Doc. No. 78-1423-01

Upgrading Run-From-Flash Software Images in the Cisco 2500

Product Numbers:
SW-G25A-9.14.x=
SW-G25B-9.14.x=
SW-G25C-9.14.x=
SW-G25A-9.21.x=
SW-G25B-9.21.x=
SW-G25C-9.21.x=
SW-G25A-10.0.x=
SW-G25B-10.0.x=
SW-G25C-10.0.x=

Note The *x* variable following 9.14, 9.21, and 10.0 in the product number represents the maintenance release number of your software upgrade. For example, if you were upgrading a Cisco 2500 to IOS Release 10.0(2), the product number would be SW-G25A-10.0.2=.

Read this entire publication before attempting any of its procedures.

This publication describes how to upgrade Cisco 2500 routers with run-from-Flash software images. It also provides information about the rxboot image, which is a limited ROM-based image you use to perform the Cisco 2500 system software upgrade. These tasks include the following:

- Install a 9.14, 9.21, or 10.0 System Software Release upgrade from 3.5-inch PC-DOS formatted floppy disks to a personal computer (PC) or UNIX workstation configured as a TFTP server
- Use TFTP to transfer the system software to Cisco routers set up with Flash memory
- Boot a router either manually or automatically from a system software image stored in Flash memory

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About This Publication

The information in this publication is organized within the following sections:

Note Instructions for contacting technical assistance are provided at the end of this publication.

Overview of Image Distribution and Upgrade Methods

The Cisco 2500 supports Flash memory downloading for software images. Downloadable images enable you to download new images over the network, store the images in the router's Flash memory, and load images from Flash at system startup without having to physically access the router.

Some Cisco routers, including the Cisco 2500, are designed to run from Flash memory and can only boot from the first file in Flash memory. To upgrade the system software image on such a router, you must erase the contents of Flash memory so the new system image can be written as the first file. As a result, the upgrade must be performed while running from a media other than Flash. The rxboot image is used for this purpose.

Overview of the Rxboot Image

The rxboot image is a bootable image stored in ROM on a Cisco 2500. It is limited in size, and therefore, has only a limited subset of the functionality of a complete router system image.

Functions Supported by the Rxboot Image

The following functions are supported by the rxboot image:

- Telnet operations
- TFTP operations

  In any WAN encapsulation mode (such as Frame Relay, X.25, SMDS, HDLC, or PPP), you must specify an IP default gateway between the router and a device with which it will communicate. You do so in interface configuration mode on each router you are upgrading. If you do not specify an IP default gateway, a router with an rxboot image in boot ROM mode lose routes to the network to which it is connected and cannot be reached by a TFTP server.

Functions Not Supported by the Rxboot Image

The following functions are not supported by the rxboot image:

- Routing—No packets are routed or forwarded.
- SNMP.
- Multiple Serial Links Support—When at the boot ROM prompt, IP packets only pass through the first port initialized. If the TFTP server is not on this path, connectivity to the TFTP server is lost. To ensure connectivity to the TFTP server, shut down all interfaces except the one serial port that has the optimal path to the TFTP server.
- AUX port SLIP operation (planned for a future release).
- TACACS.
- IP unnumbered option.

Caution If there are any interfaces with the IP unnumbered option enabled on a router to be upgraded, IP routes will not be complete between the TFTP server and the router. Explicit IP numbers must be entered for an interface configured with the IP unnumbered option before the upgrade. You will otherwise be locked out of the connection from the TFTP server to your router. If this occurs, you must use a modem to connect to the console port on the router.

Prerequisites and Caveats

To successfully upgrade system software and read-only memory on your Cisco 2500 routers, you should observe the following prerequisites and caveats.

Prerequisites

- You must have IP running to the devices you plan to upgrade on the network.
- Your router was shipped with Flash enabled. Flash must be enabled on the router to make a write to Flash operation possible. Refer to the hardware installation and maintenance publication for the router product you are upgrading for appropriate Flash-enabled jumper settings. If jumpered as write-protected, the system makes a write operation impossible.
- You must have a terminal connection that enables you to issue commands to each router on the network you want to upgrade. If you do not have a direct terminal connection, you must set up a Telnet session on a device attached to the router to be upgraded.
  - If you are using TCP/IP software that permits concurrent Telnet and TFTP server connections, your terminal connection and TFTP session can be from the same PC.
  - If you are using TCP/IP software that permits only the TFTP server to run (such as PC/TCP from FTP Software, Inc.), you need two machines. Set up one for your terminal connection and the other for your TFTP server.
- A TFTP file server must be active and accessible to the router. You must copy the system software image into the TFTP server directory to download it to the router.

