CHAPTER 2

Understanding the User Interface

The router user interface provides several different command modes. Each command mode provides a group of related commands. This chapter describes how to access and list the commands available in each command mode. It also discusses the user interface to Telnet, which you might use to connect to another router.

Entering a **?** at the system prompt allows you to obtain a list of commands available for each command mode.

The command interpreter is called the EXEC. The EXEC interprets the commands you type and carries out the corresponding operations. You must log into the router before you can enter an EXEC command. For security purposes, the EXEC has two levels of access to commands: *user* and *privileged*. The EXEC commands available at the user level are a subset of the EXEC commands available at the privileged level. From the privileged level, you can also access global configuration mode and six specific configuration modes: interface, subinterface, line, router, ipx-router, and route-map configuration.

Almost every system configuration command also has a **no** form. In general, use the **no** form to disable a feature or function. Use the command without the keyword **no** to reenable a disabled feature or enable a feature that is disabled by default. For example, IP routing is enabled by default. Specify the command **no ip routing** to disable IP routing and specify **ip routing** to reenable it. The *Router Products Command Reference* publication provides the complete syntax for every command and describes what the **no** form of a command does.

If your router does not find a valid system image, or if its configuration file is corrupted at startup, the system may enter read-only memory (ROM) monitor mode. A brief description of the ROM monitor mode is included in this chapter.

The user interface also provides context-sensitive help on command syntax. This chapter describes how to use the help system. It also describes the command editing and command history features that enable you to recall previous command entries and easily edit command entries.

For a complete description of the commands mentioned in this chapter, refer to Chapter 2 of the *Router Products Command Reference* publication.

User Interface Task List

You can perform the following tasks to become familiar with the router's user interface, to configure various aspects of the user interface, and to use Telnet connections:

- Access each command mode (page 2-2)
- Get context-sensitive help (page 2-15)
- Check command syntax (page 2-17)
- Use the command history features (page 2-18)
- Use the editing features (page 2-20)
- Set terminal parameters (page 2-25)
- Lock the keyboard (page 2-29)
- Set pending output notification (page 2-29)
- Prevent errant connection attempts (page 2-29)
- Configure Telnet capabilities for a session (page 2-29)
- Use Telnet connections (page 2-31)
- Monitor Telnet connections (page 2-34)

Access Each Command Mode

This section describes how to access each of the router's command modes:

- User EXEC mode
- Privileged EXEC mode
- Global configuration mode
- Interface configuration mode
- Subinterface configuration mode
- Line configuration mode
- Router configuration mode
- IPX-router configuration mode
- Route-map configuration mode
- ROM monitor mode

Table 2-1 lists the command modes, how to access each mode, the prompt you will see while you are in that mode, and the method to exit that mode. The prompts listed assume the default router name `Router`.

Table 2-1 Summary of Command Modes

Command Mode	Access Method	Prompt	Exit Method
User EXEC	Log into router.	`Router>`	Use the **logout** command.
Privileged EXEC	From user EXEC mode, use the **enable** EXEC command.	`Router#`	To exit back to user EXEC mode, use the **disable** command. To exit into global configuration mode, use the **configure** privileged EXEC command.
Global configuration	From privileged EXEC mode, use the **configure** privileged EXEC command.	`Router(config)#`	To exit to privileged EXEC mode, use the **exit** or **end** command or press Ctrl-Z. To exit to interface configuration mode, enter an **interface** configuration command.
Interface configuration	From global configuration mode, enter by specifying an interface with an **interface** command.	`Router(config-if)#`	To exit to global configuration mode, use the **exit** command. To exit to privileged EXEC mode, press Ctrl-Z. To exit to subinterface configuration mode, specify a subinterface with the **interface** command.
Subinterface configuration	From global configuration mode, specify a subinterface with an **interface** command.	`Router(config-subif)#`	To exit to global configuration mode, use the **exit** command. To exit to privileged EXEC mode, press Ctrl-Z.
Line configuration	From global configuration mode, enter by specifying a line with an **line** command.	`Router(config-line)#`	To exit to global configuration mode, use the **exit** command. To exit to privileged EXEC mode, press Ctrl-Z.
Router configuration	From global configuration mode, enter by specifying a router with a **router** command.	`Router(config-router)#`	To exit to global configuration mode, use **exit** command. To exit to privileged EXEC mode, press Ctrl-Z.
IPX router configuration	From global configuration mode, enter by specifying the **ipx router** command.	`Router(config-ipx-router)#`	To exit to global configuration mode, use the **exit** command.
Route map configuration	From global configuration mode, enter by specifying the **route-map** command.	`Router(config-route-map)#`	To exit to global configuration mode, use the **exit** command. To exit to privileged EXEC mode, press Ctrl-Z.
ROM monitor	From privileged EXEC mode, use the **reload** EXEC command. Press Break during the first 60 seconds while the system is booting.	`>`	To exit to user EXEC mode, press **c** to continue.

The preceding table might not include all of the possible ways to access or exit each command mode.

User EXEC Mode

After you log into the router, you are automatically in user EXEC command mode. The EXEC commands available at the user level are a subset of those available at the privileged level. In general, the user EXEC commands allow you to connect to remote routers, change terminal settings on a temporary basis, perform basic tests, and list system information.

To list the user EXEC commands, complete the following task:

Task	Command
List the user EXEC commands.	**?**

The user-level prompt consists of the router's host name followed by the angle bracket (>) :

```
Router>
```

The default host name is Router, unless it has been changed during initial configuration using the **setup** command. (Refer to the *Router Products Getting Started Guide* for information on the setup facility.) You can also change the router name using the **hostname** global configuration command as described in Chapter 3.

Example

To list the commands available in user EXEC mode, enter a ? as shown in the following example.

```
Router> ?
Exec commands:
 connect          Open a terminal connection
 disconnect       Disconnect an existing telnet session
 enable           Turn on privileged commands
 exit             Exit from the EXEC
 help             Description of the interactive help system
 lock             Lock the terminal
 login            Log in as a particular user
 logout           Exit from the EXEC
 name-connection  Name an existing telnet connection
 ping             Send echo messages
 resume           Resume an active telnet connection
 show             Show running system information
 systat           Display information about terminal lines
 telnet           Open a telnet connection
 terminal         Set terminal line parameters
 where            List active telnet connections
Router>
```

The list of commands may vary slightly from this example, depending upon how your router has been configured.

The user EXEC commands that set terminal parameters are shown in the section "Configure Telnet Capabilities for a Session" later in this chapter.

Privileged EXEC Mode

Because many of the privileged commands set operating parameters, privileged access should be password-protected to prevent unauthorized use. The command set includes those commands contained in user EXEC mode, as well as the **configure** command through which you can access the

remaining command modes. Privileged EXEC mode also includes high-level testing commands, such as **debug**. For details on the **debug** command, see the *Debug Command Reference* publication. For details on the **setup** command, see the *Router Products Getting Started Guide.*

To access and list the privileged EXEC commands, complete the following tasks:

Task		Command
Step 1	Enter the privileged EXEC mode.	**enable** [*password*]
Step 2	List privileged EXEC commands.	**?**

If the system administrator has set a password, you are prompted to enter it before being allowed access to privileged EXEC mode. The password is not displayed on the screen and is case-sensitive. The system administrator uses the **enable password** global configuration command to set the password that restricts access to privileged mode. This command is described in Chapter 5.

