



Route Processor Redundancy for the Cisco uBR10012 Universal Broadband Router

First Published: February 14, 2008

Last Updated: January 28, 2013

The Route Processor Redundancy feature for the Cisco CMTS Routers is supported on the Cisco CMTS routers in Cisco IOS Release 12.3BC and 12.2SC. Route Processor Redundancy (RPR) reduces unplanned downtime. RPR enables a quicker switchover between active and standby PRE modules in the event of a fatal error on the active PRE module. When you configure RPR, the standby PRE is synchronized with the active PRE. In the event of a fatal error on the active PRE, the system switches to the standby PRE, which reinitializes itself and functions as the active PRE, reducing downtime of the system.

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.

Contents

- [Prerequisites for Route Processor Redundancy, page 2](#)
- [Restrictions for Route Processor Redundancy, page 3](#)
- [Information About Route Processor Redundancy, page 3](#)
- [How to Configure Route Processor Redundancy, page 8](#)
- [Configuration Examples for Route Processor Redundancy, page 21](#)
- [Additional References, page 22](#)
- [Feature Information for Route Processor Redundancy, page 23](#)

Prerequisites for Route Processor Redundancy

- Two PRE modules must be installed in the Cisco uBR10012 chassis.
- The two processor modules must be of the same type. Both modules must be PRE2 modules or both modules must be PRE4 modules. You cannot mix PRE2 and PRE4 modules in the same chassis.
- 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.

Table below shows the hardware compatibility prerequisites for this feature.


Note

Support for Route Processor Redundancy features in Cisco IOS Releases before 12.2BC; however, several of these releases and hardware have since reached End-of-Life (EOL) and therefore only the latest Cisco IOS software release trains are shown in the hardware compatibility table. For more information about the complete feature history, see the [Feature Information for Route Processor Redundancy](#), on page 23.


Note

The hardware components introduced in a given Cisco IOS Release will be supported in all subsequent releases unless otherwise specified.

Table 1: Route Processor Redundancy for Cisco CMTS Hardware Compatibility Matrix

| CMTS Platform | Processor Engine |
|---|--|
| Cisco uBR10012 Universal Broadband Router | Cisco IOS Release 12.2(33)SCA and later <ul style="list-style-type: none"> • PRE2 |
| | Cisco IOS Release 12.2(33)SCB and later <ul style="list-style-type: none"> • PRE4 |
| | Cisco IOS Release 12.2(33)SCH and later <ul style="list-style-type: none"> • PRE5 |

Restrictions for Route Processor Redundancy

- Both PRE modules must be running Cisco IOS Release 12.2(33)SCA or Cisco IOS Release 12.2 SC releases to support the RPR feature.

Information About Route Processor Redundancy

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 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 From Cisco IOS release 12.2SC onwards, Nonstop Forwarding (NSF) and Stateful Switchover (SSO) are 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_2s/feature/guide/fssso20s.html.



Note Unless otherwise indicated, all references to a PRE module in this document also include the PRE2 or PRE4 modules. However, when using redundant PRE modules, they cannot be mixed but must both be of the same type: both must be PRE2 modules or both must be PRE4 modules.

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](#), on page 5 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.

- 1 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.

Is PRE Switchover Failing?

The usual phenomenon for a PRE switchover to be affected is when the active PRE has these issues:

- PRE module hangs
- Login to PRE console or Tenet to chassis fails
- Line cards unable to connect to active PRE module, hence crashing
- Cable modems drop offline
- Chassis reload required
- Reset of active PRE module requires to restore service

One of the reasons may be because the active PRE may not be able to release its control to the standby PRE, thus both the PRE modules behave as the primary PRE modules.

In Cisco IOS Release 12.2(33)SCE5, the PRE high-availability is enhanced to address the PRE switchover issue. The line card uses a link loop mechanism when both the PRE modules behave as primary PRE modules.

In this mechanism, the line card checks the packet sent from the active PRE module, and automatically does a switchover to the real active PRE. The link loop mechanism automatically connects to the real active PRE module based on the MAC address, thus increasing robustness. This mechanism activates before the IPC keepalive timeout mechanism between the route processor and the line card does.



Note The PRE high-availability enhancement applies to both SSO and RPR redundancy modes on the Cisco uBR10012 router. For information on configuring SSO, see *Stateful Switchover* document at: http://www.cisco.com/en/US/docs/ios/12_2s/feature/guide/fssso20s.html.



Note If you are using the Break key to collect information, ensure that it is performed within 36 seconds (36s Enhanced High System Availability Redundancy (EHSA) keepalive timeout) to prevent a reset of the active PRE module.



Note In case there is hardware issue with the PRE module, do not reinsert the faulty PRE in the chassis. Inserting a faulty PRE (although a standby PRE) may cause the line card to switch to the faulty PRE causing the line card to crash and cable modems to go offline.

