



Using Redundant Supervisor Engines

This chapter describes how to use and configure redundant supervisor engines. The Catalyst 5500 series switches support an optional redundant supervisor engine. The second supervisor engine takes over if the active supervisor engine fails.



Note

For complete information on installing redundant Catalyst 5000 family supervisor engine modules, refer to the *Catalyst 5000 Family Supervisor Engine Installation Guide*.



Note

For complete syntax and usage information for the commands used in this chapter, refer to the *Catalyst 5000 Family Command Reference*.

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Understanding How Supervisor Engine Redundancy Works

These sections describe how supervisor engine redundancy works:

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Overview of Supervisor Engine Redundancy

Catalyst 5500 series switches support supervisor engine redundancy with Supervisor Engine II, II G, III, or III G. You must install the redundant supervisor engines in slots 1 and 2 of the chassis.

Redundant supervisor engines must be of the same type. Supervisor Engine III modules are interchangeable in a redundant configuration if the feature card is the same on both supervisor engines (both EARL1+, both NFFC, or both NFFC II).

Redundant supervisor engines are hot swappable. If you hot-insert a second supervisor engine, the second module communicates with the active supervisor engine after completing its initial module-level diagnostics. The second supervisor engine immediately enters redundant mode. No switching-bus diagnostics are run for the second supervisor engine because running diagnostics can disrupt normal traffic. The active supervisor engine downloads the software image and configuration to the redundant supervisor engine, if necessary.

When you boot a Catalyst 5500 series switch with redundant supervisor engines, the first supervisor engine to come online becomes the active supervisor engine; the second supervisor engine enters redundant mode. All administrative and network management functions, such as CLI processing, SNMP, Telnet, Spanning Tree Protocol (STP), Cisco Discovery Protocol (CDP), and VLAN Trunk Protocol (VTP), are processed on the active supervisor engine.

The console port on the redundant supervisor engine is inactive and the module status for the redundant supervisor engine displays as “standby.”

Synchronization on Supervisor Engine II, II G, and III G

The Supervisor Engine II, II G, and III G modules store the boot image in onboard Flash memory. Only one boot image can be stored at a time. If you download a new system image to the supervisor engine, the new image replaces the image stored in the onboard Flash.

When you power up or reset the switch, both supervisor engines run initial module-level diagnostics. The supervisor engine in slot 1 becomes active, and the supervisor engine in slot 2 enters redundant mode. If the software images on the two supervisor engines are different, or if the NVRAM configuration of the two supervisor engines is different, the active supervisor engine automatically downloads its software image and configuration to the redundant supervisor engine.

Synchronization on Supervisor Engine III

When you power up or reset the switch, both supervisor engines run initial module-level diagnostics. The supervisor engine in slot 1 becomes active, and the supervisor engine in slot 2 enters redundant mode.

The Supervisor Engine III module uses two system images:

- Boot image—Image file stored in Flash memory and specified in the BOOT environment variable
- Runtime image—Image file resident in dynamic RAM (DRAM) after the switch boots

In most cases, the boot image and the runtime image are the same. However, if you change the BOOT environment variable or delete the boot image in Flash memory, the runtime and boot images are different. If you change or remove the boot image, the active supervisor engine synchronizes the new boot image with the boot image on the redundant supervisor engine.

The following conditions initiate the synchronization of the runtime and boot images on the active and redundant Supervisor Engine III modules:

- **Timestamp mismatch between the runtime images on the active and redundant supervisor engines**
The active supervisor engine synchronizes its runtime image with the redundant supervisor engine if the timestamps of their respective runtime images differ when the system is booted or reset.
- **Timestamp mismatch between the boot images on the active and redundant supervisor engines**
The active supervisor engine synchronizes its boot image with the redundant supervisor engine if the timestamps of their respective boot images differ when the system is booted or reset, or if you change the BOOT environment variable.
- **Current boot image overwritten**
If you overwrite the current boot image stored on one of the Flash devices, the file system management module detects this event and initiates synchronization. The active supervisor engine copies its new boot image to the redundant supervisor engine.
- **BOOT environment variables changed**
If you change the BOOT environment variables to specify a different default boot image, the active supervisor engine initiates boot-image synchronization. The NVRAM configuration module detects this event and calls the Flash synchronization function with the next probable boot filename by looking at the boot configuration parameter.
- **Flash PC cards with same boot-image filename**
If you change the Flash device on either the active or redundant supervisor engine and the new Flash device contains a boot image that has the same name (but a different timestamp) as the boot image from the previous Flash device, the Flash file management module initiates synchronization.
- **Current runtime image deleted**
If you delete the current runtime image from the Flash device, the Flash file management module prompts you to verify that you want to delete the current runtime image. If you confirm the deletion, the Flash file management module initiates Flash synchronization and informs the NVRAM configuration module of the change. The NVRAM configuration module examines the BOOT environment variable to determine the next probable image to boot and calls the Flash synchronization function using the new image name.

Supervisor Engine Switchover

If the background diagnostics on the active supervisor engine detect a major problem or an exception occurs, the active supervisor engine resets. The redundant supervisor engine detects that the active supervisor engine is no longer running and becomes active. The redundant supervisor engine can detect if the active supervisor engine is not functioning and can force a reset, if necessary. If the reset supervisor engine comes online again, it enters redundant mode.

If the active supervisor engine fails, the redundant supervisor engine becomes active. The redundant supervisor engine runs the same system image and configuration as the active supervisor engine and the system continues to operate with the same configuration after switching over to the second supervisor engine.

**Note**

The switchover time from active to redundant supervisor engine does not include spanning tree convergence time.

**Note**

In supervisor engine software release 5.1 and later, the switchover from the active to the redundant supervisor engine should occur several seconds faster than in prior software releases.

Using the Redundant Uplink Ports

The software release running on the switch determines whether you can use the uplink ports on the redundant supervisor engine.

- In software releases prior to release 4.1, the uplink ports on the redundant supervisor engine are always inactive. When there is a switchover from the active to the redundant supervisor engine, the uplink ports on the redundant supervisor engine become active.
- In software releases 4.1 and 4.2, the uplink ports on the redundant supervisor engine are active and function exactly the same as the uplink ports on the active supervisor engine.
- In software release 4.3 and later, the redundant uplink ports are inactive by default. You can configure the ports to be active or inactive. If the ports are configured as inactive and there is a switchover from the active to the redundant supervisor engine, the uplinks become active.

Redundant Supervisor Engine Configuration Guidelines and Restrictions

The following conditions and events can cause the synchronization of images between redundant Supervisor Engine III modules to fail or to produce unexpected results:

- Downloading a new image to the active supervisor engine

When you download a new image to the active supervisor engine, it is copied to a file system (in bootflash or on one of the Flash PC cards in the Flash PC card slots). Because you may or may not have configured this image as the boot image, the newly downloaded image is not copied to the redundant supervisor engine automatically.

To initiate the synchronization function between the active and redundant supervisor engines, you must configure this newly downloaded image as the boot image on the active supervisor engine. Synchronization occurs when you change the boot variable. To run the new image, you must reset the system.

- Unable to find the current runtime image

If the active supervisor engine is unable to find the current runtime image on any of the Flash devices, it signals an error condition. In this case, if the redundant supervisor engine is inserted or reset, Flash synchronization does not occur. In addition, the STATUS LED on the redundant supervisor engine turns red and the system generates a syslog error message.

- Supervisor Engines II and III installed in the same chassis

If you have a Supervisor Engine II and a Supervisor Engine III installed as the active and redundant supervisor engines in the same chassis, their boot images do not synchronize because their images are in different formats. Supervisor engine redundancy is supported only with supervisor engines of the same type.

- Active supervisor engine in slot 2

When the active supervisor engine is in slot 2, the redundant supervisor engine is in slot 1. If you change the configuration to specify a new boot image and then reset the system, the supervisor engine in slot 1 becomes the active supervisor engine and loads its default boot image, canceling the configuration changes you have just made. To avoid this problem, the system prompts you for Flash synchronization as soon as you change the boot file configuration.

