ROM Monitor

This appendix describes the Cisco router ROM monitor (also called the *bootstrap program*). The ROM monitor firmware runs when the router is powered up or reset. The firmware helps to initialize the processor hardware and boot the operating system software. You can perform certain configuration tasks, such as recovering a lost password or downloading software over the console port, by using the ROM monitor. If there is no Cisco IOS software image loaded on the router, the ROM monitor runs the router.

This appendix contains the following sections:

- Entering the ROM Monitor
- ROM Monitor Commands
- Command Descriptions
- Disaster Recovery with TFTP Download
- Configuration Register
- Console Download

Entering the ROM Monitor

To use the ROM monitor, you must be using a terminal or PC that is connected to the router by means of the console port. Refer to the installation chapter in the Hardware Installation Guide for your router, for information about connecting the router to a PC or terminal.

Follow these steps to configure the router to boot up in ROM monitor mode the next time it is rebooted.

	Command	Router Prompt	Task
Step 1	**enable**	Router>	If there is an enable password configured, enter the enable command and the enable password to enter privileged EXEC mode.
Step 2	**configure terminal**	Router#	Enter global configuration mode.
Step 3	**config-reg 0x0**	Router(config)#	Reset the configuration register.
Step 4	**exit**	Router(config)#	Exit global configuration mode.
Step 5	**reload**	Router#	Reboot the router with the new configuration register value. The router remains in ROM monitor and does not boot the Cisco IOS software.
			As long as the configuration value is 0x0, you must manually boot the operating system from the console. See the **boot** command in the "Command Descriptions" section on page B-4.
Step 6		rommon 1>	After the router reboots, it is in ROM monitor mode. The number in the prompt increments with each new line.

Timesaver A break (system interrupt) is always enabled for 60 seconds after the router reboots, regardless of its setting (on or off) in the configuration register. During this 60-second window, you can break to the ROM monitor prompt by pressing the Break key.

ROM Monitor Commands

Enter **?** or **help** at the ROM monitor prompt to display a list of available commands and options, as follows:

```
rommon 1 > ?
alias           set and display aliases command
boot            boot up an external process
break           set/show/clear the breakpoint
confreg         configuration register utility
cont            continue executing a downloaded image
context         display the context of a loaded image
cookie          display contents of cookie PROM in hex
dev             list the device table
dir             list files in file system
dis             display instruction stream
dnld            serial download a program module
frame           print out a selected stack frame
help            monitor builtin command help
history         monitor command history
meminfo         main memory information
repeat          repeat a monitor command
reset           system reset
set             display the monitor variables
stack           produce a stack trace
sync            write monitor environment to NVRAM
sysret          print out info from last system return
tftpdnld        tftp image download
unalias         unset an alias
unset           unset a monitor variable
xmodem          x/ymodem image download
```

Commands are case sensitive. You can halt any command by pressing the Break key on a terminal. If you are using a PC, most terminal emulation programs halt a command when you press the Ctrl and the Break keys at the same time. If you are using another type of terminal emulator or terminal emulation software, refer to the documentation for that product for information on how to send a Break command.

Command Descriptions

Table B-1 describes commonly used ROM monitor commands.

Table B-1   Common ROM Monitor Commands

Command	Description
help or **?**	Displays a summary of all available ROM monitor commands.

-?	Displays information about command syntax, for example:
	
	``rommon 16 > dis -?
	usage : dis [addr] [length]```
	
	The output for this command is slightly different for the **xmodem** download command:
	
	``rommon 11 > xmodem -?
	xmodem: illegal option -- ?
	usage: xmodem [-cyrx] destination filename
	-c CRC-16
	-y ymodem-batch protocol
	-r copy image to dram for launch
	-x do not launch on download completion```

reset or **i**	Resets and initializes the router, similar to a power-up.

dev	Lists boot device identifications on the router. For example:
	
	``rommon 2> dev
	Devices in device table:
	        id name
	     flash: flash
	eprom: eprom```

dir *device***:**	Lists the files on the named device (Flash, for example):
	
	``rommon 1> dir flash:
	        File size Checksum File name
	  7729736 bytes (0x75f248) 0xb86d
	c1700-bk9no3r2sy7-mz.0412```

Table B-2 describes the ROM monitor boot commands. For more information about the ROM monitor boot commands, refer to the *Cisco IOS Configuration Guide* and *Cisco IOS Command Reference* publications.