  If the TFTP server is a PC, it must have the following minimum configuration:
  - The server must be a PC or a desktop SPARCstation with a 1.44 MB 3.5-inch floppy disk drive.
  - The configuration of the computer must meet the requirements established by the vendor of the TFTP software. Cisco has tested the following software running on an Everex 386/33 running under DOS 5.0 (in both Ethernet and Token Ring environments):

    PC/TCP from FTP Software, Inc., version 2.0 and greater. The toll-free number for FTP Software, Inc. is 800 282-4387. The address for FTP Software, Inc. is 2 High Street, North Andover, MA 01845-2620.

    Chameleon TCP/IP for Windows from NetManage Inc. To contact NetManage, Inc., call 408 973-7171 or fax 408 257-6405. The address for NetManage, Inc. is 20823 Stevens Creek Blvd., Cupertino, CA 95014, USA.

  Cisco has also tested the TFTP server provided by SunOS 4.1*x* on SPARCstation platforms. A desktop SPARCstation must have a 1.44-MB, 3.5-inch floppy disk drive.

Caveats

- If you are using Chameleon TCP/IP for Windows, make sure you click the Server On checkbox in the Server Settings dialog box before you use TFTP to transfer the system software image.

Procedural Overview

This section describes the general steps required to upgrade your system software on a Cisco 2500 router. The sections that follow describe these steps in greater detail.

Step 1 Establish a route from a TFTP server to the routers to be upgraded.

Step 2 Install the system software from the 3.5-inch floppy disk onto your PC or UNIX machine into the TFTP server directory.

Step 3 Start the TFTP server if it is not already active.

Step 4 If you do not have a console port connection to the router you plan to upgrade, establish a Telnet session with the router.

Step 5 Back up the existing working system software image currently in Flash memory by copying it to the TFTP server.

Step 6 Reload the router to boot at the boot ROM prompt (router(boot)#).

Step 7 Telnet again in to the router running from the boot ROM that is to be upgraded.

Step 8 Copy the system software image from the TFTP server into Flash memory.

Step 9 Ensure that the checksum listed on the bottom line of the output for the **copy tftp flash** command matches the checksum listed in the README file on the upgrade disk. If it does not, you must invoke the **copy tftp flash** command again before booting from Flash memory.

Step 10 Return the router to its original state.

Step 11 Make sure your system is configured to boot from the new image in Flash memory.

Step 12 Boot the router from Flash. Your Cisco 2500 is intended to run from Flash memory. Other router models run the image in RAM, even if they are booted from Flash memory. Run-from-Flash images save processing space in RAM.

Step 13 Check all network connections to make sure the router with the upgraded system software is up and functioning properly. Repeat these steps to upgrade subsequent routers.

Establishing a Route to the TFTP Server

You need a TFTP server to download a new system image. This server can also hold original system images for backup purposes. This section describes how to ensure a route is established between the TFTP server and the router to be upgraded.

Step 1 Log in to the console port of each router to be upgraded (using Telnet or a modem).

Step 2 Add the command **ip default-gateway** to each router's configuration file.

Step 3 If you have a serial link to the TFTP server, make sure that all other serial lines for each router are temporarily shut down, or else the route to the server might be broken.

Figure 1 shows an example of a router named Cancun being upgraded with a system software image stored on the TFTP server named Lahonda.

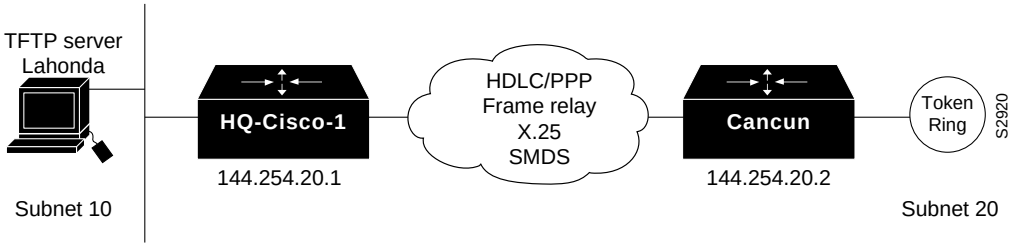

Figure 1 Sample Upgrade Scenario

To configure the router Cancun so that it has a route to Lahonda when at the boot ROM prompt, you would follow these steps:

1. Log in to the router named Cancun.
2. Enter enable mode by issuing the **enable** command, as in the following example.

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

3. Enter the **ip default-gateway** command to establish the system HQ Cisco 1 (144.254.100.1) as the IP default gateway. The following example shows this command being entered on interface serial 0 of the router Cancun.

```
cancun# configure terminal
Enter configuration commands, one per line.
Edit with DELETE, CTRL/W, and CTRL/U; end with CTRL/Z

interface serial 1
shutdown
interface serial 0
shutdown
ip default-gateway 144.254.100.1

^Z

cancun# write memory
[ok]
cancun#
```

Having established a route from the TFTP server to each router to be upgraded, refer to the next section “Installing System Software onto Your TFTP Server.”

