



# Route Processor Redundancy for the Cisco uBR10012 Universal Broadband Router

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## Feature History

Release	Modification
Release 12.2(4)XF	This feature was introduced on the Cisco uBR10012 universal broadband router.
Release 12.2(4)BC1	Support for this feature was added to Cisco IOS Release 12.2 BC for the Cisco uBR10012 universal broadband router.
Release 12.2(11)CY, 12.2(11)BC3	Support for the PRE module was removed. Only the PRE1 module can be used with the Cisco uBR10012 router.

This document describes the Route Processor Redundancy (RPR) feature on the Cisco uBR10012 universal broadband router, how to configure the feature, and the commands that apply to the feature. This document contains the following major sections:

- [Feature Overview, page 2](#)
- [Supported Platforms, page 7](#)
- [Supported Standards, MIBs, and RFCs, page 7](#)
- [Prerequisites, page 8](#)
- [Configuration Tasks, page 8](#)
- [Configuration Examples, page 18](#)
- [Command Reference, page 19](#)
- [Debug Commands, page 35](#)
- [Glossary, page 38](#)



### Note

For the most current information about the Cisco IOS commands described in this document, see the *Cisco Broadband Cable Command Reference Guide*, which is at the following URL:

<http://www.cisco.com/univercd/cc/td/doc/product/cable/bbccmref/index.htm>

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## Feature Overview

Cisco IOS Release 12.2(4)XF and Cisco IOS Release 12.2(4)BC introduce support for Route Processor Redundancy (RPR) on the Cisco uBR10012 universal broadband router. The RPR feature enables the Cisco uBR10012 to use two PRE or PRE1 modules in a redundant configuration, so that if the active PRE module fails or becomes inactive, the system automatically performs a *switchover*, where the standby PRE module takes over and assumes full responsibility for systems operations.

**Note**

Unless otherwise indicated, all references to a PRE module in this document also include the PRE1 module. However, when using redundant PRE modules, they cannot be mixed but must both be of the same type: both must be PRE modules or both must be PRE1 modules. For best performance, Cisco recommends the PRE1 module.

The RPR feature does not require a full reboot of the system to perform a switchover. When the system is originally initialized, the standby PRE module performs an abbreviated initialization routine—the PRE module performs all self-checks and loads the Cisco IOS software, but instead of performing normal systems operations it begins monitoring the active PRE module. If the standby PRE module detects a failure in the primary module, it can quickly assume the primary responsibility for systems operations.

Each PRE module 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 standby PRE module also synchronizes the major systems files, such as the Cisco IOS startup configuration file, so that during a switchover, the standby PRE module can duplicate the active PRE module's configuration. This process also resets the cable and network uplink interfaces.

**Note**

Resetting the Gigabit Ethernet and OC-12 POS line cards will interrupt traffic for approximately 45 seconds. Because of DOCSIS requirements, a reset of the cable interface line cards requires all cable modems to go offline and reregister with the Cisco uBR10012 router. This will interrupt traffic on the cable network for 10 to 15 minutes, depending on the number of customers actually online at the time. A side-effect of this process is that when the cable modems come online again, they will not necessarily be assigned the same Service IDs (SIDs) that they had before the switchover.

Because the standby PRE module is partially initialized, you can use Cisco IOS CLI commands to access its resources, such as the Flash disks and bootflash. For example, you can use the **dir** command to list the contents of a device, or use the **copy** command to transfer files between the primary and standby PRE modules. (See the [“Using Redundant File Systems”](#) section on page 3 for more information on this feature.)

## Switchover Procedure

A switchover occurs when the standby PRE module takes over responsibilities from the active PRE module. The switchover can occur automatically if the standby PRE module has determined that the active PRE module 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 PRE module verifies that the standby PRE module is present and is running Cisco IOS software that supports the RPR feature. If so, it instructs the standby PRE module to begin switchover procedures, and the active PRE module 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 PRE module 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 PRE module is configured identically to the previous active PRE module, including the IP address for its onboard FastEthernet management interface.
3. The standby PRE assumes responsibility as the active PRE module 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 POS line cards will interrupt traffic for approximately 45 seconds. Because of DOCSIS requirements, the reset of the cable interface line cards requires all cable modems to go offline and reregister with the Cisco uBR10012 router. This will interrupt traffic on the cable network for 10 to 15 minutes, depending on the number of customers actually online at the time. A side-effect of this process is that when the cable modems come online again, they will not necessarily be assigned the same Service IDs (SIDs) that they had before the switchover.

4. The new active PRE module begins normal systems operations, including passing traffic.



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

## Using Redundant File Systems

Both the primary and standby PRE modules 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.

**Table 1** Cisco uBR10012 Router File Systems (continued)

File System	Filename for CLI Commands	Description
Disk 0	disk0:	Disk refers to an ATA Flash disk (48 or 128 MB).
Disk 1	disk1:	Slot refers to a Flash memory card (8, 16, or 20 MB). <sup>1</sup>
Slot 0	slot0:	0 refers to the left slot on the PRE module.
Slot 1	slot1:	1 refers to the right slot on the PRE module.
Secondary Disk 0	sec-disk0:	The <b>sec</b> prefix refers to the Flash disk or card in the standby PRE module.
Secondary Disk 1	sec-disk1:	
Secondary Slot 0	sec-slot0:	
Secondary Slot 1	sec-slot1:	
FTP	ftp:	Protocols used to transfer files to and from remote devices.
TFTP	tftp:	
RCP	rcp:	

1. 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*.

## PRE Module Not Supported

The Cisco uBR10012 router supports only the PRE1 module in Cisco IOS Release 12.2(11)CY and Release 12.2(13)BC1, and later releases. If you attempt to boot the Cisco uBR10012 router with one of these software releases and a PRE module, the router will print the following error message and fall through to the ROM monitor:

```
%%Error: PRE not supported with this image
rommon>
```

To correct this error, replace the PRE modules in the router with PRE1 modules. To continue using the original PRE modules, you must reload the router with Cisco IOS Release 12.2(11)BC1 or an earlier 12.2 BC release.

## Console Port Usage After a PRE Module Switchover

When a active PRE module fails, and the standby PRE module becomes the active PRE module, you must use the console port on the new active PRE module to give CLI commands and display statistics for the router. If you have connected your PC or terminal to the console port on a active PRE module and a switchover occurs, you will no longer be able to access the console. The display will show the following error message:

```
Router#
Secondary console disabled
Router#
```

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

## Benefits

### **PRE Modules are Not a Single Point of Failure**

The PRE module is no longer a single point of hardware failure. If a permanent hardware failure in the active PRE module occurs, the standby PRE module recovers the system, increasing the level of network service and reliability.

### **PRE Switchover Occurs without Operator Intervention**

The standby PRE module can become the active PRE module without the manual intervention of a system operator. This increases the recovery time and reduces the need for an instant response from the network administrators.

### **Protection Against Software Failure**

The RPR feature does not operate as a hot standby system, in which the standby PRE module continually duplicates the state of the primary module. Instead, during a switchover, the standby PRE module begins operations from a known state, thereby protecting the system from the possible software or operations failures that might have affected the active PRE module.

