



Cisco 7304 High Availability

Feature History

Release	Modification
12.1(10)EX2	Route Processor Redundancy (RPR) was introduced, supporting the NSE-100 route processor.
12.2(14)SZ	Route Processor Redundancy (RPR) was introduced, supporting the NPE-G100 route processor.
12.2(18)S	Route Processor Redundancy (RPR) was introduced on Cisco 7304 routers running Cisco IOS Release 12.2S.
12.2(20)S	Route Processor Redundancy Plus (RPR+) and Stateful Switchover (SSO) were introduced on the Cisco 7304 router.
12.2(20)S3	Stateful Switchover (SSO) mode was introduced for Cisco 7304 routers using the following hardware: <ul style="list-style-type: none">• the MSC-100 populated with SPAs.• the PCI port adapter carrier card populated with a port adapter.
12.2(31)SB2	The NSE-150 was introduced with the following High Availability characteristics: <ul style="list-style-type: none">• Support for RPR, RPR+, and SSO.• Native Gigabit Ethernet ports not visible or usable on a standby NSE-150.

This document describes the High Availability feature on Cisco 7304 routers and contains the following sections:

- [Feature Overview, page 2](#)
- [Supported Platforms, page 8](#)
- [Supported Standards, MIBs, and RFCs, page 8](#)
- [Prerequisites, page 9](#)
- [Configuration Tasks, page 9](#)
- [Monitoring and Maintaining Cisco 7304 High Availability, page 20](#)



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- [Command Reference, page 22](#)
- [Glossary, page 39](#)

Feature Overview

High Availability

The Cisco 7304 Route Processor High Availability feature adds support for a second dual-wide network services engine (NSE) or network processing engine (NPE) installed in a Cisco 7304 router. Previously only one dual-wide processor could be installed in slots 0 and 1. The Route Processor High Availability feature enables a second processor to be installed in slots 2 and 3. This additional processor can be the only processor installed in the system, or it can be a second processor. The processor installed in slots 0 and 1 is the preferred active processor. Upon bootup, the processor in slots 0 and 1 assumes the role of the active processor (active RP by some High Availability definitions). The standby processor (standby RP by some High Availability definitions) in slots 2 and 3 waits for 45 seconds for the processor in slots 0 and 1 to assume the role of active RP. If there is no processor installed in slots 0 and 1, the processor in slots 2 and 3 bypasses the 45-second wait and automatically assumes the role of active RP.

Upon booting, the system recognizes the processor installed in slot 0 and slot 1 as the active RP unless it is absent or there is some error condition existing on this processor. The active RP can be made to cede its role as the active to an operational standby using the **redundancy force-switchover** command.

You do not need to configure anything on the router to activate the Cisco 7304 High Availability feature. Installing a second processor in the chassis automatically creates redundancy in the system. Make sure that you have Cisco IOS images that support High Availability installed on both the active and the standby processors. We strongly recommend that you install the same Cisco IOS release image on both the active and standby RPs. You should also make sure that the configuration register is properly configured.

The Cisco 7304 can operate in one of three redundancy modes:

- Route Processor Redundancy (RPR) mode
- Route Processor Redundancy Plus (RPR+) mode
- Stateful Switchover (SSO) mode

In all modes, the standby RP will take over when the active RP fails. However the general systems behavior is different for each mode and is summarized in [Table 1](#):

Table 1 Cisco 7304 Redundancy Modes and Systems Behavior

Redundancy Mode	Startup-config Sync	Running-config Sync	Line Cards Reset	Nonstop Forwarding (NSF) Awareness
RPR	Yes	No	Yes	No
RPR+	Yes	Yes	No	No
SSO	Yes	Yes	No	Yes

For information on SSO, refer to the Stateful Switchover feature at:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s20/fssso20s.htm>

For information on the Nonstop Forwarding (NSF) feature, introduced on the Cisco 7304 router in Cisco IOS Release 12.2(20)S as part of the support for SSO, refer to the Cisco Nonstop Forwarding feature at: <http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s20/fsnsf20s.htm>

Line Card Reset Behavior

Line cards can reset across a switchover depending on the type of line card and the redundancy mode your system is in. Table 2 describes the reset behavior of line cards based on the redundancy mode. The “N/A” indicated in the table reflects that the PCI port adapter carrier cards do not support the RPR+ and SSO redundancy modes.

Table 2 Line Card Reset Behavior by Redundancy Mode

Redundancy Mode	Native Line Cards (Except ATM)	ATM Line Cards	PCI Port Adapter Carrier Cards
RPR	Yes	Yes	Yes
RPR+	No	Yes	N/A
SSO	No	No	N/A

Fast Software Upgrade

The High Availability feature supports Fast Software Upgrade (FSU) for Cisco 7304 routers. Using FSU, you can reduce planned downtime. With FSU, you can configure the system to switch over to a standby RP that is preloaded with an upgraded Cisco IOS software image. FSU reduces outage time during a software upgrade by transferring functions to the standby RP that has the upgraded Cisco IOS software pre-installed. The only downtime with Fast Software Upgrade is the time required for the standby RP to take control during the switchover. You can also use FSU to downgrade a system to an older version of Cisco IOS or have a backup system loaded for downgrading to a previous image immediately after an upgrade.



Note

FSU forces the system into RPR mode irrespective of the configured redundancy mode because in all modes other than RPR, the images running on the active and standby RPs must be the same.



Note

Cisco IOS Release 12.2(20)S is not backward compatible; Fast Software Upgrade will not function properly if one RP is running a version of Cisco IOS prior to Cisco IOS Release 12.2(20)S.



Note

You must also install a boot image that supports High Availability. We recommend that the boot image be the same version as the system image.

Online Insertion and Removal

The Cisco 7304 High Availability feature supports online insertion and removal (OIR) of processors.

Once the standby RP boots up, it becomes the standby RP and the startup configuration is synchronized from the active to the newly inserted standby RP. The file systems on the standby RP also become visible and usable on the active RP as remote file systems.

If you perform a removal of the active RP from a Cisco 7304 router with redundant RPs, the standby RP (if it is booted up and ready as the standby RP) detects the removal of the active RP and switches over to become the new active RP.

If the previously active RP is inserted, it comes up as the standby RP.

The NSE-100 handles native Gigabit Ethernet interfaces differently than the NPE-G100 and NSE-150. When a standby Route Processor is present and running on the NSE-100, the Gigabit Ethernet interfaces on the standby Route Processor are visible and usable on the active Route Processor, irregardless of whether the standby system has or has not booted the Cisco IOS image.

On the NPE-G100, the three Gigabit Ethernet interfaces on the standby Route Processor are not designed to be visible or usable on the active Route Processor. On the NSE-150, the four Gigabit Ethernet interfaces are not designed to be visible or usable on the active Route Processor.

The Fast Ethernet management interface, however, should not be used by the active Route Processor at any time on both the NSE-100 and NSE-150.

The different handling of interfaces by the processors is the reason for the different interface numbering schemes for the Ethernet ports on the NSE-100. The Gigabit Ethernet interfaces require that slot and interface number (slot/interface-number) be specified in the CLI, while the Fast Ethernet interface only requires an interface number be specified. Similarly, because the Gigabit Ethernet interfaces on the standby Route Processor are not designed to be visible or usable on the active Router Process for the NPE-G100 or NSE-150, only the interface number must be entered in the CLI to specify a native NPE-G100 or NSE-150 Gigabit Ethernet interface.

Management Port

The Fast Ethernet port on the Cisco 7304 routers is the default management port. When two NSEs are installed in your system, the Fast Ethernet management port is configured as Fast Ethernet 0, not Fast Ethernet 0/0.

In Cisco IOS software images that pre-date the introduction of RPR support on the Cisco 7304, the Fast Ethernet port on the NSE-100 was numbered in the slot/unit format. The NSE-150 supported RPR at release and the Fast Ethernet management port is always Fast Ethernet 0.

If you already have configurations in your system for the management port configured as Fast Ethernet 0/0, the configuration is still recognized as valid. However new configuration changes will not accept Fast Ethernet 0/0, only Fast Ethernet 0. All configurations displayed by the **show running-config** command are displayed as Fast Ethernet 0.

On the NPE-G100, there is no dedicated management interface and so any of the GigabitEthernet ports on the NPE-G100 can be used as the management port.

CompactFlash Disk Commands with Cisco 7304 High Availability

With support for the Cisco 7304 High Availability feature, you can configure many Cisco IOS file system commands from the active RP to display and configure information on the standby RP by appending the **stby-** prefix to the usual file system commands.

