Distributed Routing Software

System Software Guide

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This manual provides information about installing, configuring, and operating the Distributed Routing Software system software.

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Maynard, Massachusetts

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3 Booting, Dumping, and Upgrading the System

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Objectives

This manual contains information for installing, configuring, and operating the Digital Distributed Routing Software. Specifically, this guide enables you to:

- Configure, monitor, and use the MOS (micro-operating system) bridging router software.

- Configure, monitor, and use the interfaces and Link Layer software supported by your bridging router.

This preface describes how to use this book and the documentation set to which it belongs.

Audience

This manual is intended for persons who install and operate computer networks. Although experience with computer networking hardware and software is helpful, you do not need programming experience to configure, monitor, and manage your network.

Preface

Using This Guide

The following table helps you locate information in this guide.

If You Want Information About...	See Chapter or Appendix...
• Summary of document contents • Related documentation • Document set structure • Documentation Conventions	Preface
• Local and remote terminals • Using the user interface • Using EasyStart • Using the OPCON Process • Using the CONFIG Process • Using the Console Process	**1** Getting Started
• Configuring interfaces, protocols, users, and booting • Quick configuration and specific router capabilities • Entering and exiting CONFIG • CONFIG commands • Feature names and numbers • Protocol names and numbers • Default and maximum settings for interfaces • Restarting the router • CONFIG-ONLY mode	**2** Configuring the System
• Entering and Exiting Boot CONFIG • Dumping • Boot CONFIG commands • Using Trivial File Transfer Protocol (TFTP) between memory, IBD, and diskette • The BOOTP forwarding utility • Upgrading system software	**3** Booting, Dumping, and Upgrading the System

If You Want Information About...	See Chapter or Appendix...
• Entering and exiting GWCON • GWCON Commands	**4** Monitoring the System
• Entering and exiting ELS configuration and monitoring menus • Interpreting ELS messages • Capturing ELS output • Setting up traps • Using ELS for troubleshooting • ELS commands	**5** Using the Event Logging System
• Commands affecting MONITR • Entering and exiting MONITR • Receiving MONITR messages	**A** The MONITR Process

Preface

Using Related Documentation

Digital Documents

This Document...	Describes...
RouteAbout Access EI Installation EK-DEXBR-TE	Installation and use of the RouteAbout Access EI router.
RouteAbout Access EW Installation EK-DE28R-IN	Installation and use of the RouteAbout Access EW router.
RouteAbout Access TW Installation EK-DEWTR-IN	Installation and use of the RouteAbout Access TW router.
RouteAbout Central EW Installation EK-DEZ8R-IN	Installation and use of the RouteAbout Central EW router.
RouteAbout Central EI Installation EK-DEZBR-IN	Installation and use of the RouteAbout Central EI router.
Bridging Configuration Guide AA-QL29D-TE	The configuration and monitoring procedures for bridging methods. Bridging features that enhance system performance.
Event Logging System Messages Guide AA-QL2AD-TE	How events are logged, how to interpret Event Logging System (ELS) messages. Provides a description of each ELS message with a corresponding corrective action.
Network Interface Operations Guide AA-QL2BD-TE	Configuring and monitoring the network interfaces in the Distributed Routing Software bridging router.

This Document...	Describes...
Routing Protocols User's Guide, AA-QL2CD-TE	How to configure and monitor the following protocols: • AppleTalk Phase 1 • AppleTalk Phase 2 • ARP • Bandwidth Reservation • BGP4 • DVMRP • IP • IPX • OSPF • OSI/DNA V • PIM • SNMP How to use the Digital Trace Facility.
Protocol Quick Reference Card Set	How to configure and monitor a protocol, feature, or interface, and lists the associated commands.
Routing Protocols Reference Guide AA-QL2CD-TE	Reference information about the micro-operating system structure, and the protocols and interfaces supported by bridging routers.
Systems Network Architecture Guide AA-QU5SB-TE	SNA interfaces and protocols for the Distributed Routing Software System.

Document Set Structure

Figure 1 shows the structure of the documentation set.

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Figure 1   Document Set Structure
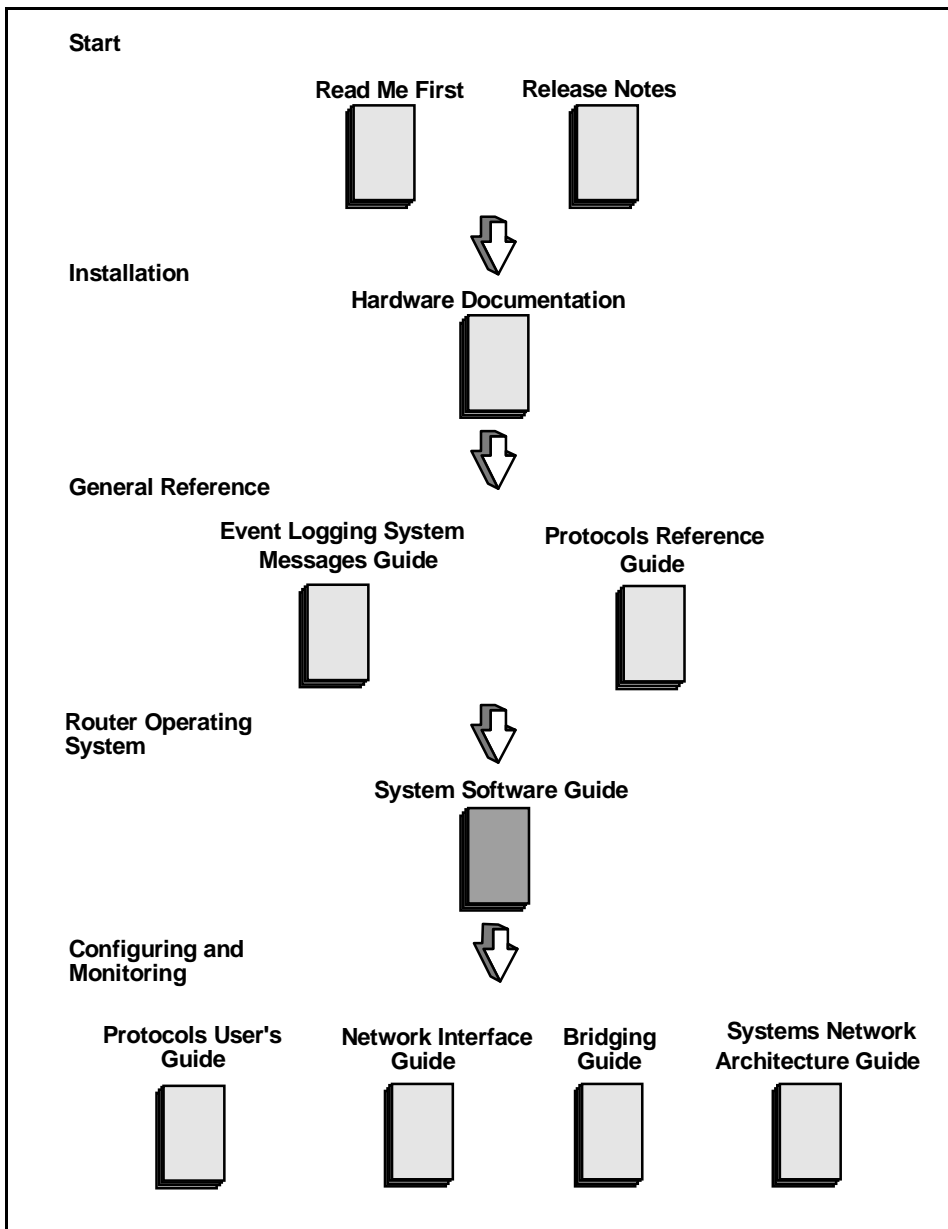
Conventions

The following conventions are used in this manual:

`Monospace type`	Monospace type in examples indicates system output or user input.
Boldface type	Boldface type in examples indicates user input. Boldface type is also used for file names and command names within text.
lowercase italics	Lowercase italics in command syntax or examples indicate variables for which either the user or the system supplies a value.
[ ]	Brackets enclose operands or symbols that are either optional or conditional. Specify the operand and value if you want the condition to apply. Do not type the brackets in the line of code.
key	A key name enclosed in a box indicates that you press the specified key.
CTRL/x	indicates that you hold the Ctrl key while pressing the key specified by the *x*. The server displays the key combination as ^x.
underscore	Characters underlined in a command listing represent the fewest number of characters you must enter to identify that command to the interpreter. Characters are also underlined to indicate emphasis, such as notes and cautions.

Commands

Figure 2 shows command components.

Figure 2   Command Components

> # Command Name
>
> Description of commands.
>
> **Syntax:**   command name
> parameter 1 . . .
> parameter 2 . . .
>
> parameter   *option*
>
> Description of parameter and options.
>
> Example: **command name   parameter**
>
> Prompt? **options**
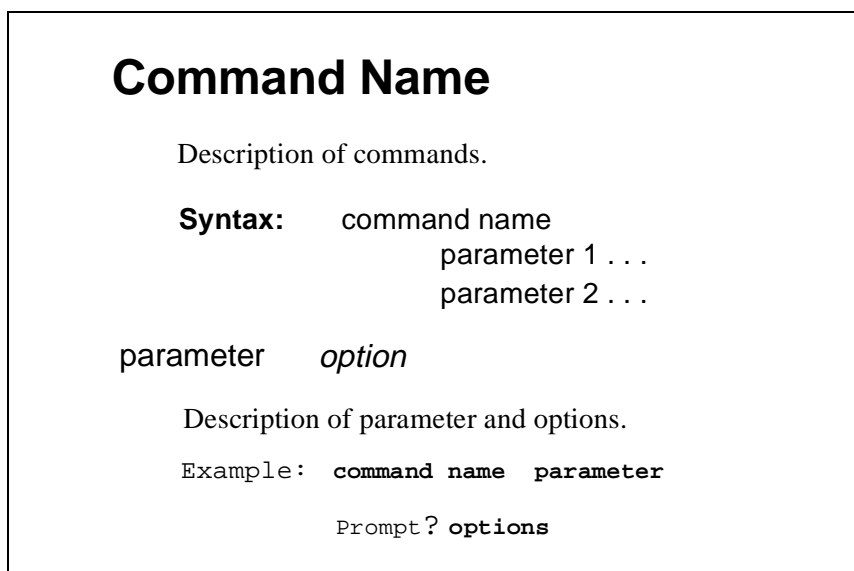
Syntax: The command followed by each parameter you can configure using that command. If an ellipsis follows a parameter, you need to enter additional information (*options*). When you enter a command, you can save time by typing only the underlined letters.

parameter   Description of each parameter.

option   (in italics) Information you must enter with the command and parameter.

Example: An example of how you enter that command and parameter.

Entering Commands

Instead of being prompted for options, you can save time by entering the complete com-mand on one line. For example, you can enter the **set framesize** command shown in Figure 3 as follows:

```
set framesize 2048
```

If you abbreviate the command using the underlined letters, you can enter

```
s f 2048
```

Figure 3   Set Framesize Command

Set

Configure frame size and local address.

Syntax: set

framesize . . .

framesize   *1024* or *2048* or *4096*

Thes size of the network-layer portion of frames transmitted and received on the interface.

```
Example: set framesize

          Framesize in bytes (1024/2048/4096) [1024]? 2048
```

Accepting the Current Setting

When the software prompts you for information, the current setting appears in brackets [ ]. To accept the information in the brackets, press RET. In this example, the current set-ting is 1024.

```
Framesize in bytes (1024/2048/4096) [1024]?
```

Preface

Reader's Comments

If you have comments or suggestions about this document, contact the Network Product Business Group.

- Send Internet electronic mail to: doc_quality@lkg.mts.dec.com

- Send comments via FAX to: 508-486-5655

- Send hardcopy mail to:

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Shared Engineering Services
550 King Street (LKG1-3/L12)
Littleton, MA 01460-1289

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1
Getting Started

This chapter discusses components related to the bridging router and the system software. It explains how to configure the bridging router software and how to monitor the software and network interfaces.

1.1 Before You Begin

Before you start, refer to the following checklist to make sure that your router is installed as described in your hardware installation guide.

DID YOU...

- Install all necessary hardware? Refer to the appropriate hardware module installation guide.

- Connect the console terminal (video terminal) to the router? Refer to the appropriate hardware module installation guide.

Note: EasyStart software can eliminate the need for a console terminal.

- Connect your router to the network using the proper network interfaces and cables? Refer to the appropriate hardware module installation guide.

- Run all necessary hardware diagnostics? Refer to the appropriate hardware module installation guide.

- Install the router software if it was not preinstalled or if you are upgrading the software? Refer to your module's hardware installation manual or to the Release Notes shipped with the software upgrade.

1.2 Using Router Consoles

The router console lets you use the router software user interface to monitor and change the function of the router's networking software. The router supports local and remote consoles. The following sections explain each type.

1.2.1 Local Console

A local console may be required for the initial configuration of the router software
(the EasyStart configuration software can eliminate the need for a console). The
local console is directly connected to the router hardware or through a modem, and
the router software automatically handles the console activity. When upgrading the
software, you may need to use the local console.

Note: After the initial configuration, you do not need a local console for router
management if either IP forwarding or TCP/IP Host Services is enabled.

1.2.2 Remote Consoles

Remote consoles connect to the router using a standard remote terminal protocol and
provide the same functionality as local consoles. No more than two remote consoles
can be used at the same time on the same router. You can connect remote consoles
to the router through a Telnet connection. You may disable the remote console fea-
ture.

1.2.2.1 Telnet Connections

The router supports both the 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
Operator Console [OPCON (*)] process.

1.2.2.2 Remote Login Names and Passwords

During a remote login, the router prompts you for a login name and password.

Use the **add user** command to supply a login name and password for remote access
to the router. These user-configurable login names and passwords control access to
the router.

Note: The router drops the Telnet connection if either of the following condi-
tions occurs: you do not enter a login name and valid password within a
minute of the initial prompt, or you enter three incorrect passwords in
succession.

Multiple users with login permissions may also be added using the **add user** com-
mand. See Chapter 3 for more details on the **add user** command.

1.2.2.3 Logging In Remotely

To log in from a remote system:

1. Connect to the router by starting Telnet and supplying the router's name or Internet Protocol address. For example:

   ```
   % telnet brandenburg
   ```

   or

   ```
   % telnet 128.185.132.43
   ```

Note: To use router names, your network must have a name server.

2. At the login prompt, enter your login name. The prompts are shown below:

   ```
   login:
   Password:
   ```

Note: The login and password prompts appear only if at least one administrative user account is set up on the router. Otherwise, logins are disabled by default.

Note: The login name is case sensitive.

3. If a password is not set, press RET at the password prompt.

4. Press Enter to obtain the main router prompt. This is displayed as an asterisk (*). Depending on the state of the Remote Operator Console process (ROPCON), you may need to press RET more than once or press CTRL/p to obtain the asterisk (*) prompt.

   When the main prompt appears, you can enter commands from the keyboard. Use the BACKSPACE key to delete the last character entered; use DEL or CTRL/u to delete all the characters entered on the command line allowing you to re-enter a command.

5. To exit the router, return to the main router prompt (*) and close the Telnet connection. For example:

   ```
   IP Config> exit
   Config> CTRL/p
   * logout

   %
   ```

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

1.3 Using the Router User Interface

This section describes the router's user interface processes and explains how to communicate with them.

1.3.1 User Interface Processes in the Router

The user interface to the router software consists of the main process, OPCON, and several subsidiary processes. These processes enable you to control and monitor the operations of the router. The three processes you communicate with most often are OPCON, Gateway Configuration (GWCON), and Configuration (CONFIG).

A configuration process called EasyStart can download the router's initial configuration, eliminating the need for a local console for each router.

Figure 1–1 shows the processes and how they fit within the structure of the router software.

Figure 1–1 Router Software Processes
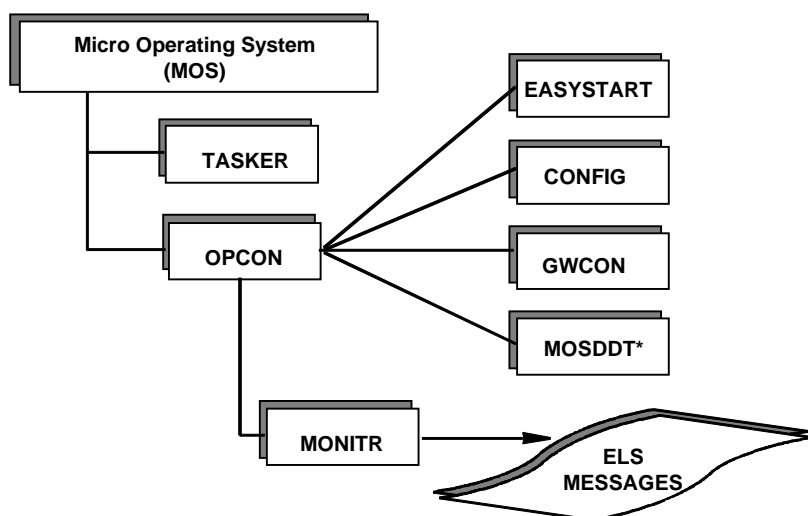
*Not available on all platforms

LKG-09869-95I

The following is a list of processes on the router:

- TASKER – Runs the router's main networking software and performs the router's internetwork data transfer operations.

- OPCON – Runs the main operator control program.

- EASYSTART – Downloads the router's initial configuration.

- CONFIG – Provides online control of various configuration parameters, such as network addresses and event logging. This manual concentrates on the CONFIG process and all its related protocol and interface configuration processes.

  You can also run the QUICK CONFIG command from the CONFIG process. The router runs QUICK CONFIG if it determines that it has insufficient configuration information to enable it to run.

- GWCON (or CGWCON) – Provides online monitoring of the various software components, such as protocols, network interfaces, and event logging.

- MOSDDT – The router debugging process.

- MONITR (Monitor) – Performs message printing services.

The following modes are also accessible through the system:

- COPCON – Provides OPCON service for one directly-connected console.

- ROPCON – Provides OPCON service for two remotely-connected console terminals.

- QUICK CONFIG – Provides a simple way to configure devices, set bridging and routing protocols, and create booting records. It is a special command of the CONFIG process.

- CONFIG-ONLY – Uses the same commands as those of the CONFIG process plus the **restart** and **reload** commands. It is a special CONFIG mode that is invoked when the router configuration is corrupted.

1.4 Using EasyStart

EasyStart is an initialization process that enables a Bridging Router to do the following:

- Act as a BOOTP client when it has no configuration information available - typically, when it is started for the first time.

- Download its configuration file from a host using the TFTP protocol.

- Send and receive BOOTP messages over PPP and Proteon Serial (WAN) interfaces, as well as over LAN interfaces.

As a BOOTP client, the router can send BOOTP requests to a BOOTP server to discover its IP address and the location of its configuration file. This eliminates the need to use a console terminal to provide initial configuration information.

The BOOTP and TFTP protocols are more fully explained in Chapter 3.

1.4.1 How EasyStart Works

EasyStart starts automatically if no configuration information is available in the router. This would be in either of the following circumstances:

- You are starting the router for the first time, and you have not entered configuration information through the console terminal.

- You have cleared the router's configuration and restarted the router.

When EasyStart first runs, it does the following:

1. Sends out BOOTP requests on all interfaces that are up.

2. If it receives a reply from a BOOTP server, stores the information and starts up TFTP.

3. Sends a TFTP request for the configuration file, specifying the location learned from the BOOTP server.

4. Once the configuration file is received, restarts the router. The new configuration parameters then take effect.

1.4.2 The Configuration File

The term **configuration file** refers to the binary file holding the router's configuration. The configuration file is also known as an SRAM file. There are two ways to create a configuration file:

*   In the Router Configurator. When you create or change a router configuration, the Router Configurator creates a new configuration file.

*   Using the **TFTP put** command (described in Chapter 3) to transfer an existing router configuration to a file on a host. You can then use EasyStart to reload this file to the router, provided that you have cleared its memory first.

1.4.3 BOOTP Servers

A BOOTP server contains a file listing the BOOTP clients the server is responsible for. This list is also known as the **BOOTP database.** The BOOTP database contains each client's IP address and MAC address, and the location of a file to be loaded. It may also contain other information, such as the hardware type of the router interface used for BOOTP.

A BOOTP server can be any of the following:

*   A UNIX host with a bootpd daemon.

*   A DOS host running BOOTP server software.

*   A Windows NT™ or Windows 95® system running the Router Configurator.

For information about setting up BOOTP information on UNIX or DOS BOOTP servers, refer to the host documentation.

1.4.4 EasyStart and the Router Configurator

The Router Configurator includes a BOOTP server implementation, and automatically sets up a BOOTP database on the PC on which it runs. For each router you configure, the Router Configurator does the following:

- Adds the router's IP address, MAC address and the configuration file location to the BOOTP database on the PC.

- Creates a loadable configuration file

If you wish to use BOOTP on the router's WAN interfaces, you will need to do some additional configuration; refer to **EasyStart Setup: WAN Interfaces**.

You can prevent the Router Configurator from setting up BOOTP information, by disabling BOOTP in the **Load Preferences** window.

1.4.5 EasyStart Setup: LAN Interfaces

In order for EasyStart to work, you need to do the following:

- Add the router to the BOOTP database on the BOOTP server. Either use the Router Configurator, or refer to the BOOTP documentation for the host used as the BOOTP server.

- Create a configuration file for the router, as described on page 1-7.

