



# Route Processor Redundancy Plus for the Cisco uBR10012 Broadband Router

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This document describes the Route Processor Redundancy Plus (RPR+) feature on the Cisco uBR10012 universal broadband router. RPR+ and DOCSIS Stateful Switchover (DSSO) support in Cisco IOS® Software for fast route processor failover without DOCSIS line card reboot.



**Note**

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Cisco IOS Release 12.2(33)SCA integrates support for this feature on the Cisco CMTS routers. This feature is also supported in Cisco IOS Release 12.3BC, and this document contains information that references many legacy documents related to Cisco IOS 12.3BC. In general, any references to Cisco IOS Release 12.3BC also apply to Cisco IOS Release 12.2SC.

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With RPR+ and DOCSIS SSO, the Cisco uBR10012 can rapidly fail over from the active route processor to the standby processor without the reloading of the cable line cards. However, even though the cable line cards are not reset, the new active route processor needs to perform certain recovery procedures in order for cable line card traffic-flow to resume. A Cisco implementation provides priority-recovery procedures for those modems carrying voice, providing more rapid recovery of voice services.



**Note**

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From Cisco IOS release 12.2SC onwards, NSF and SSO is recommended and supported on the Cisco uBR10012 router. For SSO configuration details, see the "Configuring SSO" section in the Stateful Switchover guide at the following link: [http://www.cisco.com/en/US/docs/ios/12\\_0s/feature/guide/sso26s.html#wp1338159](http://www.cisco.com/en/US/docs/ios/12_0s/feature/guide/sso26s.html#wp1338159)

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## Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to <http://tools.cisco.com/ITDIT/CFN/>. An account on <http://www.cisco.com/> is not required.

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# Prerequisites for Route Processor Plus Redundancy

- You must have the same image on both the active and standby RPs to support RPR+. If one or more RPs does not have an RPR+ image, the router reverts to RPR mode on both RPs.
- Two PRE1 or PRE2 modules must be installed in the Cisco uBR10012 chassis. The order number for the PRE1 module is UBR10-PRE1. You cannot mix PRE modules with PRE1 or PRE2 modules in the same chassis.



### Note

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The PRE module no longer ships with the Cisco uBR10012 chassis.

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- For full redundancy, the Fast Ethernet port on the standby RP must have its own connection to the network. The console port on the standby RP must also be connected to a terminal, either by connecting it to a second terminal or by using a terminal server or other device to connect it to the same terminal used by the PRE1 or PRE2 module.
- Both PRE1 or PRE2 modules must be configured with the same amount of onboard SDRAM. A standby RP cannot come online as the active RP if the standby RP has a smaller amount of SDRAM than the active RP.

# Restrictions for Route Processor Plus Redundancy

## ARP Filtering Statistics

The Cisco uBR10012 router maintains ARP filtering statistics on the Performance Routing Engine (PRE) module. Statistics are viewed with the **show cable arp-filter** command for a specified interface. When a switchover event occurs, as in RPR+ Redundancy, these ARP filtering statistics are reset to zero.

For additional information about ARP filtering, refer to the following document on Cisco.com:

- *Cable ARP Filtering*

<http://www.cisco.com/en/US/docs/cable/cmts/feature/cblarpfl.html>

### Command-line Interface Synchronization and SNMP

Command-line interface (CLI) configuration commands are synchronized only with the standby Performance Routing Engine (PRE) module. Simple Network Management Protocol (SNMP) persistence is not supported through a PRE1 or PRE2 switchover. Any configuration that is done with SNMP commands is not synchronized with the standby PRE module.

### Console Port Usage After a PRE1 or PRE2 Module Switchover

When an active RP fails, and the standby RP becomes the active RP, you must use the console port on the new active RP to give command-line interface (CLI) commands and display statistics for the system. If you have connected your PC or terminal to the console port on an active RP and a switchover occurs, you no longer are able to access the console and the display shows "Standby console disabled."

To access the console, move the PC or terminal's serial cable to the console port on the other PRE1 or PRE2 module, which is now acting as the active RP.

### Encrypted Multicast

Encrypted multicast is not supported during a line card switchover nor during a PRE1 or PRE2 switchover.

### External Management Stations

External management stations lose connectivity with the cable modem termination system (CMTS) during PRE1 or PRE2 switchover. Stations must reestablish connectivity after the switchover between PRE1 or PRE2 modules is complete.

### Flap Detection on WAN Interfaces During Switchover

Neighboring routers detect flapping on WAN interfaces during a switchover. The neighboring routers reconverge after the switchover is complete.

**Note**

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Cable interfaces do not flap during a switchover. Service may be temporarily suspended for approximately 30 seconds during a switchover and reinitialization, but service to cable interfaces does not stop.

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### Link States Reinitialized After Switchover

The synchronization of link states is not maintained between the active and standby RP. Link states are reinitialized after switchover.

### MIB Variables Reinitialized After Switchover

All MIB variables will be re-initialized following a switchover.

### Telnet Sessions Disconnected During Switchover

A switchover automatically disconnects any Telnet sessions on the active (failed) RP.

## Information About Route Processor Plus Redundancy

When two route processors (RPs) are installed in a Cisco uBR10012 router chassis, one RP acts as the active RP, and the other acts as a backup, or standby, RP. If the active RP fails, or is removed from the system, the

standby RP detects the failure and initiates a switchover. During a switchover, the standby RP assumes control of the router, connects with the network interfaces, and activates the local network management interface and system console.