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 below 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 2: 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. |

| File System | Filename for CLI Commands | Description |
|--|---|--|
| 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). ¹ 0 refers to the left slot on the PRE module. 1 refers to the right slot on the PRE module. The sec prefix refers to the Flash disk or card in the standby PRE module. |
| FTP TFTP RCP | ftp: tftp: rcp: | Protocols used to transfer files to and from remote devices. |

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* section in the [Cisco IOS Release 12.2 Configuration Fundamentals Configuration Guide](#).

Console Port Usage After a PRE Module Switchover

When an 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 an 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.

Reload PXF in the Standby PRE

Introduced in Cisco IOS Release 12.2(33)SCG2, the Reload PXF in the Standby PRE feature fixes most of the double-hit IRAM parity errors by reloading the Parallel Express Forwarding (PXF) in the standby PRE. The PXF can be reloaded periodically, or by a process based on timeout events, in the standby PRE. For the

Reload PXF in the Standby PRE feature, both the PRE modules should run the same Cisco IOS Release 12.2(33)SCG2 or later releases.

When Toasters (PXF Network Processing ASICs) continue to run for more than six months, Instruction RAM (IRAM) of the Toasters could encounter parity error where some bits of the IRAM are inverted. If a packet that is injected into the Toasters reaches the affected memory bits, the PRE will crash. If the IRAM parity error occurs in the standby PRE, it could remain undetected for a long time. During this period, if the active PRE crashes, the standby PRE will also crash after switchover, leading to collapse of the Cisco CMTS. This is called a double-hit IRAM parity error.

Restrictions

- Services may be affected when switchover and periodic reload of the PXF occur at the same time. The probability of this coincidence can be calculated by the following formula: $10s / (30 * 6 * 24 * 3600) * A = 1/1555200 * A = A * 6.43e-7$ A is the probability of IRAM parity error of toasters on one PRE board.
- Standby PRE crashes on Reload failure

For benefits of the Reload PXF in the Standby PRE feature, see the [Reload PXF in the Standby PRE ensures Enhanced Stability](#), on page 7.

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.

Reload PXF in the Standby PRE ensures Enhanced Stability

The Reload PXF in the Standby PRE feature ensures enhanced stability of the Cisco uBR10012 router by providing the following enhancements:

- Prevent double-hit IRAM parity errors.
- Reloading the PXF in the standby PRE when a timeout event is generated.

- Prevents the standby PRE crash and subsequent crashing of the Cisco CMTS. If the current PRE is in standby mode, the Toasters and Cobalt3 are reset.
- Interval of periodic reload is set at six months.
- Reload is scheduled at 3 a.m. (0300) local time, which is estimated as low traffic time, for minimal performance impact.

Toaster IRAM Parity Improvement

Starting from Cisco IOS Release 12.2(33)SCJ1a, the system shuts down the TMC cores which has Toaster IRAM parity error, and keeps other cores running. It can avoid the PXF crush and PRE switch over.

This feature is enabled by default, it can be disabled using **no cable toaster-iram-recover** command, to re-enable it, use **cable toaster-iram-recover** command.

Restrictions

- TMC core shutting down can only initiate once. The second occurrence of the Toaster IRAM parity error will trigger PXF crush.
- PRE5 PXF consists of five Toasters, this solution is effective only on the first four, which are T0, T1, T2 and T3.

How to Configure Route Processor Redundancy

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



Tip

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.



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.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **redundancy**
4. **main-cpu**
5. **auto-sync *option***
6. **end**
7. **copy running-config startup-config**

DETAILED STEPS

| | Command or Action | Purpose |
|--------|---|---|
| Step 1 | enable Example: Router> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Router# config terminal | Enters global configuration mode. |
| Step 3 | redundancy Example: Router (config) # redundancy | Enters redundancy configuration mode. |
| Step 4 | main-cpu Example: Router (config-red) # main-cpu | Enters the main CPU configuration mode. <ul style="list-style-type: none"> • This configures the active PRE module, not the standby PRE module. |
| Step 5 | auto-sync <i>option</i> Example: Router (config-r-mc) # auto-sync^{option} | Specifies the files to be synchronized. The <i>option</i> parameter can be one of the following: <ul style="list-style-type: none"> • startup-config —(Specifies that the PRE modules should synchronize the startup configuration files. |

| | Command or Action | Purpose |
|---------------|---|--|
| | | <ul style="list-style-type: none"> • config-register —(Specifies synchronization of the configuration register values. • bootvar —(Specifies synchronization of the following boot variables: <ul style="list-style-type: none"> ◦ BOOT ◦ CONFIG_FILE ◦ BOOTLDR • standard—(Default) Specifies synchronization of all the system files. |
| Step 6 | end Example: Router(config-r-mc)# end | Returns to privileged EXEC mode. |
| Step 7 | copy running-config startup-config Example: Router# copy running-config startup-config | Saves the current configuration as the default startup configuration. |

Configuring Reload PXF in the Standby PRE

The Reload PXF in the Standby PRE feature on the Cisco uBR10012 router is disabled by default. Use the following procedure to enable the Reload PXF in the Standby PRE feature.

