



Configuring RPR and RPR+ Supervisor Engine Redundancy

Release 12.1(13)E and later releases support supervisor engine redundancy with Route Processor Redundancy (RPR) and Route Processor Redundancy Plus (RPR+). This chapter describes how to configure supervisor engine redundancy with RPR and RPR+.



Note

Enhanced high system availability (EHSA) is not supported in Release 12.1(13)E and later releases.

This chapter consists of these sections:

- [Understanding Supervisor Engine Redundancy, page 5-1](#)
- [Supervisor Engine Redundancy Guidelines and Restrictions, page 5-4](#)
- [Configuring Supervisor Engine Redundancy, page 5-6](#)
- [Performing a Fast Software Upgrade, page 5-9](#)
- [Copying Files to an MSFC, page 5-10](#)

Understanding Supervisor Engine Redundancy

These sections describe supervisor engine redundancy:

- [Supervisor Engine Redundancy Overview, page 5-1](#)
- [RPR+ Operation, page 5-2](#)
- [Supervisor Engine Synchronization, page 5-3](#)

Supervisor Engine Redundancy Overview

Catalyst 6500 series switches support fault resistance by allowing a redundant supervisor engine to take over if the primary supervisor engine fails. RPR supports a switchover time of 2 to 4 minutes and RPR+ supports a switchover time of 30 to 60 seconds.

When RPR+ mode is used, the redundant supervisor engine is fully initialized and configured, which shortens the switchover time. The active supervisor engine checks the image version of the redundant supervisor engine when the redundant supervisor engine comes online. If the image on the redundant supervisor engine does not match the image on the active supervisor engine, RPR redundancy mode is used.

RPR Operation

RPR supports the following features:

- Auto-startup and bootvar synchronization between active and redundant supervisor engines
- Hardware signals that detect and decide the active or redundant status of supervisor engines
- Clock synchronization every 60 seconds from the active to the redundant supervisor engine
- A redundant supervisor engine that is booted but not all subsystems are up: if the active supervisor engine fails, the redundant supervisor engine become fully operational
- An operational supervisor engine present in place of the failed unit becomes the redundant supervisor engine
- Support for fast software upgrade (FSU) (See the [“Performing a Fast Software Upgrade” section on page 5-9](#)).



Note

When a redundant supervisor engine is in standby mode, the two Gigabit Ethernet interfaces on the redundant supervisor engine are always active.

When the switch is powered on, RPR runs between the two supervisor engines. The supervisor engine that boots first, either in slot 1 or 2, becomes the RPR active supervisor engine. The Multilayer Switch Feature Card (MSFC or MSFC2) and Policy Feature Card (PFC or PFC2) become fully operational. The MSFC and PFC on the redundant supervisor engine come out of reset but are not operational.

The following events cause an RPR switchover:

- Clock synchronization failure between supervisor engines
- MSFC or PFC failure on the active supervisor engine
- A manual switchover.

In a switchover, the redundant supervisor engine becomes fully operational and the following occurs:

- All switching modules power up again
- Remaining subsystems on the MSFC (including Layer 2 and Layer 3 protocols) are brought up
- Access control lists (ACLs) are reprogrammed into supervisor engine hardware



Note

In a switchover, there is a disruption of traffic because some address states are lost and then restored after they are dynamically redetermined.

RPR+ Operation

With RPR+, the redundant supervisor engine is fully initialized and configured, which shortens the switchover time if the active supervisor engine fails or if a manual switchover is performed.

When the switch is powered on, RPR+ runs between the two supervisor engines. The supervisor engine that boots first, either in slot 1 or 2, becomes the active supervisor engine. The Multilayer Switch Feature Card (MSFC or MSFC2) and Policy Feature Card (PFC or PFC2) become fully operational. The MSFC and PFC on the redundant supervisor engine come out of reset but are not operational.

RPR+ enhances RPR by providing the following additional benefits:

- Reduced switchover time

Depending on the configuration, the switchover time is in the range of 30 to 60 seconds.

- Installed modules are not reloaded

Because both the startup configuration and the running configuration are continually synchronized from the active to the redundant supervisor engine, installed modules are not reloaded during a switchover.

- Online insertion and removal (OIR) of the redundant supervisor engine

RPR+ allows OIR of the redundant supervisor engine for maintenance. When the redundant supervisor engine is inserted, the active supervisor engine detects its presence and begins to transition the redundant supervisor engine to fully initialized state.