The privileged-level prompt consists of the router's host name followed by the pound sign (#). (If the router was named with the **hostname** command, that name would appear as the prompt instead of "Router.")

```
Router#
```

Example

The following example shows how to access privileged EXEC mode and list privileged EXEC commands:

```
Router> enable
Password:
Router# ?
Exec commands:
 bfe              For manual emergency modes setting
 clear            Reset functions
 clock            Manage the system clock
 configure        Enter configuration mode
 connect          Open a terminal connection
 copy             Copy a config file to or from a tftp server
 debug            Debugging functions
 disable          Turn off privileged commands
 disconnect       Disconnect an existing telnet session
 enable           Turn on privileged commands
 exit             Exit from the EXEC
 help             Description of the interactive help system
 llc2             Execute llc2 tests
 lock             Lock the terminal
 login            Log in as a particular user
 logout           Exit from the EXEC
 name-connection  Name an existing telnet connection
 ping             Send echo messages
 reload           Halt and perform a cold restart
 resume           Resume an active telnet connection
 send             Send a message to other tty lines
 setup            Run the SETUP command facility
 show             Show running system information
 systat           Display information about terminal lines
 telnet           Open a telnet connection
 terminal         Set terminal line parameters
 test             Test subsystems, memory, and interfaces
 trace            Trace route to destination
 where            List active telnet connections
 which-route      Do route table lookup and display results
 write            Write running configuration to memory, network, or terminal
Router#
```

The list of commands may vary slightly from this example, depending upon how your router has been configured.

From the privileged level, you can access global configuration mode. For instructions, see "Global Configuration Command Mode" which follows this section.

To return from privileged EXEC mode to user EXEC mode, perform the following task:

Task	Command
Move from privileged EXEC mode to user EXEC mode.	**disable**

Global Configuration Mode

Global configuration commands apply to features that affect the system as a whole. Use the **configure** privileged EXEC command to enter global configuration mode. When you enter this command, the EXEC prompts you for the source of the configuration commands.

```
Configuring from terminal, memory, or network [terminal]?
```

You can then specify either the terminal, nonvolatile memory (NVRAM), or a file stored on a network server as the source of configuration commands (see Chapter 3). The default is to type in commands from the terminal console. Pressing the Return key begins this configuration method.

Commands to enable a particular routing or bridging function are also global configuration commands. For information on protocol-specific global configuration commands, see the appropriate chapter in this guide.

To access and list the global configuration commands, complete the following tasks:

Task		Command
Step 1	At the terminal, from the privileged EXEC mode, enter configuration mode.	**configure** <CR>
Step 2	List the global configuration commands.	**?**

Example

The following example shows how to access global configuration mode and list global configuration commands:

```
Router# configure
Configuring from terminal, memory, or network [terminal]? <CR>
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# ?
Configure commands:
 access-list            Add an access list entry
 apollo                 Apollo global configuration commands
 appletalk              Appletalk global configuration commands
 arp                    Set a static ARP entry
 async-bootp            Modify system bootp parameters
 autonomous-system      Specify local AS number to which we belong
 banner                 Define a login banner
 boot                   Modify system boot parameters
 bridge                 Transparent bridging
 buffers                Adjust system buffer pool parameters
 busy-message           Display message when connection to host fails
 chat-script            Define a modem chat script
 clns                   Global CLNS configuration subcommands
 clock                  Configure time-of-day clock
 decnet                 Global DECnet configuration subcommands
 default-value          Default character-bits values
 dialer-list            Create a dialer list entry
 enable                 Modify enable password parameters
 end                    Exit from configure mode
 exit                   Exit from configure mode
 frame-relay            Global frame relay configuration commands
 help                   Description of the interactive help system
 hostname               Set system's network name
 interface              Select an interface to configure
 ip                     Global IP configuration subcommands
 ipx                    Novell/IPX global configuration commands
 line                   Configure a terminal line
 lnm                    IBM Lan Manager
 locaddr-priority-list  Establish queueing priorities based on LU address
 logging                Modify message logging facilities
 login-string           Define a host-specific login string
 mop                    The DEC MOP Server
 netbios                NETBIOS access control filtering
 no                     Negate a command or set its defaults
 ntp                    Configure NTP
```

```
  priority-list          Build a priority list
  queue-list             Build a custom queue list
  rif                    Source-route RIF cache
  route-map              Create route-map or enter route-map command mode
  router                 Enable a routing process
  scheduler-interval     Maximum interval before running lowest priority process
  service                Modify use of network based services
  smt-queue-threshold    Set the max number of unprocessed SMT frames
  snmp-server            Modify SNMP parameters
  source-bridge          Source-route bridging ring groups
  stun                   STUN global configuration commands
  tacacs-server          Modify TACACS query parameters
  tftp-server            Provide TFTP service for netload requests
  tn3270                 tn3270 configuration command
  username               Establish User Name Authentication
  vines                  Vines global configuration commands
  x25                    X.25 Level 3
  xns                    XNS global configuration commands
Router(config)#
```

The list of commands may vary slightly from this example, depending upon how your router has been configured.

To exit global configuration command mode and return to privileged EXEC mode, use one of the following commands:

Task	Command
Exit global configuration mode.	**exit** **end** **Ctrl-Z**

From global configuration mode you can access six configuration sublevels: interface, subinterface, line, router, ipx-router, and route-map configuration commands. These command modes are described in the following sections.

Interface Configuration Mode

Many features are enabled on a per-interface basis. Interface configuration commands modify the operation of an interface such as an Ethernet, FDDI, or serial port. Interface subcommands always follow an **interface** command, which defines the interface type.

For details on interface configuration commands that affect general interface parameters, such as bandwidth, clock rate, and so on, see Chapter 6. For protocol-specific commands, see the appropriate chapter in this guide.

To access and list the interface configuration commands, complete the following tasks.

Task		Command
Step 1	From global configuration mode, enter interface configuration mode.	**interface** *interface-type interface-number*
Step 2	List the interface configuration commands.	**?**

Example

In the following example, serial interface 0 is about to be configured. The new prompt `(config-if)#` indicates interface configuration mode. In this example, the user asks for help by requesting a list of commands.

```
Router(config)# interface serial 0 <CR>
Router(config-if)# ?
Interface configuration commands:
 access-expression     Build a bridge boolean access expression
 apollo                Apollo interface subcommands
 appletalk             Appletalk interface subcommands
 arp                   Set arp type (arpa, probe, snap) or timeout
 backup                Modify dial-backup parameters
 bandwidth             Set bandwidth informational parameter
 bridge-group          Transparent bridging interface parameters
 clns                  CLNS interface subcommands
 clockrate             Configure serial interface clock speed
 custom-queue-list     Assign a custom queue list to an interface
 decnet                Interface DECnet config commands
 delay                 Specify interface throughput delay
 description           Interface specific description
 dialer                Dial-on-demand routing (DDR) commands
 dialer-group          Assign interface to dialer-list
 down-when-looped      Force looped serial interface down
 encapsulation         Set encapsulation type for an interface
 ethernet-transit-oui  Token-ring to Ethernet OUI handling
 exit                  Exit from interface configuration mode
 frame-relay           Set frame relay parameters
 hdh                   Set HDH mode
 help                  Description of the interactive help system
 hold-queue            Set hold queue depth
 ip                    Interface Internet Protocol config commands
 ipx                   Novell interface subcommands
 isis                  IS-IS commands
 iso-igrp              ISO-IGRP interface subcommands
 keepalive             Enable keepalive
 lapb                  X.25 Level 2 parameters (Link Access Procedure, Balanced)
 llc2                  LLC2 Interface Subcommands
 lnm                   IBM Lan Manager
 locaddr-priority      Assign a priority group
 loopback              Configure internal loopback on an interface
 mac-address           Manually set interface MAC address
 mop                   DEC MOP server commands
 mtu                   Set the interface Maximum Transmission Unit (MTU)
 netbios               Use a defined NETBIOS access list or enable name-caching
 no                    Negate a command or set its defaults
 ntp                   Configure NTP
 ppp                   Point-to-point protocol
 priority-group        Assign a priority group to an interface
 pulse-time            Enables pulsing of DTR during resets
 pup                   PUP interface subcommands
 sdlc                  SDLC commands
 sdllc                 Configure SDLC to LLC2 translation
 shutdown              Shutdown the selected interface
 smds                  Modify SMDS parameters
 source-bridge         Configure interface for source-route bridging
 stun                  STUN interface subcommands
 transmit-interface    Assign a transmit interface to a receive-only interface
 transmitter-delay     Set dead-time after transmitting a datagram
 tunnel                protocol-over-protocol tunneling
 tx-queue-limit        Configure card level transmit queue limit
 vines                 Vines interface subcommands
 xns                   XNS interface subcommands
```

