

Upgrade and Install IOS Software Image

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Introduction

This document describes how to upgrade your Cisco IOS[®] software image on Cisco High-End routers.

Prerequisites

Requirements

Cisco recommends that you have knowledge of these topics:

- How to install a TFTP Server.
- How to install Cisco IOS Software image.

See the Background Information section for specifics on these topics.

Components Used

The information in this document is based on Cisco IOS Software Release 12.1 or later.

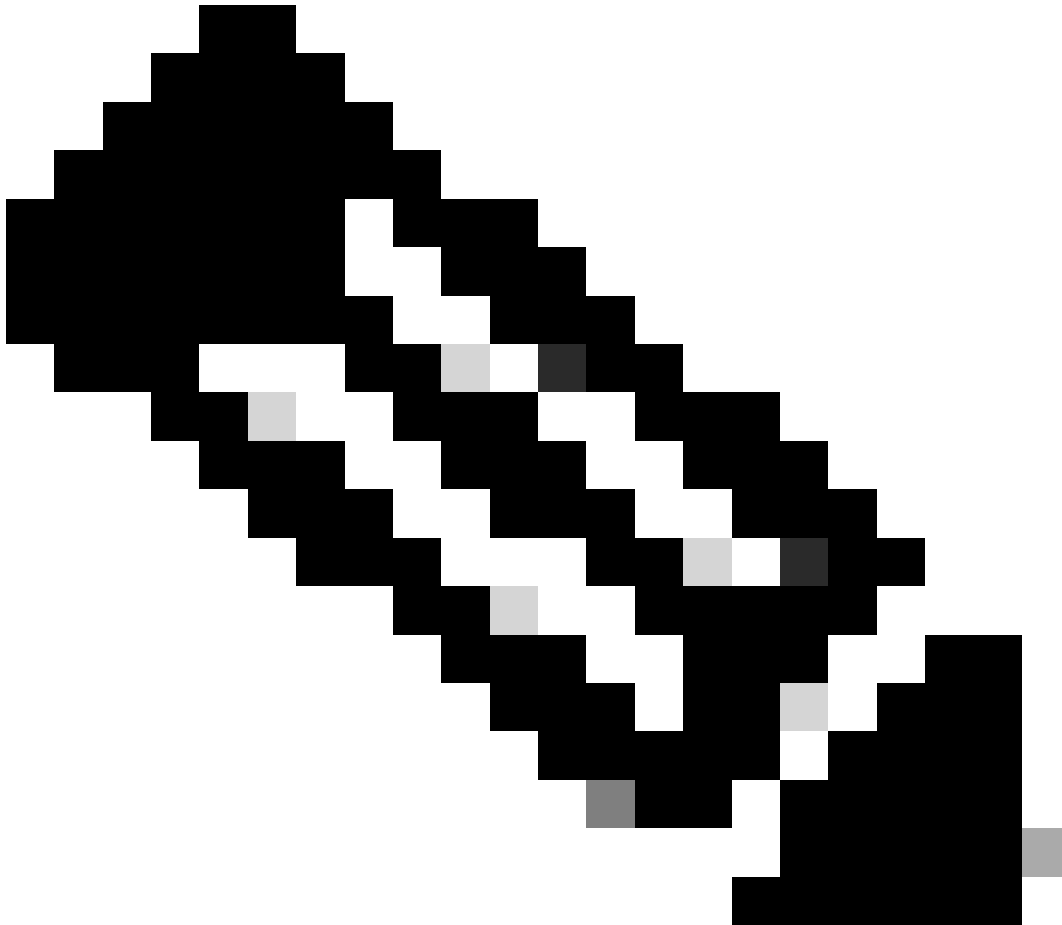
The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

Conventions

For more information on document conventions, see the [Cisco Technical Tips Conventions](#).

Background Information

This document discusses the procedure for upgrading your Cisco IOS software image on Cisco High-End routers. The examples provided in this document are based on the 7500 router, but the procedure is applicable to other routers. The Cisco IOS software filenames can vary based upon the type of product used.



Note: To use the troubleshooting tools described in this document, you must be a registered user and you must be logged in.

These Cisco series routers are addressed in this article:

- Cisco 7000 Series Routers with RP & RSP7000
- Cisco 7100 Series Routers

- Cisco 7200 Series Routers
- Cisco 7300 Series Routers
- Cisco 7400 Series Routers
- Cisco 7500 Series Routers
- Cisco 7600 Series Routers
- Cisco 10000 Series Internet Routers (ESR)
- Cisco 12000 Series Internet Routers
- Cisco uBR71xx, uBR 72xx, uBR10000 Series Routers

Step 1: Install a TFTP Server

A Trivial File Transfer Protocol (TFTP) server, a Remote Copy Protocol (RCP) server, or a File Transfer Protocol Server (FTP) application must be installed on a TCP/IP-ready workstation or PC. Once the application is installed, a minimal level of configuration must be performed. Use these steps:

1. Configure the TFTP application to operate as a TFTP server as opposed to a TFTP client .
2. Specify the outbound file directory. This is the directory in which the Cisco IOS Software images are stored. Most TFTP applications provide a set-up routine to assist in these configuration tasks.



Note: A number of TFTP or RCP applications are available from independent software vendors or as shareware from public sources on the World Wide Web.



Note: Most TFTP applications cannot transfer files larger than 16MB in size. If the Cisco IOS software you install is larger than 16MB, you must use an FTP or RCP server.

Step 2: Select a Cisco IOS Software Image

Verify that the Cisco IOS Software image that you download supports both your hardware and the required software features. You can find this information with the Cisco Software Advisor (registered customers only). Ensure that your router has enough Dynamic RAM (DRAM) and Flash for the Cisco IOS software image before you download the software version you have selected. You can find the minimum recommended DRAM and Flash requirements in the release notes for each specific Cisco IOS software version, as well as in the [Cisco Technical Support & Downloads](#). For additional information on how to select the right software version and feature set, see [Compare Features to Select the Best Software Release](#).

Step 3: Download the Cisco IOS Software Image

Download the Cisco IOS software image into your workstation or PC from the [Cisco Technical Support & Downloads](#).

