



Quad-Supervisor with Route Processor Redundancy

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Prerequisites for Quad-Supervisor with RPR

- The minimum required software version for all the supervisors in the Quad-Supervisor setup is Cisco IOS XE Amsterdam 17.2.1 .

If the system detects that either of the redundant supervisor modules is running a software version that is not compatible with this feature, it displays a syslog to upgrade the supervisor module. After 5 warnings to upgrade, the system forces the supervisor module running the incompatible software version into reset mode.

- All supervisors in the chassis must be running the same software version.



Note If you are replacing any supervisor in the Quad-Supervisor setup, you must ensure that the new supervisor is running the same software version as the other supervisors in the setup *before* installing it.

- You must be familiar with the Cisco StackWise Virtual feature and related terminologies. For more information, see the *Configuring Cisco StackWise Virtual* chapter in this guide.
- You must have installed at least one redundant supervisor. This serves as the in-chassis standby supervisor (ICS) (terms are explained below).

Restrictions for Quad-Supervisor with RPR

- When using a Quad-Supervisor with Route Processor Redundancy (RPR), a console is not available for the ICS supervisors.
- Cisco In-Service Software Upgrade (ISSU) or image upgrade in a Quad-Supervisor setup is not supported if one of the chassis is not available at the time of the upgrade.

Information About Quad-Supervisor with RPR

Understanding Quad-Supervisor with RPR

The Quad-Supervisor with Route Processor Redundancy (RPR) feature provides intra-chassis redundancy where Cisco StackWise Virtual is configured between two chassis. This intra-chassis redundancy is provided by the redundant supervisor installed in the chassis. The added redundancy reduces the time taken to reach the ready state with full bandwidth in the event of a supervisor failure or a forced switchover.

The following supervisors make up a Quad-Supervisor with RPR:

- A Cisco StackWise Virtual active supervisor
- A Cisco StackWise Virtual standby supervisor
- In-Chassis Standby supervisors (ICS) – These are the redundant supervisors which are partially booted. In Quad-Supervisor with RPR, there can be an ICS present in one of the chassis or an ICS in both the chassis.

In Quad-Supervisor with RPR, when the Cisco StackWise Virtual active supervisor goes down or is rebooted, the Cisco StackWise Virtual standby supervisor becomes the new active supervisor, and the in-chassis standby supervisor takes over as the new Cisco StackWise Virtual standby supervisor. Since the ICS is partially booted, the time taken for it to come up to ready state is reduced.

Switchovers are automatically triggered by supervisor failures. You can also manually initiate a switchover.

SSO and RPR Operations in a Quad-Supervisor Setup

With Stateful Switchover (SSO), both start-up and running configurations are synced. Applications also sync all their state data. On switchover, line cards are not reset and state reconciliation is not required since all data have been synced by the applications.

With RPR, only start-up configuration is synced between the supervisors. Applications do not sync any state data. When a switchover occurs, all line cards are reset and the system state is reconciled.

When a failure occurs in a Quad-Supervisor setup and a switchover takes place:

1. SSO operates between two chassis (where the Cisco StackWise Virtual standby becomes the new Cisco StackWise Virtual active and continues to forward traffic).
2. RPR operates within a chassis (the line cards in the old active chassis are reset).

Switchovers in Quad-Supervisor with RPR

The switch supports Quad-Supervisor with RPR where there may be one ICS or two ICSs. The following subsections explain and illustrate how the feature works in both setups.

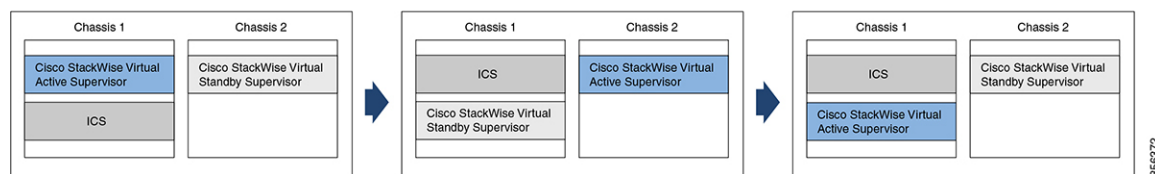
Quad-Supervisor with RPR with One ICS

In a Quad-Supervisor with RPR with one in-chassis standby supervisor, the ICS can be present in the chassis with the Cisco StackWise Virtual active supervisor or in the chassis with the Cisco StackWise Virtual standby supervisor.