- Synchronization of OIR events
- Manual user-initiated switchover using the **redundancy force-switchover** command

The following events cause an RPR+ switchover:

- Clock synchronization failure between supervisor engines
- MSFC or PFC failure on the active supervisor engine

Supervisor Engine Synchronization

During RPR mode operation, the startup-config and config-registers configuration are synchronized by default between the two supervisor engines. In a switchover, the new active supervisor engine uses the current configuration.



Note

Unless auto-synchronization has been disabled, the boot variables are synchronized by default.

When a redundant supervisor engine configuration is running in RPR+ mode, the following operations trigger synchronization:

- When a redundant supervisor engine first comes online, the configuration information is synchronized in bulk from the active supervisor engine to the redundant supervisor engine. This synchronization overwrites any existing startup configuration file on the redundant supervisor engine.
- When configuration changes occur during normal operation, RPR+ performs an incremental synchronization from the active supervisor engine to the redundant supervisor engine. RPR+ synchronizes user-entered CLI commands incrementally line-by-line from the active supervisor engine to the redundant supervisor engine.



Note

- Even though the redundant supervisor engine is fully initialized, it only interacts with the active supervisor engine to receive incremental changes to the configuration files as they occur. You cannot enter CLI commands on the redundant supervisor engine.
 - Synchronization of the startup configuration file is enabled by default in RPR+ mode.
-

Supervisor Engine Redundancy Guidelines and Restrictions

These sections describe supervisor engine redundancy configuration guidelines and restrictions:

- [RPR+ Guidelines and Restrictions, page 5-4](#)
- [Hardware Configuration Guidelines and Restrictions, page 5-5](#)
- [Configuration Mode Restrictions, page 5-6](#)

RPR+ Guidelines and Restrictions

The following guidelines and restrictions apply to RPR+:

Restrictions

- RPR+ redundancy does not support configuration entered in VLAN database mode. Use global configuration mode with RPR+ redundancy (see [Chapter 9, “Configuring VLANs”](#)).
- Configuration changes made through SNMP are not synchronized to the redundant supervisor engine. Enter a **copy running-config startup-config** command to synchronize the configuration on the redundant supervisor engine.
- Supervisor engine redundancy does not provide supervisor engine mirroring or supervisor engine load balancing. Only one supervisor engine is active. Network services are disrupted until the redundant supervisor engine takes over and the switch recovers.
- With RPR+, both supervisor engines must run the same version of Cisco IOS software. If the supervisor engines are not running the same version of Cisco IOS software, the redundant supervisor engine comes online in RPR mode.
- The Forwarding Information Base (FIB) tables are cleared on a switchover. As a result, routed traffic is interrupted until route tables reconverge.
- Static IP routes are maintained across a switchover because they are configured from entries in the configuration file.
- Information about dynamic states maintained on the active supervisor engine is not synchronized to the redundant supervisor engine and is lost on switchover.

These are examples of dynamic state information that is lost at switchover:

- Frame Relay switched virtual circuits (SVCs)



Note Frame Relay-switched DLCI information is maintained across a switchover because Frame Relay-switched DLCI configuration is in the configuration file.

- All terminated PPP sessions
- All ATM SVC information
- All terminated TCP and other connection-oriented Layer 3 and Layer 4 sessions
- BGP sessions
- All Automatic Protection System (APS) state information

Guidelines

- The two Gigabit Ethernet interfaces on the redundant supervisor engine are always active.
- RPR+ switchover takes place after the failed supervisor engine completes a core dump. A core dump can take up to 15 minutes. To get faster switchover time, disable core dump on the supervisor engines.

Hardware Configuration Guidelines and Restrictions

For redundant operation, the following hardware configuration guidelines and restrictions apply:

Restrictions

- Supervisor engine redundancy does not support nondefault VLAN data file names or locations. Do not enter the **vtp file** *file_name* command on a switch that has a redundant supervisor engine.
- Cisco IOS running on the supervisor engine and the MSFC supports redundant configurations where the supervisor engines and MSFC routers are identical. If they are not identical, one will boot first and become active and hold the other supervisor engine and MSFC in a reset condition.
- Each supervisor engine must have the resources to run the switch on its own, which means all supervisor engine resources are duplicated. In other words, each supervisor engine has its own Flash device and console port connections.

