



## **System Management Configuration Guide, Cisco IOS Release 15.2(2)E (Catalyst 2960-X Switch)**

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## Preface

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- [Related Documentation](#), page xiii
- [Obtaining Documentation and Submitting a Service Request](#), page xiii

## Document Conventions

This document uses the following conventions:

Convention	Description
^ or Ctrl	Both the ^ symbol and Ctrl represent the Control (Ctrl) key on a keyboard. For example, the key combination <b>^D</b> or <b>Ctrl-D</b> means that you hold down the Control key while you press the D key. (Keys are indicated in capital letters but are not case sensitive.)
<b>bold font</b>	Commands and keywords and user-entered text appear in <b>bold font</b> .
<i>Italic font</i>	Document titles, new or emphasized terms, and arguments for which you supply values are in <i>italic font</i> .
Courier font	Terminal sessions and information the system displays appear in <i>courier font</i> .
<b>Bold Courier font</b>	<b>Bold Courier font</b> indicates text that the user must enter.
[x]	Elements in square brackets are optional.
...	An ellipsis (three consecutive nonbolded periods without spaces) after a syntax element indicates that the element can be repeated.
	A vertical line, called a pipe, indicates a choice within a set of keywords or arguments.
[x   y]	Optional alternative keywords are grouped in brackets and separated by vertical bars.

Convention	Description
{x   y}	Required alternative keywords are grouped in braces and separated by vertical bars.
[x {y   z}]	Nested set of square brackets or braces indicate optional or required choices within optional or required elements. Braces and a vertical bar within square brackets indicate a required choice within an optional element.
string	A nonquoted set of characters. Do not use quotation marks around the string or the string will include the quotation marks.
<>	Nonprinting characters such as passwords are in angle brackets.
[ ]	Default responses to system prompts are in square brackets.
!, #	An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.

### Reader Alert Conventions

This document may use the following conventions for reader alerts:



#### Note

Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the manual.



#### Tip

Means *the following information will help you solve a problem*.



#### Caution

Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.



#### Timesaver

Means *the described action saves time*. You can save time by performing the action described in the paragraph.



#### Warning

### IMPORTANT SAFETY INSTRUCTIONS

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071

SAVE THESE INSTRUCTIONS

## Related Documentation

**Note**

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Before installing or upgrading the switch, refer to the release notes.

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- Catalyst 2960-X Switch, located at [http://www.cisco.com/go/cat2960x\\_docs](http://www.cisco.com/go/cat2960x_docs).
- Cisco SFP and SFP+ modules documentation, including compatibility matrixes, located at: [http://www.cisco.com/en/US/products/hw/modules/ps5455/tsd\\_products\\_support\\_series\\_home.html](http://www.cisco.com/en/US/products/hw/modules/ps5455/tsd_products_support_series_home.html)

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## CHAPTER

# 1

## Using the Command-Line Interface

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- [Information About Using the Command-Line Interface, page 1](#)
- [How to Use the CLI to Configure Features, page 6](#)

## Information About Using the Command-Line Interface

### Command Modes

The Cisco IOS user interface is divided into many different modes. The commands available to you depend on which mode you are currently in. Enter a question mark (?) at the system prompt to obtain a list of commands available for each command mode.

You can start a CLI session through a console connection, through Telnet, a SSH, or by using the browser.

When you start a session, you begin in user mode, often called user EXEC mode. Only a limited subset of the commands are available in user EXEC mode. For example, most of the user EXEC commands are one-time commands, such as **show** commands, which show the current configuration status, and **clear** commands, which clear counters or interfaces. The user EXEC commands are not saved when the switch reboots.

To have access to all commands, you must enter privileged EXEC mode. Normally, you must enter a password to enter privileged EXEC mode. From this mode, you can enter any privileged EXEC command or enter global configuration mode.

Using the configuration modes (global, interface, and line), you can make changes to the running configuration. If you save the configuration, these commands are stored and used when the switch reboots. To access the various configuration modes, you must start at global configuration mode. From global configuration mode, you can enter interface configuration mode and line configuration mode.

This table describes the main command modes, how to access each one, the prompt you see in that mode, and how to exit the mode.

Table 1: Command Mode Summary

Mode	Access Method	Prompt	Exit Method	About This Mode
User EXEC	Begin a session using Telnet, SSH, or console.	Switch>	Enter <b>logout</b> or <b>quit</b> .	Use this mode to <ul style="list-style-type: none"> <li>• Change terminal settings.</li> <li>• Perform basic tests.</li> <li>• Display system information.</li> </ul>
Privileged EXEC	While in user EXEC mode, enter the <b>enable</b> command.	Switch#	Enter <b>disable</b> to exit.	Use this mode to verify commands that you have entered. Use a password to protect access to this mode.
Global configuration	While in privileged EXEC mode, enter the <b>configure</b> command.	Switch(config)#	To exit to privileged EXEC mode, enter <b>exit</b> or <b>end</b> , or press <b>Ctrl-Z</b> .	Use this mode to configure parameters that apply to the entire switch.
VLAN configuration	While in global configuration mode, enter the <b>vlan <i>vlan-id</i></b> command.	Switch(config-vlan)#	To exit to global configuration mode, enter the <b>exit</b> command.  To return to privileged EXEC mode, press <b>Ctrl-Z</b> or enter <b>end</b> .	Use this mode to configure VLAN parameters. When VTP mode is transparent, you can create extended-range VLANs (VLAN IDs greater than 1005) and save configurations in the switch startup configuration file.
Interface configuration	While in global configuration mode, enter the <b>interface</b> command (with a specific interface).	Switch(config-if)#		Use this mode to configure parameters for the Ethernet ports.