Note that the name of the configuration file in the BOOTP database entry must be in the following form:

config.*router-name*

where *router-name* is the name of the router.

1.4.6 EasyStart Setup: WAN Interfaces

BOOTP requires that the BOOTP database map the BOOTP client's MAC address to its IP address. Since WAN interfaces do not use MAC addresses and do not run ARP, BOOTP is generally not implemented over WAN interfaces.

EasyStart provides an extension to the BOOTP protocol that allows the router to use BOOTP over WAN interfaces. The extension provides a special format for WAN interface MAC addresses that you must use in the router's entry in the BOOTP database.

This section describes the requirements for using BOOTP over WAN interfaces, and the additional configuration you need to do.

1.4.6.1 General Requirements

In order to use BOOTP over the router's WAN interfaces, the following requirements must be met:

- The WAN interface using BOOTP must be connected to a BOOTP relay agent that can communicate with the required BOOTP server.

- The WAN interface on the BOOTP relay agent, to which the router connects, must be running either PPP or the Proteon Serial protocol. EasyStart will try both protocols in turn when sending BOOTP requests; if one does not work, it will try the other.

- The WAN interface on the BOOTP relay agent must have an IP address.

- The router's BOOTP client entry on the BOOTP server must use the required format, as described in **Requirements for the BOOTP Server**.

1.4.6.2 Configuring the BOOTP Relay Agent

To configure the system to which your router's WAN interface connects as a BOOTP relay agent, follow these steps:

1. If BOOTP forwarding has not been enabled on the system, enable it by entering the following command:

   ```
   IP Config> enable bootp
   ```

2. Specify the IP address of the BOOTP server:

   ```
   IP Config> add BOOTP-SERVER ipaddress of server
   ```

   where *ipaddress of server* is the IP address of the BOOTP server for your router.

Note that you can use the Router Configurator to set up a router as a BOOTP relay agent. Refer to Chapter 3 for more information about BOOTP relay agents.

1.4.6.3 Requirements for the BOOTP Server

In the router's entry in the BOOTP database on the BOOTP server, you need to do the following:

- Specify the WAN interface's MAC address as six pairs of hexadecimal digits in the following format:

  80 00 *aa bb cc dd*

  where:

  `aa bb cc dd` are the digits (in hexadecimal) of the IP address of the BOOTP Relay agent's WAN interface.

- Specify the hardware type as 6.

In addition, make sure that the name of the configuration file in the default directory for BOOTP files is in the following form:

  config.*router-name*

  where *router-name* is the name of the router.

By default, BOOTP looks for the file name in this form. Refer to your BOOTP server documentation for the name of the default directory for BOOTP files.

1.4.6.4 Example

You want Router 1 in Figure 1–2 to discover its IP address from BOOTP server 16.24.10.117, over its WAN link. The WAN link is connected to interface 1.2.2.2 on the BOOTP relay agent. The BOOT relay agent is configured to know the IP address of the BOOTP server 16.24.10.117.

Figure 1–2   Example Configuration for BOOTP
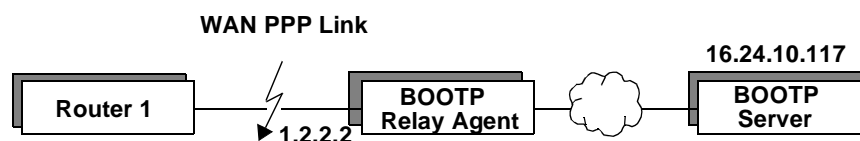
If the BOOTP server is a UNIX system, then:

- The entry for Router 1 in the BOOTP database (`bootptab` file) could be:

  ```
  router-1:ht=6:ha=800001020202:
  ```

- The configuration file would be named:

  ```
  config.router-1
  ```

1.4.6.5 Using the Router Configurator

If you wish to use the Router Configurator to set up BOOTP WAN interfaces, do the following:

1. Configure the router in the usual way.

2. Go to the **EasyStart BOOTP** tab page under the **System** button. For each WAN interface that you want to use for BOOTP, enter the IP address of the BOOTP relay agent WAN interface to which it connects.

1.4.7 Using EasyStart to Load a Configured Router

You may wish to clear all information from a configured router and use EasyStart to reload a configuration file. Follow these steps:

1. Start CONFIG and enter the following:

   ```
   Config>clear all

   You are about to clear all non Device configuration information
   Are you sure you want to do this (Yes or [No]): yes
   non Device configuration cleared
   ```

2. Enter the following:

   ```
   Config>clear device

   You are about to clear all Device configuration information
   Are you sure you want to do this (Yes or [No]): yes
   Device configuration cleared
   ```

3. Enter the following command to restart the router:

   ```
   *restart
   Are you sure you want to restart the gateway? (Yes or [No]): yes


   Entering EasyStart operation.
   Type 'stop' to terminate.
   ELS messages are automatically displayed in this mode.

   EasyStart>

     EZ.001: Starting.
     EZ.007: Waiting up to 30 seconds for devices to pass self-test.
   ```

Note the following:

- None of these steps is reversible.

- You must enter **clear all** before you enter **clear device**.

1.4.8 Stopping EasyStart

You can pause or stop an EasyStart session at any time by typing **pause** (to hold the program), or **stop** (to end the program).

If you type **stop**, the router clears all the changes EasyStart made, restarts, and puts you into Quick Config automatically.

1.5 Using the OPCON Process

The Operator Console process (OPCON) is the root level process of the router software user interface. The main function of OPCON is to control the processes that are connected to consoles. Using OPCON commands, you can do the following:

- Configure a process.

- Change the intercept character.

- Reload the router software.

- Monitor a process.

- Communicate with other processes.

- Manipulate the output from a process.

- Restart the router software.

- Telnet to other routers or hosts.

- Display process statistics.

- Display information about router memory usage.

- Display status information about all router processes.

Refer to Figure 1-1 to see how OPCON fits into the router software structure.

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

1.6 Entering the OPCON Process

When you start the router (before users are configured), a platform-specific installation menu appears on the console followed by the OPCON prompt (*). At this point, you can begin entering OPCON commands.

1.6.1 Process 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 RET 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 all the characters entered on the command line, allowing you to re-enter a command.

1.6.2 Getting Help

You can obtain help at any of the OPCON, GWCON, or CONFIG prompts by pressing ? followed by RET. Help is displayed as a list of the commands available at that prompt level. Use **? (help)** to list the commands that are available from the current prompt level. You can enter a ? after a specific command name to list its options.

1.7 Communicating with Different Processes

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 operations are identical.

Processes interact with consoles by means of input and output channels. Using OPCON commands, you pass commands from your console to the input channel of any process and control any consoles attached to the output channel.

1.7.1 Connecting to a Process

To connect your console to a process, use the OPCON **talk** *pid* command, where *pid* (process ID) is the number of the process to which you want to connect.

To find the pid number of a process, use the OPCON **status** command. The **status** command displays information about the router processes, such as the pids and process names.

1.8 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 1–1. To use them, access the OPCON process and enter the OPCON command at the OPCON prompt (*).

Table 1–1 OPCON Commands

Command	Function
? (Help)	Lists all the OPCON commands.
Breakpoint	Enters the DDT debugger.
Divert	Sends output from a process to a console or other terminal.
Dump	Dumps the contents of router memory to a remote host specified by the Boot config dump-entry records.
Flush	Discards the output from a process.
Halt	Stops a process output.
Intercept	Sets the OPCON default intercept character.
Logout	Logs out a remote console.
Memory	Reports the router's memory usage.
Restart	Restarts (but does not reload) the router software.
Reload	Reloads the router software.
Status	Shows information about all router processes.
Talk	Contacts another router process and enables the use of its commands.
Telnet	Connects to a remote host.

? (Help)

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:  ?

    BREAKPOINT
    DIVERT output from process
    DUMP contents of memory
    FLUSH output from process
    HALT output from process
    INTERCEPT character is
    LOGOUT
    MEMORY statistics
    RESTART
    RELOAD
    STATUS of process(es)
    TALK to process
    TELNET to IP-Address (this terminal type)
```

Breakpoint

Trap information in the DDT debugger, inspect memory, place breakpoints, or
obtain a memory dump. Because the watchdog is always running, when you use the
breakpoint command, the contents of memory are dumped when the watchdog
timer expires.

Note: Do not use this command during normal operation because it halts opera-
tion of the software. If you accidentally enter the **breakpoint** command,
quickly press ESC/p .

Syntax: breakpoint

```
Example:  breakpoint
```

Divert

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 view the
output simultaneously. The **divert** command is commonly used to redirect
MONITR output messages to a specific terminal. The router allows only certain pro-
cesses to be redirected.

After entering the command, enter the pid and tty# (number of the output terminal). The terminal number can be the number of either the local console (tty0) or one of the remote consoles (tty1, tty2,...ttn). The example below shows Event Logging System messages generated by the MONITR process (**2**) being sent to a remote console *tty1* (**1**).

Syntax: d̲ivert *pid tty#*

Example: **divert 2 1**

Dump

Dump the contents of router memory to a remote host and file name specified by the Boot config dump-entry records.

Syntax: dump

Flush

Discard all subsequent output from a specified process until the **divert** or **talk** command is issued to that process. The router only allows certain processes to be redirected.

Syntax: f̲lush *pid*

Example: **flush 2**

Halt

Suspend all subsequent output from a specified process until the **divert, flush,** or **talk** command is issued to the process. The router cannot redirect all processes. **Halt** is the default state for output from a process.

Syntax: halt pid

Example: **halt 2**

Intercept

Change the OPCON intercept character. You enter the **intercept** character from other processes to get back to the OPCON process. The default intercept character is CTRL/p .

Note: Do not set the intercept character to the return key or to a printable character.

Syntax: intercept *character*

Example: **intercept** CTRL/p

Logout

Terminate remote console sessions.

Syntax: logout

Example: **logout**

Memory

Obtain and display information about the router's global heap memory usage.

Syntax: memory

Example: **memory**

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

Idle   Specifies the number of bytes previously allocated but freed and available for reuse. The sum of the Idle and Free memory equals the total available heap memory.

Free   Specifies the number of bytes that were never allocated from the initial free storage area. The sum of the Idle and Free memory equals the total available heap memory.

Restart

Reinitialize the software. When the software initializes, it forces a bus reset, which causes the connected network interfaces to perform their self-test routines, to clear all routing tables, and to drop any packets in the router. Before the restart takes effect, the software prompts you for confirmation. This command is functionally equivalent to pressing the reset button, except that in the latter case the router dumps (if dumping is enabled). The router does not dump when it executes the **restart** command. A restart reinitializes the router, and runs the same image.

Note: If you use this command from a remote console, your Telnet session will be lost.

Syntax: <u>res</u>tart

```
Example:  restart

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

Reload

Obtain a new copy of the router software specified by the boot-entry records. This new image is stored in FLASH and is run each time the router boots. Before the reload takes effect, the software prompts you for confirmation.

Syntax: <u>rel</u>oad

```
Example:  reload

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

Status

Display information about all router processes. By entering the pid after the **status** command, you can select the status of a particular process. The example below shows the total status display. The actual processes may be different depending on the hardware you are using.

Syntax: <u>s</u>tatus *pid*

```
Example:  status
```

```
Pid     Name    Status  TTY     Comments
1       COpCon  IOW     TTY0
2       Monitr  DET     --
3       Tasker  IDL     --
4       MOSDDT  DET     --
5       CGWCon  IOW     --
6       Config  IOW     --
7       DEChub  IDL     --
8       ROpCon  IOW     TTY1    128.186.314.132
9       ROpCon  RDY     TTY2    128.186.314.133
```

Note: ISDN devices (AW90EI and AW900EI) indicate six additional processes
at the *** stat** command. These processes manage the ISDN interfaces,
but are not accessible:

* status

```
Pid     Name    Status  TTY     Comments
10      CES3    IDL     --
11      TOUT    IDL     --
12      L2S3    IDL     --
12      L3L2    IDL     --
14      LLL2    IDL     --
15      S3CE    IDL     --
```

Pid   The process ID. This is the process that communicates with OP-
                   CON, or it can be an argument to the STATUS command to request
                   status information about a specific process.

Name   The process name.

Status   One of the following:

- **IDL** – This process is idle and waiting for completion of an external event, such as asynchronous I/O.

- **RDY** – This process is ready to run and is waiting to use the CPU.

- **IOW** – This process is waiting for synchronous I/O to complete.

- **DET** – This process has output ready to be displayed and is either waiting to be attached to a display console or waiting to have its output diverted to a specified console.

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

TTYn   The output terminal, if any, to which the process is currently connected. TTY0 indicates a local console while TTY1 or TTY2 denote Telnet consoles. "Sink" indicates that a process was flushed. Two dashes (- -) indicate that a process was halted.

C*omments*   The user's login IP address provided when a user is logged on using Telnet (ROPCON).

Talk

Attach to other router processes, such as GWCON 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 processes. To obtain the pid, use the OPCON **status** command.

Syntax: t̲alk *pid*

```
Example:  talk 5
```

Telnet

Remotely attach to another bridging router or to a remote host (*ip address*). The only optional parameter is the terminal type that you want to emulate. Enter any 80-character terminal type.

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

Telnet uses the terminal type that you supply on the command line on the remote host to define the characteristics of the Telnet session.

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

Syntax: <u>te</u>lnet *ip address <terminal type>*

```
Example:  telnet 128.185.10.30
                   or
          telnet 128.185.10.30  vt100

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

If you are telneting to a nonexistent IP address, the router displays the following:

```
     Trying 128.185.10.30  ...
```

To enter the **telnet** command mode, type the escape character **^]**.

```
   telnet>
```

The **telnet** command mode consists of four subcommands that allow you to close the current connection, to quit the current session, to send an ayt (Are You There) to your current connection, or to display status about the connection. For example:

```
   telnet> ?
   closeclose current connection
   quitexit telnet
   statusprint status information
   sendtransmit special characters ('send ?' for more)
   ? print this help information
```

Note: Press RET to resume a telnet session that you temporarily escaped (by pressing CTRL-]).

The **status** and **send** sub-commands elicit 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 only supports 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 **telnet** command mode, to close a connection, or to terminate a Telnet session.

```
telnet> close
```

or

```
telnet> quit

logout
*
```

1.9 Getting Back to OPCON

You must always return to OPCON before you can communicate with another process.   To get back to OPCON, press CTRL/p .   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.

1.10 Accessing and Using the Configuration Process

This section describes how to access the configuration process.

All interfaces described in the *Network Interface Operations Guide* and all protocols described in the *Routing Protocols User's Guide* have commands that are executed by accessing the *configuration* process to configure, enable, or modify the interface or protocol.

The procedures to access this process are basically the same for both. The following sections describe these procedures.

1.10.1 Accessing Configuration Commands

You access configuration commands through the router's CONFIG process.

When you log onto the router from a directly connected console, your process is the Connected Operator Console process (COPCON) and is process identifier (pid) 1. When you log onto the router through a Telnet session, your process is one of the two Remote Operator Console processes (ROPCON) with pid 7 or 8. These processes are collectively known as OPCON.

As one of the OPCON processes, you can connect to (**talk**) any of the four user-accessible processes:

- MONITR – The Monitor process (pid 2) that displays ELS messages.

- GWCON – The Gateway Console process (pid 5) that displays router statistics and lets you manipulate the volatile environment.

- CONFIG – The Configuration process (pid 6) that configures the nonvolatile environment.

- DEBUG – The Debug process (pid 4) that is used for debugging.

Only one user can **talk** to each of these processes at a time. If another user chooses to **talk** to the same process you are currently using, the message "Output Redirected" is displayed, and you are returned to your originating process. The user who redirected the process that you were talking to receives all redirected output from the process that had not yet appeared on your screen. Any command executing while you were talking to that process completes, unless the current user cancels it.

You use the Configuration process (CONFIG) to manipulate configuration information for the router. Within the context of the CONFIG process, and available from the `Config>` prompt, are configuration commands that are logically grouped according to interface or protocol function. Each interface and protocol configuration module has its own prompt. For example, the prompt for the TCP/IP protocol command interface is `IP config>`.

To access a configuration prompt, do the following:

- Enter the CONFIG command process from OPCON and obtain the CONFIG prompt: `Config>`

- Invoke the desired interface or protocol configuration prompt from the CONFIG prompt using the appropriate command described in the sections that immediately follow. You can enter the minimum number of characters that makes the command unique such as **p**, **pr**, and so forth for **protocol**, or **n**, **net**, and so forth for **network**.

The following sections describe these procedures in more detail.

1.10.1.1 Entering the CONFIG Process

To enter the CONFIG command process from OPCON and obtain the CONFIG prompt (Config>), perform the following steps:

1. At the OPCON prompt, enter the **status** command to find the pid of CONFIG.

```
* status

Pid    Name    Status  TTY     Comments
 1     COpCon  IOW     TTY0
 2     Monitr  DET     --
 3     Tasker  IDL     --
 4     MOSDDT  DET     --
 5     CGWCon  IOW     --
 6     Config  IOW     --
 7     DEChub  IDL     --
 8     ROpCon  IOW     TTY1    128.186.314.132
 9     ROpCon  RDY     TTY2    128.186.314.133
```

Note: ISDN devices (AW90EI and AW900EI) indicate six additional processes at the *** stat** command. These processes manage the ISDN interfaces, but are not accessible:

```
* status

Pid    Name    Status  TTY     Comments
10     CES3    IDL     --
11     TOUT    IDL     --
12     L2S3    IDL     --
12     L3L2    IDL     --
14     LLL2    IDL     --
15     S3CE    IDL     --
```

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 RET again.

1.10.1.2 Accessing an Interface Configuration Prompt

This process gives you access to a specific interface's configuration commands. To access the router's configuration process, perform the following steps:

1. At the CONFIG prompt, enter the **list devices** command to see the network interface numbers for which the router is currently configured. For example:

    The following example applies to the DECswitch 900EE.

    ```
    Config>list devices

    Ifc 0 (Ethernet): CSR      0, vector 0
    Ifc 1 (Ethernet): CSR      1, vector 0
    Ifc 2 (Ethernet): CSR      2, vector 0
    Ifc 3 (Ethernet): CSR      3, vector 0
    Ifc 4 (Ethernet): CSR      4, vector 0
    Ifc 5 (Ethernet): CSR      5, vector 0
    ```

    The following example applies to the RouteAbout Access EW.

    ```
    Config>list devices

    Ifc 0 (Ethernet): CSR 1001600, CSR2 1000C00, vector 94
    Ifc 1 (WAN PPP): CSR 1001620, CSR2 1000D00, vector 93
    Ifc 2 (WAN PPP): CSR 1001640, CSR2 1000E00, vector 92
    ```

2. Record the desired interface numbers.

3. 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 TKR Config> for token-ring), now appears on the console.

Note: Not all network interfaces are userconfigurable. For interfaces that cannot be configured, you receive the following message:

```
        That network is not configurable.
```

1.10.1.3 Displaying an Interface Configuration

From some interface configuration prompts, you might list configuration information specific to that selected interface by using the **list** command. For example:

```
TKR Config> list

Packet size (INFO field):4472
Speed:            16 Mb/sec
Media:            Unshielded
```

1.10.1.4 Configuring Network Interfaces

Refer to the specific chapters in the *Network Interface Operations Guide* for complete information on configuring your types of network interfaces or pseudo interfaces. The possible types of network interfaces are Token-ring, Ethernet, FDDI, ISDN, and Serial Line plus the pseudo interfaces X.25-LLC2 and PPP-FR.

Also refer to the specific chapters in the *Network Interface Operations Guide* for complete information on configuring serial interfaces with data links set to Frame Relay, PPP, X.25, V.25 *bis,* and so forth.

1.10.1.5 Exiting an Interface Configuration Prompt

After you configure the desired interface information, exit the interface configuration prompt by performing the following steps:

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

    ```
    TKR Config> exit
    ```

2. Return to the OPCON process by entering the OPCON intercept character. For example:

    ```
    Config>
    ```
    CTRL/p

1.10.1.6 Accessing a Protocol Configuration Prompt

Note: To list all of the available protocols, type **p ?** from the Config> prompt. You can also use the **list config** command to discover this same information.

To access the desired protocol configuration prompt from the CONFIG prompt, perform the following steps:

1. At the CONFIG prompt, enter the **list configuration** command to see the numbers and names of the protocols contained in the software. For example:

    ```
    Config>list conf
    Hostname: wg07

    Maximum packet size: [autoconfigured]
    Maximum number of global buffers: [autoconfigured]
    Number of Restarts before a Reload/Dump: 64
    Logging disposition: detached
    Console inactivity timer (minutes): 0
    Physical console login: disabled
    Modem control: disabled
    Contact person for this node: [none]
    ```

```
Location of this node: [none]

Configurable Protocols:
Num Name  Protocol
0   IP    DOD-IP
3   ARP   Address Resolution
4   DN    DNA Phase IV
5   XNS   Xerox Network Systems*
6   VIN   Banyan Vines*
7   IPX   NetWare IPX
8   OSI   ISO CLNP/ESIS/ISIS
9   DVMRP Distance Vector Multicast Routing Protocol
10  BGP   Border Gateway Protocol
11  SNMP  Simple Network Management Protocol
12  OSPF  Open SPF-Based Routing Protocol
14  APL   AppleTalk
15  DDS   Apollo Domain*
22  AP2   AppleTalk Phase 2
23  ASRT  Adaptive Source Routing Transparent Enhanced Bridge
24  HST   TCP/IP Host Services
7857 bytes of configuration memory free


*  Not supported in this release.
```

2. From the CONFIG prompt, enter the **protocol** command with the number or *short name* of the protocol you want to configure. You can obtain the protocol number and *short name* from the **list configuration** command display. The following example shows the command to access the IP protocol configuration prompt by the protocol *short name*:

```
Config> protocol IP
```

The protocol configuration prompt then appears on the console. This example shows the IP protocol prompt IP config>:

```
IP config>
```

You can obtain the same result by entering the **protocol** command followed by the protocol "number." The following example shows the command you use to access the IP protocol configuration prompt by the protocol number:

```
Config> protocol 0
```

The protocol configuration prompt then appears on the console.

```
IP config>
```

You can now enter that protocol's configuration commands. See the corresponding
protocol section of the *Routing Protocols User's Guide* for more information on spe-
cific protocol configuration commands.