Guidelines

- Make separate console connections to each supervisor engine. Do not connect a Y cable to the console ports.
- Both supervisor engines must have the same system image (see the [“Copying Files to an MSFC” section on page 5-10](#)).



Note If the redundant supervisor engine is running Catalyst operating system software, remove the active supervisor engine and boot the switch with only the redundant supervisor engine installed. Follow the procedures in the current release notes to convert the redundant supervisor engine from Catalyst software.

- The configuration register in the startup-config must be set to autoboot (see the [“Modifying the Boot Field” section on page 3-23](#)).
- Before installing a redundant supervisor engine, enter the **no vtp file** command to return to the default configuration.



Note

There is no support for booting from the network.

Configuration Mode Restrictions

The following configuration restrictions apply during the startup synchronization process:

- You cannot perform configuration changes during the startup (bulk) synchronization. If you attempt to make configuration changes during this process, the following message is generated:

```
Config mode locked out till standby initializes
```

- If configuration changes occur at the same time as a supervisor engine switchover, these configuration changes are lost.

Configuring Supervisor Engine Redundancy

These sections describe how to configure supervisor engine redundancy:

- [Configuring RPR and RPR+, page 5-6](#)
- [Synchronizing the Supervisor Engine Configurations, page 5-7](#)
- [Displaying the Redundancy States, page 5-8](#)

Configuring RPR and RPR+

To configure RPR or RPR+, perform this task:

	Command	Purpose
Step 1	Router(config)# redundancy	Enters redundancy configuration mode.
Step 2	Router(config-red)# mode {rpr rpr-plus}	Configures RPR or RPR+. When this command is entered, the redundant supervisor engine is reloaded and begins to work in RPR or RPR+ mode.
Step 3	Router# show running-config	Verifies that RPR or RPR+ is enabled.
Step 4	Router# show redundancy states	Displays the operating redundancy mode.

This example shows how to configure the system for RPR+ and display the redundancy state:

```
Router> enable
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# redundancy
Router(config-red)# mode rpr-plus
Router(config-red)# ^Z
Router# show redundancy states
    my state = 13 -ACTIVE
    peer state = 1 -DISABLED
    Mode = Simplex
    Unit = Primary
    Unit ID = 1

Redundancy Mode (Operational) = Route Processor Redundancy Plus
Redundancy Mode (Configured) = Route Processor Redundancy Plus
    Split Mode = Disabled
    Manual Swact = Disabled Reason: Simplex mode
    Communications = Down Reason: Simplex mode
```

```

client count = 11
client_notification_TMR = 30000 milliseconds
  keep_alive TMR = 4000 milliseconds
  keep_alive count = 0
keep_alive threshold = 7
  RF debug mask = 0x0

Router#

```

Synchronizing the Supervisor Engine Configurations

During normal operation, the startup-config and config-registers configuration are synchronized by default between the two supervisor engines. In a switchover, the new active supervisor engine uses the current configuration.

To manually synchronize the configurations used by the two supervisor engines, perform this task on the active supervisor engine:

	Command	Purpose
Step 1	Router(config)# redundancy	Enters redundancy configuration mode.
Step 2	Router(config-red)# main-cpu	Enters main-cpu configuration submenu.
Step 3	Router(config-r-mc)# auto-sync { startup-config config-register bootvar standard }	Synchronizes the configuration elements.
Step 4	Router(config-r-mc)# end	Returns to privileged EXEC mode.
Step 5	Router# copy running-config startup-config	Forces a manual synchronization of the configuration files in NVRAM. Note This step is not required to synchronize the running configuration file in DRAM.



Note

The **auto-sync standard** command does not synchronize the boot variables.

This example shows how to reenabling the default automatic synchronization feature using the **auto-sync standard** command to synchronize the startup-config and config-register configuration of the active supervisor engine with the redundant supervisor engine:

```

Router(config)# redundancy
Router(config-red)# main-cpu
Router(config-r-mc)# auto-sync standard
Router(config-r-mc)# auto-sync bootvar
Router(config-r-mc)# end
Router# copy running-config startup-config

```



Note

To manually synchronize only individual elements of the standard auto-sync configuration, disable the default automatic synchronization feature.

