



# Managing Switch Stacks

This chapter provides the concepts and procedures to manage Catalyst 3750 switch stacks.



**Note**

For complete syntax and usage information for the commands used in this chapter, refer to the command reference for this release.

This chapter consists of these sections:

- [Understanding Switch Stacks, page 5-1](#)
- [Assigning Stack Member Information, page 5-13](#)
- [Accessing the CLI of a Specific Stack Member, page 5-14](#)
- [Displaying Information about the Switch Stack, page 5-14](#)

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

## Understanding Switch Stacks

A *switch stack* is a set of up to nine Catalyst 3750 switches connected through their StackWise 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*. The stack members use the Cisco StackWise technology to behave and work together as a unified system. Layer 2 and Layer 3 protocols present the entire switch stack as a single entity to the network.

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

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

A switch stack is identified in the network by its *bridge ID* and, if the switch stack is operating as a Layer 3 device, its router MAC address. The bridge ID and router MAC address are determined by the MAC address of the stack master. Every stack member is uniquely identified by its own *stack member number*.

All stack members are eligible stack masters. If the stack master becomes unavailable, the remaining stack members participate in electing a new stack master from among themselves. A set of factors determine which switch is elected the stack master. One of the factors is the *stack member priority value*. The switch with the highest priority value becomes the stack master.

The system-level features supported on the stack master are supported on the entire switch stack. If the switch stack must have switches running both standard multilayer software image (SMI) and enhanced multilayer software image (EMI) software, we recommend that a switch running the EMI software be the stack master. EMI features become unavailable if the stack master is running the SMI software.

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

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

You can use these methods to manage switch stacks:

- Using the CMS software through a Netscape or Internet Explorer browser session
- Using the command-line interface (CLI) over a serial connection to the console port of any stack member
- Using a network management application through Simple Network Management Protocol (SNMP)
- Using the CiscoWorks network management software

To manage switch stacks, you should understand:

- These concepts on how switch stacks are formed:
  - [Switch Stack Membership, page 5-3](#)
  - [Stack Master Election and Re-Election, page 5-5](#)
- These concepts on how switch stacks and stack members are configured:
  - [Switch Stack Bridge ID and Router MAC Address, page 5-5](#)
  - [Stack Member Numbers, page 5-6](#)
  - [Stack Member Priority Values, page 5-7](#)
  - [Stack Protocol Versions and Software Image Compatibility, page 5-7](#)
  - [Switch Stack Configuration Files, page 5-8](#)
  - [Switch Stack Management Connectivity, page 5-10](#)
  - [Switch Stack Configuration Scenarios, page 5-11](#)

**Note**

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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 [“Switch Clusters and Switch Stacks” section on page 6-15](#).

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## Switch Stack Membership

A switch stack has up to nine stack members connected through their StackWise ports. A switch stack always has one stack master.

A standalone switch is a switch stack with one stack member that also operates as the stack master. You can connect one standalone switch to another (Figure 5-1) to create a switch stack containing two stack members, with one of them being the stack master. You can connect standalone switches to an existing switch stack (Figure 5-2) to increase the stack membership.

If you replace a stack member with an identical model, the new switch functions with exactly the same configuration as the replaced switch, assuming that the new switch is using the same member number as the replaced switch. The specific procedure for replacing a failed switch is described in the “Troubleshooting” chapter in the hardware installation guide.

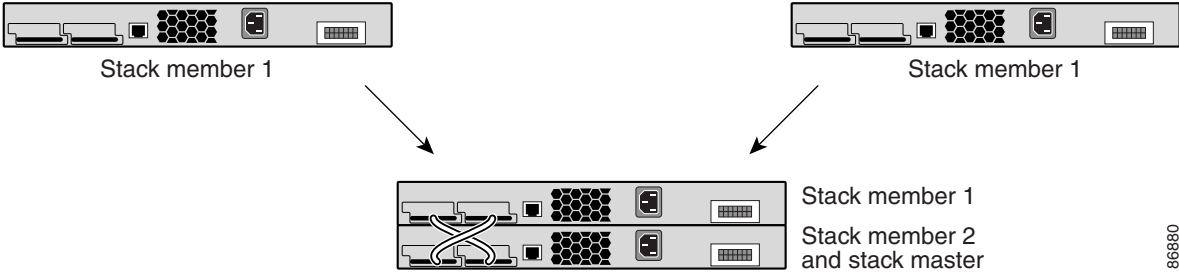
The operation of the switch stack continues uninterrupted during membership changes unless you remove the stack master or you add powered-on standalone switches or switch stacks.