1.10.1.7 Exiting a Protocol Configuration Prompt

After completing the desired changes to configuration information for a protocol,
exit to the `Config>` prompt by performing the following steps:

1. To exit from the protocol configuration, enter the protocol **exit** command. For
    example:

    ```
    IP config> exit
    ```

2. Return to the OPCON process by entering the OPCON intercept character
    (CTRL/p). For example:

    ```
    Config>  CTRL/p
    ```

1.10.2 Restarting the Router

Changes that you make to the protocol parameters through CONFIG, except for cer-
tain **NCP SET** commands, do not take effect until you restart the router.

Note: The changes you make through CONFIG are retained in a configuration
         database in non-volatile memory. They are retained during power downs
         and are recalled when you restart the router.

To restart the router, enter the OPCON **restart** command. For example:

```
* restart

Are you sure you want to restart the router? (Yes or No)[No]: yes
```

1.11 Accessing and Using the Console Process

All interfaces described in the *Network Interface Operations Guide* and all protocols
described in the *Routing Protocols User's Guide* have commands that are executed
by accessing the *console* process to monitor network statistics, test network inter-
faces, view the configured protocols on the router, or make temporary changes to the
volatile configuration of the router.

You access the console process through the GWCON process. This process is
described in detail in Chapter 4 of this manual. The procedures to access this process
are basically the same for both. The following sections describe these procedures.

1.11.1 Accessing the Console Process

To monitor information related to a specific interface or protocols, access the interface *console* process by performing the following steps:

1. Enter the **status** command to find the pid of GWCON. For example:

   ```
   * status

   Pid    Name    Status  TTY     Comments
    1     COpCon   IOW     TTY0
    2     Monitr   DET     --
    3     Tasker   IDL     --
    4     MOSDDT   DET     --
    5     CGWCon   IOW     --
    6     Config   IOW     --
    7     DEChub   IDL     --
    8     ROpCon   IOW     TTY1    128.186.314.132
    9     ROpCon   RDY     TTY2    128.186.314.133
   ```

   Note: ISDN devices (AW90EI and AW900EI) indicate six additional processes
   at the *** stat** command. These processes manage the ISDN interfaces,
   but are not accessible:

   ```
   * status

   Pid    Name    Status  TTY     Comments
    10    CES3     IDL     --
    11    TOUT     IDL     --
    12    L2S3     IDL     --
    12    L3L2     IDL     --
    14    LLL2     IDL     --
    15    S3CE     IDL     --
   ```

2. At the OPCON prompt, enter the OPCON **talk** command and the pid number for
   GWCON. For example:

   ```
   * talk 5
   ```

3. The GWCON prompt (+) is displayed on the console. If the prompt does not
   appear when you first enter GWCON, press RET again.

1.11.1.1 Entering an Interface Console Prompt

To access an interface console prompt from the GWCON prompt, perform the following steps:

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

    ```
    + configuration

    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  Source Routing Transparent Enhanced Bridge


    Num Name  Feature
    1    BRS   Bandwidth Reservation


    4 Networks:
    Net Interface  MAC/Data-Link      Hardware           State
    0     Eth/0  Ethernet/IEEE 802.3 Ethernet/802.3      Up
    ```

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

    ```
    + network 3
    ```

    In this example, the X.25 console prompt appears on the console. You can then view information about the X.25 interface by entering the X.25 console commands.

    ```
    X.25>
    ```

1.11.1.2 Monitoring the Network Interface

Refer to the specific chapters in the *Network Interface Operations Guide* for complete information about monitoring your particular network interfaces.

1.11.1.3 Exiting an Interface Console Prompt

To exit the interface console prompt and return to the OPCON process, do the following:

1. Enter the **exit** command to return to the GWCON process. For example:

    ```
    X.25> exit
    ```

2. Press CTRL/p to return to the OPCON process. For example:

    ```
    + CTRL/p
    ```

1.11.1.4 Entering a Protocol Console Prompt

To enter a protocol console prompt from the GWCON prompt, perform the following steps:

1. At the GWCON prompt (see Chapter 4 for information about accessing the GWCON prompt), enter the **configuration** command to see the protocols and networks configured for the router. For example:

    ```
    + configuration

    4 Protocols:
    Num Name  Protocol
    0   IP    DOD-IP
    3   ARP   Address Resolution
    11  SNMP  Simple Network Management Protocol
    12  OSPF  Open SPF-Based Routing Protocol
    ```

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 to access the IP protocol console process. Enter either one of the following:

    ```
    + protocol 0
    ```

    ```
    + protocol IP
    ```

    The protocol console prompt then appears on the console. This example shows the TCP/IP prompt (IP>):

    ```
    IP>
    ```

You can enter that protocol's console commands. See the corresponding protocol section of the *Routing Protocols User's Guide* for more information on specific protocol console commands.

1.11.1.5 Exiting a Protocol Console Prompt

To exit the protocol console process and return to the OPCON process, perform the following steps:

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

        IP> **exit**

2. Return to the OPCON process by entering the OPCON intercept character (CTRL/p). For example:

        + **CTRL/p**

1.11.1.6 Protocol Names and Numbers

Table 1–2 lists the numbers that you enter along with the **protocol** command when accessing a specific protocol configuration or console process. Not all protocols are supported by all hardware platforms.

Table 1–2 Protocol Numbers and Names

Protocol Number	Protocol Short Name	Accesses the following protocol process
0	IP	Internet Protocol
3	ARP	Address Resolution Protocol
4	DN	DNA - a subset of Network Control Program
7	IPX	Novell NetWare Internetwork Packet Exchange
8	OSI	ISO Open Systems Interconnect Connectionless Network Layer Protocol / ES-IS / IS-IS
9	DVMRP	Distance Vector Multicast Routing Protocol
10	BGP	Border Gateway Protocol
11	SNMP	Simple Network Management Protocol
12	OSPF	Open Shortest Path First
14	APL	AppleTalk Phase 1
20	SDLC	SDLC Relay
22	AP2	AppleTalk Phase 2
23	ASRT	Adaptive Source Routing Transparent Bridge

Table 1–2 Protocol Numbers and Names (Continued)

Protocol Number	Protocol Short Name	Accesses the following protocol process
24	HST	TCP/IP Host Services
26	DLS	Data Link Switching
27	PIM	Protocol Independent Multicast

1.12 Accessing Feature Configuration and Console Prompts

This section describes how to access the bridging router feature configuration and console processes.

You run all bridging router features described in this manual by performing one of the following:

- Accessing the *configuration* process to configure, enable, or modify the feature

- Accessing the *console* process to monitor information about each feature or to make temporary configuration changes

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

1.12.1 Accessing Feature Configurations

To access configuration commands for specific bridging router features that are not part of the protocol and network interface configuration processes, use the **feature** command of the CONFIG process.

To obtain a listing of the features available for your software release, enter ? after the **feature** command. For example:

```
config> feature ?
WRS
BRS
MCF
X25S
Feature name or number [WRS]?
```

To access that feature's configuration prompt, enter the **feature** command followed
by the feature number or the *short name*. For example:

```
config> feature brs
Bandwidth reservation user configuration
BRS>
```

Note: For the Co-resident SNMP Agent feature, CONFIG also prompts you to
enter the number of the interface that you want to configure or monitor.

Table 1–3 lists available bridging router feature numbers and names.

Note: Not all features are supported by all hardware platforms.

Table 1–3 Bridging Router Feature Numbers and Names

Feature Number	Feature Short Name	Accesses the following feature configuration and console process
0	WRS	WAN Restoral
1	BRS	Bandwidth Reservation
2	MCF	MAC Filtering
3	BSA	BOSS SNMP Agent
4	X25S	X.25 Switching

After you access the configuration prompt for a feature, you may enter specific con-
figuration commands for that feature. To return to the CONFIG prompt, enter the
exit command at the feature's configuration prompt.

1.12.2 Accessing Features Functions from the Console Process

Use the **feature** command from the GWCON process to access console commands
for specific bridging router features that are not part of the protocol and network
interface console processes.

Enter ? 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 followed by the feature number or *short name*. For example:

```
+ feature brs
```

After you access the console prompt for a feature, you may enter specific console commands for that feature. To return to the GWCON prompt, enter the **exit** command at the feature's console prompt.

Note: For the Co-resident SNMP Agent feature, GWCON also prompts you to enter the number of the interface that you want to configure or monitor.

1.13 System Security

You can add multiple users, each having login permissions, by using the **add user** command. See the section "Configuring User Access" in Chapter 2 for details about security issues and for information about the **add user** command.

2
Configuring the System

This chapter describes the Configuration (CONFIG) process. It explains how you use CONFIG and Quick Config, and discusses the CONFIG commands.

2.1 Using CONFIG

CONFIG is a process of the router user interface. Using CONFIG commands, you can do the following:

- Add an interface to or delete an interface from the non-volatile RAM (NVRAM) hardware configuration.

- Enter the Boot CONFIG command.

- Enter Quick Configuration (QUICK CONFIG).

- Clear, list, or update configuration information.

- Enable or disable console login and modem control.

- Communicate with protocol environments.

- Set or change various configuration parameters.

CONFIG lets you display or change the configuration information stored in the router's NVRAM. Changes to system and protocol parameters, except changes made by the NCP **set** command, do not take effect until you restart the router. (For more information, refer to the OPCON **restart** command.)

Note: The changes you make through CONFIG are retained in a configuration database in NVRAM. They are stored in FLASH memory and are recalled when you restart the router.

Figure 2–1 shows how CONFIG fits into the router software structure.

Figure 2–1   CONFIG in the Router Software Structure
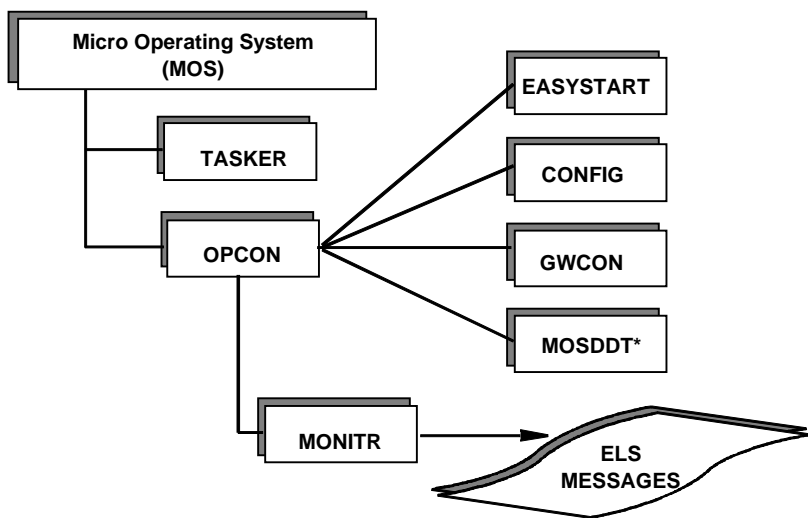
*Not available on all platforms   LKG-09869-95I

The CONFIG interface contains commands that let you configure and monitor inter-
faces and protocols. Each command has its own prompt. For example, the prompt
for the TCP/IP protocol is IP config>.

If you want to know the process and command you are communicating with, press
RET 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.

2.2 Quick Configuration

When you load, start, or restart the router with no configuration, you enter Quick
Configuration (QUICK CONFIG).

Quick Configuration (QUICK CONFIG) allows you to configure a minimal set of
parameters in order to boot the router and run it with a minimal configuration or to
download a complete configuration by means of TFTP. QUICK CONFIG steps you
through most user protocols for your hardware specific platform.

QUICK CONFIG enables you to configure the minimum number of parameters for
different devices, bridging protocols, routing protocols, and booting records without
exiting and entering the different configuration submenus of the CONFIG processes.

For more information about QUICK CONFIG and to see how it is used, refer to the
INSTALLATION MENU section in the installation manual that accompanies your
router.

Figure 2–2 is a flow diagram that illustrates how the router determines which config-
uration you use.

Figure 2–2   Router Configuration Determination Flow Chart
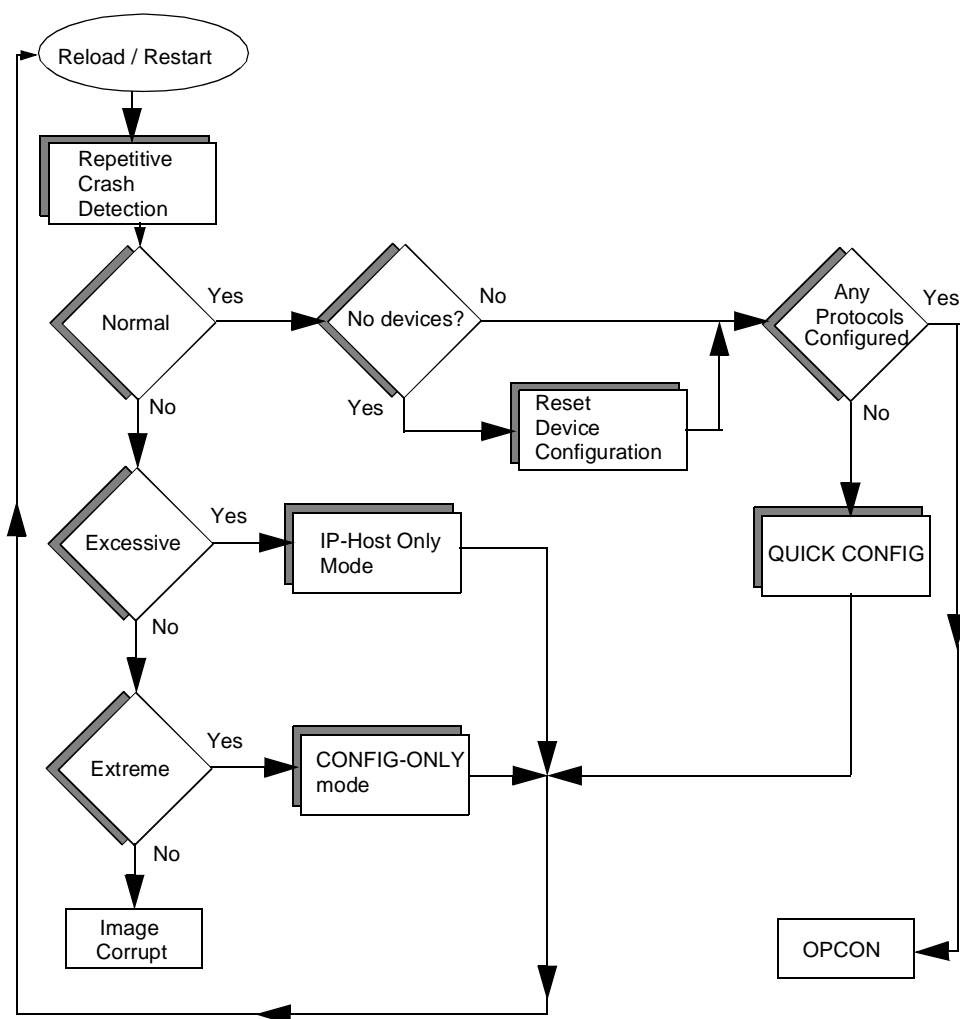
2.3 Configuring User Access

The router configuration permits user names (case sensitive, 8 characters maximum), passwords (8 characters maximum), and permission levels. Each user added must have a password and permission level. There are three permission levels: *Administrative*, *Operations*, and *Monitor*.

Users with *Administrative* permission can access any router function, including router configuration and user administration.

Users with *Operations* permission can view any network configuration parameter or statistic, run potentially disruptive tests, dynamically change the router operation, and restart the router.

Users with *Monitor* permission can only view configuration parameters or network statistics.

Note: Only a user with *Administrative* permission can change the configuration in NVRAM. In your hardware installation guide, NVRAM is referred to as non volatile memory.

You receive the following prompts each time you log in on the console:

```
login:
password:
```

2.3.1 Technical Support Access

When system administrators add new users for the first time, they are asked if they want to add technical support access. If they answer yes, technical support access is granted *Administrative* access.

The software automatically selects the password, known to Digital Customer Services, for this account. This password can be changed.

2.4 Entering and Exiting CONFIG

To enter the CONFIG command environment from OPCON and obtain the CONFIG prompt, perform the following steps:

1. At the OPCON prompt, enter the **status** command to find the pid of CONFIG:

```
   * s

Pid  Name     Status TTY  Comments
1    COpCon   RDY    TTY0
2    Monitr   DET    --
3    Tasker   RDY    --
4    MOSDDT   DET    --
5    CGWCon   IOW    --
6    Config   DET    --
7    EZstrt   IDL    --
8    SNMP     IDL    --
9    DEChub   IDL    --
10   ROpCon   IDL    TTY1
11   ROpCon   IDL    TTY2
```

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 RET again. To exit CONFIG and return to OPCON, enter the OPCON intercept character CTRL/p .

2.5 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 2–1.

Note: Some of these commands are not available on all hardware platforms. For example, the DECswitch 900 only has Ethernet and FDDI interfaces, so the **add**, **change** and **delete** commands are not present. Refer to your hardware installation guide to determine which interfaces are supported by your hardware platform.

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

Table 2–1 CONFIG Command Summary

Command	Function
? (Help)	Lists the CONFIG commands or lists the options associated with specific commands.
Add	Adds a user to the router or adds a dial-circuit, PPP-FR pseudo device, X25-LLC2 pseudo device, or null device.
Boot	Enters Boot CONFIG command.
Change	Changes a current user's password or dial-circuit, PPP-FR pseudo device, X25-LLC2 pseudo device, or null device.
Clear	Clears configuration information.
Delete	Deletes a configured user or a dial-circuit, PPP-FR pseudo device, X25-LLC2 pseudo device, or null device.
Disable	Disables login from a remote console, disables remote access using a modem, or disables a specified interface.
Enable	Enables login from a remote console, enables remote access using a modem, or enables a specified interface.
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.
List	Displays the system parameters, hardware configuration, users, obm ip-address, or v25-bis-address.
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 Quick Config.
Set	Sets systemwide parameters for buffers, hostname, inactivity timer, logging disposition and level, packet size, restart count, location, obm ip-address, and contact-person.
Time	Keeps track of system time and displays it on the console.
Unpatch	Restores variables of the patches to default values.
Update	Updates the current version of the configuration.

? (Help)

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
      NETWORK
      PATCH
      PROTOCOL
      QCONFIG
      SET
      TIME OF DAY PARAMS
      UNPATCH
      UPDATE


Example:  add ?

      device
      isdn-address
      v25-bis-address
      user
```

Add

Add a device, V.25 *bis* address, ISDN address, or user-access to the configuration.

Note: Hardware device records are automatically recreated (if they are missing) when the router restarts.

Syntax: <u>a</u>dd   <u>d</u>evice . . .
                 <u>u</u>ser . . .
                 <u>v</u>25-bis-address . . .
                 <u>i</u>sdn-address . . .

device *device_type additional-config-info*

Adds a new interface, or pseudo interface, of the type specified by *device_type*. CON-
FIG prompts you for any additional configuration parameters. This additional infor-
mation varies by device and platform. You can enter the additional configuration
information that CONFIG prompts for on the command line. To obtain this informa-
tion, refer to the site specification sheet shipped with the router.

<u>**Note:**</u> If you are adding more than one interface, the order in which you add
them is important because the router assigns a sequential interface num-
ber 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 configu-
ration information, such as the IP addresses associated with the device.
(For more information, refer to the **list devices** command.) All device
and protocol configuration information related to network interfaces is
stored by interface number. Any changes made to interface numbers
invalidate some of the device configuration information in the protocols.

Not all of the interfaces are available on all hardware platforms. Refer to your hard-
ware installation guide to determine which interfaces are supported by your hard-
ware platform.

Short Name	Interface Described
NULL	No device
PPP-FR	Pseudo device for PPP over Frame Relay
X25-LLC2	Pseudo device for X.25 over LLC2
DIAL-CIRCUIT	Dial circuit device (V.25 *bis* or ISDN)

<u>**Note:**</u> *Pseudo devices* (or *pseudo interfaces*) are not directly associated with
physical ports on the router. They provide a means of using one protocol
over a device that otherwise would not support that protocol. For exam-
ple, the PPP-FR pseudo device enables the use of a PPP circuit over a
Frame Relay link.

The following command adds a dial circuit and assigns it the next interface number. For information about configuring dial circuits, refer to the *Network Interfaces Operations Guide* chapters that discuss the V.25 *bis* network interface or the ISDN network interface.

Example: **add device dial-circuit**

The following command adds a pseudo device that uses Point-to-Point Protocol over a Frame Relay interface (PPP-FR) and assigns it the next interface number. For information about configuring PPP-FR, refer to the *Network Interfaces Operations Guide*.

Example: **add device ppp-fr**

The following command adds a pseudo device that uses X.25 protocol over an Ethernet interface. The Ethernet interface uses LLC2 to transfer packets to a DTE on the LAN. You must supply the interface number of the Ethernet device, and the MAC address of the remote DTE. For information about configuring X.25-LLC2, refer to the *Network Interfaces Operations Guide*.

Example: **add device x25-llc2**

```
LAN ifc [0]?
Remote MAC address[]? AA-00-04-00-6B-A5
```

LAN Ifc   Interface number of the LAN device that the X.25-LLC2 pseudo device will be using.

Remote MAC address   MAC address of the DTE interface on the associated host system.

isdn-address *address_name dial-address subdial-address*

Adds an ISDN network address. Each entry has an address name, which is used for reference, and the network dial address (telephone number) and an optional subdial address. You must enter an ISDN address for each ISDN interface as well as for each destination.