Using the RPR+ feature, the standby RP is fully initialized and configured. This allows RPR+ to dramatically shorten the switchover time if the active RP fails, or if a manual switchover is performed. Because both the startup configuration and running configuration are continually synchronized from the active to the standby RP, line cards are not reset during a switchover. The interfaces remain up during this transfer, so neighboring routers do not detect a link flap (that is, the link does not go down and back up).

Each RP contains all the resources required to operate the router, such as bootflash memory, Flash disks, Ethernet ports, and console port. In the default operation, the secondary RP also synchronizes the major systems files, such as the Cisco IOS startup configuration file, so that during a switchover, the secondary RP can duplicate the active RP's configuration. This process also resets the cable and network uplink interfaces.

This section describes the switchover process with RPR+, including synchronization between the active and standby RPs, and includes the following topics:

## Benefits

### DOCSIS Stateful Switchover (DSSO)

DOCSIS stateful switchover (DSSO) increases service uptime by instantaneously switching over between dual route processors should one processor fail. Switchover takes place without resetting or reloading line cards or affecting related subsystems or processes. The advantage of DOCSIS Stateful Switchover (DSSO) (with RPR+) is that a switchover between the primary and standby RP will not require the cable interfaces to be reset, nor do the modems reregister or go offline. Furthermore, the cable modems retain their service IDs (SIDs) through the switchover.

### Standard RPR

In standard RPR, the system implemented Extended High System Availability (EHSA) redundancy, wherein the standby RP suspended its initialization midway through the startup process. To complete the initialization during a switchover, all line cards were reset and the switch fabric was reinitialized. Because initialization of the standby RP was suspended before configuration was parsed, chassis discovery and startup configuration parsing were conducted during the switchover.

### Improved Switchover Time with RPR+

RPR+ provides a faster switchover by fully initializing and fully configuring the standby RP. The configuration data on the standby RP is fully synchronized with the active RP. With RPR+, the communication with line cards is reinitialized, but the line cards are not reset.

### Supported Cable Interface Line Cards and Interface Modules

Beginning with Cisco IOS Release 12.2(11)BC3, the Cisco uBR10012 router supports the following cable interface line cards and interface modules with RPR+ and PRE1 or PRE2 modules:

- Cisco uBR10-LCP2-MC16C/MC16E/MC16S Line Card
- Cisco uBR10-LCP2-MC28C/B Line Card
- Cisco uBR10-MC5X20S Cable Interface Line Card

- Cisco uBR10-SRP-OC12SML/SMI DPT Adapter Card
- Cisco uBR10012 OC-48 DPT/POS Interface Module

## Terminology Changes with Cisco IOS Release 12.2(11)BC3

In Cisco IOS Release 12.2(11)BC3 and later, the following High Availability terms for the Cisco uBR10012 universal broadband router have been changed:

Old Term	New Term
Failover	Switchover
N+1 Redundancy	1:n Redundancy
Primary RP	Active RP
Secondary RP	Standby RP

## Synchronization

To achieve the benefits of RPR+, the chassis and slot configuration information is synchronized from the active RP to the standby RP at startup and whenever changes to the active RP configuration occur. This synchronization occurs in two separate phases:

- 1 When a standby RP first comes online, the configuration information is synchronized in bulk from the active RP to the standby RP.
- 2 When configuration changes occur, an incremental synchronization from the active RP to the standby RP is conducted. Incremental synchronizations contain either the modifications to the shelf configuration or the trigger that caused the modification.

### Synchronization During Initialization

When a system with RPR+ is initialized, the active RP performs a chassis discovery (discovery of the number and type of line cards and fabric cards in the system) and parses the startup configuration file.

The active RP then synchronizes this data to the standby RP and instructs the standby RP to complete its initialization. This method ensures that both RPs contain the same configuration information.



#### Note

Even though the standby RP is fully initialized, it interacts only with the active RP to receive incremental changes to the configuration files as they occur. CLI commands on the standby RP are not supported.

## Synchronization of Startup Configuration

The startup configuration is a text file stored in the RP's NVRAM. During system startup, the startup configuration file is copied from the active RP to the standby RP. Any existing startup configuration file on the standby RP is overwritten.

The startup configuration file is also synchronized whenever you perform the following operations:

- CLI command: copy system:running-config nvram:startup-config
- CLI command: copy running-config startup-config
- CLI command: write memory
- CLI command: copy filename nvram:startup-config
- SNMP SET of MIB variable ccCopyEntry in CISCO\_CONFIG\_COPY MIB
- System Configuration Saved on reload command.
- System Configuration Saved on redundancy force-failover command.

**Note**

Synchronization of the startup configuration file is enabled by default in RPR+ mode. Because this is necessary for RPR+ functionality, the command [no] auto-sync startup-config is not available in RPR+ mode. This command is available only in standard RPR mode. For additional information on the use of [no] auto-sync startup-config with standard RPR, see the [Route Processor Redundancy for the Cisco uBR10012 Universal Broadband Router](#).

## Incremental Synchronization of the Running Configuration

When both RPs are fully initialized, any further changes to the running configuration are synchronized to the standby RP as they occur.

### CLI commands

CLI changes to the running configuration are synchronized from the active RP to the standby RP. In effect, the CLI command is run on both the active and the standby RP.