[Table 3](#) lists some of the CompactFlash Disk commands that can be issued on the active RP and affect the standby RP.

Table 3 CompactFlash Disk-Related Software Commands

Command and Arguments	Description
<code>cd stby-[disk0: bootdisk: nvram:] directory-name</code>	Changes current directory of the standby RP. Allows you to move between directories on a CompactFlash Disk, where <i>directory-name</i> is the directory to which you want to move.
<code>copy stby-[disk0: bootdisk: nvram:] source-filename [disk0: bootdisk: stby-disk0: stby-bootdisk:] destination-filename</code>	Copies from one file to another. Allows you to make a copy of a file (<i>source-filename</i>) located on a source file system (disk0: , bootdisk: or nvram:) and place it with either the same filename or a different filename (<i>destination-filename</i>) on a destination file system.
<code>delete stby-[disk0: bootdisk:] filename</code>	Deletes a file from the file system of the standby RP. Allows you to delete any file you designate, where <i>filename</i> designates the name of the file.
<code>dir stby-[disk0: bootdisk: nvram:]</code>	Lists files on the standby RP file system.
<code>format stby-[disk0: bootdisk:]</code>	Formats the standby RP file system. Allows you to format a new CompactFlash Disk (disk0: or bootdisk:). This command also allows you to reformat a CompactFlash Disk that was formatted on another type of system. Note This command destroys all data currently in Flash memory; therefore, we strongly recommend that you use the format command with caution to prevent irretrievable loss of data.
<code>mkdir stby-[disk0: bootdisk:] directory-name</code>	Creates a new directory. Allows you to create directories on a CompactFlash Disk for a standby RP, where <i>directory-name</i> is the name you assign to this directory.
<code>rename stby-[disk0: bootdisk:] filename stby-[disk0: bootdisk:] filename</code>	Renames a file. Allows you to rename a file that is located on one compact Flash Disk and assign to that file another (or the same) file system path and filename. The first group of arguments defines the source (current) file system path and filename, and the second set of arguments defines the destination file system path and filename.
<code>rmdir stby-[disk0: bootdisk:] directory-name</code>	Removes an existing directory. Allows you to remove a directory that currently exists on a CompactFlash Disk on the standby RP, where <i>directory-name</i> is the name of the directory you want to remove.
<code>show stby-[disk0: bootdisk:]</code>	Lists information about CompactFlash Disk format and geometry on the standby RP.

For more information about using file system commands, see the [Cisco IOS File System Commands](#) part of the [Cisco IOS Configuration Fundamentals Command Reference](#), Release 12.1.

For more information about basic software commands you can use with the CompactFlash Disk in a Cisco 7304 router, see the “[Removing and Installing the NSE-100](#)” chapter of the [Cisco 7304 Network Service Engine Installation and Configuration](#) guide.

For more information about basic software commands you can use with a CompactFlash Disk on a network processing engine (NPE-G100), see the “[Working with a CompactFlash Disk](#)” chapter of the [Cisco 7304 Network Processing Engine Installation and Configuration](#).

Benefits

The Cisco 7304 Route Processor High Availability feature provides the following benefits based on the redundancy mode the system is configured for:

High Availability Benefits—RPR Redundancy Mode

- Unplanned downtime is reduced with a faster switchover to a standby RP. (The standby RP is partially booted with a Cisco IOS image.)
- Fast Software Upgrade reduces outage time during a software upgrade by transferring functions to a standby RP that has an upgraded Cisco IOS software image pre-installed.
- The standby RP boots and takes control of the line cards without user intervention if a fatal error is detected on the active RP.
- Configuration synchronization of startup configuration is performed between the active and standby RPs. This synchronization happens first when the active and standby RPs boot up the Cisco IOS software. Subsequently the configuration synchronization happens whenever the **copy running-config startup-config** command is issued.
- Online insertion and removal (OIR) of the active and standby RPs is supported.

High Availability Benefits—RPR+ Redundancy Mode

Route Processor Redundancy Plus (RPR+) redundancy mode provides the following benefits in addition to the benefits provided by Route Processor Redundancy (RPR) mode:

- The standby RP boots up completely instead of being suspended in a partially booted state as happens with RPR. This allows for a faster switchover to a standby RP, usually in 4-5 seconds.
- The running configuration as well as the startup configuration are synchronized from the active RP to the standby RP.
- Line cards are not reset across the switchover (except as noted in the [Restrictions](#) section).

High Availability Benefits—SSO Redundancy Mode

Stateful Switchover (SSO) redundancy mode is the most sophisticated redundancy mode and provides the most benefits on a Cisco 7304 router. Benefits include Nonstop Forwarding (NSF) of data traffic in addition to the benefits provided by the RPR+ mode.

For information on High Availability benefits when your system is in the SSO redundancy mode, see the Stateful Switchover feature at the following URL:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s20/fssso20s.htm>

Also see the Cisco Nonstop Forwarding feature at:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s20/fsnsf20s.htm>

Restrictions

Restrictions in All Redundancy Modes

The following restrictions apply in all modes:

- Mixed processor configurations are not allowed. Either two NSE-100s, two NSE-150s, or two NPE-G100s must be installed. If you mix processors in a configuration, then the processor in slot 0 will become the active RP and force the other processor to stay in reset.
- The entire system loses functionality for the duration of the switchover from the active to the standby RP.
- All traffic flowing through the router at the time of failure is lost until the standby RP can take over as the active RP.
- A reload will reload the entire chassis (both processors).
- You must use the **redundancy force-switchover** command to force a switchover.
- The standby console is disabled until the standby RP switches over to being the active RP.

Restrictions—RPR Redundancy Mode

- The standby RP is only partially initialized.
- Only the startup configuration between the active and standby RP is synchronized. This happens at the time the standby RP boots up and subsequently whenever the startup configuration is saved to NVRAM on the active RP.
- All line cards are reset across the switchover.

Restrictions—RPR+ Redundancy Mode

- If you are using Cisco IOS Release 12.2(20)S2 or earlier, the presence of the PCI port adapter carrier card or the MSC-100 forces the system to fall back to the RPR redundancy mode. In Cisco IOS Release 12.2(20)S3 and later Cisco IOS release versions, SSO is supported for the PCI port adapter carrier card and for the MSC-100. RPR+ is not supported for the PCI port adapter carrier and the MSC-100, however.
- A switchover in RPR+ mode does not result in the reset of any line cards, except for the ATM line cards.
- Interfaces on the processor itself are reset across an RPR+ switchover.

Restrictions—SSO Redundancy Mode

- If you are using Cisco IOS Release 12.2(20)S2 or earlier, the presence of the PCI port adapter carrier card or the MSC-100 forces the system to fall back to the RPR redundancy mode. In Cisco IOS Release 12.2(20)S3 and later Cisco IOS release versions, SSO is supported for the PCI port adapter carrier card and for the MSC-100. RPR+ is not supported for the PCI port adapter carrier and the MSC-100, however.
- A switchover in SSO mode does not result in the reset of any line cards.

- Interfaces on the processor itself are not stateful and will experience a reset across switchovers. In particular, the Gigabit Ethernet interfaces on the processors are reset across switchovers and do not support SSO.

For information on High Availability restrictions when your system is in the SSO Redundancy Mode, see the Stateful Switchover document at the following URL:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s20/fssso20s.htm>

Related Documents

- *Cisco IOS Configuration Fundamentals Command Reference*, Release 12.2
- *Cisco IOS Configuration Fundamentals Configuration Guide*, Release 12.2
- *Cisco 7304 Router Platform-Specific Commands*
- *Cisco 7304 Installation and Configuration Guide*
- *Cisco 7304 Quick Start Guide*
- *Cisco 7304 Router Troubleshooting*
- *Cisco 7304 Network Service Engine Installation and Configuration*
- *Cisco 7304 Network Processing Engine Installation and Configuration*
- *Software Configuration Register*
- *Stateful Switchover*
- *Nonstop Forwarding*

Supported Platforms

- Cisco 7304 routers

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at <http://www.cisco.com/go/fn>. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

Supported Standards, MIBs, and RFCs

Standards

No new or modified standards are supported by this feature.