```
Example:  add isdn-address

    Assign address name [1-23] chars []? baltimore
    Assign network dial address [1-15 digits] []? 1-555-0983
    Assign network subdial address [0-20 digits] []? 23
```

Assign address name   Description of the address. You can use any string of up to 23 printable ASCII characters. Address names are case sensitive.

Assign network dial address   The network dial address (telephone number) of the local or destination port. You can enter up to 15 numbers as well as 16 other characters, including spaces and punctuation. The router only uses the numbers.

Assign network subdial address   Optional. Additional part of the telephone number, such as an extension, that gets interpreted once the interface connects to the PBX. You can enter up to 20 digits as well as spaces and punctuation. The router only uses the digits.

v25-bis-address *address_name dial-address*

Adds a V.25 *bis* network address. Each entry has an address name, which is used for reference, and the network dial address (telephone number). When adding a V.25 *bis* dial circuit, you must enter a V25 *bis* address for the local and remote routers.

```
Example:  add v25-bis-address

    Assign address name [1-23] chars []?
    Assign network dial address [1-30 digits] []?
```

Assign address name   Description of the address. You can use any string of up to 23 printable ASCII characters. Address names are case sensitive.

Assign network dial address   Network dial address (telephone number) of the local or destination port. You can enter up to 30 characters. You may include spaces and punctuation. The router only uses the numbers.

user *user_name*

Add a user access name to the router configuration. Each user added must be assigned one of three permission levels: *Administrative*, *Operations*, or *Monitor*. *Administrative* permission allows the user access to any router function, and allows the user to write to NVRAM. *Operations* permission allows a user to view any network configuration parameter or statistic, run potentially disruptive tests, and restart the router. *Monitor* permission only allows the user to view the configuration parameters or network statistics.

When the first user is added, console login is automatically enabled. The user name is limited to 8 characters, and the password is limited to 8 characters.

Note: To add a user, you must have *Administrative* permission. All user names
and passwords are case sensitive.

Example: **add user John**

```
Enter password:
Enter password again:
Enter permission (A)dmin, (O)perations, (M)onitor [A]?
```

Enter password   The access password for the user. Limited to 8 characters.

Enter password again   Confirms the access password for the user.

Enter permission   The access permission for the user: A, O, or M.

Boot

Enter the Boot CONFIG command environment. For Boot CONFIG information, refer to Chapter .

Syntax: boot

Example: **boot**

```
TFTP Boot/dump configuration
Boot config>
```

Change

Modify an interface in the configuration, change your own password, or change user information.

Syntax: ch̲ange d̲evice
                              p̲assword
                              u̲ser

device *device-type*

Modifies the configuration of an interface to be a PPP-FR or X25-LLC2 pseudo device.

```
Example:  change device ppp-fr

    Interface number [0]?3
```

password

Modifies the current user's password.

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 Your current password.

Enter new password   Your new password.

Enter new password again | Confirms your new access password. 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)?
    Enter permission: (A)dmin, (O)perations, or (M)onitor [A]?
```

Clear

Delete the router's configuration information from NVRAM.

To clear a protocol from NVRAM, enter the **clear** command and the protocol name.
To clear all information from the NVRAM except for device information, use the
clear all command. If you want to clear all information including the device infor-
mation, use the **clear all** and **clear device** commands.

Note: To clear user information, you must have *Administrative* permission.

Caution: Only use this command after calling your Digital Customer Services repre-
sentative.

Syntax: <u>c</u>lear <u>all</u>
              <u>ap2</u> (AppleTalk 2)
              <u>apl</u> (AppleTalk 1)
              <u>ar</u>p (ARP)
              <u>asr</u>t (Adaptive Source Route Protocol)
              <u>at</u>m
              <u>bg</u>p (Border Group Protocol)
              <u>bo</u>ot information
              <u>dd</u>s (Apollo Domain protocol)   *
              <u>dev</u>ice information
              <u>dialer</u>-circuit
              <u>dls</u> (Data Link Switching)
              <u>dn</u> (DNA IV)

* dds, vines and xns are not supported in this release

dvmrp (Distance Vector Multicast Routing Protocol)

els (Event Logging System Information)

fr   (Frame Relay)

ip   (IP)

ipx (Novell IPX)

isdn

lnm (LAN Network Manager)

osi   (OSI)

ospf (OSPF routing protocol)

pim (Protocol Independent Multicast)

ppp (Point-to-Point)

sdlc (Synchronous Data Link Control)

slc   (Serial Line Controller SRAM block)

snmp

srb   (Source Route Bridge)

srly (SDLC Relay)

stb   (Spanning Tree Bridge)

tcp/ip-host

time (Time of day information)

user info (User Access information)

v25bis (V.25 *bis* protocol)

vines (Banyan Vines protocol)   *

wrs (WAN Restoral)

x25

x25s(X.25 Switching)

xns (Xerox Network Standard)   *

Example: **clear all**

```
You are about to clear all non-device configuration information
Are you sure you want to do this? [Yes or (No)]:
```

* dds, vines and xns are not supported in this release

Note: This message appears whenever you erase any configuration parameter.
The **clear user** command clears all user information except the router
console login information. The value is set to ENABLED (if configured
as such) even though the default value is DISABLED.

Delete

Remove a dial-circuit, PPP-FR pseudo device, X25-LLC2 pseudo device, or null de-
vice from the list of devices stored in the configuration or remove user login informa-
tion, isdn addresses, or V.25 *bis* addresses. To use the **delete** command, you must
have *Administrative* permission.

Syntax: <u>de</u>lete   <u>in</u>terface . . .
<u>is</u>dn-address . . .
<u>u</u>ser . . .
<u>v2</u>5-bis-address

interface *intfc#*

To delete a device, enter the interface or net number as part of the command. To ob-
tain the interface number that the router assigns, use the **list device** command.

If the interface you specify is the last interface in the device list, the **delete** command
automatically removes it.

```
Example:  delete interface 5
```

If it is not the last interface in the device list, **delete** prompts you to confirm the dele-
tion. The next interface in the list inherits the number of the interface that you deleted,
and the remaining interfaces are renumbered (moved up by one position).

```
Example:  delete interface 2

    This is not the largest configured interface.  If you
    delete it, you will probably invalidate configuration
    information attached to the higher numbered interfaces.
    Are you sure you want to do this?(Yes or [No]):
```

If you delete an interface from the middle of the device list, you must enter the CON-
FIG environments of each of the packet forwarders affected by the deletion. Then,
you must modify their configurations to be consistent with the reassigned interface
numbers. All device and protocol configuration information related to network inter-
faces is stored by interface number. Any changes made to interface numbers invali-

date some of the device configuration information in the protocols.

isdn-address *address_name*

Removes the named ISDN address entry.

```
Example:  delete isdn-address

     Delete address name []?
```

user *user_name*

Removes user access to the router for the specified user.

```
Example:  delete user mary

     Delete 'mary'? (Yes or [No]:
```

v25-bis-address *address_name*

Removes the named V.25 *bis* address entry.

```
Example:  delete v25-bis-address

     Delete address name []?
```

Disable

Prevent prompting for login data from a remote console and disable modem control. The **disable** command also disables the specified interface.

Syntax: disable console-login
                   interface . . .
                   modem-control

console-login

Prevents prompting for a user ID and password on the physical console. The default is disabled.

```
Example:  disable console-login
```

interface *interface#*

Disables the specified interface after issuing the **restart** command. The default is enabled.

```
Example:  disable interface 2
```

modem-control

Disables monitoring of modem control lines on the console port. The default is disabled.

```
Example:  disable modem-control
```

Enable

Allow logins from a remote console and enable modem control. The enable command also enables the specified interface.

Syntax: en̲able c̲onsole-login
                    i̲nterface . . .
                    m̲odem-control

console-login

To provide security to the console, **console-login** enables prompting for a user ID and password on the physical console. If you do not configure an administrative user, 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#*

Enables the interface after issuing the **restart** command.

```
Example:  enable interface 2
```

modem-control

Sets up the router for login on the physical console, if the physical console is connected to the router through a modem. Before using this command, make sure to:

• Set your modem for auto-answer.

- Verify that the console baud rate is equal to the modem baud rate.

- Verify that the cable connecting the modem to the router is configured correctly.

The router automatically disconnects the modem when you log out. If your modem disconnects before you log out, the router logs you out.

```
Example:  enable modem-control
```

Event

Enter the ELS (Event Logging System) environment to display messages on the console. Refer to Chapter for information about the Event Logging System (ELS).

Syntax: event

```
Example:  event

    ELS config>
```

Feature

Access configuration commands for specific bridging router features outside the protocol and network interface configuration processes.

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

```
Example:  feature ?

    WRS
    BRS
    MCF
    X25S
    Feature name or number [WRS]?


    SL     15     Proteon Serial Line Handler
```

To access that feature's configuration prompt, enter the **feature** command followed by the feature number or *short name*. Table 2–2 lists available feature numbers and names.

Table 2–2 Bridging Router Feature Numbers and Names

Feature Number	Feature Short Name	Accesses the following feature configuration process
0	WRS	WAN Restoral
1	BRS	Bandwidth reservation
2	MCF	MAC Filtering
3	BSA	BOSS SNMP Agent
4	X25S	X.25 Switching

```
Example:  feature brs

   Bandwidth reservation user configuration

   Reservation>
```

After you access the feature's configuration prompt, you may enter specific configuration commands for that 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 1
   or     feature BRS
```

List

Display configuration information for all network interfaces or configuration information for the router.

Syntax: list   devices
                     configuration
                     isdn—address
                     patches
                     obm
                     users
                     v25—bis—address

devices

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

Example: **list devices**

```
Ifc 0 (FDDI):     CSR    0, vector 0
Ifc 1 (Ethernet): CSR    0, vector 0
Ifc 2 (Ethernet): CSR    1, vector 0
Ifc 3 (Ethernet): CSR    2, vector 0
Ifc 4 (Ethernet): CSR    3, vector 0
Ifc 5 (Ethernet): CSR    4, vector 0
Ifc 6 (Ethernet): CSR    5, vector 0
```

configuration

Displays configuration information about the router.

Example: **list configuration**

```
Hostname: lennon 1.98
Maximum packet size: [autoconfigured]
Maximum number of global buffers: [autoconfigured]
Number of Restarts before a Reload/Dump: 64
Logging disposition: detached
Console inactivity timer (minutes): 0
Physical console login: disabled
Modem control: disabled
Contact person for this node: john
Location of this node: Atlantis
Hub-type set to three-slot
```

```
Configurable Protocols:
Num Name  Protocol
0   IP    DOD-IP
3   ARP   Address Resolution
4   DN    DNA Phase IV
                         *
6   VIN   Banyan Vines
7   IPX   NetWare IPX
8   OSI   ISO CLNP/ESIS/ISIS
9   DVM   Distance Vector Multicast Routing Protocol
10  BGP   Border Gateway Protocol
11  SNMP  Simple Network Management Protocol
12  OSPF  Open SPF-Based Routing Protocol
14  APL   AppleTalk
22  AP2   AppleTalk Phase 2
23  ASRT  Adaptive Source Routing Transparent Enhanced Bridge
24  HST   TCP/IP Host Services
27  PIM   Protocol Independent Multicast

Configurable Features:
Num   Name   Feature
0     WRS    WAN Restoral
1     BRS    Bandwidth Reservation
2     MCF    MAC Filtering
4     X25S   X25 Switching

127808 bytes of configuration memory free
```

isdn-address

Displays the configured ISDN addresses.

```
Example:  list isdn-address
```

patches

Displays the patches and their variables that were implemented using the **patch** command.

```
Example:  list patches

    Patched variableValue

    ping-size 60
    ping-ttl 59
    ip-default-ttl60
    ethernet-security3
    rip-static-suppress3
```

---

[*] Not supported in this release.

obm

Displays out-of-band management port information such as IP address, port speed, and ready-to-send (RTS) enable/disable state (where they apply).

```
Example:  list obm

   OBM Address: 0.0.0.0
   OBM Port Speed:  9600
   OBM Port RTS disabled
```

Note: Setting the **obm** IP address to 0.0.0.0 deletes the current obm address entry.

users

Displays the users configured to access the system.

```
Example:  list users

   USERPERMISSION

   joeoperations
   maryadministrative
   petermonitor
```

v25-bis-address

Displays the configured V.25 *bis* addresses.

```
Example:  list v25-bis-address
```

Network

Enter the network interface configuration environment for supported networks, such as the FDDI, Ethernet, ISDN, and Token-ring networks.

Enter the interface or network number as part of the command. To obtain the interface number, use the CONFIG **list device** command.

Syntax: network *interface#*

```
Example:  network 2

   TKR config>
```

Patch

Modify the router's global configuration. Patches are recorded in non-volatile configuration memory and take effect immediately. Use this command only to handle uncommon configurations. Use specific configuration commands to modify commonly configured items. The following is a list of the current patches documented and supported for this release.

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.
rip-static-suppress	When set to a non-zero value, static routes are not advertised by RIP out 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 through RIP is the union of those specified by the interface's RIP flags.
ping-size	The size of the data portion (that is, excluding IP and ICMP headers) of the ICMP ping packet that is sent through the IP>**ping** command. Default: 56 bytes.
ping-ttl	The TTL (time-to-live) sent in pings by the IP>**ping** command. Default: 60.
ip-default-ttl	The TTL used in packets that are originated by the router itself. Default: 60.

Syntax: patch

Example: **patch**

```
    Variable to patch []?
    New value [0]?
```

Variable to patch	The complete name of the patch that you want to change. You cannot use the short syntax.

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

Protocol

Enter the configuration environment for the protocol software installed in your 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 protocol-specific commands.

Table 2–3 lists examples of protocol numbers and names. To see the list of protocols that have been installed on your router, use the **list configuration** command.

To return to CONFIG, enter the **exit** command.

Table 2–3 Protocol Numbers and Names

Protocol Number	Protocol Short Name	Accesses the following protocol process
0	IP	Internet Protocol
3	ARP	Address Resolution Protocol
4	DN	DECnet - a subset of Network Control Program
7	IPX	Novell NetWare Internetwork Packet Exchange
8	OSI	ISO Open Systems Interconnection - Connectionless Network Layer Protocol
9	DVMRP	Distance Vector Multicast Routing Protocol
10	BGP	Border Gateway Protocol
11	SNMP	Simple Network Management Protocol
12	OSPF	Open Shortest Path First
14	APL	AppleTalk Phase 1
20	SDLC	SDLC/HDLC Relay
22	AP2	AppleTalk Phase 2
23	ASRT	Adaptive Source Routing Transparent Bridge
24	HST	TCP/IP Host Services

Table 2–3 Protocol Numbers and Names (Continued)

Protocol Number	Protocol Short Name	Accesses the following protocol process
26	DLS	Data Link Switching
27	PIM	Protocol Independent Multicast

Syntax: protocol   *prot#*

```
Example:  protocol 7 or protocol ipx

     IPX config>
```

Qconfig

Initiate QUICK CONFIG. QUICK CONFIG prompts for information necessary to
configure selected devices, bridging protocols, routing protocols, and boot records
without entering separate configuration environments.

Syntax: qconfig

Set

Configure various systemwide parameters.

Syntax: set   contact-person . . .
                       data-link . . .
                       down-notify
                       global-buffers
                       hostname
                       hub-type. . .
                       inactivity-timer

input-low-water

location . . .

logging disposition

logging level

obm

packet-size

receive-buffers

restart-count

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.

Example: **set contact-person nautilus**

data-link *type interface#*

Select the data link type for a serial interface. The *type* can be one of the following: PROTEON, PPP, X25, FRAME-RELAY, SDLC, SRLY (SDLC relay), or V25BIS. *Interface#* is the number of the interface you are configuring.

Example: **set data-link PPP 3**

down-notify *interface# interval*

Sets the number of seconds with no response being received before an interface is considered to be down. The *interval* is the number of seconds, between 1 and 300, and *interface#* is the number of the interface you are configuring.

Example: **set down-notify**

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.

Caution: Use this command only under direct instructions from your Digital Customer Services representative.

```
Example:  set global-buffers 30
```

hostname

Adds or changes the router name. The router name is for identification purposes and
it does not affect or change any router addresses.

```
Example:  set hostname
```

inactivity-timer

Changes the setting of the Inactivity Timer. The Inactivity Timer is the period of time
that a remote or physical console may remain inactive before the system logs you out.
This command affects only consoles that require login. The default setting of 0 turns
the inactivity timer off, performing no logoff, no matter how long a console remains
inactive.

```
Example:  set inactivity-timer
```

input-low-water *interface# threshold*

Used for flow control. This command changes the threshold on the device receive
queues. When the queue length drops below the low water mark, and the output de-
vice transmit queue is above its fair threshold (high water mark), the packet is discard-
ed.

Caution: Use this command only under direct instructions from your Digital Custom-
er Services representative.

```
Example:  set input-low-water
```

location *sysLocation*

Sets the physical location of an SNMP node. There is a limit of 80 characters for the
sysLocation name length.

```
Example:  set location atlantis
```

logging disposition

Changes the NVRAM record for the default logging disposition. This command af-
fects the MONITR process (that is, it changes the default setting at startup).

The logging disposition settings do the following:

- *console* writes to the console (equivalent to the OPCON **divert 2 0** command).

- *detached* holds the data and does not print it (equivalent to the OPCON **halt 2** command).

- *flush* discards the data (equivalent to the OPCON **flush 2** command).

If you have a printing terminal attached to the router's console port, you can obtain a hard copy of the startup messages by setting the logging disposition to **console**, and restarting the router.

```
Example: set logging disposition
```

logging level

Controls the output of messages that were not converted to the ELS. The logging level is recorded in the configuration. When you power on or start the router, the logging level takes effect and determines message output. The default logging level is 76.

```
Example: set logging level
```

obm

Sets the out-of-band management port ip-address, port speed, and ready-to-send (RTS) enable or disable state (where they apply).

```
Example: set obm ip-address
```

packet-size

Establishes or changes the maximum size of a packet buffer.

Note: Use this command only under direct instructions from your Digital Customer Services representative. NEVER use it to reduce packet size - ONLY to increase it.

```
Example: set packet-size
```

receive-buffers *max#*

Adjusts the number of private receive buffers for most interfaces. The range is 5 to 255. (On some devices, the maximum value is restricted further, as shown in Table 2–4.) To restore the default, set the value to 0.

The **set receive-buffers** command can be used to increase the receive performance of an interface. In addition, this command can be used to reduce flow control drops when the router forwards many packets from a fast interface to a slow interface. The effect of this command is visible on the GWCON **buffer** command and the **list devices** command.

Note: Use this command only under direct instructions from your Digital Customer Services representative.

Example: **set receive-buffers 30**

Table 2–4 Default and Maximum Settings for Interfaces

Interface	Default	Maximum
ETH	40	255
Serial	10	40

Note: The maximum settings listed in listed in Table 1-4 are hardware dependent. Refer to your hardware installation guide for the values that apply to your specific hardware platform.

restart-count

Establishes the number of times a router restarts on a serious error before dumping (if enabled) and reloading. In general, do not change the restart-count.

Example: **set restart-count**

Time

Set the bridging router system time and date and display the values to the console.

Syntax: <u>t</u>ime <u>h</u>ost . . .
<u>l</u>ist
<u>o</u>ffset
<u>se</u>t . . .
<u>sy</u>nc . . .

host *IP_address*

Sets the IP address of the RFC868-compliant host that is used as the time source. This is the address of a host that responds to an empty datagram on UDP port 37 with a datagram containing the current time.

```
Example:  time host 131.210.1.4

     IP address of time host [0.0.0.0]?
```

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  Monday July 26, 1993
     Set by: operator
     Time Host:  131.210.4.1          Sync Interval: 10 seconds
     GMT Offset:  -300 minutes
```

offset *minutes*

Defines the time zone, 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 is "time offset -300." For DST, the value would be -240.

```
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 the entire time is not specified in the command, you are prompted for the remaining values.

<u>**Note:**</u>   If you use the **time set** command to manually set the time, the router will
act as an RFC868 time server.

```
Example:  time set

     year [0]? 1996
     month [0]? 6
     date [0]? 26
     hour [0]? 10
     minute [0]? 18
     second [0]? 00
```

sync *seconds*

Indicates the number of seconds that the router polls the time host for the current time.
If you do not set a value for sync, it defaults to 0. Sync must have a value other than
0 for updates to occur.