## Restrictions

Both PRE modules must be running Cisco IOS software Release 12.2(4)BC1 or later Cisco IOS Release 12.2 BC release to support the RPR feature.

## Related Features and Technologies

The Hot-Standby 1+1 Redundancy feature is a high system availability feature that allows a backup Cisco uBR10012 router to be cabled and configured to act as a spare for an active Cisco uBR10012 router. Any failure in the active router switches in the hot-standby router.

## Related Documents

The following sections describe the documentation available for the Cisco uBR10012 universal broadband router. These documents are available on Cisco.com and the Documentation CD-ROM:

- [Cisco uBR10012 Series Hardware Installation Guide](#)
- [Cisco uBR10012 Series Software Configuration Guide](#)
- [Cisco uBR10012 Series Troubleshooting Guide](#)
- [Field Replaceable Units \(FRUs\)](#)
- [Cisco Broadband Cable Command Reference Guide](#)
- [Hot-Standby 1+1 Redundancy](#)

On Cisco.com, beginning under the **Service & Support** heading:

**Technical Documents: Broadband/Cable Solutions: Cisco uBR10000 Series Universal Broadband Routers**

On the Documentation CD-ROM:

**Cisco Product Documentation: Broadband/Cable Solutions: Cisco uBR10000 Series Universal Broadband Routers****Note**

The *Broadband Command Consolidation* is available on the Documentation CD-ROM through the following path: **Cisco Product Documentation: Broadband/Cable Solutions**

**Tip**

Information about features of the Cisco *uBR10012* universal broadband router, as well as software release notes, are available on Cisco.com at <http://www.cisco.com/univercd/cc/td/doc/product/cable/ubr10k/index.htm>.

## Cisco IOS Software Documentation Set

The Cisco IOS software documentation set consists of the Cisco IOS configuration guides, Cisco IOS command references, and several other supporting documents. The Cisco IOS software documentation set is shipped with your order in electronic form on the Documentation CD-ROM, unless you specifically ordered the printed versions.

### Documentation Modules

Each module in the Cisco IOS documentation set consists of one or more configuration guides and one or more corresponding command references. Chapters in a configuration guide describe protocols, configuration tasks, and Cisco IOS software functionality, and contain comprehensive configuration examples. Chapters in a command reference provide complete command syntax information. Use each configuration guide with its corresponding command reference.

On Cisco.com and the Documentation CD-ROM, two master hot-linked documents provide information for the Cisco IOS software documentation set.

On Cisco.com, beginning under the **Service & Support** heading:

**Technical Documents: Cisco IOS Software Configuration: Cisco IOS Release 12.2: Configuration Guides and Command References**

On the Documentation CD-ROM:

**Cisco IOS Software Configuration: Cisco IOS Release 12.2: Configuration Guides and Command References**

### Release 12.2 Documentation Set

**Note**

You can find the most current Cisco IOS documentation on Cisco.com and the Documentation CD-ROM. These electronic documents may contain updates and modifications made after the paper documents were printed.

On Cisco.com, beginning under the **Service & Support** heading:

**Technical Documents: Cisco IOS Software Configuration: Cisco IOS Release 12.2: Configuration Guides and Command References**

On the Documentation CD-ROM:

**Cisco Product Documentation: Cisco IOS Software Configuration: Cisco IOS Release 12.2: Configuration Guides and Command References****Note**

The *Cisco Management Information Base (MIB) User Quick Reference* publication is no longer published. For the latest list of MIBs supported by Cisco, see *Cisco Network Management Toolkit* on Cisco.com. From Cisco.com, click on the following path: **Service & Support: Software Center: Network Mgmt Products: Cisco Network Management Toolkit: Cisco MIB.**

## Supported Platforms

The Route Processor Redundancy for the Cisco uBR10012 Universal Broadband Router feature is supported on the following platform:

- Cisco uBR10012 universal broadband router

**Determining Platform Support Through Feature Navigator**

Cisco IOS software is packaged in feature sets that support specific platforms. To get updated information regarding platform support for this feature, access Feature Navigator. Feature Navigator dynamically updates the list of supported platforms as new platform support is added for the feature.

Feature Navigator is a web-based tool that enables you to quickly determine which Cisco IOS software images support a specific set of features and which features are supported in a specific Cisco IOS image.

To access Feature Navigator, 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](mailto: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 at <https://tools.cisco.com/RPF/register/register.do>.

Feature Navigator is updated regularly when major Cisco IOS software releases and technology releases occur. For the most current information, go to the Feature Navigator home page at the following URL:

<http://www.cisco.com/go/fn>

## Supported Standards, MIBs, and RFCs

**Standards**

No new or modified standards are supported by this feature.

**MIBs**

No new or modified MIBs are supported by this feature.

To obtain lists of supported MIBs by platform and Cisco IOS release, and to download MIB modules, go to the Cisco MIB website on Cisco.com at the following URL:

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

**RFCs**

No RFCs are supported by this feature.

## Prerequisites

To support the Route Processor Redundancy feature, the Cisco uBR10012 universal broadband router must fulfill the following prerequisites:

- Two PRE or PRE1 modules must be installed in the Cisco uBR10012 chassis. The order number for the PRE module is UBR10-PRE, and the order number for the PRE1 module is UBR10-PRE1.
- The two processor modules must be of the same type. Both modules must be PRE modules or both modules must be PRE1 modules. You cannot mix PRE and PRE1 modules in the same chassis.

**Note**


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The PRE module is no longer shipping with the Cisco uBR10012 chassis.

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- Each PRE or PRE1 module must be running Cisco IOS Release 12.2(4)XF or a later Cisco IOS Release 12.2 BC software release. Both PRE modules must be running identical software releases.
- For full redundancy, the FastEthernet port on the standby PRE module must have its own connection to the network. The console port on the standby PRE module 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 PRE module.
- Both PRE modules must be configured with the same amount of onboard SDRAM. A standby PRE cannot come online as the active PRE if the standby PRE has a smaller amount of SDRAM than the active PRE module.

## Configuration Tasks

See the following sections for configuration tasks for the RPR feature.

- [Configuring Route Processor Redundancy, page 9](#)
- [Verifying Route Processor Redundancy, page 10](#)
- [Forcing Switchover, page 11](#)
- [Verifying the PRE Switchover, page 12](#)
- [Upgrading Cisco IOS Software on the PRE Modules, page 13](#)
- [Verifying the Software Upgrade, page 14](#)
- [Changing the System Boot Behavior, page 14](#)
- [Moving a Configuration File to the Flash Disk, page 16](#)
- [Verifying the Configuration File Setting, page 17](#)

**Tip**


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These procedures refer to primary and standby PRE modules. Under normal circumstances when the Cisco uBR10012 router starts up, the PRE module in slot A becomes the active PRE module.

However, the PRE module in slot B could also function as the active PRE module at any time. When using these procedures, be aware that the term active PRE module refers to whichever PRE module is active at the current time, not necessarily to a PRE module in a particular physical slot.