MIBs

The Cisco 7304 router now supports the following MIB:

- RF MIB

To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:

<http://tools.cisco.com/ITDIT/MIBS/servlet/index>

If Cisco MIB Locator does not support the MIB information that you need, you can also obtain a list of supported MIBs and download MIBs from the Cisco MIBs page at the following URL:

<http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>

To access Cisco MIB Locator, you must have an account on Cisco.com. If you have forgotten or lost your account information, send a blank e-mail to cco-locksmith@cisco.com. An automatic check will verify that your e-mail address is registered with Cisco.com. If the check is successful, account details with a new random password will be e-mailed to you. Qualified users can establish an account on Cisco.com by following the directions found at this URL:

<http://www.cisco.com/register>

RFCs

No new or modified RFCs are supported by this feature.

Prerequisites

- Both the boot image and the Cisco IOS image must support High Availability.
- You must have two NSE-100s, two NPE-G100s, or two NSE-150s installed in a Cisco 7304 router. The Cisco 7304 router only supports dual processor configurations when the two processors in the Cisco 7304 router are identical.
- We strongly recommend loading the same Cisco IOS version and the same physical configuration on both the active and the standby RPs. The recommendation regarding the same Cisco IOS version applies with the exception of the Fast Software Upgrade (FSU) case where during the upgrade the active and standby RP would be running different Cisco IOS versions.

Configuration Tasks

No configuration is necessary for the Cisco 7304 High Availability feature. RP redundancy is automatic when a second processor is installed in slot 2 and slot 3. See the following sections for optional configuration tasks for the Cisco 7304 High Availability feature:

- [Setting the Config-Register Boot Variable, page 10](#) (optional)
- [Configuring Fast Software Upgrade, page 11](#) (optional)

See the following sections for verification tasks and troubleshooting tips for the Cisco 7304 High Availability feature:

- [Verifying Cisco 7304 High Availability, page 13](#) (optional)
- [Troubleshooting Tips, page 14](#) (optional)

Setting the Config-Register Boot Variable

Though it is not required for RPR redundancy mode, we recommend that you modify the software configuration register boot field so that the system boots the same image that is loaded on the standby RP. The RPR+ and SSO redundancy modes will only operate if the same software version is running on both the active and standby RPs.

	Command	Purpose
Step 1	Router# show version	Displays the current configuration register setting.
Step 2	Router# configure terminal	Enters configuration mode, selecting the terminal option.
Step 3	Router(config)# boot system flash disk0:[<i>imagenam</i>e]	Specifies the image filename for the system to boot up. <ul style="list-style-type: none"> <i>imagenam</i>e—Filename of an image stored in Flash memory.
Step 4	Router(config)# config-register value	Modifies the existing configuration register setting to reflect the way in which you want to load a system image. <ul style="list-style-type: none"> <i>value</i>—Hexadecimal or decimal value that represents the 16-bit configuration register value that you want to use the next time the router is restarted. The value range is from 0x0 to 0xFFFF (0 to 65535 in decimal). The recommended value is 0x2102. <p>See Table 4 and Table 5 for more information about the configuration register settings.</p>
Step 5	Router# Ctrl-Z	Exits configuration mode.
Step 6	Router# reload	Reboots the router to make your changes take effect.

Table 4 Software Configuration Register Bit Meanings

Bit Number	Hex	Meaning
00–03	0x0000–0x000F	Boot field (see Table 5)
06	0x0040	Ignore nonvolatile RAM (NVRAM) contents
07	0x0080	OEM bit enabled
08	0x0100	Break disabled
10	0x0400	IP broadcast with all zeros
11–2	0x0800–0x1000	Console line speed
13	0x2000	Boot default ROM software if network boot fails

Table 4 Software Configuration Register Bit Meanings (continued)

Bit Number	Hex	Meaning
14	0x4000	IP broadcasts do not have net numbers
15	0x8000	Enable diagnostic messages and ignore NVRAM contents

Table 5 Explanation of Boot Field (Configuration Register Bits 00–03)

Boot Field	Meaning
00	Stays at the system bootstrap prompt
01	Boots system image on EPROM
02-F	Specifies a default netboot filename Enables boot system commands that override default netboot filename. ¹

1. Values of the boot field are 2–15 in the form *cisco<n>-processor_name*, where $2 < n < 15$.

For more information about setting the configuration register, refer to the document [Software Configuration Register](#).

Configuring Fast Software Upgrade

To configure Fast Software Upgrade, use the commands below beginning in privileged EXEC mode:

Command	Purpose
<p>Step 1</p> <pre>Router# copy tftp disk0: Address or name of remote host []? ip-address Source filename []? imagename Destination filename imagename1? Accessing tftp://ip-address filename1. Loading filename from ip-address (via GigabitEthernet0/0): !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! !!! . . [OK - 12513988/25027584 bytes] 12513988 bytes copied in 470.900 secs (26625 bytes/sec)</pre>	<p>Uses TFTP to copy a High Availability Cisco IOS image onto the CompactFlash Disk of the active RP.</p> <ul style="list-style-type: none"> disk0:—Specifies the CompactFlash Disk memory card of the active RP. <p>The router prompts you for the IP address of the TFTP server.</p> <ul style="list-style-type: none"> <i>ip-address</i>—Specifies the IP address of the TFTP server that contains the new image. <p>The router prompts you for the name of the image file you are copying to the CompactFlash Disk.</p> <ul style="list-style-type: none"> <i>imagename</i>—Indicates the name of the image to be loaded onto the CompactFlash Disk. <p>The router prompts you to enter the name under which you want the file to appear at the destination.</p> <ul style="list-style-type: none"> <i>imagename1</i>—Indicates the name of the image as it appears at the destination.

Step 2	<pre>Router# copy tftp bootdisk: Address or name of remote host [ip-address]? Source filename [] imagename? Destination filename [imagenamel]? Accessing ip-address imagenamel Loading imagenamel from ip-address (via GigabitEthernet0/0): !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! . . . [OK - 6479384/12958720 bytes] 6479384 bytes copied in 253.184 secs (25610 bytes/sec)</pre>	<p>Uses TFTP to copy a High Availability boot image onto the CompactFlash Disk of the active RP.</p> <ul style="list-style-type: none"> bootdisk—Specifies the CompactFlash Disk of the active RP. <p>The router prompts you for the IP address of the TFTP server.</p> <ul style="list-style-type: none"> <i>ip-address</i>—Specifies the IP address of the TFTP server that contains the new image. <p>The router prompts you for the name of the image file you are copying to the CompactFlash Disk.</p> <ul style="list-style-type: none"> <i>imagenam</i>—Indicates the name of the image to be loaded onto the CompactFlash Disk. <p>The router prompts you to enter the name under which you want the file to appear at the destination.</p> <ul style="list-style-type: none"> <i>imagenam1</i>—Indicates the name of the image as it appears at the destination.
Step 3	<pre>Router# copy tftp stby-disk0: Address or name of remote host [ip-address]? Source filename []? imagename Destination filename [imagenamel]? Accessing ip-address imagename Loading filename from ip-address (via GigabitEthernet0/0):!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! . . . [OK - 12513988/25027584 bytes] 12513988 bytes copied in 475.800 secs (26625 bytes/sec)</pre>	<p>Copies the image loaded on the active RP in Step 1 onto the standby RP.</p>
Step 4	<pre>Router# copy tftp stby-bootdisk: Address or name of remote host [ip-address]? Source filename []? imagename Destination filename [imagenamel]? Accessing ip-address imagename Loading imagename from ip-address(via GigabitEthernet0/0):!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! [OK - 6479384/12958720 bytes] 6479384 bytes copied in 255.254 secs (25511 bytes/sec)</pre>	<p>Copies the boot image loaded on the active RP in Step 2 onto the standby RP.</p>
Step 5	<pre>Router# configure terminal</pre>	<p>Enters global configuration mode.</p>
Step 6	<pre>Router(config)# boot system flash disk0: imagename</pre>	<p>Specifies the system image that the router loads at startup.</p> <ul style="list-style-type: none"> <i>imagenam</i>—High Availability Cisco IOS image loaded in Step 1.

Step 7	Router(config)# boot bootldr bootdisk: imagename	Specifies the boot image that the router loads at startup. <ul style="list-style-type: none"> <i>imagename</i>—High Availability boot image loaded in Step 2.
Step 8	Router(config)# end	Exits global configuration mode.
Step 9	Router# copy running-config startup-config	(Optional) Saves the configuration changes to your startup configuration in NVRAM so the router boots with the configuration you have entered.
Step 10	Router# hw-module standby (reload reset)	Resets and reloads the standby RP with the Cisco IOS image copied onto the CompactFlash Disk and executes the image. <ul style="list-style-type: none"> reload—Reloads the standby RP. Use this option to restart the processor to upgrade an image. Use this option when the processor is operating normally. reset—Resets the standby RP. Use this option for a hard reset of the processor. Use this option if the processor is experiencing problems and does not respond to the reload option. <p>Note If you do not specify a Cisco IOS image in Step 2, this command loads and executes the bundled default Cisco IOS standby image.</p>
Step 11	Router# redundancy force-switchover	(Optional) Forces a switchover to the standby RP.