Table B-2   Boot Commands

Command	Description
b	Boots the first image in Flash memory.
b flash: [*filename*]	Attempts to boot the image directly from the first partition of Flash memory. If you do not enter a filename, this command will boot the first image in Flash.
b flash:2: [*filename*]	Attempts to boot the image directly from the second partition of Flash memory. If you do not enter a filename, this command will boot the first image in the second partition of Flash memory.

Disaster Recovery with TFTP Download

The standard way to load new software on your router is using the **copy tftp flash** privileged EXEC command from the Cisco IOS software command-line interface (CLI). However, if the router is unable to boot the Cisco IOS software, you can load new software while in ROM monitor mode.

This section tells how, in ROM monitor mode, to download a Cisco IOS software image from a remote TFTP server to the router Flash memory. Use the **tftpdnld** command only for disaster recovery because it erases all existing data in Flash memory before downloading a new software image to the router.

Note   A 10BASE-T Ethernet Port is not active in ROM monitor mode and, thus, cannot be used for TFTP download.

TFTP Download Command Variables

This section describes the system variables that can be set in ROM monitor mode and that are used during the TFTP download process. There are required and optional variables.

> ✎
>
> **Note** The commands described in this section are case sensitive and must be entered exactly as shown in the lists.

Required Variables

The following variables must be set with the commands shown before using the **tftpdnld** command:

Variable	Command
IP address of the router.	**IP_ADDRESS**= *ip_address*
Subnet mask of the router.	**IP_SUBNET_MASK**= *ip_address*
IP address of the default gateway of the router.	**DEFAULT_GATEWAY**= *ip_address*
IP address of the TFTP server from which the software will be downloaded.	**TFTP_SERVER**= *ip_address*
The name of the file that will be downloaded to the router.	**TFTP_FILE**= *filename*

Optional Variables

The following variables can be set with the commands shown before using the **tftpdnld** command:

Variable	Command
Whether or not the router performs a checksum test on the downloaded image: **1**—Checksum test is performed. **0**—No checksum test is performed.	**TFTP_CHECKSUM**=*setting*

Variable	Command
Number of times the router attempts ARP and TFTP download. The default is 7.	**TFTP_RETRY_COUNT=** *retry_times*
Amount of time, in seconds, before the download process times out. The default is 2400 seconds (40 minutes).	**TFTP_TIMEOUT=** *time*
Configures how the router displays file download progress. **0**—No progress is displayed. **1**—Exclamation points (!!!) are displayed to indicate file download progress. This is the default setting. **2**—Detailed progress is displayed during the file download process. For example: Initializing interface. Interface link state up. ARPing for 1.4.0.1 ARP reply for 1.4.0.1 received. MAC address 00:00:0c:07:ac:01	**TFTP_VERBOSE=** *setting*

Using the TFTP Download Command

The steps described in this section should be performed while in ROM monitor mode.

Step 1   Use the appropriate commands to enter all the required variables and any optional variables.

Step 2   Enter the **tftpdnld** command as follows:

```
rommon 1 > tftpdnld [ -r ]
```

> ✎
>
> **Note** The **-r** variable is optional. Entering this variable downloads and boots
> the new software but does not save the software to Flash. You can then
> use the image that is in Flash the next time you enter the **reload**
> command in the Cisco IOS software CLI.