### SNMP SET Commands

Configuration changes caused by an SNMP SET are also synchronized on a case-by-case basis. Currently only two SNMP configuration SETs are supported on the Cisco uBR10012 router:

- shut/no-shut (of an interface)
- link up/down trap enable/disable

### Changes to Chassis State

- Any changes to the chassis state because of line card insertion or removal are synchronized over to the standby RP.

- Changes to the chassis state because of switch card insertion or removal, or from configuration changes to the alarm or power supply cards, are not synchronized to the standby RP. The standby learns these configuration changes using a discovery and reconciliation process during a switchover.
- Information regarding line card states is not synced. Line cards that are not on line at the time of a switchover (that is, any cards not running the Cisco IOS software and not communicating with the active RP) are reset and reloaded during a switchover. This process does not add downtime.

## The RPR+ Switchover Process

A switchover occurs when the standby RP takes over responsibilities from the active RP. The switchover can occur automatically if the standby RP has determined that the active RP has failed, or an operator can initiate a manual switchover whenever desired.

A switchover triggers the following events:

- 1 If this is a manual switchover, the active RP verifies that the standby RP is present and is running Cisco IOS software that supports the RPR feature. If so, it instructs the standby RP to begin switchover procedures, and the active RP either attempts to reload its configured Cisco IOS software image or enters ROM monitor mode, depending on the setting of its configuration register.
- 2 The standby RP completes its initialization procedures, which includes completely loading the Cisco IOS software, verifying the physical components of the Cisco uBR10012 chassis, and parsing the startup configuration file. The standby RP is configured identically to the previous active RP, including the IP address for its onboard Fast Ethernet management interface.
- 3 The standby RP assumes responsibility as the active RP and brings the Cisco uBR10012 chassis into a known state, which includes resetting all installed and enabled line cards and respective interfaces.

**Note**

Resetting the Gigabit Ethernet and OC-12 Packet Over SONET (POS) line cards will interrupt traffic for approximately 30 seconds. The cable interface is not reset, and in support of DOCSIS requirements, the cable modems do not go offline.

**Note**

Depending on the network configuration and on the configuration of the Ethernet/Fast Ethernet interfaces, the network could take between 3 to 25 seconds after an RPR+ switchover before all end-to-end connections are fully restored. During that time it is possible that some packets might be dropped.

- 1 The new active RP begins normal systems operations, including passing traffic.

**Note**

Depending on the setting of the PRE1 or PRE2 module's configuration register, it either reloads the Cisco IOS software or is left in the ROM monitor state. If the PRE1 or PRE2 module is in the ROM monitor state, it does not begin functioning as a standby RP until it is reloaded with the hw-module sec-cpu reset command.

**Note**

The backup PRE1 or PRE2 module starts forwarding traffic immediately to cable modems, presuming that the interfaces are up, and that all the FIB, adjacency, service flow, classifiers, and Virtual Traffic Management System (VTMS) queue information are correctly configured.

## Redundant File Systems

Both the active and standby RPs have active file systems that can be accessed to store and transfer files. Table 1 lists the available file systems, the filenames that you can use with CLI commands to access the file systems, and a short description of each.

**Table 1: Cisco uBR10012 Router File Systems**

File System	Filename for CLI Commands	Description
Bootflash Secondary bootflash	bootflash: sec-bootflash:	Stores image and dump files.
NVRAM Secondary NVRAM	nvrnram: sec-nvrnram:	Typically stores the system default configuration file and startup configuration file.
System	system:	Stores the running configuration and other system files.
Disk 0 Disk 1 Slot 0 Slot 1 Secondary Disk 0 Secondary Disk 1 Secondary Slot 0 Secondary Slot 1	disk0: disk1: slot0: slot1: sec-disk0: sec-disk1: sec-slot0: sec-slot1:	Disk refers to an ATA Flash disk (48 or 128 MB). Slot refers to a Flash memory card (8, 16, or 20 MB). <sup>1</sup> 0 refers to the left slot on the PRE1 or PRE2 module. 1 refers to the right slot on the PRE1 or PRE2 module. The sec prefix refers to the Flash disk or card in the standby RP.
FTP TFTP RCP	ftp: tftp: rcp:	Protocols used to transfer files to and from remote devices.

<sup>1</sup> Because of the small file system, the slot devices are not typically used on the Cisco uBR10012 router. The disk and sec-disk file systems are typically used instead.

You can use the privileged EXEC commands `dir`, `del`, and `copy` to manage the contents of the file systems. You can also use the commands `mkdir` and `rmdir` to create and remove directories on Flash disks. You cannot use the commands `squeeze` and `undelete` on Flash disks.

**Note**

For more information about using these file systems, see the “File Management” manual in the Cisco IOS Release 12.2 Configuration Fundamentals Configuration Guide.



## DSX Messages and Synchronized PHS Information

Cisco IOS Release 12.3(17a)BC introduces support for PHS rules in a High Availability environment. In this release, and later releases, PHS rules synchronize and are supported during a switchover event of these types:

- Route Processor Redundancy Plus (RPR+) for the Cisco uBR10012 router, with Active and Standby Performance Routing Engines (PREs)
- HCCP N+1 Redundancy, with Working and Protect cable interface line cards

For further information about DSX messages and Payload Header Suppression (PHS) information on the Cisco CMTS, refer to these documents, and additional DOCSIS PHS information:

- *Cable DOCSIS 1.1 FAQs*, Cisco TAC Document 12182

[http://www.cisco.com/en/US/tech/tk86/tk168/technologies\\_q\\_and\\_a\\_item09186a0080174789.shtml](http://www.cisco.com/en/US/tech/tk86/tk168/technologies_q_and_a_item09186a0080174789.shtml)

- DOCSIS 1.1 for the Cisco CMTS

[http://www.cisco.com/en/US/docs/cable/cmts/feature/guide/ufg\\_docs.html](http://www.cisco.com/en/US/docs/cable/cmts/feature/guide/ufg_docs.html)

## High Availability Support for Encrypted IP Multicast

Cisco IOS Release 12.3(17a)BC introduces support for IP Multicast streams during switchover events in a High Availability environment. This feature is supported for Route Processor Redundancy Plus (RPR+), N+1 Redundancy, and encrypted BPI+ streams.

