiated” or “best” set of parameters acceptable to both parties before signalling for the Data Direct VCC.

- Valid Values:** YES,NO

**Default Value:** NO

### Accept QoS Params from LECS (accept-qos-params-from-lecs)

This parameter gives the ability to configure an LE Client to accept/reject QoS parameters from a LECS. When this parameter is YES, the LE Client should use the QoS parameters obtained from the LE Clients in the LE\_CONFIGURE\_RESPONSE frames, that is, the QoS parameters from the LE Clients override the locally configured QoS parameters. If this parameter is NO then the LE Client will ignore any QoS parameters received in an LE\_CONFIGURE\_RESPONSE frame from the LE Clients.

**Valid Values:** YES,NO

**Default Value:** YES

---

## Accessing the QoS Configuration Prompt

Use the **feature** command from the CONFIG process to access the Quality of Service configuration commands. Enter **feature** followed by the feature number (6) or short name (QOS). For example:

```
Config> feature qos
Configurable Quality of Service for LAN Emulation
QoS Config>
```

Once you access the QoS Config> prompt, you can configure the Quality of Service (QoS) of an LE Client, an Emulated LAN, or an ATM Interface. To return to the Config> prompt at any time, enter the **exit** command at the QoS Config> prompt.

Alternatively, you can configure QoS parameters for an LE Client, an Emulated LAN, or an ATM Interface by accessing the entities as follows:

- LE Client
  1. At the Config> prompt, enter the **network** command and the LE Client interface number.
  2. At the LE Client configuration> prompt enter **qos-configuration**.

#### Example:

```
config> network 3
Token Ring Forum Compliant LEC Config> qos-configuration
elan-x LEC QoS Config>
```

- ATM Interface
  1. at the Config> prompt, enter the **network** command and the ATM interface number to get you to the ATM Config> prompt.
  2. Enter the **interface** parameter to get to the ATM Interface Config> prompt.
  3. At the ATM InterfaceConfig> prompt enter **qos-configuration**.

#### Example:

```
config> network 0
ATM Config> interface
ATM Interface Config> qos-configuration
ATM-I/F 0 QoS>
```

- Emulated LAN



1. At the Config> prompt, enter the **network** command and the ATM interface number to get to the ATM Config> prompt.
2. Enter **le-service** to get to the LE Services config> prompt.
3. Enter **lecs** to get to the LECS config> prompt.
4. At the LECS config> prompt enter **elans** to get to the LECS ELANS configuration> prompt.
5. Select an ELAN by entering **select elan elan-x**, where *elan-x* is the ELAN you wish to configure. This will get you to the Selected ELAN '.elan-x'> prompt.
6. At the Selected ELAN 'elan-x'> prompt, QoS parameters can be configured as TLVs. See “Detailed Configuration of an ELAN at the LECS” on page 21-19 for more information.

**Example:**

```

config> network 0
ATM Config> le-services
LE Services config> lecs
LECS config> elans
LECS ELANS config> select elan elan-x
Selected ELAN 'elan-x'>

```

---

## Quality of Service Commands

This section summarizes and explains the QoS configuration commands. Use the following commands to configure Quality of Service. Enter the commands from the QoS Config> prompt.

<i>Table 14-1. Quality of Service (QoS) Configuration Command Summary</i>	
Command	Function
? (Help)	Displays all the QoS configuration commands.
LE-CLIENT	Gets you to the LE Client QoS configuration > prompt for the selected LE client.
ATM-INTERFACE	Gets you to the ATM Interface QoS configuration> prompt for the selected ATM interface.
ELAN (at LECS)	Gets you to the ELAN QoS configuration> prompt at LECS for configuring QoS parameters.
Exit	Exits the QoS configuration process.

---

## LE Client QoS Configuration Commands

This section summarizes and explains the commands for configuring QoS for a specific LE Client.

Use the following commands at the LEC QoS config> prompt.

## Using and Configuring Quality of Service (QoS)

Command	Function
? (Help)	Displays all the LE Client QoS configuration commands, or displays the parameters associated with specific commands.
List	Lists the current QoS configuration of the LE Client.
Set	Sets the QoS parameters of the LE Client.
Remove	Removes the QoS configuration of the LE Client.
Exit	Returns to the previous prompt level.

### ? (Help)

Use the **? (help)** command to list the commands that are available from the current prompt level. You can also enter a ? after a specific command name to list its options.

**Syntax:** ?

**Example:** ?

```
list
set
remove
exit
```

### List

Use the **list** command to list the QoS configuration of this LE Client. QoS parameters are listed only if at least one has been specifically configured (see Example 1). Otherwise, no parameters are listed (see Example 2).

**Syntax:** list

**Example 1:**

```
LEC QoS Config> list
```

```
LE Client QoS Configuration for Data Direct VCCs
=====
(ATM interface number = 0, LEC interface number = 3)
```

```
Maximum Reserved Bandwidth for a Data-Direct VCC = 10000 Kbps
Data-Direct VCC Type ..... = Best-Effort
Data-Direct VCC Peak Cell Rate ..... = 155000 Kbps
Data-Direct VCC Sustained Cell Rate ..... = 155000 Kbps
Desired QoS Class of Reserved Connections ..... = 0
Max Burst Size of Reserved Connections ..... = 0 frames
```

```
Validate Peak Rate of Best-Effort connections .. = No
Enable QoS Parameter Negotiation ..... = Yes
Accept QoS Parameters from LECS ..... = Yes
```

```
LEC QoS Config>
```

**Example 2:**

```
LEC QoS Config> list
```

```
QoS has not been configured for this LEC.
Please use the SET option to configure QoS.
```

```
LEC QoS Config>
```

## Set

Use the **set** command to specify LE Client QoS parameters.

**Syntax:** **set** all-default-values  
 max-reserved-bandwidth  
 traffic-type  
 peak-cell-rate  
 sustained-cell-rate  
 max-burst-size  
 qos-class  
 validate-pcr-of-best-effort-vccs  
 negotiate-qos  
 accept-qos-parms-from-lecs

### all-default-values

Use this option to set the QoS parameters to default values. In the following example the default values are also listed.

#### Example:

```
LEC QoS Config> set all-default-values
Failed to locate existing QoS configuration record!
Using a new set of default values ...
Initializing all parameters to default values
elan-x LEC QoS Config> list

      LE Client QoS Configuration for Data Direct VCCs
      =====
      (ATM interface number = 0, LEC interface number = 3)

      Maximum Reserved Bandwidth for a Data-Direct VCC = 0 Kbps
      Data-Direct VCC Type ..... = Best-Effort
      Data-Direct VCC Peak Cell Rate ..... = 155000 Kbps
      Data-Direct VCC Sustained Cell Rate ..... = 155000 Kbps
      Desired QoS Class of Reserved Connections ..... = 0
      Max Burst Size of Reserved Connections ..... = 0 frames

      Validate Peak Rate of Best-Effort connections .. = No
      Enable QoS Parameter Negotiation ..... = No
      Accept QoS Parameters from LECS ..... = Yes
```

```
LEC QoS Config>
```

### max-reserved-bandwidth

Use this option to set the maximum reserved bandwidth allowable per Data Direct VCC. See “Maximum Reserved Bandwidth (max-reserved-bandwidth)” on page 14-2 for a more detailed description of this parameter.

**Valid Values:** Integer in the range 0 to the line speed of ATM device in Kbps

**Default Value:** 0

#### Example:

```
LEC QoS Config> set max-reserved-bandwidth
Maximum reserved bandwidth acceptable for a data-direct VCC (in Kbps) [0]? 20000
LEC QoS Config>
```

## Using and Configuring Quality of Service (QoS)

### traffic-type

Sets the desired traffic for Data Direct VCCs. See “Traffic Type (traffic-type)” on page 14-3 for a more detailed description of this parameter.

**Valid Values:** BEST\_EFFORT or RESERVED\_BANDWIDTH

**Default:** BEST EFFORT.

### Example:

```
elan-x LEC QoS Config>set traffic-type
Choose from:
(0): Best-Effort
(1): Reserved-Bandwidth
Data Direct VCC Type [0]? 1
NOTE: Peak Cell Rate has been reset to 1
Sustained Cell Rate has been reset to 1
Max Reserved Bandwidth has been reset to 1
Please configure appropriate values.
elan-x LEC QoS Config>
```

### peak-cell-rate

Sets the desired peak cell rate for Data Direct. See “Peak Cell Rate (peak-cell-rate)” on page 14-3 for a more detailed description of this parameter.

**Valid Values:** An integer value in the range 0 to the line speed of ATM device in Kbps

**Default Value:** Line speed of LEC ATM Device in Kbps.

### Example:

```
elan-x LEC QoS Config> set peak-cell-rate
Data-Direct VCC Peak Cell Rate in Kbps [1]? 25000
elan-x LEC QoS Config>
```

### sustained-cell-rate

Sets the desired sustained cell rate for Data Direct VCCs. See “Sustained Cell Rate (sustained-cell-rate)” on page 14-3 for a more detailed description of this parameter.

**Valid Values:** An integer value in the range 0 to the minimum of max-reserved-bandwidth and peak-cell-rate, specified in Kbps

**Default Value** None

### Example:

```
elan-x LEC QoS Config> se sus
Data-Direct VCC Sustained Cell Rate in Kbps [1]? 10000
elan-x LEC QoS Config>
```

### max-burst-size

Sets the desired maximum burst size in frames. See “Maximum Burst Size (max-burst-size)” on page 14-4 for a more detailed description of this parameter.

**Valid Values:** An integer number of frames; must be greater than 0

**Default:** 1 frame

### Example:

```
elan-x LEC QoS Config> se ma
Maximum Burst Size in Kbps [1]? 10000
elan-x LEC QoS Config>
```

**qos-class**

Sets the desired QoS Class for Data Direct VCCs. See “QoS Class (qos-class)” on page 14-4 for a more detailed description of this parameter.

**Valid Values:** 0: for Unspecified QoS Class  
 1: for Specified QoS Class 1  
 2: for Specified QoS Class 2  
 3: for Specified QoS Class 3  
 4: for Specified QoS Class 4

**Default Value:** 0 (Unspecified QoS Class)

**Example:**

```
elan-x LEC QoS Config> se qos
Desired QoS Class for Data Direct VCCs [0]? 1
elan-x LEC QoS Config>
```

**validate-pcr-of-best-effort-vccs**

Use this option to enable/disable validation of the Peak Cell Rate traffic parameter of the Data Direct VCC calls received by this LE Client. See “Validate PCR of Best-Effort VCCs (validate-pcr-of-best-effort-vccs)” on page 14-5 for a more detailed description of this parameter.

**Valid Values:** YES,NO

**Default Value:** NO

**Example:**

```
elan-x LEC QoS Config> se val y
elan-x LEC QoS Config>
```

**negotiate-qos**

Use this option to enable/disable the LE Client's participation in QoS negotiation. See “Negotiate QoS (negotiate-qos)” on page 14-5 for a more detailed description of this parameter.

**Valid Values:** YES,NO

**Default Value:** NO

**Example:**

```
elan-x LEC QoS Config> se neg y
elan-x LEC QoS Config>
```

**accept-qos-parms-from-lecs**

Use this option to enable/disable the LE Client to accept/reject the QoS parameters received from an LECS as TLVs. See “Accept QoS Parms from LECS (accept-qos-parms-from-lecs)” on page 14-6 for a more detailed description of this parameter.

**Valid Values:** YES,NO

**Default Value:** YES

**Example:**

```
elan-x LEC QoS Config> se acc y
elan-x LEC QoS Config>
```

### Remove

Use the **remove** command to remove the QoS configuration of this LE Client.

**Syntax:**        **remove**

**Example:**

```
elan-x LEC QoS Config> remove
WARNING: This option deletes the QoS configuration.
        To re-configure use any of the SET options.
Should the LEC QoS configuration be deleted? [No]: yes
Deleted QoS configuration successfully
elan-x LEC QoS Config>
```

### Exit

Use the **exit** command to return to the previous prompt level.

**Syntax:**        **exit**

**Example 1:**

```
elan-x LEC QoS Config> exit
QoS Config>
```

**Example 2:**

```
elan-x LEC QoS Config> exit
Token Ring Forum Compliant LEC Config>
```

---

## ATM Interface QoS Configuration Commands

Command	Function
? (Help)	Displays all the ATM Interface QoS configuration commands, or displays the parameters associated with specific commands.
List	Lists the current ATM Interface QoS configuration.
Set	Sets the ATM Interface QoS parameters.
Remove	Removes the QoS configuration of the ATM Interface.
Exit	Returns to the previous prompt level.

### List

Use the **list** command to list the QoS configuration of this ATM Interface. QoS parameters are listed only if at least one parameter has been configured (see following example). Otherwise, no parameters are listed.

**Syntax:** **list**

**Example:**

```

ATM-I/F 0 QoS> list

      ATM Interface Quality of Service' Configuration
      =====
      (ATM interface number = 0 )

Maximum Reserved Bandwidth for a VCC = 15000 Kbps
VCC Type ..... = RESERVED-BANDWIDTH
Peak Cell Rate ..... = 20000 Kbps
Sustained Cell Rate ..... = 5000 Kbps
QoS Class ..... = 4
Maximum Burst Size ..... = 5 frames
ATM-I/F 0 QoS>

```

## Set

Use the **set** command to specify ATM Interface QoS parameters.

**Syntax:** **set** max-reserved-bandwidth  
traffic-type  
peak-cell-rate  
sustained-cell-rate  
max-burst-size  
qos-class

### max-reserved-bandwidth

Use this option to set the maximum reserved bandwidth allowable for each Data Direct VCC. See “Maximum Reserved Bandwidth (max-reserved-bandwidth)” on page 14-2 for a more detailed description of this parameter.

**Valid Values:** Integer in the range 0 to the line speed of ATM device in Kbps

**Default Value:** 0

#### Example:

```

ATM-I/F 0 QoS> se max-reserved-bandwidth
Maximum reserved bandwidth acceptable for a data-direct VCC (in Kbps) [0]?
15000
ATM-I/F 0 QoS>

```

### traffic-type

Sets the desired traffic for Data Direct VCCs. See “Traffic Type (traffic-type)” on page 14-3 for a more detailed description of this parameter.

**Valid Values:** BEST\_EFFORT or RESERVED\_BANDWIDTH

**Default:** BEST EFFORT.

#### Example:

```

ATM-I/F 0 QoS> set traffic-type
Choose from:
(0): Best-Effort
(1): Reserved Bandwidth
Traffic Type of VCCs [1]? 0
ATM-I/F 0 QoS>

```

### peak-cell-rate

Sets the desired peak cell rate for Data Direct VCCs. See “Peak Cell Rate (peak-cell-rate)” on page 14-3 for a more detailed description of this parameter.

## Using and Configuring Quality of Service (QoS)

**Valid Values:** An integer value in the range 0 to the line speed of ATM device in Kbps

**Default Value:** Line speed of LEC ATM Device in Kbps.

**Example:**

```
ATM-I/F 0 QoS Config> set peak-cell-rate
Data-Direct VCC Peak Cell Rate in Kbps [1]? 25000
ATM-I/F 0 QoS Config>
```

### sustained-cell-rate

Sets the desired sustained cell rate for Data Direct VCCs. See “Sustained Cell Rate (sustained-cell-rate)” on page 14-3 for a more detailed description of this parameter.

**Valid Values:** An integer value in the range 0 to the minimum of max-reserved-bandwidth and peak-cell-rate; specified in Kbps

**Default Value** None

**Example:**

```
ATM-I/F 0 QoS Config> se sus
Data-Direct VCC Sustained Cell Rate in Kbps [1]? 10000
ATM-I/F 0 QoS Config>
```

### max-burst-size

Sets the desired maximum burst size in frames. See “Maximum Burst Size (max-burst-size)” on page 14-4 for a more detailed description of this parameter.

**Valid Values:** An integer number of frames; must be greater than 0

**Default:** 1 frame

**Example:**

```
ATM-I/F 0 QoS Config> se ma
Maximum Burst Size in Kbps [1]? 10000
ATM-I/F 0 QoS Config>
```

### qos-class

Sets the desired QoS Class for Data Direct VCCs. See “QoS Class (qos-class)” on page 14-4 for a more detailed description of this parameter.

**Valid Values:** 0: for Unspecified QoS Class

1: for Specified QoS Class 1

2: for Specified QoS Class 2

3: for Specified QoS Class 3

4: for Specified QoS Class 4

**Default Value:** 0 (Unspecified QoS Class)

**Example:**

```
ATM-I/F 0 QoS Config> se qos
Desired QoS Class for Data Direct VCCs [0]? 1
ATM-I/F 0 QoS Config>
```



## Remove

Use the **remove** command to remove the QoS configuration of this ATM Interface.

**Syntax: remove Example:**

```
ATM-I/F 0 QoS> remove
WARNING: This option deletes the QoS configuration.
         To re-configure use any of the SET options.
Should the ATM Interface QoS configuration be deleted? [No]: yes
Deleted QoS SRAM record successfully
ATM-I/F 0 QoS>
```

## Exit

Use the **exit** command to return to the previous prompt level.

**Syntax: exit**

**Example 1:**

```
ATM-I/F 0 QoS> exit
QoS Config>
```

**Example 2:**

```
ATM-I/F 0 QoS> exit
ATM Interface Config>
```

## Using and Configuring Quality of Service (QoS)

---

## Chapter 15. Monitoring Quality of Service (QoS)

This chapter describes how to monitor Quality of Service (QoS) for LAN and ELAN interfaces in the router. It contains the following sections:

- “Accessing the QoS Console Commands”
- “Quality of Service Console Commands”
- “LE Client QoS Console Commands” on page 15-2

---

### Accessing the QoS Console Commands

Use the **feature** command from the GWCON process to access the Quality of Service console commands. Enter the **feature** followed by the feature number (6) or short name (QOS). For example:

```
+feature qos
Quality of Service (QoS) - User Console
QoS+
```

Once you access the QoS console prompt, you can select the console of a particular LE Client. To return to the GWCON prompt at any time, enter the exit command at the QoS console prompt.

Alternatively, you can access the QoS Console of an LE Client as follows:

1. At the GWCON prompt (+), enter the network command and the LE Client interface number.
2. At the LE Client console prompt enter **qos-information**.

#### Example:

```
+network 3
ATM Emulated LAN Console
LEC+qos information
LE Client QoS Console
LEC 3 QoS+
```

---

### Quality of Service Console Commands

This section summarizes and explains the QoS console commands. Enter these commands at the QoS+ prompt.

<i>Table 15-1. Quality of Service (QoS) Console Command Summary</i>	
Command	Function
? (Help)	Displays all the QoS console commands.
LE-CLIENT	Gets you to the LE Client QoS console + prompt for the selected LE client.
Exit	Exits the QoS console process.

### LE Client QoS Console Commands

This section summarizes and explains the LE Client QoS console commands. Enter the commands from the LEC num QoS+ prompt.

Command	Function
? (Help)	Displays all the LE Client QoS console commands or displays the options associated with specific commands.
List	Lists the current LE Client QoS information. Options include: configuration parameters, TLVs, VCCs, and statistics.
Exit	Returns to the previous prompt level.

#### ? (Help)

Use the ? (**help**) command to list the commands that are available from the current prompt level. You can also enter a ? after a specific command name to list its options.

**Syntax:** ?

**Example:** ?

```
list
exit
```

#### List

Use the list command to list the QoS related information of this LE Client.

**Syntax:** list configuration-parameters  
tlv-information  
vcc-information  
data-direct-VCCs (Detailed Information)  
statistics

##### *configuration-parameters*

Lists the QoS configuration parameters. Because parameters can be configured for an LE Client, ATM Interface or the ELAN, these parameters are displayed along with a resolved set of parameters that are used by the LE Client.

##### le-client

The parameters configured for this LE Client which are obtained from the SRAM records. If the SRAM records contain an invalid set of parameters then this column will not display any parameters values.

##### ATM Interface

The parameters configured for the ATM Interface used by this LE Client. These parameters are obtained from the local SRAM records. If the SRAM records contain an invalid set of parameters then this column will not display any parameter values.

##### From LECS

The parameters received by this LE Client from the LE Configuration Server. The parameters are received as individual TLVs in the LE\_CONFIGURE\_RESPONSE control message.

used

The resolved set of traffic parameters which are used by for its Data Direct VCCs. If none of the entities is configured with QoS parameters, then the USED parameters represent the default parameters. If parameters are configured for at least one entity, then they are resolved as follows:

- If only the LE Client or the ATM Interface is configured with parameters and either the accept-parms-from-lecs is FALSE or no parameters were received from the LECS, then the configured LE Client or the ATM Interface parameters are used.
- If both the LE Client and the ATM Interface have configured parameters, then the LE Client parameters are used.
- If the accept-parms-from-lecs is TRUE and parameters were received from the LECS, then the LE Client parameters (or the default if the LE Client is not configured) are combined with those received from the LECS to form a complete set of the first six QoS parameters described in “QoS Configuration Parameters” on page 14-2.
- If the set of the first six QoS parameters described in “QoS Configuration Parameters” on page 14-2 contains an invalid combination then the parameters from the LECS are rejected. Note that the two flags negotiate-qos and validate-pcr-of-best-effort-vccs are validated independently.

**Example:**

LEC 1 QoS+ list configuration parameters

ATM LEC Configured QoS Parameters				
QoS		LEC	ATM-IF	FROM
PARAMETER	USED	SRAM	SRAM	LECS
Max Reserved Bandwidth (cells/sec) :	23584	23584	0	none
(Kbits/sec) :	10000	10000	0	none
VCC Type .....	ResvBW	ResvBW	BstEft	0
Peak Cell Rate .....	18867	18867	365566	365566
(Kbits/sec) :	8000	8000	155000	155000
Sustained Cell Rate ...	18867	18867	365566	none
(Kbits/sec) :	8000	8000	155000	none
QoS Class .....	4	4	0	none
Max Burst Size .....	95	95	0	none
(frames) :	1	1	0	none
Validate PCR of Best-Effort VCCs . :	NO	NO	n/a	none
Enable QoS Negotiation .....	YES	YES	n/a	none
Accept QoS Parameters from LECS .. :	YES	YES	n/a	n/a

(BstEft = Best Effort, ResvBW = Reserved Bandwidth)  
(n/a = not applicable, none = no value is specified)

LEC 1 QoS+

*tlv-information*

Lists the IBM Traffic Information TLV that this LE Client registered with the LE Server. The TLV is registered only if the LE Client is participating in QoS Negotiation.

**Example:**

## Monitoring Quality of Service (QoS)

LEC 1 QoS+ list tlv

Traffic Info TLV of the LEC (registered with the LES)

```
=====
TLV Type .....= 268458498
TLV Length .....= 24
TLV Value:
  Maximum Reserved Bandwidth = 23584 cells/sec (10 Mbps)
  Data Direct VCC Type..... = RESERVED BANDWIDTH VCC
  Data Direct VCC PCR..... = 18867 cells/sec (8 Mbps)
  Data Direct VCC SCR..... = 18867 cells/sec (8 Mbps)
  Data Direct VCC QoS Class = 4
  Maximum Burst Size       = 95 cells (1 frames)
```

LEC 1 QoS+

### vcc-information

Lists all active VCCs of the LE Client. The information includes the traffic parameters of the connections. For BEST-EFFORT connections, the Sustained Cell Rate is displayed to be the same as the Peak Cell Rate, QoS Class and the Maximum Burst Size are displayed as 0.

The Parameter Descriptor entries are:

SrcParms Parameters of a connection established by this LE Client.

DestParms Parameters of a connection received by this LE Client.

NegoParms Parameters of a connection established by the LE Client for which the QoS Negotiation was used.

RetryParms Parameters of a connection established by this LE Client after failing at least once.

### Example:

LEC 1 QoS+ li vcc

LEC VCC Table  
=====

Conn Index	Conn Handle	VPI	VCI	Conn Type	Status	VCC Type	PCR (kbps)	SCR (kbps)	QoS Class	Burst Size (cells)	Parameters Descriptor
2)	69	0	535	Cntrl	Ready	BstEft	155000	155000	0	0	SrcParms
3)	71	0	537	Cntrl	Ready	BstEft	0	0	0	0	DestParms
4)	72	0	538	Mcast	Ready	BstEft	155000	155000	0	0	SrcParms
5)	74	0	540	Mcast	Ready	BstEft	0	0	0	0	DestParms
6)	78	0	544	Data	Ready	ResvBW	25000	7000	1	95	DestParms

LEC 1 QoS+

### data-direct-vccs (Detailed Information)

This option lists the Data Direct VCC information of this LE Client. Similar information is also listed using **list vcc-information**.

### Example:

### LEC 1 QoS+ list data direct vccs

```
LEC Data Direct VCCs - QoS Information
=====
```

```
Conn Handle = 80, VPI = 0, VCI = 546
  Connection Type = RETRIED CONNECTION PARAMETERS
  TrafficType    = BEST EFFORT VCC
  PCR            = 58962 (25 Mbps)
  SCR            = 58962 (25 Mbps)
  QoS Class      = 0
  Max Burst Size = 0

Conn Handle = 78, VPI = 0, VCI = 544
  Connection Type = PARAMETERS SET BY DESTINATION
  TrafficType    = RESERVED BANDWIDTH VCC
  PCR            = 58962 (25 Mbps)
  SCR            = 16509 (7 Mbps)
  QoS Class      = 1
  Max Burst Size = 95
```

### LEC 1 QoS+

#### *statistics*

Counters are maintained for the following statistics:

#### Successful QoS Connections

Number of RESERVED-BANDWIDTH connections established by the LE Client.

#### Successful Best-Effort Connections

Number of BEST-EFFORT connections established by the LE Client.

#### Failed QoS Connections

Number of RESERVED-BANDWIDTH connection requests made by the LE Client that failed.

#### Failed Best-Effort Connections

Number of BEST-EFFORT connection requests made by the LE Client that failed.

#### QoS Negotiation Applied

Number of times the QoS negotiation extension was applied. Parameters are negotiated if the LE Client receives the destination LE Client's parameters in an LE\_ARP\_RESPONSE control message.

#### PCR Proposal (IBM) Applied

Number of times the IBM Peak Cell Rate Proposal was applied. This proposal recommends using specific rate parameters if signaling at 100 Mbps or 155 Mbps for BEST-EFFORT connections. This allows other participating IBM products (for example, 25-Mbps ATM adapters) to reject a connection based on the signaled peak cell rates.

#### QoS Connections Accepted

Number of RESERVED-BANDWIDTH connections accepted by this LE Client.

#### Best-Effort Connections Accepted

Number of BEST-EFFORT connections accepted by this LE Client.

#### QoS Connections Rejected

Number of RESERVED-BANDWIDTH connection requests received by this LE Client that were rejected.

#### Best-Effort Connections Rejected

Number of BEST-EFFORT connection requests received by this LE Client that were rejected.

## Monitoring Quality of Service (QoS)

Rejected due to PCR Validation

Number of BEST-EFFORT connections rejected by the LE Client due to validation of Peak Cell Rate when the `validate-pcr-of-best-effort-vccs` parameter is TRUE.

### Example:

```
LEC 1 QoS+ li stat
```

```
QoS Statistics: of Data Direct Calls Placed by the LEC
```

```
-----  
Successful QoS Connections           = 0  
Successful Best-Effort Connections   = 1  
Failed QoS Connections               = 1  
Failed Best-Effort Connections       = 1  
QoS Negotiation Applied              = 0  
PCR Proposal (IBM) Applied           = 0
```

```
QoS Statistics: of Data Direct Calls Received by the LEC
```

```
-----  
QoS Connections Accepted             = 1  
Best-Effort Connections Accepted     = 0  
QoS Connections Rejected             = 0  
Best-Effort Connections Rejected     = 0  
Rejected due to PCR Validation        = 0
```

```
LEC 1 QoS+
```

## Exit

Use the **exit** command to return to the previous prompt level.

**Syntax:**        **exit**

### Example:

```
LEC 1 QoS+ exit  
QoS+
```



---

## Part 2. ATM and LAN Emulation



---

## Chapter 16. Overview of LAN Emulation

**Note:** See the glossary for definitions of the acronyms and terms used in this chapter.

The server implements the *LAN Emulation Over ATM: Version 1.0 Specification* which is widely accepted as the industry standard for multivendor multiprotocol interoperability. This chapter introduces basic LAN emulation (LE) concepts in the context of the MSS implementation. It begins by examining the motivation for installing emulated LANs (ELANs).

---

### LAN Emulation Benefits

LAN emulation protocols allow ATM networks to provide the appearance of Ethernet and token-ring LANs. Although LAN emulation does not exploit all of the benefits of ATM, it is useful in migrating to ATM technology and lowering network management costs. It enables you to utilize high-speed ATM links and still protect your software and hardware investments.

Software investments are protected because application interfaces are unchanged (LAN emulation is implemented within the data link control layer, which is below the device driver interface of end stations). Hardware investments are protected with forwarding engines that bridge LAN and ATM networks so that existing adapters and wiring can continue to be used.

LAN emulation allows incremental installation of ATM adapters in stations with high-bandwidth requirements, for example, servers and engineering or multimedia workstations. Physical and logical views of a simple LAN emulation example are illustrated in 16-1.

## Simple LAN Emulation Network

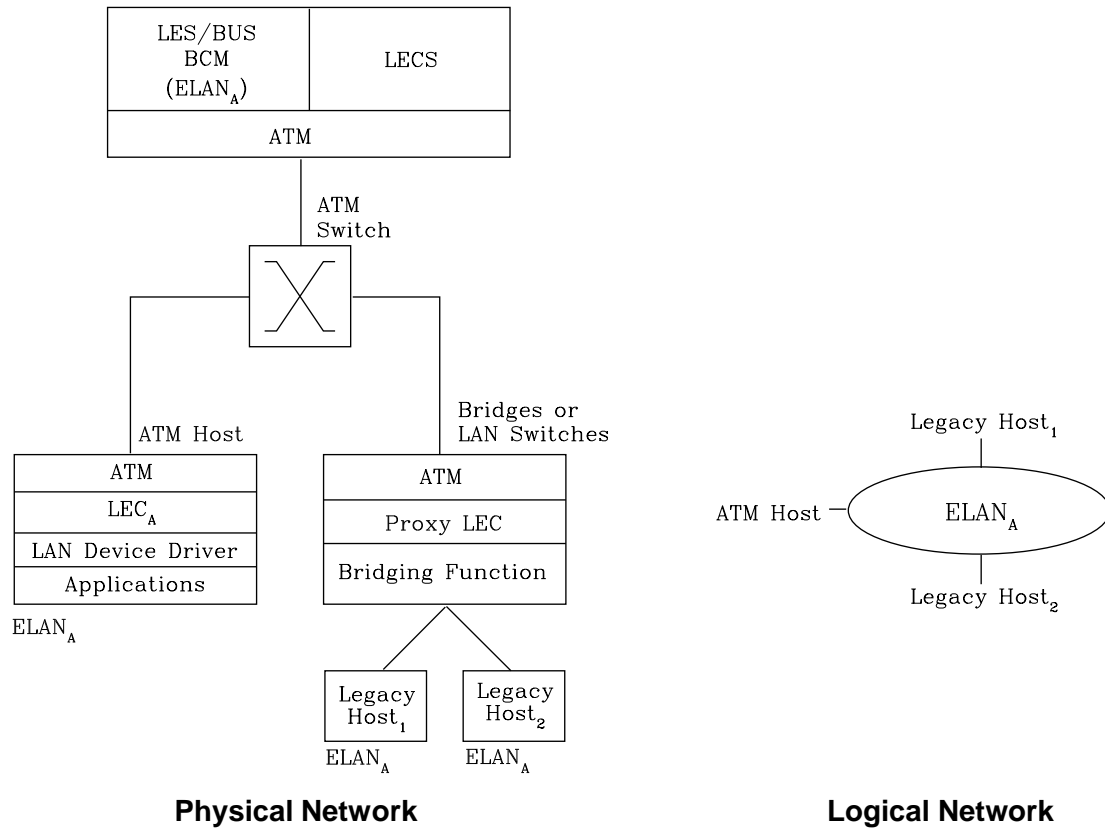


Figure 16-1. Physical and Logical Views of a Simple LAN Emulation Network

The network management benefits of emulated LANs (ELANs) come from increased flexibility in handling moves, adds, and changes. Membership in an ELAN is not based on physical location; instead, logically-related stations are grouped to form an ELAN (stations can also be members of multiple ELANs).

As long as ELAN memberships are retained, no reconfiguration is needed when stations move to new physical locations. Similarly, no wiring modifications are needed to move stations from one ELAN to another.

---

## LAN Emulation Components

The following components implement an ELAN:

### LAN emulation (LE) clients (LECs)

LAN emulation components that represent users of the Emulated LAN.

### LE configuration server (LECS)

A LAN emulation service component that centralizes and disseminates configuration data.

### LE server (LES)

A LAN emulation service component that resolves LAN destinations to ATM addresses.

**Broadcast and Unknown Server (BUS)**

A LAN emulation service component responsible for the delivery of multicast and unknown unicast frames.

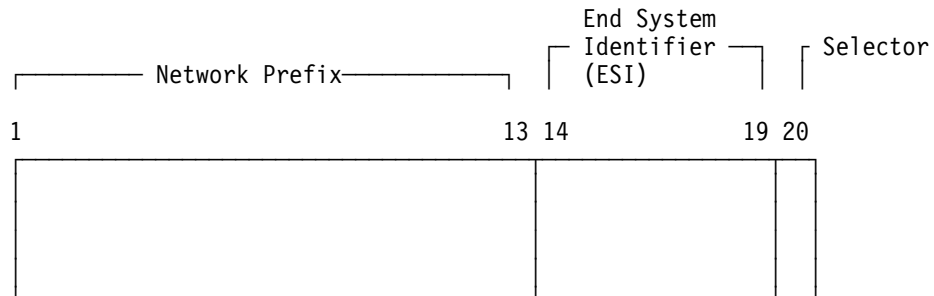
The LES, BUS, and LECS are collectively referred to as the LE service components. Each ELAN has a dedicated LES and BUS. LE clients reside in end systems, either in ATM-attached hosts or in bridges or LAN switches. The bridges or LAN switches represent hosts that are connected to Ethernet or token-ring LANs. LE clients provide a MAC-level service to higher level software. Either Ethernet IEEE 802.3 or IEEE 802.5 token-ring LANs can be emulated, but all stations on an ELAN must be of the same type.

The function that bridges between token-ring or Ethernet LAN segments and ELANs is called a Proxy LEC. To emulate a LAN, LE clients request services from the LECS, LES, and BUS. The following sections briefly review ATM addressing and pertinent Interim Local Management Interface (ILMI) functions. You need to understand these concepts before you can understand how the LE components function in the network.

---

**Addressing in ATM**

ATM uses 20-byte hierarchical addressing:



The first 13 octets of an ATM address are the Network Prefix. Each switch in your ATM network must have a unique Network Prefix. ATM switches use the Network Prefix to route VCC setup requests the destination ATM switch. End systems, like this router, retrieve their Network Prefix from their ATM switch when they activate.

Octets 14–19 of an ATM address are the End System Identifier (ESI). Each end system attached to the same switch must use a disjoint set of ESIs. When an end system activates, it attempts to register its ESIs with its ATM switch using the Interim Local Management Interface (ILMI).

The ILMI defines a set of SNMP-based procedures used to manage the interface between an end system and an ATM switch. End systems use ILMI to:

- Obtain the network prefix from the switch
- Register their ESIs with the switch
- Dynamically determine the UNI version of the ATM switch
- LECs may get a list of LECS addresses from the switch

The switch forces all of its registered ESIs to be unique.

Octet 20 of an ATM address is the selector.

## Overview of LAN Emulation

End stations obtain their Network Prefix from the switch and form their own addresses by appending an ESI and selector. These addresses must then be registered with the switch, which rejects the registration if the ATM address is not unique.

## ESI

Each ATM interface on the router has a universally administered, or burned-in, MAC address. You can use the MAC address as an ESI for some or all of the router's ATM addresses. Alternatively, you can define up to 64 locally administered ESIs on each interface. If every end system uses its universally administered MAC address as its ESI, then ATM addresses are guaranteed to be unique. This eases the configuration burden. However, using locally administered ESIs can ease problem determination. You can use any combination of universal or locally administered ESIs.

One way to obtain a unique ATM address is to use a burned-in IEEE MAC address as the ESI and to locally choose a unique selector. By default, the router uses the MAC address of the ATM interface as the ESI in its ATM addresses. Additional ESIs can be configured on each ATM interface.

Each ESI can have up to 255 associated selectors (0x00 through 0xff). The range of selectors is partitioned into two subranges, a configured selector range and an automatically assigned selector range. The ATM interface parameter `max-configured-selector` gives the upper bound on the configured selector range.

The ATM components on the router have various ways of choosing a selector. Some components require you to explicitly configure a selector from the configured selector range. LES/BUSs are an example of such a component. Other components, such as Classical IP clients, allow the selector to be automatically assigned at run-time. You do not have to choose the selector because the router does this when it activates. This selector is not guaranteed to be consistent across router restarts. Automatic selector assignment is useful only for those ATM components whose ATM address does not have to be already known by other network devices.

You must configure ATM before you configure emulated LANs, bridging or routing.

---

## ATM Addresses of LAN Emulation Components

In general, ATM addresses must be unique among LAN emulation components. The only exception is that a LES and BUS serving the same ELAN can share an ATM address, as is the case on the server.

LAN emulation components are configured for a particular ATM interface. You can decide to use the burned-in MAC address as the ESI portion of the ATM address of the component or you can select one of the locally-administered ESIs that have been defined for the ATM interface. Multiple LE components can share the same ESI if they have unique selectors. By default, the configuration interface assigns each LE component a unique selector value for the configured ESI; however, you can override this assignment and explicitly configure a particular selector value.

An ATM interface parameter determines the number of selectors per ESI reserved for explicit assignment. The remainder are available for dynamic assignment by the ATM interface at run-time. LE components use only the selectors reserved for

explicit assignment; by default, 200 of the 256 possible selectors per ESI are reserved for explicit assignment. Run-time selector assignment is beneficial when you do not need to control the assigned selector, for example, when you are configuring clients in Classical IP that are not paired with an ARP server.

While ATM addresses must be unique among LE components, LE components can use the same ATM addresses as non-LE components, such as Classical IP servers.

---

### Overview of Related ILMI Functions

ILMI defines a set of SNMP-based procedures used to manage the user-network interface (UNI) between an ATM end system and an ATM switch. The following three ILMI functions are particularly relevant to LAN emulation:

1. ATM address registration, which is described in “Addressing in ATM” on page 16-3
2. Dynamic determination of the signaling version being run at the switch
3. Acquisition of the LECS ATM addresses

As mentioned in “Addressing in ATM” on page 16-3, ATM address registration is a joint effort between ATM end systems and switches. ATM addresses must be registered with the switch before calls can be placed or received.

By default, the ATM interfaces of a server use ILMI procedures to query the switch MIB in an attempt to determine the signaling version (UNI 3.0 or 3.1) being run at the switch. If the query succeeds, the ATM interface runs the same UNI version as the switch; if the query fails, the ATM interface runs UNI 3.0. Alternatively, you can override the default and explicitly configure the UNI version that will run on the ATM interface.

### Manual Configuration of the Signaling Version

You need to configure the signaling version manually if the ATM switch runs UNI 3.1 and has no UNI Version MIB variable. In this case, the ATM interface cannot dynamically determine the UNI version. Because the ATM interface in the server uses UNI 3.0 by default, you should manually configure the ATM interface to use UNI 3.1.

### Locating the LECS Using ILMI

ILMI is the method of choice for locating the LECS. The ILMI MIB at the ATM switch includes a list of LECS ATM addresses that can be retrieved by LE clients. This method is useful because the LECS ATM addresses need only be configured at ATM switches, not at LE clients, and there are fewer switches than LE clients. Clients attempt to connect to the first LECS on this list. If the connection fails, they try the next LECS address in succession until a connection is established.

---

### Overview of the LECS Function

LE clients are not required to use the LECS, although it is recommended. If the LECS is not used, each LE client must be configured with the ATM address of the LES that serves its ELAN. The LECS reduces the network management burden by serving as a centralized repository for configuration data, minimizing configuration of the LE clients.

## Overview of LAN Emulation

**Note:** At most, one LECS is configurable on each server.

Clients connect to the LECS using well-defined procedures. The following steps are attempted by a client, in order, until a virtual channel connection (VCC) to the LECS is established:

1. Connect to the LECS using any configured LECS address information (configuration of an LECS ATM address at LE clients is optional and is **not** recommended).
2. Obtain a list of LECS addresses using ILMI and attempt to connect to each LECS on the list, in order, until a VCC is established.
3. Establish a VCC to the well-known LECS ATM address as defined by the ATM Forum.

As previously stated, ILMI is the preferred method for LE clients to locate the LECS. The well-known LECS address is needed because some switches do not support the ILMI method. Configuring the LECS address at the LE clients should be done **only** when the switch does not support the ILMI method and the LE service does not support the well-known LECS address.

The server and the IBM ATM switch support all three methods: the pre-configured LECS address, ILMI connection, and the well-known LECS ATM address.

The LECS must provide initial configuration data to LE clients. The most crucial piece of data is the ATM address of the LECS. To provide this information to an LE client, the LECS must be able to identify the LE client and to determine the correct LECS for that LE client. The LECS identifies an LE client using information in the LE\_CONFIGURATION\_REQUEST frame sent by the LE client. The configuration request can also contain information to identify the ELAN that the LE client is seeking to join. The following information can be included in the configuration request:

1. Primary ATM address of the LE client  
This field is required and uniquely identifies the LE client.
2. LAN destination associated with the LE client  
This field can contain a MAC address or a route descriptor that uniquely identifies the LE client or it can be unspecified.
3. ELAN Name  
This field can contain a name identifying the requested ELAN or the requesting LE client. In the server implementation, ELAN names are standard ASCII strings. The ELAN name can be unspecified in the request.
4. ELAN Type  
This field can specify that the LE client belongs to an Ethernet or token-ring ELAN, or it can be unspecified. If the LE client specifies the type of ELAN, the LECS cannot assign the client to an ELAN of a different type.
5. Maximum frame size supported by the LE client  
This field can specify the upper bound on the size of a data frame that can be processed by the LE client, or it can be unspecified. The LECS cannot assign a client to an ELAN with a maximum frame size **larger** than that specified by the



client. If the ELAN allows frames too large for the client to handle, the client cannot function on that ELAN.

Given this information, the LECS assigns the LE client to a LES. This is accomplished through the use of policies and policy values. A policy is a criterion that the LECS uses to make LE client-to-LES assignment decisions. A policy value is a (value, LES) pair that indicates that the specified value should be assigned to the specified LES. For example, a policy could be the MAC address of the LE client, and a policy value could be (MAC\_ADDR\_A, LES\_1). An LE client with MAC\_ADDR\_A will be assigned to LES\_1 if the LE client has not already been assigned to another LES because of a higher-priority policy. One set of policies and policy values applies to all the ELANs.

In accordance with the LE service MIB Specification of the ATM forum, these are the six policies defined:

1. ATM address
2. MAC address
3. Route descriptor
4. ELAN type
5. Max frame size
6. ELAN name

Policies also have priorities. The LECS examines policies in prioritized order. Policies with smaller values in the priority field are considered before policies with larger values in the priority field. Policies with equal values in the priority field are considered at the same time and *ANDed* together.

The LECS assigns an LE client to a LES when all of the policies at the current priority level are satisfied and in agreement. The policies are satisfied when there is a policy value that matches the corresponding field in the configuration request for each policy at the current level. The policies are in agreement when the set of matches include a LES that is common to all the policies. If these conditions are not met, the LECS considers the policies at the next priority level. If the LECS is unable to find a LES at any priority level, an unsuccessful configuration response is returned to the LE client.

To understand the meaning of agreement of the policies, consider this example of policies not in agreement. Suppose that the policies at priority 1 are a MAC address and an ELAN name. One of the policy values is (X'400000121225', LES\_A) and one is (ELAN 1, LES\_B). If the LE client provides a LAN destination of X'400000121225', the MAC address policy is satisfied. If the LE client provides an ELAN name of *ELAN 1*, then the ELAN name policy is also satisfied. In this case the policies at priority 1 are **not** in agreement because they refer to different LESs. In this example, the LECS would examine the policies at the next priority level.

After determining the correct LES for an LE client, the LECS returns a configuration response to the LE client that includes the following information: LES ATM address, ELAN type, max frame size, and ELAN name. The configuration response can also include type/length/value (TLV) parameters. TLVs provide a method to download optional or user-defined parameters to the LE client.



This setup requires configuring the LE clients with the correct ELAN Name.

- Use names for the LE clients

Each LE client can be given its own name. For example, you could create the policy values (Joe, LES\_A) and (Mary, LES\_A). Then, the LE clients configured with these names would be directed to the same LES. This method requires configuring the ELAN name at each LE client and at the LECS. However, it allows Joe and Mary to move the client to a new location. Even though moving causes the client to have a new ATM address or MAC address, as long as you configure the new LE client with the same ELAN name, you retain membership in the original ELAN. This technique also offers a moderate amount of security if the names of each LE client are considered to be passwords.

### ELAN Type Policy

ELAN type policy values are most useful for providing default ELANs. For example, the following policy values would ensure that every LE client is assigned to one of the LESs:

```
(Token-ring ELAN Type,  LES_A)
(Ethernet ELAN Type,    LES_B)
(Unspecified ELAN Type, LES_C)
```

In general, policies used for providing default ELAN assignments should be given a low priority, so that the more specific policies are considered first.

### Max Frame Size Policy

The max frame size policy can also be used to provide default ELAN assignments.

### Duplicate Policy Values

Duplicates occur when the same policy value is associated with multiple LESs for a given policy. Duplicate policy values are allowed for the ELAN type and max frame size policies, but are not allowed for other policies. Duplicate values are useful only when combined with a different policy of the same priority.

For example, assume that there are three ELANs: an Ethernet ELAN with a max frame size of 4544 bytes, a token-ring ELAN with a max frame size of 4544 bytes, and another token-ring ELAN with a max frame size of 18190 bytes. LE clients could be assigned to the appropriate ELAN by setting the ELAN type and max frame size policies to the same priority level and defining the following policy values:

```
(Ethernet ELAN Type,    LES_1)    (Max Frame Size = 4544,  LES_1)
(Token-Ring ELAN Type,  LES_2)    (Max Frame Size = 4544,  LES_2)
(Token-Ring ELAN Type,  LES_2)    (Max Frame Size = 18190, LES_2)
```

## More Information About TLVs

TLVs are defined on an ELAN basis; therefore, the same set of TLVs is returned to all LE clients that are assigned to a particular ELAN. When a TLV is included in a configuration response, the LE client *must* use the value specified in the TLV as an operating parameter (if the LE client recognizes the ELAN type). A few examples of situations where TLVs might be beneficial are as follows:

- When ELANs are spread over large geographic locations, the default timeout values for LE clients may be insufficient. These timeouts can be controlled for all LE clients by specifying their value in a TLV at the LECS.

## Overview of LAN Emulation

- By default, ELANs use best-effort connections to connect to the BUS. For ELANs where BUS traffic is heavy, better performance can be obtained by using reserved bandwidth connections to the BUS. The characteristics of the Multicast Send VCC between the LE client and the BUS can be controlled with TLVs.
- A TLV can be used to download the ELAN segment number to source route bridges.

In addition to fine-tuning the configuration, TLVs force all clients on the ELAN to operate with consistent parameters. The server supports all ATM Forum-defined TLVs along with arbitrary, user-defined TLVs.

---

## Connecting to the LES

After obtaining the ATM address of the LES, the LE client initiates a Control Direct VCC to the LES. When this VCC has been established, the LE client sends an LE\_JOIN\_REQUEST to the LES. The LES responds by adding the LE client to the appropriate point-to-multipoint Control Distribute VCC and returning an LE\_JOIN\_RESPONSE. By default, the LES partitions proxy and non-proxy clients onto separate Control Distribute VCCs as illustrated in Figure 16-2; however, you can configure the LES to use a single Control Distribute VCC for all LE clients in order to reduce the number of point-to-multipoint VCCs that are required. Partitioning the VCCs is generally useful because it reduces the amount of nuisance traffic that is sent to non-proxy clients. No LE\_ARP\_REQUESTs are sent to non-proxy LE clients, as described in “Address Resolution” on page 16-11.

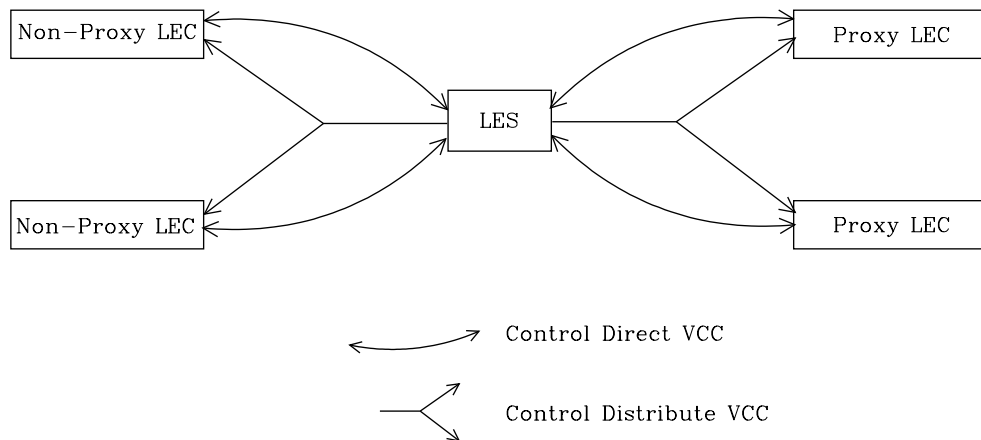


Figure 16-2. Default Connections Between LE Clients and the LES

The following ATM connections are established between the LE client and the LES:

**Control Direct VCC (bidirectional point-to-point)**

From LE client to LES

**Control Distribute VCC (point-to-multipoint)**

From LES to LE client

---

## Address Registration

LE clients register LAN destinations with the LES to ensure uniqueness and to allow the LES to answer LE\_ARP\_REQUESTs, which LE clients issue to learn the ATM address associated with a particular LAN destination. Registrations include the LAN destination and the ATM address that the LE client associates with the LAN destination. A LAN destination can be either a MAC address or a route descriptor.

Proxy LE clients do not register the MAC addresses of stations on LAN segments that they are bridging to the ELAN. On the other hand, non-proxy LE clients must register all the LAN destinations that they represent. All route descriptors must be registered, regardless of whether they are associated with a proxy or a non-proxy LE client. Route descriptors are applicable only to proxy LECs that are performing source route bridging. A route descriptor contains the bridge number of the proxy LE client and the segment number of a ring that the LE client is bridging to that is equivalent to one hop away.

---

## Address Resolution

LAN communications are based upon source and destination MAC addresses. To enable such communication on an ATM network, MAC addresses must be resolved to ATM addresses. An LE client sends an LE\_ARP\_REQUEST to the LES to learn the ATM address of a particular LAN destination. If the LAN destination is registered, the LES responds with the ATM address associated with the LAN destination. Otherwise, the request is forwarded to all proxy LE clients on the Control Distribute VCC. There is no need to forward the request to non-proxy LECs because all of their LAN destinations are registered; however, if the LES is configured to use a single Control Distribute VCC, both proxy and non-proxy LE clients will receive the request. Control Distribute VCCs provide an efficient way for the LES to distribute control frames to multiple LE clients.

Proxy LE clients respond to LE\_ARP\_REQUESTs for unregistered MAC addresses that they represent. The LE\_ARP\_RESPONSE is sent to the LES on the Control Direct VCC, and the LES forwards the response to the LE client that issued the request.

---

## Connecting to the BUS

After connecting to the LES, an LE client issues an LE\_ARP\_REQUEST for the all 1s broadcast MAC address. The LES responds with the ATM address of the BUS. The LE client then initiates the establishment of a Multicast Send VCC to the BUS. The BUS responds by adding the LE client to the appropriate point-to-multipoint Multicast Forward VCC. By default, the BUS partitions proxy and non-proxy clients onto separate Multicast Forward VCCs; however, as was the case with the Control Distribute VCC, you can configure the BUS to use a single Multicast Forward VCC for all LE clients. Figure 16-3 on page 16-12 shows partitioned Multicast Forward VCCs.

## Overview of LAN Emulation

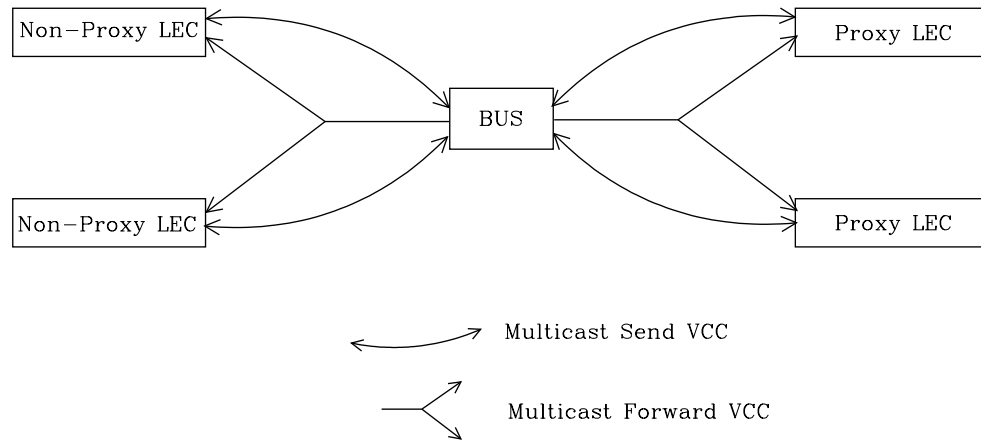


Figure 16-3. Default Connection Between LE Clients (LECs) and BUS

This list is provided to help you clarify the ATM connections that are established between the LE client and the BUS:

**Multicast Send VCC (bidirectional point-to-point)**

From LE client to BUS

**Multicast Forward VCC (point-to-multipoint)**

From BUS to LE client

---

## BUS Functions

The BUS has two basic functions:

1. Distribute multicast frames to all the LE clients in the ELAN
2. Forward unicast frames to the appropriate destinations

An LE client sends unicast frames to the BUS if it does not have a direct connection to the LE client that represents the destination. To avoid creating a bottleneck at the BUS, the rate at which an LE client can send unicast frames to the BUS is limited.

In the server implementation, the BUS has two modes of operation: partitioning the unicast frame domain and not partitioning the unicast frame domain. If you partition the unicast frame domain, the BUS uses two Multicast Forward VCCs. Otherwise, the BUS uses a single Multicast Forward VCC.

If a single Multicast Forward VCC is used, the BUS operation is very simple; all received frames are simply forwarded to all LE clients. If two Multicast Forward VCCs are used, the BUS will not broadcast unicast frames to all LE clients; instead, unicast frames destined for non-proxy LE clients will be transmitted directly to the destination LE client on a Multicast Send VCC, and all other unicast frames will be transmitted only to proxy LE clients, using the Proxy Multicast Forward VCC. When two multicast VCCs are used, the server is considered to be in intelligent BUS (IBUS) mode.

IBUS mode reduces nuisance unicast frames, which are unicast frames not destined for the client; proxy clients do not receive unicast frames destined for non-proxy clients, and non-proxy clients never receive nuisance unicast frames. Network bandwidth devoted to nuisance frames is also reduced. On the other hand,

BUS processing requirements are increased and multicast frames must be transmitted twice (once on each Multicast Forward VCC). In general, IBUS operation is recommended; however, this option should be disabled in configurations that have source route bridges that join the ELAN as non-proxies.

---

## Establishing Data Direct VCCs

Data Direct VCCs connect two LE clients, and are used to exchange unicast frames without involving the BUS. The LE client uses the address resolution procedures to determine the ATM address associated with the required LAN destination. If the LE client already has a Data Direct VCC to the ATM address (perhaps for another LAN destination represented by the target LE client), unicast data frames are subsequently transmitted on the existing VCC; otherwise, the LE client invokes the signaling protocol to establish a new VCC.

The LE client maintains an LE\_ARP cache containing LAN destination-to-ATM address mappings. Entries in this cache are aged and must be periodically refreshed. The entries are refreshed when a data frame is received from the LAN destination. The LE client also attempts to refresh entries in the absence of data traffic.

Utilization of Data Direct VCCs is also monitored and the VCCs are released if there is no traffic for the VCC time-out period, which is configurable. Additionally, Data Direct VCCs are released in a least-recently used manner when establishment of a new Data Direct VCC fails due to insufficient resource availability.

---

## Overview of server Extensions for LAN Emulation

IBM has made value-add extensions to ATM Forum LAN Emulation available on the server. These extensions offer improved performance, reliability, security, and manageability:

### **Broadcast Manager (BCM)**

This function can improve overall network performance by reducing ELAN broadcasts.

### **Redundancy**

The redundancy mechanism improves reliability by allowing backup servers to take over if failures occur at primary servers.

### **Security**

Security is improved by letting the LECS control ELAN memberships.

### **BUS Monitor**

This function enhances manageability by identifying the top users of the BUS.

The following sections describe each of these extensions.

---

## Broadcast Manager

Broadcast Manager (BCM) is an extension to LAN emulation that consists of IBM enhancement of the LAN emulation BUS. Without BCM, the following events occur:

- A multicast frame sent to the BUS is forwarded to all LE clients on the ELAN.

## Overview of LAN Emulation

- LE clients that include the proxy function to provide bridging support forward the broadcast frame on to other LAN segments.
- All end stations receive and process every broadcast frame.

BCM can be enabled on individual ELANs for any of these protocols:

IP  
IPX  
NetBIOS

When BCM is enabled, a minimal amount of layer 2 and layer 3 information is decoded for specific types of broadcast frames sent to the BUS. Whenever possible, BCM transforms broadcast frames into unicast frames, and sends them only to interested LE clients and end stations. BCM reduces both network traffic and associated end-station overhead by filtering nuisance broadcast frames. These functions can improve overall system performance and enable practical deployment of larger ELANs.

### BCM Support for IP

When enabled for IP, BCM scans all IP ARP requests and replies to learn the location of IP addresses in the IP subnet that contains this ELAN. The objective is for BCM to take each broadcast ARP request frame and forward it as a unicast frame directly to the LE client representing the target IP station. Both network traffic and end-station processing time are reduced when the request is forwarded directly to the appropriate LE client on the Multicast Send VCC instead of being broadcast to all LE clients on the Multicast Forward VCCs. When the destination station is located behind a bridge function, the LAN that the destination station belongs to also benefits from the reduced broadcast traffic.

### BCM Support for IPX

For IPX, BCM limits the scope of advertisement broadcasts. IPX routers and servers periodically broadcast their known network and service information. Generally, these broadcasts, called Routing Information Protocol (RIP) and Service Advertising Protocol (SAP) general response packets, need to be received only by other IPX routers and servers.

When it is enabled for IPX, BCM dynamically identifies the set of IPX routers and servers based on advertisement transmissions, and only forwards RIP and SAP advertisements to other IPX routers and servers.

With BCM enabled, any quiet device (that is, a device that does not transmit IPX advertisements) that needs to receive IPX advertisements has to be configured as a static target. An example of such a device is a station running software that discovers the IPX network topology by monitoring IPX advertisements.