The list of commands may vary slightly from this example, depending upon how your router has been configured.

To exit interface configuration mode and return to global configuration mode, enter the **exit** command. Or, press Ctrl-Z to exit configuration mode and return to privileged EXEC mode.

Subinterface Configuration Mode

You can configure multiple virtual interfaces (called subinterfaces) on a single physical interface. This feature is supported on the following interfaces:

- Serial interfaces with Frame Relay encapsulation
- Token Ring interfaces (IPX only)
- FDDI interfaces (IPX only)
- Ethernet interfaces (IPX only)

Subinterfaces appear to be distinct physical interfaces to the various protocols. For example, Frame Relay networks provide multiple point-to-point links called permanent virtual circuits (PVCs). PVCs can be grouped under separate subinterfaces that in turn are configured on a single physical interface. From a bridging spanning tree viewpoint, each subinterface is a separate bridge port, and a frame arriving on one subinterface can be sent out on a another subinterface.

Subinterfaces also allow multiple encapsulations for a protocol on a single interface. For example, a router can receive an ARPA-framed IPX packet and forward the packet back out the same physical interface as a SNAP-framed IPX packet.

For detailed information on how to configure subinterfaces, see Chapter 6. For information on how to configure Frame Relay, bridging, IPX, and IP subinterfaces, see the appropriate chapters in this guide.

To access and list the subinterface configuration commands, complete the following tasks:

Task		Command
Step 1	From interface configuration mode, configure a virtual interface.	See the example that follows. For a list of all interface commands that allow subinterface implementation, see Chapter 6.
Step 2	List the subinterface configuration commands.	**?**

Example

In the following example, a subinterface is configured for serial line 2, which is configured for Frame Relay encapsulation. The subinterface is called 2.1 to indicate that it is subinterface 1 of serial interface 2. The new prompt `(config-subif)#` indicates subinterface configuration mode. The subinterface can be configured to support one or more Frame Relay PVCs. To list the commands available in subinterface configuration mode, enter a question mark (**?**).

```
Router(config)# interface serial 2
Router(config-if)# encapsulation frame-relay
Router(config-if)# interface serial 2.1
Router(config-subif)# ?
Interface configuration commands:
 apollo        Apollo interface subcommands
 appletalk     Appletalk interface subcommands
 bandwidth     Set bandwidth informational parameter
 bridge-group  Transparent bridging interface parameters
```

```
clns          CLNS interface subcommands
decnet        Interface DECnet config commands
delay         Specify interface throughput delay
description   Interface specific description
exit          Exit from interface configuration mode
frame-relay   Set frame relay parameters
ip            Interface Internet Protocol config commands
ipx           Novell interface subcommands
isis          IS-IS commands
iso-igrp      ISO-IGRP interface subcommands
no            Negate a command or set its defaults
ntp           Configure NTP
shutdown      Shutdown the selected interface
```

The list of commands may vary slightly from this example depending upon how your router has been configured.

To exit subinterface configuration mode and return to global configuration mode, enter the **exit** command. Or, press Ctrl-Z to exit configuration mode and return to privileged EXEC mode.

Line Configuration Mode

Line configuration commands modify the operation of a serial terminal line. Line configuration commands always follow a **line** command, which defines a line number. These commands are generally used to connect to remote routers, change terminal parameter settings on a line-by-line basis, and set up the auxiliary port modem configuration to support Dial-on-Demand Routing (DDR) (see Chapter 10).

To access and list the auxiliary port, console port, and virtual terminal line configuration commands, complete the following tasks:

Task		Command
Step 1	From global configuration mode, configure an auxiliary, console, or virtual terminal line.	**line aux** | **con** | **vty** *line-number* [*ending-line-number*]
Step 2	List the line configuration commands.	**?**

Example

The following example shows how to enter line configuration mode for virtual terminal line 3 and list the line configuration commands:

```
Router(config)# line vty 3 <CR>
Router(config-line)# ?
Line configuration commands:
 access-class            Filter connections based on an IP access list
 activation-character    Define the activation character
 autobaud                Set line to autobaud
 autocommand             Automatically execute an EXEC command
 autohangup              Automatically hangup when last connection closes
 autohost                Automatically connect to a host
 cts-required            Require CTS on line
 data-character-bits     Size of characters being handled
 databits                Set number of data bits per character
 disconnect-character    Define the disconnect character
 dispatch-character      Define the dispatch character
 dispatch-timeout        Set the dispatch timer
 editing                 Enable command line editing
 escape-character        Change the current line's escape character
```

```
 exec                    Start an EXEC process
 exec-banner             Enable the display of the EXEC banner
 exec-character-bits     Size of characters to the command exec
 exec-timeout            Set the EXEC timeout
 exit                    Exit from line configuration mode
 flowcontrol             Set the flow control
 help                    Description of the interactive help system
 history                 Set the size of the command history buffer
 hold-character          Define the hold character
 length                  Set number of lines on a screen
 location                Enter terminal location description
 lockable                Allow users to lock a line
 login                   Enable password checking
 modem                   Configure the Modem Control Lines
 monitor                 Copy debug output to the current terminal line
 no                      Negate a command or set its defaults
 notify                  Inform users of output from concurrent sessions
 padding                 Set padding for a specified output character
 parity                  Set terminal parity
 password                Set a password
 private                 Configuration options that user can set will remain in effect
                         between terminal sessions
 refuse-message          Define a refuse banner
 rotary                  Add line to a rotary group
 rxspeed                 Set the receive speed
 session-limit           Set maximum number of sessions
 session-timeout            Set interval for closing connection when there is no input
traffic
 special-character-bits  Size of the escape (and other special) characters
 speed                   Set the transmit and receive speeds
 start-character         Define the start character
 stop-character          Define the stop character
 stopbits                Set async line stop bits
 telnet                  Telnet protocol-specific configuration
 telnet-transparent      Send a CR as a CR followed by a NULL instead of a CR followed
                         by a LF
 terminal-type           Set the terminal type
 transport               Define transport protocols for line
 txspeed                 Set the transmit speeds
 vacant-message          Define a vacant banner
 width                   Set width of the display terminal
 Router(config-line)#
```

The list of commands may vary from this example, depending upon how your router has been configured.

To exit line configuration mode and return to global configuration mode, use the **exit** command. To exit configuration mode and return to privileged EXEC mode, press Ctrl-Z.