Installing System Software onto Your TFTP Server

This section describes how to use the installation program on the disk with your software upgrade to install the system software onto your DOS-based PC or your desktop SPARCstation.

Refer to the online README file on the software upgrade disk for details about the image for the routers to be upgraded. The README file lists details such as product number, image type, file size, and checksum of the compressed or uncompressed image.

Installing System Software onto a DOS-Based PC

To copy your system software upgrade into the appropriate directory on the PC you plan to use as the TFTP server, follow this procedure. Allow five minutes to complete this procedure.

Caution Do not install the system software image to the TFTP server a first time, then install it again. If you do, the system appends the second image to the first image rather than writing over it, and the altered image will not function in your routers. If you want to install the image a second time, first delete the image from the destination directory on the TFTP server, then reinstall it.

Step 1 Make a backup copy of the master system software upgrade distribution disk and work from the backup copy. Archive the master disk.

Step 2 Insert the upgrade disk containing the system software upgrade into your 3.5-inch disk drive.

Step 3 Type the following command and press Enter.

```
C:\> a:install
```

where **a** is the drive in which you insert the source disk. The drive letter can be either **a** or **b**.

A screen similar to the following appears. This screen is for a 9.21(3) software image on a Cisco 2500. If you are upgrading to a different release of router system software, the header fields (first four lines in the display) will be different.

```
********************** IC92130N.DOC ********************************

    PRODUCT NO. SW-G25C-9.21.3=
    System Software Image IC92130N, IGS-BFPX Version 9.21(3)
    Uncompressed size = 1989999 bytes; Checksum=0x5alc
    Copyright (c) 1994 Cisco Systems, Inc.

File IC92130N contains an uncompressed image that supports all software
capabilities for the Cisco 2500 except booting from RAM and ROM.

To install this software in a PCDOS environment enter:
    A:install          (or use the appropriate drive letter)
To install this software in a UNIX environment enter:
    #mount -rt pcfs /dev/fd0 /pcfs
    #/pcfs/install.unx    (where the user has root privileges)

To install this software onto a router, follow the procedures in the
accompanying publication, "Upgrading Run-From-Flash Software Images
in the Cisco 2500."

*********************************************************************
```

Step 4 A prompt appears asking if you want to continue with the installation. Press Y (or Enter) to continue, or N to abort.

Step 5 A prompt appears asking where the files will be installed. The default directory is C:\TFTPBOOT. To accept this directory, press Enter. To specify a different directory, type the full pathname, then press Enter.

If the nondefault directory you specify does not already exist, a message appears asking if you want to create the directory.

Step 6 To create the directory, press Y. If you do not want to create a new directory on your PC and want to abort this process, press N.

The software displays a set of messages indicating the status of the installation. The copy process takes about one minute.

Step 7 If you have multiple disks, the system prompts you to insert the second disk and press Enter.

When the process is complete, the following message appears. This example shows the 9.21(3) image for the Cisco 2500—IC92130N.

```
Installation for ic92130n complete!
```

Step 8 Eject the disk from the disk drive and keep it in a safe place.

Step 9 Change to the directory in which you installed the software image. For example, if you installed it in the default directory, type the following command and press Enter:

```
C:\> cd \tftpboot
```

Step 10 List the contents of the images in this directory. For example, if you installed a 10.0(1) image for the Cisco 2500, type the following command and press Enter:

```
C:\> dir ic10010n.*
```

The following two files should appear:

- IC10010N
- IC10010N.DOC (the README file that appears when you install the image on the server)

Refer to the section “Establishing a TFTP Session” later in this publication.

Installing System Software onto a Sun Workstation

The following procedures describe how to install the system software upgrade onto a desktop SPARCstation with SunOS 4.1.*x*. The workstation must have a 3.5-inch, 1.44-MB floppy disk drive. Allow ten minutes to complete this procedure.

You must have superuser (SU) access to install the router system software to the UNIX system.

Note If you have a different UNIX-based system, refer to your system’s documentation for how to load a PC-DOS formatted floppy disk and how to configure the system as a TFTP server.

Use the following procedure to create a mount point and install the system software image on your TFTP server. Note that filenames are case sensitive.

Caution Do not install the system software image to the TFTP server a first time, then install it again. If you do, the system appends the second image to the first image rather than writing over it, and the altered image will not function in your routers. If you want to install the image a second time, first delete the image from the destination directory on the TFTP server, then reinstall it.

