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Silicon Switch Processor (SSP) Installation and Configuration

Product Numbers: SSP=, UPG-SSP, SSP-2MB=, UPG-SSP-2MB, and UPG-SSP-.5to2MB

This publication contains instructions for installing the Silicon Switch Processor (SSP) and upgrading the software in Cisco 7000 series routers: the Cisco 7000 and the Cisco 7010.

The sections of this publication include the following:

- SSP Description, page 2
- Prerequisites, page 6
- Software Upgrade Prerequisites, page 8
- Software Upgrade Overview, page 9
- Establishing a Telnet Session, page 9
- Loading the System Software, page 10
- Enabling SSE Switching, page 13
- Additional Show Commands, page 14
- Installing the SSP, page 15

Following are the SSP-related product numbers:

- *SSP=* is a spare SSP.
- *UPG-SSP* is the SP-to-SSP upgrade.
- *SSP-2MB=* is a spare 2-megabyte (MB) SSP.
- *UPG-SSP-2MB* is the SP to 2-MB SSP upgrade.
- *UPG-SSP-.5to2MB* is the 512 kilobyte (KB) to 2-MB SSP upgrade.

SSP Description

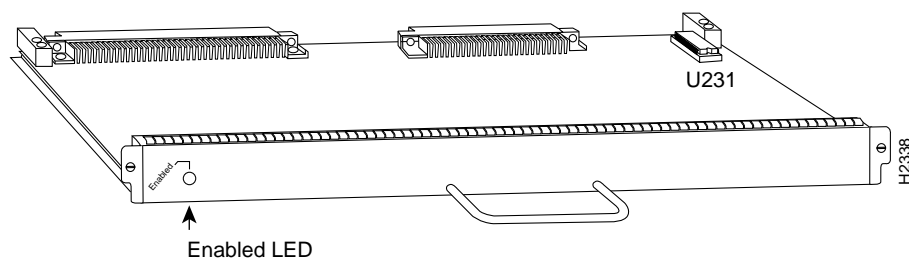
The SSP is the high-performance silicon switch for Cisco 7000 series routers. There are two hardware versions of the SSP: one with 512 KB of packet memory and another with 2 MB of packet memory, for installations requiring increased memory capacity.

Note The SSP with 2 MB of packet memory did not support the Asynchronous Transfer Mode interface processor (AIP) in Cisco Internetwork Operating System (Cisco IOS) software releases prior to 10.0(11), 10.2(8), 10.3(5), and 11.0(1). The SSP with 2 MB of packet memory supports the AIP in Cisco IOS software releases 10.0(11), 10.2(8), 10.3(5), and 11.0(1), as well as all subsequent releases of the Cisco IOS software.

For specific software requirements for each SSP configuration, refer to the section “Software Upgrade Prerequisites” on page 8.

The SSP and the Route Processor (RP), which contains the system processor, provide distributed processing and control for the interface processors. Network interfaces reside on the modular interface processors that provide a direct connection between the high-speed, 533-Mbps Cisco Extended Bus (CxBus) and the external networks. The SSP, shown in Figure 1, communicates with and controls the interface processors on the high-speed CxBus. The SSP determines the destination of a packet and switches the packet, based on that decision. The SSP is always installed in the backplane SP slot adjacent to the RP. (See Figure 2 and Figure 3.) A few seconds after bootup, the LED labeled Enabled goes on to indicate that the SSP is enabled for operation. One SSP (or SP) is required in each Cisco 7000 series router.

Figure 1 Silicon Switch Processor (SSP)



Cisco 7000 Series Overview

The Cisco 7000 Series comprises the five-slot Cisco 7010 and the seven-slot Cisco 7000. Both models use the same Route Processor (RP), Silicon Switch Processor (SSP), and interface processors. The Cisco 7000 provides five interface slots and offers a second modular power supply for redundant power. The Cisco 7010 provides three interface slots, and offers the same performance as the Cisco 7000.

Figure 2 shows the interface processor end of the Cisco 7000 model, which provides access to the seven processor slots and the removable power supplies. When facing the interface processor end of the chassis, the RP and SP slot are on the far right. The five interface processor slots are numbered 0 to 4 from left to right. In both models, interface processor slots support any combination of network interface types: Ethernet, Token Ring, fiber distributed data interface (FDDI), serial, and high-speed serial interface (HSSI). The RP, SP, and interface processors are keyed with guides on the backplane to prevent them from being fully inserted in the wrong slot. The SSP (or SP), RP, and

interface processors slide into slots in the rear of the chassis and connect directly to the backplane. The backplane slots are keyed so that the SSP or SP, RP, and interface processors are installable only in the slots designated for them. The SSP inserts into the slot formerly reserved for the SP.