If the ICS is present in the chassis with the Cisco StackWise Virtual active supervisor, and the Cisco StackWise Virtual active supervisor fails, the following changes occur:

- The Cisco StackWise Virtual active supervisor which failed becomes the new ICS in the set up.
- The Cisco StackWise Virtual standby supervisor takes over as the new Cisco StackWise Virtual active supervisor.
- The ICS completes booting and becomes the new Cisco StackWise Virtual standby supervisor.

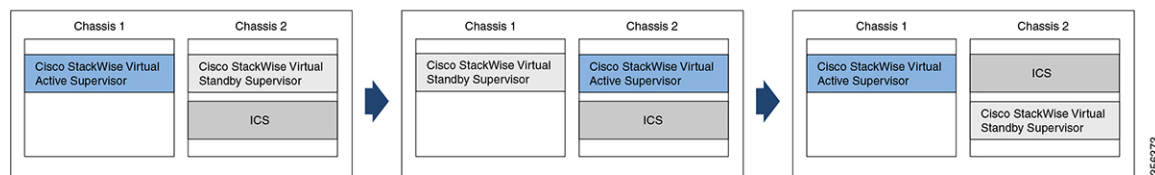
Each of the following boxes represents a possible existing setup; the adjacent box represents the outcome of a switchover scenario:



If the ICS is present in the chassis with the Cisco StackWise Virtual standby supervisor, and the Cisco StackWise Virtual active supervisor fails, the following changes occur:

- The Cisco StackWise Virtual standby supervisor takes over as the new Cisco StackWise Virtual active supervisor.
- The Cisco StackWise Virtual active supervisor which failed becomes the new Cisco StackWise Virtual standby supervisor in the set up.
- The ICS remains unchanged.

Each of the following boxes represents a possible existing setup; the adjacent box represents the outcome of a switchover scenario:

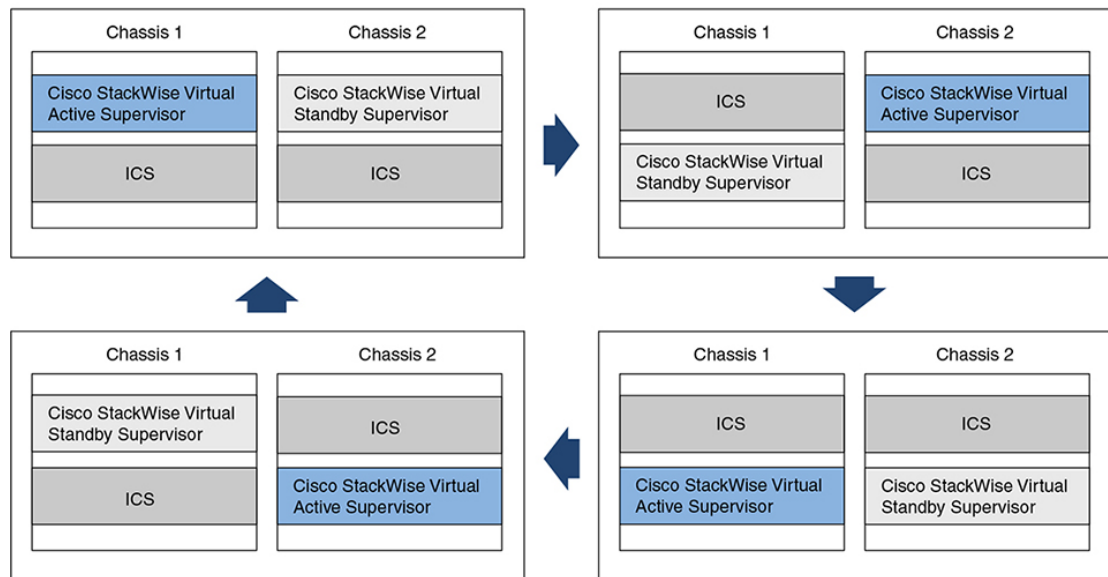


Quad-Supervisor with RPR with Two ICS

In a Quad-Supervisor with RPR with two in-chassis standby supervisors, if the Cisco StackWise Virtual active supervisor fails, the following changes occur:

- The Cisco StackWise Virtual active supervisor which failed becomes the new ICS in Chassis 1.
- The Cisco StackWise Virtual standby supervisor takes over as the new Cisco StackWise Virtual active supervisor in Chassis 2.
- The ICS in Chassis 1 completes booting and becomes the new Cisco StackWise Virtual standby supervisor.
- The ICS in Chassis 2 remains unchanged.