Step 1 Create a directory named pcfs as follows (you must have superuser capability to execute this instruction):

```
hostname# mkdir /pcfs
```

Step 2 Insert the disk containing the system software upgrade into your 3.5-inch floppy disk drive.

Step 3 Mount the floppy disk drive as a device by entering the following command:

```
hostname# mount -t pcfs /dev/fd0 /pcfs
```

If the disk is write-protected, you should enter the following command:

```
hostname# mount -rt pcfs /dev/fd0 /pcfs
```

The floppy is now set up as the device /pcfs.

Step 4 Copy the router system software to your TFTP directory. To copy it to the default (/tftpboot) directory, enter the following command:

```
hostname# /pcfs/install.unx
```

Step 5 A message appears prompting you to specify the device from which the software is being installed. The default is /dev/fd0. To accept the default, press Return. To specify a different directory, type the name of the built-in floppy drive on the SPARCstation.

Step 6 A message appears prompting you to specify the path from the mounted floppy drive. The default is /pcfs. To accept the default, press Return. To specify a different path, type the full pathname.

A screen similar to the following appears. This screen is for a 9.21(3) software image on a Cisco 2500. If you are upgrading to a different release of router system software, the header fields (first four lines in the display) will be different.

```
********************** IC92130N.DOC ********************************

    PRODUCT NO. SW-G25C-9.21.3=
    System Software Image IC92130N, IGS-BFPX Version 9.21(3)
    Uncompressed size = 1989999 bytes; Checksum=0x5alc
    Copyright (c) 1994 Cisco Systems, Inc.

File IC92130N contains an uncompressed image that supports all software
capabilities for the Cisco 2500 except booting from RAM and ROM.

To install this software in a PCDOS environment enter:
    A:install          (or use the appropriate drive letter)
To install this software in a UNIX environment enter:
    #mount -rt pcfs /dev/fd0 /pcfs
    #/pcfs/install.unx    (where the user has root privileges)

To install this software onto a router, follow the procedures in the
accompanying publication, "Upgrading Run-From-Flash Software Images
in the Cisco 2500."

*********************************************************************
```

Step 7 Print the README file screen, or note the filename, checksum, and image size on a piece of paper for later reference.

Step 8 A prompt appears asking if you want to continue with the installation. Press Y (or Enter) to continue, or N to abort.

The screen displays a set of messages indicating the status of the installation. The copy process takes five minutes.

Step 9 If you have multiple floppy disks, the system prompts you to insert the second disk and press Enter.

After the image is installed on your TFTP server, the disk is automatically ejected and the disk drive is automatically unmounted. The following message appears. This example shows the 9.21(3) image for a Cisco 2500—ic92130n.

```
Installation for ic92130n complete!
```

Step 10 Eject the disk from the disk drive and keep it in a safe place.

Step 11 Change to the directory in which you installed the system software image. For example, if you installed it in the default directory, enter the following command:

```
hostname# cd /tftpboot
```

Step 12 List the contents of the images in this directory. For example, for a 9.14(7) system software image for a Cisco 2500, enter the following command:

```
hostname# ls -l ic91470n.*
```

The following two files should appear for the 9.14(7) image on a Cisco 2500. Other image names would be different, such as ic10010n for the 10.0(1) image.

- ic91470n
- ic91470n.doc (the README file that appears when you install the software image on the server)

Refer to the next section, “Making Your Network Connections.”

Making Your Network Connections

This section describes the following topics:

- Testing the TCP/IP software
- Establishing a TFTP session (to the router)
- Establishing a Telnet session (from the router to the TFTP server)

Testing the TCP/IP Software

After installing the TCP/IP software you will use to copy the Cisco 2500 software image to the routers on your network, make sure it functions properly by following this procedure:

Step 1 Make sure a router with which you plan to communicate is up and running by transmitting an IP **ping** from that router to the TFTP server on the network. Use the following syntax for the **ping** command:

```
router# ping ip-address
```

If the router is appropriately connected, you see a series of exclamation points (!!!!!). However, the following messages indicate that you have no connection:

- [timed out]
- [failed]

Step 2 Verify the connection to the TFTP file server by transmitting a **ping** from the TFTP file server to the router.

If the connection fails, make sure you reconfigure the interface, check the physical connection to the TFTP file server, and retransmit the **ping**.

If you are using PC/TCP Network Software for DOS from FTP Software, Inc., you can verify the appropriate driver and IP address by entering the following command:

```
C:\> ifconfig drivers\drivername show
```

You can verify your IP configuration by entering the following command:

```
C:\> ipconfig ftp_3c\ipcust.sys show
```

If you are using Chameleon TCP/IP for Windows from NetManage, Inc., run its Setup program to verify that you are using the appropriate driver and have configured the TCP/IP software properly.