Figure 2 Cisco 7000—Interface Processor End

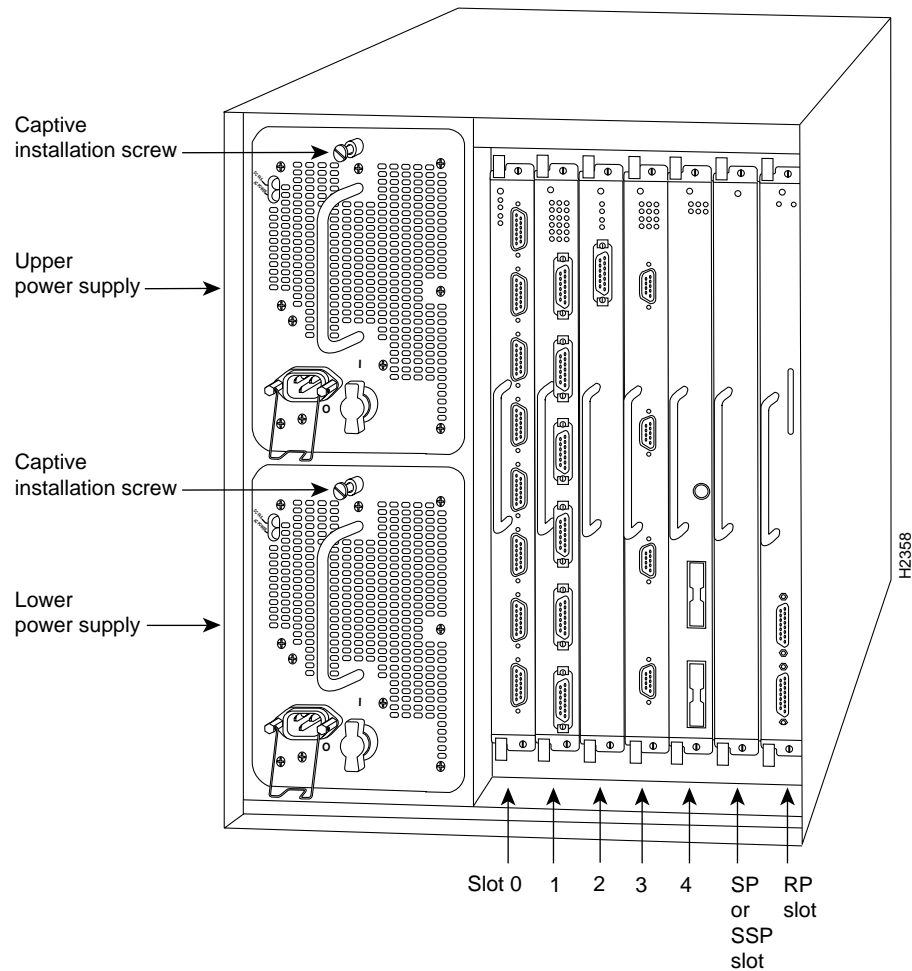


Figure 3 shows the interface processor end of the Cisco 7010 model, which provides access to the five processor slots, the AC input receptacle, the power switch, and a power status indicator. When facing the interface processor end of the chassis, the RP and SP slots are at the top. The three interface processor slots are numbered from the bottom up beginning with slot 0 (the bottom slot) through slot 2 (the center slot).

Figure 3 Cisco 7010—Interface Processor End

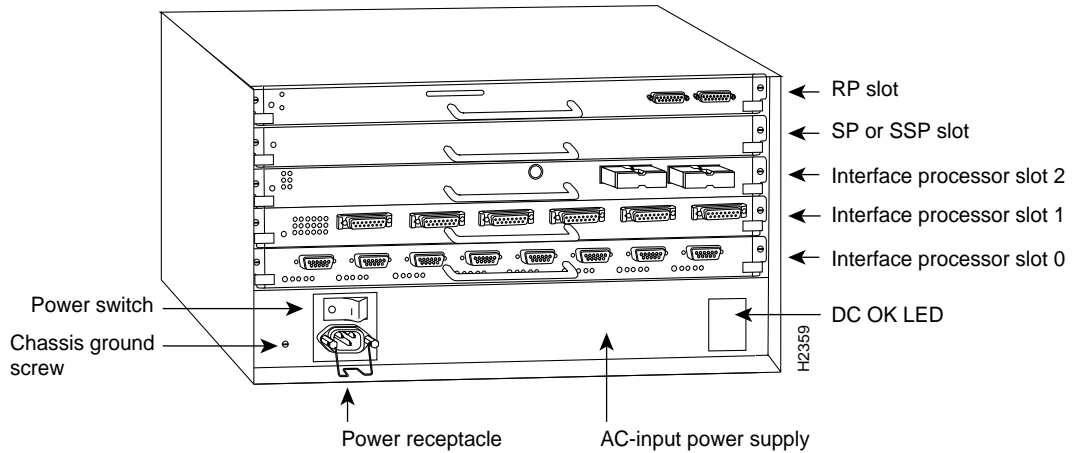


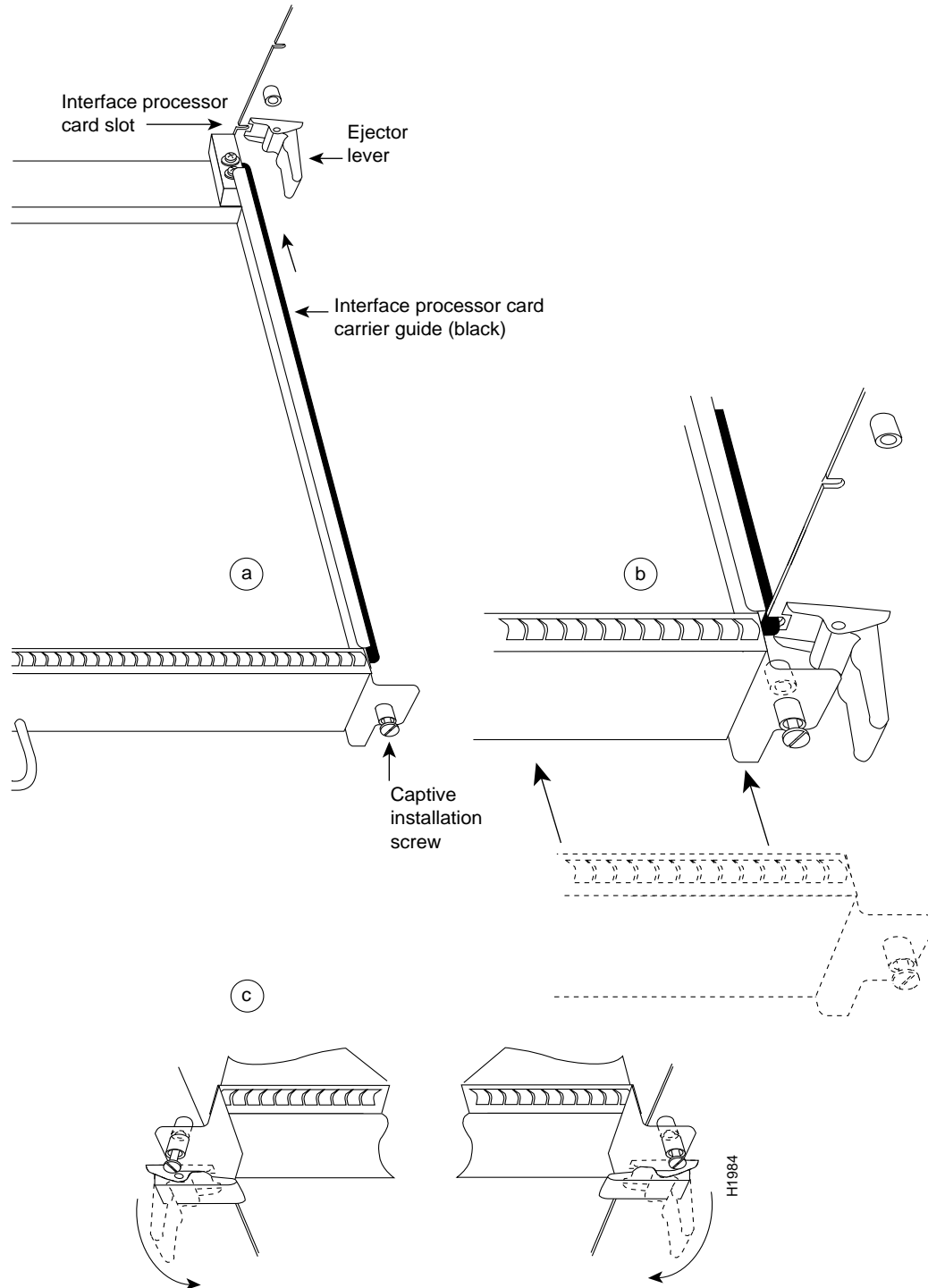
Figure 4 shows the ejector levers and captive installation screws on a typical interface processor. To remove an interface processor, loosen the captive screws and pull the ejector levers to the sides; then pull the module out using the handle. To insert an interface processor, reverse the process, making sure to firmly seat the interface processor in its connectors on the backplane. For detailed directions, follow the procedures in “Removing the SP or SSP” and “Replacing an SSP in the Chassis.”