### BCM Support for NetBIOS

NetBIOS is considered to be a broadcast-abusive protocol and therefore an excellent candidate for BCM. NetBIOS communication is based on names. Transmitting stations can learn the MAC address associated with a particular destination name by broadcasting a query or by having the frame multicasted to the NetBIOS functional address. In the latter case, every NetBIOS device in the network must receive the frame and determine whether the destination name on the frame applies to itself. To make things even worse, NetBIOS devices tend to repeat trans-



mission of certain types of frames as much as 10 times. Historically, this was to ensure that all devices receive the frame in cases where the network is heavily congested.

The BCM strategy is to associate unique NetBIOS names with MAC addresses and LE clients by learning names from NetBIOS frames sent to the BUS. After a unique NetBIOS name is learned, subsequent NetBIOS broadcast frames destined for that name are forwarded to a single LE client as a unicast frame. BCM also filters certain NetBIOS frames that are broadcast repeatedly.

### BCM Support for Source Route Bridging

Source Route Management (SRM) is an additional BCM feature that can be configured for 802.5 ELANs. When enabled, this feature will further process frames managed by BCM IP or BCM NetBIOS and, whenever possible, transform All Routes Explorer (ARE) or Spanning Tree Explorer (STE) frames into Specifically Routed Frames (SRF). Once a frame is transformed into an SRF, the frame no longer needs to be transmitted onto each ring in the bridged network.

The token-ring topology behind each LE client is learned by recording the routing information field (RIF) of frames received by the BUS. Because SRM dynamically learns token-ring topology information, an aging mechanism is used to remove information that has not been refreshed recently.

To decide whether to enable BCM or SRM (or both), you should compare the net system-wide benefit with the inevitable reduction in the rate at which packets are forwarded when BCM or SRM is enabled.

**Note:** Broadcast Manager and Source Route Management are unavailable and cannot be enabled if **bus-mode** is set to *adapter*.

### LAN Emulation Reliability

A perceived lack of robustness has been one of the most widely proclaimed criticisms of LAN emulation. While the ATM Forum is addressing this issue with specifications for distributing the LE service, the server offers an answer in the interim. Figure 16-4 provides a framework for describing the MSS redundancy solution. See the chapter entitled "Configuring"

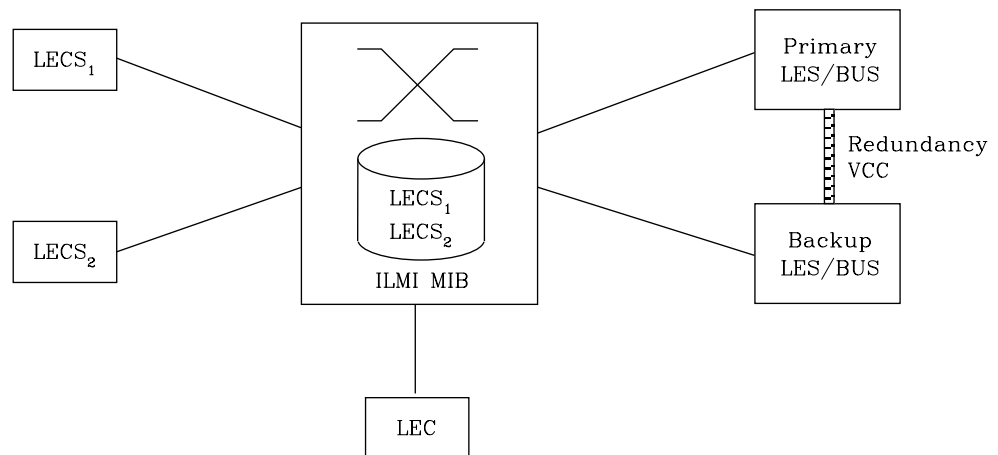


Figure 16-4. LAN Emulation Redundancy

## Overview of LAN Emulation

Each LES/BUS may be independently configured for redundancy (the default is no redundancy). If redundancy is enabled, the LES/BUS is configured to assume the role of a primary or a backup LES/BUS. Unless it has been configured as a redundant LES/BUS, the LES/BUS is primary. The primary LES/BUS is typically the only LES/BUS visible to the LE clients. It is responsible for setting up and maintaining a Redundancy VCC to the backup LES. The presence of this VCC indicates that the primary LES/BUS is operational. The backup LES will not accept Control Direct VCC calls while the Redundancy VCC is established. However, if the Redundancy VCC is *not* present, the backup LES/BUS services ELAN requests in the usual manner.

For the redundancy protocol to be effective, LE clients must detect the failure of the primary LES/BUS and connect to the backup. LE clients detect server failures by means of released VCCs. Connection to the backup LES/BUS is accomplished through the LECS.

Upon receiving an LE\_CONFIGURE\_REQUEST, the LECS assigns the LE client to the appropriate LES and ELAN. If this LES has no configured backup, then the LECS returns the ATM address of the LES. If the LES is configured with a backup LES, then the LECS returns either the primary or backup LES address.

The LECS returns the backup LES address if the backup LES exists on the same MSS Server as the LECS and is currently serving the ELAN, if the primary LES exists on the same MSS Server as the LECS and it is not currently serving the ELAN, or if neither LES exists on the same MSS Server as the LECS and the client was last assigned to the primary LES (within the past 5 minutes). Otherwise, it returns the primary LES address to the LE client.

The LECS retains a short-term memory of all client assignments so that it can alternately direct an LE client to a primary and backup LES. This simple heuristic makes the correct assignment in the nominal case of no failure and is self-correcting. At worst, the heuristic causes the LE client to repeat the configuration phase of joining an ELAN.

LECS robustness can be achieved by establishing duplicate LECSs on multiple platforms and including their ATM addresses in the ILMI database. LE clients will then connect to the backup LECS if the primary is unavailable. For example, LECS 1 and the backup LES/BUS in Figure 16-4 on page 16-15 could be on MSS Server 1, while LECS 2 and the primary LES/BUS could be on MSS Server 2.

Additionally, note that servers need not be dedicated to backup functions, because a single server can host backup LES/BUSs for some ELANs and primary LES/BUSs for other ELANs.

---

## LAN Emulation Security

Traditional LANs offer security in the sense that a physical connection implies that two stations are on the same LAN. Because multiple emulated LANs can exist on a single ATM network, stations that are not on the ELAN can be physically connected to stations that are on the ELAN. This situation presents a security risk in that unauthorized stations can connect to the LES and attempt to use its services.

To control ELAN membership, an MSS LES can be configured to validate LE\_JOIN\_REQUESTs with the LECS. In this mode the LES forms an

LE\_CONFIGURE\_REQUEST on behalf of the LE client using information from the LE\_JOIN\_REQUEST. These LE\_CONFIGURE\_REQUESTs include the source LAN destination, source ATM address, ELAN type, max frame size, and ELAN name from the LE\_JOIN\_REQUEST, along with an IBM Security TLV. The security requests are transmitted to the LECS by a multiplexing component called the LECS interface, and the LECS must validate the requests using its ELAN assignment database before LE clients are allowed to join the ELAN.

A LECS interface is associated with an ATM interface, and all LESs configured on the ATM interface use the same LECS interface. The LECS interface conserves VCC resources by multiplexing security requests from multiple LESs onto a single VCC to the LECS. The LECS interface locates the LECS dynamically using the ILMI and well-known LECS address mechanisms. After the VCC to the LECS is established, the LECS interface issues a local query to determine whether the LECS is located on the same server. If the LECS is located on the same server, a local interface is used to confirm requests to join without transmitting requests onto the ATM network.

To maximize the security of an ELAN, the following steps are recommended:

1. At the LECS, use ATM addresses to assign clients to the LES. See “Overview of the LECS Function” on page 16-5 for more information.
2. Activate the LECS Interface on the server.
3. Activate the security option of the LESs.
4. Use *Address Screening* at the ATM switches. This option causes switches to validate that calling stations use their actual ATM addresses in the call setup. Thus, stations cannot impersonate other stations.

These steps ensure that stations are correctly identified and that only authorized stations join the ELAN.

---

## BUS Monitor

The BUS Monitor provides a way to pinpoint end users who may be over-utilizing the BUS. When enabled, the BUS Monitor periodically samples the traffic sent to the BUS on a particular ELAN. At the end of each sample interval, the BUS Monitor identifies the top users of the BUS by their source MAC addresses, LE client ATM addresses, and the number of sampled frames each of them has sent to the BUS. You can configure the following parameters for the BUS monitor:

- The number of MAC addresses (hosts) to record as top users
- The number of seconds in each sample interval
- The sample rate. The sample rate consists of the fraction of all the frames received that the sample consists of, for example, 1 out of every 100 frames, 1 out of every 10 frames, or every frame.
- The number of minutes between sample intervals

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### SuperELAN

SuperELAN is essentially the precursor to LAN Emulation Network to Network (LNNI) specification currently being addressed by the ATM Forum LAN Emulation standards committee. SuperELAN provides distributed LE services for version 1.0 emulated LANs.

A SuperELAN is a collection of emulated LANs. A client on any of the SuperELAN member emulated LANs can set up a data direct VCC to any other client on the SuperELAN. In essence, a SuperELAN emulates a standard ELAN, distributing the LE services among the member ELANs. The reliability and performance of the LE services increases with the number of ELANs. Resource utilization becomes less centralized, allowing a SuperELAN to be much larger than a standard ELAN.

Distributing LE services is accomplished by logically linking together individual ELANs. When ELANs are linked together in a SuperELAN, certain LAN Emulation control frames (such as LE ARP requests and LE ARP responses) and data frames are forwarded between the member ELANs. By forwarding certain LE control frames, clients are able to locate a target client on another ELAN and establish a data direct VCC to it.

Data Direct VCCs between ELANs also utilize the switched fabric of the ATM network. Although each LE server still exhibits a concentration of utilization, no single LE server serves the entire SuperELAN, and network utilization is distributed among the constituent LE servers. Thus, SuperELAN LE Services can serve larger numbers of clients.

Because a SuperELAN is made up of multiple ELANs, reliability is improved. If one LE server fails, other LE servers within the SuperELAN are not affected. Only the inter-ELAN data-direct VCCs to clients in the failed ELAN are affected. In addition, clients that were joined to the failed ELAN can be configured to join one of the other SuperELAN LE services by requesting another LES address from the LECS.

The propagation of broadcast and unknown frames is a major concern within a SuperELAN network. Both types of frames are forwarded to every member ELAN except the ELAN from which the frames were received. This forwarding uses bandwidth on every segment of the network, and, in the case of broadcast frames, causes an interruption at every station.

A SuperELAN is equipped with two additional functions to combat the effects of these frames.

Bridging Broadcast Manager (BBCM) can transform many broadcast frames into unicast frames, thus lessening their effects on network performance. BBCM snoops on packets to learn bindings between layer 3 and layer 2 network addresses. Future broadcast packets to any learned layer 3 address can be transformed into unicast packets and forwarded by the bridge as any other unicast packet. If the transformed unicast address is in the bridge database, then the packet can be forwarded to its destination segment. The packet will not cause an interruption at every station, nor will it utilize bandwidth on every network segment.

Dynamic Protocol Filtering (DPF) also snoops on packets. It learns the different protocols being received on every bridge port. Packets for a particular protocol are not forwarded over ports that are not actively using that protocol. Although many

bridges permit filtering based on protocol, DPF performs this filtering automatically based on current traffic.

Refer to the chapter entitled “Bridging Features” in the *Multiprotocol Switched Services (MSS) Configuring Protocols and Features* for more information about BBCM and DPF.

SuperELAN, aided by Bridging Broadcast Manager and dynamic protocol filtering, combine to provide a reliable, distributed, emulated LAN with strong controls on the propagation of broadcast and unknown frames.

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## SuperELAN II

SuperELAN II is the enhanced successor to SuperELAN. SuperELAN II supports the following additional new functions:

- Source-Route ATM Token Ring Topologies
- Multiple SuperELANs in a single device
- Independent operation from existing ASRT bridging function

SuperELAN II is based on a source-route aware transparent LAN Emulation bridge technology. LAN Emulation control frames are bridged as described in “SuperELAN” on page 16-18, and data frames are bridged using the new SuperELAN II bridge path while the data direct VCC is being established. All data frames forwarded between ELANs in the SuperELAN use the transparent MAC and/or Route Descriptor cache to forward non-broadcast unicast traffic. All broadcast frames are treated like Spanning Tree Explorer frames and are forwarded onto every ELAN in SuperELAN Spanning Tree forwarding state.

Each SuperELAN maintains independent MAC, LE Control Frame, BBCM, VLAN, and Route Descriptor (Token Ring only) forwarding caches. Multiple SuperELANs can be bridged together using the ASRT bridging function (This is especially useful for interconnecting Ethernet and Token Ring SuperELANs using SR-TB).

Distributed SuperELANs can be constructed using multiple devices.

The existing SuperELAN support under the ASRT bridging function is still supported. Refer to the chapter entitled “Bridging Features” in the *Multiprotocol Switched Services (MSS) Configuring Protocols and Features* for more information.

BBCM, Dynamic Protocol Filtering VLANs, and MAC filters are all supported in SuperELAN II. Static bridging filters like SAP and or NetBIOS name filters, manual Spanning Tree port control, and IP Host bridge support are not currently supported.

SuperELAN users should review their current network configuration prior to migrating the MSS configuration to SuperELAN II to insure that SuperELAN II meets their network requirements. See “Migration to SuperELAN II” on page 17-13.

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## Key Configuration Parameters for LAN Emulation

This section briefly describes the required configuration parameters of the server LAN emulation components. The ATM interface for the LAN emulation components must be defined before the components can be created.

1. **LEC:**

## Overview of LAN Emulation

To create an LE client, you only need to specify the ELAN type. If you define two LE clients on a single ATM interface and bridge them together, then one of the LE clients must use a non-default MAC address. By default, LE clients use the burned-in MAC address of the ATM interface. The default maximum frame size is 1516 bytes for Ethernet LE clients and 4544 bytes for token-ring LE clients.

### 2. LES/BUS:

The required parameters for a LES/BUS are the ELAN name, the ELAN type, and the ESI (which you select from a list that includes the burned-in MAC address and any locally-administered values defined for the ATM interface). Defaults are supplied for other parameters.

The maximum frame size default is 1516 bytes for Ethernet ELANs and 4544 bytes for token-ring ELANs. LE clients will not be allowed to join the ELAN if their maximum frame size is less than the maximum frame size of the ELAN; LE clients that have a larger maximum frame size will be allowed to join the ELAN, but will use the maximum frame size of the ELAN as a result of join-time negotiation with the LES.

### 3. LECS:

At a minimum, you must select the LECS ESI and configure a default ELAN assignment policy. See "Overview of the LECS Function" on page 16-5 for more information.

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## Chapter 17. Using and Configuring ATM

This chapter describes how to configure the ATM interface. It includes the following sections:

- “ATM and LAN Emulation”
- “How to Enter Addresses”
- “ATM-LLC Multiplexing” on page 17-2
- “Accessing the ATM Interface Configuration Process” on page 17-2
- “ATM Configuration Commands” on page 17-3
- “ATM Interface Commands” on page 17-4
- “ATM Virtual Interface Concepts” on page 17-31
- “ATM Virtual Interface Configuration Commands” on page 17-33

---

### ATM and LAN Emulation

LAN emulation provides support for virtual Token-Ring and Ethernet LANs over an ATM network. Refer to “How to Enter Addresses” for a discussion of ATM addressing.

---

### How to Enter Addresses

Enter addresses in two ways, depending upon whether the address represents (1) an IP address, or (2) an ATM address, MAC address, or route descriptor, as follows:

1. IP address

Enter IP addresses in dotted decimal format, a 4-byte field represented by four decimal numbers (0 to 255) separated by periods (.).

**Example of IP Address:**

01.255.01.00

2. ATM or MAC address or route descriptor

Enter ATM addresses, MAC addresses, and route descriptors as strings of hexadecimal characters with or without optional separator characters between bytes. Valid separator characters are dashes (-), periods (.), or colons (:).

Examples of ATM address, MAC address or route descriptor

A1FF010203

or

A1-FF-01-02-03

or

A1.FF.01.02.03

or

39.84.0F.00.00.00.00.00.00.00.00.03.10.00.5A.00.DE.AD.08

or

A1:FF:01:02:03

or even

A1-FF.01:0203

Each type of address requires a different number of hexadecimal characters:

**ATM**        40

**MAC**        12

**ESI**        12

**Route descriptor** 4

## Accessing the ATM Interface Configuration Process

This information applies to addresses entered for ATM; LAN emulation; Classical IP and ARP over ATM; and IPX and ARP over ATM.

---

### ATM-LLC Multiplexing

Protocols that run natively over an ATM interface can use ATM-LLC multiplexing to share ATM addresses and both SVC and PVC channels between users. ATM-LLC is implicitly configured when the protocols are configured and can be monitored using the ATM Config+ command prompt from **t 5**. There are no explicit configuration options for the ATM-LLC multiplexing function. For example, if two protocols which use ATM-LLC multiplexing are configured to use the same local ATM address (local endpoint), this implicitly configures ATM-LLC to use the same shared ATM address for both protocols.

See “ATM-LLC Monitoring” on page 18-19 for additional information.

Sharing of ATM addresses or SVC/PVC channels is not possible between protocols that use the ATM-LLC multiplexing function and those that do not use the ATM-LLC multiplexing function (such as Classical IP). Currently, Server Cache Synchronization Protocol (SCSP) and APPN are the only two protocols that use the ATM-LLC multiplexing function.

---

## Accessing the ATM Interface Configuration Process

Use the following procedure to access the configuration process.

1. At the OPCON prompt, enter **talk 6**. (For more detail on this command, refer to Chapter 5, “The OPCON Process and Commands” on page 5-1.) For example:

```
* talk 6
Config>
```

The CONFIG prompt (Config>) displays on the console. If the prompt does not appear when you first enter configuration, press **Return** again.

2. At the CONFIG prompt, enter the **list devices** command to display the network interface numbers for which the router is currently configured.
3. Record the interface numbers. If ATM is not specified as an interface, then create an ATM interface by using the **add device** command at the Config> prompt.

If ATM is not specified as an interface, enter the **add device atm** command.

```
Config> add dev atm
Device Slot x(0-3) 0?
Adding CHARM ATM Adapter device in slot 0 port 1 as interface xx
(where x is the interface number assigned)
```

**Note:** You can define two ATM interfaces.

4. Enter the **network** command and the number of the ATM interface you want to configure. For example:

```
Config> network 0
ATM Config>
```

The ATM configuration prompt (ATM Config>), is displayed.



## ATM Configuration Commands

This section summarizes the ATM configuration commands. Enter the commands at the ATM config> prompt.

<i>Table 17-1. ATM Configuration Command Summary</i>	
Command	Function
? (Help)	Lists all of the ATM configuration commands, or lists the options associated with specific commands.
INTERFACE	Displays the ATM Interface Config> prompt from which you can list, change, or configure the ATM Interface. <ul style="list-style-type: none"> <li>• Add an ESI.</li> <li>• List the current configuration or list ESIs.</li> <li>• Remove an ESI.</li> <li>• Set parameters of the ATM network.</li> <li>• Enable or disable an ESI.</li> <li>• Exit</li> </ul>
LE-SERVICES	Displays the LE Services Config> prompt from which you can list, change, or configure LAN Emulation Services as described in Chapter 21, “Configuring LAN Emulation Services” on page 21-1 . <ul style="list-style-type: none"> <li>• LECS displays the LECS Config&gt; prompt from which you can configure a LAN Emulation Configuration Server.</li> <li>• LES-BUS displays the LES-BUS config for ELAN 'x'&gt; prompt from which you can configure a LAN Emulation Server — Broadcast and Unknown Server (LES-BUS).</li> <li>• List all LES-BUS names.</li> <li>• SECURITY (LES/LECS INTERFACE TO VALIDATE JOINS) displays the LECS Interface Config&gt; prompt from which you can list, change, or configure security between the LECS and LES-BUS pairs.</li> </ul>
SE-SERVICES	Displays the SE Services Config> prompt from which you can list, change, or configure SuperElan Services.
LE-CLIENT	Displays the LE Client Config> prompt from which you can list, change, or configure the LAN Emulation Client Interface as described in Chapter 19, “Using and Configuring LAN Emulation Clients” on page 19-1. <ul style="list-style-type: none"> <li>• Add a LAN Emulation Client (LEC) for a token-ring or Ethernet emulated LAN.</li> <li>• Configure a LEC by network #. This command displays the LE Config&gt; prompt, from which you can configure a specific LAN Emulation Client (LEC).</li> <li>• List LAN Emulation Clients (LECs).</li> <li>• Remove a LAN Emulation Client (LEC).</li> </ul>
VIRTUAL ATM	Displays the ATM Virtual Interface Config> prompt from which you can list, add, or remove the ATM Virtual Interface as described in “ATM Virtual Interface Configuration Commands” on page 17-33
Exit	Exit the ATM Configuration process and returns to the Config> prompt.

### ATM Interface Commands

This section summarizes and then explains the commands for configuring a specific ATM interface.

Enter the commands at the ATM INTERFACE> prompt.

<i>Table 17-2. ATM INTERFACE Configuration Command Summary</i>	
Command	Function
? (Help)	Lists all the ATM Interface configuration commands, or lists the options associated with specific commands.
Add	Adds an ESI.
List	Lists the current configuration or list ESIs.
Qos	Displays the ATM I/F 0 QoS Config> prompt from which you can configure Quality of Service as described in "QoS Configuration" on page 17-5.
Remove	Removes an ESI.
Set	Sets parameters of the ATM network.
Disable	Disables an ESI.
Enable	Enables an ESI.
Exit	Returns to the ATM Config> prompt.

### Add

Use the **add** command to add an ESI to your ATM configuration.

Octets 14–19 of an ATM address are the End System Identifier (ESI). Each end system attached to the same switch must use a disjoint set of ESIs. When an end system activates, it attempts to register its ESIs with its ATM switch using ILMI. The switch forces all of its registered ESIs to be unique.

**Syntax:** `add esi esi-address`

`esi esi-address`

Address of End System Identifier.

**Valid Values:** Any 12 hexadecimal digits

**Default Value:** none

ATM INTERFACE> `add esi 014617183763`

### List

Use the **list** command to list the configuration of this ATM device or to list the set of configured ESIs.

**Syntax:** `list configuration esi`

`configuration`

Lists the ATM device configuration. For an explanation of the listed fields, see "Set" on page 17-5.

**Example:** `list`

## ATM Configuration

```

Interface (net) number =    0
Maximum VCC data rate Mbps =    155
Maximum frame size = 9234
Maximum number of callers = 209
Maximum number of calls = 1024
Maximum number of parties to a multipoint call = 512
Maximum number of Selectors that can be configured = 200
UNI Version = UNI 3.0
Packet trace = OFF

```

## ESIs

Lists the ESIs in the ATM configuration.

**Example: list esi**

```
ATM INTERFACE> list esi
```

ESI	Enabled
000000000009	YES
0000000000100	YES

## QoS Configuration

Use the **qos-configuration** command to display the ATM I/F 0 QoS Config> prompt from which you can configure Quality of Service as described in “QoS Configuration.”

## Remove

Use the **remove** command to remove an ESI from your ATM configuration. All ATM components using this ESI should be reconfigured to use a different ESI. An ATM component that attempts to use a removed ESI may not activate on the next router restart.

**Syntax:** `remove esi esi-address`

`esi esi-address`

Address of End System Identifier.

**Valid Values:** Any 12 hexadecimal digits

**Default Value:** none

## Set

Use the **set** command to specify ATM network parameters.

**Syntax:** `set` `max-data-rate`  
`max-frame`  
`max-config-selectors`  
`max-calls`  
`max-callers`  
`max-mp-parties`  
`trace`  
`uni-version`  
`network-id`

## ATM Interface Commands

### max-data-rate

Sets the default and upper bound for VCC traffic parameters of most LANE and CIP connections. For example, this is the default PCR for best-effort VCCs initiated by LE Clients. Signaled SCRs and PCRs cannot exceed this limit. The default value should be satisfactory in most situations. An example of a situation where it is beneficial to change this value would be if the majority of the stations use 25-Mbps adapters. In this case, it may be desirable to limit the data rate on VCCs to 25 Mbps so that the lower speed stations are not overwhelmed with frames from the router. The units for this parameter are Mbps.

**Valid Values:** 25  
100  
155

**Default Value:** 155

#### Example:

```
ATM INTERFACE> set speed 155
```

### max-calls

Sets the maximum number of switched virtual circuits (SVCs) that can exist on this ATM device. Every point-to-point and point-to-multipoint SVC uses system resources. This parameter helps limit the system resources reserved for signaling and switched connections. Increasing this parameter will allow more simultaneous SVCs. However, more system memory will be required to manage these connections.

**Valid Values:** An integer in the range 64 – 10500  
**Default Value:** 1024

#### Example:

```
ATM INTERFACE> set max-calls 500
```

### max-callers

Sets the maximum number of entities on the router that use the ATM interface. Each LEC, LES/BUS, LECS, LECS Interface, Classical IP Client, and 1483 bridge interface qualifies as a user of the ATM interface. Increasing this parameter allows more users of the interface and uses more system memory.

**Valid Values:** An integer in the range 64 – 1024  
**Default Value:** 209

#### Example:

```
ATM INTERFACE> set max-callers 25
```

### max-config-selectors

Sets the maximum number of selectors under your specific control.

The selector is used to distinguish different users on the same end system. VCC setup requests are routed in the following hierarchical fashion: ATM switches route to the destination ATM switch using the Network Prefix, the destination ATM switch routes to the destination end system using the ESI, and the end system notifies the destination user based on the selector.

Each ESI can have up to 255 associated selectors (0x00 through 0xff). The range of selectors is partitioned into two subranges, a configured selector range and an automatically assigned selector range. The ATM interface

parameter `max-configured-selector` gives the upper bound on the configured selector range.

The ATM components on the router have various ways of choosing a selector. Some components require you to explicitly configure a selector from the configured selector range. LES/BUSs are an example of such a component. Other components, such as Classical IP clients, allow the selector to be automatically assigned at run-time. You do not have to choose the selector because the router does this when it activates. This selector is not guaranteed to be consistent across router restarts. Automatic selector assignment is useful only for those ATM components whose ATM address does not have to be already known by other network devices.

The relative sizes of the selector range can be modified to conform to the types and numbers of ATM users on the router.

**Valid Values:** 0 – 255 (0x00 – 0xFF)

**Default Value:** 200

**Note:** The selector is byte 20 of a 20-byte ATM address.

**Example:**

```
ATM INTERFACE> set max-config-selectors 225
```

**max-frame**

Sets the maximum number of octets permitted in any data frame sent or received on the ATM interface. System memory is allocated based upon this parameter. Increasing the `max-frame` requires more system memory, but allows processing of larger frames.

All router entities using the ATM interface must use a maximum frame size less than or equal to the `max-frame-size` of the ATM interface. This includes all LECs, CIP clients, and 1483 bridge interfaces.

**Valid Values:** An integer in the range 16 – 32000

**Default Value:** 9234

**Example:**

```
ATM INTERFACE> set max-frame 1000
```

**max-mp-parties**

Sets the maximum number of leaves on a point-to-multipoint connection initiated by the router. This parameter affects system memory allocation. Increasing this value is necessary if the router must set up point-to-multipoint connection(s) to a large number of destinations.

**Valid Values:** An integer in the range 1 – 5000

**Default Value:** 512

**Example:**

```
ATM INTERFACE> set max-mp-parties 300
```

**Valid Values:** 155 (Mbps)

**Default Value:** 155 (Mbps)

**Example:**

```
ATM INTERFACE> set speed 155
```

## ATM Interface Commands

### trace

Sets the packet tracing parameters on the interface. Packet tracing can be enabled or disabled on a range of VPI/VCI values. Common VPI/VCI values to trace are:

- 0/5 for signalling packets
- 0/16 for ILMI packets.

**Valid Values:** ON or OFF

**Default Value:** ON

You are prompted for the VPI/VCI range you want to trace.

**Beginning VPI Valid Values:** 0 – 255

**Default Value:** 0

**Ending VPI Valid Values:** 0 - 255

**Default Value:** 255

**Beginning VCI Valid Values:** 0 - 65535

**Default Value:** 0

**Ending VCI Valid Values:** 0 - 65535

**Default Value:** 65535

#### Example:

```
ATM INTERFACE> set trace on
beginning of VPI range [0]? 0
end of VPI range [255]? 0
beginning of VCI range [0]? 5
end of VCI range [65535]? 5
```

### uni-version

Sets the User Network Interface (UNI) version used by the ATM interface with communicating with the attached ATM switch. The UNI versions used by the ATM interface and by the ATM switch must match. If the UNI version is configured as AUTO, the ATM device attempts to learn the UNI version to use from the switch.

**Valid Values:** [UNI 3.0|UNI 3.1|AUTO-DETECT|None]

**Default Value:** UNI 3.0

**Note:** Must be compatible with the ATM switch.

#### Example:

```
ATM INTERFACE> set uni-version 3.0
```

### network-id

Sets the network id of the ATM interface. Multiple ATM interfaces should have the same network id if there is ATM connectivity between the interfaces.

**Valid Values:** 0 - 255

**Default Value:** 0

## Enable

Use the **enable** command to enable an ESI in the configuration of your ATM device. The ATM interface attempts to register only enabled ESIs when it activates.

**Syntax:** `enable esi esi-address`

`esi esi-address`

Address of End System Identifiers.

**Valid Values:** Any 12 hexadecimal digits  
**Default Value:** none

**Example: enable esi**

```
ATM INTERFACE> enable esi 00:00:00:00:00:09
```

## Disable

Use the **disable** command to disable an ESI in the configuration. ATM components using disabled ESIs will not become active on the next router restart.

**Syntax:** `disable esi esi-address`

`esi esi-address`

Address of End System Identifiers.

**Valid Values:** Any 12 hexadecimal digits  
**Default Value:** none

**Example: disable esi**

```
ATM INTERFACE> disable esi 00:00:00:00:00:09
```

## Exit

Use the **exit** command to return to the ATM Config> prompt.

**Syntax:** `exit`

**Example: exit**

```
ATM INTERFACE> exit
ATM Config>
```

---

## ATM SuperELAN II Configuration Concepts

Reasons for using SuperELANs for building large ATM LAN Emulation networks can be grouped into two categories:

- Improved ATM LAN Emulation network performance
- Improved ATM LAN Emulation network reliability

Using a SuperELAN to combine multiple ELANs with fewer clients instead of placing all clients on one large ELAN can:

1. Improve VCC setup times since clients can be distributed across multiple LES/BUSES in different switches
2. Reduce the impact of failure of one LES/BUS on network connectivity, since clients in the other ELANs remain active
3. If bridging, improve the inter-ELAN data traffic transmission speed since inter-ELAN data traffic is transmitted at hardware switching speed along a direct path because the software necessary to perform bridging is no longer in the middle of the client-to-client communication.

With the appropriate network design utilizing multiple ATM switches, LES/BUSES, LECSs, and SuperELANs, a high performance redundant ATM LAN Emulation network can be configured to provide reliable high bandwidth communication.

## Configuring a SuperELAN II

Once the LES/BUSes have been configured for each ELAN (LES/BUSes are not required to be located in the same device as the SuperELAN. See Chapter 21, “Configuring LAN Emulation Services” on page 21-1 for information about configuring LES/BUSes.),

1. Use the SE-SERVICES **add** command to add a SuperELAN.
2. Use the **work** command to select the SuperELAN just added.
3. Add each ELAN to the SuperELAN using the **add elan to superelan** command.

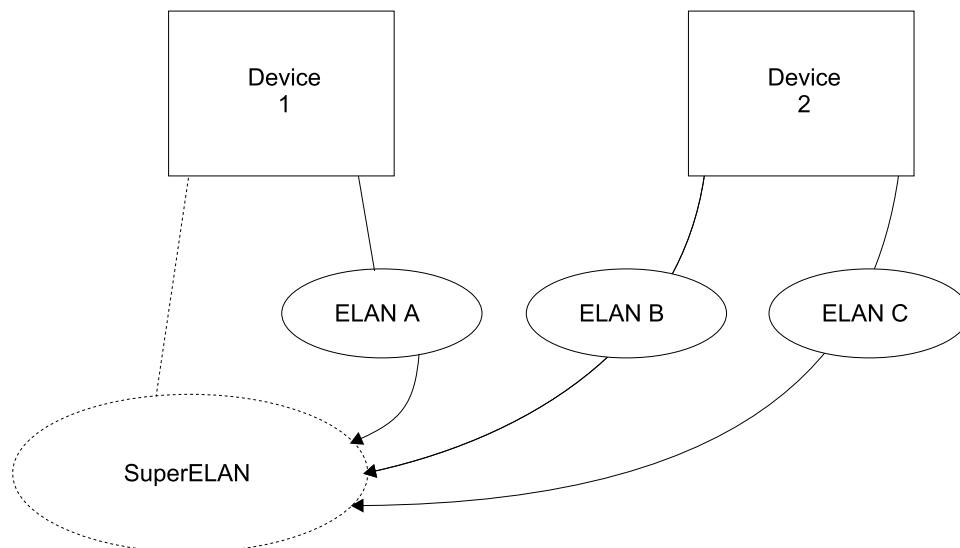


Figure 17-1. Adding ELANs to Form a SuperELAN

The **add elan to superelan** command will present a list of locally configured ELANs and an option to add a remotely configured ELAN. Only those ELANs allowed to participate in the SuperELAN will be displayed.

ELANs may not be displayed because:

- a. ELAN type does not match the SuperELAN type, either Ethernet or token-ring
- b. ELAN frame size does not match the SuperELAN frame size
- c. ELAN is on an ATM interface with a different network ID than that of the SuperELAN
- d. ELAN is currently configured in another SuperELAN

Remote ELAN configurations must conform to the above four conditions for proper SuperELAN operation.

4. Use the **broadcast-manager**, **set**, and **vlan** commands to tune the SuperELAN.

Cache parameters, broadcast management, VLAN enablement, and MAC filters may be configured to enhance the performance of the SuperELAN. See the chapter entitled “Using and Configuring MAC Filtering” in *Configuring Protocols and Features* for information about configuring MAC filters.



## SuperELAN II Spanning Tree

Each SuperELAN runs an independent modified-802.1d spanning tree. This insures that there are no SuperELAN loops in the network and that each ELAN receives at most one copy of a unknown unicast, broadcast frame, or LE Control frame. Bridges running a true 802.1d or the Token Ring bridging spanning tree do not participate in the SuperELAN spanning tree nor does the SuperELAN participate in bridging spanning trees. This means that from a bridging spanning tree perspective, the SuperELAN appears as a single network segment. As shown in Figure 17-2, bridges connected to different ELANs in a SuperELAN and also connected to the same legacy network, either directly or through another bridge, are considered to be in parallel.

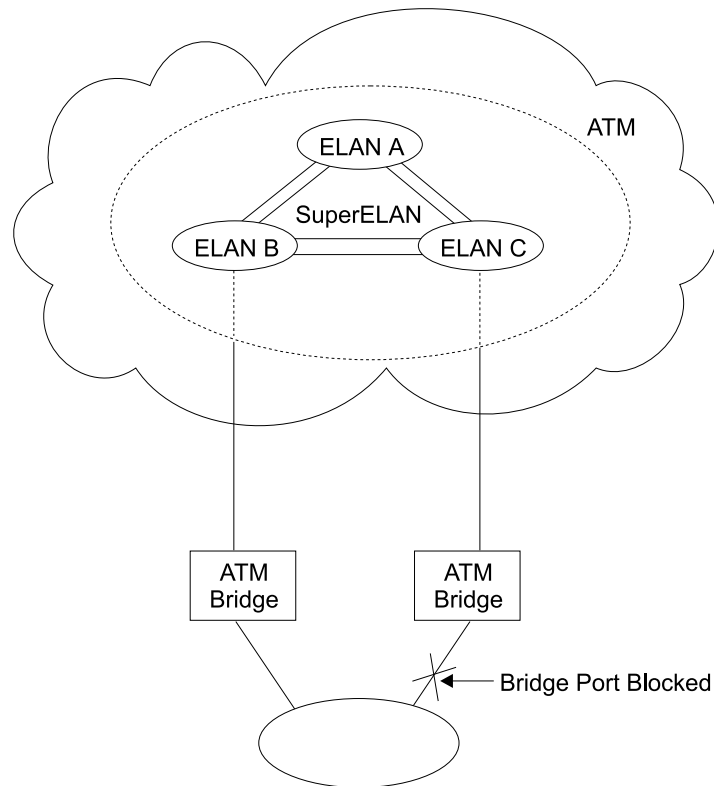


Figure 17-2. Parallel SuperELANs

## Redundant SuperELANs

Redundant SuperELANs provide inter-ELAN connectivity in the event one or more devices fail. Redundant SuperELANs can be constructed using multiple devices. In Figure 17-3 on page 17-12, a second SuperELAN is added to the second device with the same SuperELAN ID as the first device. Both SuperELANs (which may have different SuperELAN names) contain ELAN A, ELAN B, and ELAN C. One possible SuperELAN spanning tree scenario is shown in Figure 17-4 on page 17-12. If device 1 fails, the SuperELAN forwarding path (2b) will move to forwarding state from blocked state. Clients joined to ELAN A should return to the LECS and be assigned to either ELAN B or ELAN C. SuperELAN paths 1a, 1b, and 1c will cease to exist. Clients on the SuperELAN may see a short disruption in communication while the SE spanning tree converges, depending on which ELAN they joined and to which clients they were communicating at the time of the failure.

# ATM SuperELAN II Configuration Concepts

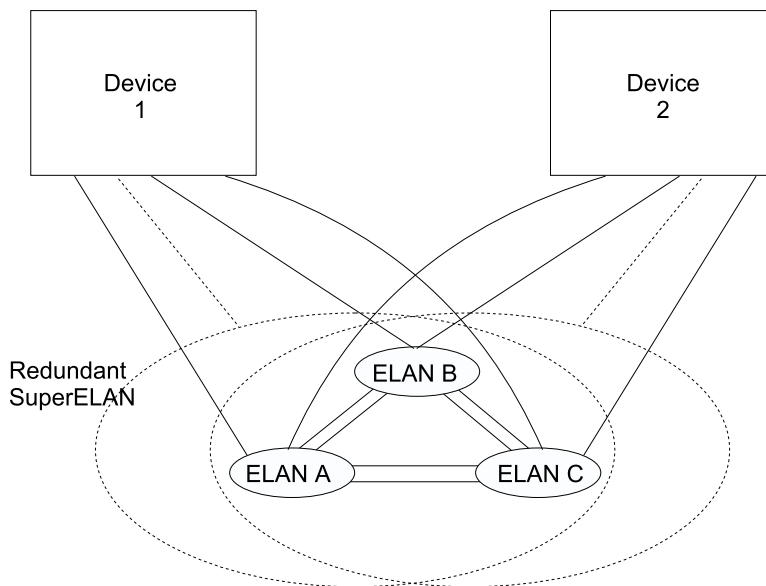


Figure 17-3. Redundant SuperELAN

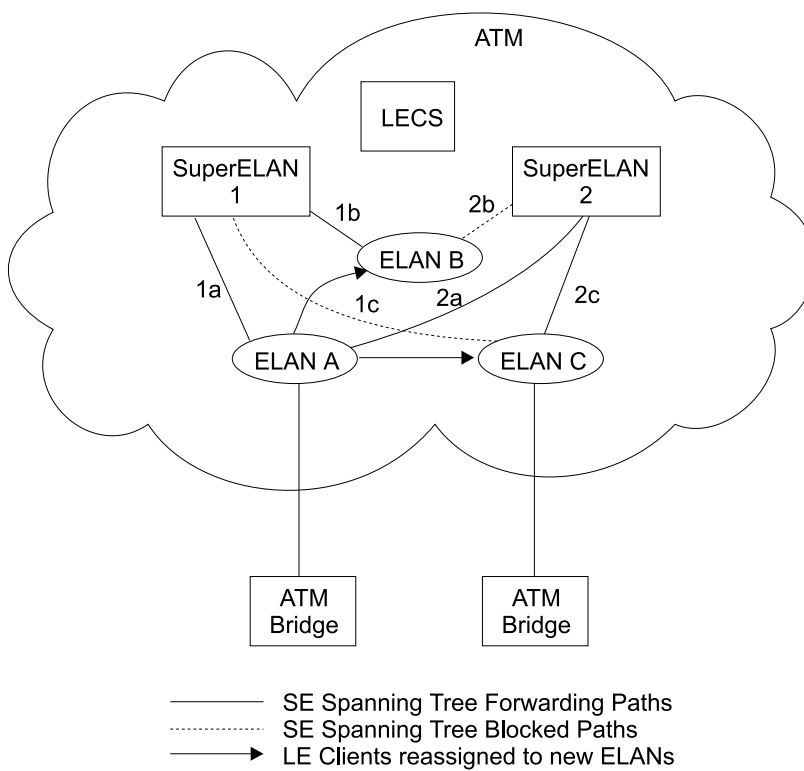


Figure 17-4. SuperELAN II Spanning Tree

## Token Ring SuperELANs

Since the SuperELAN concept is based on grouping ELANs to form a single larger super ELAN, Token Ring SuperELANs treat the collection of ELANs as one Token Ring segment. All bridges connected to the SuperELAN should define the SuperELAN segment as the same ring number.

The SuperELAN ring number is not configured but is learned. Once learned, specifically routed frames can be forwarded to the correct ELAN by looking up the next hop in the SuperELAN route descriptor cache. All routes and spanning tree explorer frames are transmitted to every ELAN in forwarding state (provided broadcast manager or VLAN filters have processed the frame).

## Migration to SuperELAN II

Migration from ASRT SuperELAN to SuperELAN II is provided via the **migrate** command under SE Services> configuration command prompt.

Once a configuration is migrated from ASRT SuperELAN to SuperELAN II, there is no automated reverse migration. Although ASRT SuperELAN and SuperELAN II can coexist within an ATM network, they can not coexist on the same device.

## Access to the SuperELAN II Configuration

From the ATM Config> prompt of a selected real ATM interface, use the **se-services** command to access the SE Services config> prompt for SuperELAN configuration command mode.

You can also access the SE Services config> prompt for SuperELAN configuration command mode by issuing the **protocol se** command from the Config> prompt.

---

## SuperELAN II Configuration Commands

This section summarizes the SuperELAN configuration commands. Enter the commands at the SE Services config> prompt.

*Table 17-3. SuperELAN Configuration Command Summary*

Command	Function
? (Help)	Lists all of the SuperELAN II configuration commands, or lists the options associated with specific commands.
ADD	Adds a SuperELAN.
DELETE	Deletes a SuperELAN configuration.
LIST	Lists the current configured SuperELANs.
MIGRATE	Migrates older ASRT SuperELAN configurations to the current SuperELAN II operational release code level.
RENAME	Renames a SuperELAN.
WORK with SuperELAN	Allows you to work with the SuperELAN configuration.
EXIT	Exit the SuperELAN Configuration process and return to the ATM Config> prompt.

## SuperELAN Configuration Commands

### Help (?)

Use the ? command to list the configuration options for SuperELANs.

**Syntax:** ?

**Example:** ?

```
SE Services config> ?
ADD
DELETE
LIST
MIGRATE
RENAME
WORK with SuperELAN
EXIT
SE Services config>
```

### Add

Use the **add** command to add a SuperELAN. A new Super ELAN is added to the corresponding ATM real interface (the ATM> configuration menu from which this SuperELAN configuration menu is accessed).

Even though a SuperELAN is directly associated with a single ATM Adapter, a SuperELAN can span multiple ATM Adapters provided the *ATM Adapter network ID* for all ATM Adapters on which the SuperELAN resides have the same value. The *ATM Adapter network ID* is a configurable parameter which identifies the ATM network to which the ATM adapter is attached. Therefore, if two ATM Adapter interfaces are configured with different ATM network IDs, a SuperELAN can not be configured to span both ATM interfaces since short-cut VCCs could not be established between ELANs on the two ATM networks.

**Syntax:** add

**Example:** add

```
SE Services config>add
ELAN Name [] super_test_elan
ELAN ID [1] 6
( 1) Ethernet
( 2) Token-Ring
Type of ELAN [2]
( 1) 1516
( 2) 4544
( 3) 9234
( 4) 18190
Maximum Frame Size of ELAN [2]
ELAN 'super_test_elan' added.
```

### Delete

Use the **Delete** command to delete a SuperELAN. If you do not specify an SuperELAN index number, a list of configured SuperELANs will be displayed. You can select from the list the SuperELAN you want to delete.

**Syntax:** delete superelan#

**Example:**

```
SE Services config>del
( 1) << All ELANs >>
( 2) super_eth
( 3) << Exit (no selection) >>
ELAN Name [1] 3
No action taken.
```

## List

Use the **list** command to list all configured SuperELANs defined on all real ATM interfaces.

**Syntax:** `list`

**Example:** `list`

```
SE Services config>list
Mode E=Enabled/D=Disabled                                BCM
| ATM Interface Net Number                               IP
| | | Type E=Ethernet/T=Token Ring                       | NetBIOS
| | | | | | | | | | | | | | | | | | | | | | | | | | | |
v v v SuperELAN Name                                     ID #ELANs #VLANs v v
-----
E 0 T super_tok 88 3 0 N N
E 1 E super_eth 77 3 2 Y N
```

## Migrate

Use the **migrate** command to migrate an existing ASRT SuperELAN configuration to the current SuperELAN II operational release code level.

The **migrate** command can only be invoked when an ASRT SuperELAN configuration is present. If invoked, the current ASRT SuperELAN configuration will be migrated to a SuperELAN II configuration. Once migrated to SuperELAN II, there is no migration path back to the ASRT SuperELAN configuration.

**Syntax:** `migrate`

## Rename

Use the **rename** command to rename a SuperELAN.

**Syntax:** `rename`

**Example:**

```
SE Services config>rename
( 1) super_eth
( 2) super_test_elan
( 3) << Exit (no selection) >>
ELAN Name [1] 2
ELAN Name [super_test_elan] super_tok
Renamed ELAN 'super_test_elan' to 'super_tok'
```

## Work with SuperELAN

Use the **Work with SuperELAN** command to select a SuperELAN for detailed configuration. Use this command to access the Selected SuperELAN 'x'> prompt so that you can provide detailed configuration of SuperELAN x.

**Syntax:** `work superelan#`

**Example: work**

```

SE Services config> work
( 1) super_eth
( 2) super_tok
( 3) << Exit (no selection) >>
ELAN Name [1] 2
ELAN 'super_tok' selected for detailed configuration.

```

**Exit**

Use the **exit** command to exit the configuration menu for SuperELANs and return to the real ATM interface configuration prompt.

**Syntax: `exit`****Example:**

```

SuperELAN config> exit
ATM config>

```

**Selected SuperELAN Configuration**

This section summarizes the selected SuperELAN detailed configuration commands. Enter the commands at the Selected SuperELAN 'x'> prompt.

*Table 17-4. Selected SuperELAN Configuration Command Summary*

Command	Function
? (Help)	Lists all of the selected SuperELAN configuration commands, or lists the options associated with specific commands.
ADD ELAN to SuperELAN	Adds an ELAN to a SuperELAN.
BROADCAST-MANAGER	Enters the Broadcast Manager configuration menu.
Delete ELAN from SuperELAN	Deletes an ELAN from a Super ELAN configuration.
DISABLE SuperELAN	Disables a Super ELAN configuration.
ELANS	Lists an ELAN configuration on the selected SuperELAN.
ENABLE SuperELAN	Enables a Super ELAN configuration.
LIST	Lists the current configured SuperELAN.
SET	Sets the value of configuration parameters associated with the selected ELAN.
TRACE	Allows tracing of packets for a SuperELAN.
VLANS	Enters the VLANS configuration menu.
Work with ELAN	Allows you to work with the selected ELAN configuration.
EXIT	Exit the selected Super ELAN Configuration process and return to the SE Services Config> prompt.

## Help (?)

Use the ? command to list the configuration options for selected SuperELANs.

**Syntax:** ?

**Example:** ?

```
Selected ELAN 'x' config> ?
Selected SuperELAN 'super_eth'?
ADD ELAN to SuperELAN
BROADCAST-MANAGER protocol
DELETE ELAN from SuperELAN
DISABLE
ELANs (Lists ELANs in SuperELAN)
ENABLE
LIST SuperELAN Configuration
SET
TRACE
VLANs
WORK with ELAN
EXIT
```

## Add ELAN to SuperELAN

Use the **ADD ELAN to SuperELAN** command to add an ELAN to the selected SuperELAN.

Both local and remote ELANs may be added. Local ELANs represent LES/BUSES defined in the same device as the SuperELAN. Remote ELANs represent LES/BUSES defined in other devices.

**Syntax:** add

**Example:**

```
Selected SuperELAN 'setest'>add

( 1) << All ELANs >>
( 2) eth1
( 3) eth2
( 4) eth4
( 5) << Remote Ethernet ELAN >>
( 6) << Exit (no selection) >>
ELAN Name [1]? 2
Remote ELAN Name []? ext ethernet elan
Connect to remote ELAN via LECS? [Yes]: no
Remote ELAN LES Address []? 3999999999990000999902004444455555502
ELAN 'ext ethernet elan' added to SuperELAN 'super_eth'
```

The listed ELANs are locally defined and are eligible to be added to a SuperELAN. Selecting << *All ELANs* >> adds all listed ELANs to the selected SuperELAN. Selecting << *Remote ELAN* >> allows you to add an remotely defined ELAN configuration to the selected SuperELAN.

## Broadcast-Manager

Use the **broadcast-manager** command to access the BBCM > configuration prompt. Refer to the chapter entitled “Configuring Bridging” in the Multiprotocol Switched Services (MSS) Configuring Protocols and Features for additional information.

## Delete ELAN from SuperELAN

Use the **Delete ELAN from SuperELAN** command to delete an ELAN from a SuperELAN configuration. All ELANs in the selected SuperELAN will be listed and you can select from that list the ELAN you want to delete.

**Syntax:** `delete n`

### Example:

```
Selected ELAN 'super_tok'>delete
( 1) << All ELANs >>
( 2) tok1
( 3) tok2
( 4) tok3
( 5) << External ELAN >>
( 6) << Exit (no selection) >>
ELAN Name [1] 2
ELAN 'tok1' deleted from to ELAN 'super_tok'.
```

## Disable

Use the **disable** command to disable the selected SuperELAN.

Once the SuperELAN is started, it can be enabled from the talk 5 monitoring menu by issuing the **enable** command from the Selected SuperELAN 'x' prompt. See "Enable" on page 18-9 for more information.

**Syntax:** `disable`

### Example:

```
Selected SuperELAN 'super_eth'>disable
SuperELAN 'super_eth' is disabled.
```

## ELANs

Use the **elans** command to list the configured ELANs on the selected SuperELAN.

**Syntax:** `elans`

### Example:

```
Selected SuperELAN 'super_eth'>elans
SuperELAN Name:      super_eth

Mode E=Enabled/D=Disabled
SuperELAN Port Number
MSS Server Interface Number
ELAN Services Location
spanning tree Priority
spanning tree Path Cost
v v v v v v ELAN Name
-----
E 1 5 Local 128 32768 eth1
E 2 6 Local 128 32768 eth2
E 3 7 Local 128 32768 eth3
```



## Enable

Use the **enable** command to enable the selected SuperELAN.

**Syntax:** `enable`

### Example:

```
Selected SuperELAN 'super_eth'>enable
SuperElan 'super_eth' is enabled.
```

## List

Use the **list** command to list a configured SuperELAN.

**Syntax:** `list`

### Example: list

```
----- SuperELAN Configuration -----
SuperELAN Name:      super_eth
Type:                Ethernet
Mode:                Enabled
Associated ATM Net   0
Frame Size:          1516
SuperELAN ID:        3

----- ELAN Cache Parameters -----
MAC Filter Cache Age: 300
RD Filter Cache Age: 1800 1
Maximum MAC Cache Size: 1000

----- spanning tree Parameters -----
SuperELAN Address:   000000000000
Max Age:              20
Hello Time:           2
Forward Delay:        15
Priority:              32768

----- Packet Tracing Parameters -----
Packet Tracing:      Disabled
Trace Dest Addr Mask: 000000000000
Trace Dest Addr Value: 000000000000
Trace Source Addr Mask: 000000000000
Trace Source Addr Value: 000000000000

----- VLAN Configuration Summary -----
                          Enabled/Configured
IP VLANs:                1/1
IPX VLANs:                0/0
NetBios VLANs:           0/0
Sliding Window VLANs:    1/1
Mac Address VLANs:        0/0

----- Broadcast Management -----
IP:                       Enabled
NetBIOS Dupl. Filter:     Disabled
NetBIOS Route Caching:    Disabled
```

### Note:

**1** This field does not appear for Ethernet SuperELANs.

## Set

Use the **set** command to set ELAN parameters on the selected SuperELAN.

**Syntax:** **set**        address  
                  cache age  
                  cache size  
                  frame  
                  spanning  
                  super-elan-id

### Example:

```
Selected SuperELAN 'super_eth'>set ?  
ADDRESS of SuperELAN spanning tree Node  
CACHE  
FRAME Size  
SPANNING Tree Parameters  
SUPER-ELAN ID
```

The following parameters can be specified with the **set** command:

**address**            Identifies the SE spanning tree address used for constructing the SuperELAN spanning tree.  
**Default Value:** the lowest MAC address for all ELAN interfaces in the SuperELAN

**cache**             This parameter sets the MAC cache age and size. For a Token-ring SuperELAN, this parameter also sets the route-descriptor cache age.

### Example:

```
Selected SuperELAN 'super_tok'>set cache ?  
AGE  
SIZE  
Selected SuperELAN 'super_tok'>set cache age  
MAC Filter Cache Age (60-3600 seconds) [300]? 400  
RD Filter Cache Age (600-65535 seconds) [1800]? 900  
Cache Age parameters set for SuperELAN 'super_tok'.
```

**frame**             Sets the SuperELAN frame size. Only ELANs matching the SuperELAN frame size can be configured in the SuperELAN.

**spanning tree parameters** Sets the SuperELAN spanning tree parameters:

**Priority**           Indicates the SuperELAN short-cut bridge spanning tree priority. A lower value will increase the likelihood of a SuperELAN short-cut bridge becoming the root. This value is prefixed to the SuperELAN spanning tree MAC Address to form a SuperELAN short-cut bridge ID.

**Valid Values:** 0 - 65535

**Max age**           The age at which the current spanning tree configuration is considered too old. A value that is too small may cause the spanning tree to unnecessarily reconfigure. A value too large will increase the time it takes for the spanning tree to converge once an outage is detected.

**Valid Values:** 6 - 40

**Hello Time** The interval of time, in seconds, between the generation of spanning tree configuration messages generated by the root. Lower values increase the spanning tree robustness, but increase the network traffic overhead.

**Valid Values:** 1 - 10

**Forward Delay** The delay, in seconds, that the SuperELAN bridge waits before transitioning to the next port state. The forward delay should be large enough to allow all SuperELAN bridges in the SuperELAN to disable ports in the new topology prior to this short-cut bridge forwarding data frames. Values too low may cause temporary loops in the SuperELAN. Values too large may lengthen network partitions after the spanning tree has converged. The default value of 15 indicates that the short-cut bridge will begin forwarding frames 30 seconds after the spanning tree has converged: 15 seconds in listening state and 15 seconds in learning state.

**Valid Values:** 4 - 30

**Default Value:** 15

**SuperELAN id** Sets the identifier associated with this SuperELAN.

Unlike the SuperELAN implementation under the ASRT Config> command prompt, the SuperELAN ID is used to construct redundant SuperELANs that span multiple devices. The SuperELAN ID is included as part of the spanning tree Topology frames and has external significance.

**Valid Values:** 1 - 65279

## Trace

The **trace** command, used with the ELS packet tracing facility, controls packet tracing configuration for the SuperELAN. Issuing the **trace on** command enables the selected SuperELAN for packet tracing. The default for packet tracing is *off*. See "Packet-trace Console Commands" on page 12-22 for additional information.

Setting the *Destination Address Value*, *Destination Address Mask*, *Source Address Value*, and *Source Address Mask* provides a mechanism for limiting the frames sent or received by the SuperELAN bridge to be traced. Frames passing the MAC address trace filter will be forwarded to ELS to be traced. A frame is considered traceable if:

*destination MAC Address* of the frame ANDed with *destination address trace mask* equals the *destination address trace value*

AND

*source MAC Address* of the frame ANDed with *source address trace mask* equals the *source address trace value*

For example, the following trace address settings will trace any frame received or transmitted to any ELAN in the SuperELAN that has a destination address of

0x000012120021 and was originated from any device with a MAC address beginning with 0x10005A.

```
Trace Dest Address Mask   = FFFFFFFFFFFFFFFF
Trace Dest Address Value  = 000012120021
Trace Source Address Mask = FFFFFFFF000000
Trace Source Address Value = 10005A000000
```

**Syntax:** trace     on  
                          off  
                          address

**Example:**

```
Selected SuperELAN 'super_eth'>trace on
Packet Tracing enabled for SuperELAN 'super_eth'.
```

## Work with ELAN

Use the **work with ELAN** command to get to the Selected ELAN 'x'> prompt. At this prompt, you can provide detailed ELAN configuration parameters for this ELAN in the selected SuperELAN

**Syntax:** work with ELAN elan#

**Example:**

```
Selected ELAN 'super_tok'> work
( 1) tok1
( 2) tok2
( 3) tok3
( 4) << Exit (no selection) >>
ELAN Name [1] 2
ELAN 'tok2' selected for detailed configuration
```

```
Selected ELAN 'tok2'>
```

See “Selected ELAN Configuration” on page 17-23 for information about commands available at the Selected ELAN 'x'> prompt.

## VLANs

Use the **vlan** command to access the SuperELAN 'x'>VLAN config> configuration prompt. Refer to the chapter entitled “Configuring Bridging” in the Multiprotocol Switched Services (MSS) Configuring Protocols and Features for additional information.

**Syntax:** vlan

## Exit

Use the **exit** command exit the selected SuperELAN configuration menu and return to the SE Services config> prompt.

**Syntax:** exit

## Selected ELAN Configuration

This section summarizes the selected SuperELAN detailed configuration commands. Enter the commands at the Selected ELAN 'x'> prompt.

Table 17-5. Selected ELAN Configuration Command Summary

Command	Function
? (Help)	Lists all of the selected SuperELAN configuration commands, or lists the options associated with specific commands.
Disable	Disables an ELAN.
Enable	Enables an ELAN from a Super ELAN configuration.
LIST	Lists the current configured ELAN.
LE-CLIENT Configuration	Points to the LE-CLIENT configuration menu.
LES-BUS Configuration	Points to the LES-BUS configuration menu.
SPANNING TREE PORT	Sets spanning tree port parameters.
TRACE	Controls packet tracing for the ELAN.
EXIT	Exit the selected ELAN Configuration process and return to the Selected SuperELAN 'x' Config> prompt.

## Help (?)

Use the ? command to list the configuration options for Selected ELAN.

**Syntax:** ?

**Example:**

```
Selected ELAN 'x' config> ?
DISABLE
ENABLE
LE-CLIENT Configuration
LES-BUS Configuration 1
LIST
SPANNING TREE PORT Parameters
EXIT
Selected ELAN 'x' config>
```

**Note:**

- 1** This menu item does not appear for remote ELANs.

## Disable

Use the **Disable** command to disable an ELAN. Disabling the ELAN prevents clients of the disabled ELAN from setting up short-cut Data Direct VCCs with clients on other ELANs in the SuperELAN. It does not prevent clients in the disabled ELAN from communicating with clients in other ELANs if routing has been enabled on the disabled SuperELAN interface. Also, it does not prevent clients on the disabled ELAN from setting up Data Direct VCCs among themselves.