**Note**

- Make sure the switches that you add to or remove from the switch stack are powered off.
  - After adding or removing stack members, make sure that the switch stack is operating at full bandwidth (32 Gbps). Press the Mode button on a stack member until the Stack mode LED is on. The last two port LEDs on all switches in the stack should be green. Depending on the switch model, the last two ports are either 10/100/1000 ports or small-form pluggable (SFP) module ports. If, on any of the switches, one or both of the last two port LEDs are not green, the stack is not operating at full bandwidth.
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- Adding powered-on switches (merging) causes the stack masters of the merging switch stacks to elect a stack master from among themselves. The re-elected stack master retains its role and configuration and so do its stack members. All remaining switches, including the former stack masters, reload and join the switch stack as stack members. They change their stack member numbers to the lowest available numbers and use the stack configuration of the re-elected stack master.
  - Removing powered-on stack members causes the switch stack to divide (partition) into two or more switch stacks, each with the same configuration. This can cause an IP address configuration conflict in your network. If you want the switch stacks to remain separate, change the IP address of the newly created switch stacks. If you did not intend to partition the switch stack:
    - a. Power off the newly created switch stacks.
    - b. Reconnect them to the original switch stack through their StackWise ports.
    - c. Power on the switches.

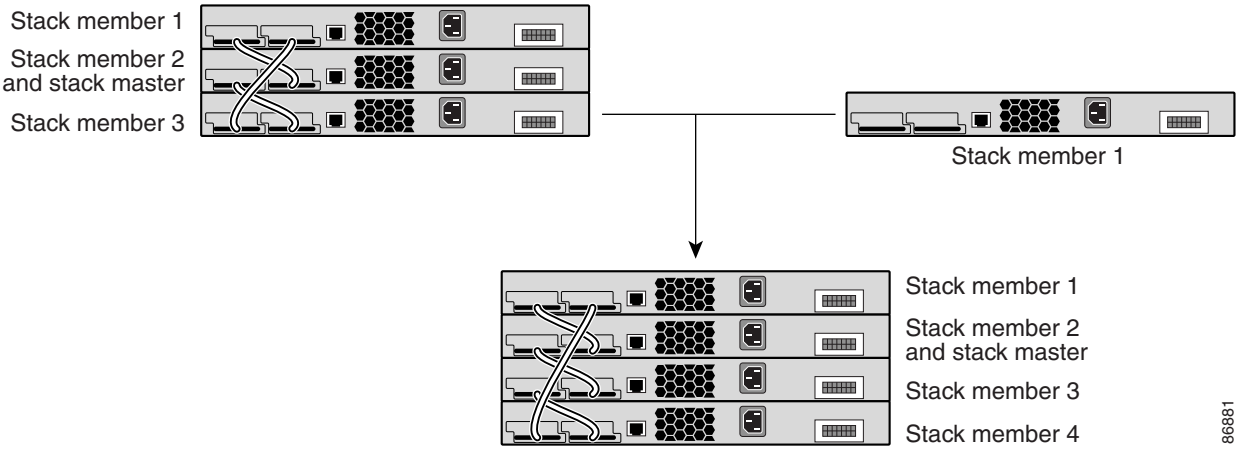
For additional information about cabling and powering switch stacks, refer to the “Switch Installation” chapter in the hardware installation guide.

