Route Processor Redundancy Plus (RPR+)

Route Processor Redundancy (RPR) provides an alternative to the High System Availability (HSA) feature. HSA enables a system to reset and use a standby Route Switch Processor (RSP) if the active RSP fails. Using RPR, you can reduce unplanned downtime because RPR enables a quicker switchover between an active and standby RSP if the active RSP experiences a fatal error.

RPR Plus (RPR+) is an enhancement of the RPR feature. RPR+ keeps the Versatile Interface Processors (VIPs) from being reset and reloaded when a switchover occurs between the active and standby RSPs.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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 module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Route Processor Redundancy Plus (RPR+)

RPR and RPR+ require a Cisco 7500 series router loaded with two RSP16s, one RSP16 and one RSP8, two RSP8s, or a combination of RSP2s and RSP4s. If you are using the one RSP16 and one RSP8 combination, you must use the same memory--256 MB--in both RSPs because the secondary RSP must be able to support the primary RSP during a failover.

Restrictions for Route Processor Redundancy Plus (RPR+)

- RSP1s do not support RPR or HSA.

- RPR is supported only on routers that support dual RSPs. Only the Cisco 7507 and Cisco 7513 support dual RSPs.

- RPR+ operates only in a system with VIPs as the line cards. Systems with legacy interface processors default to RPR.

- In RPR+ mode, configuration changes done through Simple Network Management Protocol (SNMP) may not be automatically configured on the standby RSP after a switchover occurs.

- RPR+ does not work on routers configured with MPLS.

Information About Route Processor Redundancy Plus (RPR+)

RPR

Route Processor Redundancy (RPR) provides an alternative to the High System Availability (HSA) feature currently available on Cisco 7500 series routers. HSA enables a system to reset and use a standby Route Switch Processor (RSP) if the active RSP fails.

Using RPR, you can reduce unplanned downtime. RPR enables a quicker switchover between an active and standby RSP if the active RSP experiences a fatal error. When you configure RPR, the standby RSP loads a Cisco IOS image on bootup and initializes itself in standby mode. In the event of a fatal error on the active RSP, the system switches to the standby RSP, which reinitializes itself as the active RSP, reloads all of the line cards, and restarts the system.

RPR+

The RPR+ feature is an enhancement of the RPR feature on Cisco 7500 series routers. RPR+ keeps the VIPs from being reset and reloaded when a switchover occurs between the active and standby RSPs. Because VIPs are not reset and microcode is not reloaded on the VIPs, and the time needed to parse the configuration is eliminated, switchover time is reduced to 30 seconds.

The table below describes the average time for a router to switchover to a standby RSP if the active RSP fails.

Table 1: Average Switchover Time Comparison Table

Feature	Time to Immediately Switch a Packet on New RSP After Failover	Expected Overall Time to Have New RSP in New High Availability State After Failover	Notes
HSA	10 minutes	20 minutes	System default.
RPR	5 minutes	15 minutes	VIPs and legacy interface processors (IPs) supported.
RPR+	30 seconds	11 minutes	VIPs supported.[1]

[1] Legacy IPs default to RPR. To allow RPR+ for VIPs when up to two legacy IPs exist in the router, you must configure the service single-slot-reload-enable command. If you do not enable the service single-slot-reload-enable command or if you have more than two legacy IPs, all the line cards are reloaded.

Note   The table above shows average switchover times. Recovery time will vary depending on the configuration of the router.

In the table above we have noted that RPR+ supports up to two legacy IPs in the router if the **service single-slot-reload-enable** command is configured. By default, the existence of any legacy IPs in the router causes all the line cards to be reloaded during an RPR+ switchover and a message similar to the following to be displayed:

```
%HA-2-MAX_NO_Quiesce: 1 linecard(s) not quiesced exceeds limit of 0, all slots will be
reloaded.
```
If the **service single-slot-reload-enable** command is configured, then the NO_Quiesce limit is set to two, allowing two quiesce failures during an RPR+ switchover. When more than two legacy IPs exist in the router, all the line cards are reloaded during an RPR+ switchover, and a message similar to the following is displayed:

```
%HA-2-MAX_NO_Quiesce: 3 linecard(s) not quiesced exceeds limit of 2, all slots will be
reloaded.
```

How to Configure Route Processor Redundancy Plus (RPR+)

Copying an Image onto Active and Standby RSPs

Perform this task to use TFTP to copy a high availability Cisco IOS image onto the active and standby RSPs.