Each of the following boxes represents a possible existing set-up; the adjacent box represents the outcome of a switchover scenario:



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Interaction with Other Features

The following sections describe the interaction of Quad-Supervisor RPR with different features.

Performing ISSU in a Quad-Supervisor with RPR

You can perform ISSU in a Quad-Supervisor with RPR. This section describes the sequence of events that occur during ISSU in a Quad-Supervisor with RPR.

When you enter the **install activate issu** command in privileged EXEC mode to install the new software version on all the supervisors:

1. The new version is downloaded on all the supervisors in the setup.
2. The new version is activated on the ICSs on both the chassis and the ICSs are then reloaded.
3. Then the new version is activated onto the Cisco StackWise Virtual standby supervisor and it is reloaded.
4. The new version is activated onto the Cisco StackWise Virtual active supervisor. This triggers the switchover process in the Quad-Supervisor setup.



Note During ISSU, if any of the supervisors fail, the system cancels the ISSU process and all the supervisors revert to the original version and you have to start the ISSU process again.

For more information about performing ISSU, refer to the *Configuring ISSU* chapter in this guide.

Upgrading in Install Mode in Quad-Supervisor with RPR

You can upgrade a Quad-Supervisor setup with RPR in install mode. This section describes the sequence of events that occur when upgrading a Quad-Supervisor setup with RPR in install mode.

When you enter the **install add file *file-name* activate commit** command in privileged EXEC mode, the new software version is activated onto all the supervisors at the same time and after reload, the Quad-Supervisor comes up with the same setup as before.

For more information about upgrading in install mode, refer to the release notes for the software release.

How to Implement Quad-Supervisor with RPR

Depending on your current setup, there are two methods to implement a Quad-Supervisor setup with RPR:

- Implementing a Quad-Supervisor with RPR on two chassis.
- Implementing a Quad-Supervisor with RPR on an existing Cisco StackWise Virtual setup.

The following sections provide information on both methods.

Implementing Quad-Supervisor with RPR on Two Chassis

If you have one supervisor module installed in each chassis, follow the procedure below to implement Quad-Supervisor with RPR:

Procedure

Step 1 Configure **software auto-upgrade enable**.

Note The redundant supervisor module should be running the same software version as the rest of the setup.

To upgrade the software version of the supervisor modules, enter the **software auto-upgrade enable** command in global configuration mode on the active supervisor modules in the two chassis.

Step 2 Insert the ICS.

Insert the redundant supervisor module in the chassis.

Note To know more about the procedure to upgrade the software version of a supervisor module, refer to the [Upgrading the Software Version, on page 6](#) section in this chapter.

Step 3 Configure Cisco StackWise Virtual.

Configure a StackWise Virtual link between the two chassis. The setup will now come up in Quad-Supervisor with RPR.

Step 4 Verify the setup.

Run the **show module** command in privileged EXEC mode to verify that the setup is in Quad-Supervisor with RPR.

Implementing Quad-Supervisor with RPR on an Existing Cisco StackWise Virtual Setup

If you have a Cisco StackWise Virtual link configured between two chassis, follow the procedure below to implement Quad-Supervisor with RPR:



Note The Cisco StackWise Virtual setup must be running the minimum required software version or higher.

Procedure

Step 1 Configure **software auto-upgrade enable**.

Enter the **software auto-upgrade enable** command in global configuration mode on the Cisco StackWise Virtual active supervisor module.

Step 2 Insert the ICS running the same software version as the rest of the setup.

Insert the redundant supervisor module in the chassis. The setup will now come up in Quad-Supervisor with RPR.

Note To know more about the procedure to upgrade the software version of a supervisor module, refer to the *Upgrading the Software Version* section in this chapter.

Step 3 Verify the setup.

Run the **show module** command in privileged EXEC mode to verify that the setup is in Quad-Supervisor with RPR.

Upgrading the Software Version

You must upgrade the software version of a supervisor in any of the following scenarios:

- When you are implementing Quad-Supervisor.

In this scenario, all the supervisor modules may not be running a software version that supports the feature.

- When you are installing a new supervisor in a Quad-Supervisor setup.

In this scenario, the new or replacement supervisor module may not be running the same software version as the others in the setup, or it may be shipped with a version where the feature is not available.

