CHAPTER 7

Managing Switch Stacks

This chapter provides the concepts and procedures to manage Catalyst 2960-S stacks, also referred to as Cisco FlexStacks. See the command reference for command syntax and usage information.

Note Stacking is supported only on Catalyst 2960-S switches running the LAN base image.

The switch command reference has command syntax and usage information.

For other switch stack-related information, such as cabling the switches through their stack ports and using the LEDs for switch stack status, see the hardware installation guide.

Understanding Stacks

A *switch stack* is a set of up to four Catalyst 2960-S switches connected through their stack ports. One of the switches controls the operation of the stack and is called the *stack master*. The stack master and the other switches in the stack are *stack members*. Layer 2 protocol presents the entire switch stack as a single entity to the network.

Note A switch stack is different from a *switch cluster*. A switch cluster is a set of switches connected through their LAN ports, such as the 10/100/1000 ports. For more information about how switch stacks differ from switch clusters, see the "Planning and Creating Clusters" chapter in the *Getting Started with Cisco Network Assistant* on Cisco.com.

The master is the single point of stack-wide management. From the master, you configure:

- System-level (global) features that apply to all members
- Interface-level features for each member

If the stack master is running the cryptographic version (that is, supports encryption) of the software, the encryption features are available.

Every member is uniquely identified by its own *stack member number*.

All members are eligible masters. If the master becomes unavailable, the remaining members elect a new master from among themselves. One of the factors is the *stack member priority value*. The switch with the highest stack-member priority-value becomes the master.

The system-level features supported on the master are supported on the entire stack.

The master contains the saved and running configuration files for the stack. The configuration files include the system-level settings for the stack and the interface-level settings for each member. Each member has a current copy of these files for back-up purposes.

You manage the stack through a single IP address. The IP address is a system-level setting and is not specific to the master or to any other member. You can manage the stack through the same IP address even if you remove the master or any other member from the stack.

You can use these methods to manage stacks:

- Network Assistant (available on Cisco.com)
- Command-line interface (CLI) over a serial connection to the console port of any member
- A network management application through the Simple Network Management Protocol (SNMP)

Note Use SNMP to manage network features across the stack that are defined by supported MIBs. The switch does not support MIBs to manage stacking-specific features such as stack membership and election.

- CiscoWorks network management software

To manage stacks, you should understand:

- These concepts on stack formations:
  - Stack Membership, page 7-3
  - Master Election, page 7-5
- These concepts on stack and member configurations:
  - Stack MAC Address, page 7-6
  - Member Numbers, page 7-6
  - Member Priority Values, page 7-7
  - Stack Offline Configuration, page 7-7
  - Stack Software Compatibility Recommendations, page 7-9
  - Stack Protocol Version Compatibility, page 7-10
  - Major Version Number Incompatibility Among Switches, page 7-10
  - Minor Version Number Incompatibility Among Switches, page 7-10
  - Incompatible Software and Member Image Upgrades, page 7-13
  - Stack Configuration Files, page 7-14
  - Additional Considerations for System-Wide Configuration on Switch Stacks, page 7-14

– Stack Management Connectivity, page 7-15
– Stack Configuration Scenarios, page 7-16

- This concept on stack topology changes:
  – Data Recovery After Stack Topology Changes, page 7-17

Stack Membership

Note A switch stack can have only Catalyst 2960-S stack members.

A *standalone switch* is a stack with one member that is also the master. You can connect one standalone switch to another (Figure 7-1 on page 7-4) to create a stack containing two stack members, with one of them as the master. You can connect standalone switches to an existing stack (Figure 7-2 on page 7-4) to increase the stack membership.

If you replace a stack member with an identical model, the new switch functions with the same configuration as the replaced switch (assuming that the new switch is using the same member number as the replaced switch). For information about the benefits of provisioning a switch stack, see the "Stack Offline Configuration" section on page 7-7. For information about replacing a failed switch, see the "Troubleshooting" chapter in the hardware installation guide.

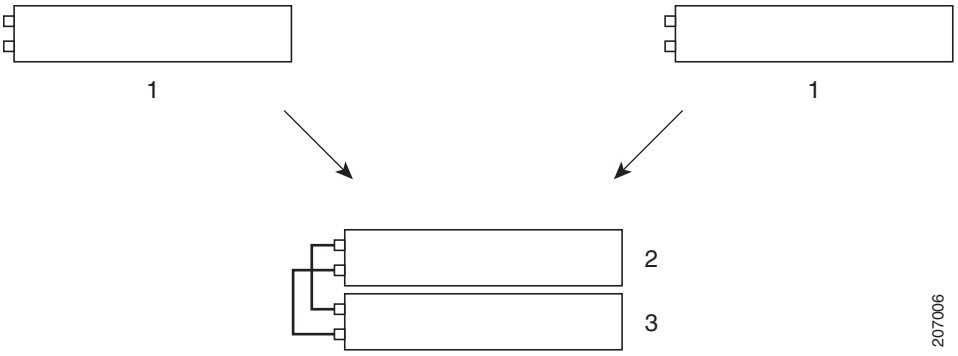
The operation of the stack continues uninterrupted during membership changes unless you remove the master or you add powered-on standalone switches or stacks.

Note To prevent interrupted stack operations, make sure the switches that you add to or remove from the stack are powered off.

After adding or removing members, make sure that the stack ring is operating at full bandwidth (20 Gb/s). Press the Mode button on a member until the Stack mode LED is on. The last two port LEDs on all switches in the stack should be green. If any one or both of any the last two port LEDs are not green, the stack is not operating at full bandwidth.