```
Example:  time sync 10

     seconds between time syncs [0]? 10
```

Unpatch

Restores the values of the patch variables to their default values.

Syntax: <u>unpatch</u> *variable name*

```
Example:  unpatch ethernet-security
```

Update

Updates the configuration memory when you receive a new software release. 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: <u>u</u>pdate version-of-SRAM

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

2.6 CONFIG-ONLY Mode

CONFIG-ONLY mode is used for making configuration changes without running normal operational router software (bridging and forwarding disabled).

CONFIG-ONLY mode uses commands identical to the CONFIG process with the addition of the **restart** and **reload** commands.

The main difference between operational mode and CONFIG-ONLY mode is that operational mode used configuration records to configure the router while CONFIG-ONLY mode assumes the configuration records are corrupt and does not use them.

You enter CONFIG-ONLY mode in the following way:

Operational Failure. The router encounters a problem during operation and automatically comes up in CONFIG-ONLY mode. Any of the situations listed below cause the router to enter CONFIG-ONLY mode (see Figure 2–2).

- Repetitive crash detection wherein the router cannot run for more than 5 minutes without crashing. After sixteen such crashes, the router attempts to download new router software.

- An unsupported device is in the software load.

- Certain configuration errors have occurred during startup, including:

    – Non-volatile RAM is corrupted.

    – All router interface information was deleted.

    – Incorrect configuration information was entered.

    – No protocol is configured.

3

Booting, Dumping, and Upgrading the System

This chapter describes the Boot CONFIG utility. It explains how to use Boot CON-FIG, Boot CONFIG Commands, BOOTP Forwarding, and Trivial File Transfer Protocol (TFTP). The information in this chapter is used to boot the router, configure the router for a software upgrade, or save your configuration database to a remote system.

3.1 Using Boot CONFIG

Router nonvolatile memory includes the data that controls the router boot and dump capabilities. This data is called the configuration database. The Boot CONFIG commands allow you to modify this data.

Using Boot CONFIG commands, you can do the following:

* Add, modify, or remove entries from the boot and dump configuration database.

* Disable or enable network memory dumping and assign a unique name to the dump files.

* Use the TFTP protocol to transfer configuration information between router non-volatile memory and remote hosts.

* View the current boot and dump configuration database.

* Retrieve the load image from a remote source and load it into the router.

Changes made to system and protocol parameters through Boot CONFIG take effect when you restart the router or when you reload the router software.

3.1.1 Boot Files

Boot files are the same as load image files. A boot file contains the software load for the router and resides on a host server. The host server can be any device - PC, router, or workstation - that is running the IP protocol and TFTP. The router only knows about the load files that are manually entered into its configuration database.

When you enter the **reload** command (at the OPCON prompt), the router loads the image described by the last boot-entry record you entered in the configuration database.   Each entry contains the location of the host server and the path, timeout, and file names for the boot files.

Note: In Version 1.1 of the Bridge Router Software, only the most recent (last entered) boot file is used with the **reload** command.

You can use the **add** command to configure more than one boot file in the boot configuration database by specifying the path and name of each boot file. If you have more than one host server, you can use a different host server to boot the router when another host server cannot be reached over the network.

3.2 Entering and Exiting Boot CONFIG

To enter the Boot CONFIG command environment, use the CONFIG **boot** command. This chapter explains how to use this command from the CONFIG process. After you access the Boot CONFIG environment, enter the Boot CONFIG commands at the Boot config> prompt.

To return to the CONFIG prompt, use the **exit** command.

3.3 Dumping the System Memory Contents

The Bridge Router Software that is loaded on your module includes the capability of dumping the system memory contents for analysis. There are three parts to dump functionality, each of which is controlled by three distinct commands:

- GWCON **dump information** option – Prints information describing the last dump.

- Boot CONFIG **dump-entries** – A database of locations on the network for dumping (to file).

- OPCON **dump** command – Produces a dump of the router's memory contents. This command allows you to test dump-entry records to ensure that the router dumps correctly in the event of a crash.

Triggering a Dump

The OPCON **dump** command dumps the contents of memory. This command causes the contents of router memory to be dumped to a remote host as specified by one more more existing dump-entry records. Use this command to test your dump-entries to ensure that they work in the event of a system crash.

You manipulate dump-entry records from the OPCON process by entering the following commands:

Command	Result
t 6	Sets you into the CONFIG process
boot	Sets you at the BOOT CONFIG menu
list dump	Prints out all dump entry records
add dump	Allows you to add a new dump-entry entry
change dump	Allows you to modify an existing dump-entry entry
delete dump	Allows you to remove an existing dump entry entry

The **dump** command verifies that at least one dump-entry record is defined before allowing you to activate the dump procedure.

3.3.1 Configuring Dumping

An important feature of the Bridging Router is its ability to dump the contents of system memory and the processor's registers to another host during a system reset resulting from a software crash, hardware failure, or user action (pressing the reset switch).

To configure dumping, do the following:

- **Add a dump entry** – This is the location of the host or server that is going to receive the dump file. You add a dump entry with the **add dump-entry** command of the CONFIG process**.**

  The dump code attempts to dump to the first defined dump-entry in the same subnet as the router. If that fails, the dump code then attempts to dump to the next defined record in the same subnet, and so on, until all existing dump-entry records have been attempted. You can view the status of these

attempts through the GWCON **dump information** command (not to be confused with the OPCON **dump** (contents of memory) command. The size of the dump file depends upon the amount of memory on a particular platform.

- **Enable dumping** – Dumping does not work unless you enable it using the **enable dumping** command of the CONFIG process. Dumping remains enabled until you use the **disable dumping** command to terminate it.

3.3.2 Dump Files

When the router crashes and dumping is enabled, the router writes the memory contents to a remote host using TFTP. Each dump entry contains the location of the host server and the path, timeout, and file names for the dump files.

You can configure the router to automatically append a unique character string to the dump file names to prevent subsequent dumps from overwriting an existing dump file. See the **enable unique-naming** and **disable unique-naming** commands in this chapter.

Dump files are for diagnostic purposes only. Enable the router's dump and unique-naming capabilities only on the advice of your Digital Customer Services representative.

3.3.3 Boot and Dump Directories

You must create directories to contain the boot and dump files. These directories must reside on a host server. The boot directories must be globally readable and the dump directories globally writeable.

You must also create a world-writable dump file in the dump directory. On UNIX systems, use the **touch** command to create a new (empty) file. To give it world write access use the UNIX command **chmod a+w** *filename*.

The boot and dump functions use the TFTP protocol. Your TFTP server may impose additional restrictions.

3.3.3.1 Displaying Dump Information

You obtain dump information from the GWCON (+) prompt, using the DUMP command. Refer to Chapter 4 for information about entering the GWCON process.

The *dump* command prints out a list of eight possible dump entries and information detailing the status of the last dump performed by the system. This status information appears as in the following example:

```
1: Dump Failed to "/usr/router1.dmp" on 1.2.3.4
   error = TFTP protocol error
2: Dump Not Attempted to "/usr/tftp/router1.dmp" on 10.23.2.5
3: Dump Successful to "/usr/tftp/router1.dmp" on 1.2.3.4
```

Possible outcomes for each dump entry are:

- Not Attempted

- Failed

- Successful

Note: By design, in the example above, all configured dump entries are displayed, not just those up to and including the successful dump location.

If the IP address of a gateway is different from the default (0.0.0.0), then that information is printed, otherwise, it is left blank.

If a dump failed (status = Failed), an appropriate error message ("string") is displayed. Possible error messages are listed below:

- Invalid ROMBLKOUT
- Invalid request passed via ROMBLKOUT
- No dump requested
- No interface with IP protocol
- Unattended dump is disabled by config recs
- All dump records have been tried
- Dump not supported on interface type
- Interface board is not present
- Network device cannot be initialized
- TFTP Timeout
- TFTP protocol error

3.4 Boot CONFIG Commands

This section describes the Boot CONFIG commands. Each command includes a description, the syntax requirements, and an example. Table 3–1 summarizes the Boot CONFIG commands.

Note: Not all Boot CONFIG commands apply to all hardware platforms.

Table 3–1 Boot CONFIG Commands

Command	Function
? (Help)	Displays a list of the commands available from that prompt level.
Add	Adds a network boot interface, IP address to a specified interface, host boot entry, host dump entry, or bootp device.
Change	Changes the boot interface IP address, network boot entry data, network dump entry data, or bootp device.
Delete	Deletes a network boot interface, host boot entry, host dump entry, address, or bootp device.
Disable	Disables memory dump or unique naming of the dump files.
Enable	Enables memory dump and allows unique naming of dump files.
List	Displays all network boot addresses, all boot and dump configuration data, and name settings.
Load	Copies the boot file to RAM, copies the boot file from a remote host, or copies a new software image from a remote host.
TFTP	Initiates TFTP file transfers between router memory and remote hosts.
Exit	Leaves the Boot CONFIG environment and returns to the CONFIG process.

? (Help)

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
    CHANGE
    DELETE
    DISABLE
    ENABLE
    LIST
    LOAD
    TFTP
    EXIT
```

Example: **add ?**

```
    ADDRESS
    BOOT-ENTRY
    BP-DEVICE
    DUMP-ENTRY
```

Add

Create an entry in the boot and dump configuration database.

Syntax: add   address
                      boot-entry
                      bp-device
                      dump-entry

address

The IP address of the interface or device over which the router can boot or dump. When you enter the **add address** command, you must supply the value for the following information (or accept the default):

- Interface number of the network interface

- IP address

- Network mask

Note: To obtain the interface number (Ifc#), use the CONFIG **list devices** command. Chapter 3 describes this command. You must provide an address in order for the router to boot or dump over the network.

```
Example:  add address

    Which interface is this address for [0]?
    New address [0.0.0.0] ?
    Net mask for this interface [255.255.255.0]?
```

boot-entry

Enables you to enter information related to the boot server's location and boot file name. You can configure more than one boot device. When you enter the **add boot-entry** command, you must supply the following information:

- IP address of the remote host.

- IP address of the first hop router, if any.

- TFTP retransmission timer value. The default is 10 seconds. You may need to set this value to a longer time over exceptionally slow boot paths.

- Path and file name.

Note: To view a list of the current boot configuration, enter the Boot CONFIG **list boot** command.

```
Example:  add boot-entry

    remote host [0.0.0.0]?  10.0.0.5
    through gateway (0.0.0.0 if none) [0.0.0.0]?  10.0.0.7
    timeout in seconds [10]  10?
    file name [ ]?  /loads/routeabout.ldc
```

bp-device

Adds the specified interface as a BOOTP (Boot Protocol) device. The BOOTP device is the interface that BOOTP requests are sent through if the router image becomes corrupted. A BOOTP client sends out its hardware address, requesting its IP address, the IP address of a host that is willing to load it, and the load file name. There must be a BOOTP server set up on the LAN (or reachable from that LAN) designated as the BOOTP device for this to work. Once this information is obtained, the client uses TFTP to obtain the load file.

```
Example:  add bp-device

    Which interface number [0]?
```

dump-entry

The IP address of the remote host that receives the dump files. When you enter the
add dump-entry command, you must supply the following information:

- IP address of the remote host

- IP address of the first hop router (if any)

- TFTP retransmission timer value

- Base dump file name (may have unique suffix appended)

Note: To view a list of the dump configurations, enter the Boot CONFIG **list
dump** command. The GWCON **dump** command lists the status of the
last dump attempted from this router. It uses data from the dump-entry
records to display this information. However, if changes are made to any
dump-entry records, the displayed information is invalid.

```
Example:  add dump-entry

    remote host [0.0.0.0]? 1.2.3.4
    through gateway (0.0.0.0 if none) [0.0.0.0]?
    timeout in seconds [10]?
    file name []? /usr/tftp/router11.dmp
```

Change

Modify an entry in the boot and dump configuration database. Changes an existing
address for a boot interface or device that was previously added.

Syntax: change address
                        boot-entry
                        bp-device
                        dump-entry

address

Prompts you to provide new information to modify an existing address for a boot
interface or device. When you respond to the prompts from the **change address**
command, you must supply the following information:

- Address entry number

- Interface number of the network interface

- IP address

- Net mask

Note: When you enter the Boot CONFIG **list** command, the console displays
some of this information, such as the address entry number. To obtain
the interface number (Ifc#), use the CONFIG **list devices** command.
(The previous chapter describes this command.)

Example: **change address**

```
Change which entry [1]?
Which interface is this address for [0]?
New address [192.9.1.1]?
Net mask for this interface [255.255.255.0]?
```

boot-entry

Prompts you to provide new configuration information for a previously added net-
work boot file. When you enter the **change boot-entry** command, you must supply
the following information:

- Boot entry number

- IP address of the remote host

- IP address of the first hop router, if any

- TFTP timeout value, if any

- Boot file name, if different from the current file name

Note: When you enter the Boot CONFIG **list boot-entries** command, the con-
sole displays some of this information, such as the boot entry number.

Example: **change boot-entry**

```
change which entry [1]?
remote host [18.123.0.16]?
through gateway (0.0.0.0 if none) [0.0.0.0]?
timeout in seconds [3]?
file name [user/lib/gw/gwimage.ldb]? /user/lib/gw/gwimag1.ldb
```

bp-device

Prompts you to provide a new number for the interface that is the **BOOTP** device.
To obtain the entry number for an interface, use the **list boot-entries** command.

```
Example:  change bp-device

    Change which entry [1]?
    Which interface is this entry for [1]?
```

Note: For more information on the BootP protocol and its related functions,
refer to the section, "The BootP Forwarding Utility," in this chapter.

dump-entry

Prompts you to provide new information for a previously added network dump file.
When you enter the **change dump-entry** command, you must supply the following
information:

- Dump entry number

- IP address of the remote host

- IP address of the first hop router, if any

- TFTP retransmission timer value

- Dump file name, if different from the current file name

Note: Use the Boot CONFIG **list dump-entries** command to display this infor-
mation.

```
Example:  change dump-entry

    change which entry [1]?
    remote host [18.123.0.16]?
    through gateway (0.0.0.0 if none) [0.0.0.0]?
    timeout in seconds [3]?
    file name [user/lib/gw/gwimage.ldb]? /usr/tftp/router11.dmp
```

Delete

Remove entries from the boot and dump configuration database.

Syntax: <u>d</u>elete   <u>a</u>ddress
              <u>b</u>oot-entry
              <u>bp</u>-device
              <u>d</u>ump-entry

address

Prompts you to enter the number of the interface address of the entry you want to delete from the boot and dump configuration database.

Enter the number of the interface address that appears under the *Interface addresses* heading when you enter the Boot CONFIG **list address** command.

```
Example:  delete address

    Delete which entry [1]?
```

To verify the deletion, use the **list** command.

boot-entry

Prompts you to enter the number of the boot entry you want to delete from the boot and dump configuration database. The boot entry number appears under the *Boot files* heading when you enter the Boot CONFIG **list boot-entries** command.

```
Example:  delete boot-entry

    Delete which entry [1]?
```

To verify the deletion, use the **list** command.

bp-device

Prompts you to enter the number of the interface of the **BOOTP** device you want to delete.

```
Example:  delete bp-device

    Delete which entry [1]?
```

Note: For more information on the **BOOTP** protocol and its related processes, refer to the section "The **BOOTP** Forwarding Utility" in this chapter.

dump-entry

Prompts you to enter the number of the dump entry you want to delete from the boot and dump configuration database. The dump entry number appears under the *Dump to* heading when you enter the Boot CONFIG **list dump-entries** command.

```
Example:  delete dump-entry

   Delete which entry [1]?
```

To verify the deletion, use the **list** command.

Disable

Disable network memory dumping and the unique naming of dump files.

Syntax: d̲isable d̲umping
                      u̲nique-naming

dumping

Suppresses the network memory dump feature of the router when a system failure occurs. After you enter this command, use the Boot CONFIG **list all** command to verify the dump settings. Dumping is suppressed until you enter the **enable dumping** command (the default setting).

Note: This function is used for unattended dumping only. The OPCON **dump** command ignores this setting.

```
Example:  disable dumping
```

unique-naming

Suppresses the automatic unique naming of dump files. After entering this command, use the Boot CONFIG **list all** command to verify the unique naming settings. Unique naming is suppressed until you enter the **enable unique-naming** command (the default setting).

```
Example:  disable unique-naming
```

Enable

Enables network memory dumping and the unique naming of dump files.

Syntax: <u>en</u>able <u>d</u>umping
<u>u</u>nique-naming

dumping

Enable the network memory dump feature of the router when a system failure occurs. After you enter this command, use the Boot CONFIG **list all** command to verify the dump settings. Dumping is enabled until you enter the **disable dumping** command.

```
Example:  enable dumping
```

unique-naming

Enables the automatic unique naming of dump files. A random suffix (hexadecimal) of 1 to 5 characters is added to the configured dump file name when the dump occurs.

After you enter this command, use the Boot CONFIG **list all** command to verify the unique naming settings. Dump files include unique names until you enter the **disable unique-naming** command.

<u>**Note:**</u> Use the **enable unique-naming** command with caution on certain operating systems. For example, TFTP cannot create files on UNIX-based systems and, for that reason, dumping with automatic file name creation cannot succeed on these systems.

```
Example:  enable unique-naming
```

Exit

Leave the current process command level and return to the previous process level.

Syntax: <u>e</u>xit

```
Example:  exit
```

List

Display the current boot and dump configuration database.

Syntax: l̲ist   a̲ddresses
                        a̲ll
                        b̲oot-entries
                        b̲p-device
                        d̲ump-entries

addresses

Displays the IP addresses and their subnet masks of all of the network boot inter-
faces.

Example: **list addresses**

```
    Interface addresses:
    1: 192.9.1.1 on interface 0, mask 255.255.255.252
    2: 192.9.223.39 on interface 5, mask 255.255.255.0
```

all

Displays all boot and dump configuration data and the current settings for the dump
and unique-naming capabilities.

Example: **list all**

```
Interface Addresses:
 1: 128.185.208.3 on interface 0, mask 255.255.255.0
Boot files:
 1: "gw/routeabout.13.0Z.ldc" on 128.185.123.17 through 128.185.208.49 for 3 secs
BOOTP over interface(s): 3
Dumping disabled
Unique-naming disabled
Dump to:
 1: "/usr/local/tftp/router1.dmp" on 1.2.3.4 via 0.0.0.0 for 10 secs
 2: "/usr/tftp/router1.dmp" on 13.12.2.3 via 13.12.245.7 for 10 secs
```

boot-entries

Displays the boot file configuration.

Example: **list boot-entries**

```
    1: /usr/lib/gw/this-dn.ldb on 192.9.1.2 through 0.0.0.0 for 3 secs
    2: /usr/lib/gw/this.ldb on 192.9.2.2 through 192.9.1.4 for 3 secs
```

bp-device

Lists the interfaces that were previously added as BOOTP devices (Token-Ring only).

Example: **list bp-device**

```
   BOOTP over interface(s): 0 1
```

dump-entries

Displays the dump file configuration.

Example: **list dump-entries**

```
   1: "/usr/local/tftp/router1.dmp" on 1.2.3.4 via 0.0.0.0 for 10 secs
   2: "/usr/tftp/router1.dmp" on 13.12.2.3 via 13.12.245.7 for 10 secs
```

Load

Syntax: load   remote

remote

Interactively prompt for boot information and attempt to obtain the specified file using TFTP. If the download is successful, the file is loaded into FLASH. To perform a remote load, do the following:

1. Enter the **load remote** command after the Boot config> prompt and enter the remote host address, remote path name, first hop address, and TFTP timeout value after the prompts.

2. When the prompt asks you to confirm the load, enter No to cancel the command, or enter yes to load the boot file.

Example: **load remote**

```
   Remote Host Address[0.0.0.0]? 1.2.3.4
   Remote Pathname[ ]?   /usr/tftp/router11.ldc
   First Hop Address[0.0.0.0]?
   TFTP Timeout Value[3]?
```

3. After you enter the information above, the **load remote** command prompts you to confirm the action. Choose Yes to cause the router to restart in MOS and attempt to load the image (See the "Starting the Upgrade" section in this chapter). Choose No to cancel the operation.

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

Remote Host Address	IP address of the host containing the boot file.
Remote Pathname	Path name and file name of the boot file you want to load.
First Hop Address	Address of the first hop router that routes to other networks. This is needed if the remote host address is not on a directly connected network
TFTP Timeout Value	Time interval between the TFTP packet retransmissions. Longer values (longer than the default value of 3) may be needed when booting over or across slow networks or serial lines.

3.4.1 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 a router's nonvolatile configuration (NVRAM) and remote hosts.

TFTP transfers involve a *client* node and a *server* node. The client node generates a TFTP request on the network. The router acts as a client node by generating TFTP requests from the router console using the Boot CONFIG process **TFTP** command.

The client can transfer a copy of the configuration file stored in nonvolatile configuration memory from a TFTP server.

The server is any device (for example, PC, router, workstation) that receives and services the TFTP requests. When the router acts as a server, transfers are transparent to the user. Use the ELS message log to view the transfer in progress.

Note: For security reasons, this implementation of TFTP does not allow any remotely initiated writes (put) to the router.

Before using the **TFTP** command, note the following:

* The router configuration must include the IP protocol and have at least one configured IP address. Also, the router must not be operating in CONFIG-ONLY mode.

- When a router's NVRAM memory is empty (that is, before the router is config-
  ured, or if corrupted NVRAM is deleted), you must set the following parameters
  in order to restore the router's configuration:

  – Set the router's host name.