For additional information about IP Multicast and High Availability, refer to these documents on Cisco.com:

- *Cisco CMTS Universal Broadband Router MIB Specifications Guide*

[http://www.cisco.com/en/US/docs/cable/cmts/mib/12\\_2sc/reference/guide/ubrmibv5.html](http://www.cisco.com/en/US/docs/cable/cmts/mib/12_2sc/reference/guide/ubrmibv5.html)

- *Dynamic Shared Secret for the Cisco CMTS*

<http://www.cisco.com/en/US/docs/cable/cmts/feature/ubrdmic.html>

- *IP Multicast in Cable Networks*, White Paper

[http://www.cisco.com/en/US/technologies/tk648/tk828/technologies\\_case\\_study0900aecd802e2ce2.html](http://www.cisco.com/en/US/technologies/tk648/tk828/technologies_case_study0900aecd802e2ce2.html)

- *N+1 Redundancy for the Cisco Cable Modem Termination System*

[http://www.cisco.com/en/US/docs/ios/cable/configuration/guide/cmts\\_nplus1\\_redun.html](http://www.cisco.com/en/US/docs/ios/cable/configuration/guide/cmts_nplus1_redun.html)

## How to Configure, Verify, and Troubleshoot Route Processor Plus Redundancy

This section provides the following procedures to configure and verify RPR+ and high availability on the Cisco uBR10012 router.

## Configuring RPR+ on the Cisco uBR10012 Universal Broadband Router

The default redundancy mode in the Cisco uBR10012 router is standard Route Processor Redundancy (RPR). Perform the steps below to enable RPR+ on the Cisco uBR10012 router.

### Before You Begin

To enable RPR+, both route processors must be running the same version of Cisco IOS software.



#### Note

If necessary, refer to the “Upgrading Cisco IOS Software Images” section on page 14 to change the image on the Cisco uBR10012 router. Reload is required.

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Router> <b>enable</b>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Router# <b>configure terminal</b>	Enters global configuration mode.
<b>Step 3</b>	<b>main-cpu</b>  <b>Example:</b> Router (config) # <b>main-cpu</b>	Enters the main CPU configuration mode. (This configures the active RP, not the standby RP.) Refer to <b>main-cpu</b> command, for additional command syntax information.
<b>Step 4</b>	<b>auto-sync option</b>  <b>Example:</b> Router (config-r-mc) # <b>auto-sync standard</b>	Specifies the files to be synchronized. Refer to <b>auto-sync</b> command, for additional command syntax information.  <b>Note</b> Cisco strongly recommends that you use the auto-sync standard command to ensure that all system files remain synchronized between the two PRE1 or PRE2 modules.
<b>Step 5</b>	<b>no auto-sync option</b>  <b>Example:</b> Router (config-r-mc) # <b>no auto-sync standard</b>	(Optional) Specifies that one or more files should not be synchronized. Option can be any of the values specified previously.  <b>Note</b> The <b>no auto-sync</b> command is not typically used in production plants.
<b>Step 6</b>	<b>CTRL-Z</b>  <b>Example:</b> Router (config-r-mc) # <b>CTRL-Z</b>	Returns to privileged EXEC mode.

	Command or Action	Purpose
<b>Step 7</b>	<b>copy running-config startup-config</b>  <b>Example:</b> <pre>Router# copy running-config startup-config</pre>	Saves the current configuration as the default startup configuration.

## Verifying RPR+ Configuration

Perform the steps below to verify that RPR+ is configured on the Cisco uBR10012 router:

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> <pre>Router&gt; enable</pre>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>show startup-config</b>  <b>Example:</b> <pre>Router# show startup-config ... redundancy main-cpu auto-sync standard ...</pre>	Displays the startup configuration and verify that the lines configuring redundancy appear. <p><b>Note</b> If the auto-sync line contains anything other than standard, it indicates that only some of the required system files are being synchronized between the two PRE1 or PRE2 modules. Verify that this is the desired configuration. If necessary, refer to the <a href="#">Configuring RPR+ on the Cisco uBR10012 Universal Broadband Router, on page 10</a> to reconfigure the router for auto-sync standard operation.</p>
<b>Step 3</b>	<b>show redundancy</b>  <b>Example:</b> <pre>Router# show redundancy PRE1 A (This PRE1) : Primary PRE1 B : Secondary ...</pre>	Displays the current RPR state. The active RP typically is shown in slot A.