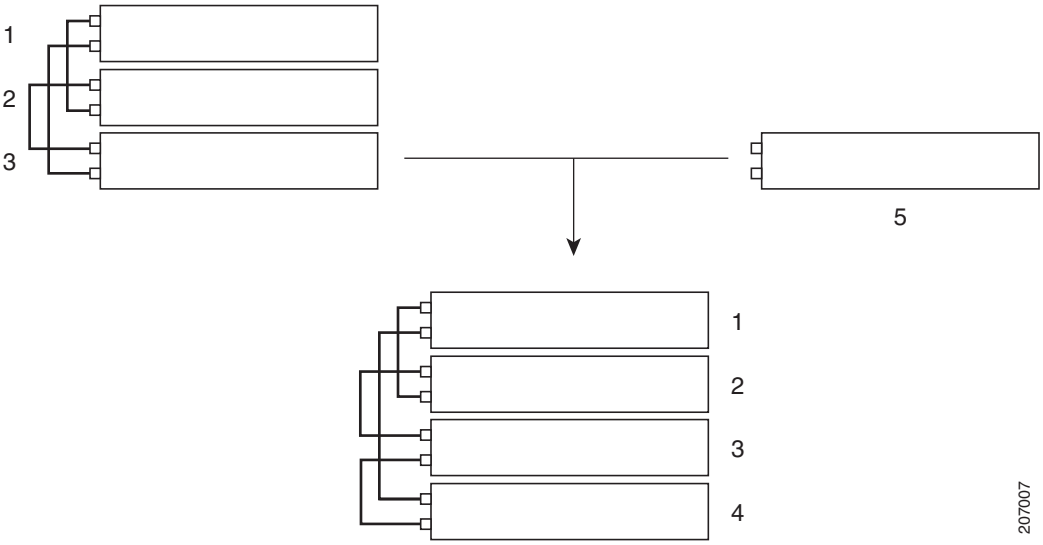
- Adding powered-on switches (merging) causes the masters of the merging stacks to elect a master from among themselves. The new master keeps its role and configuration and so do its members. All remaining switches, including the former masters, reload and join the stack as members. They change their member numbers to the lowest available numbers and use the configuration of the new master.
- Removing powered-on members divides (partitions) the stack into two or more switch stacks, each with the same configuration. This can create an IP address configuration conflict in your network. If you want the stacks to remain separate, change the IP address or addresses of the newly created stacks.

Figure 7-1 Creating a Switch Stack from Two Standalone Switches



1	Standalone switch	**3**	Stack member 2 and stack master
2	Stack member 1		

Figure 7-2 Adding a Standalone Switch to a Switch Stack



1	Stack member 1	**4**	Stack member 4
2	Stack member 2 and stack master	**5**	Standalone switch
3	Stack member 3		

For information about cabling and powering switch stacks, see the “Switch Installation” chapter in the hardware installation guide.

Master Election

The stack master is elected based on one of these factors in the order listed:

1. The switch that is currently the stack master.
2. The switch with the highest stack member priority value.

Note We recommend you assign the highest priority value to the switch that you want to be the master. The switch is then re-elected as master if a re-election occurs.

3. The switch that has the configuration file.
4. The switch with the highest uptime.
5. The switch with the lowest MAC address.

A stack master keeps its role unless one of these events occurs:

- The stack is reset.*
- The master is removed from the stack.
- The master is reset or powered off.
- The master fails.
- The stack membership is increased by adding powered-on standalone switches or switch stacks.*

In the events marked by an asterisk (*), the current stack master *might* be re-elected based on the listed factors.

When you power on or reset an entire stack, some stack members *might not* participate in the master election.

- All members participate in re-elections.
- Members that are powered on within the same 20-second time frame participate in the master election and have a chance to become the master.
- Members that are powered on after the 20-second time frame do not participate in this initial election and only become members.

The new master is available after a few seconds. In the meantime, the switch stack uses the forwarding tables in memory to minimize network disruption. The physical interfaces on the other available stack members are not affected while a new stack master is elected and is resetting.

When a new master is elected and the previous stack master becomes available, the previous master *does not* resume its role as stack master.

For all powering considerations that affect stack-master elections, see the “Switch Installation” chapter in the hardware installation guide.

Stack MAC Address

The MAC address of the master determines the stack MAC address.

When the stack initializes, the MAC address of the master determines the bridge ID that identifies the stack in the network.

If the master changes, the MAC address of the *new* master determines the new bridge ID. However, when the persistent MAC address feature is enabled, there is an approximate 4-minute delay before the stack MAC address changes. During this time period, if the previous master rejoins the stack, the stack continues to use its MAC address as the stack MAC address, even if the switch is now a member and not a master. If the previous master does not rejoin the stack during this period, the stack takes the MAC address of the new stack master as the stack MAC address. See Enabling Persistent MAC Address, page 7-18 for more information.

Member Numbers

The member number (1 to 4) identifies each member in the stack. The member number also determines the interface-level configuration that a member uses.

A new, out-of-the-box switch (one that has not joined a stack or has not been manually assigned a member number) ships with a default member number of 1. When it joins a stack, its default stack member number changes to the lowest available member number in the stack.

Members in the same stack cannot have the same member number.

- If you manually change the member number by using the **switch** *current-stack-member-number* **renumber** *new-stack-member-number* global configuration command, the new number goes into effect after that member resets (or after you use the **reload slot** *stack-member-number* privileged EXEC command) and only if that number is not already changed.

  You can also change the stack member number is by using the SWITCH_NUMBER environment variable.

  If the number is being used by another member in the stack, the switch selects the lowest available number in the stack.

  If you manually change the member number and no interface-level configuration is associated with that number, that member resets to its default configuration.

  You cannot use the **switch** *current-stack-member-number* **renumber** *new-stack-member-number* global configuration command on a provisioned switch. If you do, the command is rejected.
- If you move a stack member to a different switch stack, the stack member keeps its number only if the number is not being used by another member in the stack. If it is being used by another member in the stack, the switch selects the lowest available number in the stack.