Establishing a TFTP Session

This section describes how to set up your UNIX system or PC as a TFTP server and start a TFTP session with the router you want to upgrade remotely.

If you are using a PC and do not already have TFTP software, we recommend the following two TCP/IP software packages:

- PC/TCP Network Software for DOS from FTP Software, Inc. (character-based TFTP software capability)
- Chameleon software from NetManage, Inc. (a Windows-based TFTP server)

The section “Prerequisites and Caveats” lists some issues to keep in mind while installing the software.

Setting Up TFTP on a Sun Workstation

To set up the Sun system as a TFTP server, you must verify that the TFTP daemon is enabled, the TFTP environment variable is set correctly, and a tftpboot directory exists. To see if TFTP is enabled, enter the following command:

```
hostname# netstat -a | grep tftp
```

If the TFTP daemon is already enabled, skip to “Creating a tftpboot Directory” on page 12.

Enabling the TFTP Daemon

The TFTP daemon (tftpd) permits the system to be a TFTP server. If you are using the standard Sun software, verify that tftpd is enabled by completing the following steps:

Step 1 Log in as a superuser.

Step 2 Using a text editor such as vi, edit the /etc/inetd.conf file.

Step 3 Look in the file /etc/inetd.conf for the line that invokes tftpd. If the line is commented out (starts with a pound sign [#]), remove the pound sign with an editor. This example shows sample output for the /etc/inetd.conf file.

```
# tftp dgram udp wait root /user/etc/in.tftpd
in.tftpd -s /tftpboot
```

Step 4 Save the changes in the edited file and exit.

Step 5 At the UNIX prompt, enter the following command to display the process ID number for the inetd configuration:

```
hostname# ps -ax | grep -v grep | grep inetd
```

The system response is similar to the following:

```
119 ?   S   0:05 inetd
```

The first number in the output is the process ID of the inetd process. You must kill this inetd process by entering the following command:

```
hostname# kill -HUP 119
```

Step 6 Verify that TFTP is enabled by entering the following command:

```
hostname# netstat -a | grep tftp
```

The output should be similar to the following:

```
udp     0       0   *.tftp        *.*
```

If there is no output, tftpd is not enabled. For additional information about TFTP, refer to the UNIX man pages about **tftp** and **tftpd**.

Creating a tftpboot Directory

The tftpboot directory can be used to save and store configuration files that are loaded to a device. Device configuration files can be saved as TFTP boot files.

Note The tftpboot directory is accessible by all users. To protect the security of your system, do not leave sensitive files in this directory.

You must have superuser (SU) access to perform the following steps. These steps describe how to create a tftpboot directory.

Step 1 If the tftpboot directory does not exist, use the following command to create it:

```
hostname# mkdir /tftpboot
```

Step 2 The tftpboot directory must have the appropriate permissions. Modify the permissions with the following command:

```
hostname# chmod 777 /tftpboot
```

As a result, all users accessing this directory will have read, write, and execute permissions.

After completing all the preparations required to set up the Sun system as a TFTP server, refer to “Testing the TCP/IP Software” on page 10.

Establishing a Telnet Session

You must be able to issue commands to the router you plan to upgrade. For example, this publication will tell you to issue a command to download the image from the TFTP server to the router.

If you have a console port connection to the router, you need not invoke a Telnet session.

If you do not have a console port connection to the router, you must establish a Telnet session with it so that you can issue commands.

You can set up a Telnet session from a Sun workstation or from a PC.

- If you are using a Sun workstation as a TFTP server, you can also establish a Telnet session from the workstation to the router in addition to the TFTP session.
- If you are running TCP/IP software on a PC, is the software character-based or Windows-based?
  - If character-based, you need a second PC from which you can establish a Telnet session.
  - If Windows-based, you can open one window for the TFTP session and one window for the Telnet session.

Loading the New Image

This section presents the following topics:

- Backing up your current system software image (including learning the existing system software image name and copying the image from Flash memory to the TFTP server)
- Reloading the router to boot ROM prompt
- Copying the image from a TFTP server to Flash memory
- Verifying the new image in Flash memory
- Returning your router to its original state

Backing Up Your Current System Software Image

If you do not already have the current system software image on your TFTP server, make sure you back up this image before copying the new system software image to Flash memory on your router.

