



Using Cisco IOS Software

This appendix describes the basics about using the Cisco IOS software that is installed on every Cisco uBR924 cable access router. This appendix describes the following topics:

- [Accessing the Router's Command-Line Interface](#)
- [Understanding the Command-Line Interface](#)
- [Understanding Cisco IOS Configuration Files](#)
- [Useful Commands](#)



Caution

Before attempting to reconfigure the Cisco uBR924 cable access router at a subscriber site, contact your provisioning or billing system administrator to ensure remote configuration is allowed. To ensure proper levels of service for all customers, service providers typically disable remote configuration of the cable modems on their system and allow only the configuration that is specified by the cable provisioning or billing system.

If remote configuration is disabled, any changes you make do not remain in effect after the Cisco uBR924 router is powered off and on. Instead, the router returns to its previous configuration. In some cases, these settings will cause the cable interface to disconnect and may be lost when the cable interface is reset.

Accessing the Router's Command-Line Interface

The Cisco uBR924 router's command-line interface (CLI) can be accessed either through a Telnet connection over a TCP/IP network or by a direct connection to the router's console port. See the following sections for more information.



Note

The Cisco uBR924 router also supports accessing the CLI through the Cisco web server, but this feature is automatically disabled when the Cable Monitor is active. See [Appendix B, "Using the Cable Monitor Tool"](#) for details.

Connecting Using Telnet

If the Cisco uBR924 router has successfully booted up and is operational and online, its CLI interface can be accessed by establishing a Telnet connection. Telnet can be used from any computer or terminal that has TCP/IP connectivity with the Cisco uBR924 router—the TCP/IP connectivity can exist either through the Ethernet interface or the cable interface.

**Note**

As a security measure, you can enter EXEC mode during a Telnet session only if an enable password has been set on the router. If an enable password has not been set, you can only display the current configuration when you log in using Telnet; to change the configuration you must log in through the router's console port.

**Caution**

Care must be taken if you use a laptop computer to make a Telnet connection through the Cisco uBR924 router's Ethernet interface, either by connecting the laptop directly to one of the router's Ethernet ports or by connecting the laptop to a hub that is connected to one of the router's Ethernet ports. If the laptop computer will not be regularly used at the subscriber site, you should power cycle the Cisco uBR924 router after you use the CLI and save your configuration changes.

Power cycling the Cisco uBR924 router ensures the laptop computer does not remain in the router's list of allowable Customer Premises Equipment (CPE) devices at the subscriber site. Reinitialization of the cable interface clears out the bridge table and resets the counter that specifies the number of CPE devices being bridged. This is particularly important when the Cisco uBR924 router is configured to operate in a DOCSIS-compliant bridging mode.

If the headend is a Cisco uBR7200 series universal broadband router, the system administrator at the headend might have to issue the **clear cable modem host** *mac address* command to remove the laptop computer from its list of CPE devices.

This behavior is required by the DOCSIS 1.0 specification.

Connecting to the Console Port

The router's CLI is available by connecting directly to the console port on the back panel of the router. The console port is an EIA/TIA-232 serial interface configured as data communications equipment (DCE) and uses an RJ-45 connector. The port is wired the same as Cisco's other routers and uses the same console kit and cable.

The console port can be accessed by any computer or terminal with an RS-232 serial port set for 9600 baud, 8 data bits, no parity, 1 stop bit (9600 8N1). Unless the router's default configuration has been changed, your terminal software should be set to emulate an ANSI, VT100, or compatible terminal.

**Note**

Typically, the console port is disabled when the CMTS downloads a Cisco IOS configuration file to the router. If this is the case, the CLI can be accessed only through a Telnet connection.

Understanding the Command-Line Interface

The Cisco IOS command-line interface (CLI) is a text-based interface available on every Cisco router that uses the Cisco IOS software. This allows a network administrator to quickly configure any of Cisco's many different models of routers without having to learn a unique interface for each.

The following guidelines apply to the CLI:

- The CLI is case-insensitive—for example, you can enter either **SHOW VERSION** or **show version** to display the Cisco uBR924 router's software revision.
- You can abbreviate commands and keywords to the minimum number of characters that define a unique abbreviation. For example, you can abbreviate the **show** command to **sh** (but you cannot abbreviate the show command to just **s** because several other commands also start with the letter **s**).
- If you enter an unrecognized command, the router assumes the command is actually the host name of a PC or other router and tries to open a Telnet connection to it. If the router cannot find that host, the connection will eventually time out and the CLI prompt will be redisplayed.
- By default, if a command displays more than one screen of data, it pauses the screen and displays **--More--** at the bottom of the screen. You can advance one line at a time by pressing the Return key, advance one screen at a time by pressing the spacebar, or quit by pressing **q**.
- As a general rule, every configuration command can be disabled by prefixing the command with the keyword **no**. For example, IP routing is enabled with the **ip routing** command; IP routing is disabled with the **no ip routing** command.
- The CLI on the Cisco uBR924 router can be accessed either through a Telnet connection or through a serial connection with its console port. (Web browser access to the CLI is not supported on the Cisco uBR924 router when the Cable Monitor is active.)