  – Configure IP so that the router can reach each host with the archived config-
    uration. The *Routing Protocols User's Guide* explains the IP configuration
    commands.

- The source IP address for TFTP transfers is the router ID. By default, this ID is
  a configured IP address for one of the router's network interface cards. To
  change the router ID, use the **set router ID** command at the `IP Config>`
  prompt.

- All TFTP data transfers are 512 bytes long. A data transfer of less than 512
  bytes indicates an end to the transfer. A protocol, client, or remote host error
  generates an error packet that terminates the transfer.

- You must download configuration files into the same type of router from which
  you are uploading the file.

Every TFTP transfer has a client and server UDP port number. When a client node
generates an initial request to the server, an unused UDP port number on the client
node is randomly selected as the client port. The server port is the UDP port number
69 (decimal). If a TFTP server is running on the <u>server</u>, it listens on UDP port 69.
When the server receives a request from the network, a UDP port number currently
unused on the server is randomly selected as the host port. The file transfers then
occur on these two UDP ports.

TFTP

Initiate TFTP file transfers between a remote host and the router's nonvolatile config-
uration (CONFIG). TFTP is also used to download new system software for the
router.

Note: "CONFIG" is a special file name assigned for storage of nonvolatile con-
figuration memory in the router.

TFTP can be used to save (**put**) and restore (**get**) configuration information to and
from remote hosts. The router operating system also uses TFTP to reload new soft-
ware images, and the router DUMP functionality uses a different implementation of
TFTP to save the state of the router and the contents of memory for later analysis.

Here, the router acts as a TFTP client. The remote host is any device (for example, router, workstation, PC) running IP that acts as a TFTP server node.

The **TFTP get** and **put** commands lock the CONFIG process for the duration of the operation. The following two keyboard characters are recognized during the TFTP operation:

CTRL/p	Displays the OPCON prompt (*)
CTRL/c	Cancels the TFTP operation

Note: Do not press the reset switch or power off the router while it is perform-ing a **TFTP get** operation. This may leave the configuration memory in an inconsistent (and invalid) state.

Syntax: t̲ftp   g̲et
                           p̲ut

get

Requests that a TFTP server transfer a file *from* the server *to* the router. The server sends a data packet and the client acknowledges receipt of the data. This cycle con-tinues until the transfer is complete.

```
Example:  tftp get config 11.22.33.44 /usr/local/tftp/router11.cfg
```

or

```
Example:  tftp get

   Local filename [CONFIG]? config
   Remote host [0.0.0.0]? 11.22.33.44
   Host filename []? /usr/local/tftp/router11.cfg
```

Local filename	Currently, the only valid file name is CONFIG.
Remote Host	Specifies the address of the host containing the file you want to transfer.
Host filename	Specifies the name of the file on the host that you want to transfer. Make sure that you specify the **complete** path name.

The following message appears on the console when the transfer completes:

```
TFTP transfer complete,  Status: OK
```

If the TFTP transfer is unsuccessful, a detailed error message appears on the screen. While transferring a file to NVRAM, the following message appears on the console:

```
Updating CONFIG:  Do Not Interrupt!
```

If you attempt to transfer a file and there is not enough memory to buffer the file, the following message appears on the console:

```
TFTP transfer complete,  Status: Out of Memory
```

Caution: Do not reset or power off the router while updating of the CONFIG is in progress. This may corrupt the data in NVRAM, forcing you to reconfigure the router.

Magic Numbers

There are three tests for validating an image before the process writes it into the router's NVRAM memory. First, the router assigns a *Magic Number* to each platform type for the archived image and the image to be restored. If the numbers do not match, the process aborts the transfer and the console displays the following message:

```
Bad Magic Number
```

In the second test, the host name for the router that originally archived the image is compared to the host name for the router that is restoring the image. If the host names do not match, you are prompted

```
Is this acceptable? (Yes or [No])
```

If you answer Yes, the transfer proceeds; if you answer No, the transfer is aborted.

The third test checks for adequate available memory. If there is not enough memory to accommodate the transfer and its accompanying operations, the transfer fails. When a transfer fails due to insufficient available memory, the console displays one of the following messages:

```
Out of Memory.
```

or

```
Unable to allocate buffer memory.  Config not updated.
```

Note: All of the tests listed above must be successful (pass) before the existing configuration is deleted and the new configuration is written to NVRAM.

put

Requests that a TFTP server transfer a file *to* the server *from* the router.   The server acknowledges the request and the client transfers the file. This cycle continues until the transfer is complete.

The console display is the same as for the **TFTP get** command.

Example: **tftp put config 11.22.33.44 /usr/local/tftp/router11.cfg**

or

Example: **tftp put**

```
    Local filename [CONFIG]? config
    Remote host [0.0.0.0]? 11.22.33.44
    Host filename []? /usr/local/tftp/router11.cfg
```

The following message appears on the console when the transfer is complete:

```
    TFTP transfer complete,  Status: OK
```

Note: On UNIX systems, the file must exist and be world-accessible prior to transfer. Use the UNIX command **touch** to create a new (empty) file if needed, and give it world write access with the UNIX command **chmod a+w** *filename*.

The **TFTP** command generates the following error messages:

Error Message	Meaning
Unknown Error	Protocol failure.
File Not Found	Specified host file does not exist.
Access Violation	File protection error.
Disk Full	File system full during write.
Illegal Operation	Undefined TFTP operation requested.
Unknown TID	Unexpected TFTP packet received.
File Already Exists	File already exists.
No Such User	TFTP not supported on host.

3.5 The BOOTP Forwarding Utility

BOOTP (documented in RFC 951) is a bootstrap protocol used by a router or a disk-less workstation to learn its IP address, the location of its boot file, and the location of its boot server. The Bridging Router can act as a *BOOTP client* or as a *BOOTP relay agent* for another device. The following sections describe these two processes.

3.5.1 The Bridging Router As a BOOTP Client

The router acts as a BOOTP client when it needs to find the location of the boot file and boot server. You can configure the Bridging Router's boot PROM to have the router act as a BOOTP client. It can also be a BOOTP Client if, during booting, it cannot find the boot file and server. When either of these conditions exist, the router broadcasts a UDP packet over one of its LAN interfaces (it looks for the LAN inter-face that completes its self-test first, usually Ethernet) to the *BOOTP server* that con-tains the path name of the boot file and server. The following steps illustrate this process:

1. The BOOTP client copies its MAC address (or ethernet address if it is booting over an Ethernet LAN) into a BOOTP packet (UDP packet) and broadcasts it onto the local LAN. BOOTP is running on top of UDP.

2. The BOOTP server receives the request and looks up the client's Ethernet address in its database. If found, it formats a BOOTP reply containing the cli-ent's IP address, subnet mask, and boot server name. The reply is sent back over the LAN to the BOOTP client.

Note: If multiple hops are required before reaching the BOOTP server, a BOOTP relay agent receives the packet. BOOTP relay agent is explained in the next section.

3. When the router receives the BOOTP reply packet, it uses the information to ini-tiate a TFTP request to the boot server.

3.5.2 The Bridging Router as a BOOTP Relay Agent

If the BOOTP request needs multiple hops before reaching the BOOTP server, the BOOTP relay agent routes the packet through IP to all BOOTP servers that it knows about. If any other router receives this packet while it is being routed through IP, it examines the packet to determine whether it is a BOOTP packet and routes that packet to the BOOTP servers that it knows about. The following steps describe the BOOTP relay agent forwarding process.

1. Acting as the local BOOTP relay agent, the bridging router receives the BOOTP request packet from the BOOTP client. It then modifies the checksum, places an IP header on the packet, and routes the packet to all BOOTP servers.

2. The BOOTP server receives the request and looks up the client's MAC address in its database. If found, it formats a BOOTP reply containing the client's IP address, subnet mask, and boot server name. The reply is then sent to the BOOTP relay agent.

3. The BOOTP relay agent receives the reply and makes an entry in its ARP table for the client and then forwards the reply to the BOOTP client.

4. The client then continues to boot using the information that is contained in the BOOTP reply packet to initiate a TFTP request to the boot server.

3.5.2.1 BOOTP Server

The BOOTP server is either a UNIX host with a *bootpd* daemon or a DOS host (running software available from FTP Software). The BOOTP server contains a file (maintained by the network administrator) that lists all the BOOTP clients that this server is responsible for, their associated IP addresses, and the locations and names of their boot files.

When the BOOTP server receives a BOOTP request, it compares the MAC address of the client with the MAC address in its BOOTP file. If a match occurs, the server constructs a BOOTP reply and adds the client's IP address, along with the location of the boot server and boot file name. If a match does not occur, the packet is dropped.

3.5.3 Enabling/Disabling BOOTP Forwarding

To enable or disable BOOTP forwarding on the router, enter the following command line at the IP configuration prompt:

```
IP Config> enable bootp
```

```
IP Config> disable bootp
```

When enabling BOOTP, you must enter the following values:

*   Maximum number of application hops you want the BOOTP request to span. This is the maximum number of BOOTP relay agents that can forward the packet. This is NOT the maximum number of IP hops to the BOOTP server. A typical value for this parameter is 1.

- Number of seconds you want the client to retry before you forward the BOOTP request. *This parameter is not commonly used.*   A typical value for this parameter is 0.

After accepting a BOOTP request, the router forwards it to each BOOTP server. If there are multiple servers configured for BOOTP, the transmitting server replicates the packet.

3.5.4 Configuring a BOOTP Server

To add a BOOTP server to the router's configuration, enter the following command at the IP configuration prompt:

```
IP Config> add BOOTP-SERVER [IP address of server]
```

You can configure multiple servers. In addition, if you know only the network number of the server or if multiple servers reside on the same network segment, you can configure a broadcast address for the server.

3.6 Upgrading the System Software

Digital router modules are designed with a facility that enables you to obtain a copy of the operating system software from a remote host. You can use this facility to upgrade the system software to a more recent release or to reload the current release.

When you invoke the upgrade function through the **reload** or **load remote** commands, the resident image restarts in IP Host-Only mode and the router attempts to obtain a new load image using TFTP. IP Host-Only mode causes the router to restart as an IP end station (no routing or bridging enabled), which allows the router to devote all its resources to loading the new image.

If you invoke the **reload** command, the router attempts to load the file specified by the most recent (highest numbered) boot-entry configuration record. If you invoked the **load remote** command, the router attempts to obtain the image specified by the data entered on the command line.

To ensure that the load host is reachable (because the router is now an IP end station), the router automatically installs a static route to the specified load host in the routing table using the data specified by the load request (either a boot-entry or command line data).

When the TFTP transfer of the new image completes successfully, the received image is validated, then written to FLASH. When the FLASH write is complete (which may take several minutes), the router restarts the new image using the existing configuration information.

If the TFTP transfer fails for any reason, the router restarts the original resident image using the existing configuration information. If the FLASH write fails for any reason (power failure, for example) while overwriting the old image, the router is left without a valid image. In this case, a platform-specific PROM-based loader attempts to obtain a new image using BOOTP or TFTP.

3.6.1 Starting the Upgrade

You activate the upgrade function through the command line interface using the OPCON **reload** command (see Chapter 1) or the Boot CONFIG **load remote** command. When the upgrade procedure initially restarts MOS, it displays the following notice:

```
[IP Host-Only Mode — Upgrading Operational Image]
```

During the upgrade procedure, the following output appears on the monitor:

```
*reload
Are you sure you want to reload the Gateway? (Yes or [No]): y

System Restart ...
..
Copyright Notices:
Copyright 1995 Digital Equipment Corp.
Copyright 1985-1994 Proteon, Inc.
Copyright 1984-1987, 1989 by J. Noel Chiappa

MOS Operator Control

[IP Host-Only Mode - Upgrading Operational Image]

Network FLASH update proceeding...
```

After a wait of 30 seconds (to assure that the router initialization is complete), the following message appears:

```
 initialization complete
```

Note: Between the start of the upgrade TFTP transfer and the FLASH update, you can press CTRL/p to enter OPCON from which you can enter any other process (for example, to **talk** to process 2 to view the status of the

TFTP transaction for diagnostic purposes). Display must be enabled for the TFTP subsystem in the ELS. If display is not enabled, you can enter process 5 and enable it.

If you do switch to another process, you cannot view the output of the CONFIG process because there is now no device connected to the CON-FIG process. The upgrade is not blocked, however, and completes nor-mally. Unless you need to switch to another process, remain in process 6.

You can still cancel the upgrade operation by pressing CTRL/c .

3.6.1.1 The reload Command

The OPCON **reload** command obtains the upgrade parameters (TFTP remote host IP address, gateway IP address, timeout value in seconds, and remote file name) from a predefined boot-entry configuration record. The **reload** command checks to make sure that at least one boot-entry is defined before it is activated. If no boot-entries are defined, the following message is displayed:

```
Aborted, No boot entries defined Configure a boot entry or use LOAD REMOTE
```

If the **reload** command finds a boot-entry, it prompts you with the message:

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

3.6.1.2 The load remote Command

The **load remote** command obtains the necessary TFTP information through a series of prompts issued in response to the command. Refer to the section "Boot CONFIG Commands" for information about the **add boot-entry** command and the **load remote** command.

To use the upgrade feature, you must have administrative privileges.

3.6.2 IP Host-Only Mode

IP Host-only (HST) mode is a restart state that the router enters as a result of repeti-tive crash detection or as part of the upgrade procedure.

When restarted in IP Host-Only mode, the router becomes an IP end station. Only UDP, TCP, ARP, TELNET, TFTP, and SNMP are enabled. IP routing, bridging, RIP, OSPF, ISIS, EGP, BGP, and all other protocols are disabled. During normal

operation, most RAM is allocated as buffers for protocol forwarders. During an upgrade, a large amount of RAM is needed to receive the image file being copied onto the router by TFTP. With the forwarders disabled, this RAM is available to receive the image file.

Note: In HST mode (bridge only, no IP routing), ASRT bridging is enabled so that IP Host Services are available.

3.6.2.1 Crash Handler

Repetitive crash detection defines three distinct severities: normal, excessive, and extreme.   Each state is defined by a maximum number of crashes within a fixed time interval. If the number of crashes in the time interval exceeds the number allowable for the severity, the severity is escalated to the next higher level.

The crash severity in effect at the time of a crash (at the time of a reboot following a crash) determines how the system is rebooted. The severities and their corresponding reboot personalities are:

- **Normal** – Normal MOS startup (full configured protocol initialization)

- **Excessive** – IP Host-Only mode MOS startup (minimal configured protocol initialization)

- **Extreme** – CONFIG-ONLY mode MOS startup (no configured protocol initialization)

When the crash detection handler reports unrecoverable image problems, one further severity condition exists, the Image Corrupt severity level:

- **Image Corrupt** – Operational image checksum intentionally corrupted and control passed to boot PROM. This results in a platform BOOTP load request sent on the default interfaces. It is an ultimate attempt to reload a new operational image and requires a suitably configured BOOTP network server and load file.

4

Monitoring the System

This chapter describes the GWCON process. It explains how to use GWCON and discusses its commands.

4.1 Using GWCON

The Gateway Console process, GWCON (also referred to as CGWCON), is a second-level process of the router user interface. Using GWCON commands, you can do the following:

- List the protocols and interfaces currently configured in the router.

- Display memory and network statistics.

- Set current ELS parameters.

- Test a specified network interface.

- Configure volatile configuration parameters.

- Enable and disable interfaces.

GWCON fits into the router software structure as shown in Figure 4–1.

Figure 4–1   CONFIG in the Router Software Structure
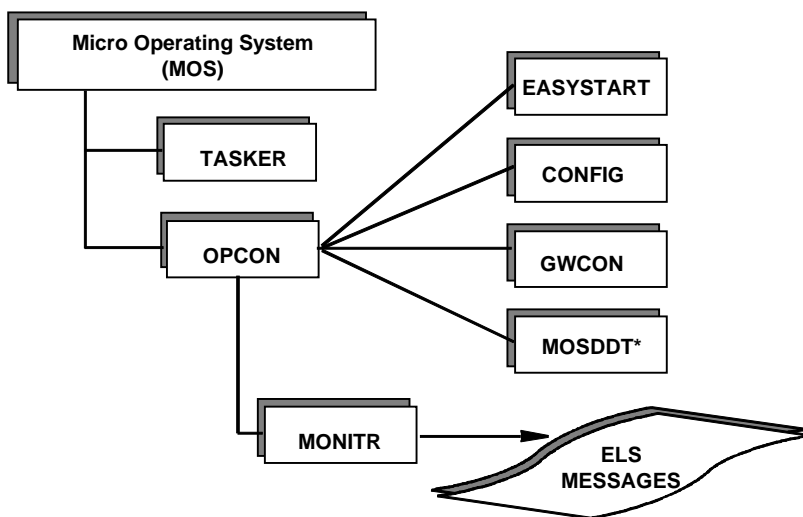
*Not available on all platforms   LKG-09869-95I

The GWCON command interface consists of a group of commands. Some of these commands, such as **clear,** perform actions.   Some commands, such as **network**, invoke a command interpreter that allows you to execute a subset of commands. Each group of commands has its own prompt.

If you want to know the process you are communicating with, press RET to display the prompt. CONFIG prompts usually appear as *xxx* Config>, where *xxx* is the protocol you are configuring; GWCON prompts appear as *xxx*>.

4.2 Entering and Exiting GWCON

To enter the GWCON command environment from OPCON and obtain the GWCON prompt, do the following:

1.   At the OPCON prompt, enter the **status** command to find the pid of GWCON.

```
Example:  *s

    Pid    Name    Status  TTY    Comments
     1    COpCon    IOW    TTY0
     2    Monitr    DET    --
     3    Tasker    IDL    --
     4    MOSDDT    DET    --
     5    CGWCon    IOW    --
     6    Config    IOW    --
     7    ROpCon    IOW    TTY1   128.183.142.17
     8    ROpCon    RDY    TTY2   128.182.178.5
```

2. Enter the **talk** command and the pid for GWCON to get to the GWCON process.

    `*talk 5`

The console displays the GWCON prompt (+). Now you can enter GWCON com-
mands.

If the prompt does not appear, press RET .

To return to OPCON, enter the OPCON intercept character (the default is CTRL/p).

4.3 GWCON Commands

This section contains the GWCON commands. Each command includes a descrip-
tion, the syntax requirements, and an example. After accessing the GWCON envi-
ronment, enter the GWCON commands at the + prompt. Table 4–1 summarizes the
GWCON commands.

Table 4–1 GWCON Command Summary

Command	Function
? (Help)	Lists the GWCON commands.
Boot	Displays boot information for the bridging router.
Buffer	Displays information about packet buffers assigned to each interface.
Clear	Clears statistics.
Configuration	Lists the current protocols and interfaces.
Disable	Takes the specified interface off line.
Dump	Displays information about the last system dump.
Error	Displays error counts.

Table 4–1 GWCON Command Summary (Continued)

Command	Function
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.
Log	Sets or views the logging level for events not included in the Event Logging System.
Memory	Displays memory, buffer, and packet data.
Network	Enters the command environment of the specified network.
Protocol	Enters the command environment of the specified protocol.
Queue	Displays buffer statistics for a specified interface.
Statistics	Displays statistics for the specified interface.
Test	Enables a disabled interface or tests the specified interface.
Uptime	Displays time statistics for the router.

? (Help)

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 information
    BUFFER statistics
    CLEAR statistics
    CONFIGURATION of gateway
    DISABLE interface
    DUMP information
    ERROR counts
    EVENT logging
    FEATURE commands
    INTERFACE statistics
    LOG level
    MEMORY statistics
    NETWORK commands
    PROTOCOL commands
    QUEUE lengths
    STATISTICS of network
    TEST network
    UPTIME of gateway


Example:  protocol ?

    IP
    ARP
    DN
    IPX
    DVMRP
    DLSW
    OSI
    SNMP
    OSPF
    APL
    SDLC
    APL2
    SRT
    HST
```

Boot

Display boot information for this bridging router.

Syntax: <u>bo</u>ot

```
Example:  boot
```

```
Booted using Ethernet, line 0 at (80740000, 4) as 128.185.227.220
Filename gw/mwwD.ldc
Host 128.185.122.17, Gateway 128.185.227.15
```

Notes: The actual display may vary depending on your hardware platform.

Refer to your hardware installation guide for information about the boot process for your specific hardware module.

Buffer

Display information about packet buffers assigned to each interface.

Note: Each buffer on a device is the same size and is built dynamically. 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 1
```

		Input Buffers				Buffer sizes					Bytes
Nt	Interface	Req	Alloc	Low	Curr	Hdr	Wrap	Data	Trail	Total	Alloc
0	TKR/0	20	20	7	0	109	92	2052	7	2260	45200
1	TKR/1	20	20	7	20	109	92	2052	7	2260	45200
2	FDDI/0	40	40	10	40	111	92	4478	19	4700	188000
3	SL/0	10	10	4	0	108	92	2048	0	2248	22480
4	Eth/0	40	40	10	40	108	92	1500	4	1704	68160
5	Eth/1	40	40	10	40	108	92	1500	4	1704	68160

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 (for flow control).

Curr   Current number of buffers on this device. The value is 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   Amount of buffer memory for this device. This value is determined
Alloc by multiplying the values of *Alloc* x *Total.*

Clear

Reset the statistical information about a network interface from the console display. This command is useful when tracking changes in large counters.

Enter the interface (or net) number as part of the command. To get the interface number, use the GWCON **configuration** command.