Software Installation and Upgrade Procedures

Step-by-Step Procedure

Step 1: Establish a Console Session to the Router

This can be done with a direct console connection or a virtual Telnet connection. A direct console connection is preferred over a Telnet connection because most disaster recovery procedures require you to be physically present, and a Telnet connection gets lost during the reboot phase of the software installation. The console connection is made with [rolled cable](#) (usually a flat black cable), and connects the console port of the router to the COM port of the PC. Open Hyperterminal on the PC, and use the next settings:

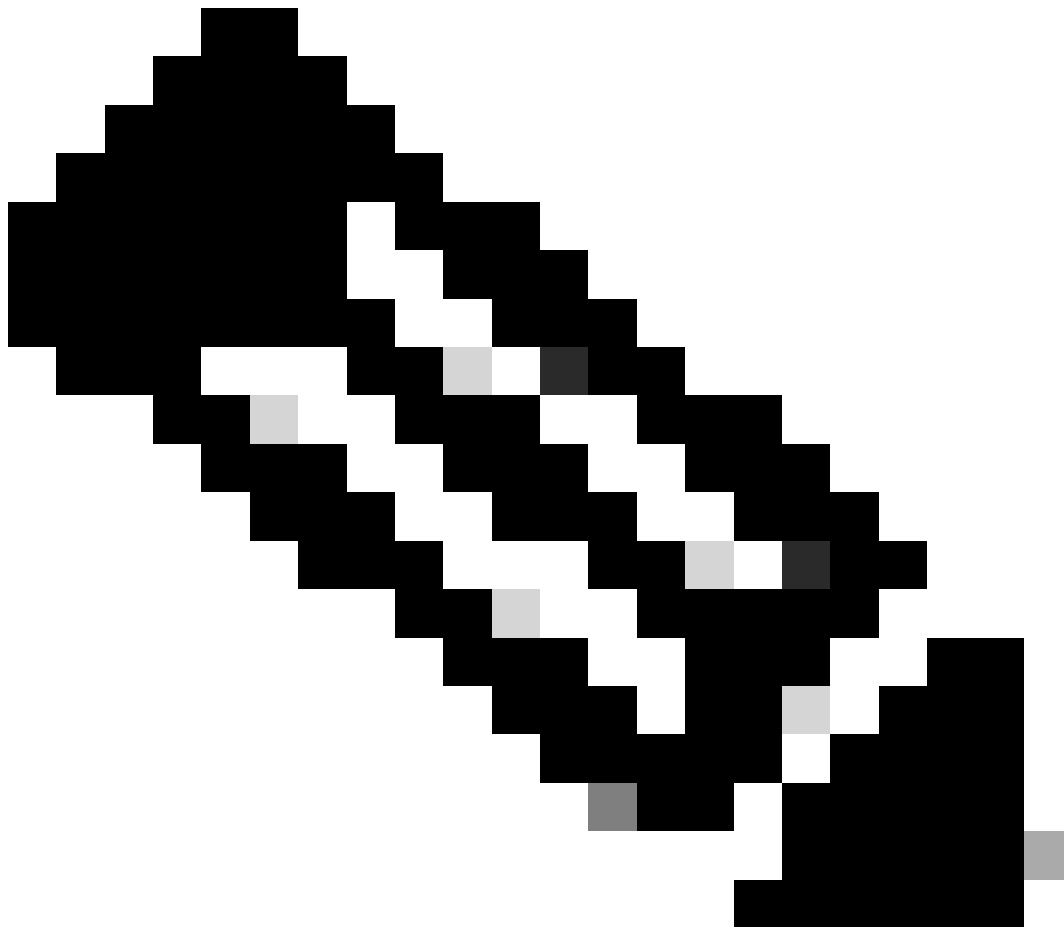
Speed 9600 bits per second

8 databits

0 parity bits

1 stop bit

No Flow Control



Note: If you get any garbage characters in the hyperterminal, this means you have not set the hyperterminal properties properly, or the configuration register of the router is set to a non-standard value for which the console connection speed is higher than 9600 bps. Check the value of the configuration register with the show version command (shown in the last line of the output) and ensure it is set to 0x2102 or 0x102. It is necessary to reload the router for a configuration register change to take effect. Once you are sure the console speed is set to 9600 bps on the router side, you must check the hyperterminal properties as previous.

For more information how to set the hyperterminal properties, see [Applying Correct Terminal Emulator Settings for Console Connections](#).

Boot Problems

Once you are connected to the console port of the router, you can see that the router is either in ROMmon or Boot mode. If the router cannot properly load a Cisco IOS software image, it goes into one of these two modes which can be used for recovery and/or diagnostic procedures. If you do not see the usual router prompt, you must use these next recommendations to continue with the upgrade procedure.

Router boots in ROMmon mode or boot mode, and something similar to the next message appears on the console:

```
device does not contain a valid magic number
boot: cannot open "slot0:"
boot: cannot determine first file name on device "slot0:"
```

If you use an ATA PCMCIA Flash disk, the same issue can look like this:

```
device does not contain a valid magic number
boot: cannot open "disk0:"
boot: cannot determine first file name on device "disk0:"
```

If you see one of the previous error messages, it means the Flash card is empty, not formatted, not formatted for the platform, the filesystem is corrupted, or the first image on the Flash card is not a bootable Cisco IOS software image.

If the router is in ROMmon mode, the router prompt can look like this:

```
rommon1>
```

If the router is in boot mode, the router prompt can look like this:

```
Router(boot)>
```

For more information on ROMmon recovery, see [ROMmon Recovery Procedure for the Cisco 7200, 7300, 7400, 7500, RSP7000, Catalyst 5500 RSM, uBR7100, uBR7200, uBR10000, and 12000 Series Routers](#).

If the router is in boot mode, you can proceed with the Cisco IOS software upgrade instructions listed. Be careful not to save your configuration while in boot mode as the boot image does not contain full routing functionality.