These additional topics are covered in the sections that follow:

- The CLI contains many different command modes that allow access to different areas of the Cisco uBR924 router's configuration. Certain commands are available only in a specific command mode. See [“Command Modes” section on page A-3](#).
- The question mark character (?) displays a list of the available commands and can be used to display help about a specific command. See [“Context-Sensitive Help” section on page A-6](#).
- You can use the command history feature to quickly recall and edit previous commands. See [“Command History Features” section on page A-7](#).
- When commands produce long displays, you can use output modifiers to select which parts of the display you want to see. See [“Using Output Modifiers” section on page A-8](#).

Command Modes

The Cisco IOS software has many different modes of operation—each mode contains its own set of commands that either display or configure a particular aspect of the Cisco uBR924 router's configuration. When you initially log in to the Cisco uBR924 router, you enter user EXEC mode, which provides a limited number of commands that can only display information about the router; you cannot change the router's configuration in user EXEC mode.

To change the router's configuration, you must enter privileged EXEC mode or one of the other configuration modes. Each command mode has a unique prompt so that you can easily see which mode you are in.

[Table A-1](#) shows the most common modes that are used on the Cisco uBR924 router:

Table A-1 Cisco uBR924 Router Command Modes

Command Mode	Function	Access Method	Prompt ¹
User EXEC	Contains a limited number of commands that only display information about the Cisco uBR924 router.	Log in.	Router>
Privileged EXEC	Contains a larger number of display commands, as well as other commands that can change the configuration of the router. Also provides access to the global configuration mode.	From user EXEC mode, enter the enable command.	Router#
Global configuration	Contains commands that can change the operation of the Cisco uBR924 router at a system level and provides access to the interface configuration mode.	From privileged EXEC mode, enter the configure terminal command.	Router(config)#
Interface configuration	Contains commands that change the operation of the router's Ethernet and cable interfaces.	From global configuration mode, enter the interface interface-num command.	Router(config-if)#

1. The prompt always displays the router's hostname. The default hostname is "Router" but this can be changed with the global configuration **hostname** command.

Table A-1 lists the command modes in the order they must be accessed. You must log in to a higher-level mode before accessing the next lower mode. For example, before you can enter global configuration mode, you must first log in to user EXEC mode and then privileged EXEC mode. Then you can enter global configuration mode, and if desired, log in to interface configuration mode.

To leave a command mode and return to the previous mode, enter either the **exit** or **end** command. See the following sections for more details on each command mode.

**Note**

For complete information on using the CLI, see the *Configuration Fundamentals Configuration Guide*, available on CCO and the Documentation CD-ROM.

User EXEC Mode

When you log in to the Cisco uBR924 router, you automatically enter the user EXEC command mode, which contains commands that only display some parts of the router's configuration. In general, user EXEC commands allow you to connect to remote devices, change terminal settings on a temporary basis, perform basic tests, and list system information.

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

```
Router>
```

To leave user EXEC mode and log out of the Cisco uBR924 router, enter the **logout** or **exit** command.

Privileged EXEC Mode

Before you can enter any commands that change the Cisco uBR924 router's configuration, you must enter privileged EXEC mode. In this mode you can change certain router parameters, use more detailed **show** commands, and other configuration modes to change the operation of the router and its interfaces.

To access the privileged EXEC mode, enter the **enable** command from user EXEC mode. You are then prompted for a password, if one has been set for the privileged EXEC mode. The password is not displayed on the screen and is case sensitive. The prompt changes to the router's host name followed by the pound sign (#) to indicate you are now in privileged EXEC mode.

**Note**

If an enable password has not been set, privileged EXEC mode can be accessed only from the router console, not through a Telnet connection.

The following example shows how to access privileged EXEC mode:

```
Router> enable
Password: <password>
Router#
```

To return from privileged EXEC mode to user EXEC mode, use the **disable** or **exit** command.

Global Configuration Mode

The global configuration mode contains commands that change configuration parameters that affect the operation of the entire Cisco uBR924 router, such as routing and bridging functions, as opposed to changing the operation of a single interface. To log in to global configuration mode, enter the **configure terminal** from privileged EXEC mode. The prompt changes to the router's host name followed by "(config)#" to indicate you are now in global configuration mode.