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**Note**

All CLI commands shown in these procedures must be given at the console for the active PRE module. You do not normally need to configure the standby PRE module because the RPR feature automatically synchronizes the configuration files between the primary and standby PRE modules.

If you have connected your PC or terminal to the console port on a active PRE module and a switchover occurs, you will no longer be able to access the console, and the display will read "Secondary console disabled." To access the console, move the PC or terminal's serial cable to the console port on the other PRE module, which is now acting as the active PRE module.

## Configuring Route Processor Redundancy

The RPR feature on the Cisco uBR10012 router is automatically enabled when two PRE modules are installed in the Cisco uBR10012 chassis. By default the two PRE modules are also configured to automatically synchronize all critical system files.

Use the following procedure to change how the PRE modules synchronize the system files.

	Command	Purpose
Step 1	Router# <b>config t</b>	Enter global configuration mode.
Step 2	Router(config)# <b>redundancy</b>	Enter RPR configuration mode.
Step 3	Router(config-r)# <b>main-cpu</b>	Enter the main CPU configuration mode. (This configures the active PRE module, not the standby PRE module.)
Step 4	Router(config-r-mc) <b>auto-sync option</b>	Specify the files to be synchronized. The <i>option</i> parameter can be one of the following: <ul style="list-style-type: none"> <li>• <b>standard</b> = (Default) Specifies that the PRE modules should synchronize all of the system files.</li> <li>• <b>bootvar</b> = Specifies that the PRE modules should synchronize the following boot variables: <ul style="list-style-type: none"> <li>– <b>BOOT</b>—Set by the <b>boot system device:filename</b> command</li> <li>– <b>CONFIG_FILE</b>—Set by the <b>boot config device:filename</b> command</li> <li>– <b>BOOTLDR</b>—Set by the <b>boot bootldr device:filename</b> command</li> </ul> </li> <li>• <b>config-register</b> = Specifies that the PRE modules should synchronize the configuration register values.</li> <li>• <b>startup-config</b> = Specifies that the PRE modules should synchronize the startup configuration files.</li> </ul>

	Command	Purpose
Step 5	Router(config-r-mc) <b>no auto-sync option</b>	(Optional) Specify that one or more files should not be synchronized. The option parameter can be any of the values specified previously.  <b>Note</b> Cisco strongly recommends that you use the <b>auto-sync standard</b> command to ensure that all system files remain synchronized between the two PRE modules. The <b>no auto-sync</b> command is not typically used in production plants.
Step 6	Router(config-r-mc) <b>exit</b>	Exit the main CPU configuration mode.
Step 7	Router(config-r) <b>exit</b>	Exit RPR configuration mode.
Step 8	Router(config) <b>exit</b>	Exit global configuration mode.
Step 9	Router# <b>copy running-config startup-config</b>	Saves the current configuration as the default startup configuration.

## Verifying Route Processor Redundancy

Use the following procedure to verify that RPR is configured on the Cisco uBR10012 router.

- Step 1** Display the startup configuration and verify that the lines configuring redundancy appear:

```
Router# show startup-config
...
redundancy
  main-cpu
    auto-sync standard
...
```



**Note**

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 PRE modules. Verify that this is the desired configuration, and if necessary, use the procedure given in the “[Configuring Route Processor Redundancy](#)” section on page 9 to reconfigure the router for **auto-sync standard** operation.

- Step 2** Display the current RPR state using the **show redundancy** command. The Active PRE typically is shown in slot A:

```
Router# show redundancy
PRE A (This PRE)   : Primary
PRE B              : Secondary

Redundancy state is REDUNDANCY_PEERSECONDARY_INITED

Secondary PRE 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
```

If a switchover has occurred, the **show redundancy** command will produce a display similar to the following, showing that the Active PRE has changed slots (in this case, moving from slot A to slot B):

```
Router# show redundancy
PRE A           : Secondary
PRE B (This PRE) : Primary

Redundancy state is REDUNDANCY_PEERSECONDARY_INITED

Secondary PRE 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 PRE module is not installed or is not operational, the **show redundancy** command will produce a display similar to the following:

```
Router# show redundancy
PRE A (This PRE) : Primary
PRE B           : Secondary

Redundancy state is REDUNDANCY_PEERSECONDARY_NONOPERATIONAL

Secondary PRE information...
Secondary PRE is not up
```

**Note**

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

## Forcing Switchover

To manually force a switchover, so that the standby PRE module becomes active, use the **redundancy force-failover main-cpu** command in Privileged EXEC mode. Manually forcing a switchover is useful in the following situations:

- You need to remove, replace, or upgrade the currently active PRE module.
- A previous switchover has activated the standby PRE module and you now want to restore the previously active PRE module.

**Tip**

Simply removing the active PRE module would also trigger a switchover, but using the **redundancy force-failover main-cpu** command does not generate a hardware alarm.

The following procedure shows the procedure to force a switchover from the primary to the standby PRE module.

**Step 1** Use the **redundancy force-failover main-cpu** command to force the switchover:

```
Router# redundancy force-failover main-cpu
```

```

Proceed with switchover to standby PRE? [confirm]

00:38:09: %SYS-5-RELOAD: Reload requested
System Bootstrap, Version 12.0(9r)SL1, RELEASE SOFTWARE (fc1)
Copyright (c) 2000 by cisco Systems, Inc.

Reset Reason Register = RESET_REASON_RESET_REG (0x74)
C10000 platform with 524288 Kbytes of main memory
...

```

- Step 2** After the switchover has occurred, the standby PRE module becomes the active PRE module, and the previous active PRE module is put into the ROM monitor mode. To enable that module to become the new standby PRE module, use the **hw-module sec-cpu reset** command so that the module will initialize and begin monitoring the health of the active PRE module:

```

Router# hw-module sec-cpu reset
Router#
11:55:09: %REDUNDANCY-5-PEER_MONITOR_EVENT: Primary detected a secondary crash
(raw-event=PEER_REDUNDANCY_STATE_CHANGE(5))

```

## Verifying the PRE Switchover

Use the following procedure to verify that the switchover has occurred:

- Step 1** Check that the Status LED on the new active, active PRE module is lighted with a steady green to indicate that it has initialized and is acting as the active PRE module. The alphanumeric display should also show a series of dashes to indicate that the PRE module is running without problems.
- Step 2** Check that the Status LED on the new standby PRE module is OFF and that the alphanumeric display shows the message **IOS STBY** to indicate that the module is now acting as the standby PRE module.



**Note** After a failure, the non-active PRE module will either reload the Cisco IOS software image or enter ROM monitor mode, depending on the setting of its configuration register. If it loads the Cisco IOS software, it will automatically begin functioning as a standby PRE module. If it enters ROM monitor mode, it will become the standby PRE module only if it is reloaded using the **hw-module sec-cpu reset** command.

- Step 3** To verify that a switchover has occurred, use the **show redundancy** command. Assuming that the original PRE module had been in slot A, and that the standby PRE module is in slot B, the **show redundancy** command would display the following:

```

Router# show redundancy
PRE A                : Secondary
PRE B (This PRE)    : Primary