See the following sections for information about stack member configuration:

- The procedure to change a member number, see the "Assigning a Member Number" section on page 7-20.
- The SWITCH_NUMBER environment variable, see the "Controlling Environment Variables" section on page 3-21.
- Member numbers and configurations, see the "Stack Configuration Files" section on page 7-14.
- Merging stacks, see the "Stack Membership" section on page 7-3.

Member Priority Values

A high priority value for a member increases the chance that it will be elected master and keep its member number. The priority value can be 1 to 15. The default priority value is 1.

Note We recommend that you assign the highest priority value to the switch that you want to be the stack master. The switch is then re-elected as master if a re-election occurs.

The new priority value takes effect immediately but does not affect the current master until the current master or the stack resets.

Stack Offline Configuration

You can use the offline configuration feature to *provision* (to configure) a new switch before it joins the stack. You can configure the member number, the switch type, and the interfaces associated with a switch that is not yet part of the stack. That configuration is the *provisioned configuration*. The switch to be added to the stack and to get this configuration is the *provisioned switch*.

The provisioned configuration is automatically created when a switch is added to a stack and when no provisioned configuration exists. You can manually create the provisioned configuration by using the **switch** *stack-member-number* **provision** *type* global configuration command.

When you configure the interfaces for a provisioned switch (for example, as part of a VLAN), the information appears in the stack running configuration whether or not the provisioned switch is part of the stack. The interface for the provisioned switch is not active and does not appear in the display of a specific feature (for example, in the **show vlan** user EXEC command output). Entering the **no shutdown** interface configuration command has no effect.

The startup configuration file ensures that the stack can reload and can use the saved information whether or not the provisioned switch is part of the stack.

Effects of Adding a Provisioned Switch to a Stack

When you add a provisioned switch to the switch stack, the stack applies either the provisioned configuration or the default configuration to it. Table 7-1 lists the events that occur when the switch stack compares the provisioned configuration with the provisioned switch.

Table 7-1 Results of Comparing the Provisioned Configuration with the Provisioned Switch

Scenario		Result
The stack member numbers and the switch types match.	1. If the stack member number of the provisioned switch matches the stack member number in the provisioned configuration on the stack, and 2. If the switch type of the provisioned switch matches the switch type in the provisioned configuration on the stack.	The switch stack applies the provisioned configuration to the provisioned switch and adds it to the stack.
The stack member numbers match but the switch types do not match.	1. If the stack member number of the provisioned switch matches the stack member number in the provisioned configuration on the stack, but 2. The switch type of the provisioned switch does not match the switch type in the provisioned configuration on the stack.	The switch stack applies the default configuration to the provisioned switch and adds it to the stack. The provisioned configuration is changed to reflect the new information.
The stack member number is not found in the provisioned configuration.		The switch stack applies the default configuration to the provisioned switch and adds it to the stack. The provisioned configuration is changed to reflect the new information.
The stack member number of the provisioned switch is in conflict with an existing stack member.	The stack master assigns a new stack member number to the provisioned switch. The stack member numbers and the switch types match: 1. If the new stack member number of the provisioned switch matches the stack member number in the provisioned configuration on the stack, and 2. If the switch type of the provisioned switch matches the switch type in the provisioned configuration on the stack.	The switch stack applies the provisioned configuration to the provisioned switch and adds it to the stack. The provisioned configuration is changed to reflect the new information.
	The stack member numbers match, but the switch types do not match: 1. If the stack member number of the provisioned switch matches the stack member number in the provisioned configuration on the stack, but 2. The switch type of the provisioned switch does not match the switch type in the provisioned configuration on the stack.	The switch stack applies the default configuration to the provisioned switch and adds it to the stack. The provisioned configuration is changed to reflect the new information.

Table 7-1 Results of Comparing the Provisioned Configuration with the Provisioned Switch (continued)

Scenario		Result
The stack member number of the provisioned switch is not found in the provisioned configuration.		The switch stack applies the default configuration to the provisioned switch and adds it to the stack.

If you add a provisioned switch that is a different type than specified in the provisioned configuration to a powered-down switch stack and then apply power, the switch stack rejects the (now incorrect) **switch** *stack-member-number* **provision** *type* global configuration command in the startup configuration file. However, during stack initialization, the nondefault interface configuration information in the startup configuration file for the provisioned interfaces (potentially of the wrong type) are executed. Depending on how different the actual switch type is from the previously provisioned switch type, some commands are rejected, and some commands are accepted.

Note If the switch stack does not contain a provisioned configuration for a new switch, the switch joins the stack with the default interface configuration. The switch stack then adds to its running configuration a **switch** *stack-member-number* **provision** *type* global configuration command that matches the new switch.

For configuration information, see the "Provisioning a New Member for a Stack" section on page 7-21.

Effects of Replacing a Provisioned Switch in a Stack

When a provisioned switch in a switch stack fails, is removed from the stack, and is replaced with another switch, the stack applies either the provisioned configuration or the default configuration to it. The events that occur when the switch stack compares the provisioned configuration with the provisioned switch are the same as those described in the "Effects of Adding a Provisioned Switch to a Stack" section on page 7-8.

Effects of Removing a Provisioned Switch from a Stack

If you remove a provisioned switch from the switch stack, the configuration associated with the removed stack member remains in the running configuration as provisioned information. To completely remove the configuration, use the **no switch** *stack-member-number* **provision** global configuration command.

Stack Software Compatibility Recommendations

All stack members must run the same Cisco IOS software version to ensure compatibility in the stack protocol version among the members.

Stack Protocol Version Compatibility

The stack protocol version has a *major* version number and a *minor* version number (for example 1.4, where 1 is the major version number and 4 is the minor version number).