- When you perform a Return Material Authorization (RMA) for a supervisor module.

There are three methods you can use to upgrade the software version.

- Upgrade using a spare chassis - in this method, you use a third chassis that is not part of your setup to upgrade the software version of the supervisor.
- Upgrade without using a spare chassis - in this method, if you do not have a spare chassis, you use one of the existing chassis to upgrade the software version of the supervisor. This method involves some downtime.
- Upgrade using a USB flash - if you do not have a spare chassis, you use this method to upgrade the software version of the supervisor without any downtime by using a USB flash.

The following sections describe all the methods.

Upgrading the Software Version Using a Spare Chassis

Perform this task to upgrade the software version of the new or replacement supervisor module.

Procedure

- Step 1** Install the supervisor module in a spare chassis.
Install the new supervisor module in a third chassis.
- Step 2** Upgrade the software version of the supervisor module.
Upgrade the software version in install mode.
For more information about upgrading in install mode, refer to the release notes for the software release.
- Note** Ensure that the software version you are upgrading to is the same version running on the other supervisor modules in the setup.
- Step 3** Verify the software version.
Run the **show version** command in privileged EXEC mode and verify that the supervisor module is running the new software version.
- Step 4** Remove the supervisor module from the chassis.
Once the supervisor module is running the new software version, remove it from the chassis.
-

Upgrading the Software Version Without Using a Spare Chassis

Perform this task to upgrade the software version of the new or replacement supervisor module if you do not have a spare chassis. This method will involve some downtime.

Procedure

- Step 1** Power down the Cisco StackWise Virtual standby chassis.
Power down the Cisco StackWise Virtual standby chassis (henceforth referred to as Chassis 2) from the Cisco StackWise Virtual setup. Traffic will continue to go to the Cisco StackWise Virtual active chassis.
- Step 2** Remove the supervisor module that was in Cisco StackWise Virtual mode.
Remove the supervisor module that was in Cisco StackWise Virtual mode from Chassis 2 and store it safely.
- Step 3** Pull out the linecards from the chassis.
Pull out the linecards from Chassis 2, but let them remain in the chassis. This will ensure that there is no impact on downstream devices.
- Caution** As the system is not running when all the linecards are pulled out, the device can be impacted due to insufficient cooling. Therefore, ensure that you perform Step 4 to Step 6 immediately after Step 3.
- Step 4** Insert the two new supervisor modules in the chassis.
Insert the two new supervisor modules (that will act as the ICS in the Quad-Supervisor setup) in Chassis 2.
- Step 5** Upgrade the software version of the supervisor modules.
Power on Chassis 2 and upgrade the software version of the two supervisor modules in install mode.
- Step 6** Remove both the supervisor modules from the chassis.
Remove both the supervisor modules from Chassis 2.
- Step 7** Reinsert the original supervisor module and the linecards into the chassis.
Reinsert the supervisor module that was in Cisco StackWise Virtual mode and all the linecards into Chassis 2.
- Step 8** The chassis reloads.
The supervisor module comes up as the Cisco StackWise Virtual standby supervisor module. All line cards also come up and traffic re-converges between the two chassis.
-

Upgrading the Software Version Using a USB Flash

Perform this task to upgrade the software version of the new or replacement supervisor module if you do not have a spare chassis.

Procedure

- Step 1** Configure **software auto-upgrade enable**.
Enter the **software auto-upgrade enable** command in global configuration mode on the Cisco StackWise Virtual active supervisor module.

- Step 2** Copy the software image to USB flash.
Copy the new software image (<imagefile>.bin) to the USB flash.
- Step 3** Insert the supervisor module.
Insert the ICS supervisor module into required slot in the chassis.
- Step 4** Insert the USB flash into the supervisor module.
Insert the USB flash with the new software image into the ICS supervisor module.
- Step 5** Connect the console port of the supervisor module to a terminal server.
Connect the console port of the ICS supervisor module to a terminal server, to access it in ROMMON mode.
- Step 6** Switch into ROM monitor (ROMMON) mode.
Press Control + C to break into ROMMON mode.
- Step 7** **Note** Perform the following substeps only if the ICS supervisor module was previously used in a Cisco StackWise Virtual setup.

Remove the Cisco StackWise Virtual settings if applicable.