Redundancy state is REDUNDANCY_PEERSECONDARY_INITED

Secondary PRE 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#

```

## Upgrading Cisco IOS Software on the PRE Modules

This section describes how to upgrade the software on redundant PRE modules in the Cisco uBR10012 router. This procedure requires that all PRE system files be synchronized, using the default synchronization setting (**auto-sync standard**).



### Note

The following CLI and ROM monitor commands must be given through the console port on the active PRE module. Although the CLI commands can be given through a Telnet connection to the active PRE module, this is not recommended because the ROM monitor commands require a connection to the active PRE module's serial console port.

- Step 1** If not already done, copy the new Cisco IOS software image from the TFTP server to the Flash disk in slot 0 of the active PRE module:

```
Router# copy tftp disk0:
Address or name of remote host [ ]? 192.168.100.10
Source filename [ ]? ubr10k-k8p6-mz.122-4.XF
Source filename [ubr10k-k8p6-mz.122-4.XF]?
Accessing tftp://192.168.100.10/ubr10k-k8p6-mz.122-4.XF

Loading ubr10k-k8p6-mz.122-4.XF from
192.168.100.10 (via FastEthernet0/0/0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 5717476/11433984 bytes]
5717476 bytes copied in 250.840 secs (22869 bytes/sec)
Router#
```

- Step 2** Copy the same image to the Flash disk in slot 0 of the standby PRE module:

```
Router# copy disk0:ubr10k-k8p6-mz.122-4.XF sec-disk0:
```

- Step 3** Configure the system to use the new software image. In the following example, the Cisco uBR10012 router will use the software image named **ubr10k-k8p6-mz.122-4.XF** on the Flash disk in slot 0 of the active PRE module:

```
Router(config)# boot system flash disk0:ubr10k-k8p6-mz.122-4.XF
```

- Step 4** If necessary, save the running configuration to the startup configuration:

```
Router# copy running-config startup-config
```

- Step 5** Reset the standby PRE module so that it reboots and uses the new image.:

```
Router# hw-module sec-cpu reset
```

- Step 6** Force a cutover to the standby PRE module, which forces the active PRE module to reboot and use the new image:

```
Router# redundancy force-failover main-cpu
```

## Verifying the Software Upgrade

Use the following procedure to verify that the Cisco uBR10012 router is running the new upgraded Cisco IOS software image.

- Step 1** Connect a PC or terminal to the console port of the active PRE module and give the **show version** command, which displays the version number and image name of the currently running software image:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) 10000 Software (UBR10K-K8P6-MZ), Released Version 12.2(4)XF
Copyright (c) 1986-2001 by cisco Systems, Inc.
Compiled Wed 1-Nov-01 22:36 by abc
Image text-base: 0x600089C0, data-base: 0x61330000

ROM: System Bootstrap, Version 12.0(9r)SL2, RELEASE SOFTWARE (fc1)
BOOTLDR: 10000 Software (C10K-EBOOT-M), Version 12.0(16.6)ST2, RELEASE SOFTWARE

Router uptime is 0 hours, 4 minutes
System returned to ROM by power-on
-> System image file is "disk0:ubr10k-k8p6-mz.122-4.XF"
```

- Step 2** Connect a PC or terminal to the console port of the standby PRE module and give the **show version** command. This command should display the same name and version information as shown on the active PRE module.

## Changing the System Boot Behavior

This section describes how to change the Cisco IOS software configuration register to modify how the system behaviors at power-on or reboot. The software configuration register is a 16-bit register in NVRAM that controls the following boot functions:

- Specifies the source of the Cisco IOS software image to be loaded
- Specifies whether the Cisco IOS software should ignore the contents of the saved configuration file in NVRAM memory
- Enables or disables the use of the Break function

Use the following procedure to change the software configuration register settings:

- Step 1** Enter global configuration mode and use the **config-register** command to set the contents of the software configuration register to a new value. You must specify the new value as a 16-bit hexadecimal bitmask, using the values shown in [Table 2](#).

**Table 2** Definition of Bits in the Software Configuration Register

Bit No.	Hex Value	Meaning/Function
00 to 03	0x0000 to 0x000F	Defines the source of a default Cisco IOS software image required to run the router: <ul style="list-style-type: none"> <li>00—On powerup, the system remains at the ROM monitor prompt (rommon&gt;), awaiting a user command to boot the system manually by means of the rommon <b>boot</b> command.</li> <li>01—On powerup, the system automatically boots the first system image found in the Flash memory single inline memory module (SIMM) on the PRE.</li> <li>02 to 0F—On powerup, the system automatically boots from a default Cisco IOS software image stored on a TFTP server in the network. For this setting, the Fast Ethernet port on the PRE must be configured and operational. This setting also enables boot system commands that override the default filename.</li> </ul>
06	0x0040	Causes system software to ignore the contents of the NVRAM configuration file.
07	0x0080	Enables the original equipment manufacturer (OEM) bit.
08	0x0100	Disables the Break function after 30 seconds.
09	0x0200	Not used.
10	0x0400	Specifies that broadcast packets are based on the 0.0.0.0 IP address.
11 and 12	0x0800 to 0x1000	Defines the console baud rate (the default setting is 9600 baud).
13	0x2000	Boots an image from the Flash memory.
14	0x4000	Specifies that broadcast packets use the subnet broadcast address.
15	0x8000	Enables diagnostic messages and ignores the contents of the NVRAM configuration file.

For example, to configure the router to boot to the ROM monitor prompt, set the configuration register to **0x2100** with the following commands:

```
Router# config t
Router(config)# config-register 0x2100
Router(config)#
```

**Tip**

The typical bitmask for normal use is 0x2102, which specifies that the router loads the Cisco IOS software from the Flash memory and boots to the Cisco IOS CLI prompt. The Break key is enabled for only 30 seconds, so that the user can break to the ROM monitor prompt if desired.

**Step 2** Exit the global configuration mode by entering the **exit** command.

```
Router(config)# exit
Router#
```

**Step 3** Display the new software configuration register setting using the **show version** command. The last line shows the settings of the configuration register:

```
Router# show version
Cisco Internetwork Operating System Software
```

```
IOS (tm) 10000 Software (UBR10K-K8P6-MZ), Released Version 12.2(4)XF
Copyright (c) 1986-2001 by cisco Systems, Inc.
```

```
...
```

→ Configuration register is 0x2102 (will be 0x141 at next reload)



**Note** When you change the configuration register, the **show version** command shows both the current value of the register, as well as the value that will be used on the next reboot or reload.

**Step 4** Save the configuration file to preserve the new software configuration register settings.

```
Router# copy running-config startup-config
```

**Step 5** The changes to the software configuration register will take effect the next time the router is rebooted or restarted. To manually reboot the router, use the **reload** command:

```
Router# reload
```

```
System configuration has been modified. Save? [yes/no]: yes
Proceed with reload? [confirm]
```



**Note** For detailed information about setting and using the configuration register, see the *Rebooting* chapter in the *File Management* manual, which is part of the *Cisco IOS Release 12.2 Configuration Fundamentals Configuration Guide*.