Verifying Cisco 7304 High Availability

To verify Cisco 7304 High Availability, follow these steps:

- Step 1** Enter the **show version** command to verify that the new Cisco IOS image has been successfully installed on the active and standby RPs and that the configuration register has been correctly configured.

```
IOS (tm) 7300 Software (C7300-JS-MZ), Version 12.1(20020306:160533) ]
Copyright (c) 1986-2002 by cisco Systems, Inc.
Compiled Tue 12-Mar-02 18:27 by abc
Image text-base: 0x40008970, data-base: 0x4192C000
.
.
.
Configuration register is 0x2002
.
.
.
```

- Step 2** Refer to the Cisco IOS release notes to verify that the loaded Cisco IOS image supports High Availability.
- Step 3** Enter the **show redundancy** command to confirm that a second processor has been installed in the system.

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Cisco Internetwork Operating System Software
IOS (tm) 7300 Software (C7300-P-M), Version 12.2(20030704:195727) [biff-cwisp1 229]
Copyright (c) 1986-2003 by cisco Systems, Inc.
Compiled Sun 17-Aug-03 10:49 by biff
Image text-base: 0x40008BF4, data-base: 0x42076000

Downloading default microcode: system:pxf/ucode1.
Successfully downloaded the production microcode.

Currently running ROMMON from ROM 1

Standby operating in RPR mode, console disabled
[OK][OK]

After this point, the standby console is not responsive to input.

Note that the standby RP boots up completely in RPR+ and SSO modes although the standby console is still disabled. The complete boot of the standby RP is one of the factors that allows a faster switchover time in RPR+ and SSO redundancy modes.

The following output is displayed on the standby RP console as the processor boots in RPR+ or SSO mode:

```
Self decompressing the image:
#####
##### [OK]
```

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cisco Systems, Inc.
170 West Tasman Drive
San Jose, California 95134-1706

Cisco Internetwork Operating System Software
IOS (tm) 7300 Software (C7300-JS-M), Version 12.2(20)S, EARLY DEPLOYMENT RELEASE SOFTWARE (fc1)
Copyright (c) 1986-2003 by cisco Systems, Inc.
Compiled Mon 06-Oct-03 16:02 by ssangiah
Image text-base:0x40008CFC, data-base:0x420B0000

```

Downloading default microcode:system:pxf/ucodel.
Successfully downloaded the production microcode.

Currently running ROMMON from ROM 1
cisco 7300 (NSE100) processor (revision D) with 114688K/16384K bytes of memory.
Processor board ID
R7000 CPU at 350Mhz, Implementation 39, Rev 3.2, 256KB L2, 1024KB L3 Cache

Last reset from software reset or reload
X.25 software, Version 3.0.0.
Bridging software.
PXF processor tmc0 'system:pxf/ucodel' is running ( v4.1 ).
PXF processor tmc1 'system:pxf/ucodel' is running ( v4.1 ).
3 FastEthernet/IEEE 802.3 interface(s)
4 Gigabit Ethernet/IEEE 802.3 interface(s)
2 ATM network interface(s)
509K bytes of non-volatile configuration memory.

31360K bytes of ATA compact flash in bootdisk (Sector size 512 bytes).
31360K bytes of ATA compact flash in disk0 (Sector size 512 bytes).[OK][OK]
STDBY_SERVICES_SYNC_CONFIG_SIZE_REQ received

Logging of %SNMP-3-AUTHFAIL is enabled
Successfully configured from rcsf file, ha_alternate_parse TRUE

Press RETURN to get started!

00:02:42:%SYS-6-BOOTTIME:Time taken to reboot after reload = 236 seconds
Router>
Standby console disabled

Router>
Standby console disabled

Router>
Standby console disabled

Router>
Standby console disabled

Router>
Standby console disabled

```

- The following situations are reasons for the system falling back to RPR redundancy mode.

If the processor is configured to operate in RPR+ or SSO redundancy modes and the processor determines at bootup that it cannot operate in those modes, then the system falls back to RPR mode. A system can fall back to RPR mode due to an error that prevents the configured mode from taking effect such as a failure in the synchronization of the running configuration. The fallback to RPR mode is reflected in the **show redundancy** command output where the configured and operations redundancy modes are different.

The most likely reason for a system falling back to RPR mode is that the Cisco 7304 chassis has installed cards that do not support RPR+ or SSO redundancy modes. For example, if a system has a PCI port adapter carrier card, the system would fall back to RPR mode even if RPR+ or SSO were the configured modes.

The fallback would also happen if any card not supported in RPR+ or SSO redundancy modes was inserted into the system using OIR.

Note that there is no support for fall-forward in that if all cards not supporting RPR+ or SSO modes are OIR removed from the system, then the system does not fall forward to the previously configured mode (such as RPR+ or SSO). The Cisco 7304 router remains in RPR mode. However if you remove the PCI port adapter carrier card, you can effect a fall-forward on your system by the following methods:

- Enter the **redundancy force-switchover** command. The newly active RP and standby RP then returns to the configured mode that it was in, whether RPR+ or SSO.
- Enter the **hw-module standby** command to reload the standby RP. Both the active and standby RP then returns to the configured mode that it was in, whether RPR+ or SSO. This method is less disruptive to the network because you avoid executing a switchover. When you execute a switchover, traffic forwarded is temporarily halted until the switchover is complete.

When redundancy mode fallback happens, the following informational message is logged to the console:

```
*Aug 19 13:32:25.979: %REDUNDANCY-3-IPC: IOS versions do not match, redundancy mode fallback
```

```
*Aug 19 13:32:28.523: %HA-6-FALLBACK: System redundancy mode fallback - configured mode(SSO), fallback mode(RPR)
```

- If you attempt to perform a manual switchover by entering the **redundancy force-switchover** command and the standby RP is not up or is in an error condition, the switchover is aborted and output similar to the following is displayed:

```
Router# redundancy force-switchover
Proceed with switchover to standby NSE? [confirm]
Standby not operational; switchover aborted.
```

- If you attempt to perform a reset of a standby RP that is not up or is in an error condition such as an indefinite pause, the following message is displayed and the reset is not performed:

```
Router# hw-module standby reload
Proceed with reload of standby NSE? [confirm]y
%Standby RP is not up
```

If you see this error message, reload the standby RP by entering the **hw-module standby reset** command.

- You cannot perform a boot from a network (TFTP) server of the standby RP. You must boot the standby RP from the CompactFlash Disk. If you attempt to perform a boot from a network server of the standby RP, error output similar to the following is displayed:

```
.
.
.
Self decompressing the image :
#####
#####
#####
#####
#####
[OK]

Currently running ROMMON from ROM 1

Downloading default microcode:system:pxf/ucode1.
Successfully downloaded the production microcode.

%Error:Flash type not supported
```

```
%Error:NSE fpga download incomplete 0x40
System in minimal boot mode...
```

```
%PLATFORM-3-MINIMALBOOT:System in minimal boot mode.
%LINK-4-NOMAC:A random default MAC address of 0000.0c70.30a0 has
been chosen. Ensure that this address is unique, or specify MAC
addresses for commands (such as 'novell routing') that allow the
use of this address as a default.
%SYS-6-BOOT_MESSAGES:Messages above this line are from the boot loader.
boot of "muck/ssangiah/c7300-p-mz 223.255.254.254" using boot helper
"bootdisk:c7300-boot-mz" failed
error returned:No usable interfaces
loadprog:error - on file open
boot:cannot load "muck/ssangiah/c7300-p-mz 223.255.254.254"
```

- In the event the active RP in the Cisco 7304 router suffers a memory leak, the High Availability functionality can be adversely affected and could potentially cause non-deterministic behavior. The reason is that memory allocation failures can cause multiple failures in the data synchronization process between the active and the standby RPs. Such failures can cause the standby RP to fall out of synchronization with the active RP so that when the memory leak eventually does cause a switchover, the standby RP would not necessarily be in a state that allows it to take over and function properly as the active RP.

To avoid a bad switchover when the router experiences a memory leak, the active RP can be configured to automatically reload itself when it reaches a certain threshold of free memory. Configure the router to create a core dump with memory size exception parameters and to reload when certain memory size parameters are violated. Use the **exception memory minimum** command and **exception dump** command.