- a) Unset the ROMMON variables related to Cisco StackWise Virtual

Look for any of the following Cisco StackWise Virtual ROMMON variables and unset them:

- D_STACK_DISTR_STACK_LINK2=""
- D_STACK_DAD=""
- D_STACK_MODE=""
- D_STACK_DOMAIN_NUM=""
- D_STACK_DISTR_STACK_LINK1=""

```
rommon 1 > unset D_STACK_DISTR_STACK_LINK2
rommon 1 > unset D_STACK_DAD
rommon 1 > unset D_STACK_MODE
rommon 1 > unset D_STACK_DOMAIN_NUM
rommon 1 > unset D_STACK_DISTR_STACK_LINK1
```

- b) Set the switch-number ROMMON variable to 1.

If the switch number ROMMON variable is set to 2, change it to *SWITCH_NUMBER=1*.

```
rommon 1 > SWITCH_NUMBER=1
```

- Step 8** Set to manual-boot the supervisor module.
Set *MANUAL_BOOT* to yes.
rommon 1 > MANUAL_BOOT=yes
- Step 9** Manually boot the new software image on the ICS from ROMMON.
Manually boot the new software image on the ICS in bundle mode from the USB flash.
- Note** Do not change the boot variable in ROMMON.

The supervisor module goes for a reset as it gets converted from Standalone mode to Cisco StackWise Virtual mode. It will then fall back into ROMMON.

- Step 10** Unset manual-boot.
Unset *MANUAL_BOOT* to enable auto-boot.

```
rommon 1 > unset MANUAL_BOOT
```

- Step 11** Manually boot the new software image on the ICS from ROMMON.
Manually boot the new software image on the ICS in bundle mode from the USB flash.

Note Do not change the boot variable in ROMMON.

The ICS in the Cisco StackWise Virtual Active chassis will now come up with the new software version.

- Step 12** Upgrade the ICS in the Cisco StackWise Virtual Standby chassis.
To upgrade the ICS in the Cisco StackWise Virtual Standby chassis, enter the **install auto-upgrade** command on the Cisco StackWise Virtual Active supervisor module.

Manually Initiating a Switchover

You can also manually initiate a switchover by entering the **redundancy force switch-over** command on the Cisco StackWise Virtual active supervisor in privileged EXEC mode.

To reload a single supervisor in the Quad-Supervisor setup enter the **hw-module switch *switch-number* subslot *subslot-number* oir power-cycle** command in privileged EXEC mode. This power cycles only the supervisor you specify. Note the following about this command:

- When you run this command on a Cisco StackWise Virtual active supervisor a switchover is triggered.
- When you run this command for a Cisco StackWise Virtual standby supervisor, it reloads and becomes the new ICS. The current ICS in the chassis takes over as the new Cisco StackWise Virtual standby supervisor and
- When you run this command on either ICS, the redundant supervisor reloads and comes up in a partially booted state.

Monitoring Quad-Supervisor with RPR

On the physical chassis, the Cisco StackWise Virtual active supervisor is denoted by a green LED. The Cisco StackWise Virtual standby supervisor and the ICS are denoted by an amber LED.

The **show module** command displays the redundancy mode that the supervisor is operating on.

The following is a sample output for the **show module** command run on the Quad-Supervisor with RPR where SUP1 is the Cisco StackWise Virtual active supervisor, SUP3 is the Cisco StackWise Virtual standby supervisor, and SUP2 and SUP4 are ICS:

```
Switch# show module
Chassis Type: C9606R
```

Switch Number 1

Mod	Ports	Card Type	Model	Serial No.
2	24	24-Port 40GE/12-Port 100GE	C9600-LC-24C	CAT2235L0DK
3	0	Supervisor 1 Module	C9600-SUP-1	EZY59054555
4	0	Supervisor 1 Module	C9600-SUP-1	CAT2139L0WE

Mod	MAC addresses	Hw	Fw	Sw	Status
2	F4DB.E673.2880 to F4DB.E673.28FF	0.6	16.12.1[FC2]	BLD_V171	ok
3	0011.2234.0000 to 0011.2234.002F	0.1	16.12.1[FC2]	BLD_V171	ok
4	--	--	--	--	Provisioned

Mod	Redundancy Role	Operating Redundancy Mode	Configured Redundancy Mode
3	Active	sso	sso
4	InChassis-Standby	rpr	rpr