## Moving a Configuration File to the Flash Disk

This section describes how to copy a configuration file to a Flash disk and configure the Cisco uBR10012 router so that it loads the configuration file from the Flash disk. This typically is necessary when the configuration file is approaching the 512KB maximum size that is allowed for configuration files that are stored in NVRAM.

Use the following procedure to copy and run the startup configuration off a Flash disk.

**Step 1** The configuration file must fit within one complete buffer on the Flash disk. The default buffer size is 512 KB, so if the configuration file is larger than this, or if you ever expect the file to be larger than this, you will need to change the buffer size. To do so, enter global configuration mode and change the buffer size with the **boot buffersize** command.

The following shows the buffer being changed to 1 MB in size:

```
Router# configure terminal
Router(config)# boot buffersize 1024000
Router(config)# exit
Router#
```

**Step 2** Copy the configuration file to the Flash disks in both PRE modules. The following example assumes the configuration file is still small enough to exist in NVRAM and is being copied to the first Flash disk in each PRE module:

```
Router# copy nvram:ubr10012-config disk0:ubr10012-config
Router# copy nvram:ubr10012-config sec-disk0:ubr10012-config
```



```
Router#
```

If the configuration file is currently on a TFTP server, the following commands copy the file to the first Flash disk in each PRE module:

```
Router# copy tftp://192.168.100.10/router-config disk0:ubr10012-config
Router# copy disk0:ubr10012-config sec-disk0:ubr10012-config
Router#
```

- Step 3** Specify the new location of the configuration file by setting the CONFIG\_FILE boot variable with the **boot config** command in global configuration mode. For example, the following specifies

```
Router# config t
Router(config)# boot config disk0:ubr10012-config
Router(config)# exit
Router#
```

- Step 4** When you have finished changing the running-configuration, save the new configuration:

```
Router# copy running-config startup-config
```

When the Cisco uBR10012 router next restarts or reboots, the router will use the configuration file on the first Flash disk in the active PRE module.

## Verifying the Configuration File Setting

To verify that the Cisco uBR10012 router is configured to use the startup configuration file on the Flash disk, use the following procedure:

- Step 1** Display the directory of the Flash disk in the active PRE module:

```
Router# dir disk0:
Directory of disk0:/

   1  -rw-   10705784   May 30 2001 20:12:46  ubr10k-k8p6-mz.122-4.XF
   2  -rw-    484772    Jun 20 2001 19:12:56  ubr10012-config

128094208 bytes total (116903652 bytes free)
Router#
```

- Step 2** Display the directory of the Flash disk in the standby PRE module:

```
Router# dir sec-disk0:
Directory of sec-disk0:/

   1  -rw-   10705784   May 30 2001 20:12:46  ubr10k-k8p6-mz.122-4.XF
   2  -rw-    484772    Jun 20 2001 19:12:56  ubr10012-config

128094208 bytes total (116903652 bytes free)
Router#
```



**Note** The contents of the Flash disk in the standby PRE module should be similar or identical to the contents of the Flash disk in the active PRE module.

- Step 3** Display the setting of the CONFIG\_FILE boot variable using the **show bootvar** command:

```
Router# show bootvar
BOOT variable =
```

```
CONFIG_FILE = disk0:ubr10012-config  
BOOTLDR variable =  
Configuration register is 0x2102
```

---

## Configuration Examples

The following example shows the relevant portion of the Cisco IOS configuration file for the default configuration for the RPR feature, which should be used for most applications:

```
redundancy  
  main-cpu  
    auto-sync standard
```

The following example shows the relevant portion of the Cisco IOS configuration file for the configuration that could be used when the two PRE modules are running different Cisco IOS software images and require different configuration files:

```
redundancy  
  main-cpu  
    no auto-sync startup-config  
    auto-sync config-register  
    auto-sync bootvar
```

# Command Reference

This section lists the command pages for the following commands that configure and monitor the RPR feature:

- [associate](#), page 20
- [auto-sync](#), page 22
- [hw-module reset](#), page 24
- [hw-module shutdown](#), page 26
- [main-cpu](#), page 28
- [redundancy](#), page 30
- [redundancy force-failover main-cpu](#), page 31
- [show redundancy](#), page 33
- [debug redundancy](#), page 36

**Note**

---

This document describes the Cisco IOS commands as they were introduced in Cisco IOS Release 12.2(4)BC1. For the most current information about the Cisco IOS commands described in this document, see the *Cisco Broadband Cable Command Reference Guide*, which is at the following URL:

<http://www.cisco.com/univercd/cc/td/doc/product/cable/bbccmref/index.htm>

---

# associate

To logically associate two line cards within the router for Automatic Protection Switching (APS) redundancy, use the **associate** command in redundancy configuration mode. To disable slot associations, use the **no** form of this command.

```
associate slot slot1 [slot2]
```

```
no associate slot slot1 [slot2]
```

## Syntax Description

<b>slot</b>	Specifies that redundancy is being set between two full-height slots.
<i>slot1</i>	Specifies the slot that contains the working (primary) card. The valid range is 1 to 8 (odd numbers only), but on the Cisco uBR10012 router, the only usable numbers are 1 and 3, and the card must support APS redundancy.
<i>slot2</i>	(Optional) Specifies the slot that contains the redundant (backup) card. The valid range is 1 to 8 (even numbers only), but on the Cisco uBR10012 router, the only usable numbers are 2 and 4. If not specified, the next higher adjacent slot is automatically configured as the redundant slot.

## Defaults

Slots are not associated.

## Command Modes

Redundancy configuration

## Command History

Release	Modification
12.2(4)XF	This command was introduced for the Cisco uBR10012 router.

## Usage Guidelines

The **associate** command associates the cards in two slots for APS redundancy protection. The two cards must be in adjacent slots, with the working card in slot 1 or 3, and the backup card in slot 2 or 4, respectively. The two cards must be identical cards and must support APS redundancy (such as the OC-12 POS line card).



### Note

You cannot use the **associate** command with PRE modules or TCC+ cards because these cards are automatically configured for redundant operation when two cards are installed in the chassis.

## Examples

The following example shows how to associate the OC-12 POS card in slot 1/0 with the OC-12 POS card in slot 2/0 on the Cisco uBR10012 router:

```
Router# config t
Router(config)# redundancy
Router(config-r)# associate slot 1 2
```

```
Router(config-r)#
```

The following example does the same as above, but the router automatically assumes that the card in slot 2 is the redundant card:

```
Router# config t
Router(config)# redundancy
Router(config-r)# associate slot 1
```

```
Router(config-r)#
```

The following example removes the association for redundant line cards:

```
Router# config t
Router(config)# redundancy
Router(config-r)# no associate slot 1
```

```
Router(config-r)#
```

The following example shows the error message that is displayed when you attempt to associate an even slot as the working slot and an odd slot as the backup slot:

```
Router# config t
Router(config)# redundancy
Router(config-r)# associate slot 2 3
```

```
Slot redundancy must be configured on adjacent odd/even slots.
```

```
Router(config-r)#
```

The following example shows the error messages that are displayed when you attempt to associate line cards that do not support APS redundancy:

```
Router(config-r)# associate slot 5 6
```

```
Associate slot command NOT accepted for chassis config.
One or more slots are occupied by linecards that don't support redundancy.
```

```
Router(config-r)#
```

The following example shows the error messages that are displayed when you attempt to associate a slot that is either empty or that does not contain a supported line card:

```
Router(config-r)# associate slot 1 2
```

```
Associate slot command NOT accepted for chassis config.
One or more slots are occupied by half height Linecards.
```

```
Router(config-r)#
```

## Related Commands

Command	Description
<a href="#">auto-sync</a>	Configures which files are synchronized between the primary and standby PRE modules.
<a href="#">main-cpu</a>	Enters main-CPU redundancy configuration mode.
<a href="#">redundancy</a>	Enters redundancy configuration mode.