Caution Always use the ejector levers to remove or install the SSP. The ejectors help ensure that backplane connectors on the card are fully seated in, or fully ejected from, the backplane. Failure to use the ejector levers could result in a partial backplane connection, which can hang the system.

The captive installation screws on the ends (see Figure 4) of each faceplate, when tightened, provide electromagnetic interference (EMI) shielding and also help ensure proper seating in the backplane. After using the ejector levers to install an SSP, tighten the captive installation screws to prevent the SSP from becoming partially dislodged from the backplane. These screws must be tightened to meet EMI specifications.

Figure 4 Ejector Levers and Captive Installation Screws—Horizontal Orientation Shown



Prerequisites

Before you begin the installation of the SSP, review the tools and parts required, and the safety and ESD-prevention guidelines in this section.

Tools and Parts Required

You need some or all of the following tools and parts to perform the following procedures. Before you begin, read the entire procedure to determine which tools you need for the installation or upgrade you will perform.

- A number 1 Phillips or 1/4-inch flat-blade screwdriver for the captive installation screws that secure the SSP in its slot. (Because of ongoing product improvements, some power supplies use slotted screws, and others use Phillips head screws.)
- ESD-prevention equipment or the disposable grounding wrist strap included with all upgrade kits.
- Antistatic mat, foam pad, or bag for the removed SSP, or Switch Processor (SP) if you are making an upgrade to an SSP. (Immediately place the removed SSP or SP into an antistatic bag if returning the SSP to the factory.)

Safety

Follow these basic guidelines when working with any electrical equipment:

- Before beginning any procedures requiring access to the chassis interior, locate the emergency power-off switch for the room in which you are working.
- Disconnect all power and external cables before moving a chassis.
- Do not work alone if potentially hazardous conditions exist.
- Never assume that power is disconnected from a circuit; always check.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe.
- Carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.

In addition, use the guidelines that follow when working with any equipment that is connected to telephone wiring or other network cabling.

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line is been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

Preventing Electrostatic Discharge (ESD) Damage

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. The SSP comprises a printed circuit board that is fixed in a metal carrier. Electromagnetic interference (EMI) shielding, connectors, and a handle are integral components of the carrier. Although the metal carrier helps to protect the board from ESD, use a preventive antistatic strap whenever handling the SSP. Handle the carriers by the handles and the carrier edges only; never touch the boards or connector pins.



Caution Always tighten the captive installation screws on the SSP. (See Figure 4.) These screws prevent accidental removal, provide proper grounding for the system, and help to ensure that the bus connectors are properly seated in the backplane.

Following are guidelines for preventing ESD damage:

- Always use an ESD wrist strap or ankle strap and ensure that the wrist strap makes good skin contact.
- Connect the equipment end of the strap to a captive installation screw on an installed power supply.
- When installing an SSP, use the ejector levers to properly seat the bus connectors in the backplane, then tighten both (top and bottom) captive installation screws. (See Figure 4.) These screws prevent accidental removal, provide proper grounding for the system, and help to ensure that the bus connectors are seated in the backplane.
- When removing an SSP, use the ejectors to release the bus connectors from the backplane. Hold the handle on the front of the SSP with one hand and support the bottom edge of the metal carrier with the other hand. Pull the SSP out slowly, using your hand along the bottom of the carrier to guide the SSP straight out of the slot.
- Handle carriers by the handles and carrier edges only; avoid touching the board or any connector pins.
- Place a removed SSP component-side-up on an antistatic surface or in a static shielding bag. If the SSP is to be returned to the factory, immediately place the SSP in a static shielding bag.
- Avoid contact between the SSP and clothing. The wrist strap only protects the card from ESD voltages on the body; ESD voltages on clothing can still cause damage.



Warning For safety, periodically check the resistance value of the antistatic wrist strap. The measurement should be within the range of 1 and 10 megohms.