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|---|--|
| Step 1 | enable Example: Router> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Router# configure terminal | Enters global configuration mode. |

| | Command or Action | Purpose |
|---------------|--|--|
| Step 3 | redundancy Example: Router(config)# redundancy | Enters redundancy configuration mode. |
| Step 4 | periodic-rel-pxf enable Example: Router(config-red) # periodic-rel-pxf enable | Enables the periodic PXF reload. Note This configuration enables the PXF to reload periodically in the standby PRE module. |
| Step 5 | end Example: Router(config-red) # end | Returns to privileged EXEC mode. |

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:

Example:

```
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, 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:

Example:

```
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):

Example:

```

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:

Example:

```

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

```

What to Do Next



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:

Example:

```
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 (fcl)
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:

Example:

```
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:

Example:

```
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#
```

Verifying Reload PXF in the Standby PRE

To verify that the Reload PXF in the Standby PRE feature is enabled, use the **show running-config | include periodic** command in privileged EXEC mode.

```
Router# show running-config | include periodic

periodic-rel-pxf enable

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:

Example:

```
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:

Example:

```
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:

Example:

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

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

Example:

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

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

Example:

```
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:

Example:

```
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:

Example:

```
Router# show version

Cisco Internetwork Operating System Software
```

Example:

```
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
```

Example:

- 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 the Table below.

Table 3: Definition of Bits in the Software Configuration Register

| Bit No. | Hex Value | Meaning/Function |
|-----------|------------------|--|
| 00 to 03 | 0x0000 to 0x000F | <p>Defines the source of a default Cisco IOS software image required to run the router:</p> <ul style="list-style-type: none"> • 00—On powerup, the system remains at the ROM monitor prompt (rommon>), awaiting a user command to boot the system manually by means of the rommon boot command. • 01—On powerup, the system automatically boots the first system image found in the Flash memory single inline memory module (SIMM) on the PRE. • 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. |
| 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). |

| Bit No. | Hex Value | Meaning/Function |
|---------|-----------|---|
| 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:

Example:

```
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.

Example:

```
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:

Example:

```
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.
...
```

Example:

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.

Example:

```
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:

Example:

```
Router# reload
```

```
System configuration has been modified. Save? [yes/no]: yes
```

```
Proceed with reload? [confirm]
```

What to Do Next**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:

Example:

```
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:

Example:

```
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:

Example:

```
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

Example:

```
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:

Example:

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

What to Do Next

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:

Example:

```
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:

Example:

```

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:

Example:

```

Router# show bootvar

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

```

Configuration Examples for Route Processor Redundancy

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

```

Additional References

Related Documents

| Related Topic | Document Title |
|--|---|
| CMTS commands | Cisco IOS CMTS Cable Command Reference |
| CMTS Hardware Installation Guide | Cisco uBR10012 Series Hardware Installation Guide |
| CMTS Software Installation Guide | Cisco IOS CMTS Cable Software Configuration Guide, Release 12.2SC |
| CMTS Troubleshooting Guide | Cisco uBR10012 Series Troubleshooting Guide |
| Route Processor Performance Routing Engines | Cisco uBR10012 Universal Broadband Router Performance Routing Engine Module |
| Route Processor Redundancy Plus for Cisco CMTS | Route Processor Redundancy Plus for the Cisco uBR10012 Universal Broadband Router |
| Stateful Switchover | Stateful Switchover |
| In Service Software Upgrade | Cisco IOS In Service Software Upgrade |

Standards

| Standard | Title |
|---|-------|
| No new or modified standards are supported by this feature. | — |

MIBs

| MIB | MIBs Link |
|--|---|
| No new or modified MIBs are supported by this feature. | To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs |

RFCs

| RFC | Title |
|--|-------|
| No new or modified RFCs are supported by this feature. | — |

Technical Assistance

| Description | Link |
|---|---|
| The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password. | http://www.cisco.com/cisco/web/support/index.html |

Feature Information for Route Processor Redundancy

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to <http://tools.cisco.com/ITDIT/CFN/>. An account on <http://www.cisco.com/> is not required.

**Note**

The below table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Table 4: Feature Information for Route Processor Redundancy

| Feature Name | Releases | Feature Information |
|----------------------------|------------|--|
| Route Processor Redundancy | 12.2(4)XF | This feature was introduced on the Cisco uBR10012 universal broadband router. |
| | 12.2(4)BC1 | Support for this feature was added to Cisco IOS Release 12.2 BC for the Cisco uBR10012 universal broadband router. |

| Feature Name | Releases | Feature Information |
|-------------------------------|-------------------------|--|
| | 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. |
| | 12.2(33)SCA | This feature was intergrated in Cisco IOS Release 12.2(33)SCA for Cisco uBR10012 router. |
| | 12.2(33)SCE5 | PRE high availability was enhanced. A link loop mechanism was added to the PRE switchover. |
| Reload PXF in the Standby PRE | 12.2(33)SCG2 | This feature is introduced on Cisco uBR10012 universal broadband router. The following were introduced or modified: periodic-rel-pxf enable |