Switch Number 2

Mod	Ports	Card Type	Model	Serial No.
2	24	24-Port 40GE/12-Port 100GE	C9600-LC-24C	CAT2235L0DB
3	0	Supervisor 1 Module	C9600-SUP-1	CAT2139L0VU
4	0	Supervisor 1 Module	C9600-SUP-1	BLF30443724

Mod	MAC addresses	Hw	Fw	Sw	Status
2	F4DB.E673.2200 to F4DB.E673.227F	0.6	16.12.1[FC2]	BLD_V171	ok
3	00A7.42DA.3140 to 00A7.42DA.316F	0.1	16.12.1[FC2]	BLD_V171	ok
4	--	--	--	--	Provisioned

Mod	Redundancy Role	Operating Redundancy Mode	Configured Redundancy Mode
3	Standby	sso	sso
4	InChassis-Standby	rpr	rpr

Chassis 1 MAC address range: 64 addresses from 6cb2.ae49.5540 to 6cb2.ae49.557f

Chassis 2 MAC address range: 64 addresses from 6cb2.ae49.5040 to 6cb2.ae49.507f

For information about the in-chassis standby supervisors, enter the **show redundancy rpr** command in privileged EXEC mode on the Cisco StackWise Virtual active supervisor.

The following is a sample output of the **show redundancy rpr** command run on the Cisco StackWise Virtual active supervisor:

```
Switch# show redundancy rpr
My Switch Id = 1
Peer Switch Id = 2
Last switchover reason = none
Configured Redundancy Mode = sso
Operating Redundancy Mode = sso
Switch 1 Slot 3 Processor Information:
-----
Current Software State = ACTIVE
Uptime in current state = 21 hours, 51 minutes
Image Version = Cisco IOS Software [Amsterdam], Catalyst L3 Switch Software (CAT9K_IOSXE),
  Expe
  rimental Version 17.1.1
Copyright (c) 1986-2019 by Cisco Systems, Inc.
Compiled Fri 13-Sep-19 07:27 by mcpre
```

```

BOOT = bootflash:packages.conf

Switch 1 Slot 4 Processor Information:
-----
Current Software State = InChassis-Standby (Ready)
Uptime in current state = 21 hours, 51 minutes
Image Version =
BOOT =

Switch 2 Slot 3 Processor Information:
-----
Current Software State = STANDBY HOT
Uptime in current state = 21 hours, 51 minutes
Image Version = Cisco IOS Software [Amsterdam], Catalyst L3 Switch Software (CAT9K_IOSXE),
  Expe
  rimental Version 17.1.1
Copyright (c) 1986-2019 by Cisco Systems, Inc.
Compiled Fri 13-Sep-19 07:27 by mcpre
BOOT = bootflash:packages.conf

Switch 2 Slot 4 Processor Information:
-----
Current Software State = InChassis-Standby (Ready)
Uptime in current state = 21 hours, 51 minutes
Image Version =
BOOT =

```

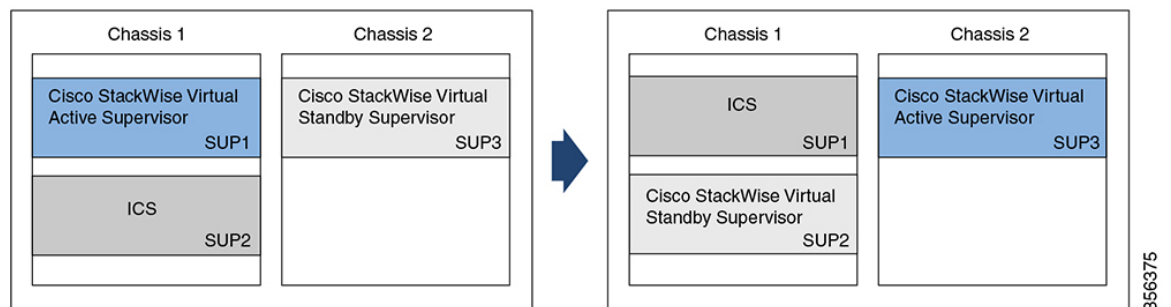
Implementation Examples for Quad-Supervisor with RPR

Example: Quad-Supervisor with RPR with One ICS

The following example describes and illustrates a switchover scenario with one ICS.

Consider a setup where SUP1 is the Cisco StackWise Virtual active supervisor in Chassis 1, SUP2 is the ICS in Chassis 1, and SUP3 is the Cisco StackWise Virtual standby supervisor in Chassis 2. If SUP1 fails, the following changes occur:

- SUP1 which failed becomes the new ICS in the set up.
- SUP3 takes over as the new Cisco StackWise Virtual active supervisor.
- SUP2 completes booting and becomes the new Cisco StackWise Virtual standby supervisor.