The **exception memory minimum** command defines a minimum contiguous block of memory in the free pool and a minimum size for the free memory pool. The command syntax is:

```
[no] exception memory minimum size
```

The value of *size* is in bytes and is checked every 60 seconds. If you enter a size that is greater than the free memory and the **exception dump** command has been configured, the router creates a core dump and reloads the Cisco IOS software after 60 seconds. If the **exception dump** command is not configured, the router reloads without generating a core dump.

The following example configures the router to monitor the free memory. If the free memory falls below 250,000 bytes, the router dumps the core and reloads the Cisco IOS software.

```
Router# configure terminal
Router (config)# exception dump 131.108.92.2
Router (config)# exception core-file memory.overrun
Router (config)# exception memory minimum 250000
```

Monitoring and Maintaining Cisco 7304 High Availability

Use the following **show** and **debug** commands to monitor and maintain Cisco 7304 High Availability:

Command	Purpose
Router# show redundancy	Displays redundancy information for the active and standby processors.
Router# debug redundancy alarms	Enables redundancy alarms debugging.
Router# debug redundancy all	Enables all debugging related to RP redundancy.
Router# debug redundancy fsm	Enables redundancy facility (RF) finite state machine (FSM) debugging.
Router# debug redundancy keepalive	Enables redundancy keepalive debugging.
Router# debug redundancy peer-monitor	Enables redundancy peer monitor debugging.
Router# debug redundancy services	Enables redundancy services debugging.
Router# debug redundancy timesync	Enables redundancy time synchronization debugging.

For more information about these commands, see the [debug redundancy](#) and [show redundancy](#) command reference pages in this document.

Configuration Examples

This section provides the following configuration examples:

- [Setting the Config-Register Boot Variable Example, page 20](#)
- [Loading a New Image Example, page 21](#)
- [Performing a Manual Switchover Example, page 21](#)

Setting the Config-Register Boot Variable Example

The following example shows how to set the config-register boot variable:

```
Router# show version
.
.
.
IOS (tm) 7300 Software (C7300-JS-MZ), Version 12.1(20020306:160533)
Copyright (c) 1986-2002 by cisco Systems, Inc.
Compiled Tue 12-Mar-02 18:27 by abc
Image text-base: 0x40008970, data-base: 0x4192C000
.
.
.
Configuration register is 0x2002
.
.
.
configure terminal
boot system flash disk0: C7300-js-mz
```

```
config-register 0x2102
Ctrl-Z
reload
```

Loading a New Image Example

The following example shows how to load a Cisco IOS image onto the active and standby RPs and how to reset the standby RP to execute the newly loaded image:

```
Router# copy tftp disk0:c7300-js-mz
Router# copy tftp bootdisk:c7300-boot-mz
Router# copy tftp stby-disk0:c7300-js-mz
Router# copy tftp stby-bootdisk:c7300-boot-mz
Router# hw-module standby reset
Proceed with reset of standby NSE? [confirm]y
Router# copy running-config startup-config
```

Performing a Manual Switchover Example

The following example shows how to manually trigger a switchover between the active and standby RPs:

```
Router# redundancy force-switchover
```

Command Reference

This section documents new or modified commands in this release or in prior releases. All other commands used with this feature are documented in the [Cisco IOS Release 12.2 command reference](#) publications and in the document *Cisco 7304 Router Platform-Specific Commands*.

- [debug redundancy](#)
- [hw-module standby](#)
- [redundancy mode](#)
- [redundancy force-switchover](#)
- [show c7300](#)
- [show redundancy](#)

debug redundancy

To enable Route Processor (RP) redundancy debugging, use the **debug redundancy** command in privileged EXEC mode. To disable RP redundancy debugging, use the **no** form of this command.

```
debug redundancy {alarms | all | fsm | keepalive | peer-monitor | services | timesync |
config-sync {bulk | lbl} | ehsa | kpa | msg | progression | status | timer }
```

```
no debug redundancy {alarms | all | fsm | keepalive | peer-monitor | services | timesync |
config-sync {bulk | lbl} | ehsa | kpa | msg | progression | status | timer }
```

Syntax Description		
alarms		Enables redundancy alarms debugging.
all		Enables all redundancy debugging.
fsm		Enables redundancy facility (RF) finite state machine (FSM) debugging.
keepalive		Enables redundancy keepalive debugging.
peer-monitor		Enables redundancy peer monitor debugging.
services		Enables redundancy services debugging.
timesync		Enables redundancy time synchronization debugging.
config-sync {bulk lbl}		Enables debugging messages for the synchronization of the configuration files.
ehsa		Enables debugging redundancy facility and EHSA interaction.
kpa		Enables redundancy facility keepalives.
msg		Enables redundancy facility message events.
progression		Enables redundancy facility progression events.
status		Enables redundancy facility status events.
timer		Enables redundancy facility timer events.

Defaults Redundancy debugging is not enabled by default.

Command Modes Privileged EXEC

Command History	Release	Modification
	12.1(10)EX2	This command was introduced.
	12.2(18)S	This command was introduced on Cisco 7304 routers running Cisco IOS Release 12.2S.

Usage Guidelines You must enter a keyword when using the **debug redundancy** command.

Use the **alarms** keyword to display information about alarms that are generated in response to various redundancy-related events.

Use the **all** keyword to turn on all debug commands relating to the redundant RP feature.

Use the **fsm** keyword to display debug information about the finite state machine that tracks the status of the peer RP.

Use the **keepalive** keyword to display information about the exchange of keepalives between the primary and standby RP. If a certain number of keepalive responses are missed, the system that notices the keepalive failure takes whatever action is appropriate for recovering a possibly indefinitely paused or crashed peer RP.

Use the **peer-monitor** keyword to display debug information about the process on the active RP that monitors the status and health of the peer standby RP.

Use the **services** keyword to display information about miscellaneous service-related actions that happen across the standby and active RPs.

Use the **timesync** keyword to display debug information about the synchronization of the system clock between the active and standby RPs.

Examples

The following example shows how to enable redundancy alarms debugging:

```
Router# debug redundancy alarms
```

```
Asserting alarm :STBDY_REMOVED
```

The following example shows how to enable all redundancy debugging:

```
Router# debug redundancy all
```

The following example shows how to enable redundancy FSM debugging:

```
Router# debug redundancy fsm
```

```
*Mar 22 18:32:15:ehsa_fsm:state change, events:major=2 minor=1
REDUNDANCY_PEERSTANDBY_INITED(9) => REDUNDANCY_PEERSTANDBY_NONOPERATIONAL(6)
*Mar 22 18:32:40:ehsa_fsm:state change, events:major=2 minor=3
REDUNDANCY_PEERSTANDBY_NONOPERATIONAL(6) => REDUNDANCY_PEERSTANDBY_NOTPRESENT(10)
```

The following example shows how to enable redundancy keepalive debugging:

```
Router# debug redundancy keepalive
```

```
Received keepalive
Sent keepalive
Received keepalive
Sent keepalive
Received keepalive
Sent keepalive
Received keepalive
Sent keepalive
```

The following example shows how to enable redundancy peer-monitor debugging:

```
Router# debug redundancy peer-monitor
00:09:48:%REDUNDANCY-5-PEER_MONITOR_EVENT:Active detected a standby crash
(raw-event=KEEPALIVE_FAILURE(7))
00:10:13:%REDUNDANCY-5-PEER_MONITOR_EVENT:Active detected a standby removal
(raw-event=PEER_NOT_PRESENT(3))
```

The following example shows how to enable redundancy services debugging:

```
Router# debug redundancy services

set_slave_monvar:syncing monvar to standby:DIAG=1
set_slave_monvar:syncing monvar to standby:BOOT=tftp:abc/c7300-boot-mz 171.69.1.129,12
set_slave_monvar:syncing monvar to standby:CONFIG_FILE=
set_slave_monvar:syncing monvar to standby:BOOTLDR=bootdisk:c7300-boot-mz
ehsa_sync_config_fn:config-sync request
```

The following example shows how to enable redundancy time synchronization debugging:

```
Router# debug redundancy timesync

set_slave_time:timesync sent, time:*17:27:14.251 UTC Fri Mar 22 2002
(3225806834.1081509396)
set_slave_time:timesync sent, time:*17:28:14.255 UTC Fri Mar 22 2002
(3225806894.1098671504)
```

Related Commands

Command	Description
show c7300	Displays the types of cards (RPs and line cards) installed in a Cisco 7304 router.
show redundancy	Displays redundancy information for the active and standby RPs.

hw-module standby

To reset the standby Route Processor (RP), use the **hw-module standby** command in privileged EXEC mode.

hw-module standby {reset | reload}

Syntax Description

reset	Resets the redundant RP.
reload	Reloads the redundant RP.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(10)EX2	This command was introduced.
12.2(18)S	This command was introduced on Cisco 7304 routers running Cisco IOS Release 12.2S.