**Syntax:** `disable elan#`

**Example:**

```
Selected ELAN 'super_tok'>disable
( 1) << All ELANs >>
( 2) tok1
( 3) tok2
( 4) tok3
( 5) << Remote ELAN >>
( 6) << Exit (no selection) >>
ELAN Name [1]:2
ELAN 'tok1' disabled
```

## Enable

Use the **Enable** command to enable an ELAN on a SuperELAN configuration.

**Syntax:** enable *elan#*

**Example:**

```
Selected ELAN 'super_tok'>enable
( 1) << All ELANs >>
( 2) tok1
( 3) tok2
( 4) tok3
( 5) << Remote ELAN >>
( 6) << Exit (no selection) >>
ELAN Name [1]:2
ELAN 'tok1' enabled
```

## LE-Client Configuration

Use the **le-client** command to move directly to the ATM LAN Emulation client configuration menu for the SuperELAN interface associated with the selected ELAN. See Chapter 19, “Using and Configuring LAN Emulation Clients” on page 19-1 for additional information.

**Syntax:** le-client

## LES-BUS Configuration

Use the **les-bus** command to move directly to the LES-BUS configuration menu for the selected ELAN. See Chapter 21, “Configuring LAN Emulation Services” on page 21-1 for additional information.

This menu item is visible only for **locally** configured LAN Emulation Services.

**Syntax:** les-bus

## List

Use the **list** command to list configured ELANs.

**Syntax:** list

**Example:**

```

Selected ELAN 'tok4'>list
----- ELAN Configuration -----
ELAN Name: ext ethernet elan
Type:                Token Ring
Mode:                Enabled
Frame Size:          4544
SuperELAN ID:        35
Port Number:         1
LANE Service Location: Remote

----- spanning tree Parameters -----
ELAN Port Priority:   128
Path Cost:           32768

----- Interface Parameters -----
ATM Physical Interface: 0
LEC Interface Number:   1
LECS Auto Configuration: No
LE Server ATM address:  39.99.99.99.99.99.00.00.99.99.02.00.44.44.44.55.55.
55.02

```

## Spanning Tree Port Parameters

Use the **spanning tree port** command to set spanning tree port parameters for the selected ELAN.

**Syntax:** `spanning tree port port priority`  
`path cost`

### Example:

```

Selected ELAN 'tok2'>span
ELAN Port Priority (0-255) [128] 5
ELAN Path Cost (0-65535) [32768] 27777
SuperELAN spanning tree parameters set for ELAN 'tok2'.

```

**ELAN port priority** A one-octet value which influences which ELAN is used when two or more ELANs are connected to the same network segment in a loop. A lower value represents a higher priority.

**Valid Values:** 0 - 255

**ELAN path cost** The cost added to the root path cost in the spanning tree configuration message received on this ELAN in order to determine the path cost to get to the root SuperELAN bridge through this ELAN.

Using a small value for this parameter increases the probability that this ELAN will be close to the root SuperELAN short-cut bridge, and thus asked to carry more broadcast unknown-unicast traffic and LE control traffic.

**Valid Values:** 0 - 65535

## Trace

The **Trace** command enables packet tracing for the selected ELAN in the SuperELAN. When used with the Packet Tracing subsystem in ELS, all frames received and transmitted for this ELAN are traced. Destination and Source MAC Address filters are provided to help limit the number of traced data frames. These trace filters are configured using the **SuperELAN TRACE ADDRESS** command and are applied to all ELANs in the SuperELAN. See "Packet-trace Console Commands" on page 12-22 for more information.

**Syntax:** `trace`    on  
                          off

**Example:**

```
Selected ELAN 'tok1'>trace ?  
ON  
OFF
```

```
Selected ELAN 'tok1'>trace on  
Packet tracing enabled for ELAN port 'tok1' on SuperElan 'super_test_elan'.
```

---

## Sample SuperELAN II Configuration

```
Console granted to this interface  
Config (only)>net 0  
ATM user configuration  
ATM Config>inter  
ATM interface configuration  
ATM Interface Config>add esi 1  
ESI in 00.00.00.00.00.00 form []? 000011111111  
ATM Interface Config>ex  
ATM Config>le-s  
LAN Emulation Services user configuration  
LE Services config>les 1 2  
New ELAN Name (ELANxx) []? tok1  
LES-BUS configuration  
LES-BUS config for ELAN 'tok1'>add  
Turn on Standard Event Logging for LES [yes]  
Select ELAN type  
    (1) Token Ring  
    (2) Ethernet  
  
Enter Selection: [1]?  
Select ESI  
    (1) Use burned in ESI  
    (2) 00.00.11.11.11.11  
  
Enter Selection: [1]? 2  
  
Selector x00 is generally reserved for use by the LECS,  
Selector x01 is generally reserved for use by the LECS Interface.  
  
Enter selector (in hex) [2]?  
Selection "Add LES-BUS" Complete  
LES-BUS config for ELAN 'tok1'>set lecid 3  
Lower bound of LECID range (in hex) [1]? 100  
Upper bound of LECID range (in hex) [FEFF]? 199  
New LECID Range: 0x0100 through 0x0199  
LES-BUS config for ELAN 'tok1'>ex
```



```

LE Services config>les 1
New ELAN Name (ELANxx) []? tok2
LES-BUS configuration
LES-BUS config for ELAN 'tok2'>add
Select ELAN type
    (1) Token Ring
    (2) Ethernet

Enter Selection: [1]?
Select ESI
    (1) Use burned in ESI
    (2) 00.00.11.11.11.11

Enter Selection: [1]? 2

Selector x00 is generally reserved for use by the LECS,
Selector x01 is generally reserved for use by the LECS Interface.

Enter selector (in hex) [3]?
Selection "Add LES-BUS" Complete
LES-BUS config for ELAN 'tok2'>set lecid
Lower bound of LECID range (in hex) [1]? 200
Upper bound of LECID range (in hex) [FEFF]? 299
New LECID Range: 0x0200 through 0x0299
LES-BUS config for ELAN 'tok2'>ex

LE Services config>les 1
New ELAN Name (ELANxx) []? tok3
LES-BUS configuration
LES-BUS config for ELAN 'tok3'>add
Select ELAN type
    (1) Token Ring
    (2) Ethernet

Enter Selection: [1]?
Select ESI
    (1) Use burned in ESI
    (2) 00.00.11.11.11.11

Enter Selection: [1]? 2

Selector x00 is generally reserved for use by the LECS,
Selector x01 is generally reserved for use by the LECS Interface.

Enter selector (in hex) [4]?
Selection "Add LES-BUS" Complete
LES-BUS config for ELAN 'tok3'>set lecid
Lower bound of LECID range (in hex) [1]? 300
Upper bound of LECID range (in hex) [FEFF]? 399
New LECID Range: 0x0300 through 0x0399

LES-BUS config for ELAN 'tok3'>ex

LE Services config>ex

```

```

ATM Config>se
SuperELAN Services User Configuration
SE Services config>add 4
SuperELAN Name []? super_tok
SuperELAN ID [0]? 88
( 1) Ethernet
( 2) Token-Ring
Type of SuperELAN [2]?
( 1) 1516
( 2) 4544
( 3) 9234
( 4) 18190
Maximum Frame Size of SuperELAN [2]?
SuperELAN 'super_tok' added.

SE Services config>work 5
( 1) super_tok
( 2) << Exit (no selection) >>
SuperELAN Name [1]?
SuperELAN 'super_tok' selected for detailed configuration.
Selected SuperELAN 'super_tok'>add 6
( 1) << All ELANs >>
( 2) tok1
( 3) tok2
( 4) tok3
( 5) << Remote ELAN >>
( 6) << Exit (no selection) >>
ELAN Name [1]? 1
ELAN 'tok1' added to SuperELAN 'super_tok'.
ELAN 'tok2' added to SuperELAN 'super_tok'.
ELAN 'tok3' added to SuperELAN 'super_tok'.

Selected SuperELAN 'super_tok'>list 7
----- SuperELAN Configuration -----
SuperELAN Name:      super_tok
Type:                Token Ring
Mode:                Enabled
Associated ATM Net:  0
Frame Size:          4544
SuperELAN ID:        88

----- ELAN Cache Parameters -----
MAC Filter Cache Age: 300
MAC Filter Cache Size: 1000
RD Filter Cache Age: 1800

----- Spanning Tree Parameters -----
SuperELAN Address:   000000000000
Max Age:              20
Hello Time:           2
Forward Delay:        15
Priority:              32768

----- Packet Tracing Parameters -----
Packet Tracing:      Disabled
Trace Dest Addr Mask: 000000000000
Trace Dest Addr Value: 000000000000
Trace Source Addr Mask: 000000000000
Trace Source Addr Value: 000000000000

----- VLAN Configuration Summary -----
                               (Enabled/Configured)
IP VLANs:                0/0
IPX VLANs:                0/0
NetBios VLANs:           0/0
Sliding Window VLANs:    0/0
Mac Address VLANs:       0/0

----- Broadcast Management -----
IP:                       Enabled
NetBIOS Dupl. Filter:     Disabled
NetBIOS Route Caching:    Disabled

```

```
Selected SuperELAN 'super_tok'>elans 8  
SuperELAN Name: super_tok
```

```
Mode E=Enabled/D=Disabled  
| SuperELAN Port Number  
| | MSS Server Interface Number  
| | | ELAN Services Location  
| | | | Spanning Tree Priority  
| | | | | Spanning Tree Path Cost  
v | | | | | | ELAN Name  
-----  
E | 1 | 1 | Local | 128 | 32768 | tok1  
E | 2 | 2 | Local | 128 | 32768 | tok2  
E | 3 | 3 | Local | 128 | 32768 | tok3
```

```
Selected SuperELAN 'super_tok'>br 9  
Enter Bridge Broadcast Manager Protocol: IP or NetBIOS [IP]?
```

IP Bridge Broadcast Manager User Configuration

```
IP B-BCM 'super_tok' config>ena 10  
IP Bridge Broadcast Manager is ENABLED
```

```
IP B-BCM 'super_tok' config>ex
```

```
Selected SuperELAN 'super_tok'>vlan 11
```

```
VLAN filter configuration  
VLAN config>add sliding-window 12  
Enter filter base (MAC or INFO) [MAC]?  
Enter window filter offset (0-255) [0]? 6  
Enter compare value in hex (1-10 bytes) []? 10005A000000  
Enter compare mask in hex (6 bytes) [fffffffffff]? 7fffff000000  
Configure This VLAN on Specific Bridge Ports? [No]:  
Age (expiration in minutes,0=infinity) [5000]?  
Track Active Mac Addresses on this VLAN? [No]: y  
Enable This Filter? [Yes]:  
VLAN Name (Required, 32 chars max) []? IBM Mac Addresses  
VLAN 'IBM Mac Addresses' (Sliding Window) successfully added
```

VLAN config>list sliding all

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----- SLIDING WINDOW VLANS -----

Compare Value = 0x10005A000000  
Compare Mask = 0x7FFFFFF00000  
Offset Length and Type = 6 (MAC)  
Port 1 (Interface 1) = Auto-Detect and Include  
Port 2 (Interface 2) = Auto-Detect and Include  
Port 3 (Interface 3) = Auto-Detect and Include  
Age (expiration in minutes) = 5000  
Tracking of Mac Addresses = Enabled  
VLAN Filter State = Enabled  
VLAN Name = IBM Mac Addresses

VLAN config>add mac-address

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Configure This VLAN on Specific Bridge Ports? [No]:

Age (expiration in minutes,0=infinity) [5000]:

Track Active Mac Addresses on this VLAN? [No]:

Enable This Filter? [Yes]:

VLAN Name (Required, 32 chars max) []? Finance Dept

VLAN 'Finance Dept' (MAC Address) successfully added

VLAN config>add address

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Choice of Mac Address VLAN:

VLAN Name

=====

(1) Finance Dept

Enter Selection [1]:

Enter New Mac Address in Hex: []? 40005A000001

New MAC Address For VLAN 'Finance Dept' successfully added

VLAN config>add address

Choice of Mac Address VLAN:

VLAN Name

=====

(1) Finance Dept

Enter Selection [1]:

Enter New Mac Address in Hex: []? 40005A000002

New MAC Address For VLAN 'Finance Dept' successfully added

VLAN config>add address

Choice of Mac Address VLAN:

VLAN Name

=====

(1) Finance Dept

Enter Selection [1]:

Enter New Mac Address in Hex: []? 40005A000003

New MAC Address For VLAN 'Finance Dept' successfully added

```

VLAN config>list mac by 16

Choice of Mac Address VLAN:
  VLAN Name
  =====
  (1) Finance Dept
Enter Selection [1]?

----- MAC ADDRESS VLAN -----

Mac Address #1          = 40.00.5A.00.00.01
Mac Address #2          = 40.00.5A.00.00.02
Mac Address #3          = 40.00.5A.00.00.03
Port 1 (Interface 1)   = Auto-Detect and Include
Port 2 (Interface 2)   = Auto-Detect and Include
Port 3 (Interface 3)   = Auto-Detect and Include
Age (expiration in minutes) = 5000
Tracking of Mac Addresses = Disabled
VLAN Filter State      = Enabled
VLAN Name              = Finance Dept
VLAN config>ex
Selected SuperELAN 'super_tok'>ex
  
```

```

SE Services config>list 17
Number of configured SuperELANS: 1

Mode E=Enabled/D=Disabled
| ATM Interface Net Number          BCM
| | Type E=Ethernet/T=Token Ring    | IP
| | |                               | NetBIOS
v v v SuperELAN Name                ID #ELANs #VLANS v v
-----
E 0 T                               super_tok 88 3 2 Y N
  
```

- 1 Add ESI to ATM Interface
- 2 Add all ELAN LES/BUSES that will be included in the SuperELAN
- 3 Set LEC ID range for each ELAN so that all LEC IDs in the SuperELAN will be unique
- 4 Add SuperELAN
- 5 Work on the SuperELAN
- 6 Add ELANs to the SuperELAN
- 7 List the SuperELAN configuration
- 8 Show the configured ELANs in the SuperELAN
- 9 Move to the BCM menu
- 10 Add IP Broadcast Management to the SuperELAN
- 11 Move to the VLAN menu
- 12 Add Sliding-Window VLAN to SuperELAN
- 13 List the Sliding-Window VLAN configuration
- 14 Add MAC-Address VLAN to SuperELAN
- 15 Add MAC Addresses to MAC-Address VLAN
- 16 List the MAC-Address VLAN
- 17 List summary of SuperELAN configuration

---

## ATM Virtual Interface Concepts

An ATM Virtual Interface (AVI) creates the appearance of multiple ATM interfaces when, in fact, there is only one physical ATM interface. One or more AVIs can be configured for each physical ATM interface on the router. AVIs have the following characteristics:

## ATM Virtual Interface Configuration Concepts

- Each AVI must be defined on one (and only one) physical ATM interface. ATM real interface (ARI) will be used to mean a physical ATM interface.
- One or more AVIs can be configured on each ARI on a router.
- Higher layer protocols treat ARIs and AVIs equally. The protocols see the total number of ATM interfaces as the sum of the number of ARIs and AVIs configured on the router.
- Protocols can be configured on each ATM interface (real or virtual) independently of other interfaces.

For example, one can configure IP on interface 0 (which is a real ATM interface) with IP address 9.1.1.1 and another instance of IP with address 9.2.1.1 on interface 1 (which is an AVI). Whether an interface is a real ATM interface or a virtual interface configured on a real interface makes no difference to the protocol (IP in the example). In addition, whether virtual interface 1 is configured on top of real ATM interface 0 or some other physical ATM interface is also transparent to the protocols.

## Advantages of Using ATM Virtual Interfaces

Major advantages of using the ATM Virtual Interfaces are:

- Using the ATM Virtual Interface feature increases the number of protocol instances that can be supported on a physical ATM interface.

The actual number of AVIs that can be configured on an ARI is limited by physical resources, such as memory, available on the router. The total number of interfaces that can be created depends on the data packet size for the interfaces and is limited to a maximum number of 253 per router.

The use of AVIs significantly improves the configuration options for protocols such as IPX that are limited to one instance or address per ATM interface. By configuring an appropriate number of AVIs, several IPX addresses can be supported on each physical ATM interface.

- The ATM Virtual Interface feature is crucial for supporting multicast routing protocols (such as OSPF) over ATM networks.

In order for multicast to operate correctly, each logical subnet **must** be configured on a different interface because multicast routing protocols typically function in such a way that a packet coming in from a router interface will never be sent out over the same interface. Thus, if more than one subnet is configured on an interface and a source in one subnet sends a multicast packet to a member in another subnet defined on the same interface, this member will never receive the packet.

By creating an individual virtual interface for each subnet, packet multicasting can be performed successfully. Typically, the number of ATM interfaces on a router will be limited, in turn limiting the number of subnets that can be correctly configured for multicast operation. However, by creating as many AVIs as needed (according to the number of subnets that are required to be configured on the router), the number of physical ATM interfaces will no longer limit the number of subnets that can be configured on a router for correct multicast operation.

For example, the “one-armed” router cannot support multicast traffic over interfaces other than ELANs without the AVI feature, because incoming packets will never be sent out the same interface and will be discarded instead.

- Creating multiple AVIs on an ARI and configuring each different protocol instance (for example, each IP subnet) on a different AVI on the same ARI, can improve performance.

For example, when multiple subnets are configured on a single physical ATM interface, the interface will have to reduce the maximum transmission unit or MTU (the maximum packet size that can be sent or received over that interface) to the smallest MTU of all subnets sharing the same interface. However, if multiple AVIs are created on that ARI and each IP subnet is configured on a different AVI, every subnet can continue to use its existing MTU size without consideration of other subnets configured on the same physical ATM interface. This avoids possible reduction in throughput and delays due to packet fragmentation and re-assembly caused by MTU size reduction.

Another performance improvement can be achieved by distributing the number of protocol addresses configured on a physical interface over different virtual interfaces configured on the same physical interface. The per-interface protocol lists get shortened, resulting in faster searches and reduced processing time.

### Disadvantages of using ATM Virtual Interfaces

The disadvantages of using ATM Virtual Interfaces are:

- Because AVIs do not have any physical resources of their own, each virtual interface may have fewer Virtual Connections (VCs) than a single physical interface. The available resources (in this example VCs) are partitioned among the different virtual interfaces configured on a single ARI and the ARI itself.

In the current implementation, resource allocation is *on demand*. Each physical ATM interface has a pool of resources that are available for use by all AVIs and the single ARI itself.

**Note:** Because all resources are shared among the ARI and all its AVIs, an ESI added on an ARI is automatically available to all AVIs configured on the ARI. You should not assign the same ESI and selector combination to two different protocol clients using the same ARI even though they are configured on different AVIs.

Limited PVC sharing is allowed across the ARI and the AVIs configured on the ARI. PVC sharing is limited to different protocol instances. Multiple instances of the same protocol are not allowed to share the same PVC.

### Access to the Virtual ATM Interface Configuration

From the ATM Config> prompt of a selected real ATM interface, use the **Virtual ATM** command to enter the Virtual ATM configuration command mode.

### ATM Virtual Interface Configuration Commands

This section summarizes the ATM virtual interface configuration commands. Enter the commands at the ATM virtual interface config> prompt.

## ATM Virtual Interface Configuration Commands

Command	Function
? (Help)	Lists all of the ATM virtual interface configuration commands, or lists the options associated with specific commands.
ADD	Adds a virtual ATM interface.
LIST	Lists the current configured virtual ATM interfaces.
REMOVE	Removes the virtual ATM interface from the current configuration.
EXIT	Exit the ATM virtual interface Configuration process and return to the ATM Config> prompt.

### Help (?)

Use the **help** command to list the configuration options for ATM virtual interfaces.

**Syntax:** `help (or?)`

#### Example: help

```
ATM Virtual Interface config> help
ADD
LIST
REMOVE
EXIT
ATM Virtual Interface config>
```

### Add

Use the **add** command to add an ATM virtual interface. A new ATM virtual interface is added to the corresponding ATM real interface (the configuration menu from which this ATM virtual interface configuration menu is accessed). The net/interface number assigned to the newly created ATM virtual interface is displayed and it is one number greater than the current largest interface number.

**Syntax:** `add`

#### Example: add

```
ATM Virtual Interface config> add
Added ATM Virtual Interface Net as interface 5 on physical ATM interface 0
ATM Virtual Interface config>
```

### List

Use the **list** command to list configured ATM virtual interfaces defined on the current real ATM interface.

**Syntax:** `list`

#### Example: list

```
ATM Virtual Interface config> list

-----
                        ATM Virtual Interface Nets
-----
ATM interface number = 0
ATM Virtual Interface Net interface number = 5

ATM Virtual Interface config>
```



### Remove

Use the **remove** command to delete an ATM virtual interface. The virtual ATM interface on the real ATM interface with the specified interface number will be removed from the SRAM configuration records. If you do not specify an interface number, the last ATM virtual interface on this real ATM interface will be deleted. If you enter a question mark (?), all ATM virtual interfaces on the current real ATM interface will be listed and you can select from that list the interface you want to remove.

**Syntax:** `remove n`

**Example: remove 5**

```
Virtual ATM 5 deleted successfully.  
ATM Virtual Interface config>
```

### Exit

Use the **exit** command exit configuration menu for ATM virtual interfaces defined on the current real ATM interface and return to the real ATM interface configuration prompt.

**Syntax:** `exit`

**Example: exit**

```
ATM Virtual Interface config> exit  
ATM config>
```

## ATM Virtual Interface Console Commands

Monitoring the ATM virtual interface is done using the ATM LLC console commands. See “ATM-LLC Monitoring” on page 18-19 for additional information.

## ATM Virtual Interface Console Commands

---

## Chapter 18. Monitoring ATM

This chapter describes how to monitor the ATM interface. It includes the following sections:

- “Accessing the ATM Console Commands”
- “ATM Console Commands”
- “ATM Interface Console Commands (ATM INTERFACE+ Prompt)” on page 18-2
- “ATM-LLC Monitoring” on page 18-19

---

### Accessing the ATM Console Commands

Use the following procedure to access the ATM console commands. This process gives you access to an ATM's *monitoring* process.

1. At the OPCON prompt, enter **talk 5**. (For more detail on this command, refer to Chapter 5, “The OPCON Process and Commands” on page 5-1.) For example:

```
* talk 5
+
```

The GWCON prompt (+) is displayed on the console. If the prompt does not appear when you first enter the console, press **Return** again.

2. Enter **interface** at the + prompt to display a list of configured interfaces.
3. Record the interface numbers.
4. Enter **network** followed by the number of the ATM interface.

```
+ network 5
ATM+
```

The ATM monitoring prompt (ATM+) is displayed.

---

### ATM Console Commands

This section summarizes the ATM console commands for monitoring ATM interfaces. Enter the commands at the ATM+ prompt.

## ATM Interface Console Commands

Command	Function
? (Help)	Lists all of the ATM configuration commands, or lists the options associated with specific commands.
INTERFACE	Displays the ATM Interface+ prompt from which you can monitor the ATM Interface, as described in “ATM Interface Console Commands (ATM INTERFACE+ Prompt)” on page 18-2.
LE-SERVICES	Displays the LE Services+ prompt from which you can monitor LAN Emulation Services as described in Chapter 22, “Monitoring LAN Emulation Services” on page 22-1.
SE-SERVICES	Displays the SE Services+ prompt from which you can monitor SuperELAN Services as described in “SE-Services” on page 18-2.
ATM-LLC	Displays the ATM LLC+ prompt from which you can monitor endpoints, a set of user clients, and a set of ATM channels.
Exit	Exits the ATM Monitoring process and returns to the + prompt.

### Interface

Displays the ATM Interface+ prompt, described in “ATM Interface Console Commands (ATM INTERFACE+ Prompt).”

### LE-Services

Displays the LE Services+ prompt. Refer to Chapter 22, “Monitoring LAN Emulation Services” on page 22-1.

### SE-Services

Displays the SE Services+ prompt.

This prompt can also be accessed using the **protocol se** command from the + prompt. See “SE Services Monitoring” on page 18-6.

### ATM-LLC

Displays the ATM-LLC+ prompt, described in “ATM-LLC Monitoring” on page 18-19.

### Exit

Returns you to the + prompt.

---

## ATM Interface Console Commands (ATM INTERFACE+ Prompt)

This section summarizes and then explains the commands for monitoring a specific ATM interface.

Enter the commands at the ATM INTERFACE+ prompt.

Table 18-2. ATM INTERFACE Console Command Summary	
Command	Function
? (Help)	List all the ATM Interface console commands, or list the options associated with specific commands.
List	Lists ATM addresses and VCCs.
Trace	Starts/Stops packet tracing on a specified VPI/VCI range. Trace can be viewed by ELS.
Wrap	Starts/Stops a loopback test on the VCC.
Exit	Returns to the ATM+ prompt.

## List

Use the **list** command to list various categories of ATM data.

**Syntax:** `list`      addresses  
                              all  
                              circuit  
                              vccs  
                              reserved-bandwidth

### addresses

Lists the ATM addresses, along with a descriptive name, in use on the device.

**Example:**

ATM INTERFACE+ `list addresses`

ATM Address	Name
-----	-----
399999999999999999990000999999020000041347391804	LEC 1 'eth1'
399999999999999999990000999999020000041347391802	LES/BUS 'eth1'

### all

Lists all of the following:

- Addresses
- Circuit statistics
- VCCs
- Reserved Bandwidth

### circuit

Lists the statistics for a particular VCC by specifying the particular VCI-VPI pair. You can also specify the circuit on the command line; for example: `list circuit 33`.

**Example:**

ATM INTERFACE+ `list circuit`  
VPI [0]?  
VCI [32]?33

Frames transmitted	=	2	Bytes transmitted	=	216
Frames received	=	2	Bytes received	=	216

### vccs

Lists all the VCCs established by the router. The VCCs may be permanent (PVC) or switched (SVC), point-to-point or point-to-multipoint, and each is

## ATM Interface Console Commands

identified by a unique VPI/VCI. The trace command uses the VPI/VCI value for a VCC to perform packet tracing over a particular VCC.

### Example:

```
ATM Interface+ list vccs
                    VCCs
VPI  VCI  Hndl  Type  FrmXmt  FrmRcv  ByteXmt  ByteRcv
-----
  0   142   17   P-MP      0      0      0      0
Name = BUS Mcast Fwd on 'eth1'

  0   143   19   P-MP      0      0      0      0
Name = LEC 1 (LECID 0001) Mcast Fwd 'eth1'

  0   138   13  B0-139      1      0      62      0
Name = LEC 1 (LECID 0001) Mcast Send 'eth1'

  0   139   16  B0-138      0      1      0      62
Name = BUS Mcast Send LECID 0001 on 'eth1'

  0   134    9   P-MP      0      0      0      0
Name = LES Cntrl Dist on 'eth1'

  0   135   11   P-MP      0      0      0      0
Name = LEC 1 (LECID 0001) Cntrl Dist 'eth1'

  0   130    5   P-P      2      2     216     216
Name = LEC 1 (LECID 0001) Cntrl Dir 'eth1'

  0   131    7   P-P      2      2     216     216
Name = LES Cntrl Dir LECID 0001 on 'eth1'

  0    5    1   SAAL     2592     2592    27380    27036
Name = SAAL

  0   16    2   ILMI      545      544    23646    35030
Name = ILMI
```

```
VCC Totals: 4 point-to-point, 4 point-to-multipoint
ATM Interface+
```

```
P-P      point to point VCC
P-MP     point to multipoint VCC
ILMI     Interim Local Management Interface VCC
SAAL     signalling VCC
Bx-y     Internally bound VCC to VPI x, VCI y
Sx-y     Internally spliced VCC to VPI x, VCI y
```

### reserved-bandwidth

Lists the reserved bandwidth on the ATM Interface.

### Example:

```
ATM INTERFACE+ list reserved-bandwidth
Line Rate           : 155000 Kbps
Peak Reserved Bandwidth : None
Sustained Reserved Bandwidth : None
```

## Trace

Use the **trace** command activate packet tracing over a specified range of VPI/VCI values. You can view trace data by using ELS as described in "View" on page 12-21.

**Syntax:** trace list  
on

off

list

Displays the current packet tracing options on the ATM interface.

**Example:**

```
ATM Interface+ trace
on | off | list []? list
Packet trace is ON
Range of VPIs to be traced:    0 -    0
Range of VCIs to be traced:   32 -   39
```

on

Starts packet tracing on all active VCCs within the specified VPI/VCI range.

**Example:**

```
ATM Interface+ trace on
beginning of VPI range [0]?
end of VPI range [0]?
beginning of VCI range [32]?
end of VCI range [65535]? 39
```

off

Stops packet tracing on all VCCs.

**Example:**

```
ATM Interface+ trace off
ATM Interface+ trace list
Packet trace is OFF
```

## Wrap

Use the **wrap** command to perform a loopback data test on the ATM interface of the adapter. Wrap can be issued on a per VC basis by specifying VPI-VCI pairs. Data is looped back internally.

You can selectively start a wrap, stop a wrap, or display the current wrap settings.

If you stop or display a wrap, the following statistics will be displayed:

- Wrap transmits
- Wrap receives
- Wrap transmit errors
- Wrap receive errors
- Wrap receive timeouts

For display, the current wrap statistics are displayed.

For stop, the final wrap statistics are displayed.

**Syntax:** wrap      display  
                         start  
                         stop

display

Displays the current wrap settings.

start

Starts the wrap procedure and specifies the VPI-VCI length of pattern and the pattern itself.

**Example:**

```

ATM Interface+ wrap start
VPI [0]?
VCI [32]?
wrap pattern length [32]?
Enter 32-byte wrap pattern: [ABCDEFGHGIJKLMNOPQRSTUVWXYZ123456]?

```

stop

Stops the wrap procedure and displays final wrap statistics.

**Exit**

Use the **exit** command to return to the previous prompt level.

**Syntax:** `exit`

**SE Services Monitoring**

*Table 18-3. SE Services Console Command Summary*

Command	Function
?	Lists all of the SE Services console commands, or lists the options associated with specific commands.
CREATE	Dynamically creates and starts a newly configured superELAN without rebooting the device.
LIST	Displays information about the current configuration.
WORK with SuperELAN	Displays the Selected SuperELAN 'x' prompt from which you can monitor SuperELAN Services.
Exit	Exits the SE Services monitoring process and returns to the + prompt.

**Create**

Use the **Create** command to create a new SuperELAN.

**Syntax:** `create superelan name`

SuperELAN name

Specifies the name of the SuperELAN to be created.

**Note:** The SuperELAN must not be currently running and must have an associated SRAM record. One spare interface per ELAN in the SuperELAN must be available. See “Configuring Spare Interfaces” on page 6-5 for information about spare interfaces.

**Example:**

```

SE Services console>create
SuperELAN Name []? super_eth
SuperELAN interface 5 activated successfully.
SuperELAN interface 6 activated successfully.
SuperELAN interface 7 activated successfully.

```

SuperELAN 'super\_eth' started.



## List

Use the **list** command to display SuperELANs.

**Syntax:** `list`

**Example:**

```
SE Services console>list
Number of SuperELANs: 2
Mode E=Enabled/D=Disabled
| Type E=Ethernet/T=Token-Ring
| |
v v SuperELAN Name ID ELANs VLANs BCM IP NetBIOS
-----|-----|-----|-----|-----|-----|-----|-----|-----|
E T super_tok 88 2/ 3 1/ 1 Y N 00.00.27.72
E E super_eth 77 3/ 3 2/ 2 N N 00.00.27.73
```

## Work with SuperELAN

Use the **Work with SuperELAN** command to access the Selected SuperELAN 'superelan name'> prompt for detailed console monitoring.

**Syntax:** `work superelan#`

**Example:**

```
SE Services console>work
( 1) setest
( 2) super_eth
( 3) << Exit (no selection) >>
SuperELAN Name [1]? 2
SuperELAN 'super_eth' selected for detailed console monitoring.
```

See “Selected SuperELAN Console Monitoring” for information about the commands that are available after issuing the **work** command:

## Exit

Use the **exit** command to exit the SE Services console> prompt and return to the ATM+ command prompt.

---

## Selected SuperELAN Console Monitoring

The following commands are available at the Selected SuperELAN 'superelan name'> console prompt:

Table 18-4. Selected SuperELAN Console Command Summary

Command	Function
BROADCAST-MANAGER	See the chapter entitled “Monitoring Bridging” in the Multi-protocol Switched Services (MSS) Configuring Protocols and Features for information.
CLEAR counters	Resets counters.
CREATE	Creates an ELAN.
ENABLE	Enables the selected SuperELAN.
DISABLE	Disables the selected SuperELAN.
DISPLAY Counters	Displays counters of all ELANs in the SuperELAN.
ELANs	Lists ELANs in the SuperELAN.
FLUSH	Flushes the data on the LE control frame cache.
LIST	Displays the configured SuperELANs.
RESTART	Restarts a disabled SuperELAN.
SET	Sets SuperELAN cache age and size.
SHOW cache	Displays the data on the LE control frame cache.
TRACE	Enables packet tracing for the selected SuperELAN.
WORK with ELAN	Displays the Selected ELAN 'elan name'> prompt from which you can monitor ELAN Services.
VLANs	See the chapter entitled “Monitoring Bridging” in the Multi-protocol Switched Services (MSS) Configuring Protocols and Features for information.
Exit	Exits the SE Services monitoring process and returns to the SE Services+ console prompt.

## Broadcast Manager

Use the **Broadcast-Manager** command to access the Bridge Broadcast Manager console prompt. Refer to the chapter entitled “Monitoring Bridging” in the Multiprotocol Switched Services (MSS) Configuring Protocols and Features for additional information.

## Clear

Use the **clear** command to reset counters for all ELANs in the SuperELAN.

**Syntax:** `clear`

## Create

Use the **create** command to create and start a new ELAN. The ELAN must have been previously configured for the selected SuperELAN under `talk 6` and the ELAN can not be currently active. There must be at least one available spare interface for the ELAN. Use the **CONFIGURATION** command from the `+` prompt to determine the number of available spare interfaces.

**Syntax:** `create elan name`

**Example:**

```
SE Services console>create
ELAN Name []? eth4
ELAN interface 8 activated successfully.

ELAN 'eth4' started.
```

## Disable

Use the **disable** command to disable the selected SuperELAN.

Disabling the SuperELAN prevents new inter-ELAN shortcut VCCs from being established between ELANs. It does not prevent clients from setting up data direct VCCs within an ELAN and it does not disconnect inter-ELAN data direct VCCs already established.

Disabling the SuperELAN moves all spanning tree ELAN states to *Configured*. See “ELANs” for a description.

**Syntax:** disable

**Example:**

```
Selected SuperELAN 'super_eth'>disable
SuperELAN 'super_eth' disabled.
```

## Display

Use the **Display** command to display counter information for all ELANs in the SuperELAN.

**Syntax:** display

See “Display” on page 18-15 for an example of the **display** command.

## Enable

Use the **enable** command to enable the specified SuperELAN. Enabling the SuperELAN moves all spanning tree states to *listening* state. See “ELANs” for a description.

**Syntax:** enable

**Example:**

```
Selected SuperELAN 'super_eth'>enable
SuperELAN 'super_eth' enabled.
```

## ELANs

Use the **ELANs** command to display information about all the ELANs in the specified SuperELAN.

**Syntax:** elans

**Example:**

```

Selected SuperELAN 'super_eth'>elans
SuperELAN Name: super_eth
Number of ELANS: 3
Interface Number          Port Number (Dec)
      | L=Local/R=Remote ELAN | Port Priority (Hex)
      | E=Enabled/D=Disabled   |
      |                         |
v    v v ELAN Name          v    v      Status  Time Since
-----
  4 L E                    eth1   1 80  Forwarding 00.01.42.00
  5 L E                    eth2   2 80  Forwarding 00.01.42.04
  6 L E                    eth3   3 80  Forwarding 00.01.42.08

```

ELAN status values:

**Forwarding** SuperELAN is forwarding LE control and data frames to this ELAN

**Learning** SuperELAN is receiving data frames for the purpose of caching MAC addresses and Route Descriptors, but no frames are being sent to this ELAN

**Listening** SuperELAN is listening for SE Spanning Tree frames to determine if this ELAN should proceed to the Learning state or Block itself

**Blocked** No frames are being sent or received since another short-cut SuperELAN path exists with higher priority to this ELAN

**Configured** ELAN interface is configured within the SuperELAN but is not participating in the SE Spanning Tree and is not receiving or forwarding frames. Most likely the ELAN has been disabled

**NetDown** LAN Emulation interface is down, usually indicates that the LEC has not successfully joined the ELAN

**Configuring** ELAN interface is initializing and will enter the Listening state (if enabled) or Configured state (if disabled) after initialization is complete

**NotSetup** ELAN interface is not defined

## Flush

Use the **flush** command to clear the control and/or data cache for all ELANs in the SuperELAN.

**Syntax:** `flush`

### Example:

```

Selected SuperELAN 'super_eth'>flush ?
CONTROL Frame Forwarding Cache
DATA Frame Forwarding Cache

```

```

Selected SuperELAN 'super_eth'>flush control
Control Frame Forwarding Cache flushed for SuperELAN 'super_eth'.

```

## List

Use the **List** command to display the status of the selected SuperELAN.

**Syntax:** `list`

### Example:

```
Selected SuperELAN 'super_eth'>list
----- SuperELAN Configuration -----
SuperELAN Name:          super_eth
Type:                   Ethernet
Mode:                   Enabled
ID:                     44
Frame Size:             1516

----- ELAN Cache Status -----
Learned ring segment (hex): 0
MAC Cache Age:          300
MAC Cache Size:         1000
Dynamic MAC Entries Count: 5

----- Spanning Tree Status -----
Bridge Priority-ID:      32768-000413473679
Designated Root Priority-ID: 32768-000413473679
Root Port:              Self
Max Age:                 20
Hello Time:              2
Forward Delay:           15
Topology Change Detected: No
Topology Change:         No

----- Packet Tracing Status -----
Packet Tracing:          Disabled
Trace Dest Address Mask: 000000000000
Trace Dest Address Value: 000000000000
Trace Source Address Mask: 000000000000
Trace Source Address Mask: 000000000000

----- VLAN Configuration Summary -----
                          Enabled/Configured
IP VLANs:                 1/1
IPX VLANs:                0/0
NetBios VLANs:           0/0
Sliding Window VLANs:    1/1
Mac Address VLANs:        0/0

----- Broadcast Management -----
IP:                       Enabled
NetBIOS Dupl. Filter:     Disabled
NetBIOS Route Caching:    Disabled
```

## Restart

Use the **restart** command to restart the SuperELAN. Restarting the SuperELAN causes the configuration record parameters to be used upon restart, instead of just enabling the ELAN, which restarts the ELAN with current runtime parameters. The SuperELAN must be disabled prior to issuing the **restart** command.

**Syntax:** `restart`

## Set

Use the **set** command to dynamically set the data cache characteristics for the selected SuperELAN.

The cache age value determines the amount of time in seconds a newly added entry will remain in the cache without being revalidated.

The cache size limits the number of MAC addresses cached to prevent excessive heap usage.

**Note:** Route descriptor cache entries are not bound by any configurable cache limit.

Once the cache is full, the next new MAC entry added will cause the oldest MAC entry to be deleted from the cache.

**Syntax:** `set cache age  
size`

### Example:

```
Selected SuperELAN 'super_eth'>set cache ?  
AGE  
SIZE
```

```
Selected SuperELAN 'super_eth'>set cache size  
MAC Filter Cache Size (1-10000) [1000]? 2000  
Cache Size parameter updated for SuperELAN 'super_eth'.
```

## Show

Use the **show** command to display data or control frame cache for all ELANs in the selected SuperELAN.

**Syntax:** `show control  
data  
dynamic-mac  
registered-mac  
route-descriptor 1`

**1** This menu item does not appear for Ethernet SuperELANs.

### Example:

```
Selected SuperELAN 'super_eth'>show ?  
CONTROL Frame Forwarding Cache  
DATA Frame Forwarding Cache
```

```
Selected SuperELAN 'super_eth'>show data dyn
```

ELAN Name	Count	MAC Address	TTL
eth1	1	000044891323	240
eth2	2	000064432998	120
		000099213011	300
eth3	0		

## Trace

Use the **trace** command to start packet tracing for the selected SuperELAN. When used with the Packet Tracing subsystem in ELS, all frames received and transmitted onto this SuperELAN are traced. Destination and Source MAC Address filters are provided to help limit the number of traced data frames. Trace filters are configured using the SuperELAN **TRACE ADDRESS** command and are applied to ELANs in the SuperELAN. See “Packet-trace Console Commands” on page 12-22 for more information.

**Syntax:** `trace`    on  
                          off  
                          address

### Example:

```
Selected SuperELAN 'super_eth'>trace ?
ON
OFF
ADDRESS

Selected SuperELAN 'super_eth'>trace addr
Enter dest MAC addr trace mask in xx.xx.xx.xx.xx.xx form [00.00.00.00.00.00]?
ffffffffffff
Enter dest MAC addr trace value in xx.xx.xx.xx.xx.xx form [00.00.00.00.00.00]?
00005a000001
Enter source MAC addr trace mask in xx.xx.xx.xx.xx.xx [00.00.00.00.00.00]?
ffffffffffff
Enter source MAC addr trace value in xx.xx.xx.xx.xx.xx [00.00.00.00.00.00]?
00005a000002
Address trace parameters updated for SuperELAN 'super_eth'.
```

Configuring the MAC mask and values as shown will allow only frames with a destination MAC address of 00005a000001 and a source MAC address of 00005a000002 to be traced.

## Work with ELAN

Use the **work with ELAN** command to get to the Selected ELAN 'elan name'> monitoring prompt. At this prompt, you can monitor detailed ELAN parameters for the selected ELAN on the SuperELAN.

**Syntax:** `work with ELAN` *elan#*

### Example:

```
Selected SuperELAN 'super_tok'>work
( 1) eth1
( 2) eth2
( 3) eth3
( 4) << Exit (no selection) >>
ELAN Name [1] 2
ELAN 'eth2' selected for detailed console monitoring

Selected ELAN 'tok2'>
```

See “Selected ELAN Monitoring” on page 18-14 for information about the commands available after you issue the **work** command.

## VLANs

Use the **vlan** command to access the SuperELAN 'x' VLANs> console prompt. At this point, you can configure and monitor VLANs on this SuperELAN. Refer to the chapter entitled "Monitoring Bridging" in the Multiprotocol Switched Services (MSS) Configuring Protocols and Features for additional information.

**Syntax:** vlan

## Exit

Use the **exit** command to exit the Selected SuperELAN 'x'> monitoring prompt and return to the SE Services+ console command menu for SuperELANs.

**Syntax:** exit

---

## Selected ELAN Monitoring

This section summarizes the selected ELAN detailed monitoring commands for a selected SuperELAN. Enter the commands at the Selected ELAN 'x'> prompt.

**Note:** Many of the commands at this prompt level perform the same action as the corresponding command at the Selected SuperELAN 'x'> command prompt level. The difference is that the action at this command prompt level is directed to an ELAN rather than a SuperELAN.

*Table 18-5. Selected ELAN Monitoring Command Summary*

Command	Function
?	Lists all of the selected ELAN monitoring commands, or lists the options associated with specific commands.
CLEAR	Clears counters for selected ELAN.
DISABLE	Disables an ELAN.
DISPLAY	Lists the current configured ELAN counters.
ENABLE	Enables an ELAN.
FLUSH	Flushes the control or data cache associated with the ELAN.
LEC	Points to the LE-CLIENT monitoring menu.
LES-BUS	Points to the LES-BUS monitoring menu.
LIST	Lists the current configured ELAN.
RESTART	Restarts the ELAN using configuration parameters.
SHOW	Displays LE control or data cache MAC and Route Descriptor entries.
Trace	Configures tracing for selected ELAN.

## Help (?)

Use the ? command to list the monitoring options for Selected ELAN.

**Syntax:** ?

**Example:**



```
Selected ELAN 'eth2'> ?
CLEAR Counters
DISABLE
DISPLAY Counters
ENABLE
FLUSH cache
LEC
LES-BUS 1
LIST
RESTART with config parms
SHOW cache
TRACE
EXIT
Selected ELAN 'eth2>
```

**Note:**

**1** This menu item does not appear for remote ELANs.

## Disable

Use the **Disable** command to disable an ELAN. Disabling the ELAN prevents clients of the disabled ELAN from setting up short-cut Data Direct VCCs with clients on other ELANs in the SuperELAN. It does not prevent clients in the disabled ELAN from communicating with clients in other ELANs if routing has been enabled on any of the SuperELAN interfaces. Also, disabling the ELAN does not prevent clients on the disabled ELAN from setting up Data Direct VCCs among themselves.

**Syntax:** `disable elan#`

**Example:**

```
Selected ELAN 'eth2'>disable
( 1) << All ELANs >>
( 2) eth1
( 3) eth2
( 4) eth3
( 5) << External ELAN >>
( 6) << Exit (no selection) >>
ELAN Name [1]: 2
ELAN 'eth2' disabled
```

## Display

Use the **Display** command to display counters for the selected ELAN.

**Syntax:** `display`

**Example:**

```
Selected ELAN 'eth2'>display
SuperELAN: super_eth
```

```
-----
ELAN: eth2
-----
```

Data Packet Counters		LE Control Frame Counters	
Pkts received . . . . .	0	LE Control Frame received .	0
Pkts transmitted. . . . .	0	LE Control Frame xmitted. .	0
Pkts disc, src addr filt. .	0	LE Ctl disc, rcv port !fwd.	0
Pkts disc, dest addr filt .	0	LE Ctl disc, xmit port !fwd	0
Pkts disc, protocol filt. .	0	ARP Requests received . . .	0
Pkts disc, rcv port !fwd. .	0	ARP Requests transmitted. .	0
Pkts disc, rcv port no bufs	0	ARP Requests disc, error. .	0
Pkts disc, rcv port q over.	0	ARP Requests filt . . . . .	0
Pkts disc, xmit port !fwd .	0	ARP Replies received. . . .	0
Pkts disc, xmit error . . .	0	ARP Replies transmitted . .	0
Pkts disc, frame too big. .	0	ARP Replies disc, error . .	0
Pkts disc, rif seg mismatch	0	NARP Requests received. . .	0
Pkts disc, rif seg dup. . .	0	NARP Requests transmitted .	0
Pkts routed, not SEed . . .	0	Flush Requests received . .	0
		Flush Requests transmitted.	0
BPDUs received . . . . .	0	Flush Replies received. . .	0
BPDUs disc, rcv port q over	0	Flush Replies transmitted .	0
		LE Ctl disc, ctl frm q over	0

## Enable

Use the **Enable** command to enable the selected ELAN.

**Syntax:** `enable elan#`

### Example:

```
Selected ELAN 'super_tok'>enable
( 1) << All ELANs >>
( 2) tok1
( 3) tok2
( 4) tok3
( 5) << External ELAN >>
( 6) << Exit (no selection) >>
ELAN Name [1] 2
ELAN 'tok1' enabled
```

## Flush

Use the **Flush** command to clear the control and/or data cache for the selected ELAN.

**Syntax:** `flush`

### Example:

```
Selected ELAN 'eth2'>flush ?
CONTROL Frame Forwarding Cache
DATA Frame Forwarding Cache
```

```
Selected ELAN 'eth2'>flush data
Data Frame Forwarding Cache flushed for ELAN 'eth2'.
```

## LEC

Use the **lec** command to jump directly to the ATM LAN Emulation client monitoring menu for the SuperELAN interface associated with the selected ELAN. See Chapter 19, “Using and Configuring LAN Emulation Clients” on page 19-1 for additional information.

**Syntax:** lec

**Example:**

```
Selected ELAN 'eth2'>lec
ATM Emulated LAN Console
LEC+
```

## LES-BUS

Use the **les-bus** command to jump directly to the LES-BUS monitoring menu for the selected ELAN. See Chapter 21, “Configuring LAN Emulation Services” on page 21-1 for additional information.

This menu item is visible only for locally configured LAN Emulation Services.

**Syntax:** les-bus

**Example:**

```
Selected ELAN 'eth2'>les
EXISTING LES-BUS 'eth2'+
```

## List

Use the **list** command to list configuration for the selected ELAN.

**Syntax:** list

**Example:**

```
Selected ELAN 'tok4'>list
----- ELAN Configuration -----
ELAN Name:                eth2
Status:                   Enabled
Location:                 Local
Interface Number:        5
Port Number:              2
Packet Tracing:          Disabled

----- Spanning Tree Status -----
STP State:                Forwarding
Time Since Last STP State Change: 00.00.39.67
Spanning Tree Priority:   128
Path Cost:                32768
Designated Root:         000413473679
Root Cost:                0
Designated Bridge:       000413473679
Designated Port:         2
```

## Restart

Use the **restart** command to restart the ELAN using the configuration parameters. The ELAN must be disabled prior to issuing this command.

**Syntax:** `restart`

### Example:

```
Selected ELAN 'eth1'>restart
Restarting ELAN 'eth1'.
```

## Show

Use the **Show** command to display the data and control frame cache for the selected ELAN.

**Syntax:** `show` *control*  
*data*  
*dynamic-mac*  
*registered-mac*  
*route-descriptor* **1**

**1** This menu item does not appear for Ethernet SuperELANs.

### Example:

```
Selected ELAN 'eth2'>show ?
CONTROL Frame Forwarding Cache
DATA Frame Forwarding Cache
```

```
Selected ELAN 'eth2'>show data ?
DYNAMIC-MAC
REGISTERED-MAC
```

ELAN Name	Count	MAC Address	TTL
-----	-----	-----	-----
	eth2	2 000064432998	120
		000099213011	300

## Trace

The **Trace** command enables packet tracing for the selected ELAN in the SuperELAN. When used with the Packet Tracing subsystem in ELS, all frames received and transmitted onto this ELAN are traced. Destination and Source MAC Address filters are provided to help limit the number of traced data frames. These trace filters are configured using the **TRACE ADDRESS** command and are applied to all ELANs in the SuperELAN. See “Packet-trace Console Commands” on page 12-22 for more information.

**Syntax:** `trace`

### Example:

```
Selected ELAN 'eth2'>trace ?
ON
OFF
```

```
Selected ELAN 'eth2'>trace on
Packet tracing enabled for ELAN port 'eth2' on SuperElan 'super_test_elan'.
```

---

## ATM-LLC Monitoring

This section explains the commands for monitoring ATM LLC multiplexing.

Enter the commands at the ATM-LLC+ prompt.

*Table 18-6. ATM LLC Configuration Command Summary*

Command	Function
? (Help)	List all the ATM LLC configuration commands, or list the options associated with specific commands.
List	Lists various options
Exit	Returns to the ATM+ prompt.

### List

Use the **list** command to list various categories of ATM LLC monitoring data.

**Syntax:** `list` endpoints  
channels

#### endpoints

Lists the ATM addresses in use by protocols using the ATM-LLC multiplexing function on the device. The endpoint is displayed as the End System Identifier and the Selector.

**Example:** `list endpoints`

```
ATM-LLC+ list endpoints
```

#### channels

Lists the channels in use by protocols using the ATM-LLC multiplexing function on the device.

**Example:** `list channels`

```
ATM-LLC+ list channels
```

### Exit

Use the **exit** command to exit the **ATM-LLC+** command prompt.

**Syntax:** `exit`



---

## Chapter 19. Using and Configuring LAN Emulation Clients

This chapter describes LAN Emulation Clients (LECs). It includes the following sections:

- “LAN Emulation Client Overview”
- “Configuring LAN Emulation Clients (LE Client Config>)” on page 19-2
- “Configuring an ATM Forum-Compliant LE Client” on page 19-4
- “Configuring an IBM LE Client” on page 19-17

---

### LAN Emulation Client Overview

As a pioneer of ATM technology, IBM defined one of the early LAN Emulation architectures. The ATM Forum LAN Emulation Specification diverged from IBM's architecture in a number of ways. IBM, like several other vendors, now has products that implement two different LAN Emulation architectures: earlier products implement the IBM LAN Emulation Architecture, while more recently developed products implement the ATM Forum LAN Emulation Specification. The MSS Server implements LE Clients for both architectures, but LE Servers for ATM Forum LAN Emulation only.

Although ATM Forum LAN Emulation is the strategic direction for multivendor interoperability, customers that have installed products implementing the IBM LAN Emulation Architecture must also be supported. These customers will generally fall into one of the following two categories:

1. Those who wish to continue using IBM LAN Emulation, which offers some technical advantages relative to the ATM Forum LAN Emulation
2. Those who wish to migrate to ATM Forum LAN Emulation.

The 8210 can provide routing and bridging services that support any combination of ATM Forum or IBM LAN Emulation clients. From routing and bridging perspectives, IBM LECs are functionally equivalent to ATM Forum LECs; both provide emulated Ethernet and Token-Ring interfaces with operational characteristics of real interfaces. You can configure a LEC to be either of these types:

- Ethernet
  - ATM Forum-Compliant
  - IBM
- Token-Ring
  - ATM Forum-Compliant
  - IBM

LECs are equivalent to “ports” or “interfaces” on traditional routers and bridges. The router bridges and routes traffic between ports by receiving and transmitting traffic through its LECs.

There are two levels to the configuration menus for LE Clients:

1. LE Client Config> permits you to view the set of LE Clients on a particular ATM interface, to add or remove LECs from this set, or to enter into a more detailed configuration environment for any member of this set (see LEC com-

mands in the following). The commands for this prompt level are described in “Configuring LAN Emulation Clients (LE Client Config>)” on page 19-2.

2. Token-Ring-Forum LEC Config>, Token-Ring-IBM LEC Config>, Ethernet-Forum LEC Config>, or Ethernet-IBM LEC Config> permits you to configure all parameters for a particular LE Client. The commands available at this level are described in “Configuring an ATM Forum-Compliant LE Client” on page 19-4 and “Configuring an IBM LE Client” on page 19-17.

An explanation of commands for LAN Emulation Clients follows.

---

## Configuring LAN Emulation Clients (LE Client Config>)

This section explains the commands for viewing, changing, using the set of LE Clients on a particular ATM interface.

Enter the commands at the LE Client Config> prompt under the ATM Config> prompt, as described in “ATM Configuration Commands” on page 17-3.

To get to the LE Client Config> prompt, enter **le-c** at the ATM Config> prompt as described in “ATM Configuration Commands” on page 17-3.

*Table 19-1. LAN EMULATION Client Configuration Commands Summary*

Command	Function
? (Help)	Lists the console commands or list the actions associated with specific commands
Add	Adds a LEC for the following types of Emulated LANs architectures: <ul style="list-style-type: none"><li>• Ethernet<ul style="list-style-type: none"><li>– ATM Forum-Compliant</li><li>– IBM</li></ul></li><li>• Token-Ring<ul style="list-style-type: none"><li>– ATM Forum-Compliant</li><li>– IBM</li></ul></li></ul>
Config	Gets you to the LEC Config> prompt, from which you can configure a specific LAN Emulation Client as described in: <ul style="list-style-type: none"><li>• “Configuring an ATM Forum-Compliant LE Client” on page 19-4</li><li>• “Configuring an IBM LE Client” on page 19-17</li></ul>
List	Lists the LECs
Remove	Removes a LEC.
Exit	Returns to the previous prompt.

## Help

Use the **? (help)** command to list the commands that are available from the current prompt level. You also can enter a ? after a specific command name to list its options.

**Syntax:** ?

**Example:** ?



```

ADD
CONFIG
LIST
REMOVE
EXIT

```

## Add

Use the **add** command to add an ATM Forum-compliant or IBM LEC for a Token-Ring or Ethernet emulated LAN.

**Syntax:** `add Ethernet Forum`  
`Ethernet IBM`  
`Token Ring Forum`  
`Token Ring IBM`

`token ring forum`  
Token ring ATM Forum compliant LEC.

**Example:** `add token ring forum`

```

LE Client Config> add token ring forum
Added device as interface 3

```

`token ring IBM`  
Token ring IBM LEC.

**Example:** `add token ring ibm`

```

LE Client Config> add token ring ibm
Added device as interface 3

```

`ethernet forum`  
Ethernet Forum-Compliant LEC.

**Example:** `add ethernet forum`

```

LE Client Config> add ethernet forum
Added device as interface 2

```

`ethernet IBM`  
Ethernet IBM LEC.

**Example:** `add ethernet ibm`

```

LE Client Config> add ethernet ibm
Added device as interface 1

```

## Config

Use the **config** command to get you to the LEC `Config>` prompt, from which you can configure the details of a specific LAN Emulation Client. Refer to “Configuring an ATM Forum-Compliant LE Client” on page 19-4 or “Configuring an IBM LE Client” on page 19-17.

**Syntax:** `config interface#`

`interface#`

An integer number assigned by the router when the LEC was added to the configuration. Use the **list** command to determine the number interface number assigned to the LEC.

**Example:** `config`

```

LE Client Config> config 3

```

## List

Use the **list** command to list the LAN emulation clients.

**Syntax:** `list`

**Example:** `list`

```
LE Client Config> list
                        ATM Emulated LANs
-----
ATM interface number = 0
LEC interface number = 1
Emulated LAN type    = Token Ring
Emulated LAN name    =
```

## Remove

Use the **remove** command to remove a LEC. You must specify the interface number that was assigned when the LEC was added to the configuration. Use the **list** command to determine the interface number assigned to the LEC.

**Syntax:** `remove interface#`

`interface#`

An integer number assigned by the router.

## Exit

Use the **exit** command to return to the previous prompt.

---

## Configuring an ATM Forum-Compliant LE Client

This section explains the commands for configuring an ATM Forum-compliant LAN Emulation Client. Enter the appropriate commands at either the Ethernet-Forum LE Client Config> prompt or the Token-Ring-Forum LE Client Config> prompt. Commands in the following table apply to both types of LECs except where indicated.

Enter the commands at the LEC Config> prompt after entering the **config** command at the LE Client Config> prompt.

<i>Table 19-2 (Page 1 of 2). LAN Emulation Client Configuration Commands Summary</i>	
Command	Function
? (Help)	Lists the console commands or lists the actions associated with a particular command.
ARP-Configuration	Allows you to configure the LE-ARP configuration for the ATM Forum-compliant client
Frame	Sets the NetWare IPX encapsulation type.
RIF-Timer	Sets the maximum amount of time that information in the RIF is maintained before it is refreshed. Applies only to Token-Ring LECs.
Source-routing	Used to enable or disable source-route bridging. Applies only to Token-Ring LECs.
IP-Encapsulation	Sets the IP encapsulation as Ethernet (type X'0800') or IEEE (802.3 with SNAP). Applies only to Ethernet LECs.
List	Lists the LAN Emulation Client configuration.

Table 19-2 (Page 2 of 2). LAN Emulation Client Configuration Commands Summary

Command	Function
QOS-Configuration	Gets you to the e1an-x LEC QoS Config> prompt from which you can configure Quality of Service as described in “LE Client QoS Configuration Commands” on page 14-7.
Set	Sets the LAN Emulation Client parameters.
Exit	Returns to the previous prompt.

## Help

Use the ? (**help**) command to list the commands that are available from the current prompt level. You also can enter a ? after a specific command name to list its options.

**Syntax:** ?

**Example:** ?

```

ARP-CONFIGURATION
FRAME
LIST
RIF-TIMER
SET
SOURCE-ROUTING
QOS-CONFIGURATION
EXIT

```

## ARP Configuration

Use the **arp-configuration** command to configure the static LE-ARP entries for the ATM forum-compliant LAN Emulation Client.