# auto-sync

To configure what system files the primary and standby PRE modules automatically synchronize, use the `auto-sync` command in redundancy configuration (`main-cpu`) mode. To disable the synchronization of all or some files, use the `no` form of this command.

**auto-sync** { **startup-config** | **config-register** | **bootvar** | **standard** }

**no auto-sync** { **startup-config** | **config-register** | **bootvar** | **standard** }

## Syntax Description

<b>startup-config</b>	Specifies that the PRE modules should synchronize the startup configuration files.
<b>config-register</b>	Specifies that the PRE modules should synchronize the configuration register values.
<b>bootvar</b>	Specifies that the PRE modules should synchronize the following boot variables: <ul style="list-style-type: none"> <li>• <b>BOOT</b>—Set by the <b>boot system</b> <i>device:filename</i> command</li> <li>• <b>CONFIG_FILE</b>—Set by the <b>boot config</b> <i>device:filename</i> command</li> <li>• <b>BOOTLDR</b>—Set by the <b>boot bootldr</b> <i>device:filename</i> command</li> </ul>
<b>standard</b>	Specifies that the PRE modules should synchronize all of the system files (default).

## Defaults

The system defaults to synchronizing all system files (**auto-sync standard**).

## Command Modes

Redundancy configuration, `main-cpu` mode

## Command History

Release	Modification
12.2(4)XF	This command was introduced for the Cisco uBR10012 router.

## Usage Guidelines

By default, the system synchronizes all system files, which is the typical setting for most applications. However, you might want to not synchronize certain files for specialized applications.

For example, if you have configured the primary and standby PRE modules to run different versions of Cisco IOS software, you might want to use different configuration files as well. In this case, you would not synchronize the startup configuration file.

## Examples

The following example shows the system being configured to synchronize only the startup configuration file.

```
router(config)# redundancy
router(config-r)# main-cpu
router(config-r-mc)# auto-sync startup-config
router(config-r-mc)# exit
```

```
router(config-r)# exit
router(config)#
```

The following example shows how to configure the system to synchronize all system files except for the startup configuration file. This typically is done when the two PRE modules are running different software images.

```
router(config)# redundancy
router(config-r)# main-cpu
router(config-r-mc)# no auto-sync startup-config
router(config-r-mc)# auto-sync config-register
router(config-r-mc)# auto-sync bootvar
router(config-r-mc)# exit
router(config-r)# exit
router(config)#
```

---

**Related Commands**

<b>Command</b>	<b>Description</b>
<a href="#">main-cpu</a>	Enters main CPU redundancy configuration mode.

---

# hw-module reset

To reset a particular PRE module or a particular line card, use the **hw-module reset** command in Privileged EXEC mode.

```
hw-module {main-cpu | pre {A|B} | sec-cpu | slot slot-number | subslot slot/card} reset
[hold | release]
```

## Syntax Description

<b>main-cpu</b>	Resets the PRE module that is currently acting as the active PRE module.
<b>pre {A B}</b>	Resets the PRE module that is physically in either PRE slot A (left slot) or PRE slot B (right slot).
<b>sec-cpu</b>	Resets the PRE module that is currently acting as the standby PRE module.
<b>slot <i>slot-number</i></b>	Resets the line cards that are physically present in the specified <i>slot-number</i> (valid range is 1 to 8).
<b>subslot <i>slot/card</i></b>	Resets the line card that is physically present in the slot with the specified slot (valid range is 1 to 8) and card (valid range is 0 to 1) numbers.
<b>hold</b>	(Optional) Specifies that the card should be held in its reset state, so that it does not begin reinitialization procedures.
<b>release</b>	(Optional) Specifies that a previously held card should be released from the reset state, allowing it to complete reinitialization procedures.

## Defaults

No default behavior or values.

## Command Modes

Privileged EXEC

## Command History

Release	Modification
12.2(4)XF	This command was introduced for the Cisco uBR10012 router.

## Usage Guidelines

The **hw-module reset** command typically is used to reset a standby PRE module so that it can load a new version of Cisco IOS software. However, this command can also be used to reset the active PRE module, as well as any other line card in the Cisco uBR10012 chassis.



### Caution

If the standby PRE module is installed and configured, resetting the active PRE module will trigger a switchover, so that the standby PRE module becomes the active PRE module.



### Note

The **hold** and **release** options are not needed for normal operations but are typically used for debugging and lab tests.



**Examples**

The following example shows the standby PRE module being reset:

```
Router# hw-module sec-cpu reset
Router#
```

The following example shows the active PRE module being reset and kept in the reset state (which will trigger a switchover to the standby PRE module):

```
Router# hw-module main-cpu reset hold
Router#
```

The following example shows the PRE module in PRE slot B being reset:

```
Router# hw-module pre B reset
Router#
```

**Note**

The **hw-module pre B reset** command resets the PRE module that is physically present in slot B, regardless of whether the module is the active or standby PRE module.

**Related Commands**

Command	Description
<a href="#">hw-module shutdown</a>	Shuts down a PRE module or line card.
<a href="#">redundancy force-failover main-cpu</a>	Forces a manual switchover between the primary and standby PRE modules.

# hw-module shutdown

To shut down a particular PRE module or a particular line card, use the **hw-module shutdown** command in global configuration mode.

**hw-module { main-cpu | pre { A|B } | sec-cpu | slot *slot-number* | subslot *slot/card* } shutdown**

Syntax Description		
<b>main-cpu</b>		Shuts down the PRE module that is currently acting as the active PRE module.
<b>pre { A B }</b>		Shuts down the PRE module that is physically in either PRE slot A (left slot) or PRE slot B (right slot).
<b>sec-cpu</b>		Shuts down the PRE module that is currently acting as the standby PRE module.
<b>slot <i>slot-number</i></b>		Shuts down the line cards that are physically present in the specified <i>slot-number</i> (valid range is 1 to 8).
<b>subslot <i>slot/card</i></b>		Shuts down the line card that is physically present in the slot with the specified slot (valid range is 1 to 8) and card (valid range is 0 to 1) numbers.

**Defaults** No default behavior or values.

**Command Modes** Global configuration

Command History	Release	Modification
	12.2(4)XF	This command was introduced for the Cisco uBR10012 router.