Verifying Redundant Supervisor Engine Status

You can verify the status of the redundant supervisor engine using several CLI commands.



Note

On the Supervisor Engine III modules, the **show module** output provides information about installed daughter cards and uplink modules. The **show test** command provides information about onboard ASICs not present on the Supervisor Engine II module.

To verify the status of the redundant supervisor engine, perform one or more of these tasks:

Task	Command
Show the status of the redundant supervisor engine.	show module [<i>mod_num</i>]
Show the state of the redundant supervisor engine uplink ports.	show port [<i>mod/port</i>]
Show diagnostic test results for the redundant supervisor engine.	show test [<i>mod_num</i>]

This example shows how to check the status of the redundant supervisor engine using the **show module** command:

```

Console> (enable) show module
Mod Module-Name          Ports Module-Type          Model      Serial-Num Status
-----
1                        4      10/100BaseTX Supervis WS-X5530  009979082 ok
2                        2      10/100BaseTX Supervis WS-X5530  007451586 standby
3                        48     10BaseT Ethernet        WS-X5012A 007879593 ok
4                        1      Network Analysis/RMON WS-X5380  008175475 ok
5                        1      Route Switch           WS-X5302  007460757 ok
6                        10BaseT Ethernet Ext
7                        48     10BaseT Ethernet        WS-X5014  007879658 ok
8                        1      MM OC-3 ATM            WS-X5155  003414855 ok
9                        2      UTP OC-3 Dual-Phy ATM WS-X5156  007646048 ok
13
/SRP

Mod MAC-Address(es)      Hw      Fw      Sw
-----
1  00-e0-4f-ac-b0-00 to 00-e0-4f-ac-b3-ff 1.8    3.1.2  4.3(1a)
2  00-e0-4f-ac-b0-00 to 00-e0-4f-ac-b3-ff 1.3    3.1.2  4.3(1a)
3  00-10-7b-50-1b-00 to 00-10-7b-50-1b-2f 0.202  4.2(108) 4.3(1a)
4  00-e0-14-10-18-00      0.100  4.1.1  4.3(0.31)
5  00-e0-1e-91-d5-14 to 00-e0-1e-91-d5-15 5.0    20.7   11.3(3a)WA4(5)
7  00-10-7b-5d-30-40 to 00-10-7b-5d-30-6f 0.102  4.2(108) 4.3(1a)
8  00-e0-1e-a9-20-b9      1.2    1.3    3.2(7)

```



```
DRAM Data 0x55 Test .....Passed
DRAM Data 0xaa Test .....Passed
DRAM Address Test .....Passed
Clearing DRAM .....Done
EARLII .....Present
EARLII RAM Test .....Passed
EARL Serial Prom Test .....Passed
Level2 Cache .....Present
Level2 Cache test.....Passed

Boot image: bootflash:cat5000-sup3.4-3-1a.bin
Downloading epld sram device please wait ...
Programming successful for Altera 10K50 SRAM EPLD
```

```
This module is now in standby mode.
Console is disabled for standby supervisor
```

This example shows the console output on the redundant supervisor engine when you force a switchover from the active to the redundant supervisor engine:

```
Cisco Systems Console

Enter password:
12/07/1998,17:04:43:MLS-5:Multilayer switching is enabled
12/07/1998,17:04:43:MLS-5:Netflow Data Export disabled
12/07/1998,17:04:44:SYS-5:Module 2 is online
12/07/1998,17:04:45:SYS-5:Module 5 is online
12/07/1998,17:04:45:SYS-5:Module 7 is online
12/07/1998,17:04:45:SYS-5:Module 3 is online
12/07/1998,17:04:52:MLS-5:Route Processor 172.20.52.6 added
12/07/1998,17:05:10:SYS-5:Module 8 is online
12/07/1998,17:05:14:SYS-5:Module 9 is online
12/07/1998,17:05:22:SYS-5:Module 4 is online
12/07/1998,17:06:13:SYS-5:Module 1 is in standby mode
Supervisor image synchronization process will start in 10 seconds
12/07/1998,17:06:37:SYS-5:Ports on standby supervisor(Module 1) are UP
12/07/1998,17:06:41:SYS-5:Active supervisor is synchronizing the NMP image.
12/07/1998,17:06:44:SYS-5:The active supervisor has synchronized the NMP image.

Console>
```