Software Upgrade Prerequisites

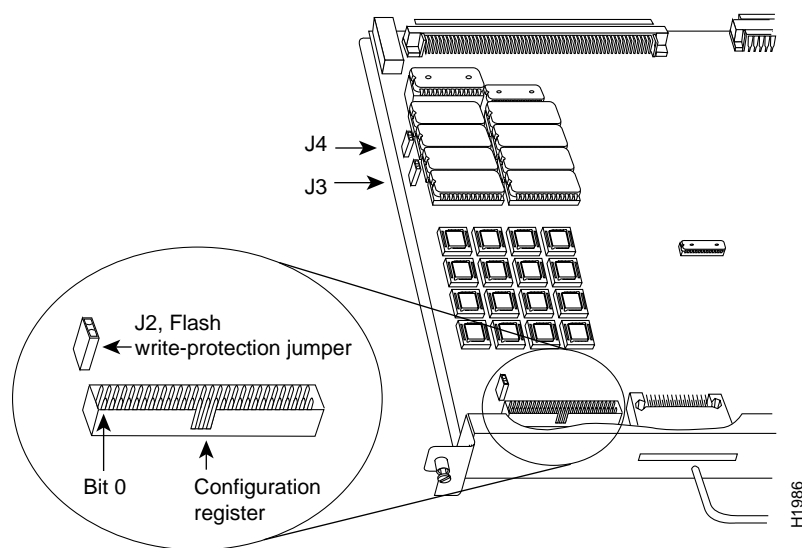
Following are minimum system requirements for the SSP hardware types:

- The SSP with 512 KB of packet memory requires Cisco Internetwork Operating System (Cisco IOS) Release 10.0, or later.
- The SSP with 2 MB of packet memory requires Cisco IOS Release 10.0(11) or later. Cisco IOS Releases 10.2(7) or later, 10.3(4) or later, and 11.0(1) or later, will provide the best use of the 2-MB SSP. (Detailed procedures for upgrading your Cisco 7000 series router software are provided separately with the software upgrade.)

To successfully upgrade the system software and microcode, you must have the following:

- Internet Protocol (IP) connections to the devices you plan to upgrade on the network.
- Write to Flash memory enabled. Your router was shipped with write to Flash memory enabled. Flash must be enabled on the router to make a write to Flash operation possible. If you removed the jumper from J2, the system makes a write operation impossible. For write enable, set the jumper on the RP hardware configuration register on J2. (See Figure 5.)

Figure 5 RP Flash Write-Protection Jumper



- You must have a terminal connection that enables you to issue commands to each router that you upgrade. If you do not have a direct terminal connection, you must set up a Telnet session on a device attached to the router you upgrade.
 - 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, 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 into the TFTP server directory (or wherever the TFTP server expects to find the system software file) to download the software to the router.

Software Upgrade Overview

This section describes the general steps required to upgrade your system software on a Cisco 7000 series router. The sections that follow describe these steps in detail.

- Step 1** Install the appropriate system software onto your TFTP server in the TFTP directory.
- Step 2** Verify that the router you are upgrading can connect to the TFTP server. Ping from the router to the TFTP server.
- Step 3** If the TFTP server is not already active, start the TFTP server.
- Step 4** If you do not have a console port connection to the router you are upgrading, establish a Telnet session with the router.
- Step 5** Back up the existing working system software and microcode images currently in Flash memory by copying the files to the TFTP server.
- Step 6** Back up your current configuration file to your TFTP server.
- Step 7** Copy the system software image from the TFTP server into Flash memory using the **copy tftp flash** command.
- Step 8** 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, as in the following:


```
(text deleted)
Verifying via checksum...
Flash verification successful. Length = 1906676, checksum = 0x12AD
```

If the checksum in the screen output does not match the checksum in the README file, invoke the **copy tftp flash** command again before booting from Flash memory.
- Step 9** Make sure your system is configured to boot from the new image in Flash memory.
- Step 10** Boot the router from Flash. This process reads the image from Flash memory and writes the image into system RAM.
- Step 11** Check all network connections to make sure the router with the upgraded system software is up and functioning properly.

Establishing a Telnet Session

You must be able to issue commands to the router on which you are upgrading the software. For example, this publication tells 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 the router so that you can issue the router 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, check to see if the software is 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 System Software

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)
- Copying the image from a TFTP server to Flash memory
- Verifying the new image in Flash memory

Note The SSP with 2 MB of packet memory requires Cisco IOS Release 10.0(11) or later. Cisco IOS Releases 10.2(7) or later, 10.3(4) or later, and 11.0(1) or later, will provide the best use of the 2-MB SSP.

Backing Up Your Current System Software and Configuration File

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

Learning the System Image Name

To display the total amount of Flash memory present, its location, any files that currently exist in Flash memory and their size, and the amount of Flash memory remaining, use the **show flash** command. The following (typical) output displays:

```
Router> show flash
4096K bytes of flash memory sized on embedded flash.
File name/status
 0 gs7-k.103-1
 1 micro/ssp10-5
[246400/4194304 bytes free/total]
```

Use the file name near the bottom of the **show flash** command screen output (in this case *gs7-k.103-1*) when you back up the image.

Backing up the Current System Image

Copy the image from Flash memory to a TFTP server using the **copy flash tftp** command:

```
Router# copy flash tftp
```

The router prompts 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 1.1.1.11 and filename *gs7-k.103-1* follows:

```
IP address of remote host [255.255.255.255]? 1.1.1.11
Name of file to copy []? gs7-k.103-1
writing gs7-k.103-1 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
Router#
```

Use the image you backed up to the TFTP server if the upgrade image is damaged.

Backing Up the Configuration File

To make a backup copy of your configuration file, enter the **write network** command. You will be prompted for the remote host IP address and the name of the configuration file, as follows:

```
Router# write net
Remote host []? 1.1.1.11
Name of configuration file to write [router-config]? cisco1-config
Write file cisco1-config on host 1.1.1.11? [confirm]
###
Writing cisco1-config !! [OK]
```

Use the backup configuration file if the image on the router is inadvertently overwritten.

Copying a System Image from a TFTP Server to Flash Memory

You can download a new system image to Flash memory by copying the image using TFTP. When the new version of the system image is available in Flash memory, you can boot the router either automatically or manually from Flash memory.

Note Before you copy a file to Flash memory, be sure there is ample space available in Flash memory. Compare the size of the file you are copying to the amount of available Flash memory shown. If the space available is less than the space required by the file you will copy, the copy process will continue, but the entire file will not be copied into Flash memory.

Follow these steps to copy a new system image version from the TFTP server to Flash memory.

Step 1 Determine the name of the system image file that you want to load into Flash memory. In the following example, the filename is *gs7-k.100-1*.