Step 2: Verify that the TFTP Server has IP Connectivity to the Router

Check the IP addresses of the TFTP server and the router targeted for the TFTP software upgrade to be sure the addresses are within the same range. Ping the router to verify that a network connection exists between them. To verify, check the IP address of the TFTP server. If the router is in boot mode, you need to set the default-gateway:

```
<#root>

Router(boot)>
Router(boot)>

enable

Router(boot)#

config terminal

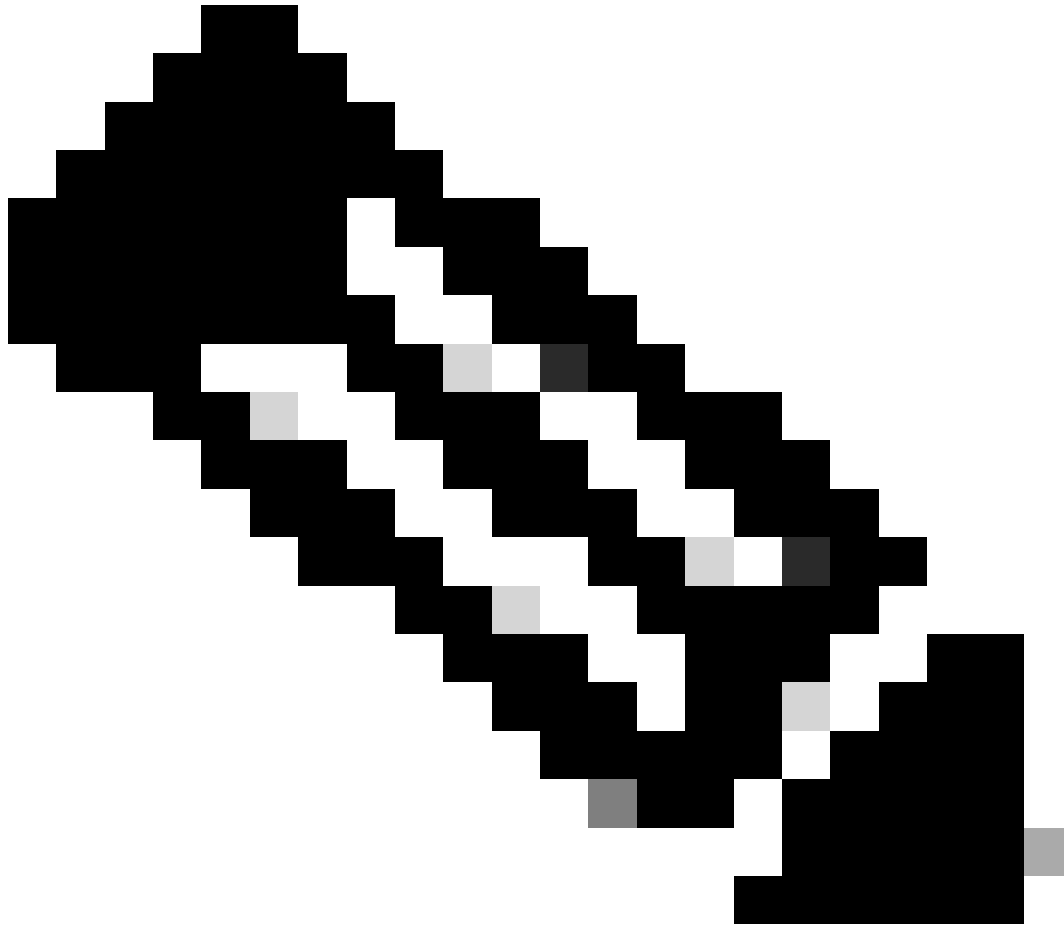
Router(boot)(config)#

ip default-gateway n.n.n.n-+
```

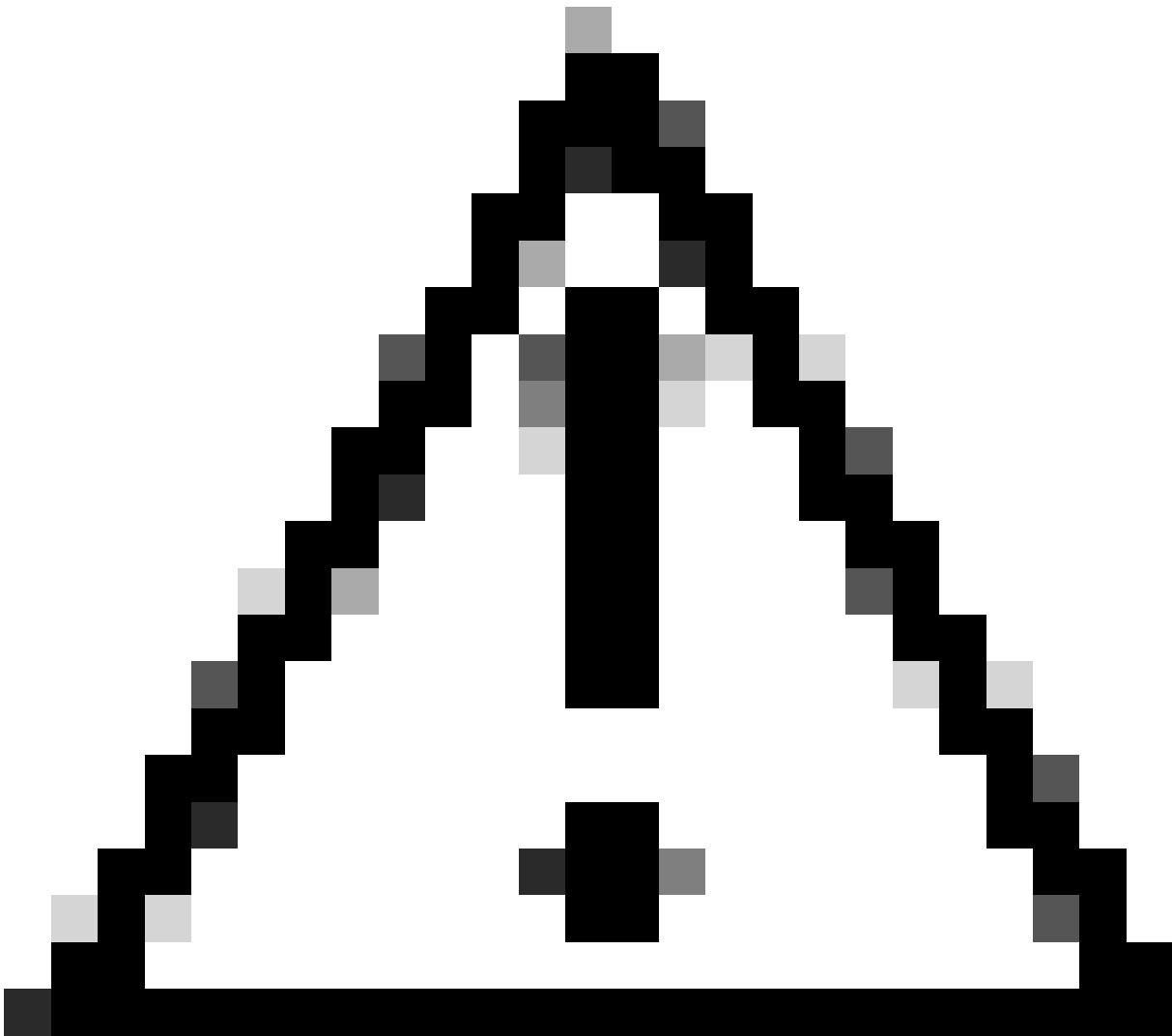
Step 3: If Needed, Format the PCMCIA Card

If the PCMCIA card is a spare which was shipped blank, it must be formatted before use.