Configuring the Redundant Uplink Ports

In software release 4.3 and later, you can configure the uplink ports on the redundant supervisor engine as active or inactive. This configuration is independent of other configuration commands such as **set port enable** and **set port disable**. The default configuration for the uplinks is inactive.

To configure the uplink ports on the redundant supervisor engine as active, perform this task in privileged mode:

	Task	Command
Step 1	Set the uplink ports on the redundant supervisor engine to active.	set standbyports enable
Step 2	Verify the configuration.	show standbyports

This example shows how to set the uplink ports on the redundant supervisor engine to active:

```
Console> (enable) set standbyports enable
Standby ports feature enabled.
Please wait while the standby ports are coming up..
Console> (enable) 12/07/1998,16:45:15:SYS-5:Ports on standby supervisor(Module 2) are UP

Console> (enable)
```

To configure the uplink ports on the redundant supervisor engine as inactive, perform this task in privileged mode:

	Task	Command
Step 1	Set the uplink ports on the redundant supervisor engine to inactive.	set standbyports disable
Step 2	Verify the configuration.	show standbyports

This example shows how to set the uplink ports on the redundant supervisor engine to inactive:

```
Console> (enable) set standbyports disable
Standby ports feature disabled.
Console> (enable)
```

Performing a Minimal Downtime Software Upgrade

In software release 5.2 and later, you can perform a minimal downtime software upgrade in a switch with redundant supervisor engines. In most cases, the minimal downtime software upgrade reduces switch downtime to approximately 30 to 45 seconds from the average 4 to 5 minutes previously required.



Caution

The minimal downtime software upgrade is most effective when the uplink ports on both supervisor engines are connected to the same network. If the uplink ports on the active and redundant supervisor engines are connected to different networks, connectivity to each network is disrupted for approximately 4 to 5 minutes as each supervisor engine resets.



Note

On *all* supervisor engines, use the **download** command to copy the new software image to the supervisor engine bootflash when performing a minimal downtime software upgrade.

In software release 5.2 and later on the Supervisor Engine III, the **download** command performs the following actions:

- If necessary, deletes the oldest image files on the bootflash: Flash device until there is space sufficient for copying the new software image and performs a **squeeze** on the bootflash: device.
- Copies the new software image to the bootflash: device.
- Prepends the new image name to the BOOT variable.

**Note**

You can also perform these tasks manually instead of using the **download** command.

The minimal downtime software upgrade process is as follows:

1. The **download** command copies the new software image to the bootflash of the active supervisor engine. On the Supervisor Engine III, the **download** command automatically deletes the oldest files in bootflash: if necessary to make room for the new image file, and prepends the new filename to the BOOT variable.
2. The active supervisor engine copies the new software image to the redundant supervisor engine bootflash.
3. The **reset mindown** command resets the switch. The redundant supervisor engine resets and reboots using the new software image.

**Caution**

If you make configuration changes after entering the **reset mindown** command, but before the active supervisor engine resets (see step 4), the *changes are not saved*. While the redundant supervisor engine is reset, the switch still accepts input from the CLI, but any changes you make to the configuration are not saved or synchronized with the redundant supervisor engine between the time you enter the **reset mindown** command and the time the supervisor engine comes online.

4. When the redundant supervisor engine comes online, the active supervisor engine resets, causing a fast switchover to the redundant supervisor engine.
5. The new active supervisor engine comes online running the new software image. The active supervisor engine resets all of the switching modules. Modules come online in approximately 30 seconds.
6. The previously active supervisor engine comes online running the new software image and enters redundant mode.