Switches with the same Cisco IOS software version have the same stack protocol version. All features function properly across the stack. These switches with the same software version as the master immediately join the stack.

If an incompatibility exists, a system message describes the cause of the incompatibility on the specific stack members. The master sends the message to all members.

For more information, see the "Major Version Number Incompatibility Among Switches" procedure on page 7-10 and the "Minor Version Number Incompatibility Among Switches" procedure on page 7-10.

Major Version Number Incompatibility Among Switches

Switches with different Cisco IOS software versions likely have different stack protocol versions. Switches with different major version numbers are incompatible and cannot exist in the same stack.

Minor Version Number Incompatibility Among Switches

Switches with the same major version number but with a different minor version number as the master are considered partially compatible. When connected to a stack, a partially compatible switch enters version-mismatch mode and cannot join the stack as a fully functioning member. The software detects the mismatched software and tries to upgrade (or downgrade) the switch in version-mismatch mode with the stack image or with a tar file image from the stack flash memory. The software uses the automatic upgrade (auto-upgrade) and the automatic advise (auto-advise) features.

The port LEDs on switches in version-mismatch mode will also stay off. Pressing the Mode button does not change the LED mode.

Note Auto-advise and auto-copy identify which images are running by examining the info file and by searching the directory structure on the switch stack. If you download your image by using the **copy tftp:** command instead of by using the **archive download-sw** privileged EXEC command, the correct directory structure is not properly created. For more information about the info file, see the "tar File Format of Images on a Server or Cisco.com" section on page A-26.

Understanding Auto-Upgrade and Auto-Advise

When the software detects mismatched software and tries to upgrade the switch in version-mismatch mode, two software processes are involved: automatic upgrade and automatic advise.

- The automatic upgrade (auto-upgrade) process includes an auto-copy process and an auto-extract process. By default, auto-upgrade is enabled (the **boot auto-copy-sw** global configuration command is enabled). You can disable auto-upgrade by using the **no boot auto-copy-sw** global configuration command on the master. You can check the status of auto-upgrade by using the **show boot** privileged EXEC command and by checking the *Auto upgrade* line in the display.
  - Auto-copy automatically copies the software image running on any member to the switch in version-mismatch mode to upgrade (auto-upgrade) it. Auto-copy occurs if auto-upgrade is enabled, if there is enough flash memory in the switch in version-mismatch mode, and if the software image running on the stack is suitable for the switch in version-mismatch mode.

    Note A switch in version-mismatch mode might not run all released software. For example, new switch hardware is not recognized in earlier versions of software.

  - Automatic extraction (auto-extract) occurs when the auto-upgrade process cannot find the appropriate software in the stack to copy to the switch in version-mismatch mode. In that case, the auto-extract process searches all switches in the stack, whether they are in version-mismatch mode or not, for the tar file needed to upgrade the switch stack or the switch in version-mismatch mode. The tar file can be in any flash file system in the stack (including the switch in version-mismatch mode). If a tar file suitable for the switch in version-mismatch mode is found, the process extracts the file and automatically upgrades that switch.

  The auto-upgrade (auto-copy and auto-extract) processes start a few minutes after the mismatched software is detected.

  When the auto-upgrade process is complete, the switch that was in version-mismatch mode reloads and joins the stack as a fully functioning member. If you have both stack cables connected during the reload, network downtime does not occur because the stack operates on two rings.

- Automatic advise (auto-advise)—when the auto-upgrade process cannot find appropriate version-mismatch member software to copy to the switch in version-mismatch mode, the auto-advise process tells you the command (**archive copy-sw** or **archive download-sw** privileged EXEC command) and the image name (tar filename) needed to manually upgrade the switch stack or the switch in version-mismatch mode. The recommended image can be the running stack image or a tar file in any flash file system in the stack (including the switch in version-mismatch mode). If an appropriate image is not found in the stack flash file systems, the auto-advise process tells you to install new software on the stack. Auto-advise cannot be disabled, and there is no command to check its status.

  The auto-advise software does *not* give suggestions when the stack software and the software of the switch in version-mismatch mode do not contain the same feature sets.The same events occur when cryptographic and noncryptographic images are running.

  You can use the **archive-download-sw /allow-feature-upgrade** privileged EXEC command to allow installing an image with a different feature set.

Auto-Upgrade and Auto-Advise Example Messages

When you add a switch that has a different minor version number to the stack, the software displays messages in sequence (assuming that there are no other system messages generated by the switch).

This example shows that the stack detected a new switch that is running a different minor version number than the stack. Auto-copy launches, finds suitable software to copy from a member to the switch in version-mismatch mode, upgrades the switch in version-mismatch mode, and then reloads it:

```
*Mar 11 20:31:19.247:%STACKMGR-6-STACK_LINK_CHANGE:Stack Port 2 Switch 2 has changed to
state UP
*Mar 11 20:31:23.232:%STACKMGR-6-SWITCH_ADDED_VM:Switch 1 has been ADDED to the stack
(VERSION_MISMATCH)
*Mar 11 20:31:23.291:%STACKMGR-6-SWITCH_ADDED_VM:Switch 1 has been ADDED to the stack
(VERSION_MISMATCH) (Stack_1-3)
*Mar 11 20:33:23.248:%IMAGEMGR-6-AUTO_COPY_SW_INITIATED:Auto-copy-software process
initiated for switch number(s) 1
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:Searching for stack member to act
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:as software donor...
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:Found donor (system #2) for
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:member(s) 1
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:System software to be uploaded:
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:System Type:            0x00000000
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:archiving  (directory)
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:archiving /.bin (4945851 bytes)
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:archiving /info (450 bytes)
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:archiving info (104 bytes)
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:examining image...
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:extracting info (104 bytes)
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:extracting /info (450 bytes)
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:extracting info (104 bytes)
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:Stacking Version Number:1.4
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:System Type:            0x00000000
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:  Ios Image File Size:  0x004BA200
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:  Total Image File Size:0x00818A00
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:  Minimum Dram required:0x08000000
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:  Image Suffix:universalk9-122-53.SE
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:  Image Directory:
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:  Image Name:
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:  Image
Feature:IP|LAYER_3|PLUS|MIN_DRAM_MEG=128
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:Old image for switch 1:flash1:
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:  Old image will be deleted after download.
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:Extracting images from archive into flash on
switch 1...
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW: (directory)
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:extracting / (4945851 bytes)
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:extracting /info (450 bytes)
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:extracting info (104 bytes)
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:Installing (renaming):`flash1:update/' ->
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:       `flash1:'
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:New software image installed in flash1:
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:Removing old image:flash1:
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:All software images installed.
```

```
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:Requested system reload in progress...
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:Software successfully copied to
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:system(s) 1
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:Done copying software
*Mar 11 20:36:15.038:%IMAGEMGR-6-AUTO_COPY_SW:Reloading system(s) 1
```