Usage Guidelines

Use this command to reset or reload the standby RP. Use the **reload** keyword to cause the standby RP to reload with an upgraded image. Use this option when the standby RP is operating normally. Use the **reset** keyword for a hard reset of the standby RP. Use this option if the standby RP is experiencing problems and does not respond to the **reload** option.

Examples

The following example shows how to reset the standby RP (NSE-100 example):

```
Router# hw-module standby reset
Proceed with reset of standby NSE? [confirm]y
```

The following example shows an attempt to reset a standby RP, which is down or experiencing some other problem such as an indefinite pause.

```
Router# hw-module standby reload
Proceed with reload of standby NSE? [confirm]y
%Standby RP is not up
```

If there is a failure to reset a standby RP because it is in some fault condition, try performing a reload of the RP.

The following example shows how to reload the standby RP:

```
Router# hw-module standby reload
Proceed with reload of standby NSE? [confirm]y
```

Related Commands	Command	Description
	debug redundancy	Enables RP redundancy debugging.
	redundancy force-switchover	Forces the standby RP to assume the role of the active RP.
	show c7300	Displays the types of cards (RP and line cards) installed in a Cisco 7304 router.
	show redundancy	Displays redundancy information for the active and standby RPs.

redundancy mode

To choose the High Availability mode, use the **redundancy mode** command in global configuration mode.

redundancy mode {rpr | rpr-plus | sso}

Syntax Description

rpr	Enables Route Processor Redundancy mode.
rpr-plus	Enables Route Processor Redundancy Plus (RPR+) mode.
sso	Enables Stateful Switchover mode.

Defaults

No default behavior or values

Command Modes

Global configuration

Command History

Release	Modification
12.2(20)S	This command was introduced on Cisco 7304 routers running Cisco IOS Release 12.2(20)S.

Usage Guidelines

Use the **redundancy mode** command to choose the High Availability mode.

You can configure your system in one of three High Availability redundancy modes wherein the standby Route Processor (RP) will take over when the active Route Processor fails. Your system behaves differently depending on the redundancy mode. Refer to the [High Availability Benefits—RPR Redundancy Mode](#), the [High Availability Benefits—RPR+ Redundancy Mode, page 6](#), and [High Availability Benefits—SSO Redundancy Mode, page 6](#) for a description of benefits under each redundancy mode.

Examples

The following example enables the Route Processor Redundancy Plus (RPR+) redundancy mode on the Cisco 7304 router. First enter global configuration mode, then enter the redundancy configuration mode (config-red) with the **redundancy** command, and finally enter the **mode rpr-plus** command to select the RPR+ redundancy mode:

```
Router# config t
Router(config)# redundancy
Router(config-red)# mode rpr-plus
```

Related Commands

Command	Description
debug redundancy	Enables RP redundancy debugging.
hw-module standby	Resets the standby RP.

Command	Description
<code>show c7300</code>	Displays the types of cards (RP and line cards) installed in a Cisco 7304 router.
<code>show redundancy</code>	Displays redundancy information for the active and standby NSEs.

redundancy force-switchover

To force the standby RP to assume the role of the active RP, use the **redundancy force-switchover** command in privileged EXEC mode.

redundancy force-switchover

Syntax Description	force-switchover	Forces switchover to the standby RP.
--------------------	------------------	--------------------------------------

Defaults	No default behavior or values
----------	-------------------------------

Command Modes	Privileged EXEC
---------------	-----------------

Command History	Release	Modification
	12.0(16)ST	This command was introduced.
	12.1(10)EX2	This command was integrated into Cisco IOS Release 12.1(10)EX2.
	12.0(17)ST	This command was introduced on Cisco 12000 series Internet routers.
	12.0(22)S	This command replaces the force-failover command on Cisco 10000 series Internet routers.
	12.2(18)S	This command was integrated into Cisco IOS Release 12.2(18)S on Cisco 7500 series routers.
	12.2(20)S	Support was added for the Cisco 7304 router. The Cisco 7500 series router is not supported in Cisco IOS Release 12.2(20)S.
	12.3(7)T	This command was integrated into Cisco IOS Release 12.3(7)T.
	12.2(27)SBC	Support for this command was integrated into Cisco IOS Release 12.2(27)SBC.

Usage Guidelines

Use the **redundancy force-switchover** command to switch control from the active processor to the standby processor. Both the active and standby processors must have a High Availability Cisco IOS image installed and must be configured for RPR redundancy mode before the **redundancy force-switchover** command can be used. Before switching over, the system first verifies that the standby processor is ready to take over.

When you use the **redundancy force-switchover** command and the current running configuration is different from the startup configuration, the system prompts you to save the running configuration before the switchover is performed.

Examples

The following example shows a switchover from the active RP to the standby RP on a Cisco 7513 router with RPR configured:

```
Router# configure terminal
Router(config)# hw-module slot 7 image slot0:rsp-pv-mz
Router(config)# hw-module slot 6 image slot0:rsp-pv-mz
```

```

Router(config)# slave auto-sync config
Router(config)# redundancy
Router(config-r)# mode rpr
Router(config-r)# end
Router# copy running-config startup-config
Router# redundancy force-switchover

```

The following example shows how to perform a manual switchover from the active to the standby processor (NSE-100) when the running configuration is different from the startup configuration:

```

Router# redundancy force-switchover

System configuration has been modified. Save? [yes/no]:y
Building configuration...
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
Proceed with switchover to standby NSE? [confirm]y

00:07:35:%SYS-5-SWITCHOVER:Switchover requested

```

The following example shows how to perform a manual switchover from the active to the standby processor when the running configuration is the same as the startup configuration:

```

Router# redundancy force-switchover

Proceed with switchover to standby NSE? [confirm]
00:07:35:%SYS-5-SWITCHOVER:Switchover requested

```

Related Commands

Command	Description
hw-module sec-cpu reset	Resets and reloads the standby RP with the specified Cisco IOS image and executes the image.
hw-module slot image	Specifies a High Availability Cisco IOS image to run on a standby RP.
mode (HSA redundancy)	Configures the redundancy mode.
redundancy	Enters redundancy configuration mode.

show c7300

To display status of RPs, information about types of line cards installed, information about line card configuration guidelines and incompatible FPGA images in a Cisco 7304 router, use the **show c7300** command in global configuration mode.

show c7300

Syntax Description This command has no arguments or keywords.

Defaults No default behavior or values

Command Modes Global configuration

Command History

Release	Modification
12.1(9)EX	This command was introduced.
12.1(10)EX	The output of this command was enhanced to include information about Field-Programmable Gate Array (FPGA) images.
12.1(10)EX2	The output of this command was enhanced to include information about a standby RP.
12.2(18)S	This command was introduced on Cisco 7304 routers running Cisco IOS Release 12.2S.

Usage Guidelines

This command displays the status of the active and standby RPs installed, types of line cards (such as native line cards, ATM line cards, and PCI port adapter carrier cards), and information about incompatible FPGA images in a Cisco 7304 router. This command also displays if your system is in compliance with line card configuration guidelines. Empty slots are not displayed in the **show c7300** command output. When the bundled and current FPGA images are compatible, they are not displayed.

If your system contains an unsupported line card or RP with no matching bundled FPGA image in Cisco IOS, then this command displays “None” instead of the bundled FPGA version number.

Examples

The following example displays information about a Cisco 7304 router that has current FPGA images:

```
Router# show c7300
Slot      Card Type      Status      Insertion time
----      -
0,1      NSE-100       Active      00:13:16 ago
4        10C48-POS     Active      00:01:43 ago
```

```
System is compliant with hardware configuration guidelines.
```

```
All the FPGAs in the system are up-to-date
```

```
Network IO Interrupt Throttling:
  throttle count=3, timer count=3
  active=0, configured=1
  netint usec=3999, netint mask usec=200
```

The following example displays information about a Cisco 7304 router that has incompatible FPGA images that need to be updated. If your system contains an unsupported line card or RP with no matching bundled FPGA image in Cisco IOS, "None" is displayed instead of a bundled FPGA version number.

```
Router# show c7300
Slot      Card Type          Status          Insertion time
----      -
0,1       NSE-100            Active          00:02:26 ago
4         6T3                Active          00:02:23 ago
5         6T3                Active          00:02:23 ago
```

System is compliant with hardware configuration guidelines.