To perform a minimal downtime software upgrade, perform this task in privileged mode:

	Task	Command
Step 1	Download the new software image to the active supervisor engine.	download <i>tftp_server filename</i>
Step 2	Reset the switch using the mindown keyword.	reset mindown


```
Boot image: bootflash:BTSYNC_cat5000-sup3.5-2-1.bin
```

```
This module is now in standby mode.  
Console is disabled for standby supervisor
```

```
Cisco Systems Console
```

```
Enter password:  
%MLS-5-NDEDISABLED:Netflow Data Export disabled  
%SYS-5-MOD_OK:Module 2 is online  
%SYS-5-MOD_OK:Module 8 is online  
%SYS-5-MOD_OK:Module 3 is online  
%SYS-5-SUP_MODSBY:Module 1 is in standby mode  
Supervisor image synchronization process will start in 10 seconds  
%SYS-5-SUP_IMGSYNCSTART:Active supervisor is synchronizing the NMP image  
%SYS-5-SUP_IMGSYNCFINISH:Active supervisor has synchronized the NMP image  
%SYS-5-MOD_OK:Module 10 is online
```

```
Console>
```

Supervisor Engine III Synchronization Examples

The following examples show what happens when the synchronization function encounters certain conditions. These examples apply to the Supervisor Engine III unless otherwise noted. These examples are not intended to cover every possible condition.

Synchronizing the Runtime Image with the BOOT Variable

This section contains four examples in which the active supervisor engine runtime image is synchronized with the redundant supervisor engine.

Example 1: Runtime image not synchronized

The configuration for this example is as follows:

Active Supervisor Engine	Redundant Supervisor Engine
Runtime image: bootflash:image_file1	Runtime image: bootflash:image_file1
BOOT variable: bootflash:image_file1;	BOOT variable: bootflash:image_file1;
Bootflash: image_file1 (timestamp 1)	Bootflash: image_file1 (timestamp 1)

The result is as follows:

- The active supervisor engine **image_file1** image is not copied to the redundant supervisor engine.
- The redundant supervisor engine BOOT variable is not modified.
- The redundant supervisor engine is not reset.

Example 2: File copied, BOOT variable changed, redundant supervisor engine reset

The configuration for this example is as follows:

Active Supervisor Engine	Redundant Supervisor Engine
Runtime image: bootflash:image_file1	Runtime image: bootflash:image_file2
BOOT variable: bootflash:image_file1;	BOOT variable: bootflash:image_file2;
Bootflash: image_file1 (timestamp 1)	Bootflash: image_file2 (timestamp 2)

The result is as follows:

- The active supervisor engine copies **image_file1** to the redundant supervisor engine and renames the file **RTSYNC_image_file1**.
- The redundant supervisor engine bootflash is modified to the following:
image_file2, RTSYNC_image_file1
- The redundant supervisor engine BOOT variable is modified to the following:
bootflash:RTSYNC_image_file1;bootflash:image_file2;
- The redundant supervisor engine is reset.

Example 3: File not copied, BOOT variable changed, redundant supervisor engine reset

The configuration for this example is as follows:

Active Supervisor Engine	Redundant Supervisor Engine
Runtime image: bootflash:image_file1	Runtime image: bootflash:image_file2
BOOT variable: bootflash:image_file1;	BOOT variable: bootflash:image_file2;
Bootflash: image_file1 (timestamp 1)	Bootflash: image_file1 (timestamp 1), image_file2 (timestamp 2)

The result is as follows:

- The active supervisor engine runtime image is synchronized to the redundant supervisor engine.
- The active supervisor engine **image_file1** image is not copied to the redundant supervisor engine.
- The redundant supervisor engine BOOT variable is modified to the following:
image_file1;image_file2;
- The redundant supervisor engine is reset.

Example 4: Oldest bootflash file deleted, bootflash squeezed

The configuration for this example is as follows:

Active Supervisor Engine	Redundant Supervisor Engine
Runtime image: bootflash:image_file1	Runtime image: bootflash:image_file2
BOOT variable: bootflash:image_file1;	BOOT variable: bootflash:image_file2;
Bootflash: image_file1 (timestamp 1)	Bootflash: image_file2 (timestamp 2), image_file3 (timestamp 3), image_file4 (timestamp 4)

There is less than 1 MB of space left on the bootflash: device. Timestamp 2 is older than timestamp 3, and the timestamp 3 is older than timestamp 4.