The following example shows how to access global configuration mode:

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

To exit global configuration mode and return to privileged EXEC mode, enter the **exit** or **end** command, or type Ctrl-Z.

Interface Configuration Mode

The interface configuration mode configures features for an individual interface. The Cisco uBR924 cable access router supports the following interfaces:

- Ethernet0—Ethernet interface on the back panel of the router
- cable-modem0—Cable interface that connects to the cable network
- Loopback0—Internal interface used primarily for debugging

To log in to interface configuration mode, enter the **interface** command followed by the name of the interface to be configured. The prompt changes to the router's host name followed by "(config-if)#" to indicate you are now in interface configuration mode.

For example, to configure the cable interface on the Cisco uBR924 router, enter the following commands from global configuration mode:

```
Router(config)# interface cable-modem 0
Router(config-if)#
```

To exit interface configuration command mode and return to global configuration mode, enter the **exit** command, or type Ctrl-Z.

Context-Sensitive Help

The Cisco IOS CLI contains a context-sensitive help feature that can display a list of the commands that are available for the current command mode. The context-sensitive help can also display the syntax for a particular command, as well as complete a partially entered command.

Table A-2 shows the different ways you can access the context-sensitive help:

Table A-2 Context-Sensitive Help for the Command-Line Interface

Command	Purpose
help	Obtain a brief description of the help system in any command mode.
?	List all commands available for a particular command mode.
<i>partial-command?</i>	Obtain a list of commands that begin with a particular character string. (Do not enter a space before the question mark.)
<i>partial-command</i> <Tab>	Complete a partial command name. (Do not enter a space before entering the tab character.)
<i>command ?</i>	List a command's associated keywords. (A space must precede the question mark.)
<i>command keyword ?</i>	List a keyword's associated arguments. (A space must precede the question mark.)

The context-sensitive help displays only the commands and options that are appropriate for the current command mode. For example, to display the available show commands in the user EXEC mode, enter **show ?** as shown in the following example:

```
ubr924> show ?

 backup          Backup status
 bootflash:     display information about bootflash: file system
 call          Show Calls
 cca           CCA information
 class-map     Show QoS Class Map
 clock        Display the system clock
 compress     Show compression statistics
 dial-peer    Dial Plan Mapping Table for, e.g. VoIP Peers
 dialer       Dialer parameters and statistics
 exception    exception informations
 flash:       display information about flash: file system
 gateway      Show status of gateway
 history      Display the session command history
 hosts        IP domain-name, lookup style, nameservers, and host table
 location     Display the system location
 num-exp      Number Expansion (Speed Dial) information
 policy-map   Show QoS Policy Map
 ppp          PPP parameters and statistics
 queue        Show queue contents
 queueing     Show queueing configuration
 radius       Shows radius information
 rmon         rmon statistics
 sessions     Information about Telnet connections
 sgcp         Display Simple Gateway Control information
 snmp         snmp statistics
 template     Template information
 terminal     Display terminal configuration parameters
 traffic-shape traffic rate shaping configuration
```

```

translation-rule Show translation rule table
users            Display information about terminal lines
version          System hardware and software status
voice            Voice port configuration & stats
ubr924>

```

Entering the same **help** command in privileged EXEC or global configuration mode would display a different list of **show** commands. The following shows how to display a list of available commands that start with “t”:

```

ubr924> t?
telnet terminal traceroute tunnel
ubr924>

```

Command History Features

The CLI command history feature remembers the commands that you have entered during the current session. You can use this feature to repeat or change previous commands without retyping them. See the following sections for more information.

Displaying the Command History

To recall commands from the history buffer, use one of the commands shown in [Table A-3](#).

Table A-3 *Recalling Previous Commands*

Command	Purpose
Press Ctrl-P or the up arrow key. ¹	Recall commands in the history buffer, beginning with the most recent command. Repeat to recall successively older commands.
Press Ctrl-N or the down arrow key. ¹	Return to more recent commands in the history buffer after recalling commands with Ctrl-P or the up arrow key. Repeat to recall successively more recent commands.
show history	List the last several commands you have just entered (user EXEC mode only).

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

Editing Previous Commands

When you display a previous command using **Ctrl-P** or **Ctrl-N**, you can edit that command to correct any errors or to change a parameter. This allows you to quickly give a series of similar commands without having to retype each command.

[Table A-4](#) shows the most commonly used editing commands.