Router Configuration Mode

Router configuration commands configure a routing protocol and always follow a **router** command. To access and list the router configuration commands, complete the following tasks:

Task		Command
Step 1	From global configuration mode, enter router configuration mode.	**router** [*keyword*] See the list in the example for keywords.
Step 2	List the router configuration commands.	**?**

Examples

To list the available router configuration keywords, enter the **router** command followed by a space and a question mark (?) at the global configuration prompt:

```
Router(config)# router ?
 bgp       Border Gateway Protocol (BGP)
 egp       Exterior Gateway Protocol (EGP)
 igrp      Interior Gateway Routing Protocol (IGRP)
 isis      ISO IS-IS
 iso-igrp  IGRP for OSI networks
 ospf      Open Shortest Path First (OSPF)
 rip       Routing Information Protocol (RIP)
 static    Static CLNS Routing
```

In the following example, the router is configured to support the routing information protocol (RIP). The new prompt is `(config-router)#`.

```
Router(config)# router rip
Router(config-router)# ?
Router configuration commands:
  default-information  Control distribution of default information
  default-metric       Set metric of redistributed routes
  distance             Define an administrative distance
  distribute-list      Filter networks in routing updates
  exit                 Exit from routing protocol configuration mode
  help                 Description of the interactive help system
  neighbor             Specify a neighbor router
  network              Enable routing on an IP network
  no                   Negate or set default values of a command
  offset-list          Add or subtract offset from IGRP, RIP, or HELLO metrics
  passive-interface    Suppress routing updates on an interface
  redistribute         Redistribute information from another routing protocol
  timers               Adjust routing timers
Router(config)#
```

The list of commands may vary slightly from this example, depending upon how your router has been configured.

To exit router configuration mode and return to global configuration mode, enter the **exit** command. Or, press Ctrl-Z to exit configuration mode and return to privileged EXEC mode.

IPX-Router Configuration Mode

Internet Packet Exchange (IPX) is a Novell network-layer protocol. To access and list the IPX routing configuration commands, complete the following tasks:

Task		Command
Step 1	From global configuration mode, enter ipx-router configuration mode.	**ipx router** [*keyword*] See the appropriate IPX chapter for keywords.
Step 2	List the ipx-router configuration commands.	**?**

In the following example, IPX RIP routing is configured. The new prompt is `(config-ipx-router)`:

```
Router(config)# ipx router rip<CR>
Router(config-ipx-router)# ?
```

To exit IPX router configuration mode and return to global configuration mode, enter the **exit** command. Or, press Ctrl-Z to exit configuration mode and return to privileged EXEC mode.

Route-Map Configuration Mode

The **route-map** command set is used to configure routing table and source and destination information. To access and list the **route-map** configuration commands, complete the following tasks:

Task		Command
Step 1	From global configuration mode, enter route-map configuration mode.	**route-map** [*route map tag*]
Step 2	List the route-map configuration commands.	**?**

In the following example, a route map named arizona1 is configured. The new prompt is `(config-route-map)`. Enter a question mark (**?**) to list **route-map** configuration commands.

```
Router(config)# route-map ?
 WORD Route map tag
Router(config)# route-map arizona1 <CR>
Router(config-route-map)# ?
Route Map configuration commands:
 exit   Exit from route-map configuration mode
 help   Description of the interactive help system
 match  Match values from routing table
 no     Negate or set default values of a command
 set    Set values in destination routing protocol
Router(config-route-map)#
```

To exit route-map configuration mode and return to global configuration mode, enter the **exit** command. Or, press Ctrl-Z to exit configuration mode and return to privileged EXEC mode.

ROM Monitor Mode

If your router does not find a valid system image, or if its configuration file is corrupted at startup, the system may enter read-only memory (ROM) monitor mode. From ROM monitor mode, you can boot the router or perform diagnostic tests.

From the Cisco 2000, Cisco 3000, and Cisco 4000, you can also enter ROM monitor mode by entering the **reload** EXEC command and then pressing the Break key during the first 60 seconds of startup. To save changes to the configuration file, use the **write memory** command before issuing the **reload** command.

To access and list the ROM monitor configuration commands, complete the following tasks:

Task	Command
Enter ROM monitor mode from privileged EXEC mode.	**reload** Press Break during the first 60 seconds while the system is booting.
List the ROM monitor commands.	**?**

The ROM monitor prompt is the angle bracket (>):

```
> ?
$ state      Toggle cache state (? for help)
B [filename] [TFTP Server IP address | TFTP Server Name]
             Load and execute system image from ROM or from TFTP server
C [address]  Continue execution [optional address]
D /S M L V   Deposit value V of size S into location L with modifier M
E /S M L     Examine location L with size S with modifier M
G [address]  Begin execution
H            Help for commands
I            Initialize
K            Stack trace
L [filename] [TFTP Server IP address | TFTP Server Name]
             Load system image from ROM or from TFTP server, but do not
             begin execution
O            Show configuration register option settings
P            Set the break point
S            Single step next instruction
T function   Test device (? for help)

Deposit and Examine sizes may be B (byte), L (long) or S (short).
Modifiers may be R (register) or S (byte swap).
Register names are: D0-D7, A0-A6, SS, US, SR, and PC
```

To return to user EXEC mode, enter **c** to continue. To boot the system image file, use the **b** command (see Chapter 3). For details on other ROM monitor mode commands, refer to the appropriate hardware installation guide.

Get Context-Sensitive Help

The previous sections described the first level of help available with the user interface. Entering a question mark (**?**) at the system prompt displays a list of commands available for each command mode. You can also get a list of any command's associated keywords and arguments with the context-sensitive help feature.

To get help specific to a command mode, a command, a keyword, or arguments, perform one of the following tasks:

Task	Command
Obtain help for the full set of user-level commands.	**terminal full-help**
Obtain a brief description of the help system in any command mode.	**help**
Obtain a list of commands that begin with a particular character string.	abbreviated-command-entry**?**
Complete a partial command name.	abbreviated-command-entry<**Tab**>
List all commands available for a particular command mode.	**?**
List the full set of user-level command in line configuration mode.	**full-help**
List a command's associated keywords.	*command* **?**
List a keyword's associated arguments.	*command keyword* **?**

When using context-sensitive help, the space (or lack of a space) before the **?** is significant. To obtain a list of commands that begin with a particular character sequence, type in those characters followed immediately by the **?**. Do not include a space. This form of help is called *word help*, because it completes a word for you.

To list keywords or arguments, enter a **?** in place of a keyword or argument. Include a space before the **?**. This form of help is called *command syntax help*, because it reminds you which keywords or arguments are applicable based on the command, keywords, and arguments you already have entered.

You can abbreviate commands and keywords to the number of characters that allow a unique abbreviation. For example, you can abbreviate the **show** command to **sh**.

Example

Enter the **help** command (which is available in any command mode) for a brief description of the help system:

```
Router# help
Help may be requested at any point in a command by entering
a question mark '?'. If nothing matches, the help list will
be empty and you must back up until entering a '?' shows the
available options.
Two styles of help are provided:
1. Full help is available when you are ready to enter a
   command argument (e.g. 'show ?') and describes each possible
   argument.
2. Partial help is provided when an abbreviated argument is entered
   and you want to know what arguments match the input
   (e.g. 'show pr?'.)
```

As described in the **help** command output, you can enter a partial command name and a **?** to obtain a list of commands beginning with a particular character set. See "Complete a Partial Command Name" later in this chapter for more detail.