If a switchover has occurred, the show redundancy command displays information similar to the following, showing that the active RP has changed slots (in this case, moving from slot A to slot B):

```
Router# show redundancy
PRE1 A : Secondary
PRE1 B (This PRE1) : Primary
Redundancy state is REDUNDANCY_PEERSECONDARY_INITED
```

```

Secondary RP information...
Secondary is up.
Secondary BOOT variable = bootflash:ubr10k-k8p6-mz
Secondary CONFIG_FILE variable =
Secondary BOOTLDR variable = bootflash:c10k-eboot-mz
Secondary Configuration register is 0x2
Router#

```

If the standby RP is not installed or is not operational, the show redundancy command displays information similar to the following:

```

Router# show redundancy
PRE1 A (This PRE1) : Primary
PRE1 B : Secondary
Redundancy state is REDUNDANCY_PEERSECONDARY_NONOPERATIONAL
Secondary RP information...
Secondary RP is not up

```

**Note**

The show redundancy command shows whether the PRE1 A slot or PRE1 B slot contains the active (Primary) PRE1 module. The other PRE1 slot will always be marked as Secondary, even if a second PRE1 module is not installed.

## Upgrading Cisco IOS Software Images

RPR+ is enabled by default with the Cisco IOS Release 12.2(11)BC3 and later releases. Use this set of procedures when you need to upgrade your Cisco IOS to a release that supports RPR+ on the Cisco uBR10012 router.

Cisco IOS software upgrade involves these three procedures:

### Prerequisites

**Note**

You are required to have the same image on both the active and standby RPs to support RPR+. If one or more RPs does not have an RPR+ image, the router reverts to RPR mode on both RPs.

### Creating Additional Disk Space (Optional)

(Optional) To create additional disk space in preparation for the RPR+ image, issue the following commands from global configuration mode on the active and standby RPs (where slot is the RP slot number and filename is the RPR+ image file name).

#### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	Do one of the following: <ul style="list-style-type: none"> <li>• delete slot 0:filename</li> <li>• delete sec-slot 0:filename</li> </ul>	Deletes an old file from the active or standby RP to make room for the new file.

	Command or Action	Purpose
	<p><b>Example:</b></p> <pre>Router(config)# delete slot 0:ubr10k-p6-mz</pre> <p>or</p> <pre>Router(config)# delete sec-slot 0:ubr10k-p6-mz</pre>	
<b>Step 2</b>	<p>squeeze flash:</p> <p><b>Example:</b></p> <pre>Router(config)# squeeze flash:</pre>	Permanently deletes all files marked "delete" on a Flash memory device, recovering space on the device.

## Copying the Cisco IOS Image

To copy the Cisco IOS image from a TFTP server, and to set the boot variable on the active RP, issue the following commands in global configuration mode (where filename is the RPR+ image file name).

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<p>Do one of the following:</p> <ul style="list-style-type: none"> <li>• copy tftp://tftp-server/filename bootflash:filename</li> <li>•</li> <li>• copy tftp://tftp-server/filename sec-bootflash:filename</li> </ul> <p><b>Example:</b></p> <pre>Router# copy tftp://tftp-server/ubr10k-p6-mz bootflash:ubr10k-p6-mz</pre> <p>or</p> <pre>Router# copy tftp://tftp-server/ubr10k-p6-mz sec-bootflash:ubr10k-p6-mz</pre>	<p>Copies the Cisco IOS image from a TFTP server to the bootflash of the active or standby RP. This command allows you to change software images without requiring access to the TFTP monitor mode.</p> <p>The image you download is made available to the Cisco uBR10012 router on the next reload (reboot).</p>
<b>Step 2</b>	<p>boot system bootflash:filename</p> <p><b>Example:</b></p> <pre>Router# boot system bootflash:ubr10k-p6-mz</pre>	Sets the BOOT environment variable. This variable specifies the location and name of the system image file to use when automatically booting the system.

	Command or Action	Purpose
<b>Step 3</b>	write memory  <b>Example:</b> Router# <code>write memory</code>	Saves the configuration.
<b>Step 4</b>	show bootvar  <b>Example:</b> Router# <code>show bootvar</code>	Displays the contents of the BOOT variable, the name of the configuration file pointed to by the CONFIG_FILE variable, the contents of the BOOTLDR variable, and the configuration register setting.

## Resetting a PRE1 or PRE2 Module or Line Card After Upgrade

To reset a particular route processor (RP) or a particular line card, use the `hw-module reset` command in privileged EXEC mode.

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	hhw-module sec-cpu reset  <b>Example:</b> Router# <code>hhw-module sec-cpu reset</code>	Resets the specified RP or line card slot.  <b>Note</b> Refer to <b>hw-module reset command</b> for additional command syntax information.

## Reloading Cisco IOS (Restarting the System)

To reload the operating system, use the `reload` command in privileged EXEC mode.



### Note

This reload is required if you are reloading an RPR+ image, but optional otherwise. The reload command restarts the entire system, including both the active and standby RPs.

### SUMMARY STEPS

1. reload

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>reload</b>  <b>Example:</b> Router# <b>reload</b>	Reloads the operating system and restarts the router.

## What to Do Next

**Note**

If you are upgrading from a Cisco IOS image previously configured with RPR+ to a newer image with RPR+, the procedure is now complete. When the new active RP comes up, it will automatically configure RPR+ from the configuration information in the startup configuration (synchronized from the old active RP).

## Performing a Manual Route Processor Switchover

For testing or maintenance, you may need to perform a manual switchover in which your standby RP becomes your active RP. Perform the following steps to force a manual switchover between RPs.