Syntax: <u>c</u>lear *interface#*

Example: **clear 1**

   Clear network statistics? (Yes or No):__

Configuration

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 state of the auto-boot switch. The second and third sections list the protocol and interface information.

Syntax: <u>co</u>nfiguration

Example: **configuration**

```
+conf

DECswitch900EF/MP, MP Brouter: 6 Enet 1 Fddi,HW=1/2,#2172,SW=X01.0.000
Hostname: router11
Boot ROM version 0.4
Watchdog timer enabled
Auto-boot switch enabled
Manufacturing rest disabled
Manufacturing test disabled
Console baud rate: 0


Num Name  Protocol
0   IP    DOD-IP
3   ARP   Address Resolution
11  SNMP  Simple Network Management Protocol



7 Networks:
Net Interface  MAC/Data-Link         Hardware     State
0   FDDI/0     FDDI/IEEE 802.2           FDDI     Down
1   Eth/0      Ethernet/IEEE 802.3   Ethernet     Up
2   Eth/1      Ethernet/IEEE 802.3   Ethernet     Up
3   Eth/2      Ethernet/IEEE 802.3   Ethernet     Down
4   Eth/3      Ethernet/IEEE 802.3   Ethernet     Up
5   Eth/4      Ethernet/IEEE 802.3   Ethernet     Down
6   Eth/5      Ethernet/IEEE 802.3   Ethernet     Down
```

Protocols: Num	Indicates the number that is associated with the protocol.
Name	Indicates the abbreviated name of the protocol.
Protocol	Indicates the full name of the protocol.
Networks:Net	Indicates the network number that the software assigns to the interface.
Interface	Indicates the name of the interface and the connector number on the card that the interface uses.
MAC/Data Link	Indicates the type of MAC/data link configured for that interface.

Hardare Indicates the specific kind of interface by hardware type.

State Indicates the current state of the network interface. The states are:

- **Down** – The interface is not operational and has failed a self-test.

- **Up** – The interface is operational and connected.

- **Disabled** – The interface is either temporarily or permanently disabled.

- **Testing** – The interface is undergoing a self-test.

- **Not installed** – No interface is present in the router.

Disable

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 is displayed. 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.

Note: This command may not be accepted during states of interface self-testing. In this case, you receive either of two messages: Network is already undergoing test, cancelling further testing; **or** Network is already undergoing test, cannot disable now. If either message appears, try the **disable** command again later.

Syntax: d̲isable *interface#*

Example: **disable 1**

Error

Displays error statistics for the network. This command provides a group of error counters.

Syntax: <u>err</u>or

Example: **error**

Nt	Interface	Input Discards	Input Errors	Input Unk Proto	Input Flow Drop	Output Discards	Output Errors
0	TKR/0	0	0	0	0	0	0
1	TKR/1	0	0	0	0	0	1
2	FDDI/0	0	0	0	0	0	2
3	SL/0	0	0	0	0	0	0
4	SL/1	0	0	0	0	0	0
5	SL/2	0	0	0	0	0	0
6	SL/3	0	0	0	0	0	0
7	Eth/0	0	0	0	0	0	0
8	Eth/1	0	0	0	0	0	0

Nt Network interface number associated with the software.

Interface Type of interface.

Input Discards Number of packets unsuccessfully received.

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 input.

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.

<u>Note:</u> The sum of the output discards is not the same as input flow drops over all networks. Output discards may indicate locally originated packets.

Event

Access the ELS environment to display messages on the console. Refer to Chapter 5 for information about the Event Logging System and its commands. Use the **exit** command to return to the GWCON process.

Syntax: e̲vent

```
Example:  event

   Event logging system user console
   ELS>
```

Feature

Access console commands for specific bridging router 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 4–2 lists available feature numbers and names.

Table 4–2 Bridging Router Feature Numbers and Names

Feature Number	Feature Short Name	Accesses the following feature console process
0	WRS	WAN Restoral
1	BRS	Bandwidth Reservation
2	MCF	MAC Filtering
3	BSA	BOSS SNMP Agent
4	X25S	X.25 Switching

After you access the console prompt for a feature, you may begin entering specific console 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 1**
          feature brs

   Reservation console>

Interface

Display statistical information about the network interfaces (for example, Ethernet, Token-ring, FDDI). You can use this command without a qualifier to provide a summary of all the interfaces (shown in the output below) or with a qualifier to reveal detailed information aout a specific interface.

To obtain the interface number, use the GWCON **configuration** command.

Syntax: interface *interface#*

Example: **interface**

```
                                Self-Test   Self-Test    Maintenance
Nt Nt'    Interface     CSR  Vec    Passed      Failed         Failed

0   0      TKR/0     80710000 1       0           0              0
1   1      TKR/1     80710080 1       2           1              0
2   2      FDDI/0    80720000 2       4           2              1
3   3      SL/0      80730000 3       0           0              0
4   4      SL/1      80730000 3       0           0              0
5   5      SL/2      80730000 3       0           230            0
6   6      SL/3      80730000 3       0           0              0
7   7      Eth/0     80740000 4       1           0              0
8   8      Eth/1     80740080 4       1           0              0
```

Note: The screen display varies depending on the device.

Nt   Global interface number.

Nt'   Reserved for dial circuit use.

Interface   Interface name.

CSR   Command and Status Register address.

Vec   Interrupt vector.

*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   Number of maintenance failures.
Failed

Log

View or temporarily change the current logging level of messages that are not included in the Event Logging System.

To display the current logging level, do not enter an octal number as part of the command. To change the logging level, enter the octal number of the new logging level as part of the command. The default logging level is 76 (octal).

Note: To change the initial logging level (that is, the level that the router uses when it starts), use the CONFIG set logging level command.

Syntax: log [*octal_#*]

```
Example: log

   Log lvl:  76
```

Memory

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 Digital Customer Services representative.

Syntax: <u>m</u>emory

Example: **memory**

```
                Total   Reserve   Never     Perm     Temp     Prev
                                  Alloc    Alloc    Alloc    Alloc
Heap memory    5463895   201824  5065383   328344   375856    22656
Buffer memory  2097024    12288    14512  2082512

Number of global buffers: Total = 294, Free = 287, Fair = 57, Low = 58
Global buff size: Data = 4478, Header = 128, Wrap = 92, Trail = 19, Total = 4700
```

Heap memory: Memory available for dynamically allocated data structures.

    Total   Original amount of space available for allocation of memory (heap size total).

    Reserve   Minimum amount of memory needed by the currently configured protocols and features.

    Never Alloc   Amount of memory that has never been allocated.

    Perm Alloc Amount of memory requested permanently.

    Temp Alloc Amount of memory allocated temporarily.

    Prev Alloc Amount of memory allocated temporarily and returned.

Buffer memory: Amount of memory used for buffer space.

    Total   Original amount of space available for allocation of buffers.

    Reserve   Minimum amount of buffer memory needed by the currently configured protocols and features.

    Never Alloc   Amount of buffer memory that has never been allocated.

    Perm Alloc Amount of buffer memory requested permanently.

Number of global buffers:

    Total   Original number of global buffers in the system.

    Free   Number of global buffers available.

Fair   Fair number of buffers for each interface. (See *Low* below.)

Low   *Low* is the number of free buffers at which the allocation strat-
      egy changes to conserve buffers. If the value of *Free* is less
      than *Low*, then buffers are not placed on any queue containing
      more than the *Fair* number of buffers on it.

Global buff size:

Data   Maximum data link packet size of all interfaces.

Header   Sum of the maximum hardware, MAC, and data link headers
      of all interfaces.

Wrap   Allowance given for MAC, LLC, or Network layer headers
      due to protocol wrapping.

Trailer   Sum of the largest MAC and hardware trailers of interfaces.

Total   Size of the largest packet buffer.

Network

Obtain the console prompt for the specified interface and enter the console environ-
ment for supported networks, such as X.25 networks. From the prompt, you can dis-
play statistical information, such as the routing information fields for X.25 networks.

Enter the interface or net number as part of the command. To obtain the interface
number, use the CONFIG **list** command. To return to GWCON, enter `exit`.

Syntax: <u>net</u>work *interface#*

```
Example:  network 2

   TKR>
```

Protocol

Access a protocol's command environment and communicate with the router soft-
ware that implements the network protocols installed in your router. After entering
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 and enter the **list configuration** command. To return to GWCON, enter `exit`.

Syntax: protocol *prot#*

```
Example:  protocol 7

   IPX>
```

Table 4–3 lists examples of protocol numbers and names.

Table 4–3 Protocol Numbers and Names

Protocol Number	Protocol Short Name	Accesses the following protocol process
0	IP	Internet Protocol
3	ARP	Address Resolution Protocol
4	DN	DECnet - a subset of Network Control Program
7	IPX	Novell NetWare Internetwork Packet Exchange
8	OSI	ISO Open Systems Interconnection - Connectionless Network Layer Protocol
9	DVMRP	Distance Vector Multicast Routing Protocol
10	BGP	Border Gateway Protocol
11	SNMP	Simple Network Management Protocol
12	OSPF	Open Shortest Path First
14	APL	AppleTalk Phase 1
20	SDLC	SDLC Relay
22	AP2	AppleTalk Phase 2
23	ASRT	Adaptive Source Routing Transparent Bridge
24	HST	TCP/IP Host Services
26	DLS	Data Link Switching
27	PIM	Protocol Independent Multicast

Queue

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:

- Total number of buffers allocated

- Low-level buffer value

- 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: <u>q</u>ueue *interface#*

Example: **queue**

```
              Input Queue        Output Queue
Nt Interface  Alloc Low  Curr    Fair   Curr
0  TKR/0       20   7    0         20      0
1  TKR/1       20   7    20        20      0
2  FDDI/0      40   10   4         30      0
3  SL/0        10   4    0         10      0
4  SL/1        10   4    0         10      0
5  SL/2        10   4    10        10      0
6  SL/3        10   4    0         10      0
7  Eth/0       40   10   40        30      0
8  Eth/1       40   10   40        30      0
```

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. A value of 0 means the device is disabled.

Output Queue:
    Fair   Fair level for the length of the output queue on this device.

4–17

> *Curr*   Number of packets currently waiting to be transmitted on this de-
> vice. For locally originated packets, the eligibility discard de-
> pends 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 is 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 **er-
ror** command. It also generates ELS event GW.036 or GW.057.

Due to the scheduling algorithms of the router, the dynamic numbers of *Curr* (partic-
ularly the *Input Queue Curr*) may not be fully representative of typical values during
packet forwarding. The console code runs when the input queues are drained. Thus,
Input Queue Curr is nonzero when those packets are waiting on slow transmit queues.

Statistics

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 num-
ber as part of the command. To obtain the interface number, use the GWCON **con-
figuration** command.

Syntax: s̲tatistics *interface#*

Example: **statistics**

```
Nt Interface   Unicast  Multicast    Bytes    Packets    Bytes
               Pkts Rcv  Pkts Rcv  Received     Trans    Trans
0  TKR/0            0         0         0         0         0
1  TKR/1         4669     12481   1041127     17150    972535
2  FDDI/0        5269      2843   1176718     10602   1335611
3  SL/0             0         0         0         0         0
4  SL/1             0         0         0         0         0
5  SL/2             0         0         0       230    138000
6  SL/3             0         0         0         0         0
7  Eth/0            3         0      1800      9754   1511069
8  Eth/1            3         0      1800      9751   1509731
```

Nt   Network interface number associated with the software.

Interface   Type of interface.

Unicast Pkts   Number of nonmulticast, nonbroadcast specifically addressed pack-
Rcv   ets at the MAC layer.

Multicast Pkts Number of multicast or broadcast packets received.
Rcv

Bytes Received Number of bytes received at this interface at the MAC layer.

Packets Trans   Number of packets transmitted.

Bytes Trans   Number of bytes transmitted at the MAC layer.

Test

Verify the state of an interface or enable an interface that was previously disabled with
the GWCON **disable** command.

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 a message similar to the following:

```
Testing net 0 FDDI/0...
```

When testing completes, fails, or GWCON times out (after 30 seconds), the console
displays a message similar to one of the following:

```
Testing net 0 FDDI/0...successful

Testing net 0 FDDI/0...failed

Testing net 0 FDDI/0...still testing
```

Some interfaces may take more than thirty seconds before testing is done.

Syntax: <u>test</u> *int_#*

Example: **test 0**

Uptime

Display time statistics about the router that includes

- 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: <u>u</u>ptime

Example: **uptime**

```
1 start, (0 known crashes) Last: Reloaded

Last Reload:  4 hours, 46 minutes ago
Last Restart:  4 hours, 46 minutes ago
```

5

Using the Event Logging System

This chapter describes the Event Logging System (ELS) and its configuration.

Refer to your hardware installation manual for information about accessing the console for your hardware platform.

5.1 Using the Event Logging System (ELS)

ELS is a monitoring system that is 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 (through the MONITR process), through SNMP (Simple Network Management Protocol), or both. You configure volatile ELS configuration information through the GWCON process; non-volatile ELS configuration through CONFIG.

Note: Specific ELS messages are described in the *Event Logging System Messages Guide*.

You access ELS from the OPCON process. Figure 5–1 shows how ELS fits into the router software structure.

Figure 5–1 ELS in the Router Software Structure
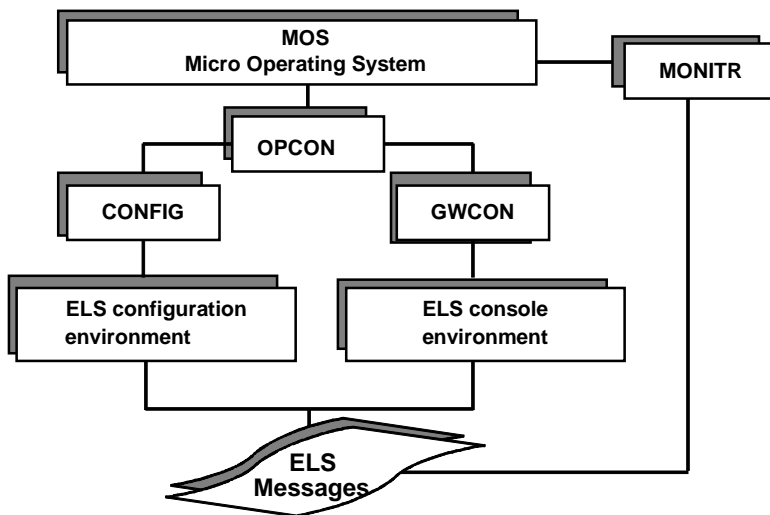
5.2 Event Logging Concepts

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 functionality is based on commands which take the subsystem, event number, and logging level as parameters.

5.2.1 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.

5.2.2 Interpreting a Message

This section describes how to interpret a message generated by ELS. Figure 5–2 shows the message contents.

Figure 5–2   Message Generated by an Event
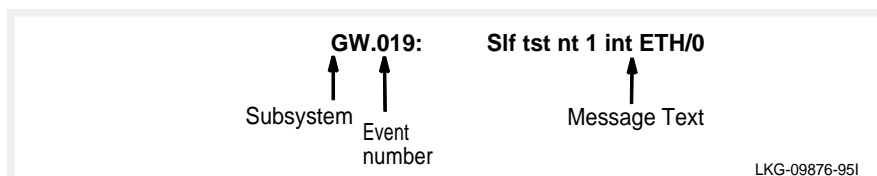
5.2.2.1 Subsystem

Subsystem is a pre-defined short name for a router component, such as a protocol interface. In Figure 5–2, **GW** identifies the subsystem through which this event occurred.

Other examples of subsystems include ARP, 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** displays all events that occur through the GW subsystem.

5.2.2.2 Event Number

Event Number is a pre-defined, unique, arbitrary number assigned to each message within a subsystem. In Figure 5–2, **19** is the event number within the GW subsystem. To see a list of all the event numbers within a subsystem, issue the **list subsystem** command, where *subsystem* is the short name for the subsystem (for example, GW for GWCON).

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.

5.2.2.3 Message Text

Message Text appears in short form. In Figure 5–2, `Slf 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 5–1 describes the error or packet completion codes.

Table 5–1 Packet Completion Codes (Error Codes)

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,
```

- **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 four decimal bytes separated by periods, such as 18.123.0.16.

DECnet addresses are printed as a pair of decimal numbers separated by a period, such as 2.17.

5.2.3 Other ELS Terms

This section describes the concepts of logging level and groups as used in messages in the Event Logging System.

5.2.3.1 Logging Level

Logging level is a pre-defined 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 5–2 lists the logging levels and types.

Table 5–2 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
U-INFO	Unusual informational comment
C-INFO	Common informational comment
INFO	Includes *all comment* levels above
STANDARD	Includes *all error* levels and *all international comment* levels (deault)
P-TRACE	Per packet trace
U-TRACE	Unusual operation Trace message
C-TRACE	Common operation Trace message
TRACE	Includes *all trace* levels above
ALL	Includes *all logging levels*

In Figure 5–2, 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 preceding commands. For example:

```
display subsystem TKR ERROR
```

The logging level on the command line modifies the **display** command so that when-ever 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.

5.2.3.2 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 pre-defined group names. You must create a group before you can specify its name on the com-mand 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 sub-systems and consists of 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 com-mand line, as follows:

```
nodisplay group grouptwo
```

To delete a group, use the **delete** command.

5.3 ELS Configuration Environment

The ELS configuration environment (available at the CONFIG process) is character-
ized by the `ELS Config>` prompt. Commands entered at this prompt create the ELS
default state that take effect after restarting 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** com-
mand at the `ELS Config>` prompt. This command configures the ELS to display
messages from all subsystems with the STANDARD logging level.

Note: The default ELS configuration is to display no subsystems. To display
ELS messages, you must configure the parameters.

5.4 ELS Console Environment

The ELS console environment (available at the CONFIG process) is characterized by
the `ELS>` prompt. Commands entered at this prompt modify the current ELS param-
eter settings. These commands are described in the next chapter.

5.5 Entering and Exiting ELS

This section describes how to enter and exit the ELS configuration and console envi-
ronments.

5.5.1 Entering and Exiting ELS Configuration Environment

To enter the ELS configuration environment from OPCON, perform the following steps:

1. At the OPCON prompt, enter the **status** command to find the pid of CONFIG.

    ```
        * s

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

2. Enter the **talk** command and the pid number for CONFIG.

    ```
        * talk 6
    ```

3. The console displays the CONFIG prompt (`Config>`). If the prompt does not appear when you first enter CONFIG, press `RET`.

4. 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.

5.5.2 Entering and Exiting ELS Console Environment

To enter the ELS console environment from OPCON, perform the following steps:

1. At the OPCON prompt, enter the **status** command to find the pid of GWCON.

    ```
        * s
    ```

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

2. Enter the **talk** command and the pid number for GWCON.

    ```
    * talk 5
    ```

3. The console displays the GWCON prompt (+). If the prompt does not appear
    when you first enter GWCON, press RET.

4. 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 con-
sole commands. To leave the ELS console environment, enter the **exit** command.
This command is described in this chapter.

5.6 ELS Configuration Commands

This section first summarizes the ELS configuration commands and then describes
each one in detail. After accessing the ELS configuration environment, you can
enter ELS Configuration commands at the ELS Config> prompt.

Table 5–3 ELS Configuration Command Summary

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.
List	Lists information on ELS settings and messages.
Nodisplay	Disables message display on the console.
Notrap	Keeps messages from being trapped and sent out over SNMP.
Set Pin	Sets the pin parameter to the maximum number of traps per second.
Trap	Allows messages to be trapped and sent out over SNMP.
Exit	Exits ELS configuration and returns you to the CONFIG process.

? (Help)

Lists 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
    NOTRAP
    SET
    TRAP
    EXIT
```

```
Example:  list ?

    ALL
    GROUPS
    PIN
    STATUS
    SUBSYSTEM
```

Add

Adds an individual event to an existing group creates a new group. Group names must start with an alphabetic character and are case sensitive.