You can also use a PCMCIA card from another platform if it is compatible with your router platform. See the [PCMCIA Filesystem Compatibility Matrix and Filesystem Information](#) for more information on Flash card compatibility between platforms.



Note: In order to boot from a Cisco IOS software file located on a PCMCIA Flash card or Flash Disk, the Flash card or disk must have been formatted in the target platform.



Caution: The formatting procedure erases all information on the Flash memory card. To prevent the loss of images and configuration files that can be stored on a Flash memory card, copy the images and files to a TFTP server before you format the card:

Do these steps:

1. Insert the Flash memory card into the available PCMCIA slot (slot0: or slot1:).
2. Format the Flash memory card with the format slot0: (or format slot1 command) as shown here:

```
<#root>
```

```
7500#
```

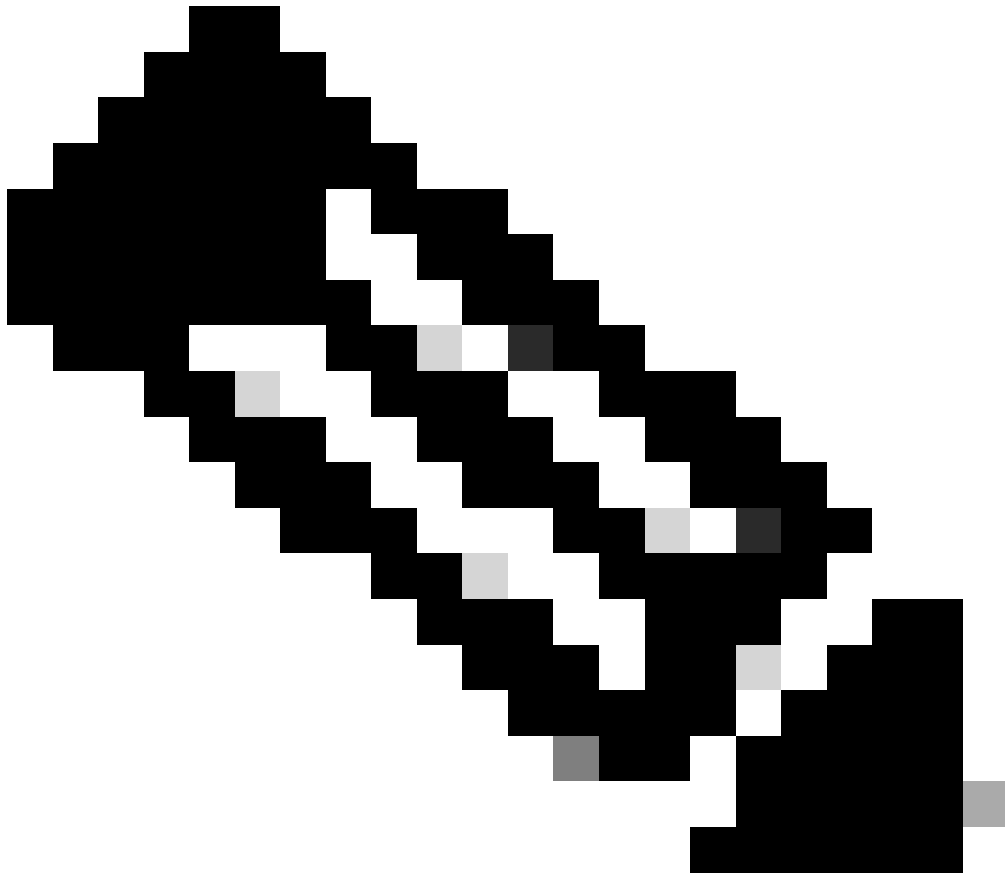
```
format slot0:
```

```
Format operation can take a while. Continue? [confirm]y
```

```
Format operation can destroy all data in "slot0:". Continue?  
[confirm]
```


y

```
Formatting sector 160.....  
Format of slot0: complete
```



Note: ATA PCMCIA Flash disks use different command syntax when you refer to the PCMCIA slot. Substitute the command syntax `disk0:` or `disk1:` if you use an ATA PCMCIA Flash disk instead of `slot0:` or `slot1:` which refers to Linear PCMCIA Flash memory cards. More information on the command syntax differences between ATA PCMCIA Flash disks and Linear PCMCIA Flash memory cards can be found in the PCMCIA Filesystem Compatibility Matrix and Filesystem Information.

Step 4: Verify Free Space on the Flash Memory Card (PCMCIA Slot)