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>show cable modem</b>  <b>Example:</b> Router> <b>show cable modem</b>	Displays information for the registered and unregistered cable modems supported by the active RP. The output from this command provides information that confirms successful switchover in pending steps.
Step 2	<b>redundancy force-failover main-cpu</b>  <b>Example:</b> Router# <b>configure terminal</b>	Forces a switchover on the active RP. The standby RP becomes the active RP with a switchover time of approximately 30 seconds or less.  <b>Note</b> The modems do not redefine their ranges and the line cards do not reset during switchover.
Step 3	<b>show cable modem</b>  <b>Example:</b> Router> <b>enable</b>	Displays information for the registered and unregistered cable modems supported by the newly active RP (formerly the standby RP).

## Troubleshooting Route Processor Redundancy Plus

If RPR+ is not enabled after mode rpr-plus is run, verify that both the active and standby RPs are running Cisco IOS Release 12.2(11)BC3 or a later release.



### Note

If the active RP detects a different version of the image on the standby RP, the system automatically reverts to standard RPR behavior.

## Configuration Examples for Route Processor Plus Redundancy

This section provides the following command examples that display the configuration and status of RPR+ on a Cisco uBR10012 router chassis with active and standby RPs. These commands all illustrate the same Cisco uBR10012 chassis:

- show redundancy
- show running configuration
- show version

The following show redundancy command displays the slots for the primary RP (PRE in slot 15), the secondary RP (PRE in slot 7), and additional redundancy mode information.

```
Router# show redundancy
Primary PRE in slot 15:
Secondary PRE in slot 7:
Preferred PRE: 15
Operating Redundancy Mode: RPR Plus
Auto synch: startup-config running-config
switchover timer 8 seconds [default]
```

The following show running configuration command displays RPR+ information such as main-cpu and auto-sync status.

```
Router# show run
Building configuration...
Current configuration : 10895 bytes
!
version 12.2
no parser cache
no service pad
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
service internal
service udp-small-servers max-servers no-limit
!
hostname "Router"
!
boot system flash bootflash:ubr10k-k8p6-mz.999-99.122BC_UB_030303
redundancy
  no keepalive-enable
  main-cpu
  auto-sync standard
no logging rate-limit
enable password cisco
!
facility-alarm intake-temperature major 49
```



```

facility-alarm intake-temperature minor 40
facility-alarm intake-temperature critical 57
facility-alarm core-temperature major 53
facility-alarm core-temperature minor 45
facility-alarm core-temperature critical 60
card 1/0 1gigetherenet-1
card 1/1 2cable-tccplus
card 3/0 1ocl2pos-1
card 4/0 1gigetherenet-1
card 5/0 2cable-mc28c
card 5/1 cable-lcp
card 6/0 2cable-mc28c
card 7/0 2cable-mc28c
card 8/0 1cable-mc16s
card 8/1 1cable-mc16s
cable modem max-cpe unlimited
cable spectrum-group 1 band 8000000 20000000
cable modulation-profile 1 request 0 16 0 8 qpsk scrambler 152 no-diff 64 fixed uw16
cable modulation-profile 1 initial 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed uw16
cable modulation-profile 1 station 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed uw16
cable modulation-profile 1 short 6 75 6 8 16qam scrambler 152 no-diff 144 shortened uw8
cable modulation-profile 1 long 8 220 0 8 16qam scrambler 152 no-diff 160 shortened uw8
cable modulation-profile 2 request 0 16 0 8 qpsk scrambler 152 no-diff 64 fixed uw16
cable modulation-profile 2 initial 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed uw16
cable modulation-profile 2 station 5 34 0 48 qpsk scrambler 152 no-diff 128 fixed uw16
cable modulation-profile 2 short 6 75 6 8 16qam scrambler 152 no-diff 144 shortened uw8
cable modulation-profile 2 long 8 220 0 8 16qam scrambler 152 no-diff 160 shortened uw8
no cable qos permission create
no cable qos permission update
cable qos permission modems
no cable service flow inactivity-threshold
cable time-server
ip subnet-zero
ip cef table resolution-timer 1
no ip domain lookup
ip host abrick 223.255.254.254
ip dhcp relay information option
!
ip dhcp pool modems-c6
network 1.6.1.64 255.255.255.224
bootfile schcfr_new.cm
next-server 1.10.41.3
default-router 1.10.41.3
option 7 ip 1.10.41.3
option 4 ip 1.6.1.65
option 2 hex ffff.8f80
!
ip dhcp pool modems-c5
network 1.5.1.64 255.255.255.224
bootfile schcfr_new.cm
next-server 1.5.1.65
default-router 1.5.1.65
option 7 ip 1.5.1.65
option 4 ip 1.5.1.65
option 2 hex ffff.8f80
!
ip dhcp pool modems-c7
network 1.7.1.64 255.255.255.224
bootfile up2-down2-nobpi.cm
next-server 1.10.41.3
default-router 1.10.41.3
option 7 ip 1.10.41.3
option 4 ip 1.7.1.65
option 2 hex ffff.8f80
!
ip dhcp pool modems-c8
network 1.8.1.64 255.255.255.224
bootfile schcfr_new.cm
next-server 1.8.1.65
default-router 1.8.1.65
option 7 ip 1.8.1.65
option 4 ip 1.8.1.65
option 2 hex ffff.8f80