**Figure 5-1** Creating a Switch Stack from Two Standalone Switches



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**Figure 5-2** Adding a Standalone Switch to a Switch Stack



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## Stack Master Election and Re-Election

The stack master is elected or re-elected based on one of these factors and in the order as listed:

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



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**Note** We recommend assigning the highest priority value to the switch that you prefer to be the stack master. This ensures that the switch is re-elected as stack master if a re-election occurs.

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3. The switch not using the default interface-level configuration.
4. The switch with the EMI software, not the SMI software.
5. The switch with the longest system up-time.
6. The switch with the lowest MAC address.

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

- The switch stack is reset.\*
- The stack master is removed from the switch stack.
- The stack master is reset or powered off.
- The stack master has failed.
- The switch 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 switch stack, some stack members *might not* participate in the stack master election. Stack members that are powered on within the same 10-second timeframe participate in the stack master election and have a chance to become the stack master. Stack members that are powered on after the 10-second timeframe do not participate in this initial election and only become stack members. All stack members participate in re-elections. For all powering considerations that affect stack master elections, refer to the “Switch Installation” chapter in the hardware installation guide.

The new stack master becomes 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.

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

As described in the hardware installation guide, you can use the Master LED on the switch to see if the switch is the stack master.

## Switch Stack Bridge ID and Router MAC Address

The bridge ID and router MAC address identify the switch stack in the network. When the switch stack initializes, the MAC address of the stack master determines the bridge ID and router MAC address.

If the stack master changes, the MAC address of the new stack master determines the new bridge ID and router MAC address.

## Stack Member Numbers

The stack member number (1 to 9) identifies each member in the switch stack. The member number also determines the interface-level configuration that a stack member uses. You can display the stack member number by using the **show switch** user EXEC command.

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

Stack members in the same switch stack cannot have the same stack member number. Every stack member, including a standalone switch, retains its member number until you manually change the number or unless the number is already being used by another member in the stack.

- If you manually change the stack 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 stack member resets (or after you use the **reload slot** *stack-member-number* privileged EXEC command) and only if that number is not already assigned to any other members in the stack. Another way to change the stack member number is by changing the SWITCH\_NUMBER environment variable, as explained in the [“Controlling Environment Variables” section on page 4-15](#).

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



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**Note** If you manually change the number of a stack member and no interface-level configuration is associated with that member number, that stack member loses its current interface-level configuration and resets to its default configuration. For more information about stack member numbers and configurations, see the [“Switch Stack Configuration Files” section on page 5-8](#).

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- If you move a stack member to a different switch stack, the stack member retains 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.
- If you merge switch stacks, the switches that join the switch stack of a new stack master select the the lowest available numbers in the stack. For more information about merging switch stacks, see the [“Switch Stack Membership” section on page 5-3](#)).

As described in the hardware installation guide, you can use the switch port LEDs in Stack mode to visually determine the stack member number of each stack member.

## Stack Member Priority Values

A higher priority value for a stack member increases its likelihood to be elected stack master and to retain its stack member number. The priority value can be 1 to 15. The default priority value is 1. You can display the stack member priority value by using the **show switch** user EXEC command.

**Note**

We recommend assigning the highest priority value to the switch that you prefer to be the stack master. This ensures that the switch is re-elected as stack master if a re-election occurs.

You can change the priority value for a stack member by using the **switch** *stack-member-number* **priority** *priority-number* global configuration command. Another way to change the member priority value is by changing the SWITCH\_PRIORITY environment variable, as explained in the “[Controlling Environment Variables](#)” section on page 4-15.

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

## Stack Protocol Versions and Software Image Compatibility

All stack members must run the same IOS software version to ensure compatibility between stack members.

These sections describe how compatibility between stack members is determined:

- “[Stack Protocol Version Compatibility](#)” section on page 5-7
- “[Software Image Compatibility](#)” section on page 5-8

### Stack Protocol Version Compatibility

Each software image includes a *stack protocol version*. The stack protocol version has a *major* version number and a *minor* version number. Both version numbers determine the level of compatibility among the stack members. You can display the stack protocol version by using the **show platform stack-manager all** privileged EXEC command.