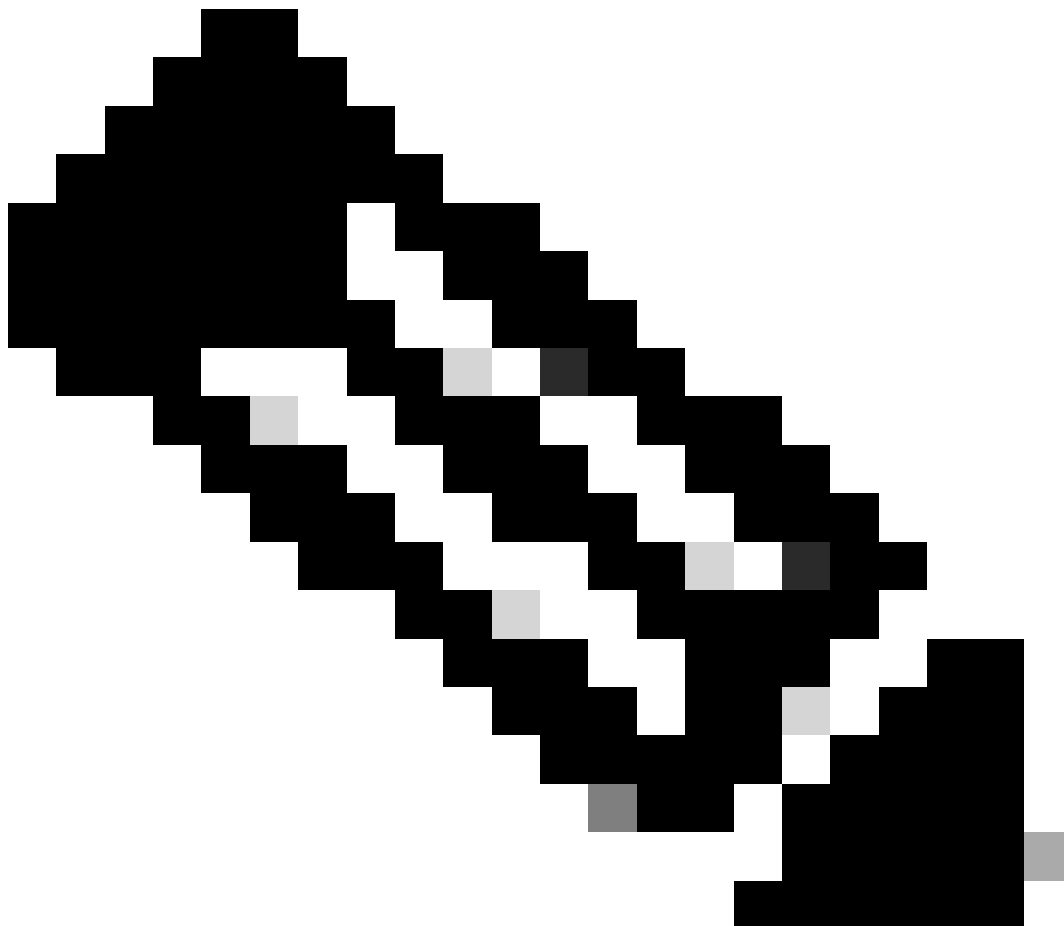
At this point, you need to verify that you have enough space in the Flash memory card to copy the new image. If there is not enough free space, you need to delete some files to make enough space. In some situations, if the image is very large, you need to delete the current image on the Flash memory card.

To determine the amount of free space, and to show files currently loaded in `slot0:`, issue the `dir{device:}command`.

In the example below, slot0 has two filesystems and 885756 bytes of free space. This is not enough to load the new image.

```
<#root>
7500#
dir slot0:
Directory of slot0:/
  1  -rw-   12531084  Jan 02 2000 00:00:20  rsp-jsv-mz.121-13.bin
  2  -rw-    7161208  Jan 02 2000 00:14:33  rsp-jsv-mz.112-26.bin

20578304 bytes total (
885756 bytes free
)
```



Note: When you see an error message such as "%Error opening slot0: (Device not ready)", try

the **dir disk0:** command.

In the example below, you delete the second file in order to free enough space for the new Cisco IOS software image.

```
<#root>
7500#
delete slot0:rsp-jsv-mz.112-26.bin
Delete filename [rsp-jsv-mz.112-26.bin]? [
enter
]
Delete slot0:rsp-jsv-mz.112-26.bin? [confirm][
enter
]
7500#
```

After you delete the file, use the `dir slot0:` command to check your free space. The next output shows the free space is still 885756 . The free space increases when you squeeze the Flash with the `squeeze` command:

```
<#root>
7500#
dir slot0:
Directory of slot0:
  1  -rw-   12531084   Jan 02 2000 00:00:20  rsp-jsv-mz.121-13.bin
20578304 bytes total (
885756 bytes free
)
```

After you have deleted the file, the file is flagged by the operating system. To free up the deleted file memory space, you need to issue the `squeeze{device:}` command which removes the deleted files permanently.

```
<#root>
7500#
squeeze slot0:
All deleted files can be removed. Continue? [confirm]
y
```

Squeeze operation can take a while. Continue? [confirm]

y

Squeezing...

Squeeze of slot0 complete

7500#

The file is removed permanently once it has been deleted and squeezed. To check whether the file has been deleted and the memory reclaimed, issue the `dir slot0:` command.

```
<#root>
```

```
7500#
```

```
dir slot0:
```

```
Directory of slot0:/
```

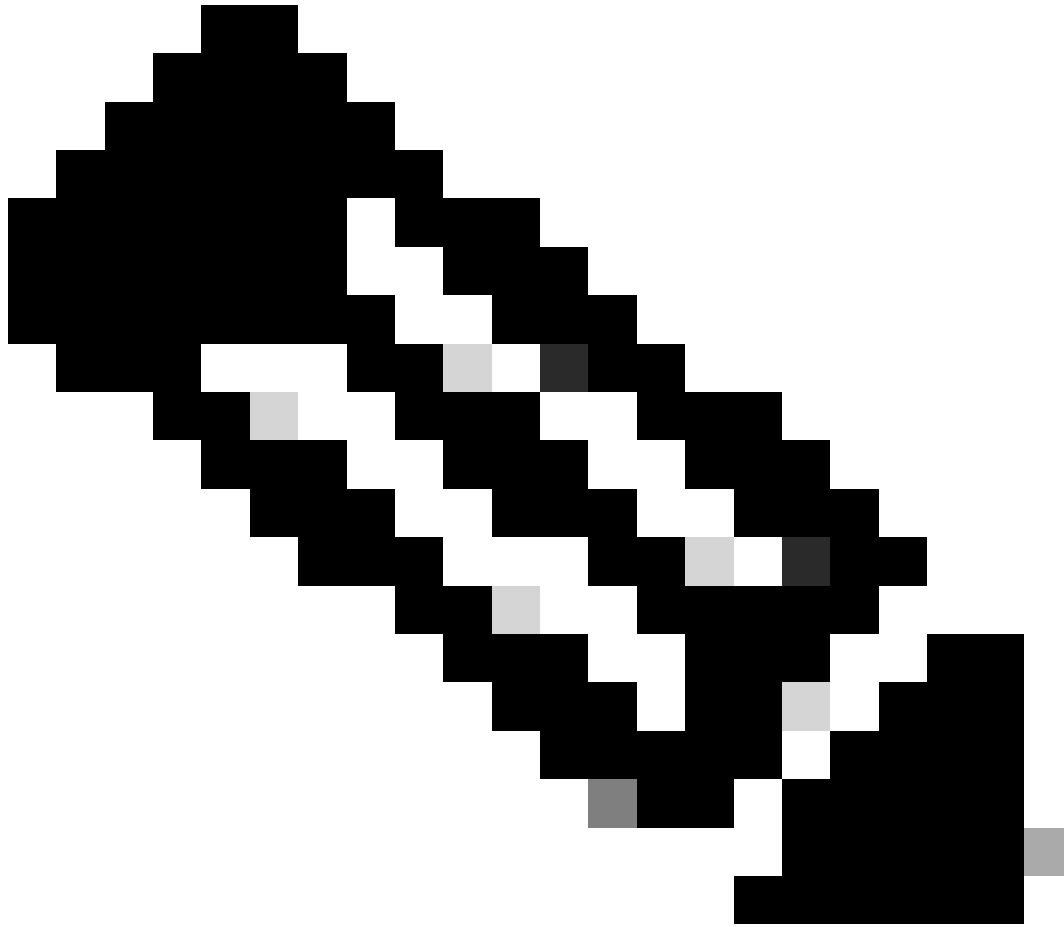
```
  1  -rw- 12531084  Jan 02 2000 00:00:20  rsp-jsv-mz.121-13.bin
```

```
20578304 bytes total (
```

```
8047092 bytes free
```

```
)
```