Learning the Image Name

First, you must know the exact spelling of the image name. To learn the image name, issue the **show flash all** command. The following sample output for a compressed Cisco 2500 image (System Software Release 9.14(2)) displays an image name of xk91420z near the bottom of the screen.

```
router# show flash all
2048K bytes of Flash address space sized on CPU board.
Memory type is Flash.
   Chip    socket   code      bytes     name
    0       U42     89BD   0x040000   INTEL 28F020
    1       U44     89BD   0x040000   INTEL 28F020
    2       U46     89BD   0x040000   INTEL 28F020
    3       U48     89BD   0x040000   INTEL 28F020
    4       U41     89BD   0x040000   INTEL 28F020
    5       U43     89BD   0x040000   INTEL 28F020
    6       U45     89BD   0x040000   INTEL 28F020
    7       U47     89BD   0x040000   INTEL 28F020

Flash address space file directory:
File  name/status
        addr     length    fcksum  ccksum
 0  xk91420z
      0x3000040  1337256   0x5A1C 0x5A1C
 [759832/2097152 bytes free/total]
router#
```

Use the name near the bottom of your router's **show flash all** command (in this case, xk91420z) when you back up the image.

Copying the Image from Flash Memory to the TFTP Server

To copy an image from Flash memory to a TFTP server, use the **copy flash tftp** command:

```
router# copy flash tftp filename
```

The router asks you for the IP address of the TFTP server and the name of the image file you are copying to the server.

A sample of the output for this command using IP address 131.108.10.6 and filename ic92130n follows:

```
IP address of remote host [255.255.255.255]? 131.108.10.6
Name of file to copy []? ic92130n
writing ic92130n !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
router#
```

Use the image you backed up to the TFTP server in case the upgrade image becomes damaged.

Reloading the Router to the Boot ROM Prompt

To reboot the router to the boot ROM prompt, you first set the configuration register to 0x101, then issue the **reload** command, as shown in the following example.

```
router# configure terminal
Enter configuration commands, one per line.
Edit with DELETE, CTRL/W, and CTRL/U; end with CTRL/Z

router(config)# config-reg 0x101
router(config)# ^Z
router#
%SYS-5-CONFIG_I: Configured from console by console ()

router# reload
[confirm]
```

If the following message appears, you can ignore it:

```
Bad arguments to line command
```

If you had telnetted to the router, your Telnet session is disconnected after the router is reloaded. Wait for the router to complete reloading and log into it again. When you do, the following prompt appears:

```
router(boot)#
```

Caution While at the boot ROM prompt, *do not* change your configuration. If you have to change something in the configuration, return to the full system image (operating mode). You could make the change while at the boot ROM prompt, but *do not* save the changes to NVRAM. Saving configuration changes to NVRAM while at the boot ROM prompt permanently erases your original router configuration file.

Copying the Image from a TFTP Server to Flash Memory

The **copy tftp flash** command retrieves an image from a TFTP server and copies (writes) the image into the router's Flash memory. The TFTP server can be another Cisco router serving ROM or Flash system software images, or a PC or UNIX workstation set up as a server for remotely downloading new images to routers on the network. If you have already established a connection with the remote server, refer to "Downloading the New Image" on page 16.

In some cases, primarily outside of North America, Cisco Systems distributors may choose not to distribute the new software image on floppy disk. Instead, they can place the new image on TFTP servers and provide their customers with the information they will need to access and download the new image. If you are downloading the new image from your distributor with this process, ensure that your distributor has provided you with all of the following information:

- IP address of the TFTP server that contains the new image
- Exact image name
- Image size (length in bytes)
- Checksum

You must have all of this information from your distributor before you can complete the upgrade. Refer to the next section, "Verifying the Connection."

Verifying the Connection

Verify the connection between your router and the remote server by pinging the server using the IP address (this may be provided by your distributor). Following is an example of a successful **ping** command to a remote server with the address 131.131.101.101:

```
router(boot)# ping 131.131.101.101 <Return>
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 131.131.101.101, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/15/64 ms
router(boot)#
```

The console displays either a series of exclamation points (!!!!!) to indicate a good connection between your router and the server or a series of periods (.....) or the messages [timed out] or [failed] to indicate that the connection failed. If the connection fails, verify that you have the correct IP address for the server and that the server is active (powered on), and repeat the **ping** command.

Downloading the New Image

To download the new image from the TFTP server to your router, issue the **copy tftp flash** command. When you do, you are prompted for the IP address (or domain name) of the TFTP server. This can be another Cisco router serving ROM or Flash system software images. You are then prompted for the filename of the software image and given the option to erase the existing Flash memory. Type Y. The filename can be lower- or uppercase; the router will see the name as lowercase. The system clears and initializes Flash memory. The entire copying process takes several minutes. This time differs from network to network.

Note To abort the copy process, simultaneously press Control, Shift, and 6. The process will abort; however, the partial file copied before the abort was issued will remain until the entire Flash memory is erased.