This example shows that the stack detected a new switch that is running a different minor version number than the stack. Auto-copy launches but cannot find software in the stack to copy to the switch in version-mismatch mode to make it compatible with the stack. The auto-advise process launches and recommends that you download a tar file from the network to the switch in version-mismatch mode:

```
*Mar  1 00:01:11.319:%STACKMGR-6-STACK_LINK_CHANGE:Stack Port 2 Switch 2 has changed to
state UP
*Mar  1 00:01:15.547:%STACKMGR-6-SWITCH_ADDED_VM:Switch 1 has been ADDED to the stack
(VERSION_MISMATCH)
stack_2#
*Mar  1 00:03:15.554:%IMAGEMGR-6-AUTO_COPY_SW_INITIATED:Auto-copy-software process
initiated for switch number(s) 1
*Mar  1 00:03:15.554:%IMAGEMGR-6-AUTO_COPY_SW:
*Mar  1 00:03:15.554:%IMAGEMGR-6-AUTO_COPY_SW:Searching for stack member to act
*Mar  1 00:03:15.554:%IMAGEMGR-6-AUTO_COPY_SW:as software donor...
*Mar  1 00:03:15.554:%IMAGEMGR-6-AUTO_COPY_SW:Software was not copied
*Mar  1 00:03:15.562:%IMAGEMGR-6-AUTO_ADVISE_SW_INITIATED:Auto-advise-software process
initiated for switch number(s) 1
*Mar  1 00:04:22.537:%IMAGEMGR-6-AUTO_ADVISE_SW:
*Mar  1 00:04:22.537:%IMAGEMGR-6-AUTO_ADVISE_SW:
*Mar  1 00:04:22.537:%IMAGEMGR-6-AUTO_ADVISE_SW:Systems with incompatible software
*Mar  1 00:04:22.537:%IMAGEMGR-6-AUTO_ADVISE_SW:have been added to the stack.  The
*Mar  1 00:04:22.537:%IMAGEMGR-6-AUTO_ADVISE_SW:storage devices on all of the stack
*Mar  1 00:04:22.537:%IMAGEMGR-6-AUTO_ADVISE_SW:members have been scanned, and it has
*Mar  1 00:04:22.537:%IMAGEMGR-6-AUTO_ADVISE_SW:been determined that the stack can be
*Mar  1 00:04:22.537:%IMAGEMGR-6-AUTO_ADVISE_SW:repaired by issuing the following
*Mar  1 00:04:22.537:%IMAGEMGR-6-AUTO_ADVISE_SW:command(s):
*Mar  1 00:04:22.537:%IMAGEMGR-6-AUTO_ADVISE_SW:
*Mar  1 00:04:22.537:%IMAGEMGR-6-AUTO_ADVISE_SW:    archive download-sw /force-reload
/overwrite /dest 1 flash1:.tar
*Mar  1 00:04:22.537:%IMAGEMGR-6-AUTO_ADVISE_SW:
```

For information about using the **archive download-sw** privileged EXEC command, see the "Working with Software Images" section on page A-25.

Incompatible Software and Member Image Upgrades

You can upgrade a switch that has an incompatible software image by using the **archive copy-sw** privileged EXEC command to copy the software image from an existing member. That switch automatically reloads with the new image and joins the stack as a fully functioning member.

For more information, see the "Copying an Image File from One Stack Member to Another" section on page A-39.

Stack Configuration Files

The master has the saved and running configuration files for the stack. All members periodically receive synchronized copies of the configuration files from the master. If the master becomes unavailable, any member assuming the role of master has the latest configuration files.

- System-level (global) configuration settings—such as IP, STP, VLAN, and SNMP settings—that apply to all members
- Member interface-specific configuration settings, which are specific for each member

A new, out-of-box switch joining a stack uses the system-level settings of that stack. If a switch is moved to a different stack, it loses its saved configuration file and uses the system-level configuration of the new stack.

The interface-specific configuration of each member is associated with its member number. A stack member keeps its number unless it is manually changed or it is already used by another member in the same stack.

- If an interface-specific configuration does not exist for that member number, the member uses its default interface-specific configuration.
- If an interface-specific configuration exists for that member number, the member uses the interface-specific configuration associated with that member number.

If you replace a failed member with an identical model, the replacement member automatically uses the same interface-specific configuration. You do not need to reconfigure the interface settings. The replacement switch must have the same member number as the failed switch.

You back up and restore the stack configuration in the same way as you do for a standalone switch configuration.

For information about

- The benefits of provisioning a switch stack, see the "Stack Offline Configuration" section on page 7-7.
- File systems and configuration files, see Appendix A, "Working with the Cisco IOS File System, Configuration Files, and Software Images."