This example shows how to disable default automatic synchronization and only allow automatic synchronization of the config-registers of the active supervisor engine to the redundant supervisor engine while disallowing synchronization of the startup configuration:

```

Router(config)# redundancy
Router(config-red)# main-cpu

```

```

Router(config-r-mc)# no auto-sync standard
Router(config-r-mc)# auto-sync config-register
Router(config-r-mc)# end
Router# copy running-config startup-config

```

Displaying the Redundancy States

To display the redundancy states, perform this task:

Command	Purpose
Router# show redundancy states	Displays the redundancy states.

This example shows how to display the redundancy states:

```

Router# show redundancy states
my state = 13 -ACTIVE
  peer state = 8 -STANDBY HOT
    Mode = Duplex
    Unit = Primary
    Unit ID = 1

Redundancy Mode (Operational) = Route Processor Redundancy Plus
Redundancy Mode (Configured) = Route Processor Redundancy Plus
  Split Mode = Disabled
  Manual Swact = Enabled
  Communications = Up

  client count = 11
  client_notification_TMR = 30000 milliseconds
  keep_alive TMR = 9000 milliseconds
  keep_alive count = 0
  keep_alive threshold = 18
  RF debug mask = 0x0

Router#

my state = 13 -ACTIVE
  peer state = 1 -DISABLED
    Mode = Simplex
    Unit = Primary
    Unit ID = 1

Redundancy Mode (Operational) = Route Processor Redundancy Plus
Redundancy Mode (Configured) = Route Processor Redundancy Plus
  Split Mode = Disabled
  Manual Swact = Disabled Reason: Simplex mode
  Communications = Down Reason: Simplex mode

  client count = 11
  client_notification_TMR = 30000 milliseconds
  keep_alive TMR = 9000 milliseconds
  keep_alive count = 0
  keep_alive threshold = 18
  RF debug mask = 0x0

```

Performing a Fast Software Upgrade

The fast software upgrade (FSU) procedure supported by RPR allows you to upgrade the Cisco IOS image on the supervisor engines without reloading the system.


Note

If you are performing a first-time upgrade to RPR from EHSA, you must reload both supervisor engines. FSU from EHSA is not supported.

To perform an FSU, perform this task:

	Command	Purpose
Step 1	<pre>Router# copy source_device:source_filename {disk0 disk1}:target_filename Or: Router# copy source_device:source_filename sup-bootflash:target_filename Or: Router# copy source_device:source_filename {slavedisk0 slavedisk1}:target_filename Or: Router# copy source_device:source_filename slavesup-bootflash:target_filename</pre>	<p>Copies the new Cisco IOS image to the disk0: device or the disk1: device on the active supervisor engine.</p> <p>Copies the new Cisco IOS image to the bootflash: device on the active supervisor engine.</p> <p>Copies the new Cisco IOS image to the disk0: device or the disk1: device on the redundant supervisor engine.</p> <p>Copies the new Cisco IOS image to the bootflash: device on the redundant supervisor engine.</p>
Step 2	<pre>Router# config terminal Router(config)# config-register 0x2102 Router(config)# boot system flash device:file_name</pre>	Configures the supervisor engines to boot the new image.
Step 3	<pre>Router# copy running-config start-config</pre>	Saves the configuration.
Step 4	<pre>Router# hw-module {module num} reset</pre>	<p>Reloads the redundant supervisor engine and brings it back online (running the new version of the Cisco IOS software).</p> <p>Note Before reloading the redundant supervisor engine, make sure you wait long enough to ensure that all configuration synchronization changes have completed.</p>
Step 5	<pre>Router# redundancy force-switchover</pre>	<p>Conducts a manual switchover to the redundant supervisor engine. The redundant supervisor engine becomes the new active supervisor engine running the new Cisco IOS image. The modules are reloaded and the module software is downloaded from the new active supervisor engine.</p> <p>The old active supervisor engine reboots with the new image and becomes the redundant supervisor engine.</p> <p>Note To perform an EHSA to RPR FSU, use the reload command in Step 5.</p>

This example shows how to perform an FSU:

```
Router# config terminal
Router(config)# config-register 0x2
Router(config)# boot system flash slot0: c6sup22-jsv-mz.121-11.E
Router# copy running-config start-config
Router# hw-module reset
Router# redundancy force-switchover
Router#
```

Copying Files to an MSFC

Use the following command to copy a file to the **bootflash:** device on an active MSFC:

```
Router# copy source_device:source_filename bootflash:target_filename
```

Use the following command to copy a file to the **bootflash:** device on a redundant MSFC:

```
Router# copy source_device:source_filename slavebootflash:target_filename
```