Caution Do not make any typographical errors while using the **copy tftp flash** command in selecting the filename of the system software image you are copying. If you type a filename that does not exist when using the **copy tftp flash** command, then instruct the system to erase the current image, the router erases the existing image in Flash memory. If this happens, you will not have a functional image in Flash memory and when you boot the router from Flash, it will not boot and will have to be reconfigured from a direct console-port connection. To make sure your image is a good one, refer to the following section “Verifying Software Images in Flash Memory.”

The following sample output shows a system image named ic91470n copied into the current Flash configuration:

```
router(boot)# copy tftp flash
File  name/status
 0  igs-bfpx.914-7
 [123816/2097152 bytes free/total]

IP address or name of remote host [255.255.255.255]? 131.108.1.111
Name of file to copy? ic91470n
Copy ic91470n from 131.108.1.111 into Flash address space?  [confirm] <Return>
123752 bytes available for writing without erasure.
Erase Flash address space before writing? [confirm] <Return>
bank 0...zzzzzzzzzzzzzzzzvvvvvvvvvvvvvvveeeeeeeeeeeeeeee
bank 1...zzzzzzzzzzzzzzzzvvvvvvvvvvvvvvveeeeeeeeeeeeeeee
Loading from 131.108.1.111: !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! [OK - 1337256/2097088 bytes]
Verify checksum...vvvvvvvvvvvvvvvvvvv
Verification successful: Length = 1999845, checksum = 0x5A1C
```

The series of exclamation points (!) in the preceding sample output indicates that the copying process is taking place. The series of Vs indicates that a checksum is being calculated. The last line in the sample configuration indicates that the file transfer is complete.

If the process was successful, refer to the next section, “Verifying Software Images in Flash Memory.” If it was not successful, refer to the section “Recovering from a Flash Memory Failure” on page 20.

Verifying Software Images in Flash Memory

Before booting from Flash memory, you must verify that the checksum of the compressed image shown at the bottom of the screen after you issue the **copy tftp flash** command matches the checksum listed in the README file on the software upgrade disk.

If the checksum value is not correct according to the value in the README file on the system upgrade disk, enter the **copy tftp flash** command and compare the checksums again. If the checksum is repeatedly wrong, copy the original system software image back into Flash memory *before* you reboot the router from Flash memory.

Returning Your Router to its Original State

Before your router can return to normal operation, you must change the configuration register back to its original state (the boot-from-Flash setting is 0x102) and reload the router, as shown in the following example:

```
router(boot)# configure terminal
Enter configuration commands, one per line.
Edit with DELETE, CTRL/W, and CTRL/U; end with CTRL/Z

router(config)# config-reg 0x102
router(config)# ^Z
router#
%SYS-5-CONFIG_I: Configured from console by console ()

router# reload
[confirm]
```

After the router is reloaded with the new software, be sure to make the following changes:

- Delete the **ip default-gateway** command you entered to ensure a route to the TFTP server
- Enable ports you turned off before entering boot ROM mode

At this point, ensure that your router is set to boot from Flash memory. Refer to the following section "Booting from Flash Memory."

Booting from Flash Memory

The following sections describe how to boot from Flash, both automatically and manually. When you boot a Cisco 2500 router from Flash memory, the software image actually runs from Flash. Some router models offer both run-from-Flash and run-from-RAM software images. Run-from-RAM images are stored in Flash memory, but are written into RAM when you reload the router.

Caution If the NVRAM-stored configuration file on your router has the line **boot system flash** *filename*, then each time you write a new software image to Flash memory, you must delete this line by issuing the **no boot system flash** *filename* system configuration command. Then add a line that reads **boot system flash** or **boot system flash** *filename*, where the filename is the exact name of the new system software image. If you do not do this, the router will repeatedly try to reboot from the now-erased file. If the configuration file includes **boot system flash** with no argument, you do not need to take these steps. In this case, the router will boot from the first system image in Flash memory by default.

From the enable-mode prompt on the router, enter the EXEC command **write terminal** to see whether the **boot system flash** command line in the configuration file has the *filename* argument, as follows:

```
router> enable
Password:
router# wr term
Current configuration:
!
(text deleted)
boot system flash
(text deleted)
```

Automatically Booting from Flash

You can configure the router to automatically boot from the image in Flash memory by following this procedure:

Step 1 Issue the **configure terminal** command in EXEC mode (at the enable [#] prompt).

Step 2 Add the **boot system flash** *filename* system configuration command to the router's configuration, where *filename* is the name of the new software image. If a filename already appears in the configuration file, remove it with the **no boot system flash** *filename* command.

Step 3 Again, make sure the configuration register is set to 0x2101, which is the boot-from-Flash setting.