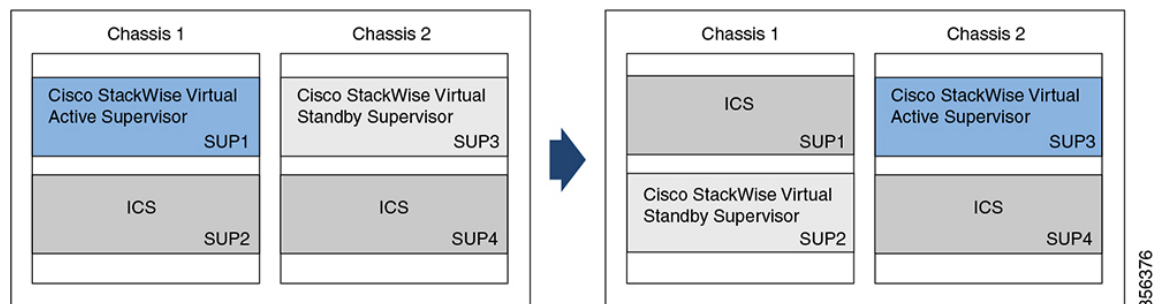
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Example: Quad-Supervisor with RPR with Two ICS

The following example describes and illustrates a switchover scenario with two ICS.

Consider a setup where SUP1 is the Cisco StackWise Virtual active supervisor in Chassis 1, SUP2 is the ICS in Chassis 1, SUP3 is the Cisco StackWise Virtual standby supervisor in Chassis 2, and SUP4 is the ICS in Chassis 2. If SUP1 fails, the following changes occur:

- SUP1 which failed becomes the new ICS in Chassis 1.
- SUP3 takes over as the new Cisco StackWise Virtual active supervisor in Chassis 2.
- SUP2 completes booting and becomes the new Cisco StackWise Virtual standby supervisor in Chassis 1.
- SUP4 in Chassis 2 remains unchanged.



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Example: Performing ISSU in a Quad-Supervisor with RPR

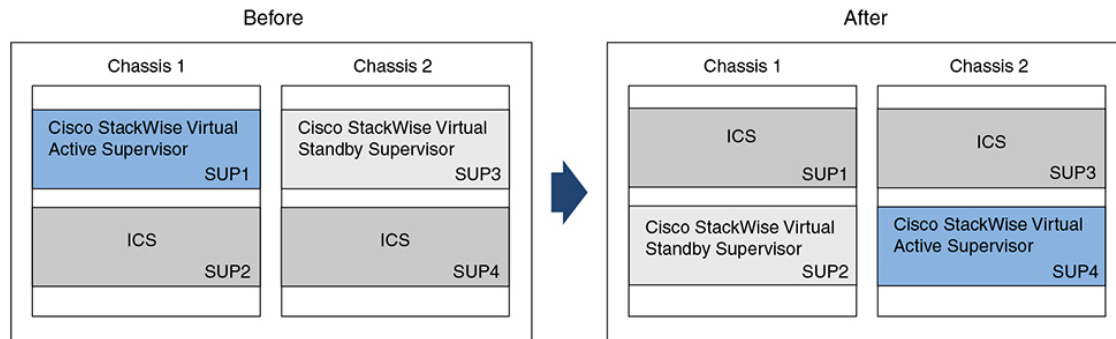
The following is an example of a 3-step ISSU in a Quad-Supervisor with RPR:

```
Device# install add file bootflash:<image.bin>
Device# install activate issu
Device# install commit
```

The following is an example of a 1-step ISSU in a Quad-Supervisor with RPR:

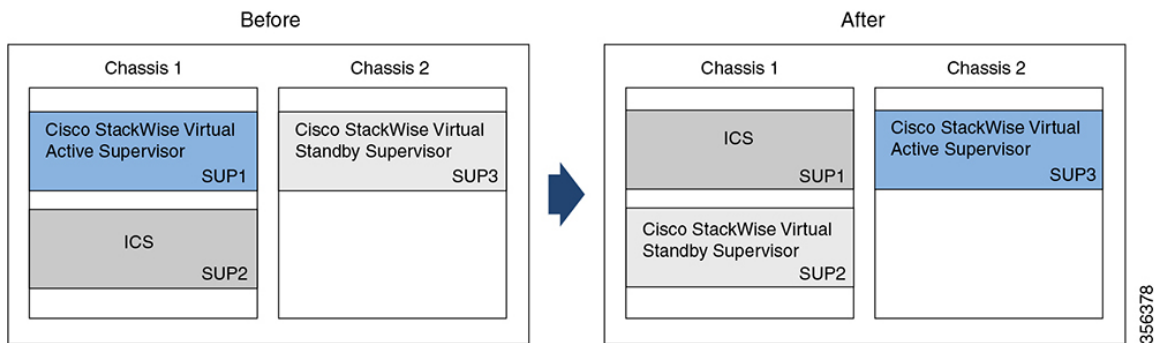
```
Device# install add file bootflash:<image.bin> activate issu commit
```

The figure below shows the Quad-Supervisor with RPR with 2 ICS before and after ISSU:

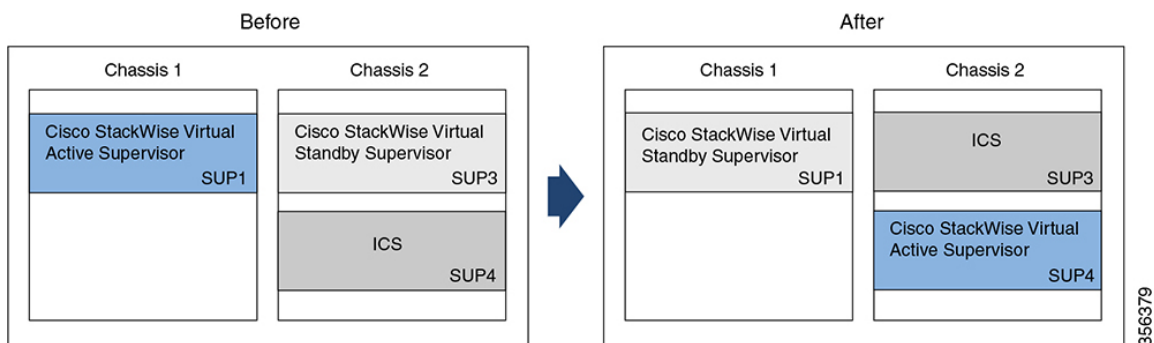


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The figure below shows the Quad-Supervisor with RPR with 1 ICS installed in the chassis with the Cisco StackWise Virtual active supervisor before and after ISSU:



The figure below shows the Quad-Supervisor with RPR with 1 ICS installed in the chassis with the Cisco StackWise Virtual standby supervisor before and after ISSU:



Command Outputs with Information About Quad-Supervisor with RPR

When Quad-Supervisor with RPR is implemented, the outputs for some commands display information that denote the role of each supervisor in the chassis.

This section shows you how to identify which supervisor the output is referring to based on the naming convention.

The following table lists some filesystems and their naming convention for each supervisor in a Quad-Supervisor setup:

Filesystems	Cisco StackWise Virtual active supervisor in Chassis 1	Cisco StackWise Virtual standby supervisor in Chassis 2	ICS in Chassis 1	ICS in Chassis 2
bootflash	bootflash:	bootflash-2-0 or stby-bootflash:	bootflash-1-1	bootflash-2-1
crashinfo	crashinfo:	crashinfo-2-0 or stby-crashinfo:	crashinfo-1-1	crashinfo-2-1
disk0	disk0:	disk0-2-0 or stby-disk0	disk0-1-1	disk0-2-1
usbflash0	usbflash0:	usbflash0-2-0 or stby-usbflash0	usbflash0-1-1	usbflash0-2-1

Feature History for Quad-Supervisor with RPR

This table provides release and related information for features explained in this module.

These features are available on all releases subsequent to the one they were introduced in, unless noted otherwise.

Release	Feature	Feature Information
Cisco IOS XE Amsterdam 17.2.1	Quad-Supervisor with Route Processor Redundancy (RPR)	A Quad-Supervisor RPR setup provides <i>intra-chassis</i> redundancy where Cisco StackWise Virtual is configured between two chassis. The added redundancy reduces the time taken to reach the ready state with full bandwidth in the event of a failure or a forced switchover.

Use Cisco Feature Navigator to find information about platform and software image support. To access Cisco Feature Navigator, go to <https://cfmg.cisco.com>.