```

```

!
ip dhcp pool modems-c51
  network 1.9.1.64 255.255.255.224
  bootfile config.cm
  next-server 1.10.41.3
  default-router 1.10.41.3
  option 7 ip 1.10.41.3
  option 4 ip 1.9.1.65
  option 2 hex ffff.8f80
!
ip multicast-routing
!
!
interface Loopback1
  ip address 222.1.1.1 255.255.255.0
!
interface FastEthernet0/0/0
  ip address 1.10.41.3 255.255.0.0
  no ip proxy-arp
  no ip route-cache
  no ip mroute-cache
  load-interval 30
  no cdp enable
!
interface GigabitEthernet1/0/0
  ip address 1.1.1.1 255.255.0.0
  no negotiation auto
  no cdp enable
!
interface POS3/0/0
  ip address 200.200.0.1 255.255.0.0
  shutdown
  crc 32
  no cdp enable
  pos ais-shut
!
interface GigabitEthernet4/0/0
  no ip address
  negotiation auto
  no cdp enable
!
interface Cable5/0/0
  no ip address
  load-interval 30
  no keepalive
  cable bundle 1 master
  cable downstream annex B
  cable downstream modulation 64qam
  cable downstream interleave-depth 32
  cable downstream frequency 441000000
  cable downstream channel-id 60
  cable upstream 0 spectrum-group 1
  cable upstream 0 power-level 0
  no cable upstream 0 concatenation
  cable upstream 0 data-backoff automatic
  no cable upstream 0 shutdown
  cable upstream 1 power-level 0
  cable upstream 1 shutdown
  cable upstream 2 power-level 0
  cable upstream 2 shutdown
  cable upstream 3 power-level 0
  cable upstream 3 shutdown
  hccp 1 working 5
  hccp 1 channel-switch 5 uc wavcom-ma 1.10.41.6 2 1.10.41.5 1
  hccp 1 channel-switch 5 nru rfswitch-group 1.10.41.7 80080000 1
  hccp 1 reverttime 6
!
interface Cable5/0/0.1
  ip address 111.111.111.1 255.255.255.0 secondary
  ip address 1.5.1.65 255.255.255.224
  ip pim sparse-mode
  ip helper-address 1.10.41.3
  ip igmp static-group 239.0.0.11

```

```

ip igmp static-group 239.0.0.12
ip igmp static-group 239.0.0.14
ip igmp static-group 239.0.0.16
ip igmp static-group 239.0.0.32
ip igmp static-group 239.0.0.35
ip igmp static-group 239.0.0.36
cable source-verify dhcp
cable dhcp-giaddr policy
!
interface Cable5/0/1
no ip address
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream channel-id 1
cable upstream 0 shutdown
cable upstream 1 shutdown
cable upstream 2 shutdown
cable upstream 3 shutdown
!
interface Cable6/0/0
no ip address
no keepalive
cable bundle 1
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream frequency 441000000
cable downstream channel-id 70
cable upstream 0 frequency 12000000
cable upstream 0 power-level 0
no cable upstream 0 shutdown
cable upstream 1 power-level 0
cable upstream 1 shutdown
cable upstream 2 power-level 0
cable upstream 2 shutdown
cable upstream 3 power-level 0
cable upstream 3 shutdown
hccp 1 working 6
hccp 1 channel-switch 6 uc wavcom-ma 1.10.41.6 2 1.10.41.5 2
hccp 1 channel-switch 6 nru rfswitch-group 1.10.41.7 80080000 2
!
interface Cable6/0/1
no ip address
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream channel-id 1
cable upstream 0 shutdown
cable upstream 1 shutdown
cable upstream 2 shutdown
cable upstream 3 shutdown
!
interface Cable7/0/0
no ip address
no keepalive
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream frequency 441000000
cable downstream channel-id 60
cable upstream 0 power-level 0
no cable upstream 0 concatenation
no cable upstream 0 shutdown
cable upstream 1 power-level 0
cable upstream 1 shutdown
cable upstream 2 power-level 0
cable upstream 2 shutdown
cable upstream 3 power-level 0
cable upstream 3 shutdown
hccp 1 protect 5 222.1.1.1
hccp 1 channel-switch 5 nru rfswitch-group 1.10.41.7 80080000 1
hccp 1 channel-switch 5 uc wavcom-ma 1.10.41.6 2 1.10.41.5 1

```

```

hccp 1 protect 6 222.1.1.1
hccp 1 channel-switch 6 uc wavecom-ma 1.10.41.6 2 1.10.41.5 2
hccp 1 channel-switch 6 nru rfswitch-group 1.10.41.7 80080000 2
hccp 1 timers 5000 15000
!
interface Cable7/0/1
no ip address
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream channel-id 1
cable upstream 0 shutdown
cable upstream 1 shutdown
cable upstream 2 shutdown
cable upstream 3 shutdown
!
interface Cable8/0/0
no ip address
ip access-group 99 in
no keepalive
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream frequency 441000000
cable downstream channel-id 60
cable upstream 0 spectrum-group 1
cable upstream 0 power-level 0
cable upstream 0 modulation-profile 2 1
no cable upstream 0 shutdown
cable upstream 1 power-level 0
cable upstream 1 shutdown
cable upstream 2 power-level 0
cable upstream 2 threshold cnr-profile1 21 cnr-profile2 11 Corr-Fec 11 Uncorr-Fec 21
cable upstream 2 shutdown
cable upstream 3 power-level 0
cable upstream 3 shutdown
cable upstream 4 shutdown
cable upstream 5 shutdown
hccp 2 working 8
hccp 2 channel-switch 8 uc wavecom-ma 1.10.41.6 2 1.10.41.5 1
hccp 2 channel-switch 8 nru rfswitch-group 1.10.41.7 80080000 1
!
interface Cable8/0/0.1
ip address 1.8.1.65 255.255.255.224
cable source-verify dhcp
!
interface Cable8/1/0
no ip address
no keepalive
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable downstream frequency 441000000
cable downstream channel-id 60
cable upstream 0 power-level 0
no cable upstream 0 shutdown
cable upstream 1 power-level 0
cable upstream 1 shutdown
cable upstream 2 power-level 0
cable upstream 2 shutdown
cable upstream 3 power-level 0
cable upstream 3 shutdown
cable upstream 4 power-level 0
cable upstream 4 shutdown
cable upstream 5 power-level 0
cable upstream 5 shutdown
hccp 2 protect 8 222.1.1.1
hccp 2 channel-switch 8 uc wavecom-ma 1.10.41.6 2 1.10.41.5 1
hccp 2 channel-switch 8 nru rfswitch-group 1.10.41.7 80080000 1
hccp 2 timers 5000 15000
no hccp 2 revertive
!
ip default-gateway 1.10.0.1