Step 4 Write the configuration to NVRAM with the **write memory** command.

The following example shows the sequence of steps for replacing a 9.21(3) image with a 10.0(2) image. If you are replacing different images, substitute the different image names.

```
router# configure terminal
no boot system flash ic92130n (Removes old filename)
boot system flash ic10020n (Tells the system to boot new filename)
^Z
router# write memory
[ok]
router#
```

Step 5 At this point, you can reboot the router with the **reload** command. The router will boot the new software image from Flash memory. The following example shows the output of the **reload** command.

```
router# reload
[confirm]

%SYS-5-RELOAD: Reload requested
System Bootstrap, Version 4.14(2), SOFTWARE
Copyright (c) 1986-1994 by cisco Systems
2500 processor with 4096 Kbytes of memory
>
```

Manually Booting from Flash

If you do not have your router set up to automatically boot from Flash, as specified in the previous section, you can manually boot from Flash by following this procedure:

Step 1 Make sure the configuration register on the router is set to boot from ROM when you reboot the router using the **reload** command. If you are not sure whether this value is correct on your router, enter configuration mode and issue the **config-reg 0x10F** command. This command causes the router to be booted from Flash memory and the Break key to be ignored.

Step 2 Write this configuration to NVRAM by issuing the **write-memory** EXEC command.

Step 3 Enter privileged user mode and issue the **reload** command, as specified in the previous section.

Step 4 The system enters ROM monitor level. At this point, initialize the system by typing **i** at the ROM monitor prompt, as shown in the following example:

```
> i

System Bootstrap, Version 4.14(1), SOFTWARE
Copyright (c) 1986-1994 by cisco Systems
2500 processor with 4096 Kbytes of memory
```

Step 5 Boot the router manually by issuing the **b flash** command.

```
> b flash

Checking Link Status...OK
Booting ic92130n from flash memory RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR
RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR
[OK - 1337256/3532618 bytes]
############################################################################
############################################################################
############################################################################
```

```
############################################################
F3: 1926336+46904+183152 at 0x12000

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         Cisco Systems, Inc.
         170 W. Tasman Drive
         San Jose, California

Cisco Internetwork Operating System Software
IOS (tm) 2500-BFPX Software, Version 10.0(2.0)
Copyright (c) 1986-1994 by cisco Systems, Inc.
Compiled Tue 31-May-94 06:34 by daveu

Cisco 2500 (68030) processor (revision 0xA0) with 4096K/4096K bytes of
memory.
Processor ID 5008909
DDN X.25 software, Version 2.0.
Bridging software.
1 Ethernet/IEEE 802.3 interface.
1 Token Ring/IEEE 802.5 interface.
2 Serial network interfaces.
128K bytes of non-volatile configuration memory.
2048K bytes of Flash address space sized on CPU board.

Press RETURN to get started!
router#
```

Recovering from a Flash Memory Failure

If the image fails to load properly into Flash memory, the following error message appears:

```
Error programming flash memory
```

If you try loading the image into Flash memory three or more times and repeatedly see this message, contact technical support immediately and inform them of the situation. In an attempt to recover from the error, you can also repeat the upgrade procedure described in this publication.

Repeating the Installation Process

Before repeating the system software upgrade process on subsequent machines, make sure the upgraded router functions properly by performing the following steps:

Step 1 Ping from the upgraded router to a system on the local network to make sure you have network connectivity. Refer to “Testing the TCP/IP Software” on page 10.

Step 2 Look at the routing tables in the updated router. To review all of the routes established in your router, issue the **show route** EXEC command, which has the following syntax: **show** *protocol* **route** *network*.

Step 3 Make sure the upgraded router is listed properly in the routing tables of nearby routers.

Only if the **ping** and **show route** commands generate positive results should you upgrade subsequent routers.

Obtaining Additional Information

This section provides information for obtaining technical assistance.

Note For technical assistance, contact a service representative or the Cisco Systems Technical Assistance Center (TAC) at 800 553-2447, 415 903-7209, or `tac@cisco.com`. For upgrade or product information, contact the Customer Response Center at 800 553-6387, 415 903-7208, or `cs-rep@cisco.com`.

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For dialup or Internet users, CIO supports Zmodem, Kermit, Xmodem, FTP PUT, Internet e-mail, Telnet, rlogin, and fax download options. Internet users also can retrieve files from CIO using FTP.

Registration for CIO is handled on line. To reach CIO via the Internet, use Telnet or FTP to `cio.cisco.com` (131.108.89.33). To reach CIO by dialup, use 415 903-8070 (Mountain View, California) or 33 1 6446 4082 (Paris, France).

This document is to be used in conjunction with the *Router Products Configuration Guide* and *Router Products Command Reference* publication.

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