In the previous output, you can see that the amount of free Flash memory space has been increased from 885756 bytes to 8047092 bytes .

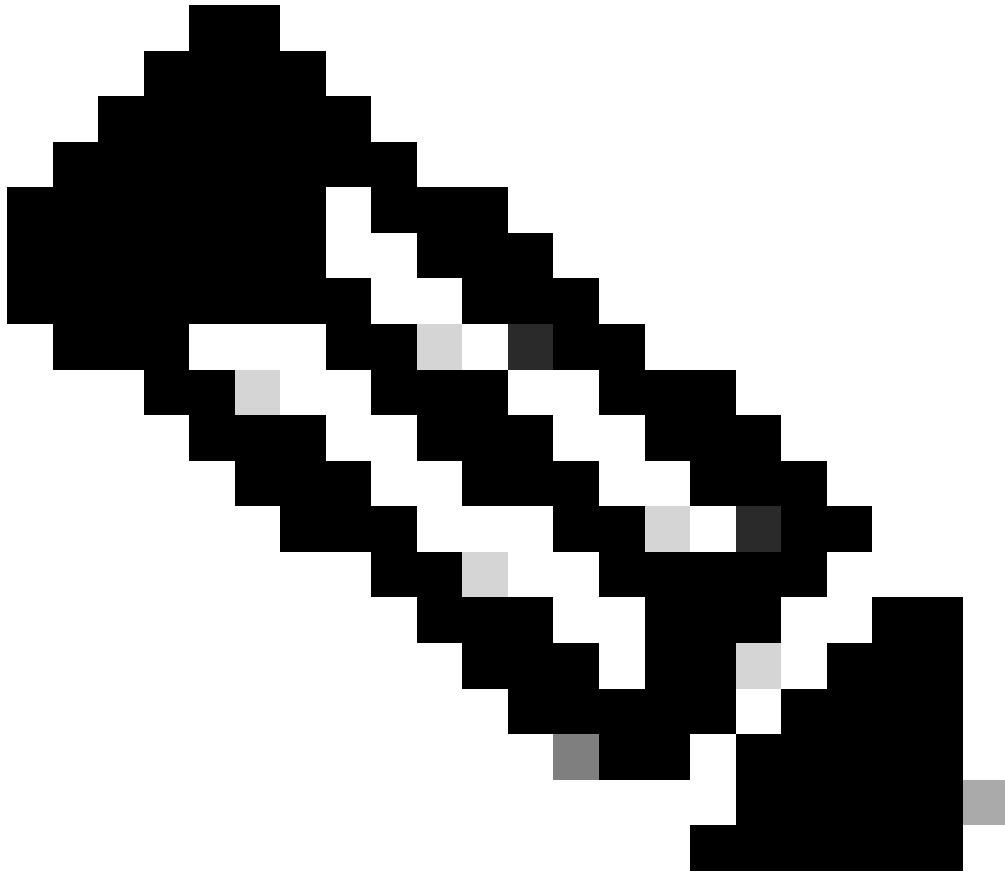


Note: Do not reload or power-cycle the router if there is not a valid image on the Flash card; this causes the router to go into ROMmon or boot mode.

Step 5: Copy the New Image into the Flash Memory Card Through the TFTP Server

Step through these instructions.

1. Now that you have IP connectivity and can ping between the computer that acts as a TFTP server and the routers, copy the image from the TFTP server into slot0.



Note: Before you copy, make sure you have started the TFTP server software on your PC and that you have the filename mentioned in the TFTP server root directory. We recommend that you keep a copy of the router configuration before upgrading. The upgrade itself does not affect the configuration (which is stored in nonvolatile RAM - NVRAM). However, this can happen if the right steps are not done correctly.

For RCP applications, substitute RCP for every occurrence of TFTP. For example, use the `copy rcp flash` command instead of the `copy tftp flash` command.

```
<#root>  
7500#  
copy tftp: slot0:
```

If necessary, you can [copy an image](#) from one device to another.