Switches with the same IOS software version have the same stack protocol version. Such switches are fully compatible, and all features function properly across the switch stack. Switches with the same IOS software version as the stack master join the switch stack immediately.

If an incompatibility exists, the incompatible stack members generate a system error message that describes the cause of the incompatibility on the specific stack members. The stack master displays the error message to all stack members.

- “[Major Incompatibility Between Switches](#)” section on page 5-7
- “[Minor Incompatibility Between Switches](#)” section on page 5-8

### Major Incompatibility Between Switches

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

## Minor Incompatibility Between Switches

Switches with the same major version number but a different minor version number as the stack master are considered partially compatible. When connected to a switch stack, partially compatible switches enter into version mismatch (VM) mode and cannot join the stack. The stack master downloads the software version it is using to any switch in VM mode.

- If there is a stack member that is not in VM mode and is running software that can also run on the switch in VM mode, the stack master uses that software to upgrade (or downgrade) the software on the switch in VM mode. The switch in VM mode automatically reloads and joins the stack as a fully functioning member.



### Note

The stack master does not automatically install EMI software on an SMI-running switch or SMI software on an EMI-running switch.

- If none of the stack members are running software that can be installed on the switch in VM mode, the stack master scans the switch stack to see if there are any other recommended actions. Recommended actions appear in the system messages log. If there are no other actions to try, the stack master displays the recommended action to upgrade the software running on the switch stack.

The port LEDs on switches in VM mode remain off and pressing the Mode button does not change the LED mode.

## Software Image Compatibility

We recommend the following:

- The IOS software version on all stack members, including the stack master, should be the same. This helps ensure full compatibility in the stack protocol version among the stack members. For example, all stack members should have either the EMI or SMI Release 12.1(11)AX installed.
- If your switch stack must have switches running SMI and EMI software, the switch running the EMI software should be the stack master. EMI features become unavailable to all stack members if the stack master is running the SMI software.
- At least two stack members should have the EMI software installed to ensure redundant support of the EMI features. The EMI has precedence over the SMI during stack master election, assuming that the priority value of the stack members are the same. If the EMI stack master fails, the other stack member running the EMI software becomes the stack master.
- When a switch running the EMI joins a switch stack running the SMI of the same version, the EMI switch does not automatically become the stack master. If you want the EMI switch to become the stack master, reset the current SMI stack master by using the **reload slot stack-member-number** privileged EXEC command. The EMI switch is elected the stack master, assuming its priority value is higher or the same as the other stack members.

## Switch Stack Configuration Files

The configuration files record

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



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

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

The interface-specific configuration of each stack member is associated with the stack member number. As mentioned in the [“Stack Member Numbers” section on page 5-6](#), stack members retain their numbers unless they are manually changed or they are already used by another member in the same switch stack.

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

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

You back up and restore the stack configuration in the same way as you would for a standalone switch configuration. For more information about file systems and configuration files, see [Appendix B, “Working with the IOS File System, Configuration Files, and Software Images.”](#)

### Additional Considerations for System-wide Configuration on Switch Stacks

These sections provide additional considerations for configuring system-wide features on switch stacks:

- [“Switch Clusters and Switch Stacks” section on page 6-15](#)
- [“MAC Addresses and Switch Stacks” section on page 7-54](#)
- [“802.1X and Switch Stacks” section on page 8-5](#)
- [“VTP and the Switch Stack” section on page 11-6](#)
- [“Spanning Tree and Switch Stacks” section on page 13-11](#)
- [“IGMP Snooping and Switch Stacks” section on page 15-5](#)
- [“Port Security and Stack Changes” section on page 16-12](#)
- [“CDP and Switch Stacks” section on page 17-2](#)
- [“SPAN and RSPAN and Stack Changes” section on page 19-9](#)
- [“ACLs and Switch Stacks” section on page 23-5](#)
- [“EtherChannel and Switch Stacks” section on page 25-8](#)
- [“IP Routing and Switch Stacks” section on page 26-3](#)
- [“HSRP and Switch Stacks” section on page 27-2](#)
- [“Multicast Routing and Switch Stacks” section on page 28-8](#)
- [“Fallback Bridging and Switch Stacks” section on page 30-3](#)

## Switch Stack Management Connectivity

You manage the switch stack and the stack member interfaces through the stack master. You can use Cluster Management Suite (CMS), the CLI, and SNMP and CiscoWorks network management applications. You cannot manage stack members on an individual switch basis.