**Syntax:** arp-configuration

**Example:**

```

Token Ring Forum Compliant LEC Config> arp-configuration
ATM LAN Emulation Clients ARP configuration

```

Table 19-3. ATM LAN Emulation Client ARP Configuration Commands Summary

Command	Function
? (Help)	Lists the console commands or lists the actions associated with a particular command.
Add	Adds an LE-ARP cache entry using a MAC or route descriptor ARP
Config	Sets cache entry QoS parameter values.
List	Lists configured ARP cache entries.
Remove	Removes an ARP cache entry.
Exit	Returns to the previous prompt.

**Add**

Use the Add command to add an ARP cache entry using the MAC address or a route descriptor.

MAC addresses, and route descriptors are entered as strings of hexadecimal characters with or without optional separator characters between bytes. Valid separator characters are dashes (-), periods (.), or colons (:).

**Add**        mac  
                 route descriptor

**Config**

Use this command to provide configuration parameter information for the ARP you are configuring. See Chapter 14, "Using and Configuring Quality of Service (QoS)" on page 14-1 for additional information about ARP configuration parameters.

Use the **Config** command to configure the permanent ARP cache entry QOS parameters for the ATM forum-specific LAN Emulation Client.

**Syntax: Config** *arp-entry-number*

**Example:**

```
ARP config for LEC> config
ARP entry number [1]
Configure LEC ARP entry
```

<i>Table 19-4. ATM LAN Emulation Client ARP Config Commands Summary</i>	
Command	Function
? (Help)	Lists the console commands or lists the actions associated with a particular command.
Set	Sets QOS parameter values.
Exit	Returns to the previous prompt.

**Help:** Use the ? (**help**) command to list the commands that are available from the current prompt level. You also can enter a ? after a specific command name to list its options.

**Syntax: ?**

**Example: ?**

```
SET
EXIT
```

**Set:** Use the **Set** command to configure the permanent ARP cache entry QOS parameters for the ATM forum-specific LAN Emulation Client.

**Syntax: Set** . . .

**Example:**

```

ARP entry 'identifier' config> set ?
MAX-RESERVED-BANDWIDTH
TRAFFIC-TYPE
PEAK-CELL-RATE
SUSTAINED-CELL-RATE
QOS-CLASS
MAX-BURST-SIZE

```

See Chapter 14, “Using and Configuring Quality of Service (QoS)” on page 14-1 for information about the following QoS parameters.

```

Set      max-reserved-bandwidth
           traffic-type
           peak-cell-rate
           sustained-cell-rate
           qos-class
           max-burst-size

```

**Exit:** Returns to the previous prompt.

### List

Use the **List** command to display information about ARP configuration.

### Remove

Use this command to remove an configured MAC address or Route Descriptor LE-ARP entry.

Select the ARP entry number to be removed from the list provided.

```
Remove arp-entry-number
```

### Exit

Use this command to exit the ARP configuration and return to the LE-client configuration.

## Frame

Use the **frame** command to set the NetWare IPX encapsulation type. The command options differ depending on the type of LEC (Token-Ring or Ethernet). For Token-Ring LECs, enter one of the following:

Option	Description	Syntax
Token-Ring using MSB	Uses the standard 802.2 IPX header with the noncanonical Token-Ring address bit ordering (MSB).	frame token-ring msb
Token-Ring using LSB	Uses the 802.2 IPX header with the canonical address bit ordering (LSB).	frame token-ring lsb
Token-Ring with 802.2 SNAP using MSB	Uses the 802.2 format with a SNAP header and noncanonical address bit ordering. This encapsulation is used primarily in bridging environments.	frame token-ring_snap msb
Token-Ring with 802.2 SNAP using LSB	Uses the 802.2 format with a SNAP header and canonical address bit ordering.	frame token-ring_snap lsb
Ethernet 2.0	Uses Ethernet version 2.0 protocol 81-37.	frame ethernet_II
Ethernet 802.2	Uses Ethernet 802.3 with 802.2 SA E0	frame ethernet_8022
Ethernet 802.3	Uses Ethernet 802.3 without any 802.2 header	frame ethernet_802.3
Ethernet SNAP	Uses 802.3, 802.2 with SNAP PID 00-00-00-81-37	frame ethernet_SNAP

**Syntax:** `frame ipx-encapsulation type`

Note: The frame command cannot be used in the network configuration process to set the IPX encapsulation unless the interface has been configured with IPX.

The IPX encapsulation can also be set in the IPX configuration environment. Refer to the Multiprotocol Switched Services (MSS) Configuring Protocols and Features chapter on Configuring IPX for details.

**Example:** `frame token_ring msb`

## RIF-Timer (for Token-Ring Forum-compliant LEC only)

Use the **RIF-Timer** command to set the maximum amount of time that information in the RIF is maintained before it is refreshed. Range is 0 to 4096. The default is 120.

**Syntax:** `rif-timer`

**Example:** `rif-timer 100`

## Source-routing (for Token-Ring Forum-compliant LEC only)

Use the **source-routing** command to enable or disable end station source-routing. Source routing is the process by which end stations determine the source route to use to cross source routing bridges. Source routing allows the IP, IPX, and AppleTalk Phase 2 protocols to reach nodes on the other side of the source route bridge.

This function of the device is not changed whether source routing is enabled or disabled. The default setting is enabled.

Some stations cannot properly receive frames with Source Routing RIF on them. This is especially common among NetWare drivers. Disabling source routing in this situation will allow you to communicate with these stations.

Source routing should be enabled only if there are source-routing bridges on this ring through which you want to bridge IP, IPX, and AppleTalk Phase 2 packets. Source routing must also be enabled so that LLC test response messages can be returned.

**Syntax:** source-routing enable  
disable

**Example:** source-routing disable

## IP-Encapsulation (for Ethernet ATM Forum-compliant LEC only)

Use the **IP-encapsulation** command to select Ethernet (Ethernet type X'0800') or IEEE 802.3 (Ethernet 802.3 with SNAP). Specify either type Ethernet or IEEE-803.3.

**Syntax:** IP-encapsulation *type*

**Example:** IP-encapsulation E

## List

Use the **list** command to list the LE client configuration.

**Syntax:** list

**Example:** list

## QoS

Use the **qos-configuration** command to get you to the LEC QoS Config> prompt from which you can configure Quality of Service as described in "LE Client QoS Configuration Commands" on page 14-7.

**Syntax:** qos-configuration

## Set

Use the **set** command to set LE Client parameters.

**Syntax:** set arp-aging-time  
arp-cache-size  
arp-queue-depth

arp-response-time  
auto-config  
best-effort-peakrate  
config-retries  
conn-completion-time  
control-timeout  
elan-name  
esi-address  
flush-timeout  
forward-delay  
frame-size  
lecs-atm-address  
les-atm-address  
mac-address  
multicast-send-avg  
multicast-send-peak  
multicast-send-type  
path-switch-delay  
retry-count  
selector  
trace  
unknown-count  
unknown-time  
vcc-timeout

arp-aging-time

Sets ARP aging time. This is the maximum time that a LEC will maintain an entry in its LE\_ARP cache in the absence of a verification of that relationship. A larger aging time may result in a faster session setup time, but may also use more memory and reacts slower to changes in network configuration.

**Valid Values:** An integer number of seconds in the range of 10 to 300.

**Default Value:** 300

**Example: set arp-aging-time**

LEC Config> **set aging-time 200**

arp-cache-size

Sets the number of entries in the ARP cache. The size of the ARP cache limits the number of simultaneous data direct VCCs. Larger ARP caches require more memory, but permit the client to simultaneously converse with a larger number of destinations.

**Valid Values:** An integer number in the range of 10 to 1024.

**Default Value:** 1024

**Example: set arp-cache-size**

LEC Config> **set arp-cache-size 10**

arp-queue-depth

Sets the maximum number of queued frames per ARP cache entry. The LEC enqueues frames when switching the data path from the Multicast Send VCC to a Data Direct VCC. Frames passed to the LEC for transmission will be discarded if the queue is full. A larger queue requires



more memory, but results in fewer discarded frames during the data path switch.

**Valid Values:** An integer number in the range of 0 to 10.

**Default Value:** 5

**Example: set arp-queue-depth**

```
LEC Config> set arp-queue-depth 10
```

#### arp-response-time

Sets expected ARP response time. This value controls how frequently an unanswered LE ARP request is retried. Larger values result in fewer LE ARPs, which causes less traffic and possibly increase the amount of time before a Data Direct VCC is established.

**Valid Values:** An integer number of seconds in the range of 1 to 30.

**Default Value:** 1 second

**Example: set arp-response-time**

```
LEC Config> set arp-response-time 20
```

#### auto-config

Specifies whether this LEC uses LECS auto-config mode. Specify YES or NO. The LEC may contact the LECS to obtain the address of its LES and various other configuration parameters. This value must be Yes for the client to use a redundant IBM MSS Server LES.

**Valid Values:** If YES, then you do not have to configure the ATM address of the LES.

If NO, then you *must* configure the ATM address of the LES using the **set les-atm-address** command as described on page 19-13.

**Default Value:** NO

**Example: set les auto-config**

```
LEC Config> set les auto-config yes
```

#### best-effort-peakrate

Sets the Best Effort Peak Rate. Used when establishing best effort multicast send connections.

The maximum peak rate depends on the maximum data rate of the ATM device.

Specify an integer from 1 to the maximum peak rate in Kbps (the definition is the maximum data rate) as follows:

- If ATM maximum data rate is 25 Mbps, the maximum peak rate is 25,000 Kbps.
- If ATM maximum data rate is 155 Mbps, the maximum peak rate is 155,000 Kbps.

**Valid Values:** An integer number in the range of 1 - device maximum data rate.

**Default Value:** 155000

**Example: set best-effort-peakrate**

```
LEC Config> set best-effort-peakrate 24000
```

### config-retries

Sets the number of configuration retries.

If the client is unable to connect to the LES address given to it in a configure response, the client will send another configure request to the LECS before releasing the configuration direct VCC. This value controls how many retries are made before the client releases the configuration direct VCC. When this limit is reached, the client will sleep for a period of time (not exceeding 30 seconds) and restart the configuration phase. Interoperability problems may arise if this value is set to zero.

**Valid Values:** An integer number in the range of 0 to 5.

**Default Value:** 3

**Example: set config-retries**

```
LEC Config> set config-retries 4
```

### connection-completion-time

Sets the connection completion time. This is the time interval in which data or a READY\_IND message is expected from a calling party.

When a Data Direct VCC is established to the client, the LEC expects data or a READY\_IND message within this time period. The LEC will not transmit frames over a Data Direct VCC established to it until receiving data or a READY\_IND. This parameter value controls the amount of time which passes before the LEC issues a READY QUERY (in hopes of receiving a READY\_IND). Smaller values lead to faster response times, but also to unnecessary transmissions.

**Valid Values:** An integer number of seconds in the range of 1 to 10.

**Default Value:** 4 seconds

**Example: set connection-completion-time**

```
LEC Config> set connection-completion-time 5
```

### control-timeout

Sets the control timeout. This is the timeout period used for timing out most request/response control frame interactions. Smaller timeout values result in more traffic and may result in faster response times.

**Valid Values:** An integer number of seconds in the range of 10 to 300.

**Default Value:** 30 seconds

**Example: set control-timeout**

```
LEC Config> set control-timeout 100
```

### elan-name

Specifies name of the ELAN that the LEC wishes to join. This is the ELAN name sent to the LECS in the configure request (if the LEC autoconfigures) or to the LES in the join request. The LECS or LES may return a different ELAN name in the response.

**Valid Values:** Any character string length of 0 - 32 bytes.

**Default Value:** Blank

**Note:** A blank name (0 length string) is valid.

**Example: set elan-name**

```
LEC Config> set elan-name FUZZY
```

**esi-address**

Sets the ESI portion of the LEC's ATM address.

Specify the ESI portion (octets 13 through 19) of the LEC's ATM address. The ESI and selector combination of the LEC must be unique among all LAN emulation components on the device.

**Valid Values:** Any 12 hexadecimal digits.

**Default Value:** none

**Example: set esi**

```
Select ESI
(1) Use burned in ESI
(2) 11.22.33.44.55.66

Enter selection [1]?
```

**flush-timeout**

Sets the flush timeout. This is the time limit to wait to receive the LE\_FLUSH\_RESPONSE after the LE\_FLUSH\_REQUEST has been sent before taking recovery action. This is the amount of time between flush requests when the LEC is attempting to switch to a Data Direct connection.

When switching from the multicast send to a data direct data path, the client sends a flush request over the multicast send VCC. Until a flush response is received, or until the path switch delay expires, frames are queued for the destination. A smaller timeout generates more flush traffic, but may result in fewer discarded data frames.

**Valid Values:** An integer number of seconds in the range of 1 to 4.

**Default Value:** 4 seconds

**Example: set flush-timeout**

```
LEC Config> set flush-timeout 3
```

**forward-delay**

Sets the forward delay. Entries in the LE ARP cache must be periodically reverified. The forward delay time is the maximum amount of time a remote entry may remain in the cache during a network topology change. Larger aging times may result in stale (invalid) entries, but also cause less reverification traffic.

**Valid Values:** An integer number of seconds in the range of 4 to 30.

**Default Value:** 15 seconds

**Example: set forward-delay**

```
LEC Config> set forward-delay 10
```

**frame-size**

Sets the frame size.

The value specified for frame-size must be equal to or less than the value specified for ATM max-frame using the ATM INTERFACE> **set max-frame** command as described on page 17-7.

**Valid Values:** 1516

4544

9234

18190

**Default Value:** If the ELAN type is token ring, the default is 4544. If the ELAN type is Ethernet, the default is 1516.

**Example: set frame-size**

```
LEC Config> set frame-size 4544
```

### lecs-atm-address

Specifies the ATM address of the LECS.

If the client is set to auto configure, it attempts to connect to a LECS. If it is unable to connect to a LECS, then it may try another LECS ATM address. The LECS ATM addresses that are tried, in order, are:

1. This configured LECS address
2. Any LECS address obtained through ILMI
3. The well-known LECS address defined by the ATM Forum.

No default is provided.

**Note:** This command should be entered on one command line. It is shown here on two lines because of spacing.

**Example: set lecs-atm-address**

```
LEC Config> set lecs-atm-address  
39.84.0F.00.00.00.00.00.00.00.00.00.01.10.00.5A.00.DE.AD.01
```

### les-atm-address

Sets the LES ATM address. This command may be optional or required depending upon the setting of lecs-auto-config as described in the **set lecs-auto-config** command on page 19-11.

- If lecs-auto-config is YES, the les-atm-address is not configurable.
- If lecs-auto-config is NO, then the les-atm-address is required.

Specify the ATM address of the LES. No default is provided.

**Note:** This command should be entered on one command line. It is shown here on two lines because of spacing.

**Example: set les-atm-address**

```
LEC Config> set les-atm-address  
39.84.0F.00.00.00.00.00.00.00.00.00.01.10.00.5A.00.DE.AD.02
```

### mac-address

Sets the MAC address for this LE client. You *may* specify that the client use the burned-in MAC address of the ATM interface, or you may specify a different MAC address. If you have two clients that are bridged together, they should use different MAC addresses.

This MAC address is registered with the LES when the client joins the ELAN.

**Valid Values:** Any valid MAC address.

**Default Value:** none

**Example: set mac-address**

```
LEC Config> set mac-address FF.FF.FF.FF.FF.01
```

### multicast-send-avg

Sets the multicast send VCC average rate in Kbps. Used by the LEC for reserving bandwidth on the VCC to the BUS. It specifies the forward and

backward sustained cell rate used when setting up a reserved bandwidth multicast send VCC.

This parameter is only applicable when the multicast-send-type is reserved bandwidth. If multicast-send-avg equals multicast-send-peak, then a constant bit rate (CBR) multicast send is signalled. Otherwise, a variable bit rate (VBR) multicast send is signalled. Multicast-send-avg must at least equal multicast-send peak.

A reserved bandwidth multicast send VCC may improve data transfer rates in congested networks, but reserving bandwidth and not using it wastes network resources.

When the multicast-send-type is reserved, then multicast-send-avg and multicast-send-peak must be specified.

**Example: set multicast-send-avg**

```
LEC Config> set multicast-send-avg 4000
```

**multicast-send-peak**

Sets the multicast send peak rate in Kbps. Used by LEC for reserving bandwidth on the VCC to the BUS. It specifies the forward and backward peak cell rate used when establishing a reserved bandwidth multicast send VCC.

This parameter is only applicable when the multicast-send-type is reserved bandwidth. If multicast-send-avg equals multicast-send-peak, then a constant bit rate (CBR) multicast send is signalled. Otherwise, a variable bit rate (VBR) multicast send is signalled. Multicast-send-avg must at least equal multicast-send peak.

A reserved bandwidth multicast send VCC may improve data transfer rates in congested networks, but reserving bandwidth and not using it wastes network resources.

When the multicast-send-type is reserved, then multicast-send-avg and multicast-send-peak must be specified.

**Example: set multicast-send-peak**

```
LEC Config> set multicast-send-peak 155
```

**multicast-send-type**

Sets the multicast send type. Specifies the method used by the LEC when establishing the multicast send VCC.

If multicast-send-avg equals multicast-send-peak, then a constant bit rate (CBR) multicast send is signalled. Otherwise, a variable bit rate (VBR) multicast send is signalled. Multicast-send-avg must at least equal multicast-send peak.

A reserved bandwidth multicast send VCC may improve data transfer rates in congested networks, but reserving bandwidth and not using it wastes network resources.

When the multicast-send-type is reserved, then multicast-send-no and multicast-send-peak must be specified.

**Valid Values:** Best Effort or Reserved

**Default Value:** Best Effort

**Example: set multicast-send-type**

```
LEC Config> set multicast-send-type best-effort
```

### path-switch-delay

Sets the path switch delay.

The LEC must ensure that all frames sent through the BUS to a destination have arrived at the destination before it can start using a Data Direct VCC. This is accomplished using the flush protocol, or by waiting path-switch-delay seconds after sending the last packet to the BUS. Smaller values improve performance, but may result in out-of-order packets in a heavily congested network.

**Valid Values:** An integer number of seconds in the range of 1 to 8.

**Default Value:** 6

**Example: set path-switch-delay**

```
LEC Config> set path-switch-delay 5
```

### retry-count

Sets the retry count. This is maximum number of times that the LEC retries an LE\_ARP\_REQUEST for a specific frame's LAN destination. If no ARP response is received after the specified number of retries, then the entry is purged from the LE ARP cache.

**Valid Values:** An integer number in the range of 0 to 2.

**Default Value:** 1

**Example: set retry-count**

```
LEC Config> set retry-count 2
```

### selector

Specifies the selector portion of the client's ATM address. The combination of ESI and selector must be unique among all LANE components on the device. By default, a unique selector is selected for the configured ESI.

**Valid Values:** Any octet, in hexadecimal, that is not in use by another LANE component with the same ESI.

**Example: set selector**

```
LEC Config> set selector 01
```

### trace

Enables tracing for the LEC. To perform packet tracing, three steps are required:

1. Enable packet tracing system (under ELS)
2. Enable tracing on the LEC subsystem (under ELS)
3. Enable packet tracing on the desired LECs (using this command).

**Valid Values:** Enable or Disable

**Default Value:** Disable

**Example: Token Ring LEC config>set trace**

```
Trace packets on the LEC? [No]?yes
```

### unknown-count

Sets the unknown frame count. This is the maximum number of frames for a specific unicast MAC address or route descriptor that may be sent to the BUS within the time specified by the unknown-time parameter.

Larger values decrease the number of discarded frames while increasing the load on the BUS.

**Valid Values:** An integer number of frames in the range of 1 to 255.  
**Default Value:** 10

**Example: set unknown-count**

```
LEC Config> set unknown-count
```

unknown-time

Sets the unknown frame time. This is the time interval during which the maximum number of frames for a specific unicast MAC address or route descriptor (specified by the unknown-count parameter) may be sent to the BUS. Larger values increase the number of discarded frames while decreasing the load on the BUS.

**Valid Values:** An integer number of seconds in the range of 1 to 60.

**Default Value:** 1

**Example: set unknown-time**

```
LEC Config> set unknown-time 5
```

vcc-timeout

Sets the VCC timeout. Data direct VCCs over which no traffic has been sent for this period of time should be released.

Specify an integer number in the range 0 to 31536000 seconds (1 year).

Default: 1200

**Note:** This parameter is meaningful only for SVC connections.

**Example: set vcc-timeout**

```
LEC Config> set vcc-timeout 1000
```

## Exit

Use the **exit** command to return to the LE Client Config> prompt.

---

## Configuring an IBM LE Client

This section summarizes and then explains the commands for configuring an IBM LAN Emulation Client.

Enter the appropriate commands at either the Ethernet-IBM LEC Config> prompt or the Token-Ring-IBM LEC Config> prompt. Commands in the following table apply to both types of LECs except where indicated.

<i>Table 19-5 (Page 1 of 2). IBM LAN Emulation Client Configuration Commands Summary</i>	
Command	Function
? (Help)	Lists the console commands or lists the actions associated with specific commands
Frame	Sets the NetWare IPX encapsulation type.

<i>Table 19-5 (Page 2 of 2). IBM LAN Emulation Client Configuration Commands Summary</i>	
Command	Function
RIF-Timer	Sets the maximum amount of time that information in the RIF is maintained before it is refreshed. Applies only to Token-Ring LECs.
Source-routing	Used to enable or disable source-route bridging. Applies only to Token-Ring LECs.
IP-Encapsulation	Sets the IP encapsulation as Ethernet (type X'0800') or IEEE (802.3 with SNAP). Applies only to Ethernet LECs.
List	Lists the LAN Emulation Client configuration.
Set	Sets the IBM LAN Emulation Client parameters.
Exit	Returns to the previous prompt.

## Help

Use the **? (help)** command to list the commands that are available from the current prompt level. You also can enter a ? after a specific command name to list its options.

**Syntax: ?**

**Example for Ethernet: ?**

```
FRAME
IP-ENCAPSULATION
LIST
SET
EXIT
```

**Example for Token-Ring: ?**

```
FRAME
RIF-TIMER
SOURCE-ROUTING
LIST
SET
EXIT
```

## Frame

Use the **frame** command to set the NetWare IPX encapsulation type. The command options differ depending on the type of LEC (Ethernet or Token-Ring) For Token-Ring LECs, enter one of the following:



Option	Description	Syntax
Token-Ring using MSB	Uses the standard 802.2 IPX header with the noncanonical Token-Ring address bit ordering (MSB).	frame token-ring msb
Token-Ring using LSB	Uses the 802.2 IPX header with the canonical address bit ordering (LSB).	frame token-ring lsb
Token-Ring with 802.2 SNAP using MSB	Uses the 802.2 format with a SNAP header and noncanonical address bit ordering. This encapsulation is used primarily in bridging environments.	frame token-ring_snap msb
Token-Ring with 802.2 SNAP using LSB	Uses the 802.2 format with a SNAP header and canonical address bit ordering.	frame token-ring_snap lsb
Ethernet 2.0	Uses Ethernet version 2.0 protocol 81-37.	frame ethernet_II
Ethernet 802.2	Uses Ethernet 802.3 with 802.2 SA E0	frame ethernet_8022
Ethernet 802.3	Uses Ethernet 802.3 without any 802.2 header	frame ethernet_802.3
Ethernet SNAP	Uses 802.3, 802.2 with SNAP PID 00-00-00-81-37	frame ethernet_SNAP

**Syntax:** `frame ipx-encapsulation type`

Note: The frame command cannot be used in the network configuration process to set the IPX encapsulation unless the interface has been configured with IPX.

The IPX encapsulation can also be set in the IPX configuration environment. Refer to the Multiprotocol Switched Services (MSS) Configuring Protocols and Features chapter on Configuring IPX for details.

**Example:** `frame token_ring msb`

## RIF-Timer (for Token-Ring-IBM LEC only)

Use the **RIF-Timer** command to set the maximum amount of time that information in the RIF is maintained before it is refreshed. Range is 0 to 4096. The default is 120.

**Syntax:** `rif-timer`

**Example:** `rif-timer 100`

## Source-routing (for Token-Ring-IBM LEC only)

Use the **source-routing** command to enable or disable end station source-routing. Source routing is the process by which end stations determine the source route to use to cross source routing bridges. Source routing allows the IP, IPX, and AppleTalk Phase 2 protocols to reach nodes on the other side of the source route bridge.

This function of the device is not changed whether source routing is enabled or disabled. The default setting is enabled.

Some stations cannot properly receive frames with Source Routing RIF on them. This is especially common among NetWare drivers. Disabling source routing in this situation will allow you to communicate with these stations.

Source routing should be enabled only if there are source-routing bridges on this ring through which you want to bridge IP, IPX, and AppleTalk Phase 2 packets. Source routing must also be enabled so that LLC test response messages can be returned.

**Syntax:** source-route enable  
disable

**Example:** source-routing disable

## IP-Encapsulation (for Ethernet-IBM LEC only)

Use the **IP-encapsulation** command to select Ethernet (Ethernet type X'0800') or IEEE 802.3 (Ethernet 802.3 with SNAP). Specify either type **E**thernet or **I**EEE-803.3.

**Syntax:** IP-encapsulation *type*

**Example:** IP-encapsulation **E**

## List

Use the **list** command to list the LE client configuration.

**Syntax:** list

**Example:** list

## Set

Use the **set** command to set IBM LE Client parameters.

**Syntax:** set backward-peakrate  
esi-address  
frame-size  
forward-peakrate  
keep-alive-count  
les-atm-address  
mac-address  
mac-cache-size  
mac-cache-aging-period  
rd-cache-size  
rd-cache-aging-period  
registration interval  
retry-count  
selector  
trace

backward-peakrate

This parameter specifies the maximum data rate (backward peak rate), in Kbps, of the ATM device for all LAN emulation connections.

Specify an integer from 1 to the maximum data rate of the ATM device.

Default: line rate in Kbps

**Example: set backward-peakrate**

```
LEC Config> set backward-peakrate 155000
```

#### esi-address

Sets the ESI portion of the client's ATM address.

**Valid Values:** Any 12 hexadecimal digits.

**Default Value:** none

**Example: token ring lec config>set esi**

```
Select ESI
(1) Use burned in ESI
(2) 11.22.33.44.55.66
```

```
Enter selection [1]?
```

#### frame-size

Sets the frame size.

The value specified for frame-size must be equal to or less than the value specified for ATM max-frame using the ATM INTERFACE> **set max-frame** command as described on page 17-7. The specified maximum frame size includes any Layer 2 header information. All transparently bridged LANs must have the same maximum frame size.

**Valid Values:** 1024 - 17843

**Default Value:** If the ELAN type is token ring, the default is 4551. If the ELAN type is Ethernet, the default is 1523.

#### forward-peakrate

This parameter specifies the maximum data rate (forward peak rate), in Kbps, of the ATM device for all LAN emulation connections.

Specify a decimal integer between 1 and the maximum data rate of the ATM device.

Default: data rate in Kbps

**Example: set forward-peakrate**

```
Ethernet IBM LEC Config> set forward-peakrate 155000
```

#### keep-alive-count

Specifies the number of times that the LEC sends a registration message without requiring a response from the LES.

Specify a decimal integer between 5 and 50.

Default: 10

**Example: set keep-alive-count**

```
Ethernet IBM LEC Config> set keep-alive-count 20
```

#### les-atm-address

Sets the LES ATM address.

Specify the ATM address of the LES. \*

**Note:** This command should be entered on one command line. It is shown here on two lines because of spacing.

**Example: set les-atm-address**

```
Ethernet IBM LEC Config> set les-atm-address  
39.84.0F.00.00.00.00.00.00.00.01.10.00.5A.00.DE.AD.02
```

### mac-address

Sets the MAC address for this LE client. You *may* specify that the client use the burned in MAC address, of the ATM interface, or you may specify a different MAC address. If you have two clients that are bridged together, they should use different MAC addresses.

**Valid Values:** Any valid MAC address.

**Default Value:** none

**Example: set mac-address**

```
Ethernet IBM LEC Config> set mac-address FF.FF.FF.FF.FF.FF.01
```

### mac-cache-size

Specifies the maximum number of MAC entries that the LEC caches.

Specify an integer number in the range 5 to 1024.

Default: 32

**Example: set mac-cache-size**

```
Ethernet IBM LEC Config> set mac-cache-size 48
```

### mac-cache-aging-period

Specifies the amount of time (in seconds) after which MAC addresses are aged out of the cache, if not refreshed.

Specify an integer number of seconds in the range 1 to 300.

Default: 60 seconds

**Example: set mac-cache-aging-period**

```
Ethernet IBM LEC Config> set mac-cache-aging-period 120
```

### rd-cache-size

Specifies the maximum number of route descriptor entries that the LEC caches.

Specify an integer number in the range 5 to 1024.

Default: 32

**Example: set rd-cache-size 48**

```
Ethernet IBM LEC Config> set rd-cache-size 48
```

### rd-cache-aging-count

Specifies the amount of time (in seconds) after which entries are aged out of the route descriptor cache, if not refreshed.

Specify an integer number of seconds in the range 1 to 300.

Default: 60 seconds

**Example: set rd-cache-aging-period**

```
Ethernet IBM LEC Config> set rd-cache-aging-period 120
```

### registration-interval

Specifies the frequency (in seconds) that the LEC sends registration messages to the LES.

Specify an integer number of seconds in the range 30 to 240.

Default: 60 seconds

**Example: set registration-interval**

```
Ethernet IBM LEC Config> set registration-interval 75
```

**retry-count**

Sets the retry count. This is maximum number of times that the LEC retries an LE\_ARP\_REQUEST for a specific frame's LAN destination.

**Valid Values:** An integer number in the range of 2 to 10.

**Default Value:** 3

**Example: set retry-count**

```
Ethernet IBM LEC Config> set retry-count 2
```

**selector**

Specifies the selector portion of the client's ATM address. The combination of ESI and selector must be unique among all LANE components on the device. By default, a unique selector is selected for the configured ESI.

**Valid Values:** Any octet, in hexadecimal, that is not in use by another LANE component with the same ESI.

**Example: set selector**

```
LEC Config> set selector 01
```

**trace**

Sets packet trace for the LEC.

**Valid Values:** Enable or Disable

**Default Value:** Disable

To perform packet tracing, three steps are required:

1. Enable packet tracing system (under ELS)
2. Enable tracing on the LEC subsystem (under ELS)
3. Enable packet tracing on the desired LECs (using this command).

**Example: Token Ring LEC config>set trace**

```
Trace packets on the LEC? [No]?yes
```

**Exit**

Use the **exit** command to return to the LE Client Config> prompt.



---

## Chapter 20. Monitoring LAN Emulation Clients

This chapter describes how to monitor LAN Emulation Clients (LECs). It includes the following sections:

- “Accessing the LEC Console Environment”
- “LEC Console Commands”

---

### Accessing the LEC Console Environment

Use the following procedure to access the LEC console commands. This process gives you access to the LEC *monitoring* process.

1. At the OPCON prompt, enter **talk 5**. (For more detail on this command, refer to Chapter 5, “The OPCON Process and Commands” on page 5-1.) For example:

```
* talk 5
+
```

After you enter the **talk 5** command, the GWCON prompt (+) displays on the console. If the prompt does not appear when you first enter configuration, press **Return** again.

2. At the + prompt, enter the **network** command to display the network interface numbers for which the router is currently configured, and enter the *interface number* for the LEC you wish to monitor. For example:

**Example: network**

```
+ network

1 : ATM Ethernet LAN Emulation: ETH
2 : IP Protocol Network
3 : Bridge Application
5 : CHARM ATM Adapter
Network number [0]? 1
LEC+
```

The LEC monitoring prompt (LEC+), is displayed.

If you know the interface number of the LEC you wish to monitor, enter the **network** command followed by the *interface number* of the LEC.

```
+ network 1
LEC+
```

---

### LEC Console Commands

This section summarizes and then explains the LEC console commands. You can access LEC console commands at the LEC+ prompt. Table 20-1 on page 20-2 shows the commands.

## Monitoring LECs

Command	Function
? (Help)	Lists the LEC console commands or lists the options associated with specific commands.
List	Lists: <ul style="list-style-type: none"><li>• LEC Address Resolution Table (ARP)</li><li>• LEC configuration</li><li>• Data Direct VCC information</li><li>• LEC statistics.</li></ul>
MIB	Displays LEC MIB objects including: <ul style="list-style-type: none"><li>• LEC MIB Configuration Table</li><li>• LEC MAC ARP Table</li><li>• LEC Route Descriptor Table</li><li>• LEC MIB Server VCC Tables</li><li>• LEC MIB Statistics Table</li><li>• LEC MIB Status Table</li></ul>
QoS	Gets you to the LEC x QoS+ prompt from which you can monitor Quality of Service as described in "Quality of Service Console Commands" on page 15-1.
Trace	Sets packet tracing on or off
Exit	Exits the LEC console process.

### ? (Help)

Use the **? (help)** command to list the commands that are available from the current prompt level. You can also enter a ? after a specific command name to list its options.

**Syntax:** ?

**Example:** ?

### List

Use the **list** command to list the LEC Address Resolution Table (ART), list the LEC configuration, list Data Direct VCC information, or list LEC statistics.

**Syntax:** list      arp-table  
                         configuration  
                         data-direct-vccs  
                         statistics  
                         vcc-table

arp

Lists the LEC Address Resolution Table (entries in the ARP cache).

**Example:** list arp



## LEC+ list arp

## LEC Address Resolution (LE ARP Cache) Table

Max Table Size	= 10	Total # of entries
Free Table Entries	= 10	# of free entries.
Current Mac Entries	= 0	MAC - ATM entries
Current RD Entries	= 0	RD - ATM entries
Arp Aging Time	= 300	Time for an entry to be 'aged' out
Verify Sweep Interval	= 60	

MAC Address	Remote	Conn Handle	Xmit Queue Depth	BUS Frame Count	Arp Retry Count	Aging Timer	Destination	ATM Address
40.00.00.00.00.09	False	652	0	0	0	60	39.99.99.99.99.99.	99.00.00.99.99.30.02.40.00.00.00.00.09.81

**Note:** The Sweep Interval is always one-fifth of the ARP Aging Timer value.

Max Table Size	The total number of entries available
Free Table Entries	The number of free entries
Current MAC Entries	
Current RD Entries	Route Descriptor ATM entries
ARP Aging Time	Time for an entry to be aged out
Verify Sweep Interval	
MAC Address	
Remote	
Connection Handle	
Queue Depth	
Xmit Frame Count	
BUS Retry Count	
ARP Aging Timer	
Destination ATM Address	

## configuration

Lists the LEC configuration.

For Ethernet:

**Example: list config**

## Monitoring LECs

### LEC+ list config

#### ATM LEC Configuration

```
ATM interface number      = 0
LEC interface number      = 1
LECS auto configuration   = No

C1: Primary ATM address
    ESI address           = Use burned in addr
    Selector byte         = 3
C2: Emulated LAN type     = Ethernet
C3: Maximum frame size    = 1516
C5: Emulated LAN name     =
C6: LE Client MAC address = Use burned in addr
C7: Control timeout       = 120
C9: LE Server ATM address = 39.84.0F.00.00.00.00.00.00.00.01.10.00.5A.00.DE.AD.02
C10: Maximum unknown count = 1
C11: Maximum unknown time = 1
C12: VCC timeout period   = 1200
C13: Maximum retry count  = 1
C17: Aging time           = 300
C18: Forward delay time   = 15
C20: LE ARP response time = 1
C21: Flush timeout        = 4
C22: Path switch delay    = 6
C24: Multicast send VCC type = Best-Effort

C25: Multicast send VCC avg rate = 155000000
C26: Multicast send VCC peak rate = 155000000
C28: Connection completion timer = 4

LE ARP queue depth        = 10
LE ARP cache size         = 10

Best effort peak rate     = 155000
Maximum config retries    = 3
Packet Trace              = No
IP Encapsulation          = Ether
No IPX Interface Configuration
```

For Token Ring:

**Example: list config**

## LEC+list config

## ATM LEC Configuration

```

ATM interface number      = 0
LEC interface number      = 1
LECS auto configuration   = No

C1: Primary ATM address
    ESI address           = Use burned in addr
    Selector byte         = 2
C2: Emulated LAN type     = Token Ring
C3: Maximum frame size    = 4544
C5: Emulated LAN name     =
C6: LE Client MAC address = 10.00.5A.11.11.11
C7: Control timeout       = 120
C9: LE Server ATM address = 39.84.0F.00.00.00.00.00.00.00.01.10.00.5A.00.DE.AD.02
C10: Maximum unknown count = 1
C11: Maximum unknown time = 1
C12: VCC timeout period   = 1200
C13: Maximum retry count  = 1
C17: Aging time           = 300
C18: Forward delay time   = 15
C20: LE ARP response time = 1
C21: Flush timeout        = 4
C22: Path switch delay    = 6
C24: Multicast send VCC type = Best-Effort

C25: Multicast send VCC avg rate = 155000
C26: Multicast send VCC peak rate = 155000
C28: Connection completion timer = 4

LE ARP queue depth        = 10
LE ARP cache size         = 36920

Best effort peak rate     = 155000
Maximum config retries    = 999
Packet trace              = Yes
RIF Aging Timer           = 120
Source Routing            = Enabled
IPX interface configuration record missing

```

See "Set" on page 19-9 for a definition of the parameters shown in the above examples.

## data

Lists the LEC Data Direct VCC information.

**Example: list data**

LEC+ list data

## LEC Data Direct VCC Table

```

Max Table Size      = 1019    Max no of SVC connections
Current Size        = 0       Currently used
Inactivity Timeout  = 1200    No Data Xfer Timeout before connection is
                                closed (seconds)
Sweep Interval      = 60
Conn                Inactive User
Handle  VPI  VCI  Timer  Count  Destination ATM Address
-----
652    0    7241  300   1      39.99.99.99.99.99.00.00.99.99.30.02.
                                40.00.00.00.00.09.81
-----

```

## Monitoring LECs

### statistics

Lists LEC statistics.

#### Example: list statistics

```
LEC+ list stat
```

##### LEC Statistics

```
In Octets.high      = 0      No of Bytes received
In Octets.low       = 346
In Discards         = 2      Packets discarded
In Errors           = 0      Rx.Errors
In Unknown Protos  = 0      Unknown protocols received
Out Octets.high     = 0      No of Bytes xmitted.
Out Octets.low      = 0
Out Discards        = 0
Out Errors          = 0      Tx.Errors
In Frames           = 0
Out Frames          = 0
In Bytes            = 0
Out Bytes           = 0
```

## MIB

Use the **mib** command to display MIB objects.

**Note:** Some of this information may be displayed in a different format using the **list** command.

**Syntax:** mib config-table  
mac-arp-table  
rd-arp-table  
server-vcc-table  
statistics-table  
status-table  
super-elan-table

### config

Displays the LEC MIB Configuration Table.

**Example: list mib config**

## LEC+ mib config

```

lecConfigTable:
lecConfigMode                = Manual
lecConfigLanType             = 802.3 - Ethernet
lecConfigMaxDataFrameSize   = 1516
lecConfigLanName             =
lecConfigLesAtmAddress       = 39.84.0F.00.00.00.00.00.11.23.24.24.24.24.55.66.77.88.99.00
lecControlTimeout           = 120
lecMaxUnknownFrameCount     = 1
lecMaxUnknownFrameTime      = 0
lecVccTimeoutPeriod         = 1200
lecMaxRetryCount            = 1
lecAgingTime                 = 300
lecForwardDelayTime         = 15
lecExpectedArpResponseTime  = 1
lecFlushTimeout             = 4
lecPathSwitchingDelay       = 6
lecLocalSegmentId           = 0
lecMulticastSendType        = 1

lecMulticastSendAvgRate     = 155000000
lecMulticastSendPeakRate    = 155000000
lecConnectionCompleteTimer  = 4

```

*lecConfigMode*

LEC config mode: AUTO or MANUAL. If AUTO, LEC Uses LECS to get the LES ATM address.

*lecConfigLanType*

LAN type, either Ethernet or token-ring

*lecConfigMaxDataFrameSize*

Maximum frame size

*lecConfigLanName*

ELAN Name

*lecConfigLesAtmAddress*

LE Server ATM address

*lecControlTimeout*

Timeout for request/response control frame

*lecMaxUnknownFrameCount*

Maximum number of unknown frames

*lecMaxUnknownFrameTime*

Period in which LEC will send a maximum of MaxUnknownFrameCount frames to the BUS for a given unicast LAN Destination, and it must also initiate the address resolution protocol to resolve that LAN Destination.

*lecVccTimeoutPeriod*

Inactivity timeout of SVC Data Direct VCCs

*lecMaxRetryCount*

LE ARP retry count

*lecAgingTime*

Life of unverified entry in the ARP table

*lecForwardDelayTime*

## Monitoring LECs

*lecExpectedArpResponseTime*

ARP Request/Response cycle time

*lecFlushTimeout*

LE Flush Request/Flush Reply timeout period

*lecPathSwitchingDelay*

*lecLocalSegmentId*

Segment ID of emulated LAN. Only for 802.5 clients

*lecMulticastSendType*

Signaling parameter used by LEC for multicast send VCC

*lecMulticastSendAvgRate*

Signaling parameter used by LEC for multicast send VCC

*lecMulticastSendPeakRate*

Signaling parameter used by LEC for multicast send VCC

*lecConnectionCompleteTimer*

mac

Displays the LEC MAC ARP Table

rd

Displays the LEC Route Descriptor Table

server

Displays the LEC MIB Server VCC Tables

### **Example: mib server**

LEC+ **mib server**

```
lecServerVccTable:
  lecConfigDirectInterface    = 0
  lecConfigDirectVpi         = 0
  lecConfigDirectVci         = 0
  lecControlDirectInterface  = 1
  lecControlDirectVpi        = 0
  lecControlDirectVci        = 38
  lecControlDistributeInterface = 1
  lecControlDistributeVpi    = 0
  lecControlDistributeVci    = 37
  lecMulticastSendInterface  = 1
  lecMulticastSendVpi        = 0
  lecMulticastSendVci        = 34
  lecMulticastForwardInterface = 1
  lecMulticastForwardVpi     = 0
  lecMulticastForwardVci     = 33
```

*lecConfigDirectInterface*

The interface associated with the Configuration Direct VCC

*lecConfigDirectVpi*

VPI which identifies the above VCC if it exists

*lecConfigDirectVci*

VCI which identifies the above VCC if it exists

*lecControlDirectInterface*

The interface associated with the Control Direct VCC

*lecControlDirectVpi*

VPI which identifies the above VCC if it exists

*lecControlDirectVci*

VCI which identifies the above VCC if it exists

*lecControlDistributeInterface*

The interface associated with the Control Distribute VCC

*lecControlDistributeVpi*

VPI which identifies the above VCC if it exists

*lecControlDistributeVci*

VCI which identifies the above VCC if it exists

*lecMulticastSendInterface*

The interface associated with the Multicast Send VCC

*lecMulticastSendVpi*

VPI which identifies the above VCC if it exists

*lecMulticastSendVci*

VCI which identifies the above VCC if it exists

*lecMulticastForwardInterface*

The interface associated with the Multicast Forward VCC

*lecMulticastForwardVpi*

VPI which identifies the above VCC if it exists

*lecMulticastForwardVci*

VCI which identifies the above VCC if it exists

## statistics

Displays the LEC MIB Statistics Table.

**Example: mib statistics**LEC+ **mib statistics**

```
lecStatisticsTable:
  lecArpRequestsOut      = 1
  lecArpRequestsIn      = 0
  lecArpRepliesOut      = 0
  lecArpRepliesIn       = 1
  lecControlFramesOut   = 2
  lecControlFramesIn    = 2
  lecSvcFailures        = 1
```

*lecArpRequestsOut*

No. of LE ARP requests sent by this LEC

*lecArpRequestsIn*

No. of LE ARP requests received by this LEC

*lecArpRepliesOut*

No. of LE ARP responses sent by this LEC

*lecArpRepliesIn*

No. of LE ARP responses received by this LEC

*lecControlFramesOut*

No. of Control Packets sent by this LEC

### *lecControlFramesIn*

No. of Control Packets received by this LEC

### *lecSvcFailures*

The total number of:

- Outgoing LAN Emulation SVCs which this client tried but failed, to open
- Incoming LAN Emulation SVCs which this client tried, but failed to establish
- Incoming LAN Emulation SVCs which this client rejected for protocol or security reasons

### status

Lists MIB status.

#### Example: mib status

```
LEC+ mib status
lecStatusTable:
  lecPrimaryAtmAddress      = 39.84.0F.00.00.00
  Client ATM address=     = 00.00.00.00.01.10.00.5A.00.DE.AD.03
  lecId                     = 1 Assigned by LES
  lecInterfaceState        = Operational State of the LEC
  lecLastFailureRespCode   = None Error code from last
                             failed Config/Join resp.
  lecLastFailureState      = Initial State State of LEC when
                             updating above field.
  lecProtocol              = 1 Protocol specified by
                             LEC in Join requests.
  LecVersion               = 1 LEC Protocol Version
                             of above
  lecTopologyChange        = False
  lecConfigServerAtmAddress = 00.00.00.00.00.
  ATM Address of LECS      = 00.00.00.00.00.00.00.00.00.00.00
  lecConfigSource          = Did not use LECS
  lecActualLanType         = 802.3 - Ethernet Frame format currently
                             used by LEC
  lecActualMaxDataFrameSize = 1516
  lecActualLanName         = ETH Name of emulated LAN
                             that LEC joined.
  lecActualLesAtmAddress   = 39.84.0F.00.00.00.
  ATM Address of LES      = 00.00.00.00.00.00.00.00.00.01.10.00.5A.00.DE.AD.02
  lecProxyClient           = False Is LES acting like a
                             proxy ?
```

### super-elan

#### Example: super-elan

```
LEC+ mib super-elan
```

## QoS Information

Use the **qos-information** command to get to the LEC x QoS+ prompt from which you can monitor Quality of Service as described in “Quality of Service Console Commands” on page 15-1.

**Syntax:** qos-information

**Example:** qos

## Exit

Use the **exit** command to return to the previous prompt level.

**Syntax:** exit

**Example:** exit



---

## Chapter 21. Configuring LAN Emulation Services

This chapter describes configuration of LAN Emulation Services for an Emulated LAN (ELAN). It includes the following sections:

- “About LAN Emulation Services”
- “Accessing the LAN Emulation Services Environment”
- “Configuring a LES-BUS” on page 21-4
- “Commands for Configuring a LECS” on page 21-14
- “Configuring ELANs at the LECS” on page 21-17
- “Detailed Configuration of an ELAN at the LECS” on page 21-19
- “Configuring the Policies of a LECS” on page 21-30
- “Configuring Security for ELANs” on page 21-32

---

### About LAN Emulation Services

LAN Emulation (LE) protocols allow ATM networks to appear as local area networks such as Ethernet or Token-Ring. An emulated LAN (ELAN) provides flexibility in handling moves, adds, and changes to your network topology. A client’s association with an ELAN is logical and is independent of physical location. Consequently, reconfiguration is not required when a station is physically moved, provided the station’s ELAN *membership* is retained. A station can be a member of multiple ELANs. Wiring modifications are not required when a station is moved from one ELAN to another.

An ELAN is a collection of LAN Emulation Clients (LECs) that are coordinated by LAN Emulation (LE) Services. There are three standard LE Services components that provide services for your ELANs:

- LE Server (LES)
- Broadcast and Unknown Server (BUS)
- LE Configuration Server (LECS)

This chapter describes configuration of the LES, BUS, and LECS components. For a description of LAN Emulation Client (LEC, not to be confused with LECS), refer to Chapter 19, “Using and Configuring LAN Emulation Clients” on page 19-1.

The MSS Server has an additional LE Services component that provides a value-added security feature to LE Services. For additional detail on this security feature and on the overall LAN Emulation environment, refer to the *Multiprotocol Switched Services (MSS) Configuration and Operations Guide*.

---

### Accessing the LAN Emulation Services Environment

To get to the LE-services environment, enter the **le-services** command at the ATM config> prompt:

```
ATM config> le-services
LAN Emulation Services user configuration
LE Services config>
```

To start the configuration process, enter the following commands at the LE Services config> prompt:

Table 21-1. LAN EMULATION Services Configuration Commands Summary

Command	Function
Lecs	Enters the LECS Configuration environment. For additional information, see "Commands for Configuring a LECS" on page 21-14.
Les-bus	Enters the LES-BUS Configuration environment for a particular ELAN. For additional information, see "Configuring a LES-BUS" on page 21-4.
List	Lists all LES-BUSs that you have configured.
Rename	Changes the name of the LES-BUS.
Security	Enters the LES-LECS Security Interface Configuration environment. For additional information, see "Configuring Security for ELANs" on page 21-32.
Exit	Returns you to the ATM config> prompt.

**Note:** For a description of addressing requirements in this environment, see "How to Enter Addresses" on page 17-1.

### Lecs

Type the **lecs** command at the LE Services config> prompt to enter the LECS Configuration environment. The LECS Configuration environment is characterized by the LECS config> prompt.

**Syntax:** lecs

**Example:**

```
LE Services config> lecs
LAN Emulation Configuration Server configuration
LECS config>
```

For additional information, see "Commands for Configuring a LECS" on page 21-14.

### Les-bus

Type the **les-bus** command at the LE Services config> prompt to enter the LES-BUS Configuration environment for a particular LES-BUS. A selection list will appear, or you can use the **list** command to display all of the currently configured LES-BUSs. The LES-BUS Configuration environment is characterized by the LES-BUS Config for ELAN 'n'> prompt.

**Syntax:** les-bus

```
elan-name
item-number
```

**elan-name** Name of the ELAN

**item-number** Item number from selection list

**Example:** les-bus

```
LE Services config>les-bus
( 1) <<< New LES/BUS >>>
( 2) Test Ethernet Elan
( 3) Test Token Ring Elan
Choice of LES/BUS [1]? 3
LES-BUS configuration
LES-BUS config for ELAN 'Test Token Ring Elan'>
```

**Example: les-bus elan-name**

```
LE Services config>les-bus Test Token Ring Elan
LES-BUS configuration
LES-BUS config for ELAN 'Test Token Ring Elan'>
```

**Example: les-bus item-number**

```
LE Services config>les-bus 3
LES-BUS configuration
LES-BUS config for ELAN 'Test Token Ring Elan'>
```

For additional information, see “Configuring a LES-BUS” on page 21-4.

## List

Enter the **list** command to display a list of all the ELANs that are served by LES-BUSs configured on the MSS Server.

**Syntax:** `list`

**Example:**

```
LE Services config> list
List of Configured LES-BUS(s)
```

```
ELAN Type (E=Ethernet/802.3, T=Token Ring/802.5)
```

Interface #	Enabled	ELAN Name	LES ESI	Se1	Max. Frame Size	Redundancy Role
E 0 Y		Test Ethernet Elan	400082104001	x02	4544	(disabled)
T 0 Y		Test Token Ring Elan	400082104001	x03	4544	(disabled)

## Rename

Enter the **rename** command to change the name of a LES-BUS.

**Note:** If you rename a LES-BUS, simply restarting the LES-BUS from the LES-BUS Console will not reflect the newly configured name. To rename an operational LES-BUS, you must either reload, or use the LES-BUS Console command **delete**, then the LAN Emulation Services Console command **create**.

**Syntax:** `rename`

**Example:**

```
LE Services config> rename
Existing ELAN Name []? test
New ELAN Name []? newtest
```

## Configuring a LES-BUS

### Security

Type the **security** command to enter the LES-LECS Security Interface Configuration environment. This environment is characterized by the LECS INTERFACE config> prompt.

**Syntax:** `security`

**Example:**

```
LE Service config> security
LECS Interface configuration
LECS INTERFACE config>
```

For additional information, see “Configuring Security for ELANs” on page 21-32.

### Exit

Use the **exit** command to return to the ATM config> prompt.

**Syntax:** `exit`

**Example:** `exit`

---

## Configuring a LES-BUS

This section describes the commands for configuring a LES-BUS. Enter the **les-bus** command at the LE Services config> prompt. The following example defines a new LES-BUS.

```
LE Services config>les-bus
( 1) <<< New LES/BUS >>>
( 2) Test Ethernet Elan
( 3) Test Token Ring Elan
Choice of LES/BUS [1]?
New ELAN Name (ELANxx) []? e1an01
LES-BUS configuration
LES-BUS config for ELAN 'e1an01'>
```

The following example allows you to change the configuration of an existing LES-BUS.

```
Choice of LES/BUS [1]? 3
LES-BUS configuration
LES-BUS config for ELAN 'Test Token Ring Elan'>
```

You can enter the following commands:

Command	Function
Add	Adds a LES-BUS to a local configuration.
Disable	Disables Broadcast Manager, BUS-Monitor, LES-BUS, Redundancy, Security, or Source Route Manager.
Enable	Enables Broadcast Manager, BUS-Monitor, LES-BUS, Redundancy, Security, or Source Route Manager.
List	Lists the operational characteristics of a LES-BUS.
Remove	Removes Broadcast Static Entries or LES-BUS.

Table 21-2 (Page 2 of 2). LES-BUS Configuration Commands Summary	
Command	Function
Set	Sets operational characteristics.
Exit	Returns to the LE Services config> prompt.

## Add

Use the **add** command to specify this LES-BUS type, ESI, and selector.

Each LES-BUS must have a unique ELAN name, and the combination of ESI and selector must be unique among all LE components.

**Syntax:** `add`

**Example:**

```
LES-BUS config for ELAN 'elan01'> add
Select ELAN type
  (1) Token Ring
  (2) Ethernet

Enter Selection: [1]1
Select ESI
  (1) Use burned in ESI

Enter Selection: [1]?1

Selector 0 is generally reserved for use by the LECS,
Selector 1 is generally reserved for use by the LECS interface.

Enter selector [4]?4
Selection "Add LES-BUS" Complete
LES-BUS config for ELAN 'elan01'>
```

## Disable

Use the **disable** command to disable Broadcast Manager, BUS-Monitor, LES-BUS, Redundancy, Security, or Source Route Manager.

**Syntax:** `disable` broadcast-manager ...  
bus-monitor  
les-bus  
redundancy  
security  
source

`broadcast manager all, or ip, or ipx, or netbios`

Disables broadcast manager for this ELAN. Broadcast manager is an IBM enhancement to the BUS that reduces broadcast traffic by transforming certain broadcast frames into unicast frames. See "Broadcast Manager" on page 16-13 for additional information about Broadcast manager. You can disable broadcast manager for all protocols, or for a specific protocol.

**Example:** `disable broadcast-manager ipx`

`bus-monitor`

Disables BUS Monitor for this ELAN. BUS Monitor is an IBM enhancement to the BUS that monitors BUS traffic to identify those stations generating the most BUS traffic. See "BUS Monitor" on page 16-17 for additional information.

## Configuring a LES-BUS

### les-bus

Disables LES-BUS for this ELAN. This LES-BUS will not activate on the next restart of the router.

### redundancy

Disables redundancy for this ELAN. Redundancy is an IBM enhancement to the LES-BUS that allows each LES-BUS to have a backup that will activate only if the primary LES-BUS fails. See “LAN Emulation Reliability” on page 16-15 for additional information.

### security

Disables LECS validation of joins. If enabled, the LES-BUS communicates with the LECS across the LES-LECS Security Interface in order to validate each LE Client’s request to join the ELAN. The LES-LECS Security Interface for this ATM Interface must be enabled (see “Configuring Security for ELANs” on page 21-32).

### source route management

Disables source route management (SRM) for this ELAN. SRM can transform spanning tree explorer and all routes explorer packets into specifically routed frames. SRM operates only on those frames managed by BCM IP or BCM NetBIOS. See “BCM Support for Source Route Bridging” on page 16-15 for additional information.

## Enable

Use the **enable** command to enable Broadcast Manager, BUS-Monitor, LES-BUS, Redundancy, Security, or Source Route Management.

**Syntax:** enable    broadcast-manager ...  
                          bus-monitor  
                          les-bus  
                          redundancy  
                          security  
                          source

### broadcast manager all *or ip or ipx or netbios*

Enables all (or individual) protocols for Broadcast Manager. Broadcast manager is an IBM enhancement to the BUS that reduces broadcast traffic by transforming certain broadcast frames into unicast frames. See “Broadcast Manager” on page 16-13 for additional information about Broadcast manager. You can enable broadcast manager for all protocols, or for a specific protocol.

**Note:** You cannot enable the Broadcast Manager while the BUS is in Adapter or VCC-Splice mode.

### bus-monitor

Enables BUS-Monitor. BUS Monitor is an IBM enhancement to the BUS that monitors BUS traffic to identify those stations generating the most BUS traffic. See “BUS Monitor” on page 16-17 for additional information.

**Note:** You cannot enable the BUS-Monitor while the BUS is in VCC-Splice mode.

### les-bus

Enables LES-BUS. This LES-BUS will be activated on the next restart of the router.



## Configuring a LES-BUS

```
Multicast Send VCC MAX Reserved Bandwidth: 0

--LES-BUS Options-
BUS mode: Adapter
Security (LECS Validation of Joins): Disabled
Partition LE_ARP_REQUEST Forwarding Domain: Yes
LE_ARP_RESPONSE Destination: One client
Partition Unicast Frame Domain: Yes
Redundancy: Disabled
ATM address trace filter value: 00000000000000000000000000000000
ATM address trace filter mask: ffffffffffffffffffffffffffffffffff

--BUS Monitor Configuration-
Monitor Host Usage of BUS: Disabled
# Top Hosts to Record: 10
# Seconds in each sample interval: 10
# Minutes between sample intervals: 30
Frame sampling rate: 1 out of 10

--Broadcast Manager Configuration-
IP BCM: Disabled
IPX BCM: Disabled
NetBIOS BCM: Disabled
BCM IP Cache Aging Time: 5
BCM IPX Cache Aging Time: 3
BCM NetBIOS Cache Aging Time: 15
Token Ring Source Route Management: Disabled
BCM IPX Maximum Forwarding List: 50
No BCM IPX Static Entries defined
LES-BUS config for ELAN 'elan01'>
```

## Remove

Use the **remove** command to remove broadcast static entries or a LES-BUS pair.

**Syntax:** `remove` broadcast  
les-bus

`broadcast`

Removes static entries defined for IPX Broadcast Manager.

`les-bus`

Deletes the LES-BUS configuration.

### Example: remove broadcast

Choose static entry to remove

- (1) 1234567890123456789012345678901234567890/FFFFFFFFFFFF
- (2) 2123456789012345678901234567890123456789/FFFFFFFFFFFF
- (3) 3212345678901234567890123456789012345678/FFFFFFFFFFFF
- (4) < CANCEL >

Enter Selection: [1]? 4  
Remove operation canceled.

## Set

Use the **set** command to set operational characteristics associated with this ELAN.

**Syntax** `set` address  
broadcast  
bus-mode  
bus-monitor  
control  
frame-age  
frame-size  
ip  
ipx-broadcast  
ipx-maximum  
le-arp  
lecid range  
netbios  
partition  
trace  
traffic





### VCC-Splice

The client's multicast send VCC to the BUS is "spliced" to the multicast forward VCC, allowing the ATM adapter to transmit received frames from one VCC to its spliced VCC pair without notifying the system processor. Statistics are not maintained by the BUS.

#### Notes:

1. Unicast partitioning must be disabled to set the BUS mode to VCC-Splice.
2. If the ELAN is operational in this mode, the Broadcast Manager and Source Route Management are unavailable and cannot be enabled.
3. BUS Monitor is unavailable in VCC-Splice mode.