```

```

ip classless
ip route 1.9.0.0 255.255.0.0 1.10.0.1
ip route 2.6.0.0 255.255.0.0 200.200.0.2
ip route 223.255.254.254 255.255.255.255 1.10.0.1
no ip http server
ip pim bidir-enable
!
ip access-list standard XYZ
 permit any
ip access-list standard pqRS
 permit any
no logging linecard
access-list 3 permit 210.221.55.46
access-list 99 permit any
access-list 110 permit ip any any
access-list 110 permit udp any eq bootps any
access-list 111 permit udp any eq bootps any
arp 1.10.41.6 0020.4a51.1776 ARPA
arp 1.10.41.5 0020.4a51.00ea ARPA
no cdp run
snmp-server manager
tftp-server bootflash:up2-down2-nobpi.cm alias up2-down2-nobpi.cm
tftp-server bootflash:tonyl1.cm alias tonyl1.cm
tftp-server bootflash:up2-down2.cm alias up2-down2.cm
tftp-server bootflash:new-privacy.cm alias new-privacy.cm
tftp-server bootflash:10.cm alias 10.cm
tftp-server bootflash:att-10plus.cm alias att-10plus.cm
tftp-server bootflash:schcfr_new.cm alias schcfr_new.cm
tftp-server bootflash:test11.cm alias test11.cm
tftp-server bootflash:4us16ds.cm alias 4us16ds.cm
!
alias exec scm show cable modem
alias exec sqos show cable qos profile
alias exec shc show hccp
alias exec nd no debug all
alias exec sr show running-config
alias exec sip show ip interface b
alias exec dc debug hccp channel-switch
alias exec spm sh proc mem | in HCCP
alias exec de debug hccp event
alias exec ds debug hccp sync
alias exec dp debug hccp plane
alias exec dt debug hccp timing
alias exec dipc debug cr10k-rp ipc
alias exec dpm debug hccp plane message
alias exec dpp debug hccp plane packet
alias exec sib show ip int br
alias exec shb show hccp br
alias exec scs show cable spectrum-group
!
line con 0
 exec-timeout 0 0
line aux 0
 stopbits 1
 speed 19200
line vty 0 4
 exec-timeout 0 0
 password lab
 login
 length 0
!
end

```

The following show version command displays active and standby RP status.

```

Router# show version
Cisco Internetwork Operating System Software
IOS (tm) 10000 Software (UBR10K-K8P6-M), Version 12.2(122BC.030303.)
Copyright (c) 1986-2003 by cisco Systems, Inc.
Compiled Mon 03-Mar-03 21:23 by
Image text-base: 0x60008954, data-base: 0x61B00000
ROM: System Bootstrap, Version 12.0(9r)SL2, RELEASE SOFTWARE (fc1)
amit-rp2 uptime is 57 minutes

```

```

System returned to ROM by reload at 02:05:40 UTC Sun Nov 26 2000
System image file is "bootflash:ubr10k-k8p6-mz.999-99.122BC_UB_030303"
cisco uBR10000 (PRE1-RP) processor with 393215K/131072K bytes of memory.
Processor board ID TBA05191959
R7000 CPU at 262Mhz, Implementation 39, Rev 2.1, 256KB L2, 2048KB L3 Cache
Backplane version 1.0, 8 slot
Last reset from other pre
Toaster processor tmc0 is running.
Toaster processor tmc1 is running.
1 OC12 POS controller (1 POS)
1 TCCplus card(s)
1 FastEthernet/IEEE 802.3 interface(s)
1 Gigabit Ethernet/IEEE 802.3 interface(s)
1 Packet over SONET network interface(s)
8 Cable Modem network interface(s)
509K bytes of non-volatile configuration memory.
125440K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
32768K bytes of Flash internal SIMM (Sector size 256KB).
Secondary is up.
Secondary has 524288K bytes of memory.
Configuration register is 0x0

```

## Additional References

### Related Documents

Related Topic	Document Title
CMTS commands	<a href="#">Cisco IOS CMTS Cable Command Reference</a>
CMTS Software Configuration Guide Guide	<a href="#">Cisco IOS CMTS Cable Software Configuration Guide, Release 12.2SC</a>
Cisco High Availability Initiatives	

### Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<a href="http://www.cisco.com/support">http://www.cisco.com/support</a>