Step 2 To copy an image into the current Flash configuration, enter the **copy tftp flash** command as follows and provide information as required:

```
Router# copy tftp flash
File name/status
0 gs7-k.100-1
[1103564/4194304 bytes free/total]
```

Step 3 Enter the IP address of the TFTP server:

```
Address or name of remote host [1.1.1.11]? 1.1.1.11
```

Step 4 Enter the name of the file you want to copy to Flash memory:

```
Source file name? [gs7-k.100-1] gs7-k.103-4
```

Step 5 Enter the name under which you want the file to appear at the destination:

```
Destination file name? [gs7-k.103-1] <Return>
Accessing file 'gs7-k.103-4' on 1.1.1.11... found !

903500 bytes available for writing without erasure.
```

Step 6 If you want Flash memory erased, enter **yes**.

```
Erase flash device before writing? [confirm] y  
Flash contains files. Are you sure? [no]: y
```

You are prompted one last time as follows:

```
Copy 'gs7-k.103-4' from server  
as 'gs7-k.103-4' into Flash WITH erase? [yes/no] y
```

The file is copied and output similar to the following is displayed:

```
Erasing... eeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeeee  
Loading gs7-k.103-4 from 1.1.1.11 (via Ethernet1/0): !  
[OK - 3320245/4194176 bytes]  
Verifying via checksum...
```

```
Flash verification successful. Length = 3320245, checksum = 0xA83D
```

Step 7 Verify that the image was copied to Flash memory using the **show flash** command.

Booting from Flash Memory

When configuring the system to boot from Flash memory, first configure **no boot system** and then configure **boot system flash filename**. Configuring **no boot system** clears all the boot system commands, which are stored in the order that they are entered.

Note We recommend that you first use the **no boot system** command to clear all boot system commands.

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

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

If the **boot system flash** command does not appear in the system configuration, 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.

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.

Step 3 Write the configuration to NVRAM with the **write memory** or **copy running-config startup-config** commands.

The following example shows the sequence of steps for replacing a Cisco IOS 10.0 image with a Release 10.3(4) image. Substitute the different image names.

Note We recommend that you first use the **no boot system** command to clear all boot system commands.

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# no boot system flash 7k10020z (Removes old filename)
Router(config)# boot system flash gs7-k.103.4 (Tells system to boot new filename)
Router(config)# ^Z
Router# write memory
[ok]
Router#
```

Reboot the router with the **reload** command.

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 the previous message, contact technical support.

In an attempt to recover from the error, you also can erase the Flash memory and try to download the file again. To erase the Flash memory, issue the **copy tftp flash** command and press Return or Y at the following prompt:

```
erase flash before writing? [confirm] <Return>
```

Having successfully copied an image into Flash memory, you can display the image name by issuing the **show flash** command.

Enabling SSE Switching

After you install the SSP, you must enable Silicon Switch Engine (SSE) switching with the **ip route-cache sse** command. The **ip route-cache sse** command is comparable to the **ip route-cache cbus** command used to enable autonomous switching in the Switch Processor (SP). Enter the **ip route-cache sse** command from the Configuration mode, as follows:

```
Router# conf term
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# int ether 1/0
Router(config-if)# ip route-cache sse
Router(config-if)# ^Z
Router#
```

For additional information on SSE switching, refer to the appropriate router software publication.

Additional Show Commands

Use the **show** commands for determining the successful installation and operation of the SSP.

The **show sse summary** command displays the following summary of the processor statistics:

```
Router# show sse sum
SSE utilization statistics

          Program words  Rewrite bytes  Internal nodes  Depth  Rebuilds
Overhead           500           5           4
IP                 6607          133          6550      15         1
IPX                 0           0           0         0         2
SRB                 0           0           0         0         2
CLNP                0           0           0         0       44082
IP access lists     0           0           0
Total used          7107          138          6554
Total free          58429         262006
Total available     65536         262144

Internals
 15001487 internal nodes allocated, 14994933 freed
 SSE manager process enabled, microcode enabled and running, 0 hangs
Router#
```

The **show ip cache** command displays the following:

```
Router# show ip cache
IP routing cache version 0, 5827 entries, 819880 bytes
Minimum invalidation interval 2 seconds, maximum interval 5 seconds,
  quiet interval 3 seconds, threshold 0 requests
Invalidation rate 0 in last second, 0 in last 3 seconds

Prefix/Length      Age           Interface      MAC Header
6.0.0.0/8          2:02:35      Hssi1/0        0F000800
13.0.0.0/8         1:23:57      Fddi0/0        00000C0BA9DA00000C0DDF9CAAAA0300
                   00000800
15.0.0.0/8         0:00:44      Fddi0/0        00000C0BA9DA00000C0DDF9CAAAA0300
                   00000800
16.0.0.0/8         0:20:15      Fddi0/0        00000C03510300000C0DDF9CAAAA0300
                   00000800
17.0.0.0/8         0:19:14      Fddi0/0        00000C0BA9DA00000C0DDF9CAAAA0300
                   00000800
```

The **show ip interface brief** command displays the interfaces that are enabled.

To display statistics, including the controller type, MAC addresses, and microcode versions, enter the **show controllers cbus** command, as follows:

```
Router# show cont cbus
Switch Processor 5, hardware version 12.0, microcode version 10.8 Altera 4
Microcode loaded from system
2048 Kbytes of main memory, 128 Kbytes cache memory
4 256 byte buffers, 4 1024 byte buffers, 438 4496 byte buffers
Restarts: 0 line down, 0 hung output, 0 controller error
FIP 0, hardware version 2.4, microcode version 10.2
Microcode loaded from system
Interface 0 - Fddi 0/0, address 0000.0c04.b038 (bia 0000.0c04.b038)
 62 buffer RX queue threshold, 47 buffer TX queue limit, buffer size 4496
 ift 0006, rql 32, tq 0000 01C0, tq1 47
```

Installing the SSP

The SSP does not support online insertion and removal (OIR), so you must turn all system power OFF before removing the SSP from the chassis.

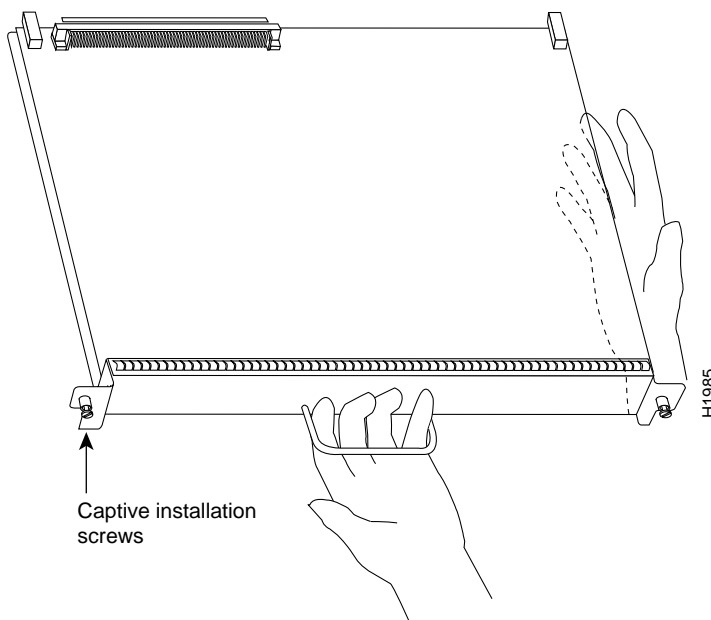
Removing the SP or SSP

Always use the ejector levers to remove or install the SSP. The ejectors help to ensure that backplane connectors on the card are fully seated in, or fully ejected from, the backplane (refer to the description in the section “Cisco 7000 Series Overview”). Failure to use the ejector levers could result in a partial backplane connection and subsequent system crash.

Follow these steps to remove and replace the SSP:

- Step 1** Turn OFF (O) all power supply switches.
- Step 2** Slip on a grounding wrist strap and attach the wrist strap to one of the captive installation screws on the rear of the chassis.
- Step 3** Use a number 1 Phillips or 1/4-inch flat-blade screwdriver to loosen the captive installation screws on the ends of the SSP. (See Figure 4.)
- Step 4** Place your thumbs on the ejector levers and simultaneously push out on the levers to release the SSP from the backplane connector. (See Figure 4.)
- Step 5** Grasp the SSP handle with one hand and place your other hand under the carrier to support and guide the SSP out of the slot. (See Figure 6.) Avoid touching the components on the board.

Figure 6 Handling the SSP During Installation



- Step 6** Carefully pull the SSP straight out of the slot, keeping your other hand under the carrier to guide the SSP. (See Figure 6.) Keep the SSP at a 90-degree orientation to the backplane.
- Step 7** Place the removed SSP on an antistatic mat or antistatic foam. If you are replacing the SSP and will return the SSP to the factory, immediately place the SSP in an antistatic bag to prevent ESD damage.

Replacing an SSP in the Chassis

Ensure that all power supplies are turned OFF (O) before installing the SSP in the chassis. The SSP, RP, and interface processors are all keyed for installation only in the correct slot. (Refer to “SSP Description.”) Install the SSP in the *SP* slot (see Figure 2 and Figure 3), as follows:



Caution Handle the SSP by the handle and carrier edges only to prevent ESD damage.

Step 1 Hold the SSP handle with one hand and place your other hand under the carrier to support the bottom as you guide the SSP into the slot (see Figure 6). Avoid touching the board or connectors.



Caution You must install the SSP in the *SSP or SP* slot, which is adjacent to the RP slot. (See Figure 3 and Figure 2.) The slots are keyed for correct installation. Forcing the SSP into a different slot can damage the backplane and the SSP.

Step 2 Place the back of the SSP in the slot and align the notch on the ends of the carrier with the groove in the chassis slot. (See Figure 4.)

Step 3 While keeping the SSP at a 90-degree orientation to the backplane, carefully slide the carrier into the slot until the SSP faceplate makes contact with the ejector levers, then stop. (See Figure 4.)

Step 4 Using the thumb and forefinger of each hand to pinch each ejector, simultaneously push the levers inward (toward the handle) until they are at a full 90-degree orientation to the faceplate. (See Figure 4.)



Caution Always use the ejector levers when installing or removing processor modules. A module that is partially seated in the backplane will cause the system to hang and subsequently crash.

Step 5 Use an appropriate screwdriver to tighten the captive installation screws on the ends of the SSP. (See Figure 4.) (These screws must be tightened for maximum EMI protection.)

Step 6 If you disconnected the console terminal to remove the SP or SSP, connect the console terminal to the Console port.

Step 7 Ensure that the console terminal is turned on.

Step 8 Proceed to the next section to restart the system and check the installation.

Restarting the System

Follow these steps to verify that the SSP is installed and functioning properly:

- Step 1** Check the ejector levers to ensure that the SSP is inserted all the way into its slot and that both the top and bottom captive installation screws are tightened.
- Step 2** Ensure that the console terminal is on.
- Step 3** Turn ON the power.
- Step 4** On model 7000 routers, after the lower power supply is on, turn the upper power supply (if present) ON for redundant power. The power LED on the power supply and the upper power LED on the front of the chassis will come ON.
- Step 5** Observe the RP LEDs. While the system initializes, the yellow boot error LED on the RP comes on for about five seconds or less, then goes out when the boot is complete. As the RP initializes each interface processor, the interface processor status LEDs come on in irregular sequence.
- Step 6** After the system boots the software and initializes the interface processors (approximately 30 seconds), verify that the RP LEDs are in the following states:
 - RP normal LED is on
 - CPU halt LED is off
 - Boot error LED is off
- Step 7** Verify that the enabled LED on the SSP comes on.
- Step 8** Verify that the enabled LEDs on the interface processors come on.
- Step 9** Verify that the console terminal displays a script and system banner similar to the following:

```
Cisco Internetwork Operating System Software
IOS (tm) GS Software (GS7), Version 10.3(3), RELEASE SOFTWARE
Copyright (c) 1986-1995 by cisco Systems, Inc.
Compiled Wed 10-May-95 03:33
(displayed text omitted from example)
```

After verifying all of the conditions in the previous steps, your installation is complete.

An error condition exists if any of the enabled LEDs fail to come on after initialization or if the boot error or CPU halt LEDs come on and remain on. If this happens, proceed to “Troubleshooting the Installation” to try to isolate the problem.

Troubleshooting the Installation

This section contains procedures to follow if the system does not restart and boot as expected. Review the descriptions that follow, so you can anticipate the expected system startup sequence. Then restart the system and try to isolate the problem by observing the LEDs as the system attempts to boot the software and initialize the SSP and each interface processor.

The troubleshooting procedures in this section assume that your system was operating correctly up until the time you install or replace the SSP and that any problems are a result of the newly installed or upgraded SSP.

If the troubleshooting procedures indicate a problem with the power subsystem or one of the interface processor cards, refer to the *Cisco 7000 Hardware Installation and Maintenance* or *Cisco 7010 Hardware Installation and Maintenance* publications for complete system startup troubleshooting procedures.

Verifying LEDs

Following are functional descriptions of the LEDs on the power supplies and processor modules, and the behavior you should observe at system startup.

System Power LEDs

Cisco 7000 series models have a system power LED that should go on and stay on when the system power is turned on. If the LED does not go on or stay on, there is most likely a problem with the input power or one of the internal DC lines.

On the Cisco 7010, the system power LED is located on the lower right of the interface processor end of the chassis and is labeled DC OK. (See Figure 3.) The rocker-type power switch turns the power supply on and starts the system.

On the Cisco 7000, which operates with either one or two power supplies, the system power LEDs are labeled and located on the individual power supplies. Each supply contains AC (or DC) power and DC fail LEDs and a power switch. (See Figure 7.) When you turn on a power supply, the green power LED should go on. The yellow DC fail LED should remain off. The power LED will not go on if the power supply switch is not fully in the ON (I) position, or if the power supply is not properly seated in the bay.

In both models, the power LED will not go on or will go off if the power supply reaches an out-of-tolerance temperature or voltage condition. The power supply is unlikely to shut down during startup because of an overtemperature condition; the power supply can, however, shut down if the power supply detects an over- or under-voltage condition during startup.

For descriptions of environmental monitoring functions, refer to the *Cisco 7000 Hardware Installation and Maintenance* or the *Cisco 7010 Hardware Installation and Maintenance* publications.

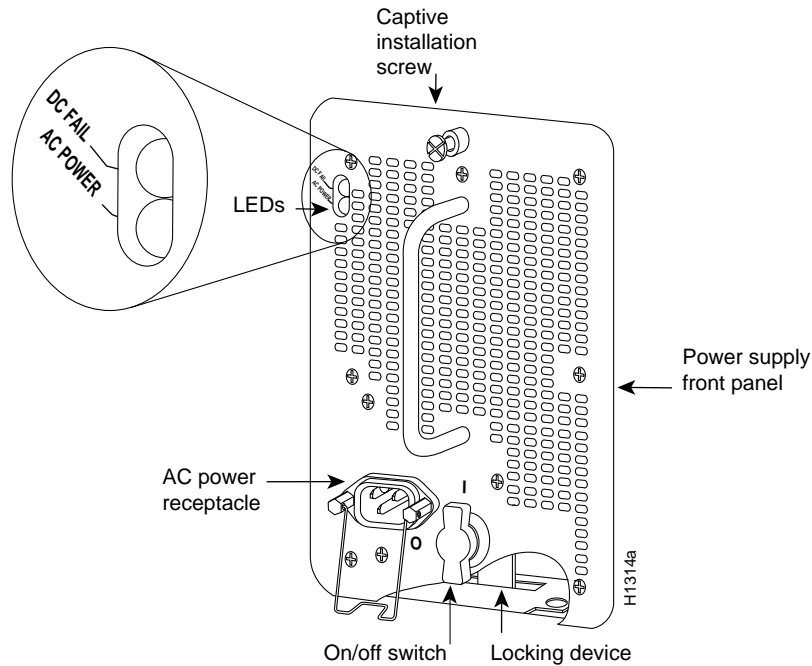
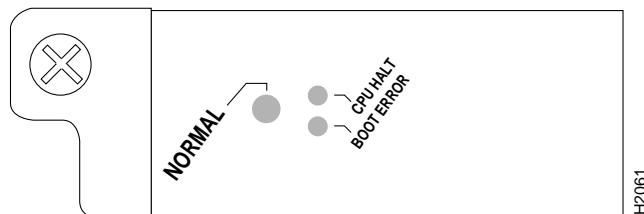
Figure 7 Cisco 7000 Power Supply LEDs**RP LEDs**

Figure 8 shows the three LEDs on the RP faceplate. These LEDs indicate the system and RP status. When the router is turned on or restarted, the boot error LED goes on for one or two seconds, then goes off. The CPU halt LED, which goes on only if the system detects a processor hardware failure, remains off. If the boot error LED remains on for more than five seconds, the router is unable to boot and you must restart the router. A successful boot is indicated when the boot error LED goes off; however, this does not necessarily mean that the system has reached normal operation. During normal operation, the CPU halt and boot error LEDs are off, and the normal LED is on.

Figure 8 RP LEDs (Horizontal Cisco 7010 Orientation Shown)

SSP and Interface Processor LEDs

The SSP and each interface processor contain an enabled LED. The enabled LED goes on to indicate that the SSP or interface processor is operational and powered up. All enabled LEDs (on the SSP and interface processors) go on when the boot sequence is complete. If the enabled LEDs do not come on, one of the following errors is indicated:

- The SSP or interface processor is not installed correctly. (The SSP is not fully seated in the backplane connector).
- The microcode and software that are loading at startup are not compatible.
- The SSP or interface processor has failed.

System Startup Sequence

By checking the state of the LEDs, you can determine when and where the system failed in the startup sequence. The Cisco 7000 features redundant LEDs on the front of the chassis for the RP normal system status LED and the power LEDs on the power supplies. However, because the states reported by these LEDs are also indicated at the interface processor end of the chassis, these LEDs are ignored in the following procedure. Because you turn the system power on with the power supply switches, the startup behavior is easiest to observe from the rear of the chassis. Use the following descriptions of the normal startup sequence to isolate the problem, then use the troubleshooting procedures wherever the system fails to operate as expected. If you are able to isolate the problem to a faulty hardware component, or if you are unable to successfully restart the system, refer to the end of this document for instructions for contacting a customer service representative.

Note The time required for the system to initialize (boot) varies with different router configurations and the amount of memory that must be initialized. During the system startup sequence, the time required to initialize the memory (not necessarily the entire boot sequence) in a system that contains 64 MB of DRAM will be approximately four times longer than in a system that contains 16 MB of DRAM.

The pause in the banner display occurs after the copyright line, and before the system displays the list of installed hardware, as shown in the following display:

```
%SYS-5-RELOAD: Reload requested
System Bootstrap, Version 4.6(7.3)
Copyright (c) 1986-1995 by cisco Systems, Inc.