**Default value:** Adapter.

### bus-monitor settings

Specifies sample interval, sampling rate, inter-sample sampling time, and the number of MAC addresses to record for BUS Monitoring. The BUS Monitor parameters control how often BUS Monitor samples frames. More frequent sampling leads to more accurate results, but also requires more processing time at the BUS.

#### Example: set bus-monitor duration

```
Duration of sample interval in seconds (1-600) [10]?10
Selection "Set BUS monitoring sample interval" Complete
LES-BUS config for ELAN 'elan01'>
```

#### Example: set bus-monitor sample

A value of 10 means 1 out of every 10 frames is sampled.

```
Frame sampling rate (1-1000) [10]?10
Selection "Set the sampling rate" Complete
LES-BUS config for ELAN 'elan01'>
```

#### Example: set bus-monitor time

```
Number of minutes between sample intervals (1-120) [30]?15
Selection "Set BUS monitoring inter-sample time" Complete
LES-BUS config for ELAN 'elan01'>
```

#### Example: set bus-monitor top

```
Number of top MAC addresses to record (1-100) [10]?10

Selection "Set number of top MAC addresses to record" Complete
LES-BUS config for ELAN 'elan01'>
```

### control

Sets the control timeout, in seconds, for the LE Server. This is the timeout used for many of the response/request exchanges. This parameter maps to the S4 parameter in the *ATM Forum LAN Emulation Over ATM Specification*. A smaller control timeout may lead to quicker response times, but may also lead to unnecessary retransmissions. This parameter should be coordinated with the control timeout of LE clients joining this LES.

#### Example: set control

```
Control Timeout (10-300): [120]?120
Selection "Set Control Timeout" Complete
LES-BUS config for ELAN 'elan01'>
```

**frame-age**

Sets maximum frame age. The BUS must discard a frame if it has not transmitted the frame to all relevant VCCs within the Maximum Frame Age following the BUS's receipt of the frame. This parameter maps to the S5 parameter in the *ATM Forum LAN Emulation Over ATM Specification*.

**Example: set frame-age**

```
Maximum Frame Age (1-4): [1]?1
Selection "Set Maximum Frame Age" Complete
LES-BUS config for ELAN 'elan01'>
```

**frame-size**

Sets maximum frame size. The maximum size of an AAL-5 Service Data Unit (SDU) that the LE Service can guarantee not to drop for being too large. Also the minimum AAI-5 SDU size that every LE Client must be able to receive. This parameter maps to the S3 parameter in the *ATM Forum LAN Emulation Over ATM Specification*

**Example: set frame-size**

```
Maximum Frame Size:
(1) 1516
(2) 4544
(3) 9234

Enter Selection: [2]?2
Selection "Set Maximum Frame Size" Complete
LES-BUS config for ELAN 'elan01'>
```

**ip-broadcast *cache age***

Sets IP Broadcast cache age in minutes. This is the maximum number of minutes an IP entry will be kept without re-verification of its location.

**Example: set ip**

```
IP cache age in minutes (2-20): [5]?5
Selection "Set IP broadcast cache age" Complete
LES-BUS config for ELAN 'elan01'>
```

**ipx-broadcast *cache age***

Sets IPX Broadcast cache age in minutes. This is the maximum number of minutes an IPX entry will be kept without re-verification of its location.

**Example: set ipx-broadcast**

```
IPX cache age in minutes (1-10): [3]?3
Selection "Set IPX broadcast cache age" Complete
LES-BUS config for ELAN 'elan01'>
```

**ipx-maximum *size of forwarding list***

Sets the maximum number of entries that BCM IPX will maintain in its Forwarding List.

**Note:** This parameter sets an upper limit to the device's performance, so use caution when increasing this limit. BCM IPX's Forwarding List consists of all the dynamically discovered IPX routers or servers in the IPX network containing this ELAN, as well as any BCM Static Targets currently active on the ELAN. Each broadcast frame managed by BCM IPX is individually transmitted to each member on the Forwarding List. If the number of members exceeds the maximum, BCM IPX automatically shuts down, allowing BUS to forward IPX broadcasts as usual.

**Example: set ipx-maximum**

```
IPX Maximum Size of Forwarding List (5-65535): [50]? 60
Selection "Set IPX Maximum Size of Forwarding List" Complete
```

## Configuring a LES-BUS

### *le-arp response destination*

Sets LE ARP response destination for either one or all clients. When ALL CLIENTS is selected, LE ARP Response frames initiated or forwarded by the LES are sent to all clients on the Control Distribute VCCs. When ONE CLIENT is selected, LE ARP Response frames are sent only to the client that originated the LE ARP Request, over the Control Direct VCC to that client. The ALL CLIENTS option is most useful when LE Clients learn MAC/ATM addresses from LE ARPs which they did not originate. Many LE Clients do not learn LE ARPs which they did not originate.

#### **Example: set le-arp**

```
LE ARP Response Destination
(1) One client
(2) All clients

Enter Selection: [1]?1
Selection "Set LE ARP Response Destination" Complete
LES-BUS config for ELAN 'elan01'>
```

### *lecid range*

Sets bounds on the range of lecid's used by this LES. By configuring a lecid range, you can guarantee that all LESs within a Super ELAN use a disjoint set of lecid's. Maintaining lecid uniqueness within a Super ELAN is required if any clients filter data-direct VCCs based on lecid, or if any clients do not implement the (C22) path switch delay timer.

This parameter can also be used to limit the number of clients served by this LES-BUS.

### *netbios broadcast cache age*

Sets NetBIOS cache age in minutes. This is the maximum number of minutes an NetBIOS will be kept without re-verification of its location.

#### **Example: set netbios**

```
NetBIOS cache age in minutes (10-20): [15]?12
Selection "Set NetBIOS broadcast cache age" Complete
LES-BUS config for ELAN 'elan01'>
```

### *partition*

Partitions the *control distribute* or *multicast forward* VCCs.

Proxy clients are placed on one Control Distribute VCC and all other clients are placed on another Control Distribute VCC. Partitioning the VCCs reduces nuisance traffic at many clients because non-proxy LECs do not receive proxy LEC traffic, and vice-versa. However, some frames must now be forwarded on two VCCs. In general, partitioning the VCCs is recommended.

The **set partition address** command partitions the control distribute VCC into a "proxy control distribute" VCC and a "non-proxy control distribute" VCC.

#### **Example: set partition address**

```
Partition address resolution forwarding domain [yes]yes
Selection "Partition address resolution forwarding domain" Complete
LES-BUS config for ELAN 'elan01'>
```

The **set partition unicast** command partitions the multicast forward VCC into a "proxy multicast forward" and a "non-proxy multicast forward" VCC.

**Note:** Unicast partitioning can not be set to *yes* when BUS Mode is set to *VCC-Splice*.

#### **Example: set partition unicast**



## Configuring a LECS

cast send VCCs that specify a peak cell rate that is greater than the maximum data rate of the ATM interface.

### Example: set traffic validate

```
Validate peak cell rate of best effort VCCs [no]no
Selection "Validate Peak Cell Rate of best effort VCCs" Complete
LES-BUS config for ELAN 'elan01'>
```

## Exit

Use the **exit** command to return to the LE Services config> prompt.

**Syntax:** exit

**Example:** exit

---

## Commands for Configuring a LECS

Enter the **lecs** command at the LE Services config> prompt to enter the LECS config> environment where you initiate configuration for the individual ELANS for your network.

*Table 21-3. LECS Configuration Commands Summary*

Command	Function
Add	Adds a LECS to the static configuration of the ATM network.
Elans	Configures the ELANS under the administrative domain of the LECS.
List	Lists the configuration of the LECS on the MSS Server.
Policies	Configures the policies guiding this LECS.
Remove	Removes the LECS from the static configuration of the ATM network.
Search	Lets you use "search keys" to simplify configuration management.
Set	Sets operational characteristics of the LECS.
Exit	Returns to the LE Services config> prompt.

## Add

The **add** command adds a LECS to your ATM network. Adds a LECS to the static configuration of the MSS Server. You are prompted to select the ESI to be used in the ATM address of the LECS. You are also asked to select whether to activate error logging on the LECS subsystem. For further information on error logging, see "ELS Configuration Commands" on page 11-7.

**Syntax:** Add

**Example:**

```
LECS config> add
( 1) Use burned in ESI
End system identifier [1]?yes
LECS added to configuration
Enable standard Error Logging System for LECS? [Yes] Y
Standard ELS activated for LECS
LECS config>
```

## Elans

Type the **elans** command to enter the LECS ELANS Configuration environment. In this environment, you configure all ELANS under the administrative domain of the LECS. This environment is characterized by the LECS ELANS config> prompt.

**Syntax:** `elans`

**Example:**

```
LECS config> elans
Configuration of ELANS for LECS
LECS ELANS config>
```

For a description of commands used in the LECS ELANS config> environment, see “Configuring ELANS at the LECS” on page 21-17.

## List

The **list** command displays the configuration of the LECS. The various configuration parameters are described under “Set” on page 21-16.

**Syntax:** `list`

**Example:**

```
LECS config>list
LECS Detailed Configuration
Lecs is                               Enabled
ATM Device number:                    0
ESI:                                   Use burned in ESI
Selector:                              0x00
Validate Best Effort PCR:              No
Configuration Direct Max Reserved BW (Kbps): 0
Maximum number of simultaneous VCCs:   128
Idle VCC Timeout (in seconds):         60
Trace ATM address value: 00.00.00.00.00.00.00.00.00.00.00.00.00.00.00.00.00.00
Trace ATM address mask: FF.FF.FF.FF.FF.FF.FF.FF.FF.FF.FF.FF.FF.FF.FF.FF.FF
```

## Policies

The **policies** command puts you in the LECS Policies Configuration environment. In this environment, you configure the policies used to guide the LECS operation. The LECS Policies Configuration environment is characterized by the LECS Policies config> prompt.

**Syntax:** `policies`

**Example:**

```
LECS config> policies
LECS Policies config>
```

For additional information, see “Configuring the Policies of a LECS” on page 21-30.

## Remove

The **remove** command removes the LECS from the static configuration of the MSS Server. You are prompted whether to remove all other LECS objects (for example, policies and ELANS) from the static configuration also.

**Syntax:** `remove`

**Example:**

## Configuring a LECS

```
LECS config>remove
Are you sure that you want to delete all LECS information from this configuration [no]? yes
Removed all policies and ELANs for LECS from configuration
Removed LECS
Selection "LAN Emulation Configuration Server (LECS) remove" Complete
LECS config>
```

## Search

The **search** command provides “search keys” to simplify configuration management. Each search key represents some unique aspect of LE Servers or LE Clients (ATM address, MAC address, name of ELAN, and so on). Search keys can be used to determine which ELAN a particular LES is serving, or to which LES a certain policy value is assigned.

**Syntax:** search     atm  
                          les  
                          mac  
                          name  
                          route

### Example: search mac

```
LECS config> search mac
Enter MAC address using its natural bit-order
MAC address to search for [ ]?11.11.11.11.11.11
MAC address 11.11.11.11.11.11
   for LES 00.00.00.00.00.00.00.00.00.00.00.00.00.00.00.00.00.00.00
   for ELAN 'lgrove01'
LECS config>
```

## Set

The **set** command lets you change the operational characteristics of the LECS.

**Syntax:** set            address  
                          enable-disable  
                          maximum  
                          reserved  
                          trace  
                          validate  
                          vcc

### Example:

```
LECS config> set address
End system identifier
   (1) Use burned in ESI

Enter Selection: [1]?
Selector 0 is generally reserved for the LECS and
selector 1 is generally reserved for the LECS interface.
Selector [0]?4
Selector of LECS' ATM address is 4
Selection "LECS address modification" Complete
LECS config>
```

### Address

Changes the address of the LECS. This is the local ATM address of the LECS. At the ATM switches, you may also configure the well-known LECS address to be associated with this local ATM address. See “Addressing in ATM” on page 16-3 for additional information about addressing.



### Enable/Disable

Enables or disables the LECS. If the LECS is disabled, it will not be started the next time the router is restarted.

### Maximum number of VCCs

Maximum number of configuration direct VCCs that the LECS supports at one time. If the actual number of VCCs to the LECS exceeds this number, the LECS releases *all* VCCs that have not been used in the number of seconds specified by the VCC idle time (described below).

### Reserved bandwidth maximum

Maximum bandwidth (in Kbps) that the LECS accepts on any reserved bandwidth configuration direct VCC.

### Trace *value* or *mask*

Each LE component supports packet tracing. You can specify an ATM address filter for packet tracing. For each VCC, if the ATM address of the entity at the other end of the VCC matches the ATM-address-value on all bits set by the ATM-address-mask, then packet tracing *can* be performed on that VCC. For packet tracing to occur, enable it in the ELS subsystem (for additional information, refer to Chapter 11, "Using and Configuring the Event Logging System (ELS)" on page 11-1.

### Validate best effort peak cell rate

Answer **yes** or **no**.

When you configure the LECS to validate best effort PCR, the peak cell rate (specified while setting up each VCC) is examined. If the peak cell rate is greater than the maximum data rate of the ATM interface, the requested VCC is rejected.

### VCC idle time

Number of seconds (of idle time) before LECS releases VCCs that have not been used when the number of VCCs exceeds the number that the LECS supports. (See also "Maximum number of VCCs" above.)

## Exit

Use the **exit** command to return to the LE Services `config>` prompt.

**Syntax:** `exit`

**Example:** `exit`

---

## Configuring ELANs at the LECS

The primary function of the LECS is to assign clients to LESs that serve ELANs. You enter commands at the LECS `ELANs config>` prompt to configure all of the ELANs under the administrative control of the LECS. Before *any* client for a particular ELAN can use this LECS, information on that ELAN must be configured on this LECS. Even if an ELAN is served by a local LES-BUS, the ELAN information must be configured here if the LECS is to refer any clients to that ELAN.

To configure ELANs under the administrative domain of the LECS, enter the **elans** command at the LECS `config>` prompt:

```
LECS config> elans
Configuration of ELANs for LECS
LECS ELANs config>
```

## Configuring ELANs at the LECS

You can enter the following commands at the LECS ELANs config> prompt:

Command	Function
Add	Adds an ELAN to the static configuration administered by the LECS.
List	Summarizes the ELANs that are under the administrative control of the LECS.
Remove	Removes an ELAN from the static configuration administered by the LECS.
Select elan	Selects an ELAN for more detailed configuration.
Exit	Returns to the LECS config> prompt.

### Add

The **add** command adds an ELAN to the static configuration administered by the LECS. You will be prompted for the ELAN name, type, and maximum frame size.

**Syntax:** `add`

**Example:**  
LECS ELANs config> **add**  
Name of ELAN [ ]? **cary02**  
Type of ELAN  
    (1) Ethernet  
    (2) TokenRing  
Enter Selection: [2]? **2**  
Maximum frame size of ELAN  
    (1) 1516  
    (2) 4544  
    (3) 9234  
    (4) 18190  
Enter Selection: [2]? **2**  
ELAN 'cary02' added  
Selection "ELAN addition" complete  
LECS ELANs config>

### List

The **list** command summarizes the ELANs under the administrative domain of the LECS.

**Syntax:** `list`

**Example:**

```
LECS ELANs config> list elan

ELAN Listing...

Name      Type      Packet Size  Enabled
-----
ELAN1     TokR      4544         Yes
ELAN2     TokR      4544         Yes

LECS ELANs config>
```

## Remove

The **remove** command prompts you remove an ELAN from the static configuration administered by the LECS. After you enter your choice, a confirmation is displayed.

**Syntax:** `remove`

**Example:**

```
LECS ELANS config>remove
Choice of ELAN
  (1) All
  (2) cary01
  (3) cary02
  (4) < CANCEL >

Enter Selection: [1]? 3
Removed ELAN 'cary02'
Selection "ELAN removal" Complete
```

## Select

The **select** command prompts you to select an ELAN for additional (detailed) configuration.

**Syntax:** `select`

**Example:**

```
LECS ELANS config> select
  ( 1) cary01
  ( 2) lgrove01
  ( 3) lgrove02
  ( 4) lgrove03
Choice of ELAN [1]?2
ELAN 'lgrove01' selected for detailed configuration

Selected ELAN 'lgrove01'>
```

Additional information on detailed configuration can be found at “Detailed Configuration of an ELAN at the LECS.”

## Exit

Use the **exit** command to return to the LECS `config>` prompt.

**Syntax:** `exit`

**Example:** `exit`

---

## Detailed Configuration of an ELAN at the LECS

This section provides examples of configuring an ELAN in detail. It assumes that you already have completed the configuration requirements outlined in “Configuring ELANs at the LECS” on page 21-17. Detailed configuration is done from the ELAN 'elan-name' selected for detailed configuration> prompt. For example:

## Detailed ELAN Configuration

```
LE Services config> lecs
Lan Emulation Configuration Server configuration
LECS config> elans
Configuration of ELANs for LECS
LECS ELANs config> select
( 1) cary01
( 2) lgrove01
( 3) lgrove02
( 4) lgrove03
Choice of ELAN [1]?2
ELAN 'lgrove01' selected for detailed configuration
Selected ELAN 'lgrove01'>
```

Use the following commands for detailed configuration:

<i>Table 21-5. LECS ELANs Detailed Configuration Commands Summary</i>	
Command	Function
Les	Manages the LESs that serve the selected ELAN.
List	Lists the configuration of the selected ELAN.
Policy	Manages the policy values assigned to the LESs serving the selected ELAN.
Set	Enables or disables the selected ELAN, and manages the name, type, and maximum frame size of the ELAN.
Tlv	Manages TLVs associated with the selected ELAN.
Exit	Returns to the LECS ELANs config> prompt.

## Les

Use the **les** command to manage the LES ATM addresses that represent LESs serving the selected ELAN. The ATM address of each LES serving this ELAN must exist here. Each LES ATM address can consist of two addresses, a primary LES address and a backup LES address. The backup LES address serves as a hot standby LES that activates when the primary LES goes down. The LECS permits two types of backups to be configured: backup LESs that utilize the IBM LES Redundancy VCC as specified in “LAN Emulation Reliability” on page 16-15, and backup LESs that do not.

The difference between these two options is that in the former option, the LECS attempts to use information on local LESs to determine the correct LES for the client. For example, the LECS can query a local backup LES to determine if the LES is currently in active or in standby mode. In the latter option, the LECS alternately assigns a client to the primary and backup, regardless of any local information. For more information on the redundancy features of the LES, see “LAN Emulation Reliability” on page 16-15 or the IBM 8210 Multiprotocol Switched Services Server Configuration Program User's Guide.

You will be prompted to enter the ATM address of the primary and backup LES. If either of the LESs is located on the same MSS Server, then you can select the local option when prompted. Using this option, you do not need to know the 20-byte ATM address of the LES; it will be determined at run-time. If no backup support is provided for a particular LES, select the unspecified option.

For the **les disable**, **les enable**, and **les remove** commands, you are asked to select the LES to which the action applies.

The **les list** command displays the ATM address information for all LESs serving the selected ELAN.

Parameters that can be used with the **les** command are illustrated in the following examples:

**Syntax:** **les** add  
           disable  
           enable  
           list  
           remove  
           set ...

**Example:**

```
Selected ELAN 'lgrove01'>les add
( 1) Local
( 2) Remote
Primary LES is [1]? 2
If primary LES is remote, enter ATM address
[]? 39.999999999999.000099990101.222222222222.04
( 1) Unspecified
( 2) Local
( 3) Remote
Backup LES is [1]? 3
If backup LES is remote, enter ATM address
[]? 39.999999999999.000099990102.001bcda02038.07
Do the LESs utilize IBM LES redundancy? [Yes]?: yes
LES ATM address 39.99.99.99.99.99.00.00.99.99.01.01.22.22.22.22.2
added to ELAN 'lgrove01'
```

**Example:**

```
Selected ELAN 'lgrove01'>les disable
ATM address of LES for ELAN

(1) All
(2) Local LES for: lgrove01

Enter Selection: [1]?2
LES disabled: Local LES for: lgrove01
Selection "LES disable" Complete
Selected ELAN 'lgrove01'>
```

**Example:**

```
Selected ELAN 'lgrove01'>les enable
ATM address of LES for ELAN

(1) All
(2) Local LES for: lgrove01

Enter Selection: [1]?2
LES enabled: Local LES for: lgrove01
Selection "LES ATM address enable" Complete
Selected ELAN 'lgrove01'>
```

**Example:**

```
Selected ELAN 'lgrove01'>les list
LESs for ELAN 'lgrove01'

Enbld LES ATM address
=====
Yes Local LES for: lgrove01
no backup provided
Selected ELAN 'lgrove01'>
```

## Detailed ELAN Configuration

### Example:

```
Selected ELAN 'lgrove01'>les remove
      ATM address of LES for ELAN

      (1) All
      (2) Local LES for: lgrove01
      (3) < CANCEL >

Enter Selection: [1]?2
Values assigned to LES removed
Delete LES: Local LES for: lgrove01
Selection "LES ATM address removal" Complete
Selected ELAN 'lgrove01'>
```

Use the **les set** command to modify the configuration of a particular LES. Use the **les set primary** command to modify the ATM address of the primary LES, and use the **les set backup** command to modify the ATM address of the backup LES.

### Example: les set backup

```
Selected ELAN 'lgrove01'>les set ba
( 1) Local LES for: lgrove01
( 2) 39.99.99.99.99.99.00.00.99.99.01.01.22.22.22.22.22.04
Choice of LES [1]? 2
( 1) Unspecified
( 2) Local
( 3) Remote
Backup LES is [3]? 3
If backup LES is remote, enter ATM address
[39.99.99.99.99.99.00.00.99.99.01.02.00.1B.CD.A0.20.38.06]?
39.99.99.99.99.99.00.00.99.99.01.02.00.1B.CD.A0.20.38.06
Do the LESs utilize IBM LES redundancy?? [Yes]: no
Backup LES ATM address modified
```

### Example: les set primary

```
Selected ELAN 'Accounting Ethernet Elan'> les set primary
( 1) Local LES for: Accounting Ethernet Elan

Choice of LES [1]?1
( 1) Local
( 2) Remote

Primary LES is [1]?2
If primary LES is remote, enter ATM address
[Local LES for: Accounting Ethernet Elan]?39.00.00.00.00.00.00.d0.d0.d0.d0.d0.d0.10.10.10.10.10.03

Primary LES ATM address modified
Selected ELAN 'Accounting Ethernet Elan'>
```

## List

The **list** command provides the following information:

**Syntax:** `list`

### Example: list

```
Selected ELAN 'lgrove01'> list
ELAN Configuration:
  ELAN is      Enabled
  Name:        'lgrove01'
  ELAN Type:   TokenRing
  Max Frame Size: 1516

Selected ELAN 'lgrove01'>
```

## Policy

Use the **policy** command to add, disable, enable, list, or remove policy values that are assigned to the LESs serving the selected ELAN.

### add

Use the **policy add** command to add a binding between a policy value and a LES to the static configuration of the LECS. Policy values are used to assign clients to LESs. Refer to “Overview of the LECS Function” on page 16-5 for details on how the LECS uses policy values to assign LECs to LESs.

**Syntax:** `policy add pv_type`

Where *pv\_type* is either:

- ESI/SEL of ATM address
- FRAME size
- MAC address
- NAME of ELAN
- PREFIX of ATM Address
- ROUTE descriptor
- TYPE of Elan

### Example:

```
Selected ELAN 'lgrove01'>policy add prefix
      ATM address of LES for policy value(s)

      (1) Local LES for: lgrove01

      Enter Selection: [1]?1
      ATM prefix [ ]?55
      ATM address prefix 55
      bound to LES Local LES for: lgrove01
      Configure another address?? [Yes]:no
      Selected ELAN 'lgrove01'>
```

### disable

Use the **policy disable** command to disable a policy value in the static configuration of the LECS. This policy value will not become active on the next router restart.

**Syntax:** `policy disable pv_type`

Where *pv\_type* is either:

- ESI/SEL of ATM address
- FRAME size
- MAC address
- NAME of ELAN
- PREFIX of ATM address
- ROUTE descriptor
- TYPE of ELAN

### Example:

```
Selected ELAN 'lgrove01'>policy disable
      ATM prefix
      (1) All
      (2) 55
      LES for: lgrove01

      Enter Selection: [1]? 2
      ATM value disabled: 55
      Selection "ATM address disable" Complete
      Selected ELAN 'lgrove01'>
```

## Detailed ELAN Configuration

### enable

Use the **policy enable** command to enable a policy value in the static configuration of the LECS. The policy value must be enabled to become active at the next router restart.

**Syntax:** `policy enable pv_type`

Where *pv\_type* is either:

- ESI/SEL of ATM address
- FRAME size
- MAC address
- NAME of ELAN
- PREFIX of ATM address
- ROUTE descriptor
- TYPE of ELAN

### Example:

```
Selected ELAN 'lgrove01'>policy enable
ATM prefix
  (1) All
  (2) 25
  (3) 55
                                     to Local LES for: lgrove01
                                     to Local LES for: lgrove01

Enter Selection: [1]?1
Enabled all ATM prefixes for ELAN 'lgrove01'
Selection "ATM address enable" Complete
Selected ELAN 'lgrove01'>
```

### list

Use the **policy list** command to display all of the policy values assigned to LESs of the selected ELAN.

**Syntax:** `policy list pv_type`

Where *pv\_type* is either:

- all
- ESI/SEL of ATM address
- FRAME size
- MAC address
- NAME of ELAN
- PREFIX of ATM address
- ROUTE descriptor
- TYPE of ELAN

### Example:

```
Selected ELAN 'lgrove01'>policy list prefix
ATM prefixes for ELAN 'lgrove01'
Enabled Value => LES
=====
Selected ELAN 'lgrove01'>
```

### remove

Use the **policy remove** command to remove policy values from the static configuration of the LECS. You will be prompted to select the policy value to remove.

**Syntax:** `policy remove pv_type`

Where *pv\_type* is either:

- ESI/SEL of ATM address
- FRAME size



- MAC address
- NAME of ELAN
- PREFIX of ATM address
- ROUTE descriptor
- TYPE of ELAN

**Example:**

```
Selected ELAN 'lgrove01'>policy remove prefix
  ATM prefix
    (1) All
    (2) 55          to Local LES for: lgrove01
  LES for: lgrove01

Enter Selection: [1]? 2
ATM addr prefix deleted: 55
Selection "ATM address removal" Complete
Selected ELAN 'lgrove01'>
```

**Set**

Use the **set** command to modify the configuration of the selected ELAN. You can enable or disable the ELAN, or modify its name, type, or maximum frame size. Parameters that you can use with the **set** command are illustrated in the following examples:

```
Syntax: set  enable-disable
         frame
         name
         type
```

**Example:**

```
Selected ELAN 'lgrove01'>set enable-disable
  Enable ELAN for LEC assignment [yes]yes
  ELAN enable-disable modified
  Selection "ELAN enable-disable modification" Complete
  Selected ELAN 'lgrove01'>
```

**Example:**

```
Selected ELAN 'lgrove01'>set frame
  Maximum frame size of ELAN
    (1) 1516
    (2) 4544
    (3) 9234
    (4) 18190

Enter Selection: [2]?2
ELAN max frame size modified
Selection "ELAN max frame size modification" Complete
Selected ELAN 'lgrove01'>
```

**Example:**

```
Selected ELAN 'lgrove01'> set name
  Name of ELAN [lgrove01]lgrove001
  ELAN name changed to 'lgrove001'
  Selection "ELAN name modification" Complete
  Selected ELAN 'lgrove001'>
```

**Example:**

## Detailed ELAN Configuration

```
Selected ELAN 'lgrove01'>set type
Type of ELAN
  (1) Ethernet
  (2) TokenRing

Enter Selection: [2]?2
ELAN type modified
Selection "ELAN type modification" Complete
Selected ELAN 'lgrove001'>
```

## TLV

Time/length/values (TLVs) are optional parameters that can be returned to all clients assigned to the selected ELAN. Use the **tlv add** command to add the specified TLVs of the selected ELAN. You can use the following parameters with the **tlv add** command:

tlv add

**Syntax:** `tlv add atm.`

Choose from :

- C7 : Control timeout
- C10:Maximum unknown frame count
- C11:Maximum unknown frame time
- C12:VCC timeout period
- C13:Maximum retry count
- C17:Aging time
- C18:Forward delay time
- C20:Expected LE\_ARP response time
- C21:Flush timeout
- C22:Path switching delay
- C23:Local segment ID
- C24:Mcast send VCC type
- C25:Mcast send VCC avg rate
- C26:Mcast send VCC peak rate
- C28:Connection complete timer

**Syntax:** `tlv add ibm.`

Choose from :

- I4: Validate PCR of DDVCCs
- I5: Maximum Reserved Bandwidth of DDVCCs
- I6: Requested DDVCC Type
- I7: Requested DDVCC Peak Cell Rate
- I8: Requested DDVCC Avg Cell Rate
- I9: Requested DDVCC QoS Class
- I10: Negotiate Cell Rates on DDVCCs

**Syntax:** `tlv add user`.

You can define and add their own TLVs.

**Example:**

```
Selected ELAN 'joe'> tlv add atm c21
C21: Flush Time-out (in seconds) [4]?2
TLV added: C21: Flush timeout (sec)
Selection "Flush timeout TLV add" Complete
Selected ELAN 'joe'>
```

**disable**

Use the **tlv disable** command to disable a TLV in the static configuration. The TLV will not become active on the next router restart. You are prompted to select the TLV to disable.

**Syntax:** `tlv disable`

TLV choice:

```
(1) All
(2) T x00A03E01 C7 : Control timeout (sec)      L 2  V 120
(3) T x00A03E01 C7 : Control timeout (sec)      L 2  V 100
(4) T x00A03E02 C10: Maxmm unknown frame count L 2  V 1
(5) T x00A03E03 C11: Mxmm unknwn frm time (sec) L 2  V 1
(6) T x00A03E04 C12: VCC timeout period (sec)   L 4  V 1200
(7) T x00A03E05 C13: Maximum retry count       L 2  V 1
(8) T x00A03E06 C17: Aging time (sec)          L 4  V 300
(9) T x00A03E07 C18: Forward delay time (sec)   L 2  V 15
(10) T x00A03E08 C20: Expctd LE_ARP rspnse (sec) L 2  V 1
(11) T x00A03E09 C21: Flush timeout (sec)       L 2  V 4
(12) T x00A03E0A C22: Path switching delay (sec) L 2  V 6
(13) T x00A03E0B C23: Local segment ID (hex)    L 2  V ff:00
(14) T x00A03E0C C24: Mcst send VCC type (dec)  L 2  V 2
(15) T x00A03E0C C24: Mcst send VCC type (dec)  L 2  V 0
(16) T x00A03E0D C25: Mcst snd VCC avrg rt (cps) L 4  V 0
(17) T x00A03E0E C26: Mcst snd VCC peak rt (cps) L 4  V 0
(18) T x00A03E0F C28: Cnnctn complete time (sec) L 2  V 4
```

**Example:**

```
Selected ELAN 'lgrove001'> tlv disable
Enter Selection: [1]? 1
Disabled all TLVs for ELAN 'lgrove001'
Selection "TLV disable" Complete
Selected ELAN 'lgrove001'>
```

**enable**

Use the **tlv enable** command to enable a TLV in the static configuration. The selected TLV will become active on the next router restart. You are prompted to select the TLV to enable.

## Detailed ELAN Configuration

TLV choice:

- (1) All
- (2) T x00A03E01 C7 : Control timeout (sec) L 2 V 120
- (3) T x00A03E01 C7 : Control timeout (sec) L 2 V 100
- (4) T x00A03E02 C10: Maxmm unknown frame count L 2 V 1
- (5) T x00A03E03 C11: Mxmm unknwn frm time (sec) L 2 V 1
- (6) T x00A03E04 C12: VCC timeout period (sec) L 4 V 1200
- (7) T x00A03E05 C13: Maximum retry count L 2 V 1
- (8) T x00A03E06 C17: Aging time (sec) L 4 V 300
- (9) T x00A03E07 C18: Forward delay time (sec) L 2 V 15
- (10) T x00A03E08 C20: Expctd LE\_ARP rspnse (sec) L 2 V 1
- (11) T x00A03E09 C21: Flush timeout (sec) L 2 V 4
- (12) T x00A03E0A C22: Path switching delay (sec) L 2 V 6
- (13) T x00A03E0B C23: Local segment ID (hex) L 2 V ff:00
- (14) T x00A03E0C C24: Mcst send VCC type (dec) L 2 V 2
- (15) T x00A03E0C C24: Mcst send VCC type (dec) L 2 V 0
- (16) T x00A03E0D C25: Mcst snd VCC avrg rt (cps) L 4 V 0
- (17) T x00A03E0E C26: Mcst snd VCC peak rt (cps) L 4 V 0
- (18) T x00A03E0F C28: Cnnctn complete time (sec) L 2 V 4

### Example: tlv enable

```
selected ELAN 'lgrove001'> tlv enable
Enter Selection: [1]?1
Enabled all TLVs for ELAN 'lgrove001'
Selection "TLV enable" Complete
Selected ELAN 'lgrove001'>
```

list

Use the **tlv list** command to list all TLVs of the selected ELAN.

### Example: tlv list

```
Selected ELAN 'lgrove001'> tlv list
TLVs for ELAN 'lgrove001'
```

```
Enabled TLV
=====
Yes Type: x00A03E01 'C7 : Control timeout (sec)'
Len: 2 Value: 120
Yes Type: x00A03E01 'C7 : Control timeout (sec)'
Len: 2 Value: 100
Yes Type: x00A03E02 'C10: Maxmm unknown frame count'
Len: 2 Value: 1
Yes Type: x00A03E03 'C11: Mxmm unknwn frm time (sec)'
Len: 2 Value: 1
Yes Type: x00A03E04 'C12: VCC timeout period (sec)'
Len: 4 Value: 1200
Yes Type: x00A03E05 'C13: Maximum retry count'
Len: 2 Value: 1
Yes Type: x00A03E06 'C17: Aging time (sec)'
Len: 4 Value: 300
Yes Type: x00A03E07 'C18: Forward delay time (sec)'
Len: 2 Value: 15
Yes Type: x00A03E08 'C20: Expctd LE_ARP rspnse (sec)'
Len: 2 Value: 1
Yes Type: x00A03E09 'C21: Flush timeout (sec)'
Len: 2 Value: 4
Yes Type: x00A03E0A 'C22: Path switching delay (sec)'
Len: 2 Value: 6
```

```

Yes  Type: x00A03E0B 'C23: Local segment ID (hex)'
      Len: 2 Value: ff:00
Yes  Type: x00A03E0C 'C24: Mcst send VCC type (dec)'
      Len: 2 Value: 2
Yes  Type: x00A03E0C 'C24: Mcst send VCC type (dec)'
      Len: 2 Value: 0
Yes  Type: x00A03E0D 'C25: Mcst snd VCC avrg rt (cps)'
      Len: 4 Value: 0
Yes  Type: x00A03E0E 'C26: Mcst snd VCC peak rt (cps)'
      Len: 4 Value: 0
Yes  Type: x00A03E0F 'C28: Cnnctn complete time (sec)'
      Len: 2 Value: 4

```

Selected ELAN 'lgrove001'>

### remove

Use the **tlv remove** command to remove a TLV from the static configuration of the selected ELAN. You are prompted to select the TLV to remove.

TLV Choice:

```

(1) All
(2) T x00A03E01 C7 : Control timeout (sec)      L 2  V 120
(3) T x00A03E01 C7 : Control timeout (sec)      L 2  V 100
(4) T x00A03E02 C10: Maxmm unknown frame count  L 2  V 1
(5) T x00A03E03 C11: Mxmm unknwn frm time (sec) L 2  V 1
(6) T x00A03E04 C12: VCC timeout period (sec)   L 4  V 1200
(7) T x00A03E05 C13: Maximum retry count       L 2  V 1
(8) T x00A03E06 C17: Aging time (sec)          L 4  V 300
(9) T x00A03E07 C18: Forward delay time (sec)   L 2  V 15
(10) T x00A03E08 C20: Expctd LE_ARP rspnse (sec) L 2  V 1
(11) T x00A03E09 C21: Flush timeout (sec)       L 2  V 4
(12) T x00A03E0A C22: Path switching delay (sec) L 2  V 6
(13) T x00A03E0B C23: Local segment ID (hex)    L 2  V ff:00
(14) T x00A03E0C C24: Mcst send VCC type (dec)  L 2  V 2
(15) T x00A03E0C C24: Mcst send VCC type (dec)  L 2  V 0
(16) T x00A03E0D C25: Mcst snd VCC avrg rt (cps) L 4  V 0
(17) T x00A03E0E C26: Mcst snd VCC peak rt (cps) L 4  V 0
(18) T x00A03E0F C28: Cnnctn complete time (sec) L 2  V 4

```

### Example:

```

Selected ELAN 'lgrove001'> tlv remove          Enter Selection: [1]?2

TLV deleted: T x00A03E01 C7 : Control timeout (sec)      L 2  V 120
Selection "TLV remove" Complete
Selected ELAN 'lgrove001'>

```

## Exit

Use the **exit** command to return to the LECS ELANs config> prompt.

**Syntax:** `exit`

**Example:** `exit`

---

### Configuring the Policies of a LECS

This section describes the commands to modify the policies that guide the LECS-to-LES assignment procedure. Enter the **policies** command at the LECS `config>` prompt to get to the LECS Policies `config>` prompt where you can enter the following commands:

Command	Function
Add	Add a policy to the static configuration of the LECS.
Disable	Disable a policy of the LECS.
Enable	Enable a policy of the LECS.
List	Lists policies configured for LECS.
Remove	Remove a policy of the LECS.
Exit	Returns to the LECS <code>config&gt;</code> prompt.

#### Add

The **add** command adds a policy to the LECS. When adding a policy, you are prompted for the “V” and “type” of the policy.

Priority specifies the order in which policies are considered; policies with lower priorities are considered earlier. For a more detailed explanation of policies and how the LECS is guided by them, refer to “Overview of the LECS Function” on page 16-5.

Type specifies what information about the client should be used to assign it at the specified priority.

**Syntax:** `add`

**Example:**

```
LECS Policies config> add
Priority of Policy [10]?10
Policy type
(1) byAtmAddr
(2) byMacAddr
(3) byRteDesc
(4) byLanType
(5) byPktSize
(6) byElanNm

Enter Selection: [1]?1
Added policy 'byAtmAddr' at priority 10
Selection "Add assignment policy" Complete
LECS Policies config>
```

#### Disable

The **disable** command disables a policy in the static configuration of the LECS. Disabled policies will not become active on the next router restart.

**Syntax:** `disable`

**Example:**

```
LECS Policies> disable
Choice of policy
  (1) All
  (2) 10 byAtmAddr

Enter Selection: [1]?1
Disabled all policies
Selection "Disable assignment policy" Complete
LECS Policies config>
```

## Enable

The **enable** command enables a policy in the static configuration of the LECS. Enable policies become active on the next router restart.

**Syntax:** `enable`

**Example:**

```
LECS Policies config> enable
Choice of policy
  (1) All
  (2) 10 byAtmAddr

Enter Selection: [1]?2
Enabled policy '10 byAtmAddr'
Selection "Enable assignment policy" Complete
LECS Policies config>
```

## List

The **list** command lists the policies currently configured for the LECS.

**Syntax:** `list`

**Example:**

```
LECS Policies config> list
Policy Listing...
Enabled Priority Type
-----
Yes      10 byAtmAddr
LECS Policies config>
```

## Remove

The **remove** command removes a policy from the static configuration of the LECS.

**Syntax:** `remove`

**Example:**

```
LECS Policies> remove
Choice of policy
  (1) All
  (2) 10 byAtmAddr

Enter Selection: [1]?1
Removed all policies
Selection "Remove assignment policy" Complete
LECS Policies config>
```

## Configuring Security for ELANs

### Exit

Use the **exit** command to return to the LECS config> prompt.

**Syntax:** `exit`

**Example:** `exit`

---

## Configuring Security for ELANs

This section describes optional commands related to authentication of LE Client requests to join ELANs. The LES-LECS Security Interface is the LE Services component responsible for multiplexing configuration requests from the LESs on the MSS Server to the LECS (which may or may not be on the MSS Server). The LES-LECS interface is a required component if any of the LES-BUSs are using the security features of the MSS Server. See “LAN Emulation Security” on page 16-16 for additional information.

Enter the **security** command at the LE-Services config> prompt to get to the LECS INTERFACE config> prompt.

*Table 21-7. LECS Interface Configuration Commands Summary*

Command	Function
Add	Provides for authentication of client-joins.
Disable	Disables ability to authenticate client-joins.
Enable	Enables ability to authenticate client-joins.
List	Lists parameters for this interface.
Remove	Removes ability to authenticate client-joins.
Set	Sets parameters for this interface (ATM address and traffic type).
Exit	Returns to the LE Services config> prompt.

### Add

Use the **add** command to add a communication path to the LECS authentication of client-joins.

**Syntax:** `add`

**Example:**

```
LECS INTERFACE config> add
( 1) Use burned in ESI
Select ESI [1]?1
Selector 0 is generally reserved for use by the LECS,
Selector 1 is generally reserved for use by the LECS Interface.
LECS Interface Selector [1]?1
LECS INTERFACE config>
```



## Disable

Use the **disable** command to disable LECS authentication of client-joins.

**Syntax:** `disable`

**Example:** `disable`

## Enable

Use the **enable** command to enable LECS authentication of client-joins.

**Syntax:** `enable`

**Example:** `enable`

## List

Use the **list** command to see a detailed list of the parameters associated with this LECS interface.

**Syntax:** `list`

**Example:**

```
LECS INTERFACE config> list
LECS Interface Detailed Configuration
  LECS Interface Enabled/Disabled: Enabled
  ATM Device number: 0
  ESI: Use Burned in ESI
  Selector: 0x01
  Configuration Direct VCC Traffic Type: Best Effort VCC
  Configuration Direct VCC PCR in Kbps: 155000
  Configuration Direct VCC SCR in Kbps: 0
LECS INTERFACE config>
```

## Remove

Use the **remove** command to remove the ability to authenticate client-joins for this ELAN.

**Syntax:** `remove`

**Example:** `remove`

## Set

Use the **set** command to configure the address and the traffic type for this interface.

**Syntax:** `set address traffic`

**Example:**

```
LECS INTERFACE config> set address
( 1) Use burned in ESI
Select ESI [1]?
Selector 0 is generally reserved for use by the LECS,
Selector 1 is generally reserved for use by the LECS Interface.
LECS Interface Selector [1]?1
LECS INTERFACE config>
```

## Configuring Security for ELANs

### Example:

```
LECS INTERFACE config> set traffic configuration
( 1) Best Effort
( 2) Reserved Bandwidth
Traffic type [1]?1
Peak cell rate in Kbps (1-155000) [155000]? 75000
LECS INTERFACE config>
```

## Exit

Use the **exit** command to return to the LE Services config> prompt.

**Syntax:** exit

**Example:** exit

---

## Chapter 22. Monitoring LAN Emulation Services

This chapter describes how to monitor and control operational LE services. Chapter 21, “Configuring LAN Emulation Services” on page 21-1 described the configuration of LE services. The commands detailed in that chapter modified the static memory of the router, and the changes would not take effect until the router is restarted. The commands in this chapter modify the current LE services and take effect immediately. These commands do not modify the static memory of the router and are lost on the next router restart.

There are many components to the LE Services Console environment. There is a component for the LECS, for the LES-LECS Security interface, and for each individual LES-BUS.

From the top-level LE Services Console, you can enter into a console environment for any particular component, or you can create a new LES-BUS component.

This chapter includes the following sections:

- “Accessing the LAN Emulation Services Console Environment”
- “LAN Emulation Services Console Commands” on page 22-2
- “LES-BUS Console Commands” on page 22-6, which includes the Broadcast Manager Console
- “LECS Console Commands” on page 22-34
- “LECS Policies Console Commands” on page 22-43
- “Monitoring ELANs at the LECS” on page 22-48
- “Monitoring ELAN Details at the LECS” on page 22-51
- “Security for LE Service Console Commands” on page 22-58, the LES-LECS interface to validate joins

Individual LE Service components can be stopped, modified, or restarted without restarting the entire router.

---

### Accessing the LAN Emulation Services Console Environment

The LE Services Console environment (available from the GWCON process) is characterized by the LE-SERVICES+ prompt. Commands entered at this prompt permit you to work more closely with a particular LE component, or to create a LES-BUS.

To access the LE Services console:

1. At the OPCODE prompt, enter **talk 5**. (For more detail on this command, refer to Chapter 5, “The OPCODE Process and Commands” on page 5-1.) For example:

```
* talk 5
+
```

The GWCON prompt (+) is displayed on the console. If the prompt does not appear when you first enter configuration, press **Return** again.

2. At the GWCON prompt, enter the **network** command to display the network interface numbers for which the router is currently configured. For example:

## LE Services Console Commands

```
*talk 5
+network ?
0 : ATM
Network number [0]? 0
ATM Console
ATM+
```

**Note:** Two ATM interfaces may be defined.

3. Enter the **le-services** command

**Example:**

```
ATM+le-s
LE-Services Console
LE-SERVICES+
```

---

## LAN Emulation Services Console Commands

Enter commands at the LE-Services+ prompt.

*Table 22-1. LAN EMULATION Services Monitoring Commands Summary*

Command	Function
? (Help)	Lists the console commands or lists the actions associated with specific commands.
Create	Creates an operating LES-BUS from its configuration data (the configuration data must also exist).
Leccs	Takes you to the LECS console environment, described in “LECS Console Commands” on page 22-34.
Les-bus	Takes you to the console environment for a particular LES-BUS, as described in “LES-BUS Console Commands” on page 22-6.
List	Displays a summary of the operating LES-BUSs.
Security	Takes you to the LES-LECS Security console environment, described in “Security for LE Service Console Commands” on page 22-58.
Summary	Displays a summary of the operating LES-BUSs, including the number of operational LE Clients.
Work	Takes you to the console environment for a particular LES-BUS, as described in “LES-BUS Console Commands” on page 22-6.
Exit	Returns to the previous prompt.

## Help

Use the **? (help)** command to list the commands that are available from the current prompt level. You also can enter a ? after a specific command name to list its options.

**Syntax:** ?

**Example:**

```

LE-SERVICES+?
CREATE a new les-bus
LECS
LES-BUS work with an existing les-bus
LIST all les-bus pairs
SECURITY (LES-LECS Interface to Validate Joins)
SUMMARY of all les-bus's
WORK with an existing les-bus
EXIT
LE-SERVICES+

```

## Create

Use the **create** command to create an operating LES-BUS from its configuration. Before you can create a LES-BUS, its configuration must first exist. See “Configuring a LES-BUS” on page 21-4 for an explanation of how to configure a LES-BUS.

**Syntax:** `create elan-name`

where *elan-name* is the name of the ELAN.

### Example:

```

LE-SERVICES+ create
ELAN Name (ELANxx) []? IBM Token Ring Test ELAN!
LES/BUS: 'IBM Token Ring Test ELAN!': STARTING

```

## Lecs

Use the **lecs** command to enter the LECS Console environment.

**Syntax:** `lecs`

### Example:

```

LE-SERVICES+ lecs
LECS console+

```

## Les-bus

Use the **les-bus** command to enter the console environment for a particular operating LES-BUS. A selection list will appear, or one can use the **list** or **summary** command to display all of the operating LES-BUSs.

**Syntax:** `les-bus`

*elan-name*  
*item-number*

*elan-name*            Name of the ELAN.  
*item-number*        Item number from selection list.

### Example: les-bus

```

LE-SERVICES+ les
( 1) boston
( 2) losangles
( 3) newyork
( 4) chicago
( 5) miami
Choice of LES/BUS [1]? 2
LE-Services Console for an existing LES-BUS Pair
EXISTING LES-BUS 'losangles'

```

**Example:** `les-bus lan-name`

## LE Services Console Commands

```
LE-SERVICES+ les losangles
LE-Services Console for an existing LES-BUS Pair
EXISTING LES-BUS 'losangles'+
```

### **Example:** `les-bus item-number`

```
LE-SERVICES+ les 2
LE-Services Console for an existing LES-BUS Pair
EXISTING LES-BUS 'losangles'+
```

## List

Use the **list** command to display a summary of the currently operating LES-BUSs.

**Syntax:** `list`

### **Example:**

```
LE-SERVICES+list
ELAN Type (E=Ethernet/802.3, T=Token Ring/802.5)
| Interface #
| | LES-BUS State (UP=Up, ID=Idle, ND=Net Down, ER=Error/Down,
| | | **=Other; Work with specific LES-BUS to see actual state)
| | |
| | | ELAN Name                               LES ATM Addr
|-----|-----|-----|-----|-----|-----|-----|-----|
T 1 UP boston                               399999999999900009999310140008210400103
T 1 UP losangles                             399999999999900009999310140008210400102
E 0 UP newyork                               399999999999900009999310140008210400002
T 1 UP chicago                              399999999999900009999310140008210400104
T 1 UP miami                                399999999999900009999310140008210400105
LE-SERVICES+
```

## Security

Use the security command to enter the console environment for the LES-LECS Security Interface component. This is the component that multiplexes security requests between the LE Servers on this router and the LECS (which may or may not be on this router).

**Syntax:** `security`

### **Example:**

```
LE-SERVICES+ security
LES-LECS Security Interface
LES-LECS interface+
```

## Summary

Use the summary command to display a summary of the currently operating LES-BUSs including the number of operational LE Clients.

**Syntax:** `summary`

### **Example:**



## LES-BUS Console Commands

Enter commands at the EXISTING LES-BUS+ prompt.

*Table 22-2. LES-BUS Monitoring Commands Summary*

Command	Function
? (Help)	Lists the console commands or lists the actions associated with specific commands.
Database	Flushes all cache entries for a specified Broadcast Manager Protocol, or lists database entries.
Delete	Deletes a LES-BUS.
Disable	Disables an existing LES-BUS component: Broadcast Manager (IP, IPX, or NetBIOS), BUS Monitor, Redundancy, Security, or Source Route Manager. It disables the chosen option immediately, but the LES-BUS's configured state in Static RAM does not change.
Enable	Enables an existing LES-BUS component: Broadcast Manager (IP, IPX, or NetBIOS), BUS Monitor, Redundancy, Security, or Source Route Manager. It enables the chosen option immediately, but the LES-BUS's configured state in Static RAM does not change.
List	Lists the status and current configuration parameters of the LES-BUS.
Restart	Restarts a running or stopped LES-BUS. A LES-BUS can be restarted using the parameters configured under the Talk 5 or Talk 6 interface.
Set	Sets LES-BUS configuration parameters. The parameter that you set is immediately used by the LES-BUS, but the LES-BUS's configured parameter values in Static RAM do not change.
Show	Shows information on LES-BUS databases, statistics, or current configuration.
Statistics	Clears or displays LES-BUS statistics.
Stop	Stops the operation of LES-BUS.
Terminate	Terminates a specified LEC from the LES-BUS.
Exit	Returns to the LE-SERVICES+ prompt.

## Help

Use the ? (**help**) command to list the commands that are available from the current prompt level. You also can enter ? after a specific command name to list its options.

**Syntax:** ?

**Example:** ?

```
DATABASES
DELETE les-bus
DISABLE
ENABLE
LIST currently running configuration
RESTART les-bus
SET
SHOW information
STATISTICS
STOP les-bus
TERMINATE lec
EXIT
```



# Database

The **database** command has two uses. You can use it to **flush** all cache entries for a Broadcast Manager Protocol, or to **list** information about database entries. See “Database Flush” on page 22-7 and “Database List” on page 22-7 for more information.

## Database Flush

Use this command to flush all cache entries for a Broadcast Manager Protocol.

**Syntax:** `database flush protocol`

Where *protocol* is one of:

- IP
- IPX
- NetBIOS
- Source Route Management

**Example:** `database flush ip`

## Database List

Use this command to list general information about all entries in a given database, or to list detailed information about a user-specified entry in a database.

**Syntax:** `database list all . . .`  
`specific . . .`

*all database*

Lists general information about all entries in the specified database. Valid databases are:

- BCM-Learned-MAC
- IP
- IPX
- LEC
- NetBIOS
- Registered-MAC
- Route-Descriptors
- Source Route Management

**Note:** The result of the **database list all** command is the same as the result of the **show** command. For example, **database list all ip** produces the same information as **show ip**.

**Example:** `database list all ip`

Number of IP Addresses to display: 2

IP Address	MAC Address	TTL	Usage Count
-----	-----	---	-----
9.67.195.1	10.00.5A.11.98.76	3	10
9.67.195.151	10.00.5A.49.13.4B	1	1

Where:

*IP address*  
Is the IP address





## LES-BUS Console commands

### JOIN REJECTED

A Join request was rejected.

### JOIN VERIFICATION

A request was sent to the LECS to validate the LEC's join request.

### SIGNAL WAIT

The LES is waiting for completion of an in-progress call to establish a first leaf of Control Distribute VCC.

### SIGNALLING

The LES is initiating signalling to establish a Control Distribute VCC to the LEC.

### OPERATIONAL

The Join was successful.

### UNKNOWN

Indicates an unknown state.

### *LEC state at BUS*

Is the operational state of the LEC at the BUS. Possible states are:

#### IDLE

A control Direct VCC was accepted, or a Multicast VCC to LEC was released.

#### SIGNAL WAIT

The BUS is waiting for completion of an in-process call to establish the first leaf of Multicast Forward VCC.

#### SIGNALLING

The BUS initiated signalling to establish Multicast Forward VCC to LEC.

#### ADD PARTY RETRY

The BUS is delaying the Add Party request for adding this LEC on the Multicast Forward VCC. Congestion is suspected in the ATM switch network. The Add Party request will take place after a random delay.

#### OPERATIONAL

A Multicast Forward VCC to the LEC was successfully established.

#### UNKNOWN

Indicates an unknown state.

### *If dormant, proto ages in*

Is the amount of time (in minutes) remaining before this entry is removed from the cache.

### *Usage count*

Is the number of times entry was refreshed

### *SRM ring number*

For SRM, 802.5 ring number where IP address is located

**Example: database list specific lec lecid**

```

LECID [0001]?
LEC ID:                0x0001
  LEC ATM Address:     399999999999900009999310110005AF972A000
  Proxy:               Yes
  LEC State at LES:    OPERATIONAL
  Entered LES State at: 00.00.03.46 (System Up Time)
  LEC State at BUS:    OPERATIONAL
  Entered BUS State at: 00.00.03.51 (System Up Time)
  Control Direct Vcc:  OPERATIONAL 0/193
  Control Distribute Vcc: OPERATIONAL 0/194
  Multicast Send Vcc:  OPERATIONAL 0/195
  Multicast Forward Vcc: OPERATIONAL 0/196
  MAC Address in Join Req: none
  Packet Tracing Eligible: No
  Add Party Being Delayed: No
  # ATM Address Mappings: 1
  # MAC Address Mappings: 5
  # RD Mappings:         1
  # BCM Learned MAC Addr: 4
  # BCM Protocol Mappings: 4
  # SRM Ring Mappings:   2
  # TLVs registered:     0
    
```

Where:

**LEC ID**

Is the LE Client Identifier

**LEC ATM address**

Is the ATM address of the LEC

**Proxy**

Indicates whether this LEC is a proxy LEC. Proxy LECs respond to LE ARP Requests for MAC addresses they serve. These MAC

**LEC state at LES**

Indicates the operational state of the LEC at the LES. Possible states are:

**IDLE**

the LEC is not connected to either the LES or the BUS.

**JOINING**

A Control Direct VCC was accepted.

**JOIN REJECTED**

A Join request was rejected.

**JOIN VERIFICATION**

A request was sent to the LECS to validate the LEC's join request.

**SIGNAL WAIT**

The LES is waiting for completion of an in-progress call to establish a first leaf of Control Distribute VCC.

**SIGNALLING**

The LES is initiating signalling to establish a Control Distribute VCC to the LEC.

**ADD PARTY RETRY**

The LES is delaying the Add Party request for adding this LEC on the Control Distribute VCC. Congestion is suspected in the ATM switch network. The Add Party request will take place after a random delay.

## LES-BUS Console commands

OPERATIONAL

The Join was successful.

UNKNOWN

Indicates an unknown state.

*Entered LES state at*

Is the System Up Time at which LEC transitioned into its current state at the LES. Time is in *hours.minutes.seconds.hundredths* format.

*LEC state at BUS*

Is the operational state of the LEC at the BUS. Possible states are:

IDLE

A Control Direct VCC was accepted, or a Multicast VCC to LEC was released.

SIGNAL WAIT

The BUS is waiting for completion of an in-progress call to establish the first leaf of Multicast Forward VCC.

SIGNALLING

The BUS initiated signalling to establish Multicast Forward VCC to LEC.

ADD PARTY RETRY

The BUS is delaying the Add Party request for adding this LEC on the Multicast Forward VCC. Congestion is suspected in the ATM switch network. The Add Party request will take place after a random delay.

OPERATIONAL

A Multicast Forward VCC to the LEC was successfully established.

UNKNOWN

Indicates an unknown state.

*Entered BUS state at*

Is the time that the LEC transitioned into its current state at the BUS. Time is in *hours.minutes.seconds.hundredths* format.

*MAC address in Join Req*

The MAC address in the Join Request, if present.

*Packet tracing eligible*

Indicates whether packets are eligible for tracing, provided ELS trace events are enabled.

*Add Party Being Delayed*

Indicates whether this LEC's request to join the ELAN is being delayed to help alleviate congestion which is suspected in the ATM switch network.

*# ATM address mappings*

Is the number of ATM addresses associated with this LEC.

*# MAC address mappings*

Is the number of MAC addresses associated with this LEC.

*# RD mappings*

Is the number of route descriptors associated with this LEC.

*# BCM learned MAC addr*

Is the number of Broadcast Manager–learned MAC addresses associated with this LEC.

*# BCM protocol mappings*

Is the number of protocols mapped to this LEC.

*# SRM ring mappings*

Is the number of Source Route Management ring numbers associated with this LEC.

*# TLVs registered*

Is the number of Type/Length/Value elements contained in this LEC's Join Request. If any TLVs are present, they are displayed as well.

**Example: database list specific mac**

```
Registered or BCM Learned MAC Address: []? 10.00.5A.BA.D0.88
Registered MAC Address:      10.00.5A.BA.D0.88
LEC ATM Address:             399999999999900009999010210005159176202
Registering ATM Address:     399999999999900009999010210005159176202
LEC ID:                       0x0001
Entry Type:                   Registered
LEC State at LES:             OPERATIONAL
LEC State at BUS:            OPERATIONAL
SRM Ring Number:             unknown
# BCM Protocol Mappings: 1
IPX Network / Node Number:    00.00.77.77 / 10.00.5A.BA.D0.88
```

Where:

*BCM learned MAC address*

Is the Broadcast Manger–learned MAC address. This field is displayed for learned MAC addresses only.

*Registered MAC address*

Is the registered MAC Address. This field is displayed for registered MAC addresses only.

*Registering ATM address*

Is an ATM address of the LEC that registered the MAC address. This field is displayed for registered MAC addresses only.

*Entry type*

Is the Database entry type. Possible values are:

Registered

Registered entry (Entry was registered by a LEC)

Static Volatile

Static volatile entry (Entry was created by the network manager)

*LEC ATM address*

Is the ATM address of the LEC that has the given MAC address.

*LEC ID*

Is the LE Client Identifier.

*LEC state at LES*

Is the operational state of the LEC at the LES. Possible states are:

IDLE

the LEC is not connected to either the LES or the BUS.