%WARNING:The following FPGAs in the system may need an update.

```
Slot      Card Type          Current FPGA    Bundled FPGA
----      -
0         NSE-100 (MB)      0.12           None
```

```
Network IO Interrupt Throttling:
  throttle count=0, timer count=0
  active=0, configured=1
  netint usec=3999, netint mask usec=200
```

The following example displays sample output information about the redundancy status of the RPs installed in the system. In the example below, the active RP is the NSE-100 installed in slot 0 and slot 1. The standby is the NSE-100 installed in slot 2 and slot 3.

```
Router# show c7300
Slot      Card Type          Status          Insertion time
----      -
0,1       NSE-100            Active          00:02:03 ago
2,3       NSE-100            Standby         00:02:03 ago
4         4OC3-POS           Active          00:01:59 ago
5         6T3                Active          00:01:59 ago
```

System is compliant with hardware configuration guidelines.

```
Network IO Interrupt Throttling:
  throttle count=0, timer count=0
  active=0, configured=1
  netint usec=3999, netint mask usec=200
```

The following example displays the high availability options and the option output.

```
NPEG100# show c7300 ha ?
registers  Show redundancy negotiation registers
statistics Show chkpt event statistics
NPEG100#
```

```
NPEG100# show c7300 ha registers
Redundancy Control Register Settings (0x1012)
  This processor controls the bus
  This processor is ready
  This processor asserted the NSE OK backplane signal
Redundancy Status Register Values (0x1011)
  Other processor is present
  Other processor is ready
  Other processor asserted the NSE OK backplane signal
```

```
Redundancy Interrupt Enable Register Value:0x5
Redundancy Interrupt Status Register Value:0x50
```

```
NPEG100#
```

```
-----
```

```
NPEG100# show c7300 ha statistics
```

```
This is Active RP
```

```
WS HA CHKPT aggregate statistics
```

```
Messages sent:3468 (Bytes 72236)
```

```
Blocking messages:11
```

```
Nonblocking messages failures:
```

```
Failures:0, Unknown events:0
```

```
Messages received:3 (Bytes 2176)
```

```
Messages dropped:Tx 0 Rx 0
```

```
Last sent 00:00:00
```

```
Last transmit dropped never
```

```
Last received 00:57:28
```

```
Last receive dropped never
```

```
CHKPT statistics for the OIR Sync Event
```

```
Messages sent:5 (Bytes 100)
```

```
Blocking messages:5
```

```
Nonblocking messages failures:
```

```
Failures:0, Unknown events:0
```

```
Messages received:0 (Bytes 0)
```

```
Messages dropped:Tx 0 Rx 0
```

```
Last sent 00:53:29
```

```
Last transmit dropped never
```

```
Last received never
```

```
Last receive dropped never
```

```
[Output elided]
```

```
CHKPT statistics for the Standby Logger Message event
```

```
Messages sent:0 (Bytes 0)
```

```
Blocking messages:0
```

```
Nonblocking messages failures:
```

```
Failures:0, Unknown events:0
```

```
Messages received:1 (Bytes 80)
```

```
Messages dropped:Tx 0 Rx 0
```

```
Last sent never
```

```
Last transmit dropped never
```

```
Last received 00:58:00
```

```
Last receive dropped never
```

```
NPEG100#
```

```
-----
```

Related Commands

Command	Description
show c7300 errorlog	Displays error information on a Cisco 7304 router.
show diag	Displays hardware information for any slot or the chassis.
show redundancy	Displays redundancy information for the active and standby RPs.
show version	Displays the configuration of the system hardware, the number of each interface type installed, the Cisco IOS software version, the names and sources of configuration files, and the boot images. Displays the configuration of the ROM monitor.

show redundancy

To display redundancy information for the active and standby Route Processors (RPs), use the **show redundancy** command in privileged EXEC mode.

show redundancy {states | counters | clients | history | switchover history}

Syntax Description		
	states	Displays redundancy states.
	counters	Displays redundancy counters.
	clients	Displays redundancy clients.
	history	Displays redundancy history.
	switchover history	Displays redundancy switchover history.

Defaults No default behavior or values.

Command Modes Privileged EXEC

Command History	Release	Modification
	12.1(10)EX2	This command was introduced.
	12.2(18)S	This command was introduced on Cisco 7304 routers running Cisco IOS Release 12.2S.
	12.2(20)S	The states , counters , clients , history , and switchover history keywords were added.

Usage Guidelines Use this command to display information about the active and standby RPs installed in a Cisco 7304 router.

Examples The following example shows sample output for the **show redundancy** command:

```
Router# show redundancy
Redundant System Information :
-----
    Available system uptime = 23 hours, 21 minutes
    Switchovers system experienced = 0
        Standby failures = 0
        Last switchover reason = none

        Hardware Mode = Duplex
    Configured Redundancy Mode = SSO
    Operating Redundancy Mode = SSO
    Maintenance Mode = Disabled
    Communications = Up
```

```

Current Processor Information :
-----
      Active Location = slot 0
      Current Software state = ACTIVE
      Uptime in current state = 23 hours, 21 minutes
      Image Version = Cisco Internetwork Operating System Software
IOS (tm) 7300 Software (C7300-JS-M), Version 12.2(20)S, EARLY DEPLOYMENT RELEASE SOFTWARE
(fc1)
Copyright (c) 1986-2003 by cisco Systems, Inc.
Compiled Mon 06-Oct-03 16:02 by ssangiah
      BOOT = disk0:c7300-p-mz,12
      CONFIG_FILE =
      BOOTLDR = bootdisk:c7300-boot-mz
      Configuration register = 0x2

Peer Processor Information :
-----
      Standby Location = slot 2
      Current Software state = STANDBY HOT
      Uptime in current state = 23 hours, 18 minutes
      Image Version = Cisco Internetwork Operating System Software
IOS (tm) 7300 Software (C7300-JS-M), Version 12.2(20)S, EARLY DEPLOYMENT RELEASE SOFTWARE
(fc1)
Copyright (c) 1986-2003 by cisco Systems, Inc.
Compiled Mon 06-Oct-03 16:02 by ssangiah
      BOOT = disk0:c7300-p-mz,12
      CONFIG_FILE =
      BOOTLDR = bootdisk:c7300-boot-mz
      Configuration register = 0x2

Router#

```

Table 6 describes the significant fields shown in the display.

Table 6 show redundancy Field Descriptions

Field	Description
Configured Redundancy Mode	Mode the system is configured to run in can be “Route Processor Redundancy”, “Route Processor Redundancy Plus” or “SSO.”
Operating Redundancy Mode	Mode the system actually is in. This can be different from the configured mode because the presence of certain hardware or errors of certain kinds can cause the system to fall back to a different mode.
Current software state	The redundancy state that the system is in. The correct state for the active system is ACTIVE. For the standby the correct terminal state depends on its operational redundancy mode. For SSO, this state is the “STANDBY HOT” state, for RPR+, it is the “STANDBY COLD CONFIG” state, while for RPR it is the “STANDBY COLD” state.

The following example shows sample output for the **show redundancy states** command:

```
Router# show redundancy states
my state = 13 -ACTIVE
    peer state = 8 -STANDBY HOT
        Mode = Duplex
        Unit ID = 0

Redundancy Mode (Operational) = SSO
Redundancy Mode (Configured) = SSO
    Split Mode = Disabled
    Manual Swact = Enabled
    Communications = Up

    client count = 18
    client_notification_TMR = 30000 milliseconds
        RF debug mask = 0x0
```

The following example shows sample output for the **show redundancy counters** command:

```
Router# show redundancy counters
Redundancy Facility OMs
    comm link up = 2
    comm link down down = 1

    invalid client tx = 2
    null tx by client = 0
    tx failures = 0
    tx msg length invalid = 0

    client not rxing msgs = 0
    rx peer msg routing errors = 0
    null peer msg rx = 0
    errored peer msg rx = 0

    buffers tx = 159
    tx buffers unavailable = 0
    buffers rx = 156
    buffer release errors = 0

    duplicate client registers = 1
    failed to register client = 0
    Invalid client syncs = 0
```