Table A-4 *Editing Previous Commands*

Command ¹	Purpose
Press Ctrl-A	Move to the beginning of the line.
Press Ctrl-B	Move back one character.
Press <Esc>-B	Move back to the previous word.

Table A-4 Editing Previous Commands

Command ¹	Purpose
Press Ctrl-D	Delete the character at the cursor position.
Press Ctrl-E	Move to the end of the line.
Press Ctrl-F	Move forward one character.
Press <Esc>-F	Move forward one word.
Press Ctrl-K	Delete all characters from the cursor to the end of the line.
Press Ctrl-U or Ctrl-X	Delete all characters from the cursor to the beginning of the line.
Press Ctrl-W	Delete a single word.

1. These editing commands are similar to those used in the EMACS text editor.

**Note**

Additional editing commands are given in the *Configuration Fundamentals Configuration Guide*, available on CCO and the Documentation CD-ROM.

Command History Buffer Size

By default, the command history feature stores the 10 most recent commands in its history buffer. You can change the size of this buffer for the current terminal session with the terminal history command:

```
ubr924> terminal history size 20
ubr924>
```

The **terminal no history size** command resets the number of lines saved in the history buffer to the default of 10 lines.

Using Output Modifiers

Many of the Cisco uBR924 router's commands output a great deal of information that takes many screens to display. You can use the Cisco IOS software's output modifiers to filter the output of almost any command, so that you can display only those lines you are interested in.

The output modifier feature is invoked by using the pipe symbol (`|`). To use this feature, enter a command as normal but add a space and the pipe symbol at the end of the command line. Then add one of the keywords

Table A-5 Using Output Modifiers

Command	Purpose
begin <i>regular expression</i>	Display the first line that matches the regular expression and then all other lines that follow that line.
include <i>regular expression</i>	Display all lines that match the regular expression.
exclude <i>regular expression</i>	Display all lines except those that match the regular expression.

The following example shows how the output from the **show ip traffic** command is filtered to display only those lines that include the word "error":


```
ubr924>show ip traffic | include error
      0 format errors, 0 checksum errors, 1 bad hop count
Rcvd: 0 format errors, 0 checksum errors, 0 redirects, 4 unreachable
Total: 0/0, 0 checksum errors, 0 format errors
Total: 0/0, Format errors: 0/0, Checksum errors: 0/0
Rcvd: 134 total, 0 checksum errors
Rcvd: 23 total, 0 checksum errors, 9 no port
Rcvd: 17 total, 0 checksum errors, 1 no port
```

Understanding Cisco IOS Configuration Files

Cisco IOS configuration files are text files that contain Cisco IOS commands to configure the Cisco uBR924 router when it boots up and is first configured. These commands are the same commands that could be given manually at the router's CLI interface; however, putting them in a configuration file avoids having to retype them whenever the router is reset.

Downloading the Configuration File

Usually, the Cisco IOS configuration file is specified as part of the DOCSIS configuration file. In this situation, the service provider creates and maintains both the DOCSIS and Cisco IOS configuration files for the routers, and those files are stored on TFTP servers located at the provider's headend plant.

The Cisco uBR924 router automatically loads the DOCSIS configuration file when it is connected to a cable network and powered on. If the DOCSIS configuration file specifies that a Cisco IOS configuration file is to be loaded, the router uses the TFTP protocol to download that file and then executes the file so that the non-DOCSIS routing and interface parameters are correctly configured.

When the DOCSIS configuration file specifies that a Cisco IOS configuration file should be downloaded, the Cisco uBR924 router automatically takes the following steps to ensure that the configuration cannot be changed by the user at the remote site:

1. Terminates any current Telnet sessions.
2. Disables console access.
3. Deletes the current Cisco IOS configuration, if any.
4. Downloads the Cisco IOS configuration file.
5. After configuring itself according to the commands in the Cisco IOS configuration file, the router comes online and starts sending traffic.

If the DOCSIS configuration file does not specify that a Cisco IOS configuration file should be loaded, the network administrator can log in to the router's CLI interface and manually load the file using the **copy tftp** command. (In this situation, console access is not disabled, allowing users at the remote site to modify the configuration if desired.)



Note

The DOCSIS configuration file is a binary file that must be in the specific format given by the DOCSIS 1.0 specification; it configures DOCSIS and cable-related parameters. The Cisco IOS configuration file is a text file that can be in any arbitrary format, as long as the lines in that file contain valid commands that could be given at the router's CLI interface. Typically, the Cisco IOS configuration file sets routing parameters and whatever other parameters are needed for special feature sets, such as the voice over IP (VoIP) or firewall features.