Additional Considerations for System-Wide Configuration on Switch Stacks

- "Planning and Creating Clusters" chapter in the *Getting Started with Cisco Network Assistant*, available on Cisco.com
- "MAC Addresses and Switch Stacks" section on page 5-22
- "802.1x Authentication and Switch Stacks" section on page 10-12
- "VTP and Switch Stacks" section on page 15-8
- "Spanning Tree and Switch Stacks" section on page 17-12
- "MSTP and Switch Stacks" section on page 18-9
- "DHCP Snooping and Switch Stacks" section on page 21-8
- "IGMP Snooping and Switch Stacks" section on page 23-7
- "Port Security and Switch Stacks" section on page 24-19
- "CDP and Switch Stacks" section on page 26-2
- "SPAN and RSPAN and Switch Stacks" section on page 28-10

- "Configuring QoS" section on page 34-1
- "ACLs and Switch Stacks" section on page 33-5
- "EtherChannel and Switch Stacks" section on page 37-10
- "IPv6 and Switch Stacks" section on page 35-6

Stack Management Connectivity

You manage the stack and the member interfaces through the master. You can use the CLI, SNMP, Network Assistant, and CiscoWorks network management applications. You cannot manage members as individual switches.

Stack Through an IP Address

The stack is managed through a system-level IP address. You can still manage the stack through the same IP address even if you remove the master or any other stack member from the stack, provided there is IP connectivity.

Note Members keep their IP addresses when you remove them from a stack. To avoid having two devices with the same IP address in your network, change the IP address of the switch that you removed from the stack.

For related information about switch stack configurations, see the "Stack Configuration Files" section on page 7-14.

Stack Through an SSH Session

The Secure Shell (SSH) connectivity to the stack can be lost if a master running the cryptographic version fails and is replaced by a switch that is running a noncryptographic version. We recommend that a switch running the cryptographic version of the software be the master.

Stack Through Console Ports

You can connect to the master through the console port of one or more members.

Be careful when using multiple CLI sessions to the master. Commands that you enter in one session are not displayed in the other sessions. Therefore, it is possible that you might not be able to identify the session from which you entered a command.

We recommend that you use only one CLI session when managing the stack.

Specific Members

If you want to configure a specific member port, you must include the stack member number in the CLI notation.

To access a specific member, see the "Accessing the CLI of a Specific Member" section on page 7-22.

Stack Configuration Scenarios

Most of the scenarios in Table 7-2 assume at least two switches are connected through their stack ports.

Table 7-2 Switch Stack Configuration Scenarios

Scenario		Result
Master election specifically determined by existing masters	Connect two powered-on stacks through the stack ports.	Only one of the two masters becomes the new stack master.
Master election specifically determined by the member priority value	1. Connect two switches through their stack ports. 2. Use the **switch** *stack-member-number* **priority** *new-priority-number* global configuration command to set one member with a higher member priority value. 3. Restart both members at the same time.	The member with the higher priority value is elected master.
Master election specifically determined by the configuration file	Assuming that both members have the same priority value: 1. Make sure that one member has a default configuration and that the other member has a saved (nondefault) configuration file. 2. Restart both members at the same time.	The member with the saved configuration file is elected master.
Master election specifically determined by the MAC address	Assuming that both members have the same priority value, configuration file, and software image, restart both stack members at the same time.	The member with the lower MAC address is elected master.
Member number conflict	Assuming that one member has a higher priority value than the other member: 1. Ensure that both members have the same member number. If necessary, use the **switch** *current-stack-member-number* **renumber** *new-stack-member-number* global configuration command. 2. Restart both members at the same time.	The member with the higher priority value keeps its member number. The other member has a new stack member number.

Table 7-2 Switch Stack Configuration Scenarios (continued)

Scenario		Result
Add a member	1. Power off the new switch. 2. Through their stack ports, connect the new switch to a powered-on stack. 3. Power on the new switch.	The master is kept. The new switch is added to the stack.
Master failure	Remove (or power off) the master.	One of the remaining stack members becomes the new master. All other members in the stack remain members and do not restart.
Add more than four members	1. Through their stack ports, connect ten switches. 2. Power on all switches.	Two switches become masters. One master has four stack members. The other master remains a standalone switch. Use the Mode button and port LEDs on the switches to identify which switches are masters and which switches belong to each master. For information about the Mode button and the LEDs, see the hardware installation guide.

Data Recovery After Stack Topology Changes

When you add or remove a stack member, the stack topology changes. Cisco IOS recovers the data flow.

Configuring the Switch Stack

Default Switch Stack Configuration

Table 7-3 shows the default switch stack configuration.

Table 7-3 Default Switch Stack Configuration

Feature	Default Setting
Stack MAC address timer	Disabled.
Member number	1
Member priority value	1
Offline configuration	The switch stack is not provisioned.
Persistent MAC address	Disabled.

Enabling Persistent MAC Address

The MAC address of the master determines the stack MAC address. When a master is removed from the stack and a new master takes over, the MAC address of the new master to become the new stack MAC address. However, you can set the persistent MAC address feature with a time delay before the stack MAC address changes. During this time period, if the previous master rejoins the stack, the stack continues to use that MAC address as the stack MAC address, even if the switch is now a member and not a master. You can also configure stack MAC persistency so that the stack MAC address never changes to the new master MAC address.

Caution When you configure this feature, a warning message displays the consequences of your configuration. You should use this feature cautiously. Using the old master MAC address elsewhere in the domain could result in lost traffic.

You can set the time period from 0 to 60 minutes.