You will see output similar to the following:

```
IP_ADDRESS: 10.0.0.1
     IP_SUBNET_MASK: 255.255.0.0
    DEFAULT_GATEWAY: 1.3.0.1
        TFTP_SERVER: 223.255.254.254
          TFTP_FILE: c1700-bnr2sy-mz.070298
Invoke this command for disaster recovery only.
WARNING: all existing data in all partitions on flash will be lost!
Do you wish to continue? y/n:  [n]:
```

Step 3 If you are sure that you want to continue, enter **y** in response to the question in the
output:

```
Do you wish to continue? y/n:  [n]:y
```

The router will begin to download the new file.

Pressing Ctrl-C or Break stops the transfer before the Flash memory is erased.

Configuration Register

The virtual configuration register is in NVRAM and has the same functionality as
other Cisco routers. You can view or modify the virtual configuration register
from either the ROM monitor or the operating system software.

To change the virtual configuration register from the ROM monitor, enter **confreg**
by itself for menu mode, or enter the new value of the register in hexadecimal. For
example:

confreg [*hexnum*]

This will change the virtual configuration register to the value specified. The value is always interpreted as hexadecimal. Entering **confreg** without an argument displays the contents of the virtual configuration register and a prompt to alter the contents by describing the meaning of each bit.

Whether or not an argument is provided, the new virtual configuration register value is written into NVRAM, but it does not take effect until you reset or power-cycle the router.

The following display shows an example of menu mode:

```
rommon 7> confreg

     Configuration Summary
enabled are:
console baud: 9600
boot: the ROM Monitor

do you wish to change the configuration? y/n  [n]:  y
enable  "diagnostic mode"? y/n  [n]:  y
enable  "use net in IP bcast address"? y/n  [n]:
enable  "load rom after netboot fails"? y/n  [n]:
enable  "use all zero broadcast"? y/n  [n]:
enable  "break/abort has effect"? y/n  [n]:
enable  "ignore system config info"? y/n  [n]:
change console baud rate? y/n  [n]:  y
enter rate: 0 = 9600, 1 = 4800, 2 = 1200, 3 = 2400
 4 = 19200, 5 = 38400, 6 = 57600, 7 = 115200   [0]:  0
change the boot characteristics? y/n  [n]:  y
enter to boot:
 0 = ROM Monitor
 1 = the boot helper image
 2-15 = boot system
    [0]:  0

Configuration Summary
enabled are:
diagnostic mode
console baud: 9600
boot: the ROM Monitor

do you wish to change the configuration? y/n  [n]:


You must reset or power cycle for new config to take effect
```

Console Download

You can use console download, a ROM monitor function, to download over the router console port either a software image or a configuration file. After downloading, the file is saved either to Flash memory or to main memory for execution (image files only).

Use console download when you do not have access to a TFTP server.

Note   If you want to download a software image or a configuration file to the router over the console port, you must use the ROM monitor command.

Note   If you are using a PC to download a Cisco IOS image over the router console port at 115,200 bps, ensure that the PC serial port is using a 16550 universal asynchronous receiver/transmitter (UART). If the PC serial port is not using a 16550 UART, we recommend using a speed of 38,400 or lower when downloading a Cisco IOS image over the console port.

Command Description

The following are the syntax and argument descriptions for the **xmodem** console download command.

The syntax is as follows:

xmodem [**-cyrx**] *destination_file_name*

The argument descriptions are as follows:

Argument	Description
c	Optional. Performs the download using 16-bit cyclic redundancy check (CRC) error checking to validate packets. Default is 8-bit CRC.

Argument	Description
y	Optional. Sets the router to perform the download using ymodem protocol. Default is xmodem protocol. The protocols differ as follows: • The xmodem protocol supports a 128-block transfer size, whereas the ymodem protocol supports a 1024-block transfer size. • The ymodem protocol uses 16-bit CRC error checking to validate each packet. Depending on the device that the software is being downloaded from, this function might not be supported by the xmodem protocol.
r	Optional. Image is loaded into DRAM for execution. Default is to load the image into Flash memory.
x	Optional. Image is loaded into DRAM without being executed.
destination_file_name	The name of the system image file or the system configuration file. In order for the router to recognize it, the name of the configuration file must be *router_confg*.