## LES-BUS Console commands

JOINING	A Control Direct VCC was accepted.
JOIN REJECTED	A Join request was rejected.
JOIN VERIFICATION	A request was sent to the LECS to validate the LEC's join request.
SIGNAL WAIT	The LES is waiting for completion of an in-progress call to establish a first leaf of Control Distribute VCC.
SIGNALLING	The LES is initiating signalling to establish a Control Distribute VCC to the LEC.
ADD PARTY RETRY	The LES is delaying the Add Party request for adding this LEC on the Control Distribute VCC. Congestion is suspected in the ATM switch network. The Add Party request will take place after a random delay.
OPERATIONAL	The Join was successful.
UNKNOWN	Indicates an unknown state.

### *LEC state at BUS*

Is the operational state of the LEC at the BUS.

Possible states are:

IDLE	A Control Direct VCC was accepted, or a Multicast VCC to LEC was released.
SIGNAL WAIT	The BUS is waiting for completion of an in-progress call to establish the first leaf of Multicast Forward VCC.
SIGNALLING	The BUS initiated signalling to establish Multicast Forward VCC to LEC.
ADD PARTY RETRY	The BUS is delaying the Add Party request for adding this LEC on the Multicast Forward VCC. Congestion is suspected in the ATM switch network. The Add Party request will take place after a random delay.
OPERATIONAL	A Multicast Forward VCC to the LEC was successfully established.
UNKNOWN	Indicates an unknown state.



*SRM ring number*

For SRM, the 802.5 ring where the registered or BCM-Learned MAC address is located.

*# BCM protocol mappings*

Is the number of protocols mapped to this MAC address. A list of the protocol mappings will be displayed. The possible mappings are:

- IPX Network / Node Number
- IP address
- NetBIOS name string
- NetBIOS name in hex (shown only if NetBIOS name string has unprintable characters)

## Delete

Use the **delete** command to stop the LES-BUS and remove it from the active configuration. (The LES-BUS definition remains in static RAM). If the **delete** command is issued and you then want to start the LES-BUS, without restarting the MSS Server, you must issue the **create** command.

**Syntax:** `delete`

**Example:** `delete`

```
EXISTING LES-BUS 'losangles'+ delete
Are you sure you want to delete this LES/BUS? [No]:
LES/BUS:'losangles':not deleted
```

## Disable

Use the **disable** command to disable various LES-BUS functions.

You can dynamically disable Broadcast Manager (IP, IPX, or NetBIOS), BUS Monitor, Redundancy, Security, or Source Route Manager. Disabling of the chosen option occurs immediately, but the LES-BUS's configured state in Static RAM does not change. If you wish to change permanently the configured state in Static RAM, use the `config>` interface.

**Syntax:** `disable`

**Example:** `disable`

## LES-BUS Console commands

```
EXISTING LES-BUS 'losangles'+ disable ?
BCM
BUS-MONITOR
REDUNDANCY
SECURITY (LECS validation of Joins)
SOURCE route management
EXISTING LES-BUS 'losangles'+ disable bcm ?
ALL
IP
IPX
NETBIOS
EXISTING LES-BUS 'losangles'+disable bcm all
LES/BUS: 'losangles' : Disable BCM for IP successful
LES/BUS: 'losangles' : Disable BCM for IPX successful
LES/BUS: 'losangles' : Disable BCM for NetBIOS successful
EXISTING LES-BUS 'losangles'+ disable bcm ip
LES/BUS: 'losangles' : parameter successfully set
EXISTING LES-BUS 'losangles'+ disable bcm ipx
LES/BUS: 'losangles' : parameter successfully set
EXISTING LES-BUS 'losangles'+ disable bcm netbios
LES/BUS: 'losangles' : parameter successfully set
EXISTING LES-BUS 'losangles'+ disable bus-monitor
LES/BUS: 'losangles' : parameter successfully set
EXISTING LES-BUS 'losangles'+ disable redundancy
LES/BUS: 'losangles' : parameter successfully set
EXISTING LES-BUS 'losangles'+ disable security
LES/BUS: 'losangles' : parameter successfully set
EXISTING LES-BUS 'losangles'+ disable source
LES/BUS: 'losangles' : parameter successfully set
EXISTING LES-BUS 'losangles'+
```

## Enable

Use the **enable** command to enable various LES-BUS functions. You may dynamically enable Broadcast Manager (IP, IPX, or NetBIOS), BUS Monitor, Redundancy, Security, or Source Route Manager. The chosen option is enabled immediately, but the LES-BUS's configured state in Static RAM does not change. If you wish to change permanently the configured state in Static RAM, you should use the `config>` interface.

### Notes:

1. You cannot enable the Broadcast Manager while the BUS is in *Adapter* or *VCC-Splice* mode.
2. You cannot enable the BUS-Monitor while the BUS is in *VCC-Splice* mode.

**Syntax:** `enable`

**Example:** `enable`

```

EXISTING LES-BUS 'losangles'+ enable ?
BCM
BUS-MONITOR
REDUNDANCY
SECURITY (LECS validation of Joins)
SOURCE route management
EXISTING LES-BUS 'losangles'+enable bcm ?
ALL
IP
IPX
NETBIOS
EXISTING LES-BUS 'losangles'+enable bcm all
LES/BUS: 'losangles' : Enable BCM for IP successful
LES/BUS: 'losangles' : Enable BCM for IPX successful
LES/BUS: 'losangles' : Enable BCM for NetBIOS successful
EXISTING LES-BUS 'losangles'+enable bcm ip
LES/BUS: 'losangles' : parameter successfully set
EXISTING LES-BUS 'losangles'+enable bcm ipx
LES/BUS: 'losangles' : parameter successfully set
EXISTING LES-BUS 'losangles'+enable bcm netbios
LES/BUS: 'losangles' : parameter successfully set
EXISTING LES-BUS 'losangles'+enable bus-monitor
LES/BUS: 'losangles' : parameter successfully set
EXISTING LES-BUS 'losangles'+enable redundancy
  ( 1) Primary LES-BUS
  ( 2) Backup LES-BUS
Redundancy Role [0]? 2
LES/BUS: 'losangles' : parameter successfully set
EXISTING LES-BUS 'losangles'+enable security
LES/BUS: 'losangles' : parameter successfully set
EXISTING LES-BUS 'losangles'+enable source
LES/BUS: 'losangles' : parameter successfully set

```

## List

Use the **list** command to list the LES-BUS's status and currently running configuration parameters.

**Syntax:** `list`

**Example:** `list`

## LES-BUS Console commands

```
ELAN Name:          IBM ethernet H52 Test ELAN!
ELAN Type:          Ethernet
ATM Device number:  0
# of Proxy LEC's:   0
# of Non-Proxy LEC's: 0
LES ATM Address:    399999999999900009999010110005A68001202

-Status-
LES-BUS State:      OPERATIONAL
Major Reason LES-BUS was last Down: unknown err code
Minor Reason LES-BUS was last Down: unknown err code
LES-BUS State last changed at: 00.00.03.10 (System Up Time)
LES-LEC Status Table changed at: 00.10.30.56 (System Up Time)
BUS-LEC Status Table changed at: 00.10.30.56 (System Up Time)
UNI Version:        3.0
IP BCM:             ACTIVE
IPX BCM:            ACTIVE
NetBIOS BCM:       ACTIVE
IPX BCM Active Forwarding List Size: 0

-Current Configuration-
LES-BUS Enabled/Disabled: Enabled
ATM Device number:      0
End System Identifier (ESI): 10.00.5A.68.00.12
Selector Byte:          0x02
ELAN Type:              (S2) Ethernet
Max Frame Size:         (S3) 1516
Control Timeout:        (S4) 120
Max Frame Age:          (S5) 1
LECID Range Minimum:    0x0001
LECID Range Maximum:    0xFEFF
Validate Best Effort Peak Cell Rate (PCR): No
Control Distribute VCC Traffic Type: Best Effort VCC
Control Distribute VCC PCR in Kbps: 155000
Control Direct VCC Max Reserved Bandwidth: 0
Multicast Forward VCC Traffic Type: Best Effort VCC
Multicast Forward VCC PCR in Kbps: 155000
Multicast Send VCC MAX Reserved Bandwidth: 0

-LES-BUS Options-
BUS Mode:              System
Security (LECS Validation of Joins): Disabled
Partition LE_ARP_REQUEST Forwarding Domain: Yes
LE_ARP RESPONSE Destination: One client
Partition Unicast Frame Domain: Yes
Redundancy:            Disabled
ATM address trace filter value: 0000000000000000000000000000000000000000
ATM address trace filter mask: FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF

-BUS Monitor Configuration-
Monitor Host Usage of BUS: Disabled
# Top Hosts to Record: 10
# Seconds in each sample interval: 10
# Minutes between sample intervals: 30
Frame sampling rate: 1 out of 10

-Broadcast Manager Configuration-
IP BCM:                Enabled
IPX BCM:               Enabled
NetBIOS BCM:          Enabled
BCM IP Cache Aging Time: 5
BCM IPX Cache Aging Time: 3
BCM NetBIOS Cache Aging Time: 15
BCM IPX Maximum Forwarding List: 50
No BCM IPX Static Entries defined
```

Where:

*LES-BUS State*

is the operational state of the LES-BUS. Possible states are:

IDLE  
LES-BUS not active.

INITIALIZATION  
LES-BUS control block is being initialized.

ATM ADDR ACTIVATION  
LES-BUS ATM addresses are being activated.

GET UNI VERSION  
Getting UNI version that is being run.

GOT UNI VERSION  
UNI version has been determined.

OPERATIONAL  
LES-BUS state is up or operational.

ATM ADDR DEACTIVATED  
ATM address deactivated by switch.

NET DOWN  
ATM interface not operational.

ERROR /DOWN  
The operation of LES-BUS instance terminated due to fatal error.

UNKNOWN  
Unknown state.

*Major Reason LES-BUS was last Down*  
is the reason why the LES-BUS was last down, if ever.

*Minor Reason LES-BUS was last Down*  
contains additional information about why the LES-BUS was last down, if ever.

*LES-BUS State last changed at*  
is the system up time at which the LES-BUS entered its current state. The format is *hours.minutes.seconds.hundredths*

*LES-LEC Status Table changed at*  
is the most recent system up time at which a LEC's state changed at the LES.

*BUS-LEC Status Table changed at*  
is the most recent system up time that a LEC entered or exited operational state at the BUS.

*IP BCM*  
The current status of IP BCM.

*IPX BCM*  
The current status of IPX BCM. IPX BCM can only be *ACTIVE* if IPX BCM is configured to Enabled, the LES-BUS State is Operational, and if the **IPX BCM Active Forwarding List Size** has not exceeded its configured threshold, **BCM IPX Maximum Forwarding List**. See 21-11 for additional information.

*NetBIOS BCM*  
The current status of NetBIOS BCM.

## LES-BUS Console commands

### *IPX BCM Active Forwarding List Size*

The number of entries currently in IPX BCM's Forwarding List. If this number exceeds the configured threshold for **BCM IPX Maximum Forwarding List**, IPX BCM will become *INACTIVE*, and the BUS will forward all IPX broadcast frames. Note that this information is only displayed if IPX BCM is currently *ACTIVE*.

See "Configuring a LES-BUS" on page 21-4 for more information about the configuration parameters.

## Restart

Use the **restart** command to restart a running or stopped LES-BUS. A LES-BUS can be restarted using the parameters configured under the Talk 5 or Talk 6 interface.

### **Syntax:**

**Syntax:** **restart** *t5*

*t6*

```
EXISTING LES-BUS 'elan01'+restart ?
T5 (Using config parms in Talk 5)
T6 (Using config parms written in Talk 6)
EXISTING LES-BUS 'elan01'+restart t5
Are you sure you want to restart this LES/BUS? ;[No];: yes
LES/BUS: 'elan01': RESTARTING
```

```
EXISTING LES-BUS 'elan01'+restart t6
Are you sure you want to restart this LES/BUS? [No];: yes
LES/BUS: 'elan01': RESTARTING
```

## Set

Use the **set** command to set the values of various LES-BUS configuration parameters.

### **Syntax:** set

You can dynamically set the following LES-BUS configuration parameters. The parameter that you set is immediately used by the LES-BUS, however the LES-BUS's configured parameter values in Static RAM do not change. To permanently change the configured state in Static RAM, use the `config>` interface should be used.

### **Example:** **set**

```

EXISTING LES-BUS+ set ?
BUS-MONITOR settings
CONTROL timeout
FRAME-AGE
IP broadcast cache age
IPX broadcast cache age
LE ARP response destination
NETBIOS broadcast cache age
TRACE
TRAFFIC type

EXISTING LES-BUS+ set bus-monitor ?
DURATION-OF-SAMPLE (# Seconds in each sample interval)
SAMPLE-RATE (Frame sampling rate)
TIME-BETWEEN-SAMPLES (# Minutes between sample intervals)
TOP-NUMBER-MACS (# Top Hosts to Record)

EXISTING LES-BUS+ set bus-monitor duration
Duration of sample interval in seconds (1-600) [10]?
LES-BUS: 'test' : parameter successfully set

EXISTING LES-BUS+ set bus-monitor sample
Frame sampling rate (1-1000) [10]?
LES-BUS: 'test' : parameter successfully set

EXISTING LES-BUS+ set bus-monitor time
Number of minutes between sample intervals (1-120) [30]?
LES-BUS: 'test' : parameter successfully set

EXISTING LES-BUS+ set bus-monitor top
Number of top MAC addresses to record (1-100) [10]?
LES-BUS: 'test' : parameter successfully set

EXISTING LES-BUS+ set control
Control timeout (10-300) [110]? 120
LES-BUS: 'test' : parameter successfully set

EXISTING LES-BUS+ set frame-age
Maximum frame age (1-4) [1]?
LES-BUS: 'test' : parameter successfully set

EXISTING LES-BUS+ set ip
IP cache age, in minutes (2-20) [5]?
LES-BUS: 'test' : parameter successfully set

EXISTING LES-BUS+ set ipx
IPX cache age, in minutes (1-10) [3]?
LES-BUS: 'test' : parameter successfully set

EXISTING LES-BUS+ set le
( 1) One client
( 2) All clients
LE ARP response destination [1]?
LES-BUS: 'test' : parameter successfully set

EXISTING LES-BUS+ set netbios
NetBIOS cache age, in minutes (10-20) [15]?
LES-BUS: 'test' : parameter successfully set

EXISTING LES-BUS+ set trace ?
MASK
VALUE

EXISTING LES-BUS+ set trace mask
ATM address trace filter mask [FF.FF.FF.FF.FF.FF.FF.FF.FF.FF.FF.FF.FF.FF.FF.FF]?
LES-BUS: 'test' : parameter successfully set

EXISTING LES-BUS+ set trace value
ATM address trace filter value [00.00.00.00.00.00.00.00.00.00.00.00.00.00.00.00.00]?
LES-BUS: 'test' : parameter successfully set

EXISTING LES-BUS+ set traffic ?
MAXIMUM reserved bandwidth
VALIDATE peak cell rate

EXISTING LES-BUS+ set traffic maximum ?
CONTROL Direct VCC maximum
MULTICAST Send VCC maximum

EXISTING LES-BUS+ set traffic maximum control
Maximum reserved bandwidth in Kbps (0 - 155000) [0]?
LES-BUS: 'test' : parameter successfully set

EXISTING LES-BUS+ set traffic maximum multicast
Maximum reserved bandwidth in Kbps (0 - 155000) [0]?
LES-BUS: 'test' : parameter successfully set

EXISTING LES-BUS+ set traffic validate
Validate peak cell rate of best effort VCCs? [No]:
LES-BUS: 'test' : parameter successfully set

```

## Show

Use the **show** command to display various information related to this LES-BUS. The **show** command consolidates other LES-BUS Console display commands and uses a shorter command syntax.

The **show** commands are equivalent to other commands contained in this chapter. For example, **show lec** is equivalent to **database list all lec**. See “Database List” on page 22-7 for additional information.

**Syntax** show            *database*  
                                  *specific database*





See 22-23 for additional information.

**Example:**

```
EXISTING LES-BUS 'losangles'+show statistics bcm all
```

current This command is equivalent to **list**. See “List” on page 22-17 for additional information.

**Example:**

```
EXISTING LES-BUS 'losangles'+show current
```

## Statistics

Use the **statistics** command to either clear or display statistics associated with LAN Emulation MIBs. Some of the fields displayed by the **statistics** command correspond to specific MIB entries that are in **ibmlesrv.mib** located at **ftp://6611ftp.raleigh.ibm.com/pub/netmgmt/MSSIBMLESERV.MIB**.

**Syntax** statistics    clear ...  
                          display ...

The **statistics clear** command zeroes statistical data that previously was gathered for BCM, LES-BUS, or Source Route Management.

**Syntax:** clear    bcm *protocol*  
                          les-bus *type*  
                          source *protocol*

Where *protocol* or *type* can be:

	<b>protocol or type</b>
clear bcm	all ip ipx netbios
clear les	bus lec-bus <i>atm-address</i> lec-bus <i>lecid</i> lec-les <i>atm-address</i> lec-les <i>lecid</i> les
clear source	all ip ipx netbios

**Example:**

```
Existing LES-BUS+ statistics clear bcm all
Existing LES-BUS+
```

The **statistics display** command provides statistical data for BCM, LES-BUS, and Source Route Management.

**Syntax:** statistics display    bcm **protocol-stats**  
  bus monitor  
  les-bus *protocol-stats*  
  source *protocol-stats*

## LES-BUS Console commands

Where "protocol-stats" can be:

```
statistics display bcm protocol-stats
                        all
                        ip
                        ipx
                        netbios

statistics display les-bus bus
                          lec-bus atm-address
                          lec-bus lecid
                          lec-les atm-address
                          lec-les lecid
                          les

statistics display source all
                        ip
                        ipx
                        netbios
```

### Example:

```
EXISTING LES-BUS+ statistics display bcm all
```

	IP	IPX	NetBIOS	Total BCM Processed
	-----	-----	-----	-----
inFrms:	182972	324	374	299518
inOctets:	11410392	36798	32840	22342391
inReturns:	129888	6	334	246076
inReturnOctets:	8113160	564	30254	19006339
inFiltered:	0	0	40	40
inFilteredOctets:	0	0	2586	2586
outFrms:	53084	318	0	53402
outFrmsOctets:	3297232	36234	0	3333466
outError:	0	0	0	0
outErrorOctets:	0	0	0	0

The statistical counters for the **statistics display bcm all** command map to MIB variables as follows:

Total BCM Processed Displayed Name -----	MIB ENTRY -----
inFrms	bcmFramesReceived
inOctets	bcmOctetsReceived
inReturns	bcmFramesReturned
inReturnOctets	bcmOctetsReturned
inFiltered	bcmFramesDiscarded
inFilteredOctets	bcmOctetsDiscarded
outFrms	bcmFramesTransmitted
outFrmsOctets	bcmOctetsTransmitted
outError	bcmTransmitErrorFrames
outErrorOctets	bcmTransmitErrorOctets
IP DISPLAYED NAME -----	MIB ENTRY -----
inFrms	bcmIpFramesReceived
inOctets	bcmIpOctetsReceived
inReturns	bcmIpFramesReturned
inReturnOctets	bcmIpOctetsReturned
inFiltered	bcmIpFramesDiscarded
inFilteredOctets	bcmIpOctetsDiscarded
outFrms	bcmIpFramesTransmitted
outFrmsOctets	bcmIpOctetsTransmitted
outError	bcmIpTransmitErrorFrames
outErrorOctets	bcmIpTransmitErrorOctets
IPX DISPLAYED NAME -----	MIB ENTRY -----
inFrms	bcmIpxFramesReceived
inOctets	bcmIpxOctetsReceived
inReturns	bcmIpxFramesReturned
inReturnOctets	bcmIpxOctetsReturned
inFiltered	bcmIpxFramesDiscarded
inFilteredOctets	bcmIpxOctetsDiscarded
outFrms	bcmIpxFramesTransmitted
outFrmsOctets	bcmIpxOctetsTransmitted
outError	bcmIpxTransmitErrorFrames
outErrorOctets	bcmIpxTransmitErrorOctets
NetBIOS DISPLAYED NAME -----	MIB ENTRY -----
inFrms	bcmNbFramesReceived
inOctets	bcmNbOctetsReceived
inReturns	bcmNbFramesReturned
inReturnOctets	bcmNbOctetsReturned
inFiltered	bcmNbFramesDiscarded
inFilteredOctets	bcmNbOctetsDiscarded
outFrms	bcmNbFramesTransmitted
outFrmsOctets	bcmNbOctetsTransmitted
outError	bcmNbTransmitErrorFrames
outErrorOctets	bcmNbTransmitErrorOctets

display bus

Displays statistical data associated with BUS Monitoring.

**Example:**

## LES-BUS Console commands

```
EXISTING LES-BUS+ statistics display bus
-BUS Monitor Status-
Currently in a sample interval ?           no
Next sample interval scheduled in:        0 minute(s), 18 second(s)

-Results of Last Complete Sample-
BUS Monitor sample interval started at:    13.27.03.98 (System Up Time)
Duration of sample interval:               59 second(s)
# Top Hosts Actually Recorded:             5
# Frames Received in sample interval:      301
# Frames Sampled in sample interval:       301
Frame sampling rate:                       1 out of 1

Rank  Source MAC Addr.  Associated LEC ATM Address  # frames
-----
1  10.00.5A.AA.AA.AA  3999999999999900009999010110005A12340002  100
2  10.00.5A.66.66.66  3999999999999900009999010110005A12340002   60
3  10.00.5A.EE.EE.EE  3999999999999900009999010110005A12340002   52
4  10.00.5A.55.55.55  3999999999999900009999010110005A12340001   50
5  10.00.5A.99.99.99  3999999999999900009999010110005A12340001   39
EXISTING LES-BUS+
```

**statistics display les lec-bus lecid**

Lists the number of multicast, broadcast, and unknown forward requests received or discarded by the BUS from this LEC.

```
EXISTING LES-BUS+ statistics display les lec-bus lecid
LECID [0]? 1
ATM Forum LEC-BUS MIB Statistics:
  recvs:           1
  discards:        0
```

The statistical counters for some fields generated by the **statistics display les lec-bus** command map to MIB variables as follows:

LEC-BUS Displayed Name	MIB ENTRY
recvs	busLecRecv
discards	busLecDiscards

**statistics display les bus or lec-bus or lec-les or les**

Displays statistical data for a given LEC or ELAN.

**Example:**

```

EXISTING LES-BUS+ statistics display les-bus bus
ATM Forum BUS MIB Statistics:
  inDiscards:                0
  inOctets:                  67200
  inUcastFrms:              0
  inMcastFrms:             1050
  frmTimeouts:              0
  mcastSendRefused:        0
  mcastFwdFailure:         0
Other Statistics:
  inExplorer:                0
  inFlushReq:                0
  outFlushReq_mcastFwd:     0
  outFlushReq_mcastSend:    0
  outUcastFrms_mcastFwd:    0
  outUcastFrms_mcastSend:   0
  outMcastFrms:             1050
  outOctets:                 67200
  mcastSendReleased:        0
  mcastFwdReleased:         0
  mcastFwdPartyReleased:    0
  invalidProtocol_droppedFrames: 0
  verNotSup_droppedFrames:  0
  invalidOpcode_droppedFrames: 0
  invalidLecid_droppedFrames: 0
  invalidSize_droppedFrames: 0
  flushToBus_droppedFrames: 0
  incompleteSourceConnect_droppedFrames: 0
  incompleteTargetConnect_droppedFrames: 0
  noProxy_droppedFrames:    0
  lecsWaitingForMcastFwd:   0
  
```

**ATM Forum BUS MIB Statistics:**

The statistical counters for some fields generated by the **statistics display les-bus bus** command map to MIB variables as follows:

BUS DISPLAYED NAME	MIB ENTRY
inDiscards	busStatInDiscards
inOctets	busStatInOctets
inUcastFrms	busStatInUcastFrms
inMcastFrms	busStatInMcastFrm
frmTimeouts	busStatFrmTimeOuts
mcastSendRefused	busStatMcastSendRefused
mcastFwdFailure	busStatMcastFwdFailure

**Other Statistics:**

The following definitions are not MIB-related:

inExplorer

Number of Token-Ring explorer frames received by BUS

inFlushReq

Number of Flush request control frames received by BUS

outFlushReq\_mcastFwd

Number of Flush request control frames forwarded by BUS on Multicast Forward VCC(s)

outFlushReq\_mcastSend

Number of Flush request control frames forwarded by BUS on Multicast Send VCC

outUcastFrms\_mcastFwd

Number of unicast frames forwarded by BUS on Multicast Forward VCC(s)

## LES-BUS Console commands

outUcastFrms\_mcastSend  
Number of unicast frames forwarded by BUS on Multicast Send VCC

outMcastFrms  
Number of multicast frames forwarded by BUS

outOctets  
Number of octets forwarded by BUS (includes both control and data)

mcastSendReleased  
Number of Multicast Send VCCs released by LEC/network for any reason

mcastFwdReleased  
Number of Multicast Forward VCCs released by LEC/network for any reason (this is release of entire point-to-multipoint VCC, not just one party)

mcastFwdPartyReleased  
Number of times call to party on Multicast Forward VCC was released by LEC/network for any reason

invalidProtocol\_droppedFrames  
Number of control frames dropped by BUS due to invalid protocol

verNotSup\_droppedFrames  
Number of control frames dropped by BUS due to incorrect version #

invalidOpcode\_droppedFrames  
Number of control frames dropped by BUS due to invalid opcode

invalidLecid\_droppedFrames  
number of frames (control or data) dropped by BUS due to invalid LECID

invalidSize\_droppedFrames  
Number of frames (control or data) dropped by BUS due to frame size being invalid

flushToBus\_droppedFrames  
Number of FLUSH request frames dropped by BUS because target ATM address was ATM address of BUS

incompleteSourceConnect\_droppedFrames  
Number of frames (control or data) dropped by BUS because source LEC had not completed the BUS connect phase

incompleteTargetConnect\_droppedFrames  
Number of frames (control or data) dropped by BUS because target LEC had not completed the BUS connect phase

noProxy\_droppedFrames  
Number of "unknown" FLUSH request or non-multicast data frames dropped by BUS because the ELAN had no proxy LEC members

lecsWaitingForMcastFwd  
Number of LECs on this ELAN waiting to be added to the BUS Multicast Forward VCC due to the Add Party message being delayed due to suspected ATM switch congestion.

### Example:

```

EXISTING LES-BUS+ statistics display les les
ATM Forum LES MIB Statistics:
  joinOK: 2
  verNotSup: 0
  invalidReqParam: 0
  dupLanDest: 0
  dupAtmAddr: 0
  insRes: 0
  accDenied: 0
  invalidReqId: 0
  invalidLanDest: 0
  invalidAtmAddr: 0
  badPkts: 0
  outRegFails: 0
  leArpIn: 2
  leArpFwd: 0
Other Statistics:
  leArpAnswers: 2
  leArpRspFwd: 0
  topologyFwd: 0
  narpFwd: 0
  flushRspFwd: 0
  outJoinFails: 0
  regOK: 2
  unRegOK: 0
  outUnRegFails: 0
  proxyLecls: 1
  nonProxyLecls: 0
  macAddrMappings: 1
  rdMappings: 0
  atmAddrMappings: 1
  joinRetransmits: 0
  joinParmChanges: 0
  joinTimeouts: 0
  reRegs: 0
  ctldirRefused: 0
  ctldirReleased_err: 0
  ctldistFailure: 0
  ctldistReleased_err: 0
  ctldistPartyReleased_err: 0
  redundancyVccRefused: 0
  redundancyVccReleased: 0
  redundancyVccFailure: 0
  oam_droppedFrames: 0
  invalidSize_droppedFrames: 0
  invalidMarker_droppedFrames: 0
  invalidProtocol_droppedFrames: 0
  verNotSup_droppedFrames: 0
  invalidLecid_droppedFrames: 0
  unknownLecid_droppedFrames: 0
  invalidOpcode_droppedFrames: 0
  dupJoin_droppedFrames: 0
  incompleteSourceJoin_droppedFrames: 0
  incompleteTargetJoin_droppedFrames: 0
  noProxy_droppedFrames: 0
  leclsWaitingForCtrlDist: 0

```

#### ATM Forum LES MIB Statistics:

The statistical counters for some fields generated by the **statistics display les les** command map to MIB variables as follows:

## LES-BUS Console commands

LES DISPLAYED NAME -----	MIB ENTRY -----
joinOK	lesStatJoinOk
verNotSup	lesStatVerNotSup
invalidReqParam	lesStatInvalidReqParam
dupLanDest	lesStatDupLanDest
dupAtmAddr	lesStatDupAtmAddr
insRes	lesStatInsRes
accDenied	lesStatAccDenied
invalidReqId	lesStatInvalidReqId
invalidLanDest	lesStatInvalidLanDest
invalidAtmAddr	lesStatInvalidAtmAddr
badPkts	lesStatInBadPkts
outRegFails	lesStatOutRegFails
leArpIn	lesStatLeArpIn
leArpFwd	lesStatLeArpFwd

### Other Statistics:

The following definitions are not MIB-related:

leArpAnswers

Number of ARP requests answered by LES

leArpRspFwd

Number of ARP responses forwarded by LES

topologyFwd

Number of topology frames forwarded by LES

narpFwd

Number of NARP frames forwarded by LES

flushRspFwd

Number of flush response frames forwarded by LES

outJoinFails

Number of join responses transmitted with unsuccessful status values, includes retransmissions

regOK

Number of successful registration responses sent by LES, includes reregistrations

unRegOK

Number of successful unregistration responses sent by LES

outUnRegFails

Number of unregistration responses transmitted with unsuccessful status values

proxyLecs

Number of Proxy LECs currently joined to LES

nonProxyLecs

Number of Non-Proxy LECs currently joined to LES

regMacAddr

Number of MAC address mappings currently in database

regRd

Number of route descriptor mappings currently in database

regAtmAddr

Number of unique ATM addresses currently in mapping database



joinRetransmits  
Number of join response retransmissions

joinParmChanges  
Number of LEC ELAN memberships terminated because parms changed on subsequent JOIN request

joinTimeouts  
Number of join timeouts

reRegs  
Number of reregistrations

ctlDirRefused  
Number of Control Direct VCC call setup requests rejected by the LES for any reason

ctlDirReleased\_err  
Number of Control Direct VCCs released by LEC/network with cause code indicating error

ctlDistFailure  
Number of Control Distribute VCC requests made by LES that failed for any reason (includes calls to first and subsequent parties)

ctlDistReleased\_err  
Number of Control Distribute VCCs released by LEC/network due to error (this is release of entire point-to-multipoint VCC, not just one party)

ctlDistPartyReleased\_err  
Number of times call to party on Control Distribute VCC was released by LEC/ network with cause code indicating error

oam\_droppedFrames  
Number of OAM frames dropped by LES

invalidSize\_droppedFrames  
Number of frames dropped by LES due to frame size being invalid for a control frame

invalidMarker\_droppedFrames  
Number of frames dropped by LES due to invalid marker

invalidProtocol\_droppedFrames  
Number of frames dropped by LES due to invalid protocol

verNotSup\_droppedFrames  
Number of frames dropped by LES due to incorrect version #

invalidLecid\_droppedFrames  
Number of frames dropped by LES due to invalid LECID NARP and topology requests

unknownLecid\_droppedFrames  
Number of frames dropped by LES due to unknown LECID ARP and FLUSH responses

invalidOpcode\_droppedFrames  
Number of frames dropped by LES due to invalid opcode

dupJoin\_droppedFrames

Number of duplicate join requests dropped by LES because processing of the original request had not completed

incompleteSourceJoin\_droppedFrames

Number of frames dropped by LES because the source LEC had not completed the JOIN phase

incompleteTargetJoin\_droppedFrames

Number of frames dropped by LES because the target LEC had not completed the JOIN phase

noProxy\_droppedFrames

Number of "unknown" ARP requests dropped by LES because the ELAN had no proxy LEC members

lecsWaitingForCtrlDist

Number of LECs on this ELAN waiting to be added to the LES Control Distribute VCC due to the Add Party message being delayed due to suspected ATM switch congestion.

**Example:**

```
EXISTING LES-BUS+ statistics display les lec-les lecid
LECID [0]? 1
ATM Forum LEC-LES MIB Statistics:
  recvs:                3
  inRegReq:             1
  inUnReg:              0
  inLeArpUcast:        0
  inLeArpBcast:        1
  inLeArpResp:         0
  inNArp:              0
Other Statistics:
  directedResp:        3
  inLeArpRd:          0
  inTopology:         0
  inFlushResp:        0
```

**ATM Forum LES MIB Statistics:**

The statistical counters for some fields generated by the **statistics display les lec-les** command map to MIB variables as follows:

LEC-LES DISPLAYED NAME	MIB ENTRY
recvs	1esLecRecvs
inRegReq	1esLecInRegReq
inUnReg	1esLecInUnReg
inLeArpUcast	1esLecInLeArpUcast
inLeArpBcast	1esLecInLeArpBcast
inLeArpResp	1esLecInLeArpResp
inNArp	1esLecInNAr

**Other Statistics:**

The following definitions are not MIB-related:

directedResp

Number of responses sent directly to LEC on Control Direct VCC

inLeArpRd

Number of ARP requests for route descriptors received from LEC

inFlushResp

Number of FLUSH responses received from LEC

inTopology

Number of topology requests received from LEC

display source all *or ip or ipx or netbios*

Displays statistical data for Source Management.

**Example:**

```

EXISTING LES-BUS+ statistics display source all
                                     IP          IPX          NetBIOS          Total
                                     -----
outNoRif:                            0           0           0           0
outAre:                               0           0           0           0
outSte:                               0           0           0           0
outSrf:                               1           0           0           1
    
```

The statistical counters for the **statistics display source all** command map to MIB variables as follows:

TOTALS DISPLAYED NAME	MIB ENTRY
-----	-----
outNoRif	bcmBroadcastFramesDirectedNoRif
outAre	bcmBroadcastFramesDirectedAre
outSte	bcmBroadcastFramesDirectedSte
outSrf	bcmBroadcastFramesDirectedSrf
IP DISPLAYED NAME	MIB ENTRY
-----	-----
outNoRif	bcmIpBroadcastFramesDirectedNoRif
outAre	bcmIpBroadcastFramesDirectedAre
outSte	bcmIpBroadcastFramesDirectedSte
outSrf	bcmIpBroadcastFramesDirectedSrf
IPX DISPLAYED NAME	MIB ENTRY
-----	-----
outNoRif	bcmIpxBroadcastFramesDirectedNoRif
outAre	bcmIpxBroadcastFramesDirectedAre
outSte	bcmIpxBroadcastFramesDirectedSte
outSrf	bcmIpxBroadcastFramesDirectedSrf
NetBIOS DISPLAYED NAME	MIB ENTRY
-----	-----
outNoRif	bcmNbBroadcastFramesDirectedNoRif
outAre	bcmNbBroadcastFramesDirectedAre
outSte	bcmNbBroadcastFramesDirectedSte
outSrf	bcmNbBroadcastFramesDirectedSrf

## Stop

Use the **stop** command to stop the operation of a LES-BUS.

**Syntax:** stop

**Example:**

```

EXISTING LES-BUS 'losangles'+stop
Are you sure you want to stop this LES/BUS? [No]:
LES/BUS:'losangles':not stopped
    
```

## Terminate

Use the **terminate** command to terminate a specific LE Client from the currently operating LES-BUS.

**Note:** The LE Client may subsequently rejoin this ELAN or another ELAN.

**Syntax:** terminate atm *atm-address*  
lecid *lecid*



Table 22-3 (Page 2 of 2). LECS Monitoring Commands Summary

Command	Function
Exit	Returns to the previous prompt

## Help

Use the **? (help)** command to list the commands that are available from the current prompt level. You can also enter **?** after a specific command name to list its options.

### Example:

```
LECS console+ ?
create
delete
elans
list
memory
policies
restart
search
set
statistics
exit
LECS console+
```

## Create

Use this command to create an operating LECS from the configuration data. Only one LECS is permitted on the MSS Server. This command also creates all of the policies, ELANs, and so on, for the LECS. These objects are created directly from the LECS configuration, described in “Commands for Configuring a LECS” on page 21-14. You can delete the LECS with the **delete** command.

**Syntax:** `create`

### Example:

```
LECS console+ create
LECS created successfully
created all configured LECS objects
LECS console+
```

## Delete

Use the **delete** command to delete an operating LECS. The LECS, along with all of its policies, ELANs, and so on, is deleted from operation. You can recreate the LECS using either the **create** or the **restart** command.

**Syntax:** `delete`

### Example:

```
LECS console+ delete
Delete LECS and all of its resources? [No]:yes
LECS deleted
LECS console+
```

## Elans

Use the **elans** command to enter the LECS ELANs console environment where you can create the ELANs, LESSs, and so on, known to this LECS.

**Syntax:** `elans`

**Example:**

```
LECS console+ elans
LECS ELANs console
LECS ELANs+
```

## List

Use this command to list the operating parameters of the LECS. Only the parameters of the LECS are listed. Individual policies, ELANs, and so on, must be accessed through submenus. The operating parameters of the LECS include its current state, an error log, the LECS ATM address, whether or not the LECS was able to register the ATM Forum well-known address with local switch, the UNI version being used, and the configuration parameters described at “Set” on page 22-40.

**Syntax:** `list`

**Example:**

```
LECS console+ list
Status of LECS:
ATM device number: 0
State: Operating normally(88)
Time of last state change: 00.24.50.03
Elapsed time since last change: 00.15.41.42
Error Log: no err (0)
Local ATM address: 39840F000000000000000000110005A0000000
Well-known address: (unable to confirm WKA registered with switch)
UNI version: UNI Version 3.0
Validate best effort PCR: No
Maximum config direct VCC reserved bandwidth:
0 Kbps
Maximum number of config direct VCCs to LECS:
128
Seconds before VCC declared idle: 60
Trace ATM address value: 0000000000000000000000000000000000000000
Trace ATM address mask: FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
LECS console+
```

### ATM device number

Number of the ATM interface over which the LECS is operating.

### State

The possible states of the LECS are:

*Idle* - The LECS exists but is not functional. This is a temporary state of the LECS; if the idle state persists, either delete or restart the LECS.

*Initializing* - The LECS is initializing its memory.

*Activating ATM address* - The LECS has initiated registration of its ATM address with the local switch but has not received confirmation of the address registration.

*Activated ATM address* - The LECS has received confirmation that its ATM address is registered with the local switch.

*Getting UNI version* - The LECS is attempting to query the local switch to determine the UNI version.

*Got UNI version* - The LECS has determined the UNI version being used.

*ATM address deactivated* - The local ATM switch has deactivated the ATM address of the LECS. If this state persists, restart the LECS.

*ATM network down* - The ATM interface has detected that the ATM network is not functioning correctly. LECS operation should return to normal once the ATM network is operational.

*Operating normally* - The normal state of the LECS.

*Down due to error* - An error occurred that terminated the operation of the LECS. The error log contains information explaining the error. The LECS must be restarted.

*Polling status of well-known address* - Certain ATM switches let you register ATM addresses that do not use the same 13-octet ATM address prefix used by the switch. For such switches, dynamic registration of the ATM Forum's well-known LECS address is possible. During initialization, the LECS always attempts to register the well-known address with the switch. This state indicates that the LECS is currently attempting this well-known address registration.

*Operating but rejecting VCCs* - The **set stop** command puts the LECS into this state where it rejects all configuration direct VCCs. Use the **set start** command to return to the normal operating state.

*State unknown* - An error caused the state variable of the LECS to assume an unknown value. Restart or delete the LECS.

“Time of last...” and “Elapsed time since...”

These two fields indicate the last time that the LECS changed its state. The field is in the format *hh.mm.ss.dd* where *hh* is hours, *mm* is minutes, *ss* is seconds, and *dd* is hundredths of seconds. The first field lists the time that elapsed between the system initialization and the last state change, while the second field lists the time that elapsed since the last state change.

Error Log:

Describes the error that caused the LECS to enter the 'Down due to error' state. This information is used for diagnostic purposes.

Local ATM address:

ATM address of the LECS consisting of the first 13 octets from the network prefix of the local ATM switch, and appending the configured ESI and selector value. The ATM address is displayed only if it has been successfully registered with the local ATM switch.

Well-known address:

The well-known address of the LECS. The LECS attempts to register the well-known address dynamically with the ATM switch. If this dynamic registration succeeds, or if the LECS begins to receive calls to the well-known address (indicating that some other entity has registered the LECS with the local ATM switch), then this field contains the ATM Forum well-known ATM address.

UNI version:

The UNI version being used by the LECS.

Validate best effort PCR

See the **set validate** command.

Maximum config direct VCC reserved bandwidth:

See the **set reserved** command.

Maximum number of config direct VCCs to LECS:

See the **set maximum** command.

## LECS Console Commands

Seconds before VCC declared idle:  
See the **set vcc** command.

Trace ATM address...  
See the **set trace** command.

## Memory

Use the **memory** command to clear the LECS short-term memory. The short-term memory of the LECS functions in both the redundancy and security aspects of the MSS Server LAN Emulation Service. For additional information on redundancy and security, see “LAN Emulation Reliability” on page 16-15. The **memory** command can be used to reinitialize the short-term memory without restarting the LECS.

**Syntax:** `memory clear`

**Example:**

```
LECS console+ memory clear
Cleared short-term memory of LECS
LECS console+
```

## Policies

Use the **policies** command to enter the LECS Policies Console environment, where you can work closely with the policies guiding the LEC-to-LES assignment procedure of the LECS. You can create, delete, and display policies, and modify various policy-related counters.

**Syntax:** `policies`

**Example:**

```
LECS console+ policies
LECS policies console
LECS policies+
```

## Restart

Use the **restart** command to restart or create the LECS. The **restart** command stops an operating LECS, frees its resources, and reinitializes/restarts the LECS. You are prompted to either keep the current databases or to rebuild them from the static configuration data when the LECS restarts.

**Syntax:** `restart`

**Example:**

```
LECS console+ restart
( 1) rebuild
( 2) retain
Retain current LECS databases or rebuild from SRAM [1]?2
LECS restarted successfully
LECS console+
```



## Search

Use the **search** command to search for LES or policy value information in the LECS databases. For example, if you wanted to know to which LES the LEC with ATM address 39.00.82.48.29.10.39.38.10.AB.CD.E1.02.FA.83.29.00.00.00.1D would be assigned, use the command **search atm**, or **search atm 39.00.82.48.29.10.39.38.10.AB.CD.E1.02.FA.83.29.00.00.00.1D**

**Syntax:** search atm  
les  
mac  
name  
route

Use the **search atm** command to search the LECS database of client ATM address prefixes. The output lists the longest prefix of that address found in the database, the LES associated with that prefix, and the ELAN associated with the LES.

**Note:** You can also search for a LES ATM address if you entered it as a non-local LES. See “Detailed Configuration of an ELAN at the LECS” on page 21-19 for a description of local and non-local LESs.

**Syntax:** search atm

### Example:

```
LECS console+ search atm
ATM prefix to search for [ ]?39.00.82.48.29.10.39.38.10.AB.CD.E1.02.FA.83.29.00.00.1D
ATM address prefix 39.00.82.48.29.10.39.38.10.AB.CD.E1.02.FA.83.29.00.00.00.1D
longest prefix 39.00.82.48.29.10.39.38.10.AB.CD.E1.02.FA.83.29.00.00.00.1D
for LES address Local LES for: Accounting Ethernet Elan
for ELAN 'Accounting Ethernet Elan'
LECS console+
```

Use the **search les** command to search for a given LES address in the LECS database of LES ATM addresses. The output lists the ELAN associated with the LES.

**Syntax:** search les

### Example:

```
LECS console+ search les
LES to search for [ ]?39.99.99.99.99.99.01.01.02.02.02.84.92.84.92.83.83.03
LES address 39.99.99.99.99.99.01.01.02.02.02.84.92.84.92.83.83.03
for ELAN 'R&D Token Ring Elan'
LECS console+
```

Use the **search mac** command to search for a given MAC address in the LECS database of client MAC addresses. You are prompted to enter whether the MAC address was entered in token-ring or Ethernet bit format (the difference being which bit is most significant). The output lists the LES associated with the MAC address and the ELAN associated with that LES.

**Syntax:** search mac

### Example:

```
LECS console+ search mac
MAC address to search for [ ]?12.34.12.34.12.35
( 1) Ethernet bit-order
( 2) Token ring bit-order
Bit order used by MAC address [1]?1
MAC address 12.34.12.34.12.35
for LES address Local LES for: Accounting Ethernet Elan
for ELAN 'Accounting Ethernet Elan'
LECS console+
```

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Use the **search name** command to search for a given ELAN name in the LECS database of ELAN name policy values. The ELAN name policy value is the ELAN name used by clients in their configuration requests. The output lists the LES associated with the given ELAN name, and the ELAN associated with the LES.

**Syntax:** `search name`

**Example:**

```
LECS console+ search name
ELAN name to search for [ ]?R&D Elan
ELAN name 'R&D Elan'
  for LES address 39.99.99.99.99.99.01.01.02.02.02.02.84.92.84.92.83.83.03
  for ELAN 'R&D Token Ring Elan'
LECS console+
```

Use the **search route** command to search for a route descriptor in the LECS database of client route descriptors. The output lists the LES associated with that route descriptor, and the ELAN associated with that LES.

**Syntax:** `search route`

**Example:**

```
LECS console+ search route
Route descriptor to search for [ ]?39.02
Route descriptor 39.02
  for LES address 39.99.99.99.99.99.01.01.02.02.02.02.84.92.84.92.83.83.03
  for ELAN 'R&D Token Ring Elan'
LECS console+
```

## Set

Use the **set** command to set various operating parameters of the LECS. These parameters take effect immediately but are not saved when you restart the LECS or the router.

**Syntax:** `set` maximum  
reserved  
start  
stop  
trace ...  
validate  
vcc

Use the **set maximum** command to set the maximum number of simultaneous configuration direct VCCs permitted by the LECS. When this number is exceeded, the LECS releases all VCCs not used within the VCC idle time. VCCs that have been used within the VCC idle time are not released.

**Example:**

```
LECS console+ set maximum
Maximum number of simultaneous VCCs [128]?64
LECS modified
LECS console+
```

Use the **set reserved** command to set the maximum reserved bandwidth on a configuration direct VCC. The LECS will not accept reserved bandwidth connections specifying a reserved bandwidth that is larger than this maximum.

**Example:**

```
LECS console+ set reserved
Configuration direct maximum reserved bandwidth (in Kbps) [0]?1000
LECS modified
LECS console+
```

Use the **set start** command to move the LECS into a state where it accepts VCCs (this is its normal operating state).

**Example:**

```
LECS console+ set start
Reject all incoming VCCs? [No]no
LECS now accepting calls
LECS console+
```

Use the **set stop** command to move the LECS into a state where it rejects all incoming VCCs. You should put the LECS in such a state before creating or deleting ELANs, policies, and so on. Otherwise, changing these other structures could result in a client issuing two identical configuration requests, but being assigned to different LESs with each request, because the modifications changed the LECS databases between configuration requests.

**Example:**

```
LECS console+ set stop
Reject all incoming VCCs? [Yes]:yes
LECS rejecting all VCCs
LECS console+
```

Use the **set trace** command to change the “trace mask” or the “trace value.” The trace mask and trace value are used by the LECS to determine over which VCCs packet tracing should be active. For each VCC, the LECS compares the logical AND of the trace value and the trace mask with the logical AND of the calling ATM address and the trace mask. If the resulting bit strings are identical, then the LECS should perform packet tracing on that VCC. To activate packet tracing over all VCCs, use a mask of all zeros. Packet tracing over particular VCCs is indicated by using a more specific trace mask and trace value. Packet tracing must also be enabled for the LECS subsystem through the ELS console or configuration. For additional information, refer to Chapter 11, “Using and Configuring the Event Logging System (ELS)” on page 11-1 and Chapter 12, “Monitoring the Event Logging System (ELS)” on page 12-1.

In the following examples, packet tracing is used over all VCCs with a calling party ATM address beginning with 39.84.0f.00.00.00.00.01.01.d0.d0.58.24

**Example:**

```
LECS console+ set trace mask
Trace ATM addr mask [ ]?ff.ff.ff.ff.ff.ff.ff.ff.ff.ff.ff.00.00.00.00.00
LECS modified
LECS console+
```

**Example:**

```
LECS console+ set trace value
Trace ATM addr value [ ]?39.84.0f.00.00.00.01.01.d0.d0.58.24.00.00.00.00.00
LECS modified
LECS console+
```

Use the **set validate** command to determine whether the LECS validates the peak cell rate of best-effort connections. If this parameter is true, the LECS rejects connections specifying a peak cell rate greater than the line rate of the ATM interface. Clients specifying such a peak cell rate expect that they may use more bandwidth than is available *which can adversely affect network performance*. Setting this

## LECS Console Commands

parameter to true may create interoperability problems with clients exhibiting this behavior.

### Example:

```
LECS console+ set validate
Validate best effort peak cell rate? [No]:yes
LECS modified
LECS console+
```

Use the **set vcc** command to set the VCC idle time of the LECS.

### Example:

```
LECS console+ set vcc
Time (in seconds) before a VCC is declared idle [60]?30
LECS modified
LECS console+
```

## Statistics

Use the **statistics** command to reset or to display many of the LECS counters.

**Syntax:** statistics clear  
list

Use the **statistics clear** command to reset the counters of the LECS.

### Example:

```
LECS console+ statistics clear
LECS statistics cleared
LECS console+
```

Use the **statistics list** command to display the counters of the LECS.

### Example:

```
LECS console+ statistics list
LECS has:
  13 ELAN(s)
  6 policy(ies) at 6 priority(ies)
LECS has 0 configure direct VCCs
  has accepted 434 VCCs and rejected 4 VCCs
  0 VCCs have been dropped by LECS, 434 dropped by caller
  has exceeded its maximum number of VCCs 0 times
LECS discarded frames: 16
LECS responses by status (zero responses if status not displayed)

  Success( 0) : 512
  Invalid request parameters( 2) : 8
  Invalid REQUESTOR-ID( 8) : 4
  Invalid LAN Destination( 9) : 12
  Invalid ATM Address(10) : 4
  LE_CONFIGURE Error(21) : 12
LECS console+
```

LECS has:

This is a two-line description of counters for the number of ELANs, policies, and policy priority levels at the LECS. These counters are not reset with the **statistics clear** command.

LECS has 0 configure direct VCCs

Describes counters on the VCC use of the LECS. The counter for the current number of VCCs will not be reset by the **statistics clear** command, but the other counters will.

LECS discarded frames:

Shows the number of frames that have been discarded by the LECS.

LECS responses by status ...

Describes counters for the number of responses sent by the LECS with various status values. For each possible status there is a counter. The counter value is displayed only if it is non-zero.

## Exit

Use the **exit** command to return to the previous prompt.

**Syntax:** exit

**Example:** exit

---

## LECS Policies Console Commands

The LECS Policy Console environment is characterized by the LECS `policies+` prompt. From this environment, you can monitor and control the policies guiding the LEC-to-LES assignment procedure of the LECS. You can create, delete, or display policies, and display or reset certain counters associated with the policies.

Enter commands at the LECS `policies+` prompt which you can get to from the LECS `console+` prompt for the specified LES-BUS.

*Table 22-4. LECS Policies Monitoring Commands Summary*

Command	Function
? (Help)	Lists the console commands or lists the actions associated with specific commands
Create	Creates a policy for the operating LECS (the policy must already exist in the configuration data).
Delete	Deletes a policy for the operating LECS.
List	Displays or resets certain counters associated with the LECS policies.
Exit	Returns to the LECS console environment.

## Help

Use the **? (help)** command to list the commands that are available from the current prompt level. You also can enter a **?** after a specific command name to list its options.

**Syntax:** ?

**Example:** ?

## LECS Policies Console Commands

```
LECS policies+ ?
create
delete
elans
list
memory
policies
restart
search databases
set
statistics
exit
```

### Create

Use the **create** command to create a policy from the configuration data. Note that the policy must exist in the static configuration before it can be created. You are prompted for the policy that you wish to create. If you specify the All enbld pols choice, then all policies that are enabled in the static configuration are created.

**Syntax:** create

**Example:**

```
LECS policies+ create
( 1) All enbld pols
( 2) 100 byAtmAddr
( 3) 200 byMacAddr
( 4) 300 byRteDesc
( 5) 400 byElanNm
( 6) 1000 byLanType
( 7) 1100 byPktSize
Choice of policy [1]? 5
Policy created: '400 byElanNm '
LECS policies+
```

### Delete

Use the **delete** command to delete a policy from the operating LECS. You will be prompted for the policy that you wish to delete. If you specify the All active pols choice, all policies of the LECS are deleted.

**Syntax:** ddelete

**Example:**

```
LECS policies+ delete
( 1) All active pols
( 2) 100 byAtmAddr
( 3) 200 byMacAddr
( 4) 300 byRteDesc
( 5) 400 byElanNm
( 6) 1000 byLanType
( 7) 1100 byPktSize
Choice of policy [1]? 3
Deleted policy: '200 byMacAddr'
LECS policies+
```

### Elans

Use the **elans** command to create, delete, list, and select ELAN parameters for the LECS.

These commands modify the current LE services and take effect immediately. These commands do not modify the static memory of the router and are lost on the next reload of the server.

Use the **Help** option to display **ELANS** help information.

Use the **Create** option to create an ELAN for the LECS from the ELAN configuration data. The configuration data must already exist in static memory. Creating the ELAN results in the creation of all LESs, TLVs, and policy values for that ELAN.

Use the **Delete** option to delete an ELAN from the LECS. The LESs, TLVs, and policy values of that ELAN are also deleted.

Use the **List** option to list an ELAN configuration for the LECS.

Use the **Select ELANS** option to enter into the LECS ELAN Details Console environment. In this environment, you work more closely with a particular ELAN.

You can:

- Use the **LES Create** option to create LES ATM address information from the configuration. Note that configuration data must already exist.  
Creation of the LES also creates all policy value information associated with that LES.
- Use the **LES Delete** option to delete a LES ATM address from the LECS. The policy value information associated with that LES is also deleted
- Use the **LES Set Backup LES Address** option to change the ATM address of a backup LES.
- Use the **LES Set Primary LES Address** option to change the ATM address of a primary LES.

Use the **Statistics** option to display statistics for an ELAN for the LECS.

#### Example:

```
LECS console+ policies
LECS policies console
LECS policies+ elans
LECS policies+ ?
?
  create
  delete
  list
  select elan
  statistics
LECS policies+ select elan
LECS policies select ELAN console
LECS policies select elan+ ?
  LES Create
  LES Delete
  LES set backup LES address
  LES set primary LES address
```

## List

Use the list command to list the policies of the active LES.

**Syntax:** `list`

**Example:**

## LECS Policies Console Commands

```
LECS policies+ list
Policy listing...
Priority: 100 Policies: byAtmAddr
Priority: 300 Policies: byRteDesc
Priority: 400 Policies: byElanNm
Priority: 1000 Policies: byLanType
Priority: 1100 Policies: byPktSize
LECS policies+
```

## Memory

Use this command to clear the short-term memory of the LECS Policies. The **memory** command can be used to reinitialize the short-term memory without restarting the LECS.

**Syntax:** memory clear

**Example:**

```
LECS policies+ memory clear
Cleared short-term memory of LECS Policies
LECS policies+
```

## Policies

Use the **policies** command to work with the policies guiding the LEC-to-LES assignment procedure of the LECS. You can create, delete, and display policies, and modify various policy-related counters.

**Syntax:** policies

## Restart

Use the **restart** command to restart or create the LECS policies. The **restart** command stops an operating LECS policy, frees its resources, and reinitializes/restarts the LECS policy. You are prompted to either keep the current databases or to rebuild them from the static configuration data when the LECS restarts.

**Syntax:** restart

## Search databases

Use the **Search** databases command to search for policy information in the LECS policy databases.

**Syntax:** search database

## Set databases

Use the **Set databases** command to set information about policies databases.

**Syntax:** set database



## Statistics

Use the **statistics clear** command to reset the counters associated with the LECS policies. You can clear the statistics of all policies, or only of the policies at a certain priority level.

**Syntax:** statistics clear

**Example:**

```
LECS policies+ statistics clear
( 1) All active policies
( 2) 100 byAtmAddr
( 3) 300 byRteDesc
( 4) 400 byElanNm
( 5) 1000 byLanType
( 6) 1100 byPktSize
( 7) < CANCEL >
Choice of policy [1]? 3
Cleared stats of 1 priority levels
LECS policies+
```

Use the **statistics list** command to display the counters associated with the LECS policies. You can display the counters for all policies, or only for the policies at a certain priority level.

**Syntax:** statistics list

**Example:**

```
LECS policies+ statistics list
( 1) All active policies
( 2) 100 byAtmAddr
( 3) 300 byRteDesc
( 4) 400 byElanNm
( 5) 1000 byLanType
( 6) 1100 byPktSize
Choice of policy [1]? 4

Priority: 400 Policies: byElanNm
#policies at this priority: 1
#times assigned by policy: 158
#times policy failed: 253

LECS policies+
```

*Priority*

Counters are maintained for each priority level.

*#policies at this priority*

This counter is not reset by the statistics clear command.

*#times assigned by policy*

This counts the number of times that the LECS used the policies at this priority level to assign a client to a LES.

*#times policy failed*

This counts the number of times that the LECS attempted to use the policies at this priority level to assign a client to a LES, but failed.

## Monitoring ELANs at the LECS

### Exit

Use the **Exit** command to return to the LES-BUS Config for ELAN 'n'> prompt.

**Syntax:** `exit`

**Example:** `exit`

---

## Monitoring ELANs at the LECS

The LECS ELAN Console environment is characterized by the LECS ELANs+ prompt. From this environment, one can create, delete, and display the ELANs of the LECS. ELAN counters can be displayed and reset. There is also a subenvironment in which one can work with the details of the ELAN, including the LESs, policy values, and so forth.

Enter commands at the LECS ELANs+ prompt.

Command	Function
? (Help)	Lists the console commands or lists the actions associated with specific commands.
Create	Creates an ELAN from its configuration. (The configuration data must already exist.)
Delete	Deletes an ELAN from the operating LECS.
List	Lists all ELANs of the LECS.
Select ELAN	Selects an ELAN to monitor in more detail.
Statistics	Clears or displays the ELAN counters.
Exit	Returns to the previous prompt.

### Help

Use the **? (help)** command to list the commands that are available from the current prompt level. You can also enter a ? after a specific command name to list its options.

**Syntax:** ?

**Example:**

```
LECS ELANs+ ?  
? (HELP)  
CREATE  
DELETE  
LIST  
SELECT  
STATISTICS  
EXIT
```

## Create

Use the **create** command to create an ELAN for the LECS from the ELAN configuration data. The configuration data must already exist in static memory. For information on entering ELAN configuration data, see Chapter 21, “Configuring LAN Emulation Services” on page 21-1. Creating the ELAN results in the creation of all LESs, TLVs, and policy values for that ELAN. If you select the All enabled ELANs choice, then all ELANs enabled in the static configuration are created.

**Syntax:** `create`

**Example:**

```
LECS ELANs+ create
( 1) All enabled ELANs
( 2) Accounting Ethernet Elan
( 3) Finance Ethernet Elan
( 4) R&D Token Ring Elan
Choice of ELAN [1]? 2
ELAN created 'Accounting Ethernet Elan'
Created TLVs for ELAN 'Accounting Ethernet Elan'
Created LESs for ELAN 'Accounting Ethernet Elan'
```

## Delete

Use the **delete** command to delete an ELAN from the LECS. The LESs, TLVs, and policy values of that ELAN are also deleted. You are prompted for the ELAN to delete. If you select the ‘All Active ELANs’ choice, then all ELANs of the LECS are deleted.