Before You Begin

Before copying a file to flash memory, you must ensure that there is enough space available in flash memory. Compare the size of the file that you are copying to the amount of available flash memory shown. If the space available is less than the space required by the file that you will copy, the copy process will not continue and and error message similar to the following will be displayed:

%Error copying tftp://*image@server/tftpboot/file-location/image-name* (Not enough space on device) .

SUMMARY STEPS

1. **enable**
2. **copy tftp slot** *slot-number* **:**
3. **copy tftp slaveslot** *slot-number* **:**

DETAILED STEPS

Step 1   **enable**
Enables privileged EXEC mode. Enter your password if prompted.

Example:

```
Router> enable
```

Step 2   **copy tftp slot** *slot-number* **:**
Use this command to copy a high availability Cisco IOS image onto the flash memory card of the active RSP. The **slot** *slot-number* keyword and argument specify the flash memory card of the active RSP.

Example:

```
Router# copy tftp slot0:
Address or name of remote host []? ip-address
```

Enter the IP address of the TFTP server that contains the new image.

Example:

```
Router# 172.18.2.3
Source filename []? image-name
```

Enter the name of the image file that you are copying to the flash memory card.

Example:

```
Router# rsp-pv-mz
Destination file name? [image-name1
] <Return>
```

Enter the name under which you want the image file to appear at the destination. The destination name is optional. To use the same image name as the source file, press the Enter key.

Example:

```
Accessing tftp://ip-address/...
```

Step 3   **copy tftp slaveslot** *slot-number* **:**
Use this command to copy a high availability Cisco IOS image onto the flash memory card of the standby RSP. The **slaveslot** *slot-number* keyword and argument specify the flash memory card of the standby RSP.

Example:

```
Router# copy tftp slaveslot0:
Address or name of remote host []? ip-address
```

Enter the IP address of the TFTP server that contains the new image.

Example:

```
Router# 172.18.2.3
Source filename []? image-name
```

Enter the name of the image file that you are copying to the flash memory card.

Example:

```
Router# rsp-pv-mz
Destination file name? [image-name1
] <Return>
```

Enter the name under which you want the image file to appear at the destination. The destination name is optional. To use the same image name as the source file, press the Enter key.

Example:

```
Accessing tftp://ip-address/...
```

What to Do Next

If you do not want to modify the software configuration register boot field, proceed to the Configuring RPR+, on page 7.

Setting the Configuration Register Boot Variable

Perform this optional task to modify the software configuration register boot field to ensure that the system boots the same image as that specified by the **hw-module slot image** command in the Configuring RPR+, on page 7.

SUMMARY STEPS

1. **enable**
2. **show version**
3. **configure   terminal**
4. **boot system flash slot** *slot-number* **:** [*image-name*]
5. **config-register** *value*
6. **exit**
7. **reload**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show version** **Example:** `Router# show version`	Displays the current configuration register setting at the end of the display.
Step 3	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 4	**boot system flash slot** *slot-number* **:** [*image-name*] **Example:** `Router(config)# boot system flash slot0:rsp-pv-mz`	Specifies the filename of an image stored in flash memory. • *slot-number* :--Specifies the active RSP slot where the flash memory card is located. Valid slot numbers are 0 and 1 for the Cisco 7500 series RSP. • *image-name* --Specifies the name of the image. It is recommended that you set the boot variable so that the system boots the same image as that specified by the **hw-module slot** *slot-number* **image** *file-spec*command. See Step 3 of the Configuring RPR+, on page 7.
Step 5	**config-register** *value* **Example:** `Router(config)# config-register 0x2102`	Modifies the existing configuration register setting to reflect the way in which you want to load a system image. • Use the *value* argument to specify the configuration register setting. Valid values are in the range from 0x0 to 0xFFFF. • In this example, when a **reload** command is issued, the router automatically boots the image specified in the **boot system flash** *image-name* configuration.
Step 6	**exit** **Example:** `Router(config)# exit`	Exits global configuration mode and returns to privileged EXEC mode.

	Command or Action	Purpose
Step 7	reload **Example:** `Router# reload`	Reboots the router to make your configuration changes take effect.