2. Specify the IP address of the TFTP server.

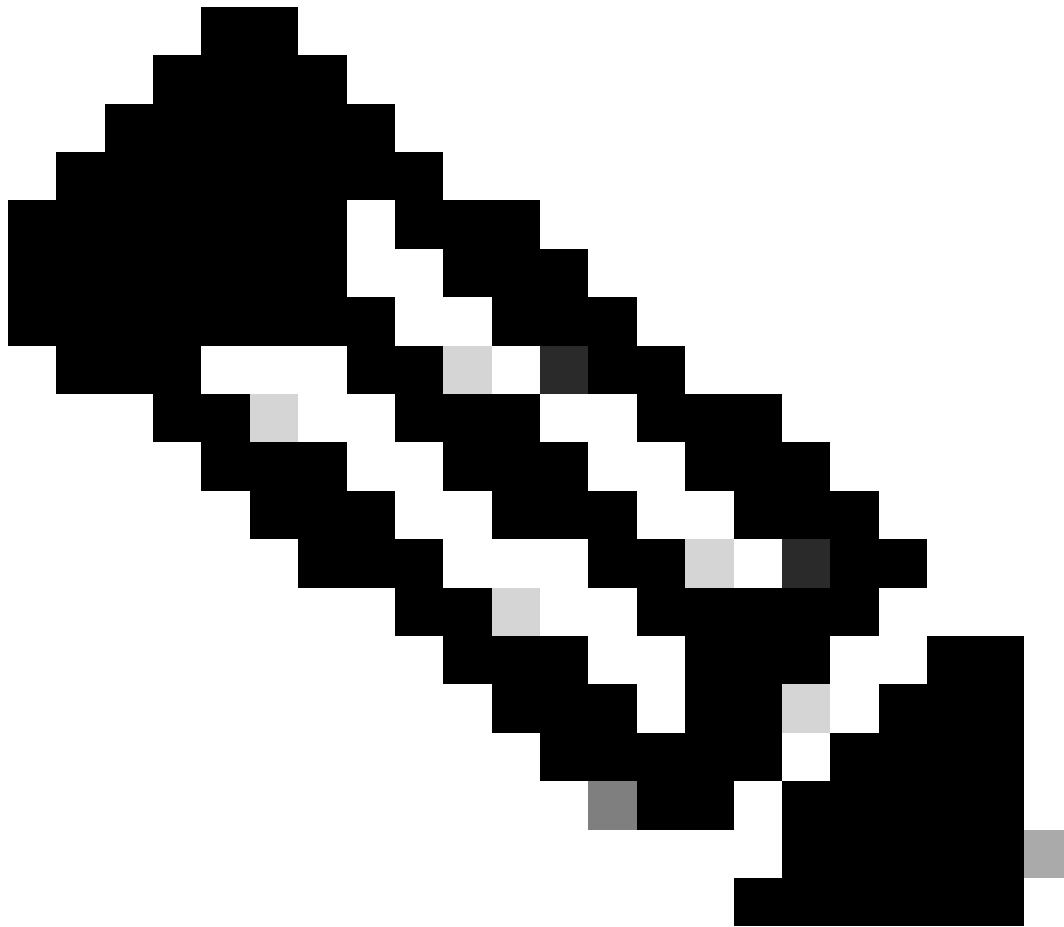
When prompted, enter the IP address of the TFTP server, as in the next example:


```
12531084 bytes copied in 641.540 secs (19549 bytes/sec)
7500#
```

After you have successfully transferred the file, you must verify that the file is in slot0. Issue the `dir{device:}` command to show files currently located in slot0:

```
<#root>
7500#
dir slot0:
Directory of slot0:/
 1  -rw-   12519472   Jan 02 2000 00:00:20  rsp-jsv-mz.121-13.bin
 2  -rw-   12531084   Jan 02 2000 00:00:20  rsp-jsv-mz.122-6.bin
```

Verify that the name and the file size are correct. If you have a standard PCMCIA Flash card, you can also verify the PCMCIA checksum is correct from the output of a `show slot0:`. If you have an ATA Flash Disk, you can use the `verify /md5 slot0:` command to get a MD5 hash on an image and compare that hash to what is on [Cisco Technical Support & Downloads](#). The MD5 option for the `verify` command was introduced in Cisco IOS Software Release 12.0(22)S and is soon to be released in the latest 12.2T images. You can view the Cisco IOS software versions that contain the MD5 verify option in the First Fixed-in Version field of Cisco bug ID [CSCdw84342](#).



Note: Only registered Cisco users can access internal tools and information.

Step 6: Set Boot Statements to Load New Image on Startup

After you copy the image through TFTP, you need to tell the router which image to load at bootup.

Check Current Boot Statements

At this point, the new image is now in slot0. You need to set the router to boot the new image. By default, the router boots the first file in Flash. The order in which Flash is searched is disk0:, disk1:, slot0:, slot1:, and finally bootflash:.The default is enabled when there are no `boot` commands in the configuration, or the boot statement is inaccurate.

There are two ways to determine the current boot parameter settings:

Option 1: Check to see if you have any `boot` commands defined in your configuration by issuing the `show running-config` command. In the example below, the boot statement is set to `boot system flash slot0:rsp-jsv-mz.121-13.bin`.

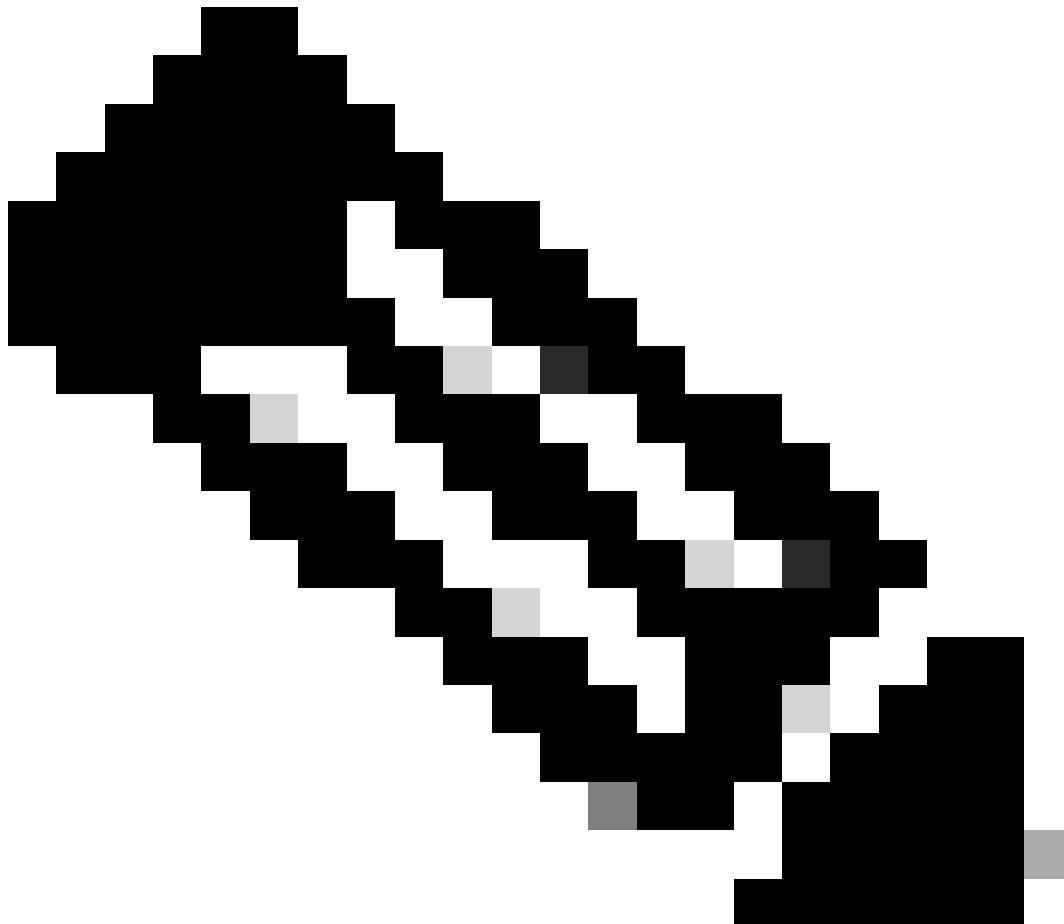
```
<#root>
```

```
7500#
```

```
show running-config
```

```
!  
version 12.2  
service timestamps debug uptime  
service timestamps log uptime  
no service password-encryption  
no service single-slot-reload-enable  
!  
hostname 7500  
!  
boot system flash slot0:rsp-jsv-mz.121-13.bin  
  
!  
ip subnet-zero
```

Option 2: Issue the `show bootvar` command.