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

Clears all 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):
```

Delete

Deletes an event number from an existing group or deletes the entire group. You are notified, if the specified event is the last event deleted in a group. If you specify *all* instead of *subsystem.event_number*, a prompt asks you to confirm the deletion of the entire group.

Syntax: <u>del</u>ete *group_name subsystem.event_number*

Example: **delete groupa gw.019**

Display

Enables message display on the console monitor for specific events, groups, or sub-systems.

Syntax: <u>di**s**</u>play <u>e</u>vent . . .

<u>g</u>roup . . .

<u>s</u>ubsystem . . .

event *subsystem.event#*

Displays messages of the specified event (*subsystem.event#*).

Example: **display event gw.019**

group *group.name*

Displays messages of a specified group (*group.name*).

Example: **display group groupb**

subsystem *subsystem.name*

Displays messages associated with the specified subsystem. The following is a list of the supported subsystems of the bridging router.

<u>**Note:**</u> Not all subsystems are supported by all hardware platforms. Refer to your hardware installation guide for information about the specific sub-systems that your platform supports.

Subsystem	Description
ALL	All subsystems
GW	Router base and network library
FLT	Filter Library
BRS	Bandwidth Reservation
ARP	Address Resolution Protocol
IP	Internet Protocol
ICMP	Internet Control Message Protocol
TCP	TCP
UDP	User Datagram Protocol
BTP	BOOTP relay agent
RIP	IP Routing Information Protocol
EGP	Exterior Gateway Protocol
OSPF	Open SPF-Based Routing Protocol
MSPF	OSPF Multicast extensions
TFTP	TFTP Protocol
SNMP	Simple Network Management Protocol
DVM	DVMRP Multicast Routing Protocol
DN	DECnet
IPX	Internetwork Packet Exchange Protocol
ISDN	Integrated Services Data Network
CLNP	ISO 8473 (Connectionless Layer Network Protocol)
ESIS	ISO 9542 (End-System to Intermediate-System Protocol)
ISIS	ISO 10589 (Intermediate-System to Intermediate-System Protocol)
DNAV	DNA Phase V
APL	AppleTalk
ZIP	Appletalk Zone Information Protocol
RTMP	Appletalk Routing Table Management Protocol
AP2	AppleTalk Phase 2
ZIP2	Appletalk Phase 2 Zone Information Protocol
R2MP	Appletalk Phase 2 Routing Table Management Protocol
SRT	Source Routing Transparent Bridge
STP	Spanning Tree Protocol

<u>Subsystem</u>	<u>Description</u> (cont.)
BR	Bridge/Routing
SDLC	SDLC Relay
ETH	Ethernet Handler
SL	Serial Line Handler
TKR	Token Ring Handler
X25	X.25 Protocols
FRL	Frame Relay
PPP	Point-to-Point
X251	X.25-Physical-Layer
X252	X.25-Frame-Layer
X253	X.25-Packet-Layer
IPPN	IP Protocol Net
WRS	WAN Restoral
LLC	Logical Link Control
BGP	Border Gateway Protocol
MCF	MAC Filtering
V25B	CCITT/ITU V.25bis
BAN	Boundary Access Node
PIM	Protocol Independent Multicast
X25S	X25 Switching
X25L	X.25 LLC Interface

```
Example:  display subsystem tkr
```

List

Lists updated information regarding ELS settings and listings of selected messages.

Syntax: l̲ist   a̲ll
                    g̲roups
                    p̲in
                    s̲tatus
                    su̲bsystem
                    su̲bsystem . . .
                    su̲bsystems a̲ll

all

Lists information from all the **list** categories.

Example: **list all**

groups

Lists the user-defined group names and contents.

Example: **list groups**

pin

Lists the current pin value.

Example: **list pin**

status

Lists the subsystems, groups and events which 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**

```
Name   Events  Description

ALL            All subsystems
GW     89      Router base and network library
FLT    7       Filter Library
BRS    4       Bandwidth  Reservation
ARP    22      Address Resolution Protocol
IP     88      Internet Protocol
ICMP   20      Internet Control Message Protocol
TCP    55      TCP
UDP    4       User Datagram Protocol
BTP    13      BOOTP relay agent
RIP    29      IP Routing Information Protocol
EGP    55      Exterior Gateway Protocol
OSPF   62      Open SPF-Based Routing Protocol
MSPF   15      OSPF Multicast extensions
TFTP   29      TFTP Protocol
SNMP   21      Simple Network Management Protocol
DVM    21      DVMRP Multicast Routing Protocol
DN     115     DECnet
XN     22      XNS/IPX/DDS common processing
XNS    1       Xerox Networking Systems Protocol
IPX    94      Internetwork Packet Exchange Protocol
CLNP   61      ISO 8473 - CLNP
ESIS   25      ISO 9542 - ESIS Protocol
ISIS   58      ISO 10589 - ISIS Protocol
DNAV   27      DNA Phase V
APL    59      AppleTalk
ZIP    42      Appletalk Zone Information Protocol
RTMP   25      Appletalk Routing Table Management Protocol
AP2    68      AppleTalk Phase 2
ZIP2   51      Appletalk Phase 2 Zone Information Protocol
DDS    35      Apollo Domain Protocol
R2MP   38      Appletalk Phase 2 Routing Table Management Protocol
VIN    78      Banyan VINES
SRT    87      Source Routing Transparent Bridge
STP    32      Spanning Tree Protocol
BR     29      Bridge/Routing
ETH    47      Ethernet Handler
SL     33      Serial Line Handler
TKR    45      Token Ring Handler
X25    61      X.25 Protocols
FRL    54      Frame Relay
PPP    135     Point-to-Point
X251   16      X.25-Physical-Layer
X252   34      X.25-Frame-Layer
X253   39      X.25-Packet-Layer
IPPN   4       IP Protocol Net
WRS    29      WAN Restoral
                  (continued on next page)
```

```
Name   Events   Description

LLC    130      Logical Link Control
BGP    73       Border Gateway Protocol
MCF     9       MAC Filtering
V25B   28       CCITT/ITU V.25bis
BAN    29       Boundary Access Node
PIM    30       Protocol Independent Multicast
X25S   49       X25 Switching
X25L   12       X.25 LLC Interface
```

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
```

Nodisplay

Use the **nodisplay** command to select and turn off messages displaying on the console monitor.

Syntax: nodisplay event . . .
                        group . . .
                        subsystem . . .

event *subsystem.event#*

Suppresses the displaying of a specified event (*subsystem.event#*).

```
Example:  nodisplay event gw.019
```

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 display of messages associated with the specified subsystem.

```
Example:  nodisplay subsystem tkr
```

Notrap

Selects and turns off messages being trapped and sent over SNMP.

Syntax: notrap event . . .
                        group . . .
                        subsystem . . .

event *subsystem.event#*

Suppresses the trapping of the specified message (*subsystem.event#*).

```
Example:  notrap event gw.019
```

group *group.name*

Suppresses the trapping messages that were previously added to the specified group (*group.name*).

```
Example:  notrap group groupb
```

subsystem *logging level*

Suppresses the trapping of messages associated with the specified subsystem (*logging level*).

```
Example:  notrap subsystem tkr error
```

Set Pin

Sets the pin parameter to the maximum number of traps per second that can be sent. Internally, the pin resets every tenth of a second. One-tenth of the number *max_traps* is sent every tenth of a second.

Syntax: ṣet p̣in *max_traps*

```
Example:  set pin 100
```

Trap

Selects and turns on messages trapped and sent over SNMP.

Syntax: ṭrap   ẹvent . . .
                         g̣roup . . .
                         ṣubsystem . . .

event *subsystem.event#*

Traps the specified message (*subsystem.event#*).

```
Example:  trap event gw.019
```

group *group.name*

Traps messages that were previously added to the specified group.

```
Example:  trap group groupb
```

subsystem *logging level*

Traps messages associated with the specified subsystem (*logging level*).

```
Example:  trap subsystem gw
```

Exit

Exits ELS and returns to the CONFIG prompt.

Syntax: ex̲it

```
Example:  exit
```

The next section describes how to use ELS to monitor and troubleshoot the network.

5.7 Monitoring the Event Logging System

This section describes how to monitor events logged by ELS and how to use the ELS console commands. The information includes the following sections:

- Accessing the ELS Console Environment

- ELS Console Commands

5.7.1 Process Characteristics

When you view ELS from the MONitor 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 appears on the screen:

```
    xx messages flushed
```

The bridging router provides no functionality to save these messages so that they can be reviewed later. When this message appears, you may want to tailor the ELS output to display information that is important to the current task you are monitoring.

It is also important to note that the ELS messages continually rotate through the router's buffers. To stop and restart the ELS message, use

$\boxed{\text{CTRL/s}}$ to stop scrolling
$\boxed{\text{CTRL/q}}$ to start scrolling.

You can also capture the ELS output to a file. To do this, start 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. Customer Service may need this information to diagnose a problem.

5.7.2 Using the ELS Monitor Process Effectively

To use ELS effectively, follow these suggestions.

- 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 MONitor 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 *Event Logging System Messages Guide* to determine which messages are normal.

5.8 Using ELS to Troubleshoot a Problem

When you are trying to troubleshoot a particular problem, display only those messages that relate to the problem. If, for example, you are experiencing a problem with bridging, turn on the bridging messages by issuing the following commands:

display subsystem srt all
display subsystem br all

Initially, because of the speed at which the messages scroll off the screen, you may want to record the numbers and look them later up in the manual. After you become familiar with the different types of messages, you can selectively turn on and off those messages you need to troubleshoot a problem. The following sections list specific ELS examples. Different problems may require different steps.

ELS Example 1

You are interested into looking at the frequency of polling on a token ring interface, and 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, look for ELS message tkr.031.

ELS Example 2

The SR-TB bridging is not working.

1. Check the configuration.

2. Use the GWCON bridging console to verify that the bridging interfaces are enabled.

3. Enter the following:

```
* t 6

config> event

ELS config> nodisplay subsystem all all

ELS config> display subsystem srt all

ELS config> exit

config> CTRL/p

* restart

* T 2
```

As the message begin to scroll, look for messages srt.071 through srt.075. If you see one these messages, you are not licensed to use one or more of the bridging features.

ELS Example 3

The router cannot communicate with an IPX server on an ethernet.

1. Using the IPX console (GWCON) command, issue the **SLIST** command to verify that the server is listed.

2. Check the IPX configuration.

3. 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, look for ELS message eth.006. This indicates that the server has a bad Ethernet config.

5.9 Accessing the ELS Console Environment

For information on how to access the ELS console environment, see the section "ELS Configuration Environment" in this chapter.

5.10 ELS Console Commands

This section summarizes the ELS console commands. After accessing the ELS Console environment, you can enter ELS console commands at the ELS> prompt.

Table 5–4 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 subsystems.
Display	Enables message display on the console.
Exit	Exits ELS console and returns the user to the GWCON process.
List	Lists information on ELS settings and messages.
Nodisplay	Disables message display on the console.

Table 5–4 ELS Console Command Summary (Continued)

Command	Function
Notrap	Keeps messages from being trapped and sent out over SNMP.
Remove	Frees up memory by erasing stored information.
Restore	Clears current settings and reloads initial ELS configuration.
Retrieve	Reloads the saved ELS configuration.
Command	**Function**
Save	Stores the current configuration.
Set	Sets the pin parameter to the maximum number of traps per second.
Statistics	Displays available subsystems and pertinent statistics.
Trap	Allows messages to be trapped and sent out over SNMP.

? (Help)

Lists 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
    NOTRAP
    REMOVE saved state
    RESTORE initial state
    SAVE current state
    SET
    STATISTICS
    TRAP
    EXIT
```

```
Example:  list ?

    ALL
    ACTIVE
    EVENT
    GROUPS
    PIN
    SUBSYSTEMS
```

Clear

Disables both the **display** and **trap** commands as they relate to specific events, groups, or subsystems.

Syntax: c̲lear   e̲vent . . .
              g̲roup . . .
              s̲ubsystem . . .

event *subsystem. event#*

Disables displaying or trapping messages for the specified event (*subsystem.event#*).

```
Example:  clear event gw.019
```

group *group.name*

Disables displaying or trapping messages for the specified group (*group.name*).

```
Example:  clear group groupb
```

subsystem *subsystem.name*

Disables displaying or trapping 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

Enables the message display of specified events on the console monitor.

Syntax: display event . . .
              group . . .
              subsystem . . .

event *subsystem.event#*

Displays messages for the specified event (*subsystem.event#*).

Example: **display event gw.019**

group *group.name*

Displays the messages that were previously added to the specified group
(*group.name*).

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**

Exit

Exits ELS and returns to the previous prompt level.

Syntax: exit

Example: **exit**

List

Updates information regarding ELS settings and displays listings of selected messag-
es.

Syntax: <u>l</u>ist   <u>a</u>ll
                        <u>ac</u>tive . . .
                        <u>e</u>vent . . .
                        <u>g</u>roups . . .
                        <u>p</u>in
                        <u>s</u>ubsystem . . .

all

Displays information from all the **list** categories.

```
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.007   89354
    ETH.009D 10

    Subsystem X25: no event active
```

event *event.name*

Displays the logging level, the message, and the count of the specified event.

```
Example:  list event ip.007

    Level: p-TRACE
    Message: %I -> %I
    Active:  Count: 84182
```

groups *group.name*

Displays the user-defined group names.

```
Example:  list groups
```

pin

Displays the current pin value.

Example: **list pin**

subsystem *subsystem.name*

Lists event names, the total number of events that occurred, and their descriptions as shown in the following example.

Example: **list subsystem**

```
Name       Events        Description

ALL                      All subsystems
GW         89            Router base and network library
FLT         7            Filter Library
BRS         4            Bandwidth  Reservation
ARP        22            Address Resolution Protocol
IP         88            Internet Protocol
ICMP       20            Internet Control Message Protocol
TCP        55            TCP
UDP         4            User Datagram Protocol
BTP        13            BOOTP relay agent
RIP        29            IP Routing Information Protocol
EGP        55            Exterior Gateway Protocol
OSPF       62            Open SPF-Based Routing Protocol
MSPF       15            OSPF Multicast extensions
TFTP       29            TFTP Protocol
SNMP       21            Simple Network Management Protocol
DVM        21            DVMRP Multicast Routing Protocol
DN         95            DECnet
IPX        94            Internetwork Packet Exchange Protocol
CLNP       61            ISO 8473 - CLNP
ESIS       25            ISO 9542 - ESIS Protocol
ISIS       58            ISO 10589 - ISIS Protocol
DNAV       27            DNA Phase V
APL        59            AppleTalk
ZIP        42            Appletalk Zone Information Protocol
RTMP       25            Appletalk Routing Table Management Protocol
AP2        68            AppleTalk Phase 2
ZIP2       51            Appletalk Phase 2 Zone Information Protocol
DDS        35            Apollo Domain Protocol
R2MP       38            Appletalk Phase 2 Routing Table Management
                         Protocol

                         (continued on next page)
```

```
Name      Events        Description (Continued)

SRT       87            Source Routing Transparent Bridge
STP       32            Spanning Tree Protocol
BR        29            Bridge/Routing
ETH       47            Ethernet Handler
SL        33            Serial Line Handler
TKR       45            Token Ring Handler
X25       61            X.25 Protocols
FRL       54            Frame Relay
PPP       95            Point-to-Point
X251      16            X.25-Physical-Layer
X252      34            X.25-Frame-Layer
X253      39            X.25-Packet-Layer
IPPN       4            IP Protocol Net
WRS       29            WAN Restoral
LLC       90            Logical Link Control
BGP       73            Border Gateway Protocol
MCF        9            MAC Filtering
V25B      28            CCITT/ITU V.25bis
BAN       29            Boundary Access Node
PIM       30            Protocol Independent Multicast
X25S      49            X.25 Switching
X25L      12            X.25 LLC Interface
```

subsystem *subsystem.name*

Lists all events, logging levels, and messages for the specified subsystem. See the following example.

```
Example:  list subsystem eth
```

```
EventLevelMessage
ETH.001P-TRACEbrd rcv unkwn type %X %E -> %E nt %d int %s/%d
ETH.002UE-ERRORrcv unkwn typ %X %E -> %E nt %d int %s/%d
ETH.010C-INFOLLC unk SAP %X %E -> %E nt %d int %s/%d
```

subsystems a̲ll

Lists all events, logging levels, and messages for every event that occurred on the bridging router. See the following example.

```
Example:  list subsystems all
```

Nodisplay

Selects and turns off the display of messages on the console monitor.

Syntax: <u>nod</u>isplay <u>e</u>vent . . .
<u>g</u>roup . . .
<u>s</u>ubsystem . . .

event *subsystem.event#*

Suppresses the display of messages for the specified event as shown in the following example.

Example: **nodisplay event gw.019**

group *group.name*

Suppresses the display of messages that were previously added to the specified group (*group.name*) as shown in the following example.

Example: **nodisplay group groupb**

subsystem *subsystem.name*

Suppresses the display of messages associated with the specified subsystem (*logging level*) as shown in the following example.

Example: **nodisplay subsystem tkr**

Notrap

Selects and turns off messages trapped and sent over SNMP.

Syntax: <u>no</u>trap <u>e</u>vent . . .
<u>g</u>roup . . .
<u>s</u>ubsystem . . .

event *subsystem.event#*

Suppresses the trapping of messages for the specified event (*subsystem#*).

Example: **notrap event gw.019**

group *group.name*

Suppresses trapping of messages that were previously added to the specified group (*group.name*).

```
Example:  notrap group groupb
```

subsystem *logging level*

Suppresses trapping of messages associated with the specified subsystem (*logging level*).

```
Example:  notrap subsystem tkr error
```

Remove

Recovers 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: <u>rem</u>ove

```
Example:  remove
```

Restore

Clears all current settings (except counters) and reloads the initial ELS configuration. To retain the current settings, use the **save** command before restoring the initial configuration.

Syntax: <u>res</u>tore

```
Example:  restore
```

Retrieve

Reloads 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: <u>ret</u>rieve

```
Example:  retrieve
```

Save

Stores 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 intentions 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.

Note: A saved configuration from one release may not be valid (or the same) when retrieved while running a newer release.

Syntax: s̲ave

Example: **save**

Set Pin

Sets the pin parameter to the maximum number of traps per second that can be sent. Internally, the pin resets every tenth of a second. One tenth of the number *max_traps* is sent every tenth of a second.

Syntax: s̲et *pin max_traps*

Example: **set pin 100**

Statistics

Displays a list of the available subsystems and their statistics.

Syntax: <u>st</u>atistics

Example: **statistics**

```
Subsys   Vector   Exist   String   Active     Heap
  GW       50       31     1033       3         34
 ARP       25       16      483       0          0
  IP       80       70     1686      11         22
ICMP       20       14      335       0          0
 UDP       10        4      109       0          0
 RIP       30       19      402       0          0
 EGP       70       53     1088       0          0
OSPF       60       51     1868       0          0
SNMP       20       12      311       0          0
  DN       90       73     4056       0          0
 APL       60       59       68       0          0
 ETH       16       16      591       0          0
  PN       20       15      708       0          0
  SL       15       12      393       0          0
 TKR       20       19      834       0          0
 X25       50       38     1324       1         30

Total     636      502    15289      15         86

Maximum: 1137 vector, 90 subsystem
Memory: 10233/360 vector + 8480/15696 data + 86 heap = 34855
```

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*

Trap

Selects and turns on messages trapped and sent over SNMP.

Syntax: ṯrap   ͜event . . .
                    ͜group . . .
                    ͜subsystem . . .

event *subsystem.event#*

Traps the specified message (*subsystem.event#*).

Example: **trap event gw.019**

group *group.name*

Traps messages that were previously added to the specified group.

Example: **trap group groupb**

subsystem *logging level*

Traps messages associated with the specified subsystem (*logging level*).

Example: **trap subsystem gw**

A

The MONITR Process

This chapter explains how to use the MONITR process and how to control the way MONITR collects and displays messages.

A.1 The MONITR Process

The MONITR process receives messages from the Event Logging System (ELS) and displays them on the console monitor. MONITR also displays logging messages from software that still uses the old logging system. MONITR fits into the router software structure as shown in Figure A–1.

Figure A–1 MONITR in the Router Software Structure
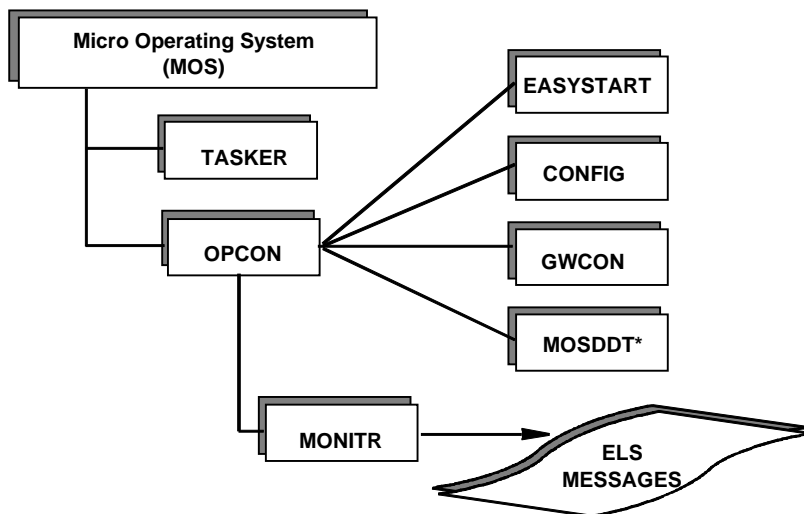
*Not available on all platforms   LKG-09869-95I

A.2 Commands Affecting MONITR

The following commands affect the MONITR process:

- OPCON commands:

    – **divert** temporarily sends output to a different device.

    – **flush** causes MONITR to discard the messages it collects.

    – **halt** reverses the action of the **divert** command.

    – **talk** causes MONITR to display its output.

- The CONFIG **set logging disposition** command sets the initial device to which MONITR sends its output.

A.3 Entering and Exiting MONITR

To enter the MONITR process from OPCON, perform the following steps:

1. At the OPCON prompt, enter the **status** command to find the pid of MONITR.

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

2. Enter the **talk** command and the pid number to enter the MONITR environment.

    ```
      * talk 2
    ```

MONITR does not display a prompt and you cannot enter any commands. However, the console begins to display the messages MONITR has accumulated.

To exit MONITR and return to OPCON, enter the OPCON intercept character CTRL/p .

A.4 Receiving MONITR Messages

To receive MONITR messages at your console, enter the MONITR process as described in the previous section. MONITR displays all the messages it recorded since it was last invoked. While you are connected to MONITR, it displays all messages as they arrive.

You can use the OPCON **divert** and **halt** commands to view MONITR messages while you are performing another task with the router. Permitted devices divert output to TTY0 (the local console), TTY1, or TTY2 (the remote consoles).

To specify a default device for MONITR, define the device in NVRAM by using the CONFIG **set logging disposition** command. Specifying a default device is useful if you have a terminal set up to print.

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