Error Reporting

Because the ROM monitor console download uses the console to perform the data transfer, error messages are displayed on the console only when the data transfer is terminated.

If an error does occur during a data transfer, the transfer is terminated, and an error message is displayed. If you have changed the baud rate from the default rate, the error message is followed by a message telling you to restore the terminal to the baud rate specified in the configuration register.

Debug Commands

Most ROM monitor debugging commands are functional only when Cisco IOS
software has crashed or stopped. If you enter a debugging command and
Cisco IOS crash information is not available, you see the following error
message:

```
"xxx: kernel context state is invalid, can not proceed."
```

The following are ROM monitor debugging commands:

- **stack** or **k**—Produce a stack trace. For example:

```
rommon 6> stack
Stack trace:
PC = 0x801111b0
Frame 00: FP = 0x80005ea8    PC = 0x801111b0
Frame 01: FP = 0x80005eb4    PC = 0x80113694
Frame 02: FP = 0x80005f74    PC = 0x8010eb44
Frame 03: FP = 0x80005f9c    PC = 0x80008118
Frame 04: FP = 0x80005fac    PC = 0x80008064
Frame 05: FP = 0x80005fc4    PC = 0xfff03d70
```

- **context**—Display processor context. For example:

```
rommon 7> context
CPU context of the most recent exception:
PC  = 0x801111b0  MSR = 0x00009032  CR  = 0x53000035  LR   = 0x80113694
CTR = 0x801065e4  XER = 0xa0006d36  DAR = 0xffffffff  DSISR = 0xffffffff
DEC = 0xffffffff  TBU = 0xffffffff  TBL = 0xffffffff  IMMR = 0xffffffff
R0  = 0x00000000  R1  = 0x80005ea8  R2  = 0xffffffff  R3   = 0x00000000
R4  = 0x8fab0d76  R5  = 0x80657d00  R6  = 0x80570000  R7   = 0x80570000
R8  = 0x00000000  R9  = 0x80570000  R10 = 0x0000954c  R11  = 0x00000000
R12 = 0x00000080  R13 = 0xffffffff  R14 = 0xffffffff  R15  = 0xffffffff
R16 = 0xffffffff  R17 = 0xffffffff  R18 = 0xffffffff  R19  = 0xffffffff
R20 = 0xffffffff  R21 = 0xffffffff  R22 = 0xffffffff  R23  = 0xffffffff
R24 = 0xffffffff  R25 = 0xffffffff  R26 = 0xffffffff  R27  = 0xffffffff
```

```
R28 = 0xffffffff  R29 = 0xffffffff  R30 = 0xffffffff  R31   =
0xffffffff
```

- **frame**—Display an individual stack frame.

- **sysret**—Display return information from the last booted system image. This information includes the reason for terminating the image, a stack dump of up to eight frames, and, if an exception is involved, the address where the exception occurred. For example:

```
rommon 8> sysret
System Return Info:
count: 19,  reason: user break
pc:0x801111b0,  error address: 0x801111b0
Stack Trace:
FP: 0x80005ea8, PC: 0x801111b0
FP: 0x80005eb4, PC: 0x80113694
FP: 0x80005f74, PC: 0x8010eb44
FP: 0x80005f9c, PC: 0x80008118
FP: 0x80005fac, PC: 0x80008064
FP: 0x80005fc4, PC: 0xfff03d70
FP: 0x80005ffc, PC: 0x00000000
FP: 0x00000000, PC: 0x00000000
```

- **meminfo**—Display size in bytes, starting address, available range of main memory, the starting point and size of packet memory, and size of nonvolatile random-access memory (NVRAM). For example:

```
rommon 3> meminfo

Main memory size: 64 MB.
Available main memory starts at 0x10000, size 65472KB
IO (packet) memory size: 25 percent of main memory.
NVRAM size: 32KB
```