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

**Note**

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Stack members retain their IP addresses when you remove them from a switch stack. To avoid a conflict by having two devices with the same IP address in your network, change the IP address of the switch that you removed from the switch stack.

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For related information about switch stack configurations, see the [“Switch Stack Configuration Files” section on page 5-8](#).

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

Be careful when using multiple CLI sessions to the stack 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.

**Note**

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We recommend using only one CLI session when managing the switch stack.

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If you want to configure a specific stack member port, you must include the stack member number in the CLI command interface notation. For more information about interface notations, see the [“Using Interface Configuration Mode” section on page 9-6](#).

To debug a specific stack member, you can access it from the stack master by using the **session** *stack-member-number* privileged EXEC command. The stack member number is appended to the system prompt. For example, `Switch-2#` is the prompt in privileged EXEC mode for stack member 2, and the system prompt for the stack master is `Switch`. Only the **show** and **debug** commands are available in a CLI session to a specific stack member.

## Switch Stack Configuration Scenarios

Table 5-1 provides scenarios of how switch stack features are determined. Most of the scenarios assume at least two switches are connected through their StackWise ports.

**Table 5-1** Switch Stack Configuration Scenarios

Scenario		Result
Stack master election specifically determined by existing stack masters	Connect two powered-on switch stacks through the StackWise ports.	Only one of the two stack masters becomes the new stack master. None of the other stack members become the stack master.
Stack master election specifically determined by the stack member priority value	<ol style="list-style-type: none"> <li>1. Connect two switches through their StackWise ports.</li> <li>2. Use the <code>switch stack-member-number priority priority-number</code> global configuration command to set one stack member with a higher member priority value.</li> <li>3. Restart both stack members at the same time.</li> </ol>	The stack member with the higher priority value is elected stack master.
Stack master election specifically determined by the configuration file	<p>Assuming that both stack members have the same priority value:</p> <ol style="list-style-type: none"> <li>1. Make sure that one stack member has a default configuration and that the other stack member has a saved (nondefault) configuration file.</li> <li>2. Restart both stack members at the same time.</li> </ol>	The stack member with the saved configuration file is elected stack master.
Stack master election specifically determined by the EMI software	<p>Assuming that all stack members have the same priority value:</p> <ol style="list-style-type: none"> <li>1. Make sure that one stack member has the EMI software installed and that the other stack member has the SMI software installed.</li> <li>2. Restart both stack members at the same time.</li> </ol>	The stack member with the EMI software is elected stack master.
Stack master election specifically determined by the MAC address	Assuming that both stack members have the same priority value, configuration file, and software image, restart both stack members at the same time.	The stack member with the lower MAC address is elected stack master.

Table 5-1 Switch Stack Configuration Scenarios (continued)