The following example illustrates how the context-sensitive help feature enables you to create an access list from configuration mode. First enter the letters **co** at the system prompt followed by a question mark (**?**). Do not leave a space between the last letter and the **?**. The system provides the commands that begin with **co**.

```
Router# co?
configure  connect  copy
```

Enter the **configure** command followed by a space and a **?** to lists the command's keywords and a brief explanation.

```
Router# configure ?
  memory    Configure from NV memory
  network   Configure from a TFTP network host
  terminal  Configure from the terminal
  <cr>
```

Enter the **terminal** keyword to enter configuration mode from the terminal:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
```

Enter the **access-list** command followed by a space and a **?** to list the command's keywords:

```
Router(config)# access-list ?
  <1-99>       IP standard access list
  <100-199>    IP extended access list
  <1000-1099>  IPX SAP access list
  <1100-1199>  Extended 48-bit MAC address access list
  <200-299>    Protocol type-code access list
  <300-399>    DECnet access list
  <400-499>    XNS standard access list
  <500-599>    XNS extended access list
  <600-699>    Appletalk access list
  <700-799>    48-bit MAC address access list
  <800-899>    IPX standard access list
  <900-999>    IPX extended access list
```

Enter the access list number **99** and then enter another **?** to see the arguments that apply to the keyword and brief explanations:

```
Router(config)# access-list 99 ?
  deny    Specify packets to reject
  permit  Specify packets to forward
```

Enter the **deny** argument followed by a **?** to list additional options:

```
Router(config)# access-list 99 deny ?
  A.B.C.D  Address to match
```

Enter the IP address followed by a **?** to list additional options:

```
Router(config)# access-list 99 deny 131.108.134.0 ?
  A.B.C.D  Mask of bits to ignore
  <cr>
```

The <cr> symbol appears in the list, indicating that one of your options is to press Return to execute the command. The other option is to add a wild-card mask. Enter the wild-card mask followed by a **?** to list further options.

```
Router(config)# access-list 99 deny 131.108.134.0 0.0.0.255 ?
<cr>

Router(config)# access-list 99 deny 131.108.134.0 0.0.0.255
```

The <cr> symbol by itself indicates there are no more keywords or arguments. Press Return to execute the command. The system adds an entry to access list 99 that denies access to all hosts on subnet 131.108.134.0.

Check Command Syntax

The user interface provides syntax checking in the form of an error location indicator (^). The ^ character appears at the point in the command string where you have entered an incorrect command, keyword, or argument. The error location indicator and interactive help system allow you to easily find and correct syntax errors.

In the following example, suppose you want to set the router clock. First, use context-sensitive help to check the syntax for setting the clock.

```
Router# clock ?
  set  Set the time and date
Router# clock
```

The help output shows that the **set** keyword is required. Next, check the syntax for entering the time:

```
Router# clock set ?
hh:mm:ss   Current time
Router# clock set
```

Enter the current time:

```
Router# clock set 13:32:00
% Incomplete command.
```

The system indicates that you need to provide additional arguments to complete the command. Press Ctrl-P (see the next section,"Use the Command History Features") to automatically repeat the previous command entry. Then add a space and question mark (**?**) to reveal the additional arguments:

```
Router# clock set 13:32:00 ?
  <1-31>     Day of the month
  January    Month of the year
  February
  March
  April
  May
  June
  July
  August
  September
  October
  November
  December
```

Now you can complete the command entry:

```
Router# clock set 13:32:00 23 February 93
                                        ^
% Invalid input detected at '^' marker.
```

The caret symbol (^) and help response indicate an error at 93. To list the correct syntax, enter the command up to the point where the error occurred and then enter a question mark (**?**):

```
Router# clock set 13:32:00 23 February ?
  <1993-2035> Year
Router# clock set 13:32:00 23 February
```

Enter the year using the correct syntax and press Return to execute the command.

```
Router# clock set 13:32:00 23 February 1993
```

Use the Command History Features

With the current software release, the user interface provides a history or record of commands you have entered. This feature is particularly useful for recalling long or complex commands or entries, including access lists. With the command history feature, you can complete the following tasks:

- Set the command history buffer size
- Recall commands
- Disable the command history feature

Set the Command History Buffer Size

By default, the system records 10 command lines in its history buffer. To set the number of command lines the system will record during the current terminal session, complete the following task in EXEC mode:

Task	Command
Enable the command history feature for the current terminal session.	**terminal history size** *number of lines*

To configure the number of command lines the system will record, complete the following task in line configuration mode:

Task	Command
Enable the command history feature.	**history size** *number of lines*

Recall Commands

To recall commands from the history buffer, perform one of the following tasks:

Task	Key Sequence/Command
Recall commands in the history buffer, beginning with the most recent command. Repeat the key sequence to recall successively older commands.	Press Ctrl-P or the Up Arrow.[1]
Return to more recent commands in the history buffer after recalling commands with Ctrl-P or the Up Arrow. Repeat the key sequence to recall successively more recent commands.	Press Ctrl-N or the Down Arrow.[1]
While in EXEC mode, list the commands you have just entered.	**show history**

1. The arrow keys function only on ANSI-compatible terminals such as VT100s.

As mentioned, this feature is particularly useful when you are entering long, complex commands, such as access lists.To create several access lists with minor variations, use Ctrl-P or the Up Arrow to recall a previous access list; then use the line editing feature to modify it.

Disable the Command History Feature

The command history feature is automatically enabled. To disable it during the current terminal session, complete the following task in EXEC mode:

Task	Command
Disable the command history feature for the current session.	**no terminal history size**

To configure the line with the command history feature disabled, complete the following task in line configuration mode:

Task	Command
Configure the line so that the command history feature is disabled.	**no history size**

Use the Editing Features

The current software release includes an enhanced editing mode that provides a set of editing key functions similar to those of the Emacs editor.

You can enter commands in uppercase, lowercase, or a mix of both. Only passwords are case-sensitive. You can abbreviate commands and keywords to the number of characters that allow a unique abbreviation. For example, you can abbreviate the **show** command to **sh**. After entering the command line at the system prompt, press the Return key to execute the command.

The following tasks are described in this section:

- Enable enhanced editing mode
- Move around on the command line
- Complete a partial command name
- Paste in buffer entries
- Edit command lines that wrap
- Delete entries
- Scroll down a line or a screen
- Redisplay the current command line
- Transpose mistyped characters
- Control capitalization
- Designate a keystroke as a command entry
- Disable enhanced editing mode

Enable Enhanced Editing Mode

Although enhanced editing mode is automatically enabled with the current software release, you can disable it and revert to the editing mode of previous software releases. See the section "Disable Enhanced Editing Mode" later in this chapter.

To reenable the enhanced editing mode for the current terminal session, complete the following task in EXEC mode:

Task	Command
Enable the enhanced editing features for the current terminal session.	**terminal editing**

To reconfigure the line to have enhanced editing mode, complete the following task in line configuration mode:

Task	Command
Enable the enhanced editing features.	**editing**

Move Around on the Command Line

Perform the following tasks to move the cursor around on the command line for corrections or changes:

Task	Keystrokes
Move the cursor back one character.	Press Ctrl-B or press the left arrow key.[1]
Move the cursor forward one character.	Press Ctrl-F or press the right arrow key.[1]
Move the cursor to the beginning of the command line.	Press Ctrl-A.
Move the cursor to the end of the command line.	Press Ctrl-E.
Move the cursor back one word.	Press Esc-B.
Move the cursor forward one word.	Press Esc-F.

1. The arrow keys function only on ANSI-compatible terminals such as VT100s.

Complete a Partial Command Name

If you cannot remember a complete command name, you can use the Tab key to allow the system to complete a partial entry. To do so, perform the following task:

Task	Keystrokes
Recall a complete command name.	Enter the first few letters and press the Tab key.

If your keyboard does not have a Tab key, press Ctrl-I instead.

Example

In the following example, when you enter the letters conf and press the Tab key, the system provides the complete command:

```
Router# conf<Tab>
Router# configure
```

If you enter a set of characters that could indicate more than one command, the system beeps to indicate an error. Enter a question mark (**?**) to obtain a list of commands that begin with that set of characters. Do not leave a space between the last letter and the question mark (**?**).

For example, there are three commands in privileged mode that start with co. To see what they are, type **co?** at the privileged EXEC prompt:

```
Router# co?
configure  connect  copy
Router# co
```

Paste in Buffer Entries

The system provides a buffer that contains the last ten items you deleted. You can recall these items and paste them in the command line by performing the following task:

Task		Keystrokes
Step 1	Recall the most recent entry in the buffer.	Press Ctrl-Y.
Step 2	Recall the next buffer entry.	Press Esc-Y.

The buffer contains only the last ten items you have deleted or cut. If you press **Esc-Y** more than ten times, you will cycle back to the first buffer entry.

Edit Command Lines that Wrap

The new editing command set a provides a wraparound feature for commands that extend beyond a single line on the screen. When the cursor reaches the right margin, the command line shifts ten spaces to the left. You cannot see the first ten characters of the line, but you can scroll back and check the syntax at the beginning of the command. To scroll back, perform the following task:

Task	Keystrokes
Return to the beginning of a command line to verify that you have entered a lengthy command correctly.	Press Ctrl-B or the left arrow key repeatedly until you scroll back to the beginning of the command entry, or press Ctrl-A to return directly to the beginning of the line. (The arrow keys function only on ANSI-compatible terminals such as VT100s.)

In the following example, the **access-list** command entry extends beyond one line. When the cursor first reaches the end of the line, the line is shifted ten spaces to the left and redisplayed The $ indicates that the line has been scrolled to the left. Each time the cursor reaches the end of the line, the line is again shifted ten spaces to the left.

```
Router(config)# access-list 101 permit tcp 131.108.2.5 255.255.255.0 131.108.1
Router(config)# $ 101 permit tcp 131.108.2.5 255.255.255.0 131.108.1.20 255.25
Router(config)# $t tcp 131.108.2.5 255.255.255.0 131.108.1.20 255.255.255.0 eq
Router(config)# $108.2.5 255.255.255.0 131.108.1.20 255.255.255.0 eq 45
```

When you have completed the entry, press Ctrl-A to check the complete syntax before pressing the Return key to execute the command. The $ appears at the end of the line to indicate that the line has been scrolled to the right:

```
Router(config)# access-list 101 permit tcp 131.108.2.5 255.255.255.0 131.108.1$
```

The router assumes you have a terminal screen 80 columns wide. If you have a width other than that, use the **terminal width** command to tell the router the correct width of your terminal.

Use line wrapping in conjunction with the command history feature to recall and modify previous complex command entries. See “Recall Commands” earlier in this chapter for information about recalling previous command entries.

Delete Entries

Perform any of the following tasks to delete command entries if you make a mistake or change your mind:

Task	Keystrokes
Erase the character to the left of the cursor.	Press the Delete or Backspace key.
Delete the character at the cursor.	Press Ctrl-D.
Delete all characters from the cursor to the end of the command line.	Press Ctrl-K.
Delete all characters from the cursor to the beginning of the command line.	Press Ctrl-U or Ctrl-X.
Delete the word to the left of the cursor.	Press Ctrl-W.
Delete from the cursor to the end of the word.	Press Esc-D.

Scroll Down a Line or a Screen

When you use the help facility to list the commands available in a particular mode, the list is often longer than the terminal screen can display. In such cases, a `---More---` prompt is displayed at the bottom of the screen. To view the next line or screen, complete the following tasks:

Task	Keystrokes
Scroll down one line.	Press the Return key.
Scroll down one screen.	Press the Space bar.

Note The `---More---` prompt is used for any output that has more lines than can be displayed on the terminal screen, including **show** command output. You can use the keystrokes listed above whenever you see the `---More---` prompt.

Redisplay the Current Command Line

If you are entering a command and the system suddenly sends a message to your screen, you can easily recall your current command line entry. To do so, perform the following task:

Task	Keystrokes
Redisplay the current command line.	Press Ctrl-L or Ctrl-R.

Transpose Mistyped Characters

If you have mistyped a command entry, you can transpose the mistyped characters by performing the following task:

Task	Keystrokes
Transpose the character to the left of the cursor with the character located at the cursor.	Press Ctrl-T.

Control Capitalization

You can capitalize or lowercase words or capitalize a set of letters with simple keystroke sequences. To do so, perform the following task:

Task	Keystrokes
Capitalize the word at the cursor.	Press Esc-C.
Change the word at the cursor to lowercase.	Press Esc-L.
Capitalize letters from the cursor to the end of the word.	Press Esc-U.

Designate a Keystroke as a Command Entry

Sometimes you may want to use a particular keystroke as an executable command, perhaps as a shortcut. Complete the following task to insert a system code for this purpose:

Task	Keystrokes
Insert a code to indicate to the system that the keystroke immediately following should be treated as a command entry, *not* an editing key.	Press Ctrl-V or Esc-Q.

Disable Enhanced Editing Mode

To disable enhanced editing mode and revert to the editing mode of previous software releases, perform the following task in EXEC mode:

Task	Command
Disable the enhanced editing features for the local line.	**no terminal editing**

You might want to disable enhanced editing if you have prebuilt scripts; for example, scripts that do not interact well when enhanced editing is enabled. You can reenable enhanced editing mode with the **terminal editing** command.

The editing keys and functions of previous software releases are listed in Table 2-2.

Table 2-2 Editing Keys and Functions for Software Release 9.1 and Earlier

Key	Function
Delete or Backspace	Erases the character to the left of the cursor.
Ctrl-W	Erases a word.
Ctrl-U	Erases a line.
Ctrl-R	Redisplays a line.
Ctrl-Z	Ends configuration mode and returns to the EXEC prompt.
Return	Executes single-line commands.

Set Terminal Parameters

The router supplies default serial communication parameters for terminal and other serial device operation. You can change these parameters as necessary to meet the requirements of the terminal or host to which you are attached. Use these commands during an EXEC session while you are using a device connected to the auxiliary port. The local settings temporarily override those configured by the system administrator, remaining in effect only until you exit the system. (To configure terminal parameters on a more permanent basis, use the commands provided in Chapter 4.)

You can define the following terminal operation characteristics:

- Communication speed, databits, stop bits, and parity
- Flow control
- Packet dispatch sequences
- Terminal type
- Terminal screen length and width
- Escape character key sequences
- International character display
- Character padding

Set Communication Speed, Databits, Stop Bits, and Parity

To change the following parameters for the duration of your session only, perform the appropriate tasks in EXEC mode:

Task	Command
Set the line speed for the current terminal session. Choose from line speed, transmit speed, or receive speed. Applies to aux port only.	**terminal speed** *bps* **terminal txspeed** *bps* **terminal rxspeed** *bps*
Set the number of data bits per character that are interpreted and generated by hardware for the current terminal session.	**terminal databits** {**5** | **6** | **7** | **8**}
Set the stop bits transmitted per byte by the current terminal session.	**terminal stopbits** {**1** | **1.5** | **2**}
Set the parity bit for the current terminal session.	**terminal parity** {**none** | **even** | **odd** | **space** | **mark**}

Set Flow Control

On the aux port, you can set both hardware and software flow control between the router and devices attached to it. Both types of flow control are bidirectional. When you specify **software** flow control, an additional keyword specifies the direction: **in** causes the router to listen to flow control from the attached device, and **out** causes the router to send flow control information to the attached device. If you do not specify a direction, the router enables software flow control in both directions.

For software flow control, the default stop and start characters are Ctrl-S and Ctrl-Q (XOFF and XON) respectively. However, you can define characters or character sequences that signal the start and end of data transmission when software flow control is in effect. This capability is useful for providing control of data over the serial line.

The keyword **hardware** sets hardware flow control. For information about setting up the RS-232 line, see the hardware installation and maintenance manual for your product.

Use these commands during an EXEC session while you are using a device connected to the auxiliary port. These commands temporarily override the configured flow control parameters. (If you want to configure terminal parameters on a more permanent basis, use the flow control commands provided in Chapter 4.)

To set temporary flow control parameters for the current session, perform one or more of the following tasks in EXEC mode:

Task	Command
Set the terminal flow control.	**terminal flowcontrol** {**none** | **software** [**in** | **out**] | **hardware**}
Set the flow control start character.	**terminal start-character** *ASCII-number*
Set the flow control stop character.	**terminal stop-character** *ASCII-number*

Create Packet Dispatch Sequences

The router supports configuration of dispatch sequences. You can set up dispatch characters that allow packets to be buffered, then transmitted upon receipt of a character. These characters are useful on an aux port only, and then only if you have some special-purpose device hooked up.

Use these commands during an EXEC session while you are using a device connected to the auxiliary port. These commands temporarily override the configured parameters. (If you want to configure terminal parameters on a more permanent basis, use the commands provided in Chapter 4.)

Perform the following tasks in EXEC mode, as needed for your particular system needs:

Task	Command
Define one or more characters that trigger packet transmission for the current terminal session.	**terminal dispatch-character** *ASCII-number1* [*ASCII-number2 . . . ASCII-number*]
Set the dispatch timer for the current terminal session.	**terminal dispatch-timeout** *milliseconds*

Specify the Terminal Type

You can specify the type of terminal connected to a line. This feature has two benefits: it provides a record of the type of terminal attached to a line, and it can be used in Telnet terminal negotiations to inform the remote host of the terminal type for display management.

To specify the terminal type for the current session, perform the following task in EXEC mode:

Task	Command
Specify the terminal type for the current terminal line.	**terminal terminal-type** *terminal-name*

Set the Terminal Screen Length and Width

By default, the router provides a screen display of 24 lines by 80 characters. You can reset these values if they do not meet the needs of your terminal. To set the terminal length or width for the current session, perform the following tasks in EXEC mode:

Task	Command
Set the screen length for the current terminal line.	**terminal length** *screen-length*
Set the screen width for the current terminal line.	**terminal width** *characters*

The values set can be learned by some host systems that use this type of information in terminal negotiation. Set a value of zero for the screen length to disable pausing between screens of output.

Define Escape Character Key Sequences

You can modify the default key sequences to execute functions such as system escape or terminal pause. To modify the system escape character or hold character for the current terminal session, perform the following task in EXEC mode:

Task	Command
Change the system escape sequence for the current line.	**terminal escape-character** *ASCII-number*
Define the local hold sequence or character that pauses output to the terminal screen.	**terminal hold-character** *ASCII-number*

Specify the International Character Display

You can use a 7-bit character set (such as ASCII) or you can enable a full 8-bit international character set (such as ISO 8859) to allow special graphical and international characters for use in banners and prompts. To change the various character sets, perform the following tasks in EXEC mode:

Task	Command
Change the number of databits per character that are generated and interpreted by hardware for the local line. Default is 8.	**terminal databits** {**5** | **6** | **7** | **8**}
Change the number of databits per character that are generated and interpreted by software for the local line. Default is 8.	**terminal data-character-bits** {**7** | **8**}
Locally set the character set used in EXEC and configuration command characters. Default is 7.	**terminal exec-character-bits** {**7** | **8**}
Specify the character set used in special characters such as software flow control, hold, escape, and disconnect characters for the current line. Default is 7.	**terminal special-character-bits** {**7** | **8**}

Setting the EXEC character width to eight bits can cause failures. For example, if a user on a terminal that is sending parity enters the command **help**, an "unrecognized command" message appears because the system is reading all eight bits, although the eighth bit is not needed for the **help** command.

Set Character Padding

You can change the character padding on a specific output character. Character padding adds a number of null bytes to the end of the string and can be used to make a string an expected length for conformity. To set the padding for the current terminal session, perform the following task in EXEC mode:

Task	Command
Set padding on a specific output character for the current line.	**terminal padding** *ASCII-number count*

Lock the Keyboard

If you have enabled a terminal-locking mechanism by using the **lockable** line configuration command, you can perform the following task in EXEC mode to lock the keyboard:

Task	Command
Lock the keyboard. Doing so prevents access to your session while keeping your connection open.	**lock**

When the terminal-locking mechanism is set and you enter the **lock** EXEC command, you are prompted for a password. You must enter this password before you can use the terminal. This allows you to leave a terminal unattended without concern about unauthorized access. The **lock** EXEC command remains in effect until you execute the **clear line** privileged EXEC command.

Set Pending Output Notification

You can set up a line to inform a user who has multiple, concurrent Telnet connections when output is pending on a connection other than the current one. To do so, perform the following task in EXEC mode:

Task	Command
Enable the current terminal line to notify a user of pending output.	**terminal notify**

Prevent Errant Connection Attempts

The system accepts a host name entry at the EXEC system prompt as a Telnet command. If you mistype the hostname, the system interprets the entry as an incorrect Telnet command and provides an error message indicating that the host does not exist. You can disable this option by specifying **terminal transport none**. In this case, if you mistype a command at the EXEC prompt, the system will not attempt to make a Telnet connection.

To specify the preferred method of transport, perform the following task in EXEC mode:

Task	Command
Define which protocol can be used to connect to the current line.	**terminal transport** {**telnet** | **none**}

Configure Telnet Capabilities for a Session

Telnet, a virtual terminal protocol that is part of the TCP/IP protocol suite, allows for connections to hosts. You can set a connection between the router and a connected device to support the following Telnet capabilities for the duration of a session:

- Generate a hardware Break signal
- Suppress Telnet remote echo and go ahead options
- Negotiate speeds

- Send a Telnet synchronize signal
- Set end-of-line control

Each item is described in a following section. If you want to configure these capabilities on a more permanent basis, use the corresponding **telnet** commands provided in Chapter 4.

Generate a Hardware Break Signal

A hardware Break signal is generated when a Telnet Break command is received. You can configure the router to also generate a Break on Interrupt Process. To enable the system to generate a hardware Break signal on the RS-232 line that is associated with a reverse Telnet connection, complete the following task in EXEC mode:

Task	Command
Set the system to generate a hardware Break signal.	**terminal telnet break-on-ip**

This capability is useful because several user Telnet programs can send an Interrupt Process command but cannot send a Telnet break signal, while other programs implement a Break signal that sends an Interrupt-Process command. RS-232 devices use the hardware Break signal for various purposes.

Suppress Telnet Remote Echo and Go Ahead Options

You can cause Telnet to refuse to negotiate full-duplex, remote echo options on incoming connections. Doing so suppresses negotiation of the Telnet Remote Echo and Suppress Go Ahead options. Perform the following task in EXEC mode on a reverse Telnet connection to allow the router to refuse these requests from the other end:

Task	Command
Set a line to refuse to negotiate full duplex, remote echo options.	**terminal telnet refuse-negotiations**

Negotiate Speeds

To allow the line to negotiate a bit rate on an incoming connection for the duration of a session, perform the following task in EXEC mode:

Task	Command
Set the line to negotiate speeds on incoming connections.	**terminal telnet speed** *default-speed maximum-speed*

The router uses *default-speed* if the connected device does not specify a speed. The argument *maximum-speed* is the highest speed the router will use during the session.

Send a Telnet Synchronize Signal

To cause an incoming connection to send a Telnet synchronize signal when it receives a Telnet Break signal during the session, complete the following task in EXEC mode:

Task	Command
Cause an incoming connection to send a Telnet synchronize signal when it receives a Telnet Break signal.	**terminal telnet sync-on-break**

This capability is used very rarely to ensure the ordering of Break reception with respect to data characters sent after the Break signal.

Set End-of-Line Control

To cause the router to send a carriage return (CR) as a CR followed by a NULL instead of a CR followed by a line feed (LF) during a session, complete the following task in EXEC mode:

Task	Command
Send a CR followed by a NULL instead of a LF.	**terminal telnet transparent**

This capability is useful for coping with different interpretations of end-of-line handling in the Telnet protocol specification.

Use Telnet Connections

Using Telnet involves connecting to remote routers, switching between Telnet connections, and executing special Telnet sequences.This section includes the **telnet** EXEC command, which is used to connect to other routers for remote configuration or to connect to local systems that might need configuration or setup changes.

Using Telnet, you can accomplish the following:

- Log in to a server
- Connect to remote routers
- Switch between Telnet connections
- Execute special Telnet sequences
- Clear a line
- Exit a session

Log into a Server

To log into a server, enter the EXEC command **login** at the system prompt. Specify your username and optionally a TACACs server by name or IP address.

Task	Command
Log into a server.	**login** [*user@tacacs-server*]

Connect to Remote Routers via Telnet

To open a new Telnet connection, exit out of the current connection by typing the escape sequence, which by default is Ctrl ^ X (press the Ctrl, Shift, and ^ keys simultaneously, let go, then press the X key) to return to the system command prompt, then open a new connection.

Perform the following tasks in EXEC mode, as necessary, to connect to a remote host using Telnet.

Task	Command
Make a Telnet connection.	[**connect** | **telnet**] *host* [*port*] [*keyword*]
Escape out of the current connection and return to the EXEC prompt to make another connection.	Ctrl ^ X

With our implementation of TCP/IP, you are not required to enter the command **connect** or **telnet** to establish a Telnet connection. If you prefer, you can just enter the learned host name. You can disable the ability of the system to interpret a host name as a Telnet command (see the section "Prevent Errant Connection Attempts" earlier in this chapter).

Switch between Telnet Connections

You can switch between connections by escaping out of one connection and resuming a previously opened connection. To do so, perform the following steps:

Task		Command
Step 1	Escape from the current connection and return to the EXEC prompt.	Ctrl ^ X
Step 2	Display the connection name or number.	**where**
Step 3	Resume a previous connection.	**resume** [*connection*] [*keyword*]

You can also resume the previous connection by pressing the Return key at the EXEC prompt.

Execute Special Telnet Sequences

The Telnet software supports special Telnet commands in the form of Telnet sequences that map generic terminal control functions to operating system-specific functions.

To issue a special Telnet command, type the escape sequence (usually Ctrl ^) and then a command character. You can type the command character as you hold down Ctrl or with Ctrl released, and you can type either uppercase or lowercase letters. Table 2-3 lists the special Telnet commands.

Table 2-3 Special Telnet Commands

Task	Key Sequence
Break	Ctrl ^ B
Interrupt Process (IP)	Ctrl ^ C
Erase Character (EC)	Ctrl ^ H
Abort Output (AO)	Ctrl ^ O
Are You There? (AYT)	Ctrl ^ T
Erase Line (EL)	Ctrl ^ U

At any time during an active Telnet session, you can list the Telnet commands by typing this command at the system prompt:

```
Ctrl ^ ?
```

To execute this command, type the escape sequence followed by a question mark. It displays an online table of the special Telnet commands for quick reference.

A sample of this list follows (the Ctrl key is represented by the first ^ character).

```
[Special telnet escape help]
^^B  sends telnet BREAK
^^C  sends telnet IP
^^H  sends telnet EC
^^O  sends telnet AO
^^T  sends telnet AYT
^^U  sends telnet EL
```

Clear a Line

You can reset a terminal line to idle state by performing the following task in EXEC mode:

Task	Command
Reset a terminal line.	**clear line** *line-number*

Exit a Session

The router EXEC provides two ways for you to terminate an active terminal session. To do so, use one of the commands in Step 1 that follows. Perform Step 2 if you also want to disconnect the line.

Task		Command
Step 1	End an active session; use either command.	**exit** **logout**
Step 2	Disconnect a session.	**disconnect** [*connection*]

Do not disconnect a session merely to end it. Instead, log off the host, thus allowing the host to initiate the disconnect and then end the session. If you cannot gracefully end an active session, then disconnect the line.

Monitor Telnet Connections

The router supports the following connection activities:

- List open connections
- Assign a logical name to a connection
- Display TCP statistics on open Telnet connections
- Display current terminal parameters
- Display line information
- Enable Finger protocol

Each activity is described in a following section.

List Open Connections

You can display information about all open Telnet connections associated with the current terminal line by using one of the following commands. The information displayed includes the host name, address, number of characters waiting to be sent to the terminal, idle time, and connection name. To display the connection information, perform the following task in EXEC mode:

Task	Command
Display connection information.	**where** **show sessions**

Assign a Logical Name to a Connection

You can assign a logical name to a connection by performing the following task in EXEC mode. This function can be useful for keeping track of multiple connections.

Task	Command
Rename a connection.	**name-connection**

You are prompted for the connection number and name to assign when you enter this command. The **where** command displays a list of the assigned logical connection names.

Display TCP Statistics on Open Telnet Connections

You can display TCP statistics on open Telnet connections by performing the following task in EXEC mode:

Display status of all Telnet connections.	**show tcp** [*line-number*]

Display Current Terminal Parameters

You can display a comprehensive report about the settings in effect on the current terminal line, including information such as the line number, line status, modem state, special characters set, and preferred transport protocol. This information can be useful for changing lines to match expected settings using the local terminal parameter-setting tasks described in the section " Set Terminal Parameters" earlier in this chapter.

To show the current terminal parameters, perform the following task in EXEC mode:

Task	Command
Display local terminal settings.	**show terminal**

Display Line Information

You can display information about the active lines on the router by using one of the following EXEC commands:

Task	Command
Display information about a line.	**show users** [**all**] **systat** [**all**] **show line** [*line-number*]

Enable Finger Protocol

You can enable the Finger protocol so that people throughout the network can get a list of the users on the router. The information displayed includes the processes running on the system, the line number, connection name, idle time, and terminal location. To enable the Finger protocol, perform the following task in global configuration mode:

Task	Command
Enable the Finger protocol requests.	**service finger**