The result is as follows:

- The active supervisor engine runtime image is synchronized with the redundant supervisor engine.
- The active supervisor engine attempts to copy **image_file1** image to the redundant supervisor engine.
- Because there is not enough space on the redundant supervisor engine bootflash, the system deletes the oldest file (**image_file2**) and squeezes the bootflash.

- The active supervisor engine copies **image_file1** image to the redundant supervisor engine and renames it **RTSYNC_image_file1**.
- The redundant supervisor engine bootflash is modified to the following:
image_file3, image_file4, RTSYNC_image_file1
- The redundant supervisor engine BOOT variable is modified to the following:
bootflash:RTSYNC_image_file1;bootflash:image_file2;
- The redundant supervisor engine is reset.

Synchronizing the Boot Images on the Active and Redundant Supervisor III Modules

This section contains four examples in which the BOOT variable on the active and redundant Supervisor Engine III modules are synchronized.

Example 1: File copied, bootflash modified, redundant supervisor engine not reset

The configuration for this example is as follows:

Active Supervisor Engine	Redundant Supervisor Engine
Runtime image: bootflash:image_file1	Runtime image: bootflash:image_file1
BOOT variable: bootflash:image_file2;	BOOT variable: bootflash:image_file1;
Bootflash: image_file1 (timestamp 1), image_file2 (timestamp 2)	Bootflash: empty

The result is as follows:

- The active supervisor engine copies its **image_file2** image to the redundant supervisor engine and renames it **BTSYNC_image_file2**.
- The redundant supervisor engine bootflash is modified to the following:
image_file1, BTSYNC_image_file2
- The redundant supervisor engine BOOT variable is modified to the following:
bootflash:BTSYNC_image_file2;bootflash:image_file1;
- The redundant supervisor engine is not reset.

Example 2: File not copied, BOOT variable modified, redundant supervisor engine not reset

The configuration for this example is as follows:

Active Supervisor Engine	Redundant Supervisor Engine
Runtime image: bootflash:image_file1	Runtime image: bootflash:image_file1
BOOT variable: bootflash:image_file2; bootflash:image_file1	BOOT variable: bootflash:image_file1;
Bootflash: image_file1 (timestamp 1), image_file2 (timestamp 2)	Bootflash: image_file1 (timestamp 1), image_file2 (timestamp 2)

The result is as follows:

- The redundant supervisor engine BOOT variable is modified to the following:
bootflash:image_file2;bootflash:image_file1;
- The redundant supervisor engine is not reset.

Example 3: File copied, oldest file deleted, bootflash squeezed, BOOT variable modified, redundant supervisor engine not reset

The configuration for this example is as follows:

Active Supervisor Engine	Redundant Supervisor Engine
Runtime image: bootflash:image_file1	Runtime image: bootflash:image_file1
BOOT variable: bootflash:image_file2, bootflash:image_file1	BOOT variable: bootflash:image_file1;
Bootflash: image_file1 (timestamp 1), image_file2 (timestamp 2)	Bootflash: image_file0 (timestamp 0), image_file1 (timestamp 1), image_file3 (timestamp 3)

There is less than 1 MB of space left on the bootflash: device. The timestamp for **image_file0** is older than **image_file1**, and the timestamp for **image_file1** is older than the timestamp for **image_file3**.

The result is as follows:

- The active supervisor engine attempts to copy its **image_file2** image to the redundant supervisor engine.
- Because there is not enough space on the redundant supervisor engine bootflash, the system deletes the oldest file (**image_file0**) and squeezes the bootflash.
- The active supervisor engine copies its **image_file2** image to the redundant supervisor engine and renames it **BTSYNC_image_file2**.
- The redundant supervisor engine BOOT variable is modified to the following:
bootflash:BTSYNC_image_file2;bootflash:image_file1;