Scenario		Result
Stack member number conflict	<p>Assuming that one stack member has a higher priority value than the other stack member:</p> <ol style="list-style-type: none"> <li>1. Ensure that both stack members have the same stack member number. If necessary, use the <b>switch</b> <i>current-stack-member-number</i> <b>renumber</b> <i>new-stack-member-number</i> global configuration command.</li> <li>2. Restart both stack members at the same time.</li> </ol>	The stack member with the higher priority value retains its stack member number. The other stack member has a new stack member number.
Add a stack member	<ol style="list-style-type: none"> <li>1. Power off the new switch.</li> <li>2. Through their StackWise ports, connect the new switch to a powered-on switch stack.</li> <li>3. Power on the new switch.</li> </ol>	The stack master is retained. The new switch is added to the switch stack.
Stack master failure	Remove (or power off) the stack master.	Based on the factors described in the <a href="#">“Stack Master Election and Re-Election”</a> section on page 5-5, one of the remaining stack members becomes the new stack master. All other stack members in the stack remain as stack members and do not reboot.
Add more than nine stack members	<ol style="list-style-type: none"> <li>1. Through their StackWise ports, connect ten switches.</li> <li>2. Power on all switches.</li> </ol>	<p>Two switches become stack masters. One stack master has nine stack members. The other stack master remains as a standalone switch.</p> <p>Use the Mode button and port LEDs on the switches to identify which switches are stack masters and which switches belong to which stack master. For information about using the Mode button and the LEDs, refer to the hardware installation guide.</p>

# Assigning Stack Member Information


**Note**

For complete syntax and usage information for the commands used in this section, refer to the switch command reference.

This section contains this configuration information:

- [Default Switch Stack Configuration, page 5-13](#)
- [Assigning a Stack Member Number, page 5-13](#) (optional)
- [Setting the Stack Member Priority Value, page 5-14](#) (optional)
- [Accessing the CLI of a Specific Stack Member, page 5-14](#) (optional)

## Default Switch Stack Configuration

Table 5-2 shows the default switch stack configuration.

**Table 5-2** Default Switch Stack Configuration

Feature	Default Setting
Stack member number	1
Stack member priority value	1

## Assigning a Stack Member Number


**Note**

This task is available only from the stack master.

Beginning in global configuration mode, follow these steps to assign a member number to a stack member:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>switch</b> <i>current-stack-member-number</i> <b>renumber</b> <i>new-stack-member-number</i>	Specify the current stack member number and the new stack member number for the stack member. The stack member number range is 1 to 9. You can display the current stack member number by using the <b>show switch</b> user EXEC command.
Step 3	<b>end</b>	Return to privileged EXEC mode.
Step 4	<b>reload slot</b> <i>stack-member-number</i>	Reset the stack member, and apply this configuration change.
Step 5	<b>show switch</b>	Verify the stack member number.

## Setting the Stack Member Priority Value



**Note** This task is available only from the stack master.

Beginning in global configuration mode, follow these steps to assign a priority value to a stack member:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>switch</b> <i>stack-member-number</i> <b>priority</b> <i>priority-number</i>	Specify the stack member number and the priority for the stack member. The stack member number range is 1 to 9. The priority value range is 1 to 15.  You can display the current priority value by using the <b>show switch</b> user EXEC command.  The new priority value takes effect immediately but does not affect the current stack master. The new priority value affects the current stack master when the current stack master or the switch stack resets.
Step 3	<b>end</b>	Return to privileged EXEC mode.
Step 4	<b>show switch</b> <i>stack-member-number</i>	Verify the stack member priority value.

## Accessing the CLI of a Specific Stack Member



**Note** This task is available only from the stack master. This task is only for debugging purposes.

You can access all or specific stack members by using the **remote command** **{all | *stack-member-number*}** privileged EXEC command. The stack member number range is 1 to 9.

You can access specific stack members by using the **session** *stack-member-number* privileged EXEC command. The stack member number range is 1 to 9. The stack member number is appended to the system prompt. For example, *switch-2#* is the prompt in privileged EXEC mode for stack member 2, and the system prompt for the stack master is *switch*. Enter **exit** to return to the CLI session on the stack master. Only the **show** and **debug** commands are available in a CLI session to a specific stack member.

## Displaying Information about the Switch Stack

You can use these commands to display the configuration changes that you save after you reset a specific stack member or the switch stack.

- **show platform stack-manager all** privileged EXEC command to display all switch stack information
- **show switch** *stack-member-number* user EXEC command to display information about a specific member
- These user EXEC commands to display switch stack information:
  - **show switch detail**
  - **show switch neighbors**
  - **show switch stack-ports**