Startup and Run-Time Configuration Files

The startup configuration file is a Cisco IOS configuration file stored in the router's non-volatile Flash memory and is automatically run whenever the router is reset or powered-on. When a DOCSIS configuration file specifies that a Cisco IOS configuration file should be downloaded, that Cisco IOS configuration file automatically becomes the startup configuration file.

The run-time configuration file is the Cisco IOS configuration file that the router is currently using as it operates. When a router is first powered-on or reset, the run-time configuration file is the same as the startup configuration file.

However, when you make configuration changes to the router, either by using the CLI or by using SNMP commands, the run-time configuration file is updated with those changes. Over time, the run-time configuration file has a different configuration than the startup configuration file. Resetting the router automatically erases the run-time configuration and restores the startup configuration.

If you want to save your changes to the router's configuration, you must save the run-time configuration as the startup configuration file. To do so, enter the following global configuration command:

```
copy running-config startup-config
```



Note

Any changes you make to either the startup or run-time configuration are automatically overwritten when the router is rebooted if the DOCSIS configuration file specifies that a new Cisco IOS configuration file must be downloaded from the TFTP server. If this is the case, you must also manually update the Cisco IOS configuration file on the TFTP server to preserve any configuration changes you make.

To restore the startup configuration without resetting the router, give the following global configuration command:

```
copy startup-config running-config
```

Displaying the Configuration Files

The startup and run-time configuration files can be displayed with the following global configuration commands:

```
show startup-config
show running-config
```

The Cisco uBR924 router displays the appropriate configuration file in a format that you can capture and save on a TFTP server so it can be downloaded to another router.



Note

The configuration files do not contain any commands that restore the router to its default values. For example, if you enable IP routing with the “**ip routing**” command, this is not saved in the configuration files because this is the default configuration. However, if you disable IP routing with the “**no ip routing**” command, this is saved in the configuration file.

The **show** command uses exclamation marks (!) to create blank lines as spacers. These extra lines do not affect the functionality of the router but exist only to make the configuration files more readable.

File Format

The Cisco IOS configuration file is an ASCII text file that contains any Cisco IOS configuration commands to configure the Cisco uBR924 router. The router is automatically put into the global configuration mode when the file is executed, but if you use any commands for any other command modes, you must give the appropriate global configuration command to enter that other command mode first.

For example, to configure the cable interface on the Cisco uBR924 router, you must first enter interface mode with the following command:

```
interface cable 0
```

You can use exclamation marks (!) to create comments and blank lines in your own configuration files. These comments and blank lines are not preserved when the file is loaded into the router. However, they are useful for communicating information to other administrators who might be working with the files on the TFTP server.

Useful Commands

Table A-6 lists some of the most commonly used commands for the Cisco uBR924 router.

Table A-6 Useful Commands

Command	Command Mode	Purpose
banner	global configuration	Displays and configures the login banners that appears when a user first logs in and when a user moves to a different command mode.
configure terminal	user EXEC	Enters global configuration mode.
copy startup-config running-config	global configuration	Configures the router with its boot-up configuration file.
enable	user EXEC	Enters privileged EXEC mode.
exit	all modes	Leaves the current command mode and returns to the next higher level. If currently in user EXEC mode, logs you out of the router.
hostname	global configuration	Sets the router's hostname.
logout	user EXEC	Logs out of user EXEC mode and the Cisco uBR924 router.
show flash	user EXEC	Displays the content of the router's Flash memory, which contains the Cisco IOS software image that was loaded.
show history	user EXEC	Displays the most recently entered commands.
show interfaces	user EXEC	Displays the configuration and status of each of the router's interfaces.
show ip arp	user EXEC	Displays the contents of the router's current Address Resolution Protocol (ARP) table.

Table A-6 Useful Commands (continued)

Command	Command Mode	Purpose
show ip dhcp server statistics	user EXEC	Displays the contents of the router's DHCP database.
show ip interface	user EXEC	Displays the IP configuration and status for the router's Ethernet and cable interfaces.
show ip protocols	user EXEC	Displays the IP routing protocol parameters and status.
show ip rip database	user EXEC	Displays the contents of the Routing Information Protocol (RIP) database.
show ip route	user EXEC	Displays the contents of the router's current IP routing table.
show ip traffic	user EXEC	Displays statistics for the IP traffic sent through the router.
show protocols	user EXEC	Displays the currently configured protocols for each interface.
show running-config	privileged EXEC	Displays the active configuration.
show startup-config	privileged EXEC	Displays the configuration loaded into the router at boot-up.
show version	user EXEC	Displays the Cisco uBR924 software and hardware versions.