- If you enter the command with no value, the default delay is 4 minutes. We recommend that you always enter a value. The time delay appears in the configuration file with an explicit timer value of 4 minutes.
- If you enter **0**, the stack MAC address of the previous master is used until you enter the **no stack-mac persistent timer** global configuration command, which changes the stack MAC address to that of the current master. If you do not enter this command, the stack MAC address does not change.
- If you enter a time delay of 1 to 60 minutes, the stack MAC address of the previous master is used until the configured time period expires or until you enter the **no stack-mac persistent timer** command.

If the previous master does not rejoin the stack during this period, the stack uses the MAC address of the new master as the stack MAC address.

Note If the entire switch stack reloads, it acquires the MAC address of the master as the stack MAC address.

Beginning in privileged EXEC mode, follow these steps to enable persistent MAC address. This procedure is optional.

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**stack-mac persistent timer** [**0** | *time-value*]	Enable a time delay after a stack-master change before the stack MAC address changes to that of the new stack master. If the previous stack master rejoins the stack during this period, the stack uses that MAC address as the stack MAC address. • Enter the command with no value to set the default delay of 4 minutes. We recommend that you always configure a value. • Enter **0** to use the MAC address of the current master indefinitely. • Enter a *time-value* from 1 to 60 to configure the time period (in minutes) before the stack MAC address changes to the new master. **Caution** When you enter this command, a warning states that traffic might be lost if the old master MAC address appears elsewhere in the network domain. If you enter the **no stack-mac persistent timer** command after a new stack master takes over, before the time expires, the stack uses the current master MAC address.
Step 3	**end**	Return to privileged EXEC mode.
Step 4	**show running-config** or **show switch**	Verify that the stack MAC address timer is enabled. The output shows `stack-mac persistent timer` and the time in minutes. The output shows `Mac persistency wait time` with the number of minutes configured and the stack MAC address.
Step 5	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

Use the **no stack-mac persistent timer** global configuration command to disable the persistent MAC address feature.

This example shows how to configure the persistent MAC address feature for a 7-minute time delay and to verify the configuration:

```
Switch(config)# stack-mac persistent timer 7
WARNING: The stack continues to use the base MAC of the old Master
WARNING: as the stack MAC after a master switchover until the MAC
WARNING: persistency timer expires. During this time the Network
WARNING: Administrators must make sure that the old stack-mac does
WARNING: not appear elsewhere in this network domain. If it does,
WARNING: user traffic may be blackholed.
Switch(config)# end
Switch# show switch
Switch/Stack Mac Address : 0016.4727.a900
Mac persistency wait time: 7 mins
                                           H/W   Current
Switch#  Role   Mac Address     Priority Version  State
-----------------------------------------------------------
*1       Master 0016.4727.a900     1      0       Ready
```

Assigning Stack Member Information

- Assigning a Member Number, page 7-20 (optional)
- Setting the Member Priority Value, page 7-21 (optional)
- Provisioning a New Member for a Stack, page 7-21 (optional)

Assigning a Member Number

Note This task is available only from the master.

Beginning in privileged EXEC mode, follow these steps to assign a member number to a member. This procedure is optional.

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**switch** *current-stack-member-number* **renumber** *new-stack-member-number*	Specify the current member number and the new member number for the member. The range is 1 to 4. You can display the current member number by using the **show switch** user EXEC command.
Step 3	**end**	Return to privileged EXEC mode.
Step 4	**reload slot** *stack-member-number*	Reset the stack member.
Step 5	**show switch**	Verify the stack member number.
Step 6	**copy running-config startup-config**	Save your entries in the configuration file.

Setting the Member Priority Value

Note This task is available only from the master.

Beginning in privileged EXEC mode, follow these steps to assign a priority value to a member: This procedure is optional.

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**switch** *stack-member-number* **priority** *new-priority-number*	Specify the member number and the new priority for the member. The member number range is 1 to 4. The priority value range is 1 to 15. You can display the current priority value by using the **show switch** user EXEC command. The new priority value takes effect immediately but does not affect the current master until the current master or the stack resets.
Step 3	**end**	Return to privileged EXEC mode.
Step 4	**reload slot** *stack-member-number*	Reset the member, and apply this configuration.
Step 5	**show switch** *stack-member-number*	Verify the member priority value.
Step 6	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

You can also set the SWITCH_PRIORITY environment variable. For more information, see the "Controlling Environment Variables" section on page 3-21.

Provisioning a New Member for a Stack

Note This task is available only from the master.

Beginning in privileged EXEC mode, follow these steps to provision a new member for a stack. This procedure is optional.

	Command	Purpose
Step 1	**show switch**	Display summary information about the stack.
Step 2	**configure terminal**	Enter global configuration mode.
Step 3	**switch** *stack-member-number* **provision** *type*	Specify the member number for the provisioned switch. By default, no switches are provisioned. For *stack-member-number*, the range is 1 to 4. Enter a member number that is not already used in the stack. See Step 1. For *type*, enter the model number of the member.
Step 4	**end**	Return to privileged EXEC mode.
Step 5	**show running-config**	Verify the correct numbering of interfaces in the configuration.

	Command	Purpose
Step 6	**show switch** *stack-member-number*	Verify the status of the provisioned switch. For *stack-member-number*, enter the same number as in Step 2.
Step 7	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

To remove provisioned information and to avoid receiving an error message, remove the specified switch from the stack before you use the **no** form of this command.

This example shows how to provision a switch with a stack member number of 2 for the stack. The **show running-config** command output shows the interfaces associated with the provisioned switch:

```
Switch(config)# switch 2 provision
Switch(config)# end
Switch# show running-config | include switch 2
!
interface GigabitEthernet2/0/1
!
interface GigabitEthernet2/0/2
!
interface GigabitEthernet2/0/3
<output truncated>
```

Changing the Stack Membership

If you remove powered-on members but do not want to partition the stack:

Step 1 Power off the newly created stacks.