(System initializes memory at this point in the display)

RP1 processor with...
```

Note The procedures in this section are based on the assumption that your system has been operating correctly up until the time you removed or replaced the SSP. If the following sequence indicates a new problem with the power subsystem or one of the interface processors, refer to the *Cisco 7000 Hardware Installation and Maintenance* or the *Cisco 7010 Hardware Installation and Maintenance* publications for system startup troubleshooting procedures.

When you restart up the system, the system power LEDs (DC OK on the Cisco 7010, and AC power on the Cisco 7000) should indicate the following:

- 1 The DC OK (Cisco 7010) or power (Cisco 7000) LED goes on. The DC fail LED on the Cisco 7000 power supply remains off.
 - If all of the system power LEDs remain off, the SSP is probably not fully inserted and connected to the backplane. Loosen the captive installation screws on the SSP, then use the ejector levers to reseal the SSP in the backplane. (Refer to the section “Removing the SP or SSP.” Also, refer to Figure 4 for an illustration of the ejector levers). Tighten both captive installation screws.
 - Cisco 7000 only: If LEDs on only one power supply fail to go on, the power supply is probably not fully inserted into the bay. Turn the power switch off (fully counterclockwise to *O*), pull the power supply out of the bay about two inches, then push the power supply firmly back into the slot. Do not force the supply into the slot; doing so can damage the connectors on the supply and the backplane. Tighten the captive installation screw before proceeding.
 - If all system power LEDs go on, the AC source is good and the power supply functional.
 - If the DC fail LED goes on, or if the power LED remains off, suspect the power supply or the power source.

When the system power LEDs indicate normal operation, proceed to the next step. If the LEDs on one or both power supplies still fail to go on as expected, suspect a power supply or AC input power failure. Before contacting a customer service representative, refer to the *Cisco 7000 Hardware Installation and Maintenance* or the *Cisco 7010 Hardware Installation and Maintenance* publications for power subsystem troubleshooting procedures.

- 2 Listen for the system blower (Cisco 7000) or the fan array (Cisco 7010). You should hear the blower start operating immediately after you turn ON the system power. If you determine that the power supplies are functioning normally and that the blower or fan array is faulty, contact a customer service representative. If the system blower or fan tray does not function properly at initial startup, make no adjustments.
- 3 After verifying that the power supplies are functioning properly, observe the LEDs on the RP. While the system initializes, the yellow boot error LED on the RP should be on for about five seconds or less, then go off when the boot is complete.
 - If the boot error LED goes on then off as expected, proceed to the next step.
 - If none of the RP LEDs go on, suspect that an improperly connected SSP or interface processor has hung the bus. Use the ejector levers to ensure that each board is seated properly. On each ejector lever pair, push the top lever down while pushing the bottom lever up until both levers are at a 90-degree orientation to the rear of the chassis (refer to “Removing the SP or SSP” for a description and an illustration of the ejector levers). Tighten all captive installation screws.
 - If the boot error LED stays on longer than 10 seconds, or if the LED remains on after system initialization, a boot error has occurred. Restart the system. If this does not correct the problem, suspect a system software error.

- 4 The CPU halt LED on the RP should always remain off. If the CPU halt LED goes on during the startup sequence, suspect a processor hardware error and contact a customer service representative.
- 5 During the boot process, the LEDs on most of the interfaces go on in an irregular sequence; this does not indicate correct system startup or failure.
- 6 When the system boot is complete, the RP begins to initialize the interface processors. During this initialization, the LEDs on each interface processor behave differently (most flash on and off). The enabled LED on each interface processor goes on when initialization is complete.
 - If the enabled LED on the SSP and all interface processors go on, the system has booted successfully and is now functional.
 - If the RP LEDs previously indicated a successful system boot, but none of the enabled LEDs on the SSP or the interface processors go on, suspect that one of them has shifted out of the backplane connector and hung the bus. Use the ejector levers to release the SSP or interface processor and reseat the module in the backplane. (Refer to the section “Removing the SP or SSP.” Also, refer to Figure 4 for an illustration of the ejector levers.) Tighten both captive installation screws.
 - If the enabled LED on a single interface processor remains off, suspect that the interface processor has shifted out of the interface processor’s slot. Use the ejector levers to release the interface processor and reseat the interface processor in the backplane (refer to “Removing the SP or SSP” for a description and illustration of the ejector levers). Tighten both captive installation screws. After the system reinitializes the interfaces, the enabled LED on the interface processor should go on.
 - If an enabled LED still fails to go on after performing these steps, suspect that the specific SSP or interface processor has failed.
- 7 When the system boot is complete, and the SSP and all interface processors have been initialized, the console screen displays a script and system banner similar to the following:

```
Cisco Internetwork Operating System Software
Cisco IOS Software (GS7), Version 10.3(4), RELEASE SOFTWARE
(or 10.0(11) or later, or 10.2[7] or later, or 11.0(1) or later)
Copyright (c) 1986-1995 by cisco Systems, Inc.
Compiled Mon 10-Apr-95 03:33
```

- If all of the previous conditions are met, and this banner is displayed, the system startup was successful, and your installation is complete.
- If an error message is displayed on the terminal, refer to the appropriate software publication for error message definitions.
- If the console screen is blank, check that the terminal is turned on and that the console cable is correctly connected between the terminal and the Console port on the RP.
- Check the terminal settings and ensure that the terminal is set for 9600 baud, 8 data bits, no parity, and 2 stop bits.
- If the terminal is set correctly and still fails to operate, suspect that the terminal is faulty. Connect a different terminal and restart the system.

If the system still fails to start up or operate properly after you perform these troubleshooting procedures, or if you isolate the cause of the problem to a failed component, contact a customer service representative for further assistance.

This completes the SSP installation and replacement procedure. For complete command descriptions and examples, refer to the appropriate software publications.

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