**Syntax:** `delete`

**Example:**

```
LECS ELANs+ delete
( 1) All active ELANs
( 2) Finance Ethernet Elan
( 3) R&D Token Ring Elan
( 4) Accounting
( 5) < CANCEL >
Ethernet Elan Choice of ELAN [1]? 2
Deleted ELAN 'Finance Ethernet Elan'
```

## List

Use the **list** command to display a summary of the ELANs on the operating LECS.

**Syntax:** `list`

**Example:**

```
LECS ELANs+ list

ELAN listing...

Type          MFS  ELAN name
-----
TokenRing    4544 'R&D Token Ring Elan'
Ethernet     1516 'Accounting Ethernet Elan'
```

### Select

Use the **select** command to enter into the LECS ELAN Details Console environment. In this environment, you work more closely with a particular ELAN. The monitoring of LESs, TLVs, and policy values is performed in this environment. You will be prompted to select an ELAN.

**Syntax:** `select`

**Example:**

```
LECS ELANs+ select
( 1) R&D Token Ring Elan
( 2) Accounting Ethernet Elan
( 3) Finance Ethernet Elan
Choice of ELAN [1]? 2
ELAN 'Accounting Ethernet Elan' selected for detailed console
ELAN 'Accounting Ethernet Elan' selected+
```

### Statistics

Use the **statistics** command to display or reset the counters associated with each ELAN.

**Syntax:** `statistics` `clear`  
`list`

*clear* resets the counters associated with an ELAN. You can clear the counters for all ELANS, or for a selected ELAN.

**Example:**

```
LECS ELANs+ statistics clear
( 1) All active ELANs
( 2) R&D Token Ring Elan
( 3) Accounting Ethernet Elan
( 4) Finance Ethernet Elan
( 5) < CANCEL >
Choice of ELAN [1]? 2
Cleared stats of 1 ELANs
```

*list* displays the ELAN counters. You can display the counters for all ELANs or for a selected ELAN.

**Example: statistics list**

```
LECS ELANs+ statistics list
( 1) All active ELANs
( 2) R&D Token Ring Elan
( 3) Accounting Ethernet Elan
( 4) Finance Ethernet Elan
Choice of ELAN [1]? 3

Type      MFS  ELAN name
-----  -
Ethernet 1516 'Accounting Ethernet Elan'
# TLVs: 0
# bytes in TLV data: 0
# LES ATM addresses: 1
```

Where:

# TLVs

is the number of TLVs which will be returned to clients assigned to this ELAN.

- # bytes in TLV data  
is the total size of the TLV information which will be returned to clients assigned to this ELAN.
- # LES ATM addresses  
is the number of LESs currently serving this ELAN.

## Exit

Use the **exit** command to return to the LECS Console environment.

**Syntax:** `exit`

**Example:** `exit`

---

## Monitoring ELAN Details at the LECS

The LECS ELAN Details Console environment is characterized by the ELAN 'elan\_name' selected+>, where *elan\_name* is the name of the ELAN with which you are currently working. In this environment, you can modify the operational characteristics of the selected ELAN. Objects associated with the ELAN are also monitored and controlled in this environment. Such objects include:

- LESs
- TLVs
- Policy values

Enter commands at the LES-BUS Config for ELAN 'n'> prompt for the specified LES-BUS.

Command	Function
? (Help)	Lists the console commands or lists the actions associated with specific commands
LESs	Monitor and control the LESs for this ELAN.
List	Display a summary of the ELAN.
Policy	Monitor and control the policy values assigned to any LES for this ELAN.
Set	Change the ELAN name, maximum frame size, or type of the ELAN.
TLVs	Monitor and control the TLVs that are returned to the clients assigned to this ELAN.
Exit	Return to the LECS ELANs Console environment.

## Help

Use the **? (help)** command to list the commands that are available from the current prompt level. You also can enter a ? after a specific command name to list its options.

**Syntax:** ?

## Monitoring ELAN Details at the LECS

### Example:

```
ELAN 'R&D Token Ring Elan' selected+ ?
LESSs
LIST
POLICY VALUEs
SET
TLVs
EXIT
```

## LES

Use the **les** command to monitor and control the LES ATM addresses that represent the LESs serving this ELAN. Note that no monitoring or control of the actual LES or BUS occurs. This command monitors and controls only the LES ATM address information that is returned to clients.

**Syntax:** les            create  
                          delete  
                          list  
                          set . . .  
                          statistics . . .

### create

Use the **les create** command to create LES ATM address information from the configuration. Note that configuration data must already exist (refer to Chapter 21, "Configuring LAN Emulation Services" on page 21-1). You will be prompted to select the LES ATM address to create. Creation of this address information also creates all policy value information associated with that LES. If you select the 'All enabled LESs' choice, then all LESs that are enabled in static memory for this ELAN will be created.

### Example:

```
ELAN 'R&D Token Ring Elan' selected+ les create
( 1) All enabled LESs
( 2) 39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03
( 3) Local LES for: R&D Token Ring Elan
Choice of LES [1]? 3
LES created: Local LES for: R&D Token Ring Elan
Created all values for LES Local LES for: R&D Token Ring Elan
```

### delete

Use the **les delete** command to delete a LES ATM address from the LECS. The policy value information associated with that LES is also deleted. You must select the LES ATM address to delete. If you select the 'All active LESs' choice, then all LESs associated with this ELAN will be deleted.

### Example:

```
ELAN 'R&D Token Ring Elan' selected+ les delete
( 1) All active LESs
( 2) 39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03
( 3) Local LES for: R&D Token Ring Elan
( 4) < CANCEL >
Choice of LES [1]? 3
LES deleted: Local LES for: R&D Token Ring Elan
```

### list

Use the **les list** command to display the LES ATM address information associated with the selected ELAN.

### Example:

```

ELAN 'R&D Token Ring Elan' selected+ les 1
Primary ATM address:
39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03
bckup ATM address: (no backup provided)
Primary ATM address: Local LES for: R&D Token Ring Elan
bckup ATM address: (no backup provided)

```

### set *primary/backup*

Use the **les set** command to change the ATM address of primary or backup LES. You must select the LES ATM address information to modify. Refer to Chapter 21, “Configuring LAN Emulation Services” on page 21-1 for an explanation of a primary and backup LES ATM addresses.

#### Example:

```

ELAN 'R&D Token Ring Elan' selected+ les set primary
( 1) 39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03
( 2) Local LES for: R&D Token Ring Elan
Choice of LES [1]?
( 1) Local
( 2) Remote
Primary LES is [2]?
If primary LES is remote, enter ATM address
[39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03]?
39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.05
Primary LES ATM address modified

```

### statistics *clear OR list*

Use the **les statistics** command to display or reset the counters associated with LESs.

#### clear

Use the **les statistics clear** command to reset the counters of the LESs. You can reset the counters for all of the LESs, or a selected LES.

#### Example:

```

ELAN 'R&D Token Ring Elan' selected+ les statistics clear
( 1) All active LESs
( 2) 39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.05
( 3) Local LES for: R&D Token Ring Elan
( 4) < CANCEL >
Choice of LES [1]? 2
Cleared stats of 1 LESs

```

#### list

Use the **les statistics list** command to display the various counters associated with each LES. You can display the counters of all LESs or a selected LES.

#### Example:

```

ELAN 'R&D Token Ring Elan' selected+ les statistics list
( 1) All active LESs
( 2) 39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.05
( 3) Local LES for: R&D Token Ring Elan
Choice of LES [1]? 2

Primary ATM address:
39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.05
# ATM prefixes:          5 # MAC addresses:      6
# Route descriptors:     4 # Lan types:        1
# Packet sizes:         2 # ELAN names:       4
# LECs assigned to primary LES address: 0
# LECs assigned to backup LES address: 0
# LECs assigned by local check: 0

```

Note:

## Monitoring ELAN Details at the LECS

- The first six counters are the number of policy values in the LECS database that are associated with this LES. There is one counter for each type of policy value, and these counters are not reset with the `les statistics clear` command.
- The # LECs assigned to primary LES address field indicates the number of clients that have been given the LES ATM address information of this primary LES. This counter records the assignment only if the primary LES ATM address is a non-local LES.
- The # LECs assigned to backup LES address field indicates the number of clients that have been given the LES ATM address information of this backup LES. This counter records the assignment only if the backup LES ATM address is a non-local LES.
- The # LECs assigned by `local check` field indicates the number of clients that have been given LES ATM address information obtained by searching the LES-BUSs local to this MSS Server. After the LECS decides to which LES the client belongs, it queries the LES-BUSs on the MSS Server for the ATM address of an active LES for this ELAN. If there is a local LES-BUS serving this ELAN, either as a primary or backup, then the LECS obtains the definitive LES serving the ELAN. Otherwise, the LECS must use its heuristic redundancy algorithm.

## List

Use this command to display a summary of the selected ELAN, including its name, maximum frame size, and type.

**Syntax:** `list`

**Example:**

```
ELAN 'R&D Token Ring Elan' selected+ list

ELAN name:      'R&D Token Ring Elan'
ELAN type:      TokenRing
Max frame size: 4544
```

## Policy

Use this command to create, delete, or display the policy values assigned to LESs for this ELAN.

`create`

Use the **policy create** command to create an active binding between a policy value and a LES. The policy values must already exist in the static configuration (see Chapter 21, “Configuring LAN Emulation Services” on page 21-1). Policy values are used to assign requesting clients to specific LESs. You will be prompted to select the policy value to create. If you choose the ‘All enabled values’ option, then all policy values of that type that exist in the static configuration will be created.

**Syntax:** `policy create pv_type`

Where *pv\_type* is one of:

- ESI/SEL of ATM address
- FRAME size
- MAC address
- NAME of ELAN



- PREFIX of ATM address
- ROUTE descriptor
- TYPE of ELAN

**Example:**

```

ELAN 'R&D Token Ring Elan' selected+ policy create mac
( 1) All enabled MAC values
( 2) 29.29.29.93.92.01 to
39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03
( 3) 29.29.29.93.92.02 to
39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03
( 4) 29.29.29.93.92.03 to
39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03
( 5) 29.29.29.93.92.04 to
39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03
( 6) 29.29.29.93.92.05 to
39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03
( 7) 29.29.29.93.92.06 to
39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03
MAC address [1]? 4
MAC address value created:
29.29.29.93.92.03 to 39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03

```

**delete**

Use this command to delete active policy values. You will be prompted for the policy value to delete. If you select the 'All active values' option, then all policy values of that type will be deleted.

**Syntax:** `policy delete pv_type`

Where *pv\_type* is one of:

- ESI/SEL of ATM address
- FRAME size
- MAC address
- NAME of ELAN
- PREFIX of ATM address
- ROUTE descriptor
- Type of ELAN

**Example:**

```

ELAN 'R&D Token Ring Elan' selected+ policy delete route
( 1) All active route descriptor values
( 2) 39.92 to
39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03
( 3) 39.93 to
39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03
( 4) 39.02 to
39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03
( 5) 39.03 to
39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03
Route descriptor [1]? 4
Deleted route descriptor value:
39.02 to 39.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03

```

**list**

Use this command to list the active policy values for this ELAN.

**Syntax:** `policy list pv_type`

Where *pv\_type* is one of:

- ESI/SEL of ATM address
- FRAME size
- MAC address
- NAME of ELAN

## Monitoring ELAN Details at the LECS

- PREFIX of ATM address
- ROUTE descriptor
- TYPE of ELAN

### Example:

```
ELAN 'R&D Token Ring Elan' selected+ policy list name

ELAN name => LES
=====
'R&D Elan'
=> 39.99.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03
'R&D'
=> 39.99.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03
'R & D'
=> 39.99.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03
'R&D Token Ring Elan'
=> 39.99.99.99.99.99.99.01.01.01.02.02.02.84.92.84.92.83.83.03
```

## Set

Use this command to change the ELAN name, maximum frame size, or type. These modifications do not affect the static configuration and are lost on a restart of the LECS or router.

**Syntax:** `set` frame  
name  
type

### frame

Use this command to change the maximum frame size of the selected ELAN.

### Example:

```
ELAN 'R&D Token Ring Elan' selected+ set frame
( 1) 1516
( 2) 4544
( 3) 9234
( 4) 18190
Maximum frame size of ELAN [2]? 3
Attempting to modify max frame size...ELAN modified
```

### name

Use this command to change the name of the selected ELAN.

### Example:

```
ELAN 'R&D Token Ring Elan' selected+ set name
Name of ELAN [R&D Token Ring Elan]? R&D Token Ring Elan 1
Attempting to modify ELAN name...ELAN modified
```

### type

Use this command to change the type of the selected ELAN.

### Example:

```
ELAN 'R&D Token Ring Elan 1' selected+ set type
( 1) Ethernet
( 2) TokenRing
Type of ELAN [2]? 2
Attempting to modify ELAN type...ELAN modified
```

## TLVs

Use this command to create, delete, and list the TLVs for this ELAN. These are the TLVs that will be returned to each client assigned to this ELAN.

**Syntax:** `TLV` `create`  
`delete`  
`list`

### create

Use this command to create a TLV from the configuration data. The TLV must already exist in the static configuration. See Chapter 21, “Configuring LAN Emulation Services” on page 21-1 for information on creating a static configuration. You will be prompted to select the TLV to create. If you select the ‘All enabled TLVs’ option, all TLVs enabled in the static configuration for this ELAN will be created. The TLVs are displayed in the format ‘T *type\_id* *type\_description* L *length* V *value*’ where

- *type\_id* is the 4 octet type identifier
- *type\_description* is a description of the TLV
- *length* is the number of octets of information in the TLV
- *value* is the value stored in the TLV.

### Example:

```
ELAN 'R&D Token Ring Elan' selected+ tlv create
( 1) All enabled TLVs
( 2) T x00A03E01 C7 : Control timeout (sec)      L 2  V 60
( 3) T x00A03E04 C12: VCC timeout period (sec)  L 4  V 600
( 4) T x00A03E05 C13: Maximum retry count      L 2  V 2
TLV Choice [1]? 2
TLV created: T x00A03E01 C7 : Control timeout (sec)      L 2  V 60
```

### delete

Use this command to delete a TLV. The TLV will no longer be returned to the clients assigned to this ELAN. You will be prompted to choose the TLV to delete. If you choose the ‘All active TLVs’ option, then all TLVs for this ELAN are deleted.

### Example:

```
ELAN 'R&D Token Ring Elan' selected+ tlv delete
( 1) All active TLVs
( 2) T x00A03E01 C7 : Control timeout (sec)      L 2  V 60
( 3) T x00A03E04 C12: VCC timeout period (sec)  L 4  V 600
( 4) T x00A03E05 C13: Maximum retry count      L 2  V 2
TLV Choice [1]? 3
Deleted TLV: T x00A03E04 C12: VCC timeout period (sec)  L 4  V 600
```

### list

Use this command to display the TLVs for this ELAN.

### Example:

```
ELAN 'R&D Token Ring Elan' selected+ tlv list
Type: [x00A03E01] C7 : Control timeout (sec)
Length: 2 Value: 60
Type: [x00A03E05] C13: Maximum retry count
Length: 2 Value: 2
```

### Exit

Use this command to return to the LECS ELANs Console environment.

**Syntax:** `exit`

**Example:** `exit`

---

## Security for LE Service Console Commands

The LES-LECS Security Interface Console environment is characterized by the LES-LECS `interface+` prompt. From this environment, the LES-LECS interface can be created, deleted, or restarted. Counters associated with the LES-LECS interface can be reset or displayed. The LES-LECS Security Interface is the LE Services component responsible for multiplexing configuration requests from the LESs on the MSS Server to the LECS (which may or may not be on the MSS Server). The LES-LECS interface is a required component if any of the LES-BUSs are using the security features of the MSS Server.

Enter commands at the LES-LECS `interface+` prompt. To access the prompt for monitoring, do the following:

```
+ network net#
ATM+ le-s
LE-Services Console
LE-SERVICES+ security
LES-LECS Security Interface
LES-LECS interface+
```

*Table 22-7. Security for LE Services Monitoring Commands Summary*

Command	Function
? (Help)	Lists the console commands or lists the actions associated with specific commands
Create	Creates the LES-LECS interface for the authentication of LE client joins.
Delete	Deletes the LES-LECS interface for the authentication of LE client joins.
List	Lists the LES-LECS interface's status and current configuration parameters.
Restart	Restarts a running LES-LECS interface.
Statistics	Clears or lists statistics of the LES-LECS interface.
Exit	Returns to the previous prompt

### Help

Use the ? (**help**) command to list the commands that are available from the current prompt level. You also can enter a ? after a specific command name to list its options.

**Syntax:** ?

**Example:**



## Security for LE Service Console Commands

Where:

### *State*

Is the operational state of the LES-LECS Interface. Possible states are:

- Idle
- Initializing
- Activating ATM address
- Activated ATM address
- Getting UNI version
- Got UNI version
- Getting list of LECSs
- Got list of LECSs
- Attempting to connect to LECS
- Failed to connect to LECS - will retry
- Operating normally
- Connection to LECS released - will retry
- ATM address deactivated
- ATM network down
- Down due to error
- State unknown!!!

### *Time of last state change*

Is the system up time that the LES-LECS Interface entered its current state.  
The format is *hours.minutes.seconds.hundredths*

### *Elapsed time since last change*

Is the amount of time since the last state change. The format is  
*hours.minutes.seconds.hundredths*

### *Error Log*

Is the reason the LES-LECS Interface last went down. If the LES-LECS Interface has not been down since the last MSS Server restart, no err appears.  
An additional error code is contained within the parentheses.

### *ATM Address*

Is the ATM address of the LES-LECS Interface.

### *Connected LECS*

Is the ATM address used by the LES-LECS Interface to connect to the LECS.  
Following this ATM address is an indication of whether the LECS is local to this MSS Server or remote, that is, on another device.

### *Configuration direct VCC type*

Indicates whether the LES-LECS Interface uses a best effort or reserved bandwidth VCC to the LECS.

### *Configuration direct VCC PCR*

Indicates the peak cell rate of the configuration direct VCC to the LECS.

### *VCC characteristics*

If VCC type is Reserved Bandwidth, the Sustained Cell Rate of the VCC in Kbps is shown.

## Restart

Use the **restart** command to restart a running LES-LECS Interface.

**Syntax:** `restart`

**Example:**

```
LES-LECS interface+ restart
LECS interface restarted on device 0
```

## Statistics

Use the **statistics** command to clear or list all LES-LECS Interface statistics.

**Syntax:** `statistics` `clear`  
`list`

`clear` Sets all LES-LECS Interface statistics to zero.

**Example:**

```
LES-LECS interface+ statistics clear
LECS interface statistics cleared
```

`list` Shows all statistics for the LES-LECS Interface.

**Example:**

```
LES-LECS interface+ statistics list
Statistics of LES-LECS Security Interface
# queries to local LECS:      3
# frames transmitted:        0
# frames received:           0
# discarded frames:          0
# VCCs released by LECS/network: 0
# failed VCC setup attempts:  0
```

Where:

# VCCs released by LECS/network

Is the number of times Security VCC from the LES-LECS Interface to the LECS has been released. Releases due to LES-LECS Interface errors or changes in the LES-LECS Interface administrative status are not counted.

# failed VCC setup attempts

Is the number of Security VCC call setup requests made by the LES-LECS Interface that failed for any reason.

## Exit

Use the **exit** command to return to the LE Services+ prompt.

**Syntax:** `exit`





---

# Appendixes



---

## Appendix A. Quick Configuration Reference

### Important

If you are attempting to configure or monitor your IBM 8210 and your service terminal is unreadable, see “Service Terminal Display Unreadable” in IBM Nways Multiprotocol Switched Services (MSS) Server Module Service and Maintenance Manual.

---

## Quick Configuration Tips

### Making Selections

On the panels that you view when using the Quick Configuration program, the information shown in brackets, [ ], is the default. For example:

Configure Bridging? (Yes, No, Quit): [Yes]

- To use the default Yes, press **Enter**.
- To use a value other than the default, such as No or Quit, choose from the values in the parentheses.
- If no value appears in the brackets, there is no default and you must type a value.

### Exiting and Restarting

- To restart the current Quick Configuration section at any time, type **r**. For example, if you are in the Interface Configuration section, type **r** and press **Enter** to return to the beginning of that section.
- To exit Quick Configuration, type **q** and press **Enter**. The Config> prompt will appear.
- To restart Quick Configuration from the Config> prompt, type **qc** and press **Enter**.

### When You're Done

- Once you have completed your configuration, you must restart the IBM 8210 for the configuration to take effect. At the end of the Quick Configuration program, you are given this option.

---

## Starting the Quick Configuration Program

The following sections describe sample configurations using the Quick Configuration program (**qconfig**).

To start the quick configuration program, enter **qc** at the Config> prompt.

The program displays the following panel after starting.

Router Quick Configuration for the following:

- o Bridging
  - Spanning Tree Bridge (STB)
  - Source Routing Bridge (SRB)
  - Source Routing Transparent Bridge (SRT)
- o Protocols
  - IP (including OSPF, RIP, and SNMP)
  - IPX

Event Logging will be enabled for all configured subsystems with logging level 'Standard'

Note: Please be warned that any existing configuration for a particular item will be removed if that item is configured through Quick Configuration

*Event logging* records system activity, status changes, data transmission and reception, data and internal errors, and service requests. The logging level is set to standard (the default). For more information about error logging, refer to the *Event Logging System Messages Guide*.

During Quick Configuration you can:

1. Configure bridging
2. Configure protocols
3. Restart the router

---

## Configuring LAN Emulation

If you added an ATM device, you will see the following prompts:

```
*****
LAN Emulation Configuration
*****

Type 'Yes' to Configure LAN Emulation
Type 'No' to skip LAN Emulation Configuration
Type 'Quit' to exit Quick Config

Configure LAN Emulation? (Yes, No, Quit): [Yes]
```

---

## Configuring Bridging

```
*****
Bridging Configuration
*****

Type 'Yes' to Configure Bridging
Type 'No' to skip Bridging Configuration
Type 'Quit' to exit Quick Config

Configure Bridging? (Yes, No, Quit): [Yes]
```

1. In response to Configure Bridging, take one of the following actions:

- Enter **y** to display the bridging configuration prompts. The prompts that appear depend on your network configuration.
  - Enter **n** to skip the bridging configuration and continue with quick configuration.
  - Enter **q** to exit quick configuration. This displays the Config> prompt. To reenter quick configuration, enter **qc** after this prompt.
2. If you choose to configure bridging, Spanning Tree Bridging (STB) will be enabled on all LAN interfaces. You will see the following panels:

```
Type 'r' any time at this level to restart Bridging Configuration
STB will be enabled on all LAN interfaces
```

Enter **y** to configure SRT bridging. Otherwise, enter **n**. For each Token-Ring interface in the configuration, you will be prompted to enable Source Routing on the interface.

```
Configure SRT Bridging? (Yes, No): [Yes]
You are now configuring the Source Routing part of SRT Bridging
Bridge Number (hex) of this Router (1-F): [A]
```

3. Enter a bridge number, which is a hexadecimal value from 1 to F that is unique between two parallel segments.

```
Interface 0 (Port 1) is of type Token Ring
Configure Source Routing on this interface (Yes, No): [Yes]
```

4. Enter **y** to configure source routing on the interface. The console displays the next two lines.

```
Configuring Interface 0 (Port 1)
Segment Number (hex) of this Interface (1-FFF): [A1]
```

**Note:** The port number increases by one because source routing bridging does not allow a port number of zero.

A unique hexadecimal value from 1 to FFF is assigned to each interface. The interfaces on each ring (segment) have the same segment number, but the segment number is unique to each ring.

These prompts appear for each Token Ring interface.

```
Interface 1 (Port 2) is of type Token Ring
Configure Source Routing on this interface? (Yes, No): [Yes]
Configuring Interface 1 (Port 2)
Segment Number (hex) of this Interface (1-FFF): [A2]
```

If more than two interfaces are configured for source routing, enter a unique hexadecimal value from 1 to FFF unique for the internal virtual segment.

```
Virtual Segment Number (hex) of this Router (1-FFF): [A4]
```

5. A panel similar to the following is displayed:

This is all configured bridging information:

Interfaces configured for STB:

Interface #	Port #	Interface Type
0	1	Token Ring
1	2	Token Ring

The Source Routing part of SRT Bridging has been enabled

Bridge Number of this Router: A

Interfaces configured for Source Routing:

Interface #	Port#	Segment #	Interface Type
0	1	A1	Token Ring
1	2	A2	Token Ring

Virtual Segment Number of this Router: A4

Save this Configuration? (Yes, No): [Yes]

6. Enter **y** to save the bridging configuration and continue with quick configuration. Enter **n** to redisplay the bridging configuration prompts.

If you enter **y**, the following message appears:

```
Bridging configuration saved
```

## Configuring Protocols

After you save the bridging configuration, you will see the following panel:

```
*****
Protocol Configuration
*****

Type 'Yes' to Configure Protocols
Type 'No' to skip Protocol Configuration
Type 'Quit' to exit Quick Config

Configure Protocols? (Yes, No, Quit): [Yes]
```

Take one of the following actions:

- Enter **y** to configure the protocols.
- Enter **n** to skip protocol configuration and continue with quick configuration.
- Enter **q** to exit quick configuration.

You will first configure IP, and then IPX.

## Configuring IP

When you answer **y** to the Configure Protocol panel, quick configuration displays the following messages:

```
Type 'r' any time at this level to restart Protocol configuration
```

```
Configure IP? (Yes, No): [Yes]
```

1. Take one of the following actions:

- Enter **y** to configure IP.
- Enter **n** to skip IP configuration and continue with quick configuration.

The following lines appear for each interface.

```
Configuring Per-Interface IP Information
```

```
Configuring Interface 0 (Token Ring)
Configure IP on this interface? (Yes, No): [Yes]
IP Address: [ ] 128.185.141.1
Address Mask: [255.255.0.0]
```

2. Enter the IP address in decimal notation for example, 128.185.142.20. The console displays one of the following error messages if you enter an invalid IP address:

```
Bad address, please try again.
```

```
This address has already been assigned. Enter a different address
```

```
Address mask is a decimal value that reflects the IP network or subnetwork to
which this interface is attached.
```

```
For more information about IP addressing or address masks, refer to the Pro-
tocol Configuration and Monitoring Reference, or consult your network adminis-
trator.
```

```
Per-Interface IP Configuration complete
```

```
Configuring IP Routing Information
Enable Dynamic Routing (Yes, No): [Yes]
```

3. Enter **y** if you want the routing protocols (RIP or OSPF) to build the routing tables. Enter **n** to manually add IP address destinations to the routing tables (static routes).

```
Enable OSPF? (Yes, No): [Yes]
```

4. Enter **y** to enable the OSPF routing protocol as the primary dynamic IP routing protocol. RIP will be enabled only to send advertisements, not to receive them. Enter **n** if you do not want to use OSPF. RIP will be enabled to send and receive advertisements.

```
OSPF Enabled with Max routes = 1000 and Max routers = 50
```

```
Max routes is the maximum number of autonomous system (AS) external
routes imported into the OSPF routing domain. Max routers is the maximum
number of OSPF routers in the routing domain.
```

```

Routing Configuration Complete

SNMP will be configured with the following parameters:

Community: public
Access:    READONLY

If you plan to use the graphical configuration tool
to download a configuration, it requires the definition
of a community name with read_write_trap access.

Define community with read_write_trap access ? (Yes, No): [Yes]

This is the information you have entered:

      Interface #      IP Address      Address Mask
          0           128.185.141.1  255.255.255.0
          1           128.185.142.1  255.255.255.0
          2           128.185.143.1  255.255.255.0

OSPF is configured, and RIP is configured only for 'sending'

SNMP has been configured with the following parameters:

Community: public
Access:    read_trap

Community: dana
Access:    read_write_trap

Save this configuration? (Yes, No): [Yes]

```

5. Enter **y** to save the IP configuration and continue with quick configuration.  
Enter **n** to redisplay the protocol configuration prompts.

## Configuring IPX

After you save the IP configuration, you will see the following messages:

```
Configure IPX? (Yes, No): [Yes]
```

1. Enter **y** to configure IPX. Enter **n** to skip IPX configuration and continue with quick configuration.

You will see messages similar to the following:

```

Type 'r' any time at this level to restart IPX Configuration
IPX Configuration is already present
Configure IPX anyway? (Yes, No): [No] yes

```

2. Enter **y** to replace the existing configuration. Enter **n** to keep the current configuration and continue.

```

Configuring Per-Interface IPX Information

Configuring Interface 0 (Token Ring)
Configure IPX on this interface? (Yes, No): [Yes]

```



3. The next messages and your responses depend on whether you are configuring Token-Ring, FDDI, or Ethernet.

#### Configuring IPX for Token-Ring:

- a. The following prompt is displayed:

```
Token Ring encapsulation (frame) type? (TOKEN-RING MSB, TOKEN-RING LSB,  
TOKEN-RING_SNAP MSB, TOKEN-RING_SNAP LSB): [TOKEN-RING MSB]
```

- b. Enter the encapsulation type used by the IPX protocol on your Token-Ring end stations.

Token-Ring MSB:	Most common encapsulation type and the default. The IBM 8210 builds outgoing packets with a 3-byte 802.2 header, (0xE0, 0xE0, 0x03). It sends the source and destination addresses in MSB (most significant bit), or noncanonical, format, which is the native address format for Token-Ring.
Token-Ring LSB	Same as Token-Ring MSB except the IBM 8210 sends the addresses in LSB (least significant bit), or canonical, format.
Token-Ring SNAP MSB	The IBM 8210 builds outgoing packets with an 8-byte 802.2/SNAP header (0xAA, 0xAA, 0x03, 0x00, 0x00, 0x00, 0x81, 0x37). It sends the source and destination addresses in most significant bit (MSB), or noncanonical, format.
Token-Ring SNAP LSB	Same as Token-Ring SNAP MSB except the IBM 8210 sends the addresses in LSB, or canonical, format.

#### Configuring IPX for Ethernet:

- a. The following prompts are displayed:

```
Ethernet encapsulation type? (ETHERNET_8022, ETHERNET_8023, ETHERNET_ii,  
ETHERNET_SNAP): [ETHERNET_8023]
```

- b. Enter the encapsulation type used by the IPX protocol on your Ethernet end stations.

Ethernet_8022	Packet includes an 802.2 header.
Ethernet_8023	Uses an IEEE 802.3 packet format without the 802.2 header. This is the default and the default for NetWare versions prior to 4.0. Ethernet 802.3 does not conform to the IEEE 802 standards because it does not include an 802.2 header. It may cause problems with other nodes on the network.
Ethernet_II	Uses Ethernet type 8137 as the packet format. This format is required if you are using NetWare VMS on the Ethernet. This is the default for NetWare Versions 4.0 and higher.
Ethernet_SNAP	Uses the 802.2 format with a SNAP header. This encapsulation type is meant to be compatible with token-ring SNAP encapsulation. However, it violates IEEE standards and is not interoperable across conformal bridges.

#### Configuring IPX for FDDI:

- a. The following prompts are displayed:

```
FDDI encapsulation (frame) type? (FDDI, FDDI_SNAP): [FDDI_SNAP]
```

- Enter the encapsulation type used by the IPX Protocol for your FDDI end stations.

```
fddi          Sets the encapsulation type to FDDI IEEE 802.2.
fddi_snap     Sets the encapsulation type to FDDI SNAP.
```

```
Network Number (hex) (1-FFFFFFFD):[1] 1
```

- Assign an IPX network number to the associated directly connected network. Every IPX interface must have a unique network number.

```
Configuring Interface 1 (WAN PPP)
Configure IPX on this interface? (Yes, No): [Yes]
Network Number (hex) (1-FFFFFFFD): [1] 2

Enable IPXWAN? (Yes, No): [No] yes

Configuring Interface 2 (WAN PPP)
Configure IPX on this interface? (Yes, No): [Yes]
Network Number (hex) (1-FFFFFFFD):[1] 3

Enable IPXWAN? (Yes, No): [No] yes

Host Number for Serial Lines: (000000000000) 1

Configure IPXWAN NodeID? (Yes, No): [Yes]
NodeID (hex) (1 - FFFFFFFD): [1] 4
```

If enabled, the IPXWAN protocol negotiates routing parameters to be used on the PPP serial interface before IPX packet forwarding begins. IPXWAN is not required to forward IPX packets on PPP serial interfaces. The IPXWAN Node ID is a unique IPX network number that identifies the router, and is required if IPXWAN is enabled on any network interfaces.

- Host number is a unique 12-digit hexadecimal value assigned to an IPX router. It is required because serial lines do not have hardware node addresses from which to build a host number.

```
This is the information you have entered:

                Per-Interface Configuration Information

Ifc  IPX Net (hex)  Encapsulation  IPXWAN
0    1              TOKEN-RING MSB  Not Configured
1    2              Enabled
2    3              Enabled

Host Number for Serial Lines: 000000000001
IPXWAN Node ID = 4
IPX Router Name = ipx_router-4
Save this configuration? (Yes, No): [Yes]
```

- Enter **y** to save the IPX configuration and continue with quick configuration. Enter **n** to redisplay the IPX configuration prompts.

If you enter **y**, the following message appears:

IPX configuration saved

---

## Restarting the IBM 8210

After configuring the protocols, you will receive the following message:

```
Quick Config Done
Do you want to write this configuration? (Yes, No): [Yes]
```

Enter **y** to save your changes and display the following information:

```
Default config file written successfully.

Configuration was written.
The system must be restarted for this configuration to take effect.
```

Enter **reload** at the OPCODE prompt (\*) to restart the IBM 8210 with the new configuration. To change or view the current configuration, enter **qc**.



---

## Appendix B. Abbreviations

<b>AAL</b>	ATM Adaptation Layer
<b>AAL-5</b>	ATM Adaptation Layer 5
<b>AARP</b>	AppleTalk Address Resolution Protocol
<b>ABR</b>	area border router
<b>ack</b>	acknowledgment
<b>AIX</b>	Advanced Interactive Executive
<b>AMA</b>	arbitrary MAC addressing
<b>AMP</b>	active monitor present
<b>ANSI</b>	American National Standards Institute
<b>AP2</b>	AppleTalk Phase 2
<b>APPN</b>	Advanced Peer-to-Peer Networking
<b>ARE</b>	all-routes explorer
<b>ARI</b>	ATM real interface
<b>ARI/FCI</b>	address recognized indicator/frame copied indicator
<b>ARP</b>	Address Resolution Protocol
<b>AS</b>	autonomous system
<b>ASBR</b>	autonomous system boundary router
<b>ASCII</b>	American National Standard Code for Information Interchange
<b>ASN.1</b>	abstract syntax notation 1
<b>ASRT</b>	adaptive source routing transparent
<b>ASYNC</b>	asynchronous
<b>ATCP</b>	AppleTalk Control Protocol
<b>ATM</b>	Asynchronous Transfer Mode
<b>ATMARP</b>	ARP in Classical IP
<b>ATP</b>	AppleTalk Transaction Protocol
<b>AUI</b>	attachment unit interface
<b>AVI</b>	ATM virtual interface
<b>ayt</b>	are you there
<b>BAN</b>	Boundary Access Node
<b>BBCM</b>	Bridging Broadcast Manager
<b>BCM</b>	BroadCast Manager
<b>BECN</b>	backward explicit congestion notification
<b>BGP</b>	Border Gateway Protocol
<b>BGP</b>	Border Growth Protocol

<b>BNC</b>	bayonet Niell-Concelman
<b>BNCP</b>	Bridging Network Control Protocol
<b>BOOTP</b>	BOOT protocol
<b>BPDU</b>	bridge protocol data unit
<b>bps</b>	bits per second
	bandwidth reservation
<b>BSD</b>	Berkeley software distribution
<b>BTP</b>	BOOTP relay agent
<b>BTU</b>	basic transmission unit
<b>BUS</b>	Broadcast and Unknown Server
<b>CAM</b>	content-addressable memory
<b>CCITT</b>	Consultative Committee on International Telegraph and Telephone
<b>CD</b>	collision detection
<b>CGWCON</b>	Gateway Console
<b>CIDR</b>	Classless Inter-Domain Routing
<b>CIP</b>	Classical IP
<b>CIPC</b>	Classical IP Client
<b>CIR</b>	committed information rate
<b>CLNP</b>	Connectionless-Mode Network Protocol
<b>CPU</b>	central processing unit
<b>CRC</b>	cyclic redundancy check
<b>CRS</b>	configuration report server
<b>CTS</b>	clear to send
<b>CUD</b>	call user data
<b>DAF</b>	destination address filtering
<b>DB</b>	database
<b>DBsum</b>	database summary
<b>DCD</b>	data channel received line signal detector
<b>DCE</b>	data circuit-terminating equipment
<b>DCS</b>	directly connected server
<b>DDLC</b>	dual data-link controller
<b>DDN</b>	Defense Data Network
<b>DDP</b>	Datagram Delivery Protocol
<b>DDT</b>	Dynamic Debugging Tool
<b>DHCP</b>	Dynamic Host Configuration Protocol
<b>dir</b>	directly connected
<b>DL</b>	data link

<b>DLC</b>	data link control
<b>DLCI</b>	data link connection identifier
<b>DLS</b>	data link switching
<b>DLSw</b>	data link switching
<b>DMA</b>	direct memory access
<b>DNA</b>	Digital Network Architecture
<b>DNCP</b>	DECnet Protocol Control Protocol
<b>DNIC</b>	Data Network Identifier Code
<b>DoD</b>	Department of Defense
<b>DOS</b>	Disk Operating System
<b>DR</b>	designated router
<b>DRAM</b>	Dynamic Random Access Memory
<b>DSAP</b>	destination service access point
<b>DSE</b>	data switching equipment
<b>DSE</b>	data switching exchange
<b>DSR</b>	data set ready
<b>DSU</b>	data service unit
<b>DTE</b>	data terminal equipment
<b>DTR</b>	data terminal ready
<b>Dtype</b>	destination type
<b>DVMRP</b>	Distance Vector Multicast Routing Protocol
<b>E1</b>	2.048 Mbps transmission rate
<b>EDEL</b>	end delimiter
<b>EDI</b>	error detected indicator
<b>EGP</b>	Exterior Gateway Protocol
<b>EIA</b>	Electronics Industries Association
<b>ELAN</b>	Emulated Local Area Network
<b>ELAP</b>	EtherTalk Link Access Protocol
<b>ELS</b>	Event Logging System
<b>ESI</b>	End System Identifier
<b>EST</b>	Eastern Standard Time
<b>Eth</b>	Ethernet
<b>fa-ga</b>	functional address-group address
<b>FCS</b>	frame check sequence
<b>FECN</b>	forward explicit congestion notification
<b>FIFO</b>	first in, first out
<b>FLT</b>	filter library

<b>FR</b>	Frame Relay
<b>FRL</b>	Frame Relay
<b>FTP</b>	File Transfer Protocol
<b>GMT</b>	Greenwich Mean Time
<b>GOSIP</b>	Government Open Systems Interconnection Profile
<b>GTE</b>	General Telephone Company
<b>GWCON</b>	Gateway Console
<b>HDLC</b>	high-level data link control
<b>HEX</b>	hexadecimal
<b>HST</b>	TCP/IP host services
<b>HTF</b>	host table format
<b>IBD</b>	Integrated Boot Device
<b>ICMP</b>	Internet Control Message Protocol
<b>ICP</b>	Internet Control Protocol
<b>ID</b>	identification
<b>IDP</b>	Initial Domain Part
<b>IDP</b>	Internet Datagram Protocol
<b>IEEE</b>	Institute of Electrical and Electronics Engineers
<b>IETF</b>	Internet Engineering Task Force
<b>lfc#</b>	interface number
<b>IGP</b>	interior gateway protocol
<b>ILMI</b>	Interim Local Management Interface
<b>InARP</b>	Inverse Address Resolution Protocol
<b>IP</b>	Internet Protocol
<b>IPCP</b>	IP Control Protocol
<b>IPPN</b>	IP Protocol Network
<b>IPX</b>	Internetwork Packet Exchange
<b>IPXCP</b>	IPX Control Protocol
<b>ISDN</b>	integrated services digital network
<b>ISO</b>	International Organization for Standardization
<b>Kbps</b>	kilobits per second
<b>LAN</b>	local area network
<b>LAPB</b>	link access protocol-balanced
<b>LAT</b>	local area transport
<b>LCP</b>	Link Control Protocol
<b>LE</b>	LAN Emulation
<b>LEC</b>	LAN Emulation Client



<b>LED</b>	light-emitting diode
<b>LECS</b>	LAN Emulation Configuration Server
<b>LES</b>	LAN Emulation Server
<b>LES-BUS</b>	LAN Emulation Server - Broadcast and Unknown Server
<b>LF</b>	largest frame; line feed
<b>LIS</b>	Logical IP subnet
<b>LLC</b>	logical link control
<b>LLC2</b>	logical link control 2
<b>LMI</b>	local management interface
<b>LRM</b>	LAN reporting mechanism
<b>LS</b>	link state
<b>LSA</b>	link state advertisement
<b>LSB</b>	least significant bit
<b>LSI</b>	LANE Shortcuts Interface
<b>LSreq</b>	link state request
<b>LSrxl</b>	link state retransmission list
<b>LU</b>	logical unit
<b>MAC</b>	medium access control
<b>Mb</b>	megabit
<b>MB</b>	megabyte
<b>Mbps</b>	megabits per second
<b>MBps</b>	megabytes per second
<b>MC</b>	multicast
<b>MCF</b>	MAC filtering
<b>MIB</b>	Management Information Base
<b>MIB II</b>	Management Information Base II
<b>MILNET</b>	military network
<b>MOS</b>	Micro Operating System
<b>MOSDDT</b>	Micro Operating System Dynamic Debugging Tool
<b>MOSPF</b>	Open Shortest Path First with multicast extensions
<b>MSB</b>	most significant bit
<b>MSDU</b>	MAC service data unit
<b>MSS</b>	Multiprotocol Switched Services
<b>MTU</b>	maximum transmission unit
<b>nak</b>	not acknowledged
<b>NBMA</b>	Non-Broadcast Multiple Access
<b>NBP</b>	Name Binding Protocol

<b>NBR</b>	neighbor
<b>NCP</b>	Network Control Protocol
<b>NCP</b>	Network Core Protocol
<b>NetBIOS</b>	Network Basic Input/Output System
<b>NHRP</b>	Next Hop Resolution Protocol
<b>NIST</b>	National Institute of Standards and Technology
<b>NPDU</b>	Network Protocol Data Unit
<b>NRZ</b>	non-return-to-zero
<b>NRZI</b>	non-return-to-zero inverted
<b>NSAP</b>	Network Service Access Point
<b>NSF</b>	National Science Foundation
<b>NSFNET</b>	National Science Foundation NETwork
<b>NVCNFG</b>	nonvolatile configuration
<b>OPCON</b>	Operator Console
<b>OSI</b>	open systems interconnection
<b>OSICP</b>	OSI Control Protocol
<b>OSPF</b>	Open Shortest Path First
<b>OUI</b>	organization unique identifier
<b>PC</b>	personal computer
<b>PCR</b>	peak cell rate
<b>PDN</b>	public data network
<b>PING</b>	Packet internet groper
<b>PDU</b>	protocol data unit
<b>PID</b>	process identification
<b>P-P</b>	Point-to-Point
<b>PPP</b>	Point-to-Point Protocol
<b>PROM</b>	programmable read-only memory
<b>PU</b>	physical unit
<b>PVC</b>	permanent virtual circuit
<b>QoS</b>	Quality of Service
<b>RAM</b>	random access memory
<b>RD</b>	route descriptor
<b>REM</b>	ring error monitor
<b>REV</b>	receive
<b>RFC</b>	Request for Comments
<b>RI</b>	ring indicator; routing information
<b>RIF</b>	routing information field

<b>RII</b>	routing information indicator
<b>RIP</b>	Routing Information Protocol
<b>RISC</b>	reduced instruction-set computer
<b>RNR</b>	receive not ready
<b>ROM</b>	read-only memory
<b>ROpcon</b>	Remote Operator Console
<b>RPS</b>	ring parameter server
<b>RTMP</b>	Routing Table Maintenance Protocol
<b>RTP</b>	RouTing update Protocol
<b>RTS</b>	request to send
<b>Rtype</b>	route type
<b>rxmits</b>	retransmissions
<b>rxmt</b>	retransmit
<b>SAF</b>	source address filtering
<b>SAP</b>	service access point
<b>SAP</b>	Service Advertising Protocol
<b>SCR</b>	sustained cell rate
<b>SCSP</b>	Server Cache Synchronization Protocol
<b>sdel</b>	start delimiter
<b>SDLC</b>	SDLC relay, synchronous data link control
<b>SDU</b>	Service Data Unit
<b>SGID</b>	server group id
<b>seqno</b>	sequence number
<b>SGMP</b>	Simple Gateway Monitoring Protocol
<b>SL</b>	serial line
<b>SLIP</b>	Serial Line IP
<b>SMP</b>	standby monitor present
<b>SMTP</b>	Simple Mail Transfer Protocol
<b>SNA</b>	Systems Network Architecture
<b>SNAP</b>	Subnetwork Access Protocol SubNetwork Attachment Point
<b>SNMP</b>	Simple Network Management Protocol
<b>SNPA</b>	subnetwork point of attachment
<b>SPF</b>	OSPF intra-area route
<b>SPE1</b>	OSPF external route type 1
<b>SPE2</b>	OSPF external route type 2
<b>SPIA</b>	OSPF inter-area route type

<b>SPID</b>	service profile ID
<b>SPX</b>	Sequenced Packet Exchange
<b>SQE</b>	signal quality error
<b>SRAM</b>	static random access memory
<b>SRB</b>	source routing bridge
<b>SRF</b>	specifically routed frame
<b>SRLY</b>	SDLC relay
<b>SRT</b>	source routing transparent
<b>SR-TB</b>	source routing-transparent bridge
<b>STA</b>	static
<b>STB</b>	spanning tree bridge
<b>STE</b>	spanning tree explorer
<b>STP</b>	shielded twisted pair; spanning tree protocol
<b>SVC</b>	switched virtual circuit
<b>SVN</b>	Switched Virtual Networking
<b>TB</b>	transparent bridge
<b>TCN</b>	topology change notification
<b>TCP</b>	Transmission Control Protocol
<b>TCP/IP</b>	Transmission Control Protocol/Internet Protocol
<b>TEI</b>	terminal point identifier
<b>TFTP</b>	Trivial File Transfer Protocol
<b>TKR</b>	token ring
<b>TLV</b>	Type/Length/Value
<b>TMO</b>	timeout
<b>TOS</b>	type of service
<b>TSF</b>	transparent spanning frames
<b>TTL</b>	time to live
<b>TTY</b>	teletypewriter
<b>TX</b>	transmit
<b>UA</b>	unnumbered acknowledgment
<b>UDP</b>	User Datagram Protocol
<b>UI</b>	unnumbered information
<b>UNI</b>	User-Network Interface
<b>UTP</b>	unshielded twisted pair
<b>VCC</b>	Virtual Channel connection
<b>VINES</b>	Virtual NETworking System
<b>VIR</b>	variable information rate

<b>VL</b>	virtual link
<b>VNI</b>	Virtual Network Interface
<b>VR</b>	virtual route
<b>WAN</b>	wide area network
<b>WRS</b>	WAN restoral
<b>X.25</b>	packet-switched networks
<b>X.251</b>	X.25 physical layer
<b>X.252</b>	X.25 frame layer
<b>X.253</b>	X.25 packet layer
<b>XID</b>	exchange identification
<b>XNS</b>	Xerox Network Systems
<b>XSUM</b>	checksum
<b>ZIP</b>	AppleTalk Zone Information Protocol
<b>ZIP2</b>	AppleTalk Zone Information Protocol 2
<b>ZIT</b>	Zone Information Table



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# Glossary

This glossary includes terms and definitions from:

- The *American National Standard Dictionary for Information Systems*, ANSI X3.172-1990, copyright 1990 by the American National Standards Institute (ANSI). Copies may be purchased from the American National Standards Institute, 11 West 42nd Street, New York, New York 10036. Definitions are identified by the symbol (A) after the definition.
- The ANSI/EIA Standard—440-A, *Fiber Optic Terminology* Copies may be purchased from the Electronic Industries Association, 2001 Pennsylvania Avenue, N.W., Washington, DC 20006. Definitions are identified by the symbol (E) after the definition.
- 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). Definitions of published parts of this vocabulary are identified by the symbol (I) after the definition; definitions taken from draft international standards, committee drafts, and working papers being developed by ISO/IEC JTC1/SC1 are identified by the symbol (T) after the definition, indicating that final agreement has not yet been reached among the participating National Bodies of SC1.
- The *IBM Dictionary of Computing*, New York: McGraw-Hill, 1994.
- Internet Request for Comments: 1208, *Glossary of Networking Terms*
- Internet Request for Comments: 1392, *Internet Users' Glossary*
- The *Object-Oriented Interface Design: IBM Common User Access Guidelines*, Carmel, Indiana: Que, 1992.

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 is defined in its proper 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 terms that have a related, but not synonymous, meaning.

## A

**AAL.** ATM Adaptation Layer, the layer that adapts user data to/from the ATM network by adding/removing headers and segmenting/reassembling the data into/from cells.

**AAL-5.** ATM Adaptation Layer 5, one of several standard AALs. AAL-5 was designed for data communications, and is used by LAN Emulation and Classical IP.

**abstract syntax.** A data specification that includes all distinctions that are needed in data transmissions, but that omits (abstracts) other details such as those that depend on specific computer architectures. See also *abstract syntax notation 1 (ASN.1)* and *basic encoding rules (BER)*.

**abstract syntax notation 1 (ASN.1).** The Open Systems Interconnection (OSI) method for abstract syntax specified in the following standards:

- ITU-T Recommendation X.208 (1988) | ISO/IEC 8824: 1990
- ITU-T Recommendation X.680 (1994) | ISO/IEC 8824-1: 1994

See also *basic encoding rules (BER)*.

**ACCESS.** In the Simple Network Management Protocol (SNMP), the clause in a Management Information Base (MIB) module that defines the minimum level of support that a managed node provides for an object.

**acknowledgment.** (1) The transmission, by a receiver, of acknowledge characters as an affirmative response to a sender. (T) (2) An indication that an item sent was received.

**active monitor.** In a token-ring network, a function performed at any one time by one ring station that initiates the transmission of tokens and provides token error recovery facilities. Any active adapter on the ring has the ability to provide the active monitor function if the current active monitor fails.

**address.** In data communication, the unique code assigned to each device, workstation, or user connected to a network.

**address mapping table (AMT).** A table, maintained within the AppleTalk router, that provides a current mapping of node addresses to hardware addresses.

**address mask.** For internet subnetting, a 32-bit mask used to identify the subnetwork address bits in the host portion of an IP address. Synonymous with *subnet mask* and *subnetwork mask*.

**address resolution.** (1) A method for mapping network-layer addresses to media-specific addresses. (2) See also *Address Resolution Protocol (ARP)* and *AppleTalk Address Resolution Protocol (AARP)*.

**Address Resolution Protocol (ARP).** (1) In the Internet suite of protocols, the protocol that dynamically maps an IP address to an address used by a supporting metropolitan or local area network such as Ethernet or token-ring. (2) See also *Reverse Address Resolution Protocol (RARP)*.

**addressing.** In data communication, the way in which a station selects the station to which it is to send data.

**adjacent nodes.** Two nodes connected together by at least one path that connects no other node. (T)

**Administrative Domain.** A collection of hosts and routers, and the interconnecting networks, managed by a single administrative authority.

**Advanced Peer-to-Peer Networking (APPN).** An extension to SNA featuring (a) greater distributed network control that avoids critical hierarchical dependencies, thereby isolating the effects of single points of failure; (b) dynamic exchange of network topology information to foster ease of connection, reconfiguration, and adaptive route selection; (c) dynamic definition of network resources; and (d) automated resource registration and directory lookup. APPN extends the LU 6.2 peer orientation for end-user services to network control and supports multiple LU types, including LU 2, LU 3, and LU 6.2.

**Advanced Peer-to-Peer Networking (APPN) end node.** A node that provides a broad range of end-user services and supports sessions between its local control point (CP) and the CP in an adjacent network node. It uses these sessions to dynamically register its resources with the adjacent CP (its network node server), to send and receive directory search requests, and to obtain management services. An APPN end node can also attach to a subarea network as a peripheral node or to other end nodes.

**Advanced Peer-to-Peer Networking (APPN) network.** A collection of interconnected network nodes and their client end nodes.

**Advanced Peer-to-Peer Networking (APPN) network node.** A node that offers a broad range of end-user services and that can provide the following:

- Distributed directory services, including registration of its domain resources to a central directory server

- Topology database exchanges with other APPN network nodes, enabling network nodes throughout the network to select optimal routes for LU-LU sessions based on requested classes of service
- Session services for its local LUs and client end nodes
- Intermediate routing services within an APPN network

**Advanced Peer-to-Peer Networking (APPN) node.** An APPN network node or an APPN end node.

**alert.** A message sent to a management services focal point in a network to identify a problem or an impending problem.

**all-stations address.** In communications, synonym for *broadcast address*.

**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)

**analog.** (1) Pertaining to data consisting of continuously variable physical quantities. (A) (2) Contrast with *digital*.

**AppleTalk.** A network protocol developed by Apple Computer, Inc. This protocol is used to interconnect network devices, which can be a mixture of Apple and non-Apple products.

**AppleTalk Address Resolution Protocol (AARP).** In AppleTalk networks, a protocol that (a) translates AppleTalk node addresses into hardware addresses and (b) reconciles addressing discrepancies in networks that support more than one set of protocols.

**AppleTalk Transaction Protocol (ATP).** In AppleTalk networks, a protocol that provides client/server request and response functions for hosts accessing the Zone Information Protocol (ZIP) for zone information.

**APPN network.** See *Advanced Peer-to-Peer Networking (APPN) network*.

**APPN network node.** See *Advanced Peer-to-Peer Networking (APPN) network node*.

**arbitrary MAC addressing (AMA).** In DECnet architecture, an addressing scheme used by DECnet Phase IV-Prime that supports universally administered addresses and locally administered addresses.

**area.** In Internet and DECnet routing protocols, a subset of a network or gateway grouped together by definition of the network administrator. Each area is



self-contained; knowledge of an area's topology remains hidden from other areas.

**asynchronous (ASYNC).** Pertaining to two or more processes that do not depend upon the occurrence of specific events such as common timing signals. (T)

**ATM.** Asynchronous Transfer Mode, a connection-oriented, high-speed networking technology based on cell switching.

**ATMARP.** ARP in Classical IP.

**attachment unit interface (AUI).** In a local area network, the interface between the medium attachment unit and the data terminal equipment within a data station. (I) (A)

**authentication failure.** In the Simple Network Management Protocol (SNMP), a trap that may be generated by an authentication entity when a requesting client is not a member of the SNMP community.

**autonomous system.** In TCP/IP, a group of networks and routers under one administrative authority. These networks and routers cooperate closely to propagate network reachability (and routing) information among themselves using an interior gateway protocol of their choice.

**autonomous system number.** In TCP/IP, a number assigned to an autonomous system by the same central authority that also assigns IP addresses. The autonomous system number makes it possible for automated routing algorithms to distinguish autonomous systems.

## B

**BCM.** BroadCast Manager, an IBM extension to LAN Emulation designed to limit the effects of broadcast frames.

**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 may 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.

**backbone network.** A central network to which smaller networks, normally of lower speed, connect. The backbone network usually has a much higher capacity than the networks it helps interconnect or is a wide-area network (WAN) such as a public packet-switched datagram network.

**backbone router.** (1) A router used to transmit data between areas. (2) One in a series of routers that is used to interconnect networks into a larger internet.

**Bandwidth.** 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 transmission unit (BTU).** In SNA, the unit of data and control information passed between path control components. A BTU can consist of one or more path information units (PIUs).

**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)

**baud.** 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)

**Border Gateway Protocol (BGP).** An Internet Protocol (IP) routing protocol used between domains and autonomous systems. Contrast with *Exterior Gateway Protocol (EGP)*.

**border router.** In Internet communications, a router, positioned at the edge of an autonomous system, that communicates with a router that is positioned at the edge of a different autonomous system.

**bridge.** A functional unit that interconnects multiple LANs (locally or remotely) that use the same logical link control protocol but that can use different medium access control protocols. A bridge forwards a frame to another bridge based on the medium access control (MAC) address.

**bridge identifier.** An 8-byte field, used in a spanning tree protocol, composed of the MAC address of the port with the lowest port identifier and a user-defined value.

**bridging.** In LANs, the forwarding of a frame from one LAN segment to another. The destination is specified by the medium access control (MAC) sublayer address encoded in the destination address field of the frame header.

**broadcast.** (1) Transmission of the same data to all destinations. (T) (2) Simultaneous transmission of data to more than one destination. (3) Contrast with *multicast*.

**broadcast address.** In communications, a station address (eight 1's) reserved as an address common to all stations on a link. Synonymous with *all-stations address*.

**BUS.** Broadcast and Unknown Server, a LAN Emulation Service component responsible for the delivery of multicast and unknown unicast frames.

## C

**cache.** (1) A special-purpose buffer storage, smaller and faster than main storage, used to hold a copy of instructions and data obtained from main storage and likely to be needed next by the processor. (T) (2) A buffer storage that contains frequently accessed instructions and data; it is used to reduce access time. (3) An optional part of the directory database in network nodes where frequently used directory information may be stored to speed directory searches. (4) To place, hide, or store in a cache.

**call request packet.** (1) A call supervision packet that a data terminal equipment (DTE) transmits to ask that a connection for a call be established throughout the network. (2) In X.25 communications, a call supervision packet transmitted by a DTE to ask for a call establishment through the network.

**canonical address.** In LANs, the IEEE 802.1 format for the transmission of medium access control (MAC) addresses for token-ring and Ethernet adapters. In canonical format, the least significant (rightmost) bit of each address byte is transmitted first. Contrast with *noncanonical address*.

**carrier.** An electric or electromagnetic wave or pulse train that may be varied by a signal bearing information to be transmitted over a communication system. (T)

**carrier detect.** Synonym for *received line signal detector (RLSD)*.

**carrier sense.** In a local area network, an ongoing activity of a data station to detect whether another station is transmitting. (T)

**carrier sense multiple access with collision detection (CSMA/CD).** A protocol that requires carrier sense and in which a transmitting data station that detects another signal while transmitting, stops sending, sends a jam signal, and then waits for a variable time before trying again. (T) (A)

**channel.** (1) A path along which signals can be sent, for example, data channel, output channel. (A) (2) A functional unit, controlled by the processor, that handles the transfer of data between processor storage and local peripheral equipment.

**channel service unit (CSU).** A unit that provides the interface to a digital network. The CSU provides line conditioning (or equalization) functions, which keep the signal's performance consistent across the channel bandwidth; signal reshaping, which constitutes the

binary pulse stream; and loopback testing, which includes the transmission of test signals between the CSU and the network carrier's office channel unit. See also *data service unit (DSU)*.