The following example shows sample output for the **show redundancy clients** command:

```
Router# show redundancy clients
clientID = 0      clientSeq = 0      RF_INTERNAL_MSG
clientID = 29     clientSeq = 60     Redundancy Mode RF
clientID = 25     clientSeq = 130    CHKPT RF
clientID = 1314   clientSeq = 137    7300 Platform RF
clientID = 22     clientSeq = 140    Network RF Client
clientID = 24     clientSeq = 150    CEF RRP RF Client
clientID = 5      clientSeq = 170    RFS client
clientID = 23     clientSeq = 220    Frame Relay
clientID = 49     clientSeq = 225    HDLC
clientID = 20     clientSeq = 310    IPROUTING NSF RF cli
clientID = 21     clientSeq = 320    PPP RF
clientID = 34     clientSeq = 350    SNMP RF Client
clientID = 52     clientSeq = 355    ATM
clientID = 35     clientSeq = 360    History RF Client
clientID = 54     clientSeq = 530    SNMP HA RF Client
clientID = 75     clientSeq = 534    VRF common
clientID = 57     clientSeq = 540    ARP
clientID = 65000  clientSeq = 65000  RF_LAST_CLIENT
```

The following example shows sample output for the **show redundancy history** command:

```
Router# show redundancy history
4w5d client added: CHKPT RF(25) seq=130
4w5d client added: 7300 Platform RF(1314) seq=137
00:00:00 client added: RFS client(5) seq=170
00:00:00 client added: History RF Client(35) seq=360
00:00:12 client added: Redundancy Mode RF(29) seq=60
00:00:12 client added: SNMP RF Client(34) seq=350
00:00:12 client added: Network RF Client(22) seq=140
00:00:12 client added: CEF RRP RF Client(24) seq=150
00:00:12 *my state = INITIALIZATION(2) *peer state = DISABLED(1)
00:00:12 RF_PROG_INITIALIZATION(100) RF_INTERNAL_MSG(0) op=0 rc=11
00:00:12 RF_PROG_INITIALIZATION(100) Redundancy Mode RF(29) op=0 rc=11
00:00:12 RF_PROG_INITIALIZATION(100) CHKPT RF(25) op=0 rc=11
00:00:12 RF_PROG_INITIALIZATION(100) 7300 Platform RF(1314) op=0 rc=11
00:00:12 RF_PROG_INITIALIZATION(100) Network RF Client(22) op=0 rc=11
00:00:12 RF_PROG_INITIALIZATION(100) CEF RRP RF Client(24) op=0 rc=11
00:00:12 RF_PROG_INITIALIZATION(100) RFS client(5) op=0 rc=11
00:00:12 RF_PROG_INITIALIZATION(100) SNMP RF Client(34) op=0 rc=11
00:00:12 RF_PROG_INITIALIZATION(100) History RF Client(35) op=0 rc=11
00:00:12 RF_PROG_INITIALIZATION(100) RF_LAST_CLIENT(65000) op=0 rc=11
00:00:12 *my state = NEGOTIATION(3) peer state = DISABLED(1)
00:00:12 RF_EVENT_GO_STANDBY(512) op=0
00:00:12 *my state = STANDBY COLD(4) peer state = DISABLED(1)
00:00:12 RF_PROG_STANDBY_COLD(101) RF_INTERNAL_MSG(0) op=0 rc=11
00:05:50 RF_PROG_STANDBY_HOT(105) IPRouting NSF RF client(20) op=0 rc=11
00:05:50 RF_PROG_STANDBY_HOT(105) PPP RF(21) op=0 rc=11
00:05:50 RF_PROG_STANDBY_HOT(105) SNMP RF Client(34) op=0 rc=11
00:05:50 RF_PROG_STANDBY_HOT(105) ATM(52) op=0 rc=11
00:05:50 RF_PROG_STANDBY_HOT(105) History RF Client(35) op=0 rc=11
00:05:50 RF_PROG_STANDBY_HOT(105) SNMP HA RF Client(54) op=0 rc=11
00:05:50 RF_PROG_STANDBY_HOT(105) VRF common(75) op=0 rc=11
00:05:50 RF_PROG_STANDBY_HOT(105) ARP(57) op=0 rc=11
00:05:50 RF_PROG_STANDBY_HOT(105) RF_LAST_CLIENT(65000) op=0 rc=0
00:05:50 RF_EVENT_CLIENT_PROGRESSION(503) RF_LAST_CLIENT(65000) op=8 rc=0
00:05:50 RF_EVENT_PEER_PROG_DONE(506) RF_LAST_CLIENT(65000) op=105
00:05:51 *my state = ACTIVE(13) *peer state = STANDBY HOT(8)
```

The following example shows sample output for the **show redundancy switchover history** command:

```
Router# show redundancy switchover history
Index Previous Current Switchover Switchover
      active active reason          time
-----
   1      2      0 user forced 13:11:00 UTC Tue Aug 19 2003
   2      0      2 user forced 13:24:09 UTC Tue Aug 19 2003
```

Related Commands

Command	Description
debug redundancy	Enables RP redundancy debugging.
hw-module standby	Resets the standby RP.
redundancy force-switchover	Forces the standby RP to assume the role of the active RP.
show c7300	Displays the types of cards (RP and line cards) installed in a Cisco 7304 router.

Glossary

Active NSE—The Network Services Engine (NSE) that controls and runs the routing protocols, and presents the system management interface.

FPGA—Field-Programmable Gate Array (FPGA) is a programmable logic device.

FSU—Fast Software Upgrade (FSU) reduces outage time during a software upgrade by transferring functions to the standby RP that has the upgraded Cisco IOS software pre-installed. You can also use FSU to downgrade a system to an older version of Cisco IOS.

NPE—Network Processing Engine (NPE). The NPE-G100 is a general-purpose processor available on the Cisco 7304 router. It handles approximately up to 1 mpps and is optimized for flexible feature support.

NSE—Network Services Engine (NSE). The high-performance NSE-100 and NSE-150 are available on the Cisco 7304 router. Both NSEs deliver an evolving set of application-specific, hardware-accelerated IP services through Cisco Parallel Express Forwarding (PXF) technology.

NSF—Cisco Nonstop Forwarding (NSF) works with the Stateful Switchover (SSO) feature in Cisco IOS software. SSO is a prerequisite of Cisco NSF. NSF works with SSO to minimize the amount of time a network is unavailable to its users following a switchover. The main objective of Cisco NSF is to continue forwarding IP packets following a Route Processor (RP) switchover.

NVRAM—nonvolatile RAM. RAM that retains its contents when a unit is powered off. Most Cisco routers store their configuration in NVRAM.

Online Insertion and Removal—online insertion and removal (OIR) of Route Processors (RPs). If you perform a removal of the active RP from a Cisco 7304 router with redundant RPs, the standby RP (if it is booted up and ready as the standby RP) detects the removal of the active RP and switches over to become the new active RP. If the previously active Route Processor is inserted, it comes up as the standby RP.

Redundancy Mode—The redundancy mode for which your system can be configured where the standby Route Processor (RP) will take over when the active Route Processor fails. The redundancy modes are Route Processor Redundancy (RPR), Route Processor Redundancy Plus (RPR+), and Stateful Switchover (SSO). Your system behaves differently depending on the redundancy mode, such as whether the standby RP boots up partially or completely, what the switchover time to a standby RP is, whether the startup configuration and running configuration are synchronized from the active RP to the standby RP, and whether line cards are reset across the switchover.

RPR—Route Processor Redundancy is a redundancy mode that allows Cisco IOS software to be booted on the standby Route Processor (RP) prior to switchover (a cold boot). In RPR mode, the standby RP loads a Cisco IOS image at boot time and initializes itself in standby mode; however, although the startup configuration is synchronized to the standby RP, system changes are not. In the event of a fatal error on the active RP, the system switches to the standby processor, which reinitializes itself as the active processor, reads and parses the startup configuration, reloads all of the line cards, and restarts the system.

RPR+—Route Processor Redundancy Plus redundancy mode. The standby Route Processor (RP) is fully initialized. The active RP dynamically synchronizes startup and the running configuration changes to the standby RP, meaning that the standby RP need not be reloaded and reinitialized (a "hot boot"). This allows for a faster switchover to a standby RP, usually in 4-5 seconds. Line cards are not reset across the switchover (except for ATM line cards).

SSO—Stateful Switchover redundancy mode provides all the functionality of RPR+ in that Cisco IOS software is fully initialized on the standby Route Processor (RP). In addition, SSO supports synchronization of line card, protocol, and application state information between RPs for supported features and protocols (a "hot standby").

Standby NSE—The network services engine (NSE) that waits, ready to take over the functions of the active NSE in the event of unplanned or planned downtime.