Examples

he following is sample partial output from the **show version** command; the output displays the current configuration register setting.

```
Router# show version
Cisco IOS Software, C7500 Software (C7500-IPBASE-MZ), Version 12.3(7)T,  RELEASE)
TAC Support: http://www.cisco.com/tac
Copyright (c) 1986-2004 by Cisco Systems, Inc.
Compiled Fri 16-Jan-04 18:03 by engineer
ROM: System Bootstrap, Version 12.1(3r)T2, RELEASE SOFTWARE (fc1)
.
.
.
Configuration register is 0x2102
```

Configuring RPR+

Perform this task to configure RPR+.

Note   RPR+ operates only in a system with VIPs as the line cards. Systems with legacy IPs default to RPR mode. Up to two legacy IPs can be supported by RPR+ if the **service single-slot-reload-enable** command is configured. For more details, see the RPR, on page 2.

>

SUMMARY STEPS

1. **enable**
2. **configure   terminal**
3. **hw-module slot** *slot-number* **image** *file-spec*
4. Repeat Step 3 for the standby RSP.
5. **redundancy**
6. **mode** {**hsa**| **rpr**| **rpr-plus**}
7. **exit**
8. **copy system:running-config nvram:startup-config**
9. **hw-module sec-cpu reset**

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**hw-module slot** *slot-number* **image** *file-spec* **Example:** `Router(config)# hw-module slot 6 image slot0:rsp-pv-mz`	Specifies a high availability Cisco IOS image to run on an active RSP. • Use the *slot-number* argument to specify the RSP slot. • Use the *file-spec* argument to specify the flash memory card to load the image into and the name of the image. • In this example, the active RSP is loaded in slot 6.
Step 4	Repeat Step 3 for the standby RSP. **Example:** `Router(config)# hw-module slot 7 image slot0:rsp-pv-mz`	Repeat Step 3 to specify a high availability Cisco IOS image to run on the standby RSP. • In this example, the standby RSP is loaded in slot 7.
Step 5	**redundancy** **Example:** `Router(config)# redundancy`	Enters redundancy configuration mode.
Step 6	**mode {hsa| rpr| rpr-plus}** **Example:** `Router(config-r)# mode rpr-plus`	Configures the redundancy mode. • Use the **rpr-plus** keyword to configure the mode as RPR+ on both the active and standby RSPs. • If no mode is specified, the default mode is HSA.
Step 7	**exit** **Example:** `Router(config-r)# exit`	Exits redundancy configuration mode and returns to global configuration mode. • Repeat this step one more time to exit global configuration mode. • Exiting global configuration mode after the redundancy mode has been set to RPR+ will trigger a timer to run for a few seconds, after which the standby RSP resets and reloads.

	Command or Action	**Purpose**

Step 8	**copy system:running-config nvram:startup-config**
	
	Example:
	
	`Router# copy system:running-config`
	`nvram:startup-config`
		(Optional) Copies the running configuration to the startup configuration to save the RPR+ configuration.
		
		• This command can be run manually immediately after exiting global configuration mode when the redundancy mode is set to RPR+, or it can be run after the standby RSP is reloaded and initialized.

Step 9	**hw-module sec-cpu reset** **Example:** `Router# hw-module sec-cpu reset`	(Optional) Resets and reloads the standby RSP with the specified Cisco IOS image and executes the image. • Although changing the redundancy mode to RPR+ will trigger a reload, using this command may initiate the standby RSP reset a few seconds faster than the automatic reload. **Note** If you do not specify a Cisco IOS image in Step 3, this command loads and executes the bundled default Cisco IOS standby image. The system then operates in HSA mode.

Verifying RPR+

Perform this task to verify whether RPR+ is configured on the router and to display other redundancy statistics.

SUMMARY STEPS

1. **enable**
2. **show redundancy**

DETAILED STEPS

Step 1   **enable**
Enables privileged EXEC mode. Enter your password if prompted.

Example:

`Router>` **`enable`**

Step 2   **show redundancy**
Use this command to verify what type of redundancy is configured on the router and to display other redundancy information.