**Usage Guidelines** The **hw-module shutdown** command shuts down a PRE module or line card in a controlled manner. The PRE module or line card resets shutdown until it is reset with the **hw-module reset** command.



**Caution**

Shutting down the active PRE module will trigger a switchover, so that the standby PRE module becomes the active PRE module.

**Examples**

The following example shows the standby PRE module being shut down:

```
Router(config)# hw-module sec-cpu shutdown
Router(config)#
```

The following example shows the active PRE module being shut down (which will trigger a switchover to the standby PRE module):

```
Router(config)# hw-module main-cpu shutdown
Router(config)#
```

The following example shows the PRE module in PRE slot B being shut down:

```
Router(config)# hw-module pre B shutdown
Router(config)#
```

**Note**

The **hw-module pre B shutdown** command shuts down the PRE module that is physically present in slot B, regardless of whether the module is the active or standby PRE module.

**Related Commands**

Command	Description
<a href="#">hw-module reset</a>	Resets a PRE module or line card.
<a href="#">redundancy force-failover main-cpu</a>	Forces a manual switchover between the primary and standby PRE modules.

# main-cpu

To enter main-CPU redundancy configuration mode, so that you can configure the synchronization of the primary and standby PRE modules, use the **main-cpu** command in redundancy configuration mode.

## main-cpu

**Syntax Description** This command has no keywords or arguments.

**Defaults** No default behavior or values.

**Command Modes** Redundancy configuration

Command History	Release	Modification
	12.2(4)XF	This command was introduced for the Cisco uBR10012 router.

**Usage Guidelines** When you enter main-CPU redundancy configuration mode, the prompt changes to the following:

```
Router(config-r-mc)#
```

After you enter main-CPU redundancy configuration mode, you can use the **auto-sync** command to specify which files are synchronized between the primary and standby PRE modules. To leave main-CPU redundancy configuration mode and to return to redundancy configuration mode, use the **exit** command.

**Examples** The following example shows how to enter main-CPU redundancy mode and the commands that are available there:

```
Router# config t
Router(config)# redundancy
Router(config-r)# main-cpu
Router(config-r-mc)# ?
```

Main Cpu redundancy configuration commands:

```
auto-sync  Sync elements
exit       Exit from main-cpu configuration mode
no        Negate a command or set its defaults
```

```
Router(config-r-mc)#
```

Related Commands	Command	Description
	<a href="#">auto-sync</a>	Configures which files are synchronized between the primary and standby PRE modules.
	<a href="#">redundancy</a>	Enters redundancy configuration mode.



# redundancy

To enter redundancy configuration mode, use the **redundancy** command in global configuration mode.

**redundancy**

**Syntax Description** This command has no keywords or arguments.

**Defaults** No default behavior or values.

**Command Modes** Global configuration

Command History	Release	Modification
	12.2(4)XF	This command was introduced for the Cisco uBR10012 router.

**Usage Guidelines** When you enter redundancy configuration mode, the prompt changes to the following:

```
Router(config-r)#
```

After you enter redundancy configuration mode, you can use the **main-cpu** command to enter main-CPU redundancy configuration mode, which allows you to specify which files are synchronized between the primary and standby PRE modules.

To leave redundancy configuration mode and to return to global configuration mode, use the **exit** command.

**Examples** The following example shows how to enter redundancy configuration mode and the commands that are available in that mode:

```
Router# config t
Router(config)# redundancy
Router(config-r)# ?
Redundancy configuration commands:
  associate Associate redundant slots
  exit      Exit from redundancy configuration mode
  main-cpu Enter main-cpu mode
  no       Negate a command or set its defaults
Router(config-r)#
```

Related Commands	Command	Description
	<a href="#">associate</a>	Associates two line cards for APS redundancy protection.
	<a href="#">redundancy</a>	Forces a switchover so that the standby PRE module becomes the active PRE module.
	<a href="#">force-failover</a>	
	<a href="#">main-cpu</a>	

# redundancy force-failover main-cpu

To force a switchover, so that the standby PRE module becomes the active PRE module, use the **redundancy force-failover main-cpu** command in Privileged EXEC mode.

## redundancy force-failover main-cpu

**Syntax Description** This command has no keywords or arguments.

**Defaults** No default behavior or values.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(4)XF	This command was introduced for the Cisco uBR10012 router.

**Usage Guidelines** The **redundancy force-failover main-cpu** command initiates a manual switchover, so that the standby PRE module becomes the active PRE module and assumes full responsibilities for router operations. This command requires that both PRE modules are running a Cisco IOS software image that supports the RPR feature.

A manual switchover is typically done for one of the following reasons:

- You want to upgrade or replace the active PRE module.
- You have upgraded the Cisco IOS software on the standby PRE module and want the standby PRE module to begin using the new software image. This also allows you to upgrade the software on the former active PRE module without interrupting systems operations.
- You want to test switchover operation on the system.

A switchover can also be manually initiated by removing the active PRE module from the chassis, but using the **redundancy force-failover main-cpu** command provides a more graceful switchover, without generating hardware alarms.



**Note**

The terms failover and switchover are interchangeable, but switchover is the term used across all Cisco platforms capable of high-availability operation.

**Examples** The following example shows a switchover being manually initiated:

```
Router# redundancy force-failover main-cpu
Proceed with switchover to standby PRE? [confirm] y
```

**Note**

---

Pressing the **enter** key or **y** confirms the action and begins the switchover. Pressing any other key aborts the switchover and returns control to the current active PRE module.

---

The following example shows a switchover being attempted but failing because the standby PRE module is either not available or not installed:

```
Router# redundancy force-failover main-cpu
Proceed with switchover to standby PRE? [confirm]
Unable to communicate with standby PRE, switchover aborted.
Router#
```

---

**Related Commands**

Command	Description
<a href="#">redundancy</a>	Enters redundancy configuration mode so that the synchronization parameters can be configured.

---



# show redundancy

To display the current redundancy status, use the **show redundancy** command in Privileged EXEC mode.

**show redundancy**

**Syntax Description** This command has no keywords or arguments.

**Defaults** No default behavior or values.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(4)XF	This command was introduced for the Cisco uBR10012 router.

**Usage Guidelines** The **show redundancy** command shows whether the PRE A slot or PRE B slot contains the active (**Primary**) PRE module, the status of the standby PRE module, and the values for the standby PRE module's boot variables and configuration register.



**Note**

The **show redundancy** command always shows the correct location of the active PRE module. The other PRE slot will always be marked as **Secondary**, even if a second PRE module is not installed.