Note: The `show bootvar` command replaces the `show boot` command.

```
<#root>
7500#
show bootvar
BOOT variable =
slot0:rsp-jsv-mz.121-13.bin,12;
CONFIG_FILE variable =
BOOTLDR variable does not exist
Configuration register is 0x102
7500#
```

The previous output also shows that the boot variable is `slot0:rsp-jsv-mz.121-13.bin`. If you have boot system command entries in your configuration, you need to remove them from the configuration. For more information on how to remove boot entries, go to the next section.

Remove Previous Boot Statements

To remove the commands, enter into configuration terminal mode. From the configuration mode, you can negate any command when you enter `no` in front of each boot statement. The next example illustrates the removal of an current boot statement:

```
<#root>
7500#
configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
7500(config)#
no boot system flash slot0:rsp-jsv-mz.121-13.bin
7500(config)#
^Z
7500#
```

The statement `boot system flash slot0:rsp-jsv-mz.121-13.bin` is removed from the configuration. Verify that the command has been removed by issuing the `show running-config` command.

Set New Boot Statements

Now, set the router to boot the new image. Issue the next command to set the boot system parameter:

```
boot system flash slot0:{imagename} (imagename = name of the new IOS image)
```

```
<#root>
7500#
configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
7500(config)#
boot system flash slot0:rsp-jsv-mz.122-6.bin
7500(config)#
^Z
7500#
write mem
3d01h: %SYS-5-CONFIG_I: Configured from console by vty0
Building configuration...
7500#
```

On platforms equipped with ATA PCMCIA Flash disks, the command syntax would be:

```
<#root>
boot system [device]:{imagenam}
```

For example:

```
<#root>
7500(config)#
boot system disk0:rsp-jsv-mz.122-6.bin
```

Be sure to verify that you use `config-register 0x2102` by issuing the `show bootvar` OR `show version` command. If it is set up differently, you can change it by issuing the next command in configuration mode:

```
<#root>
7500#
configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
7500(config)#
config-register 0x2102
7500(config)#
^Z
```

```
7500#  
  
write mem
```

Verify the boot parameters by issuing the `show bootvar` command:

```
<#root>  
  
7500#  
  
show bootvar  
  
BOOT variable =  
slot0:rsp-jsv-mz.122-6.bin,12;  
  
CONFIG_FILE variable =  
BOOTLDR variable does not exist  
  
Configuration register is 0x102 (can be 0x2102 at next reload)  
  
7500#
```

After you change the config-register, the change takes place at the next reload, as shown previously.

Step 7: Reboot the Router to Load New Image

For the router to run the new Cisco IOS software image, you need to reload the router. Make sure you have saved the configuration by issuing the `copy run start` or `write mem` command.

```
<#root>  
  
7500#  
  
write mem  
  
3d01h: %SYS-5-CONFIG_I: Configured from console by vty0 (127.0.0.11)  
Building configuration...  
7500#  
  
reload
```

Step 8: Verify the Upgrade

After the router comes up, ensure that you currently run the new version of code, by issuing the `show version` command:

```
<#root>  
  
7500#
```

`show version`

Cisco Internetwork Operating System Software

Cisco IOS (tm) RSP Software (RSP-JSV-M), Version 12.2(6), RELEASE SOFTWARE (fc3)

Copyright (c) 1986-2002 by cisco Systems, Inc.

Compiled Wed 30-Jan-02 19:58 by kellythw

Image text-base: 0x60010958, data-base: 0x6148A000

ROM: System Bootstrap, Version 11.1(8)CA1, EARLY DEPLOYMENT RELEASE SOFTWARE (fc1)

BOOTLDR: RSP Software (RSP-BOOT-M), Version 12.2(6), RELEASE SOFTWARE (fc2)

7500-A uptime is 0 minutes

System returned to ROM by reload at 00:05:37 PST Sat Jan 1 2000

System image file is "slot0:rsp-jsv-mz.122-6.bin"

!-- you have booted the correct image

cisco RSP4 (R5000) processor with 131072K/2072K bytes of memory.

R5000 CPU at 200Mhz, Implementation 35, Rev 2.1, 512KB L2 Cache

Last reset from power-on

G.703/E1 software, Version 1.0.

G.703/JT2 software, Version 1.0.

Channelized E1, Version 1.0.

X.25 software, Version 3.0.0.

SuperLAT software (copyright 1990 by Meridian Technology Corp).

Bridging software.

TN3270 Emulation software.

Primary Rate ISDN software, Version 1.1.

Chassis Interface.

1 EIP controller (6 Ethernet).

1 AIP controller (1 ATM).

2 TRIP controllers (8 Token Ring).

2 MIP controllers (2 T1) (2 E1).

6 Ethernet/IEEE 802.3 interface(s)

8 Token Ring/IEEE 802.5 interface(s)

48 Serial network interface(s)

1 ATM network interface(s)

2 Channelized E1/PRI port(s)

2 Channelized T1/PRI port(s)

123K bytes of non-volatile configuration memory.

20480K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).

16384K bytes of Flash PCMCIA card at slot 1 (Sector size 128K).

8192K bytes of Flash internal SIMM (Sector size 256K).

No slave installed in slot 6.

Configuration register is 0x2102

Verify that the Cisco IOS software version 12.2(6) is correct and that the configuration register is set to 0x2102.

Related Information

- [Configure Cable Requirements for Console and AUX Ports](#)
- [Apply Correct Terminal Emulator Settings for Console Connections](#)
- [Download Procedure for Xmodem Console with ROMmon](#)
- [PCMCIA Filesystem Information and Compatibility Matrix](#)
- [Copy a System Image to Another Device](#)
- [Cisco Technical Support & Downloads](#)