Example:

```
Router# show redundancy
Operating mode is rpr-plus
```

```
redundancy mode rpr-plus
hw-module slot 2 image disk0:rsp-pv-mz
hw-module slot 3 image disk0:rsp-pv-mz
The system total uptime since last reboot is 5 days, 19 hours 36 minutes.
The system has experienced 27 switchovers.
The system has been active (become master) for 5 days, 15 hours 14 minutes.
Reason for last switchover:User forced.
```

Configuration Examples for Route Processor Redundancy Plus (RPR+)

Configuring RPR+ Example

In the following example, the active RSP is installed in slot 2 and the standby RSP is installed in slot 3 of a Cisco 7507 router.

```
Router# copy tftp slot0:rsp-pv-mz
Router# copy tftp slaveslot0:rsp-pv-mz
Router# configure terminal
Router(config)# hw-module slot 2 image slot0:rsp-pv-mz
Router(config)# hw-module slot 3 image slot0:rsp-pv-mz
Router(config)# redundancy
Router(config-r)# mode rpr-plus
Router(config-r)# end
Router# hw-module sec-cpu reset
Router# show running-config
version 12.3(7)T
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
service single-slot-reload-enable
!
hostname Router
!
boot system rcp://path/to/image/rsp-boot-mz
boot system tftp://path/to/image/rsp-boot-mz
boot bootldr bootflash:rsp-boot-mz
enable password password
!
redundancy
 mode rpr-plus ! Indicates that redundancy mode has been configured for RPR+.
!
hw-module slot 2 image slot0:rsp-pv-mz
hw-module slot 3 image slot0:rsp-pv-mz
ip subnet-zero
ip rcmd remote-username Router
ip cef distributed
ip host iphost 192.168.0.1
mpls traffic-eng auto-bw timers
!
!
controller T3 6/0/0
 clock source line
!
!
interface Ethernet0/0/0
 ip address 10.0.0.1 255.255.0.0
 no ip directed-broadcast
```

```
 ip route-cache distributed
 no keepalive
.
.
.
exec-timeout 0 0
 history size 40
 transport preferred none
 transport input none
line aux 0
line vty 0 4
 login
!
end
```

Additional References

Related Documents

Related Topic	Document Title
File management and other configuration commands: complete command syntax, command mode, defaults, usage guidelines, and examples	*Cisco IOS Configuration Fundamentals and Network Management Command Reference*
File management and other configuration examples	*Cisco IOS Configuration Fundamentals and Network Management Configuration Guide*
Fast Software Upgrade	*Route Processor Redundancy and Fast Software Upgrade on Cisco 7500 Series Routers*
Single Line Card Reload (SLCR)	*Cisco 7500 Single Line Card Reload feature document*

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIBs	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	--

Technical Assistance

Description	Link
Technical Assistance Center (TAC) home page, containing 30,000 pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/public/support/tac/home.shtml

Feature Information for Route Processor Redundancy Plus (RPR+)

The following table provides release information about the feature or features described in this module. This 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.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to . An account on Cisco.com is not required.

Table 2: Feature Information for Phrase Based on Module Title

Feature Name	Releases	Feature Information
Route Processor Redundancy Plus (RPR+)	12.0(19)ST1	This feature was introduced.
Route Processor Redundancy Plus (RPR+)	12.0(22)S	This feature was integrated into Cisco IOS Release 12.0(22)S.
Route Processor Redundancy Plus (RPR+)	12.2(14)S	This feature was integrated into Cisco IOS Release 12.2(14)S.

Feature Name	Releases	Feature Information
Route Processor Redundancy Plus (RPR+)	12.3(7)T	This feature was integrated into Cisco IOS Release 12.3(7)T. The following commands are introduced or modified in the feature: **hw-module sec-cpu reset, hw-module slot image, redundancy, redundancy force-switchover, show redundancy (HSA redundancy).**

Glossary

Active RSP--The RSP that controls and runs the routing protocols and that presents the system management interface.

HSA --High System Availability. HSA enables a system to reset and use a standby RSP if the active RSP fails.

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

RPR+ --Route Processor Redundancy Plus. An enhancement to RPR in which the standby RSP is fully initialized. An RPR+ switchover does not involve resetting line cards or reloading line card software for VIPs. Legacy interface processors are reset and reloaded during switchover.

RSP --Route Switch Processor. The Route Processor on the Cisco 7500 series router.

Standby RSP --The RSP that waits ready to take over the functions of the active RSP in the event of unplanned or planned downtime.

Note   Refer to Internetworking Terms and Acronyms for terms not included in this glossary.