**Examples** The following example shows a typical display from the show redundancy command. The active PRE module is in PRE slot A, and the standby PRE module is in PRE slot B:

```
Router# show redundancy
PRE A (This PRE)   : Primary
PRE B              : Secondary

Redundancy state is REDUNDANCY_PEERSECONDARY_INITED

Secondary PRE 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
```

The following example shows the same display but after a switchover has occurred. The **show redundancy** command now shows that the Active PRE has changed slots (in this case, moving from slot A to slot B):

```
Router# show redundancy
PRE A              : Secondary
PRE B (This PRE)   : Primary
```

## show redundancy

```

Redundancy state is REDUNDANCY_PEERSECONDARY_INITED

Secondary PRE 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#

```

The following example shows a typical display when the standby PRE module is not installed or is not operational. The standby PRE module is shown as not up, and its boot variables and configuration register are not shown.

```

Router# show redundancy
PRE A (This PRE)   : Primary
PRE B              : Secondary

Redundancy state is REDUNDANCY_PEERSECONDARY_NONOPERATIONAL

Secondary PRE information...
Secondary PRE is not up

```

### Related Commands

Command	Description
<a href="#">redundancy</a>	Configures the synchronization of system files between the primary and standby PRE modules.
<a href="#">redundancy force-failover main-cpu</a>	Forces a manual switchover between the primary and standby PRE modules.

# Debug Commands

This section describes the following debug command that supports the RPR feature.

- [debug redundancy, page 36](#)

# debug redundancy

To enable debugging of the RPR feature and its background procedures, use the debug redundancy command in Privileged EXEC mode.

```
debug redundancy {all | alarms | configsync | fsm | keepalive | peer-monitor | services |
timesync}
```

## Syntax Description

<b>alarms</b>	Enables debugging messages for alarms sent because of redundancy procedures.
<b>all</b>	Enables all redundancy debugging messages.
<b>configsync</b>	Enables debugging messages for the synchronization of the configuration files.
<b>fsm</b>	Enables debugging for changes in the redundancy finite state machine (FSM).
<b>keepalive</b>	Enables debugging messages for the keepalive messages sent between PRE modules.
<b>peer-monitor</b>	Enables debugging messages for the standby PRE module's monitoring of the active PRE module.
<b>services</b>	Enables debugging for the services requested during redundancy processing.
<b>timesync</b>	Enables debugging messages for time synchronization procedures.

## Command Modes

Privileged EXEC

## Command History

Release	Modification
12.2(4)XF	This command was introduced for the Cisco uBR10012 router.

## Examples

The following example shows all redundancy debugging messages being enabled:

```
Router# debug redundancy all
Redundancy All debugging is on
```

```
Router#
```

The following example shows typical messages that the **debug redundancy alarms** command displays:

```
Router# debug redundancy alarms
Redundancy Alarms debugging is on
Router#
```

```
01:28:48: %REDUNDANCY-5-PEER_MONITOR_EVENT: Primary detected a secondary crash
(raw-event=KEEPALIVE_FAILURE(7))
slave_down: generating Secondary-Down alarm
Asserting alarm : SEC_FAILURE
```

```
01:28:48: %REDUNDANCY-5-PEER_MONITOR_EVENT: Primary detected a secondary crash
(raw-event=PEER_REDUNDANCY_STATE_CHANGE(5))
```

The following example shows the typical state changes that the **debug redundancy fsm** command displays when the standby PRE module is reset:

```
Router# debug redundancy fsm
Redundancy FSM debugging is on
Router#

01:15:30: %REDUNDANCY-5-PEER_MONITOR_EVENT: Primary detected a secondary crash
(raw-event=KEEPALIVE_FAILURE(7))
Flushing IPC entries in FSM queue

01:15:30: eh_sa_fsm: state change, events: major=2 minor=1
REDUNDANCY_PEERSECONDARY_INITED(9) => REDUNDANCY_PEERSECONDARY_NONOPERATIONAL(6)

01:15:31: %REDUNDANCY-5-PEER_MONITOR_EVENT: Primary detected a secondary crash
(raw-event=PEER_REDUNDANCY_STATE_CHANGE(5))

01:15:31: %REDUNDANCY-5-PEER_MONITOR_EVENT: Primary detected a secondary crash
(raw-event=KEEPALIVE_FAILURE(7))
Flushing IPC entries in FSM queue

01:15:31: eh_sa_fsm: state change, events: major=2 minor=1
REDUNDANCY_PEERSECONDARY_INITED(9) => REDUNDANCY_PEERSECONDARY_NONOPERATIONAL(6)

01:15:31: %REDUNDANCY-5-PEER_MONITOR_EVENT: Primary detected a secondary crash
(raw-event=PEER_REDUNDANCY_STATE_CHANGE(5))
```

The following example shows the messages displayed by the **debug redundancy keepalive** command:

```
Router# debug red keepalive
Redundancy Keepalive debugging is on
Router#

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

# Glossary

This glossary defines terms that are used in this document but are not otherwise explained. For a complete set of acronyms and other terms, see the *Internetworking Terms and Acronyms* on Cisco.com and the Customer Documentation CD-ROM.

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**Active PRE**—The PRE module that controls the system, runs the routing protocols, performs Layer 2 and Layer 3 packet routing and forwarding, and presents the system management interface. It also provides the active auxiliary, console, and FastEthernet ports.

**APS**—Automatic Protection Switching: SONET switching mechanism that routes traffic from working lines to protect them in case of a line card failure or fiber cut.

**CLI**—Command Line Interface.

**Cutover**—See Switchover.

**EHSA**—Enhanced High System Availability. Redundancy method wherein the standby PRE module suspends its initialization midway through the startup process. See also RPR.

**Failover**—See Switchover.

**FSU**—Fast Software Upgrade. A mechanism to upgrade the Cisco IOS software images on the PRE modules and line cards without reinitializing the entire system.

**HSA**—High System Availability. HSA enables a system to reset and use a standby PRE module in the event of a failure of the active PRE module.

**OIR**—Online Insertion and Removal. Feature that permits the addition, replacement, or removal of cards without interrupting the system power, entering console commands, or causing other software or interfaces to shut down. Also called “hot swapping” or “power-on servicing”.

**POS**—Packet-over-SONET interface. Enables core routers to send native IP packets directly over SONET/SDH frames.

**Primary PRE**—See Active PRE.

**RPR**—Route Processor Redundancy. An alternative to HSA that reduces unplanned downtime.

**PRE**—Performance Routing Engine. The Route Processor on the Cisco uBR10012 universal broadband router.

**PRE1**—Enhanced version of the Performance Routing Engine that features Error Checking and Correction (ECC), instead of parity checking, for its onboard memory.

**RP**—Route Processor. The generic term for a router’s processing module. On the Cisco uBR10012 router, the RP is the PRE module.

**RPR**—Route Processor Redundancy. RPR implements HSA, in which a standby PRE module is semi-initialized and then monitors the active PRE module. If the active PRE module fails, the secondary PRE module becomes the active PRE module and initiates failover procedures, in which the linecards are reset and the line card software is reloaded.

**Secondary PRE**—See Standby PRE.

**Standby PRE**—The PRE module that monitors the Active PRE module and is ready to take over the functions of the Active PRE module in the event of unplanned or planned downtime. At system boot, the standby PRE module begins its initialization procedures and then suspends them halfway, so that it can monitor the active PRE module.

**SNMP**—Simple Network Management Protocol

**Switchover**—An event in which system control and routing protocol execution is transferred from a failed processor to a standby RP.

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