**checksum.** (1) The sum of a group of data associated with the group and used for checking purposes. (T) (2) In error detection, a function of all bits in a block. If the written and calculated sums do not agree, an error is indicated. (3) On a diskette, data written in a sector for error detection purposes; a calculated checksum that does not match the checksum of data written in the sector indicates a bad sector. The data are either numeric or other character strings regarded as numeric for the purpose of calculating the checksum.

**CIP.** Classical IP.

**CIPC.** Classical IP Client.

**Classical IP.** An IETF standard for ATM-attached hosts to communicate using IP over ATM.

**Classical IP Client.** A Classical IP component that represents users of the Logical IP Subnet.

**circuit switching.** (1) A process that, on demand, connects two or more data terminal equipment (DTEs) and permits the exclusive use of a data circuit between them until the connection is released. (I) (A) (2) Synonymous with *line switching*.

**class A network.** In Internet communications, a network in which the high-order (most significant) bit of the IP address is set to 0 and the host ID occupies the three low-order octets.

**class B network.** In Internet communications, a network in which the two high-order (most significant and next-to-most significant) bits of the IP address are set to 1 and 0, respectively, and the host ID occupies the two low-order octets.

**class of service (COS).** A set of characteristics (such as route security, transmission priority, and bandwidth) used to construct a route between session partners. The class of service is derived from a mode name specified by the initiator of a session.

**client.** (1) A functional unit that receives shared services from a server. (T) (2) A user.

**client/server.** In communications, the model of interaction in distributed data processing in which a program at one site sends a request to a program at another site and awaits a response. The requesting program is called a client; the answering program is called a server.

**clocking.** (1) In binary synchronous communication, the use of clock pulses to control synchronization of

data and control characters. (2) A method of controlling the number of data bits sent on a telecommunication line in a given time.

**collision.** An unwanted condition that results from concurrent transmissions on a channel. (T)

**collision detection.** In carrier sense multiple access with collision detection (CSMA/CD), a signal indicating that two or more stations are transmitting simultaneously.

**Committed information rate.** The maximum amount of data in bits that the network agrees to deliver.

**community.** In the Simple Network Management Protocol (SNMP), an administrative relationship between entities.

**community name.** In the Simple Network Management Protocol (SNMP), a string of octets identifying a community.

**compression.** (1) The process of eliminating gaps, empty fields, redundancies, and unnecessary data to shorten the length of records or blocks. (2) Any encoding to reduce the number of bits used to represent a given message or record.

**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.

**configuration file.** A file that specifies the characteristics of a system device or network.

**configuration parameter.** A variable in a configuration definition, the values of which can characterize the relationship of a product to other products in the same network or can define characteristics of the product itself.

**configuration report server (CRS).** In the IBM Token-Ring Network Bridge Program, the server that accepts commands from the LAN Network Manager (LNM) to get station information, set station parameters, and remove stations on its ring. This server also collects and forwards configuration reports generated by stations on its ring. The configuration reports include the new active monitor reports and the nearest active upstream neighbor (NAUN) reports.

**congestion.** See *network congestion*.

**control point (CP).** (1) A component of an APPN or LEN node that manages the resources of that node. In

an APPN node, the CP is capable of engaging in CP-CP sessions with other APPN nodes. In an APPN network node, the CP also provides services to adjacent end nodes in the APPN network. (2) A component of a node that manages resources of that node and optionally provides services to other nodes in the network. Examples are a system services control point (SSCP) in a type 5 subarea node, a network node control point (NNCP) in an APPN network node, and an end node control point (ENCP) in an APPN or LEN end node. An SSCP and an NNCP can provide services to other nodes.

**control point management services (CPMS).** A component of a control point, consisting of management services function sets, that provides facilities to assist in performing problem management, performance and accounting management, change management, and configuration management. Capabilities provided by the CPMS include sending requests to physical unit management services (PUMS) to test system resources, collecting statistical information (for example, error and performance data) from PUMS about the system resources, and analyzing and presenting test results and statistical information collected about the system resources. Analysis and presentation responsibilities for problem determination and performance monitoring can be distributed among multiple CPMSs.

**control point management services unit (CP-MSU).** The message unit that contains management services data and flows between management services function sets. This message unit is in general data stream (GDS) format. See also *management services unit (MSU)* and *network management vector transport (NMVT)*.

## D

**D-bit.** Delivery-confirmation bit. In X.25 communications, the bit in a data packet or call-request packet that is set to 1 if end-to-end acknowledgment (delivery confirmation) is required from the recipient.

**daemon.** A program that runs unattended to perform a standard service. Some daemons are triggered automatically to perform their task; others operate periodically.

**data carrier detect (DCD).** Synonym for *received line signal detector (RLSD)*.

**data circuit.** (1) A pair of associated transmit and receive channels that provide a means of two-way data communication. (l) (2) In SNA, synonym for *link connection*. (3) See also *physical circuit* and *virtual circuit*.

**Notes:**

1. Between data switching exchanges, the data circuit may include data circuit-terminating equipment (DCE), depending on the type of interface used at the data switching exchange.
2. Between a data station and a data switching exchange or data concentrator, the data circuit includes the data circuit-terminating equipment at the data station end, and may include equipment similar to a DCE at the data switching exchange or data concentrator location.

**data circuit-terminating equipment (DCE).** In a data station, the equipment that provides the signal conversion and coding between the data terminal equipment (DTE) and the line. (I)

**Notes:**

1. The DCE may be separate equipment or an integral part of the DTE or of the intermediate equipment.
2. A DCE may perform other functions that are usually performed at the network end of the line.

**data link connection identifier (DLCI).** The numeric identifier of a frame-relay subport or PVC segment in a frame-relay network. Each subport in a single frame-relay port has a unique DLCI. The following table, excerpted from the American National Standards Institute (ANSI) Standard T1.618 and the International Telegraph and Telephone Consultative Committee (ITU-T/CCITT) Standard Q.922, indicates the functions associated with certain DLCI values:

DLCI Values	Function
0	in-channel signaling
1–15	reserved
16–991	assigned using frame-relay connection procedures
992–1007	layer 2 management of frame-relay bearer service
1008–1022	reserved
1023	in-channel layer management

**data link control (DLC).** A set of rules used by nodes on a data link (such as an SDLC link or a token ring) to accomplish an orderly exchange of information.

**data link control (DLC) layer.** In SNA, the layer that consists of the link stations that schedule data transfer over a link between two nodes and perform error control for the link. Examples of data link control are SDLC for serial-by-bit link connection and data link control for the System/370 channel.

**Note:** The DLC layer is usually independent of the physical transport mechanism and ensures the integrity of data that reaches the higher layers.

**data link layer.** In the Open Systems Interconnection reference model, the layer that provides services to transfer data between entities in the network layer over a communication link. The data link layer detects and possibly corrects errors that may occur in the physical layer. (T)

**data link level.** (1) In the hierarchical structure of a data station, the conceptual level of control or processing logic between high level logic and the data link that maintains control of the data link. The data link level performs such functions as inserting transmit bits and deleting receive bits; interpreting address and control fields; generating, transmitting, and interpreting commands and responses; and computing and interpreting frame check sequences. See also *packet level* and *physical level*. (2) In X.25 communications, synonym for *frame level*.

**data link switching (DLSw).** A method of transporting network protocols that use IEEE 802.2 logical link control (LLC) type 2. SNA and NetBIOS are examples of protocols that use LLC type 2. See also *encapsulation* and *spoofing*.

**data packet.** In X.25 communications, a packet used for the transmission of user data on a virtual circuit at the DTE/DCE interface.

**data service unit (DSU).** A device that provides a digital data service interface directly to the data terminal equipment. The DSU provides loop equalization, remote and local testing capabilities, and a standard EIA/CCITT interface.

**data set ready (DSR).** Synonym for *DCE ready*.

**data switching exchange (DSE).** The equipment installed at a single location to provide switching functions, such as circuit switching, message switching, and packet switching. (I)

**data terminal equipment (DTE).** That part of a data station that serves as a data source, data sink, or both. (I) (A)

**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)

**Notes:**

1. The rate is expressed in bits, characters, or blocks per second, minute, or hour.
2. Corresponding equipment should be indicated; for example, modems, intermediate equipment, or source and sink.

**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 DTEs 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. (3) See also *packet* and *segment*.

**Datagram Delivery Protocol (DDP).** In AppleTalk networks, a protocol that provides network connectivity by means of connectionless socket-to-socket delivery service on the internet layer.

**DCE ready.** In the EIA 232 standard, a signal that indicates to the data terminal equipment (DTE) that the local data circuit-terminating equipment (DCE) is connected to the communication channel and is ready to send data. Synonymous with *data set ready (DSR)*.

**DECnet.** A network architecture that defines the operation of a family of software modules, databases, and hardware components typically used to tie Digital Equipment Corporation systems together for resource sharing, distributed computation, or remote system configuration. DECnet network implementations follow the Digital Network Architecture (DNA) model.

**default.** Pertaining to an attribute, condition, value, or option that is assumed when none is explicitly specified. (I)

**designated router.** A router that informs end nodes of the existence and identity of other routers. The selection of the designated router is based upon the router with the highest priority. When several routers share the highest priority, the router with the highest station address is selected.

**destination node.** The node to which a request or data is sent.

**destination port.** The 8-port asynchronous adapter that serves as a connection point with a serial service.

**destination service access point (DSAP).** In SNA and TCP/IP, a logical address that allows a system to route data from a remote device to the appropriate communications support. Contrast with *source service access point (SSAP)*.

**device.** A mechanical, electrical, or electronic contrivance with a specific purpose.

**digital.** (1) Pertaining to data that consist of digits. (T) (2) Pertaining to data in the form of digits. (A) (3) Contrast with *analog*.

**Digital Network Architecture (DNA).** The model for all DECnet hardware and software implementations.

**direct memory access (DMA).** The system facility that allows a device on the Micro Channel bus to get direct access to the system or bus memory without the intervention of the system processor.

**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 knowledge of 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.

**domain.** (1) That part of a computer network in which the data processing resources are under common control. (T) (2) In Open Systems Interconnection (OSI), a part of a distributed system or a set of managed objects to which a common policy applies. (3) See *Administrative Domain* and *domain name*.

**domain name.** In the Internet suite of protocols, a name of a host system. A domain name consists of a sequence of subnames separated by a delimiter character. For example, if the fully qualified domain name (FQDN) of a host system is `ralvm7.vnet.ibm.com`, each of the following is a domain name:

- `ralvm7.vnet.ibm.com`
- `vnet.ibm.com`
- `ibm.com`

**domain name server.** In the Internet suite of protocols, a server program that supplies name-to-address translation by mapping domain names to IP addresses. Synonymous with *name server*.

**Domain Name System (DNS).** In the Internet suite of protocols, the distributed database system used to map domain names to IP addresses.

**dotted decimal notation.** The syntactical representation for a 32-bit integer that consists of four 8-bit numbers written in base 10 with periods (dots) separating them. It is used to represent IP addresses.

**dump.** (1) Data that has been dumped. (T) (2) To copy the contents of all or part of virtual storage for the purpose of collecting error information.

**dynamic reconfiguration (DR).** The process of changing the network configuration (peripheral PUs and LUs) without regenerating complete configuration tables or deactivating the affected major node.

**Dynamic Routing.** Routing using learned routes rather than routes statically configured at initialization.

## E

**echo.** In data communication, a reflected signal on a communications channel. For example, on a communications terminal, each signal is displayed twice, once when entered at the local terminal and again when returned over the communications link. This allows the signals to be checked for accuracy.

**EIA 232.** In data communication, 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.

**ELAN.** Emulated Local Area Network, a LAN segment implemented with ATM technology.

**Electronic Industries Association (EIA).** An organization of electronics manufacturers that advances the technological growth of the industry, represents the views of its members, and develops industry standards.

**encapsulation.** (1) In communications, a technique used by layered protocols by which a layer adds control information to the protocol data unit (PDU) from the layer it supports. In this respect, the layer encapsulates the data from the supported layer. In the Internet suite of protocols, for example, a packet would contain control information from the physical layer, followed by control information from the network layer, followed by the application protocol data. (2) See also *data link switching*.

**encode.** To convert data by the use of a code in such a manner that reconversion to the original form is possible. (T)

**end node (EN).** (1) See *Advanced Peer-to-Peer Networking (APPN) end node* and *low-entry networking (LEN) end node*. (2) In communications, a node that is frequently attached to a single data link and cannot perform intermediate routing functions.

**entry point (EP).** In SNA, a type 2.0, type 2.1, type 4, or type 5 node that provides distributed network management support. It sends network management data about itself and the resources it controls to a focal point

for centralized processing, and it receives and executes focal-point initiated commands to manage and control its resources.

**ESI.** End System Identifier, a 6-byte component of an ATM address.

**Ethernet.** 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 using collision detection and delayed retransmission. Ethernet uses carrier sense multiple access with collision detection (CSMA/CD).

**exception.** An abnormal condition such as an I/O error encountered in processing a data set or a file.

**exception response (ER).** In SNA, a protocol requested in the form-of-response-requested field of a request header that directs the receiver to return a response only if the request is unacceptable as received or cannot be processed; that is, a negative response, but not a positive response, can be returned. Contrast with *definite response* and *no response*.

**exchange identification (XID).** A specific type of basic link unit that is used to convey node and link characteristics between adjacent nodes. XIDs are exchanged between link stations before and during link activation to establish and negotiate link and node characteristics, and after link activation to communicate changes in these characteristics.

**explicit route (ER).** In SNA, a series of one or more transmission groups that connect two subarea nodes. An explicit route is identified by an origin subarea address, a destination subarea address, an explicit route number, and a reverse explicit route number. Contrast with *virtual route (VR)*.

**explorer frame.** See *explorer packet*.

**explorer packet.** In LANs, a packet that is generated by the source host and that traverses the entire source routing part of a LAN, gathering information on the possible paths available to the host.

**exterior gateway.** In Internet communications, a gateway on one autonomous system that communicates with another autonomous system. Contrast with *interior gateway*.

**Exterior Gateway Protocol (EGP).** In the Internet suite of protocols, a protocol, used between domains and autonomous systems, that enables network reachability information to be advertised and exchanged. IP network addresses in one autonomous system are advertised to another autonomous system by means of EGP-participating routers. Contrast with *Border Gateway Protocol (BGP)*.

## F

**File Transfer Protocol (FTP).** In the Internet suite of protocols, an application layer protocol that uses TCP and Telnet services to transfer bulk-data files between machines or hosts.

**flow control.** (1) 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 rate of flow 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. (2) See also  *pacing*.

**fragment.** See  *fragmentation*.

**fragmentation.** (1) The process of dividing a datagram into smaller parts, or fragments, to match the capabilities of the physical medium over which it is to be transmitted. (2) See also  *segmenting*.

**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. (T) (2) The unit of transmission in some local area networks, including the IBM Token-Ring Network. It includes delimiters, control characters, information, and checking characters. (3) In SDLC, the vehicle for every command, every response, and all information that is transmitted using SDLC procedures.

**frame level.** Synonymous with  *data link level*. See  *link level*.

**frame relay.** (1) An interface standard describing the boundary between a user's equipment and a fast-packet network. In frame-relay systems, flawed frames are discarded; recovery comes end-to-end rather than hop-by-hop. (2) A technique derived from the integrated services digital network (ISDN) D channel standard. It assumes that connections are reliable and dispenses with the overhead of error detection and control within the network.

## G

**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) In the IBM Token-Ring Network, a device and its associated software that connect a local area network to another local area network or a host that uses dif-

ferent logical link protocols. (3) In TCP/IP, synonym for  *router*.

**general data stream (GDS).** The data stream used for conversations in LU 6.2 sessions.

**general data stream (GDS) variable.** A type of RU substructure that is preceded by an identifier and a length field and includes either application data, user control data, or SNA-defined control data.

## H

**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.

**heap memory.** The amount of RAM used to dynamically allocate data structures.

**Hello.** A protocol used by a group of cooperating, trusting routers to allow them to discover minimal delay routes.

**hello message.** (1) A message sent periodically to establish and test reachability between routers or between routers and hosts. (2) In the Internet suite of protocols, a message defined by the Hello protocol as an Interior Gateway Protocol (IGP).

**heuristic.** Pertaining to exploratory methods of problem solving in which solutions are discovered by evaluation of the progress made toward the final result.

**high-level data link control (HDLC).** In data communication, the use of a specified series of bits to control data links in accordance with the International Standards for HDLC: ISO 3309 Frame Structure and ISO 4335 Elements of Procedures.

**hop.** (1) In APPN, a portion of a route that has no intermediate nodes. It consists of only a single transmission group connecting adjacent nodes. (2) To the routing layer, the logical distance between two nodes in a network.

**hop count.** (1) A metric or measure of distance between two points. (2) In Internet communications, the number of routers that a datagram passes through on its way to its destination. (3) In SNA, a measure of the number of links to be traversed in a path to a destination.

**host.** In the Internet suite of protocols, an end system. The end system can be any workstation; it does not have to be a mainframe.

**hysteresis.** The amount the temperature must change past the set alert threshold before the alert condition is cleared.

## I

**I frame.** Information frame.

**IETF.** Internet Engineering Task Force, an organization that produces Internet specifications.

**ILMI.** Interim Local Management Interface, SNMP-based procedures for managing the User-Network Interface (UNI).

**information (I) frame.** A frame in I format used for numbered information transfer.

**input/output channel.** In a data processing system, a functional unit that handles transfer of data between internal and peripheral equipment. (I) (A)

**integrated services digital network (ISDN).** A digital end-to-end telecommunication network that supports multiple services including, but not limited to, voice and data.

**Note:** ISDNs are used in public and private network architectures.

**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.

**interior gateway.** In Internet communications, a gateway that communicates only with its own autonomous system. Contrast with *exterior gateway*.

**Interior Gateway Protocol (IGP).** In the Internet suite of protocols, a protocol used to propagate network reachability and routing information within an autonomous system. Examples of IGPs are Routing Information Protocol (RIP) and Open Shortest Path First (OSPF).

**intermediate node.** A node that is at the end of more than one branch. (T)

**intermediate session routing (ISR).** A type of routing function within an APPN network node that provides session-level flow control and outage reporting for all sessions that pass through the node but whose end points are elsewhere.

**International Organization for Standardization (ISO).** An organization of national standards bodies from various countries established to promote develop-

ment of standards to facilitate international exchange of goods and services, and develop cooperation in intellectual, scientific, technological, and economic activity.

**International Telecommunication Union (ITU).** The specialized telecommunication agency of the United Nations, established to provide standardized communication procedures and practices, including frequency allocation and radio regulations worldwide.

**internet.** A collection of networks interconnected by a set of routers that allow them to function as a single, large network. See also *Internet*.

**Internet.** The internet administered by the Internet Architecture Board (IAB), consisting of large national backbone networks and many regional and campus networks all over the world. The Internet uses the Internet suite of protocols.

**Internet address.** See *IP address*.

**Internet Architecture Board (IAB).** The technical body that oversees the development of the Internet suite of protocols that are known as TCP/IP.

**Internet Control Message Protocol (ICMP).** The protocol used to handle errors and control messages in the Internet Protocol (IP) layer. Reports of problems and incorrect datagram destinations are returned to the original datagram source. ICMP is part of the Internet Protocol.

**Internet Control Protocol (ICP).** The Virtual NETworking System (VINES) protocol that provides exception notifications, metric notifications, and PING support. See also *RouTing update Protocol (RTP)*.

**Internet Engineering Task Force (IETF).** The task force of the Internet Architecture Board (IAB) that is responsible for solving the short-term engineering needs of the Internet.

**Internet Protocol (IP).** A connectionless protocol that routes data through a network or interconnected networks. IP acts as an intermediary between the higher protocol layers and the physical network. However, this protocol does not provide error recovery and flow control and does not guarantee the reliability of the physical network.

**Internetwork Packet Exchange (IPX).** (1) The network protocol used to connect Novell's servers, or any workstation or router that implements IPX, with other workstations. Although similar to the Internet Protocol (IP), IPX uses different packet formats and terminology. (2) See also *Xerox Network Systems (XNS)*.

**interoperability.** The capability to communicate, execute programs, or transfer data among various functional units in a way that requires the user to have little



or no knowledge of the unique characteristics of those units. (T)

**intra-area routing.** In Internet communications, the routing of data within an area.

**Inverse Address Resolution Protocol (InARP).** In the Internet suite of protocols, the protocol used for locating a protocol address through the known hardware address. In a frame-relay context, the data link connection identifier (DLCI) is synonymous with the known hardware address.

**IP address.** The 32-bit address defined by the Internet Protocol, standard 5, Request for Comments (RFC) 791. It is usually represented in dotted decimal notation.

**IP datagram.** In the Internet suite of protocols, the fundamental unit of information transmitted through an internet. It contains source and destination addresses, user data, and control information such as the length of the datagram, the header checksum, and flags indicating whether the datagram can be or has been fragmented.

**IP router.** A device in an IP internet that is responsible for making decisions about the paths over which network traffic will flow. Routing protocols are used to gain information about the network and to determine the best route over which the datagram should be forwarded toward the final destination. The datagrams are routed based on IP destination addresses.

**IPXWAN.** A Novell protocol that is used to exchange router-to-router information before exchanging standard Internetwork Packet Exchange (IPX) routing information and traffic over wide area networks (WANs).

## L

**LAN bridge server (LBS).** In the IBM Token-Ring Network Bridge Program, the server that keeps statistical information about frames forwarded between two or more rings (through a bridge). The LBS sends these statistics to the appropriate LAN managers through the LAN reporting mechanism (LRM).

**LAN Emulation (LE).** An ATM Forum standard that supports legacy LAN applications over ATM networks.

**LAN Emulation Client (LEC).** A LAN Emulation component that represents users of the Emulated LAN.

**LAN Emulation Configuration Server (LECS).** A LAN Emulation Service component that centralizes and disseminates configuration data.

**LAN Emulation Server (LES).** A LAN Emulation Service component that resolves LAN Destinations to ATM Addresses.

**LAN Network Manager (LNM).** An IBM licensed program that enables a user to manage and monitor LAN resources from a central workstation.

**LAN segment.** (1) Any portion of a LAN (for example, a bus or ring) that can operate independently, but that is connected to other parts of the network by means of bridges. (2) A ring or bus network without bridges.

**layer.** (1) In network architecture, a group of services that is complete from a conceptual point of view, that is one out of a set of hierarchically arranged groups, and that extends across all systems that conform to the network architecture. (T) (2) In the Open Systems Interconnection reference model, one of seven conceptually complete, hierarchically arranged groups of services, functions, and protocols, that extend across all open systems. (T) (3) In SNA, a grouping of related functions that are logically separate from the functions in other groups. Implementation of the functions in one layer can be changed without affecting functions in other layers.

**LE.** LAN Emulation.

**LEC.** LAN Emulation Client.

**LECS.** LAN Emulation Configuration Server.

**LES.** LAN Emulation Server.

**line switching.** Synonym for *circuit switching*.

**link.** The combination of the link connection (the transmission medium) and two link stations, one at each end of the link connection. A link connection can be shared among multiple links in a multipoint or token-ring configuration.

**link access protocol balanced (LAPB).** A protocol used for accessing an X.25 network at the link level. LAPB is a duplex, asynchronous, symmetric protocol, used in point-to-point communication.

**link-attached.** (1) Pertaining to devices that are connected to a controlling unit by a data link. (2) Contrast with *channel-attached*. (3) Synonymous with *remote*.

**link connection.** (1) 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). (2) In SNA, synonymous with *data circuit*.

**link level.** (1) A part of Recommendation X.25 that defines the link protocol used to get data into and out of the network across the full-duplex link connecting the subscriber's machine to the network node. LAP and LAPB are the link access protocols recommended by the CCITT. (2) See *data link level*.

**link-state.** In routing protocols, the advertised information about the usable interfaces and reachable neighbors of a router or network. The protocol's topological database is formed from the collected link-state advertisements.

**link station.** (1) The hardware and software components within a node representing a connection to an adjacent node over a specific link. For example, if node A is the primary end of a multipoint line that connects to three adjacent nodes, node A will have three link stations representing the connections to the adjacent nodes. (2) See also *adjacent link station (ALS)*.

**LIS.** Logical IP Subnet, an IP subnet implemented with ATM technology Virtual Networking (SVN) framework.

**local.** (1) Pertaining to a device accessed directly without use of a telecommunication line. (2) Contrast with *remote*. (3) Synonym for *channel-attached*.

**local area network (LAN).** (1) 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) (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. (3) See also *Ethernet* and *token ring*. (4) Contrast with *metropolitan area network (MAN)* and *wide area network (WAN)*.

**local bridging.** A function of a bridge program that allows a single bridge to connect multiple LAN segments without using a telecommunication link. Contrast with *remote bridging*.

**local management interface (LMI).** See *local management interface (LMI) protocol*.

**local management interface (LMI) protocol.** In NCP, a set of frame-relay network management procedures and messages used by adjacent frame-relay nodes to exchange line status information over DLCI X'00'. NCP supports both the American National Standards Institute (ANSI) and International Telegraph and Telephone Consultative Committee (ITU-T/CCITT) versions of LMI protocol. These standards refer to LMI protocol as *link integrity verification tests (LIVT)*.

**locally administered address.** In a local area network, an adapter address that the user can assign to override the universally administered address. Contrast with *universally administered address*.

**logical channel.** In packet mode operation, a sending channel and a receiving channel that together are used to send and receive data over a data link at the same

time. Several logical channels can be established on the same data link by interleaving the transmission of packets.

**logical link.** A pair of link stations, one in each of two adjacent nodes, and their underlying link connection, providing a single link-layer connection between the two nodes. Multiple logical links can be distinguished while they share the use of the same physical media connecting two nodes. Examples are 802.2 logical links used on local area network (LAN) facilities and LAP E logical links on the same point-to-point physical link between two nodes. The term logical link also includes the multiple X.25 logical channels that share the use of the access link from a DTE to an X.25 network.

**logical link control (LLC).** The data link control (DLC) LAN sublayer that provides two types of DLC operation for the orderly exchange of information. 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 establishing a link prior to the exchange of information. Connection-oriented service provides sequenced information transfer, flow control, and error recovery.

**logical link control (LLC) 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 (LLC) 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), a source service access point (SSAP), a control field, and user data.

**logical unit (LU).** A type of network accessible unit that enables users to gain access to network resources and communicate with each other.

**loopback test.** A test in which signals from a tester are looped at a modem or other network element back to the tester for measurements that determine or verify the quality of the communications path.

**low-entry networking (LEN).** A capability of nodes to attach directly to one another using basic peer-to-peer protocols to support multiple and parallel sessions between logical units.

**low-entry networking (LEN) end node.** A LEN node receiving network services from an adjacent APPN network node.

**low-entry networking (LEN) node.** A node that provides a range of end-user services, attaches directly to other nodes using peer protocols, and derives network services implicitly from an adjacent APPN network node, that is, without the direct use of CP-CP sessions.

## M

**Management Information Base (MIB).** (1) A collection of objects that can be accessed by means of a network management protocol. (2) A definition for management information that specifies the information available from a host or gateway and the operations allowed. (3) In OSI, the conceptual repository of management information within an open system.

**management station.** In Internet communications, the system responsible for managing all, or a portion of, a network. The management station communicates with network management agents that reside in the managed node by means of a network management protocol, such as the Simple Network Management Protocol (SNMP).

**mapping.** The process of converting data that is transmitted in one format by the sender into the data format that can be accepted by the receiver.

**mask.** (1) A pattern of characters used to control retention or elimination of portions of another pattern of characters. (I) (A) (2) To use a pattern of characters to control retention or elimination of portions of another pattern of characters. (I) (A)

**maximum transmission unit (MTU).** In LANs, the largest possible unit of data that can be sent on a given physical medium in a single frame. For example, the MTU for Ethernet is 1500 bytes.

**medium access control (MAC).** In LANs, the sublayer of the data link control layer that supports medium-dependent functions and uses the services of the physical layer to provide services to the logical link control (LLC) sublayer. The MAC sublayer includes the method of determining when a device has access to the transmission medium.

**medium access control (MAC) protocol.** 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)

**medium access control (MAC) 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)

**metric.** In Internet communications, a value, associated with a route, which is used to discriminate between multiple exit or entry points to the same autonomous system. The route with the lowest metric is preferred.

**metropolitan area network (MAN).** A network formed by the interconnection of two or more networks which may operate at higher speed than those networks, may cross administrative boundaries, and may use multiple access methods. (T) Contrast with *local area network (LAN)* and *wide area network (WAN)*.

**MIB object.** Synonym for *MIB variable*.

**MIB variable.** In the Simple Network Management Protocol (SNMP), a specific instance of data defined in a MIB module. Synonymous with *MIB object*.

**MIB view.** In the Simple Network Management Protocol (SNMP), the collection of managed objects, known to the agent, that is visible to a particular community.

**MILNET.** The military network that was originally part of ARPANET. It was partitioned from ARPANET in 1984. MILNET provides a reliable network service for military installations.

**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 on a telecommunication line, and converts the analog signal received to data for the computer.

**modulo.** (1) Pertaining to a modulus; for example, 9 is equivalent to 4 modulo 5. (2) See also *modulus*.

**modulus.** A number, such as a positive integer, in a relationship that divides the difference between two related numbers without leaving a remainder; for example, 9 and 4 have a modulus of 5 ( $9 - 4 = 5$ ;  $4 - 9 = -5$ ; and 5 divides both 5 and -5 without leaving a remainder).

**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) 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.

**MSS.** Multiprotocol Switched Services, a component of IBM's Switched Virtual Networking (SVN) framework.

**multicast.** (1) Transmission of the same data to a selected group of destinations. (T) (2) A special form of broadcast in which copies of a packet are delivered to only a subset of all possible destinations.

**multiple-domain support (MDS).** A technique for transporting management services data between management services function sets over LU-LU and CP-CP sessions. See also *multiple-domain support message unit (MDS-MU)*.

**multiple-domain support message unit (MDS-MU).** The message unit that contains management services data and flows between management services function sets over the LU-LU and CP-CP sessions used by multiple-domain support. This message unit, as well as the actual management services data that it contains, is in general data stream (GDS) format. See also *control point management services unit (CP-MSU)*, *management services unit (MSU)*, and *network management vector transport (NMVT)*.

## N

**Name Binding Protocol (NBP).** In AppleTalk networks, a protocol that provides name translation function from the AppleTalk entity (resource) name (character string) into an AppleTalk IP address (16-bit number) on the transport layer.

**name resolution.** In Internet communications, the process of mapping a machine name to the corresponding Internet Protocol (IP) address. See also *Domain Name System (DNS)*.

**name server.** In the Internet suite of protocols, synonym for *domain name server*.

**nearest active upstream neighbor (NAUN).** In the IBM Token-Ring Network, the station sending data directly to a given station on the ring.

**neighbor.** A router on a common subnetwork that has been designated by a network administrator to receive routing information.

**NetBIOS.** Network Basic Input/Output System. A standard interface to networks, IBM personal computers (PCs), and compatible PCs, that is used on LANs to provide message, print-server, and file-server functions. Application programs that use NetBIOS do not need to handle the details of LAN data link control (DLC) protocols.

**network.** (1) A configuration of data processing devices and software connected for information interchange. (2) A group of nodes and the links interconnecting them.

**network accessible unit (NAU).** A logical unit (LU), physical unit (PU), control point (CP), or system services control point (SSCP). It is the origin or the destination of information transmitted by the path control network. Synonymous with *network addressable unit*.

**network address.** According to ISO 7498-3, a name, unambiguous within the OSI environment, that identifies a set of network service access points.

**network addressable unit (NAU).** Synonym for *network accessible unit*.

**network architecture.** The logical structure and operating principles of a computer network. (T)

**Note:** The operating principles of a network include those of services, functions, and protocols.

**network congestion.** An undesirable overload condition caused by traffic in excess of what a network can handle.

**network identifier.** (1) In TCP/IP, that part of the IP address that defines a network. The length of the network ID depends on the type of network class (A, B, or C). (2) A 1- to 8-byte customer-selected name or an 8-byte IBM-registered name that uniquely identifies a specific subnetwork.

**Network Information Center (NIC).** In Internet communications, local, regional, and national groups throughout the world who provide assistance, documentation, training, and other services to users.

**network layer.** In Open Systems Interconnection (OSI) architecture, the layer that is responsible for routing, switching, and link-layer access across the OSI environment.

**network management.** The process of planning, organizing, and controlling a communication-oriented data processing or information system.

**network management station.** In the Simple Network Management Protocol (SNMP), a station that executes management application programs that monitor and control network elements.

**network management vector transport (NMVT).** A management services request/response unit (RU) that flows over an active session between physical unit management services and control point management services (SSCP-PU session).

**network manager.** A program or group of programs that is used to monitor, manage, and diagnose the problems of a network.

**network node (NN).** See *Advanced Peer-to-Peer Networking (APPN) network node*.

**Next Hop Resolution Protocol (NHRP).** A routing protocol, specified in Internet Draft Version 10 which has been submitted for RFC status. The Next Hop Resolution Protocol defines a method for a source station to determine the Non-Broadcast Multi-Access (NBMA) address of the “NBMA next hop” towards a destination. The NBMA next hop may be the destination itself or the router in the NBMA network that is “nearest” to the destination. The source station can then establish an NBMA virtual circuit directly with the destination or the router and reduce the number of routing hops through the NBMA network.

**network user address (NUA).** In X.25 communications, the X.121 address containing up to 15 binary code digits.

**NHRP.** Next Hop Resolution Protocol

**node.** (1) In a network, a point at which one or more functional units connect channels or data circuits. (I)  
(2) Any device, attached to a network, that transmits and receives data.

**noncanonical address.** In LANs, a format for the transmission of medium access control (MAC) addresses for token-ring adapters. In noncanonical format, the most significant (leftmost) bit of each address byte is transmitted first. Contrast with *canonical address*.

**nonseed router.** In AppleTalk networks, a router that acquires network number range and zone list information from a seed router attached to the same network.

## O

**Open Shortest Path First (OSPF).** In the Internet suite of protocols, a function that provides intradomain information transfer. An alternative to the Routing Information Protocol (RIP), OSPF allows the lowest-cost routing and handles routing in large regional or corporate networks.

**Open Systems Interconnection (OSI).** (1) The interconnection of open systems in accordance with standards of the International Organization for Standardization (ISO) for the exchange of information. (T) (A) (2) The use of standardized procedures to enable the interconnection of data processing systems.

**Note:** OSI architecture establishes a framework for coordinating the development of current and future standards for the interconnection of computer systems. Network functions are divided into seven layers. Each layer represents a group of related data processing and communication

functions that can be carried out in a standard way to support different applications.

**Open Systems Interconnection (OSI) architecture.** Network architecture that adheres to that particular set of ISO standards that relates to Open Systems Interconnection. (T)

**Open Systems Interconnection (OSI) reference model.** A model that describes the general principles of the Open Systems Interconnection, as well as the purpose and the hierarchical arrangement of its seven layers. (T)

**origin.** An external logical unit (LU) or application program from which a message or other data originates. See also *destination*.

**orphan circuit.** A non-configured circuit whose availability is learned dynamically.

## P

**padding.** (1) A technique by which a receiving component controls the rate of transmission of a sending component to prevent overrun or congestion. (2) See also *flow control*, *receive pacing*, *send pacing*, *session-level pacing*, and *virtual route (VR) pacing*.

**packet.** In data communication, a sequence of binary digits, including data and control signals, that is transmitted and switched as a composite whole. The data, control signals, and, possibly, error control information are arranged in a specific format. (I)

**packet internet groper (PING).** (1) In Internet communications, 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. (2) In communications, a test of reachability.

**packet mode operation.** Synonym for *packet switching*.

**packet switching.** (1) The process of routing and transferring data by means of addressed packets so that a channel is occupied only during transmission of a packet. On completion of the transmission, the channel is made available for transfer of other packets. (I)  
(2) Synonymous with *packet mode operation*. See also *circuit switching*.

**parallel bridges.** A pair of bridges connected to the same LAN segment, creating redundant paths to the segment.

**parallel transmission groups.** Multiple transmission groups between adjacent nodes, with each group having a distinct transmission group number.

**path.** (1) In a network, any route between any two nodes. A path may include more than one branch. (T) (2) The series of transport network components (path control and data link control) that are traversed by the information exchanged between two network accessible units. See also *explicit route (ER)*, *route extension*, and *virtual route (VR)*.

**path control (PC).** 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 session identifiers for routing, and others (subarea nodes) use network addresses for routing.

**path cost.** In link-state routing protocols, the sum of the link costs along the path between two nodes or networks.

**path information unit (PIU).** A message unit consisting of a transmission header (TH) alone, or a TH followed by a basic information unit (BIU) or a BIU segment.

**pattern-matching character.** A special character such as an asterisk (\*) or a question mark (?) that can be used to represent one or more characters. Any character or set of characters can replace a pattern-matching character. Synonymous with *global character* and *wildcard character*.

**permanent virtual circuit (PVC).** In X.25 and frame-relay communications, a virtual circuit that has a logical channel permanently assigned to it at each data terminal equipment (DTE). Call-establishment protocols are not required. Contrast with *switched virtual circuit (SVC)*.

**physical circuit.** A circuit established without multiplexing. See also *data circuit*. Contrast with *virtual circuit*.

**physical layer.** In the Open Systems Interconnection reference model, the layer that provides the mechanical, electrical, functional, and procedural means to establish, maintain, and release physical connections over the transmission medium. (T)

**physical unit (PU).** (1) The component that manages and monitors the resources (such as attached links and adjacent link stations) associated with a node, as requested by an SSCP via an SSCP-PU session. An SSCP activates a session with the physical unit in order to indirectly manage, through the PU, resources of the node such as attached links. This term applies to type

2.0, type 4, and type 5 nodes only. (2) See also *peripheral PU* and *subarea PU*.

**ping command.** The command that sends an Internet Control Message Protocol (ICMP) echo-request packet to a gateway, router, or host with the expectation of receiving a reply.

**Point-to-Point Protocol (PPP).** A protocol that provides a method for encapsulating and transmitting packets over serial point-to-point links.

**polling.** (1) On a multipoint connection or a point-to-point connection, the process whereby data stations are invited, one at a time, to transmit. (I) (2) Interrogation of devices for such purposes as to avoid contention, to determine operational status, or to determine readiness to send or receive data. (A)

**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. (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. There may be one or more ports controlled by a single DLC process. (4) In the Internet suite of protocols, a 16-bit number used to communicate between TCP or the User Datagram Protocol (UDP) and a higher-level protocol or application. Some protocols, such as File Transfer Protocol (FTP) and Simple Mail Transfer Protocol (SMTP), use the same well-known port number in all TCP/IP implementations. (5) An abstraction used by transport protocols to distinguish among multiple destinations within a host machine. (6) Synonymous with *socket*.

**port number.** In Internet communications, the identification of an application entity to the transport service.

**problem determination.** The process of determining the source of a problem; for example, a program component, machine failure, telecommunication facilities, user or contractor-installed programs or equipment, environmental failure such as a power loss, or user error.

**program temporary fix (PTF).** A temporary solution or bypass of a problem diagnosed by IBM in a current unaltered release of the program.

**protocol.** (1) A set of semantic and syntactic rules that determine 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 synchro-

nizing the states of network components. Synonymous with *line control discipline* and *line discipline*. See *bracket protocol* and *link protocol*.

**protocol data unit (PDU).** 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)

## Q

**Quality of Service (QoS).** The user-oriented performance of an end-to-end service which is accessed using performance parameters. In ATM networks, the following performance parameters determine the QoS of an end-to-end ATM connection: cell loss ratio, cell transfer delay, and cell delay variation.

## R

**Rapid Transport Protocol (RTP) connection.** In high-performance routing (HPR), the connection established between the endpoints of the route to transport session traffic.

**reachability.** The ability of a node or a resource to communicate with another node or resource.

**read-only memory (ROM).** Memory in which stored data cannot be modified by the user except under special conditions.

**reassembly.** In communications, the process of putting segmented packets back together after they have been received.

**receive not ready (RNR).** In communications, a data link command or response that indicates a temporary condition of being unable to accept incoming frames.

**receive not ready (RNR) packet.** See *RNR packet*.

**received line signal detector (RLSD).** In the EIA 232 standard, a signal that indicates to the data terminal equipment (DTE) that it is receiving a signal from the remote data circuit-terminating equipment (DCE). Synonymous with *carrier detect* and *data carrier detect (DCD)*.

**Recognized Private Operating Agency (RPOA).** Any individual, company, or corporation, other than a government department or service, that operates a telecommunication service and is subject to the obligations undertaken in the Convention of the International Telecommunication Union and in the Regulations; for example, a communication common carrier.

**reduced instruction-set computer (RISC).** A computer that uses a small, simplified set of frequently used instructions for rapid execution.

**remote.** (1) Pertaining to a system, program, or device that is accessed through a telecommunication line. (2) Synonym for *link-attached*. (3) Contrast with *local*.

**remote bridging.** The function of a bridge that allows two bridges to connect multiple LANs using a telecommunication link. Contrast with *local bridging*.

**Remote Execution Protocol (REXEC).** A protocol that allows the execution of a command or program on any host in the network. The local host receives the results of the command execution.

**Request for Comments (RFC).** In Internet communications, the document series that describes a part of the Internet suite of protocols and related experiments. All Internet standards are documented as RFCs.

**reset.** On a virtual circuit, reinitialization of data flow control. At reset, all data in transit are eliminated.

**reset request packet.** In X.25 communications, a packet transmitted by the data terminal equipment (DTE) to the data circuit-terminating equipment (DCE) to request that a virtual call or a permanent virtual circuit be reset. The reason for the request can also be specified in the packet.

**ring.** See *ring network*.

**ring network.** (1) 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) (2) A network configuration in which devices are connected by unidirectional transmission links to form a closed path.

**ring segment.** A section of a ring that can be isolated (by unplugging connectors) from the rest of the ring. See *LAN segment*.

**rlogin (remote login).** A service, offered by Berkeley UNIX-based systems, that allows authorized users of one machine to connect to other UNIX systems across an internet and interact as if their terminals were connected directly. The rlogin software passes information about the user's environment (for example, terminal type) to the remote machine.

**RNR packet.** A packet used by a data terminal equipment (DTE) or by a data circuit-terminating equipment (DCE) to indicate a temporary inability to accept additional packets for a virtual call or permanent virtual circuit.

**root bridge.** The bridge that is the root of a spanning tree formed between other active bridges in the bridging

network. The root bridge originates and transmits bridge protocol data units (BPDUs) to other active bridges to maintain the spanning tree topology. It is the bridge with the highest priority in the network.

**route.** (1) 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. (2) The path that network traffic uses to get from source to destination.

**route bridge.** A function of an IBM bridge program that allows two bridge computers to use a telecommunication 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.

**route extension (REX).** In SNA, the path control network components, including a peripheral link, that make up the portion of a path between a subarea node and a network addressable unit (NAU) in an adjacent peripheral node. See also *explicit route (ER)*, *path*, and *virtual route (VR)*.

**Route Selection control vector (RSCV).** A control vector that describes a route within an APPN network. The RSCV consists of an ordered sequence of control vectors that identify the TGs and nodes that make up the path from an origin node to a destination node.

**router.** (1) A computer that determines the 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. (3) In OSI terminology, a function that determines a path by which an entity can be reached. (4) In TCP/IP, synonymous with *gateway*. (5) Contrast with *bridge*.

**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.

**routing domain.** In Internet communications, a group of intermediate systems that use a routing protocol so that the representation of the overall network is the same within each intermediate system. Routing domains are connected to each other by exterior links.

**Routing Information Protocol (RIP).** In the Internet suite of protocols, an interior gateway protocol used to exchange intradomain routing information and to determine optimum routes between internet hosts. RIP deter-

mines optimum routes on the basis of route metrics, not link transmission speed.

**routing loop.** A situation that occurs when routers circulate information among themselves until convergence occurs or until the networks involved are considered unreachable.

**routing protocol.** A technique used by a router to find other routers and to remain up to date about the best way to get to reachable networks.

**routing table.** A collection of routes used to direct datagram forwarding or to establish a connection. The information is passed among routers to identify network topology and destination feasibility.

**Routing Table Maintenance Protocol (RTMP).** In AppleTalk networks, a protocol that provides routing information generation and maintenance on the transport layer by means of the AppleTalk routing table. The AppleTalk routing table directs packet transmission through the internet from source socket to destination socket.

**RouTing update Protocol (RTP).** The VIRTUAL NETworking System (VINES) protocol that maintains the routing database and allows the exchange of routing information between VINES nodes. See also *Internet Control Protocol (ICP)*.

**rsh.** A variant of the *rlogin* command that invokes a command interpreter on a remote UNIX machine and passes the command-line arguments to the command interpreter, skipping the login step completely.

## S

**SDU.** Service Data Unit, data as it appears at the interface between a layer and the layer immediately above.

**seed router.** In AppleTalk networks, a router that maintains configuration data (network range numbers and zone lists, for example) for the network. Each network must have at least one seed router. The seed router must be initially set up using the configurator tool. Contrast with *nonseed router*.

**segment.** (1) A section of cable between components or devices. A segment may 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) In Internet communications, the unit of transfer between TCP functions in different machines. Each segment contains control and data fields; the current byte-stream position and actual data bytes are identified along with a checksum to validate received data.



**segmenting.** In OSI, a function performed by a layer to map one protocol data unit (PDU) from the layer it supports into multiple PDUs.

**sequence number.** In communications, a number assigned to a particular frame or packet to control the transmission flow and receipt of data.

**server.** A functional unit that provides shared services to workstations over a network; for example, a file server, a print server, a mail server. (T)

**service access point (SAP).** (1) In Open Systems Interconnection (OSI) architecture, the point at which the services of a layer are provided by an entity of that layer to an entity of the next higher layer. (T) (2) A logical point made available by an adapter where information can be received and transmitted. A single service access point can have many links terminating in it.

**Service Advertising Protocol (SAP).** In Internetwork Packet Exchange (IPX), a protocol that provides the following:

- A mechanism that allows IPX servers on an internet to advertise their services by name and type. Servers using this protocol have their name, service type, and IP address recorded in all file servers running NetWare.
- A mechanism that allows a workstation to broadcast a query to discover the identities of all servers of all types, all servers of a specific type, or the nearest server of a specific type.
- A mechanism that allows a workstation to query any file server running NetWare to discover the names and addresses of all servers of a specific type.

**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.

**Simple Network Management Protocol (SNMP).** In the Internet suite of protocols, a network management protocol that is used to monitor routers and attached networks. SNMP is an application layer protocol. Information on devices managed is defined and stored in the application's Management Information Base (MIB).

**SLIP.** Serial Line IP, an IETF standard for running IP over serial communication links.

**SNA management services (SNA/MS).** The services provided to assist in management of SNA networks.

**SNAP.** (1) SubNetwork Access Protocol.  
(2) SubNetwork Attachment Point.

**socket.** An endpoint for communication between processes or application programs.

**source route bridging.** In LANs, 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 routing information field is inserted into the MAC header by the source node. The information in the routing information field is derived from explorer packets generated by the source host.

**source routing.** In LANs, 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 whether they should forward the frame.

**source service access point (SSAP).** In SNA and TCP/IP, a logical address that allows a system to send data to a remote device from the appropriate communications support. Contrast with *destination service access point (DSAP)*.

**spanning tree.** In LAN contexts, the method by which bridges automatically develop a routing table and update that table in response to changing topology to ensure that there is only one route between any two LANs in the bridged network. This method prevents packet looping, where a packet returns in a circuitous route back to the sending router.

**sphere of control (SOC).** The set of control point domains served by a single management services focal point.

**sphere of control (SOC) node.** A node directly in the sphere of control of a focal point. A SOC node has exchanged management services capabilities with its focal point. An APPN end node can be a SOC node if it supports the function to exchange management services capabilities.

**split horizon.** A technique for minimizing the time to achieve network convergence. A router records the interface over which it received a particular route and does not propagate its information about the route back over the same interface.

**spoofing.** For data links, a technique in which a protocol initiated from an end station is acknowledged and processed by an intermediate node on behalf of the final destination. In IBM 6611 data link switching, for example, SNA frames are encapsulated into TCP/IP packets for transport across a non-SNA wide area

network, unpacked by another IBM 6611, and passed to the final destination. A benefit of spoofing is the prevention of end-to-end session timeouts.

**standard MIB.** In the Simple Network Management Protocol (SNMP), a MIB module that is located under the management branch of the Structure of Management Information (SMI) and that is considered a standard by the Internet Engineering Task Force (IETF).

**static route.** The route between hosts, networks, or both that is manually entered into a routing table.

**station.** 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.

**StreetTalk.** In the Virtual Networking System (VINES), a unique network-wide naming and addressing system that allows users to locate and access any resource on the network without knowing the network topology. See also *Internet Control Protocol (ICP)* and *RouTing update Protocol (RTP)*.

**Structure of Management Information (SMI).** (1) In the Simple Network Management Protocol (SNMP), the rules used to define the objects that can be accessed by means of a network management protocol. (2) In OSI, the set of standards relating to management information. The set includes the *Management Information Model* and the *Guidelines for the Definition of Managed Objects*

**subarea.** A portion of the SNA network consisting of a subarea node, attached peripheral nodes, and associated resources. Within a subarea node, all network accessible units (NAUs), links, and adjacent link stations (in attached peripheral or subarea nodes) that are addressable within the subarea share a common subarea address and have distinct element addresses.

**subnet.** (1) In TCP/IP, a part of a network that is identified by a portion of the IP address. (2) Synonym for *subnetwork*.

**subnet address.** In Internet communications, an extension to the basic IP addressing scheme where a portion of the host address is interpreted as the local network address.

**subnet mask.** Synonym for *address mask*.

**subnetwork.** (1) Any group of nodes that have a set of common characteristics, such as the same network ID. (2) Synonymous with *subnet*.

**Subnetwork Access Protocol (SNAP).** In LANs, a 5-byte protocol discriminator that identifies the non-IEEE

standard protocol family to which a packet belongs. The SNAP value is used to differentiate between protocols that use \$AA as their service access point (SAP) value.

**SubNetwork Attachment Point (SNAP).** An LLC header extension that identifies the protocol type of a frame.

**subnetwork mask.** Synonym for *address mask*.

**subsystem.** A secondary or subordinate system, usually capable of operating independently of, or asynchronously with, a controlling system. (T)

**SVN.** Switched Virtual Networking, the name of IBM's framework for building and managing switch-based networks.

**switched virtual circuit (SVC).** An X.25 circuit that is dynamically established when needed. The X.25 equivalent of a switched line. Contrast with *permanent virtual circuit (PVC)*.

**synchronous.** (1) Pertaining to two or more processes that depend upon the occurrence of specific events such as common timing signals. (T)  
(2) Occurring with a regular or predictable time relationship.

**Synchronous Data Link Control (SDLC).** (1) A discipline conforming to subsets of the Advanced Data Communication Control Procedures (ADCCP) of the American National Standards Institute (ANSI) and High-level Data Link Control (HDLC) of the International Organization for Standardization, for managing synchronous, code-transparent, serial-by-bit information transfer over a link connection. Transmission exchanges may be duplex or half-duplex over switched or nonswitched links. The configuration of the link connection may be point-to-point, multipoint, or loop. (I) (2) Contrast with *binary synchronous communication (BSC)*.

**SYNTAX.** In the Simple Network Management Protocol (SNMP), a clause in the MIB module that defines the abstract data structure that corresponds to a managed object.

**system configuration.** A process that specifies the devices and programs that form a particular data processing system.

**system services control point (SSCP).** A component within a subarea network for managing the configuration, coordinating network operator and problem determination requests, and providing directory services and other session services for users of the network. Multiple SSCPs, cooperating as peers with one another, can divide the network into domains of control, with each SSCP having a hierarchical control relationship to the physical units and logical units within its own domain.

**Systems Network Architecture (SNA).** The description of the logical structure, formats, protocols, and operational sequences for transmitting information units through, and controlling the configuration and operation of, networks. The layered structure of SNA allows the ultimate origins and destinations of information, that is, the users, to be independent of and unaffected by the specific SNA network services and facilities used for information exchange.

## T

**Telnet.** In the Internet suite of protocols, a protocol that provides remote terminal connection service. It allows users of one host to log on to a remote host and interact as directly attached terminal users of that host.

**threshold.** (1) In IBM 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. (2) An initial value from which a counter is decremented to 0, or a value to which a counter is incremented or decremented from an initial value.

**throughput class.** In packet switching, the speed at which data terminal equipment (DTE) packets travel through the packet switching network.

**time to live (TTL).** A technique used by best-effort delivery protocols to inhibit endlessly looping packets. The packet is discarded if the TTL counter reaches 0.

**timeout.** (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 must be restarted.

**TLV.** Type/Length/Value, a generalized information element in a LAN Emulation packet.

**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) In LANs, a sequence of bits passed from one device to another along the transmission medium. When the token has data appended to it, it becomes a frame.

**token ring.** (1) According to IEEE 802.5, network technology that controls media access by passing a token (special packet or frame) between media-attached stations. (2) A FDDI or IEEE 802.5 network with a ring topology that passes tokens from one attaching ring

station (node) to another. (3) See also *local area network (LAN)*.

**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 circuit from node to node. A node that is ready to send can capture the token and insert data for transmission.

**topology.** In communications, the physical or logical arrangement of nodes in a network, especially the relationships among nodes and the links between them.

**topology database update (TDU).** A message about a new or changed link or node that is broadcast among APPN network nodes to maintain the network topology database, which is fully replicated in each network node. A TDU contains information that identifies the following:

- The sending node
- The node and link characteristics of various resources in the network
- The sequence number of the most recent update for each of the resources described.

**trace.** (1) A record of the execution of a computer program. It exhibits the sequences in which the instructions were executed. (A) (2) For data links, a record of the frames and bytes transmitted or received.

**transceiver (transmitter-receiver).** In LANs, a physical device that connects a host interface to a local area network, such as Ethernet. Ethernet transceivers contain electronics that apply signals to the cable and that sense collisions.

**Transmission Control Protocol (TCP).** A communications protocol used in the Internet and in any network that follows the U.S. Department of Defense standards for internetwork protocol. TCP provides a reliable host-to-host protocol between hosts in packet-switched communications networks and in interconnected systems of such networks. It uses the Internet Protocol (IP) as the underlying protocol.

**Transmission Control Protocol/Internet Protocol (TCP/IP).** A set of communications protocols that support peer-to-peer connectivity functions for both local and wide area networks.

**transmission group (TG).** (1) A connection between adjacent nodes that is identified by a transmission group number. (2) In a subarea network, a single link or a group of links between adjacent nodes. When a transmission group consists of a group of links, the links are viewed as a single logical link, and the transmission

group is called a *multilink transmission group (MLTG)*. A *mixed-media multilink transmission group (MMMLTG)* is one that contains links of different medium types (for example, token-ring, switched SDLC, nonswitched SDLC, and frame-relay links). (3) In an APPN network, a single link between adjacent nodes. (4) See also *parallel transmission groups*.

**transmission header (TH).** Control information, optionally followed by a basic information unit (BIU) or a BIU segment, that is created and used by path control to route message units and to control their flow within the network. See also *path information unit*.

**transparent bridging.** In LANs, a method for tying individual local area networks together through the medium access control (MAC) level. A transparent bridge stores the tables that contain MAC addresses so that frames seen by the bridge can be forwarded to another LAN if the tables indicate to do so.

**transport layer.** In the Open Systems Interconnection reference model, the layer that provides a reliable end-to-end data transfer service. There may be relay open systems in the path. (T) See also *Open Systems Interconnection reference model*.

**trap.** In the Simple Network Management Protocol (SNMP), a message sent by a managed node (agent function) to a management station to report an exception condition.

**tunneling.** To treat a transport network as though it were a single communication link or LAN. See also *encapsulation*.

**T1.** In the United States, a 1.544-Mbps public access line. It is available in twenty-four 64-Kbps channels. The European version (E1) transmits 2.048 Mbps. The Japanese version (J1) transmits 1.544 Mbps.

## U

**UNI.** User-Network Interface, the interface between user equipment and an ATM switch network.

**universally administered address.** In a local area network, the address permanently encoded in an adapter at the time of manufacture. All universally administered addresses are unique. Contrast with *locally administered address*.

**User Datagram Protocol (UDP).** In the Internet suite of protocols, a protocol that provides unreliable, connectionless datagram service. It enables an application program 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.

## V

**V.24.** In data communication, a specification of the CCITT that defines the list of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE).

**V.25.** In data communication, a specification of the CCITT that defines the automatic answering equipment and parallel automatic calling equipment on the General Switched Telephone Network, including procedures for disabling of echo controlled devices for both manually and automatically established calls.

**V.35.** In data communication, a specification of the CCITT that defines the list of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) at various data rates.

**V.36.** In data communication, a specification of the CCITT that defines the list of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) at rates of 48, 56, 64, or 72 kilobits per second.

**VCC.** Virtual Channel Connection, a connection between parties.

**VINES.** Virtual NETWORKing System.

**virtual circuit.** (1) 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*. (2) A logical connection established between two DTEs.

**virtual link.** In Open Shortest Path First (OSPF), a point-to-point interface that connects border routers that are separated by a non-backbone transit area. Because area routers are part of the OSPF backbone, the virtual link connects the backbone. The virtual links ensure that the OSPF backbone does not become discontinuous.

**Virtual Local Area Network (VLAN).** A logical grouping of one or more LANs based on protocol and subnet and used to isolate network traffic within these groups.

**Virtual Networking System (VINES).** The network operating system and network software from Banyan Systems, Inc. In a VINES network, virtual linking allows all devices and services to appear to be directly connected to each other, when they may actually be thousands of miles apart. See also *StreetTalk*.

**virtual route (VR).** (1) In SNA, either (a) a logical connection between two subarea nodes that is physically realized as a particular explicit route or (b) a logical

connection that is contained wholly within a subarea node for intranode sessions. A virtual route between distinct subarea nodes imposes a transmission priority on the underlying explicit route, provides flow control through virtual route pacing, and provides data integrity through sequence numbering of path information units (PIUs). (2) Contrast with *explicit route (ER)*. See also *path* and *route extension (REX)*.

## W

**wide area network (WAN).** (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 communication network designed to serve an area of hundreds or thousands of miles; for example, public and private packet-switching networks, and national telephone networks. (3) Contrast with *local area network (LAN)* and *metropolitan area network (MAN)*.

**wildcard character.** Synonym for *pattern-matching character*.

## X

**X.21.** An International Telegraph and Telephone Consultative Committee (CCITT) recommendation for a general-purpose interface between data terminal equipment and data circuit-terminating equipment for synchronous operations on a public data network.

**X.25.** (1) An International Telegraph and Telephone Consultative Committee (CCITT) recommendation for the interface between data terminal equipment and packet-switched data networks. (2) See also *packet switching*.

**Xerox Network Systems (XNS).** The suite of internet protocols developed by the Xerox Corporation. Although similar to TCP/IP protocols, XNS uses different packet formats and terminology. See also *Inter-network Packet Exchange (IPX)*.

## Z

**zone.** In AppleTalk networks, a subset of nodes within an internet.

**Zone Information Protocol (ZIP).** In AppleTalk networks, a protocol that provides zone management service by maintaining a mapping of the zone names and network numbers across the internet on the session layer.

**zone information table (ZIT).** A listing of network numbers and their associated zone name mappings in the internet. This listing is maintained by each internet router in an AppleTalk internet.



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# Communicating Your Comments to IBM

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Interface Configuration and  
Software User's Guide  
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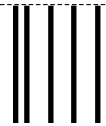


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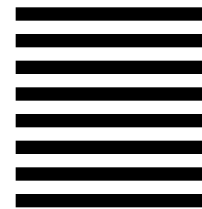
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