Step 2 Reconnect them to the original stack through their stack ports.

Step 3 Power on the switches.

Accessing the CLI of a Specific Member

Note This task is only for debugging purposes, and is only available from the master.

You can access all or specific members by using the **remote command** {**all** | *stack-member-number*} privileged EXEC command. The stack member number range is 1 to 4.

You can access specific members by using the **session** *stack-member-number* privileged EXEC command. The member number is appended to the system prompt. For example, the prompt for member 2 is `Switch-2#`, and system prompt for the master is `Switch#`. Enter exi**t** to return to the CLI session on the master. Only the **show** and **debug** commands are available on a specific member.

For more information, see the "Using Interface Configuration Mode" section on page 12-14.

Displaying Stack Information

To display saved configuration changes after resetting a specific member or the stack, use these privileged EXEC commands:

Table 7-4 Commands for Displaying Stack Information

Command	Description
show controller ethernet-controller stack port [**1** | **2**]	Display stack port counters (or per-interface and per-stack port send and receive statistics read from the hardware).
show platform stack passive-links all	Display all stack information, such as the stack protocol version.
show switch	Display summary information about the stack, including the status of provisioned switches and switches in version-mismatch mode.
show switch *stack-member-number*	Display information about a specific member.
show switch detail	Display detailed information about the stack ring.
show switch neighbors	Display the stack neighbors.
show switch stack-ports	Display port information for the stack.

Troubleshooting Stacks

Manually Disabling a Stack Port

If a stack port is flapping and causing instability in the stack ring, to disable the port, enter the **switch** *stack-member-number* **stack port** *port-number* **disable** privileged EXEC command. To re-enable the port, enter the **switch** *stack-member-number* **stack port** *port-number* **enable** command.

Note Be careful when using the **switch** *stack-member-number* **stack port** *port-number* **disable** command. When you disable the stack port, .

- A stack is in the *full-ring* state when all members are connected through the stack ports and are in the ready state.
- The stack is in the *partial-ring* state when
  - All members are connected through the stack ports, but some all are not in the ready state.
  - Some members are not connected through the stack ports.

When you enter the **switch** *stack-member-number* **stack port** *port-number* **disable** privileged EXEC command and

- The stack is in the full-ring state, you can disable only one stack port. This message appears:

  ```
  Enabling/disabling a stack port may cause undesired stack changes. Continue?[confirm]
  ```

- The stack is in the partial-ring state, you cannot disable the port. This message appears:

  ```
  Disabling stack port not allowed with current stack configuration.
  ```

Re-Enabling a Stack Port While Another Member Starts

Stack Port 1 on Switch 1 is connected to Port 2 on Switch 4. If Port 1 is flapping, disable Port 1 with the **switch 1 stack port 1 disable** privileged EXEC command.

While Port 1 on Switch 1 is disabled and Switch 1 is still powered on:

1. Disconnect the stack cable between Port 1 on Switch 1 and Port 2 on Switch 4.
2. Remove Switch 4 from the stack.
3. Add a switch to replace Switch 4 and assign it switch-number 4.
4. Reconnect the cable between Port 1 on Switch 1 and Port 2 on Switch 4 (the replacement switch).
5. Re-enable the link between the switches. Enter the **switch 1 stack port 1 enable** privileged EXEC command to enable Port 1 on Switch 1.
6. Power on Switch 4.

Caution Powering on Switch 4 before enabling the Port 1 on Switch 1 might cause one of the switches to reload.

If Switch 4 is powered on first, you might need to enter the **switch 1 stack port 1 enable** and the **switch 4 stack port 2 enable** privileged EXEC commands to bring up the link.

Understanding the show switch stack-ports summary Output

Only Port 1 on stack member 2 is disabled.

```
Switch# show switch stack-ports summary
Switch#/  Stack   Neighbor   Cable    Link   Link   Sync      #         In
 Port#     Port              Length    OK   Active   OK    Changes   Loopback
          Status                                          To LinkOK
--------  ------  --------  --------  ----  ------  ----  ---------  --------
  1/1     OK         3      50 cm     Yes    Yes    Yes        1        No
  1/2     Down      None    3 m       Yes    No     Yes        1        No
  2/1     Down      None    3 m       Yes    No     Yes        1        No
  2/2     OK         3      50 cm     Yes    Yes    Yes        1        No
  3/1     OK         2      50 cm     Yes    Yes    Yes        1        No
  3/2     OK         1      50 cm     Yes    Yes    Yes        1        No
```

Table 7-5 show switch stack-ports summary Command Output

Field	Description
Switch#/Port#	Member number and its stack port number.
Stack Port Status	• Absent—No cable is detected on the stack port. • Down—A cable is detected, but either no connected neighbor is up, or the stack port is disabled. • OK—A cable is detected, and the connected neighbor is up.
Neighbor	Switch number of the active member at the other end of the stack cable.
Cable Length	Valid lengths are 50 cm, 1 m, or 3 m. If the switch cannot detect the cable length, the value is *no cable*. The cable might not be connected, or the link might be unreliable.
Link OK	This shows if the link is stable. The *link partner* is a stack port on a neighbor switch. • No—The link partner receives invalid protocol messages from the port. • Yes—The link partner receives valid protocol messages from the port.
Link Active	This shows if the stack port is in the same state as its link partner. • No—The port cannot send traffic to the link partner. • Yes—The port can send traffic to the link partner.
Sync OK	• No—The link partner does not send valid protocol messages to the stack port. • Yes—The link partner sends valid protocol messages to the port.
# Changes to LinkOK	This shows the relative stability of the link. If a large number of changes occur in a short period of time, link flapping can occur.
In Loopback	• No—At least one stack port on the member has an attached stack cable. • Yes—None of the stack ports on the member has an attached stack cable.