Mode	Access Method	Prompt	Exit Method	About This Mode
			To exit to global configuration mode, enter <b>exit</b> .  To return to privileged EXEC mode, press <b>Ctrl-Z</b> or enter <b>end</b> .	
Line configuration	While in global configuration mode, specify a line with the <b>line vty</b> or <b>line console</b> command.	Switch(config-line)#	To exit to global configuration mode, enter <b>exit</b> .  To return to privileged EXEC mode, press <b>Ctrl-Z</b> or enter <b>end</b> .	Use this mode to configure parameters for the terminal line.

## Understanding Abbreviated Commands

You need to enter only enough characters for the switch to recognize the command as unique.

This example shows how to enter the **show configuration** privileged EXEC command in an abbreviated form:

```
Switch# show conf
```

## No and Default Forms of Commands

Almost every configuration command also has a **no** form. In general, use the **no** form to disable a feature or function or reverse the action of a command. For example, the **no shutdown** interface configuration command reverses the shutdown of an interface. Use the command without the keyword **no** to reenab a disabled feature or to enable a feature that is disabled by default.

Configuration commands can also have a **default** form. The **default** form of a command returns the command setting to its default. Most commands are disabled by default, so the **default** form is the same as the **no** form. However, some commands are enabled by default and have variables set to certain default values. In these cases, the **default** command enables the command and sets variables to their default values.

## CLI Error Messages

This table lists some error messages that you might encounter while using the CLI to configure your switch.

**Table 2: Common CLI Error Messages**

Error Message	Meaning	How to Get Help
<code>% Ambiguous command: "show con"</code>	You did not enter enough characters for your switch to recognize the command.	Reenter the command followed by a question mark (?) without any space between the command and the question mark.  The possible keywords that you can enter with the command appear.
<code>% Incomplete command.</code>	You did not enter all of the keywords or values required by this command.	Reenter the command followed by a question mark (?) with a space between the command and the question mark.  The possible keywords that you can enter with the command appear.
<code>% Invalid input detected at '^' marker.</code>	You entered the command incorrectly. The caret (^) marks the point of the error.	Enter a question mark (?) to display all of the commands that are available in this command mode.  The possible keywords that you can enter with the command appear.

## Configuration Logging

You can log and view changes to the switch configuration. You can use the Configuration Change Logging and Notification feature to track changes on a per-session and per-user basis. The logger tracks each configuration command that is applied, the user who entered the command, the time that the command was entered, and the parser return code for the command. This feature includes a mechanism for asynchronous notification to registered applications whenever the configuration changes. You can choose to have the notifications sent to the syslog.




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**Note** Only CLI or HTTP changes are logged.

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## Using the Help System

You can enter a question mark (?) at the system prompt to display a list of commands available for each command mode. You can also obtain a list of associated keywords and arguments for any command.

## SUMMARY STEPS

1. **help**
2. *abbreviated-command-entry ?*
3. *abbreviated-command-entry <Tab>*
4. **?**
5. *command ?*
6. *command keyword ?*

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>help</b>  <b>Example:</b> Switch# <b>help</b>	Obtains a brief description of the help system in any command mode.
Step 2	<i>abbreviated-command-entry ?</i>  <b>Example:</b> Switch# <b>di?</b> dir disable disconnect	Obtains a list of commands that begin with a particular character string.
Step 3	<i>abbreviated-command-entry &lt;Tab&gt;</i>  <b>Example:</b> Switch# <b>sh conf&lt;tab&gt;</b> Switch# <b>show configuration</b>	Completes a partial command name.
Step 4	<b>?</b>  <b>Example:</b> Switch> <b>?</b>	Lists all commands available for a particular command mode.
Step 5	<i>command ?</i>  <b>Example:</b> Switch> <b>show ?</b>	Lists the associated keywords for a command.
Step 6	<i>command keyword ?</i>  <b>Example:</b> Switch(config)# <b>cdp holdtime ?</b> <10-255> Length of time (in sec) that receiver must keep this packet	Lists the associated arguments for a keyword.

# How to Use the CLI to Configure Features

## Configuring the Command History

The software provides a history or record of commands that you have entered. The command history feature is particularly useful for recalling long or complex commands or entries, including access lists. You can customize this feature to suit your needs.

### Changing the Command History Buffer Size

By default, the switch records ten command lines in its history buffer. You can alter this number for a current terminal session or for all sessions on a particular line. This procedure is optional.

#### SUMMARY STEPS

1. `terminal history [size number-of-lines]`

#### DETAILED STEPS

	Command or Action	Purpose
Step 1	<code>terminal history [size number-of-lines]</code>  <b>Example:</b> Switch# <code>terminal history size 200</code>	Changes the number of command lines that the switch records during the current terminal session in privileged EXEC mode. You can configure the size from 0 to 256.

## Recalling Commands

To recall commands from the history buffer, perform one of the actions listed in this table. These actions are optional.



#### Note

The arrow keys function only on ANSI-compatible terminals such as VT100s.

#### SUMMARY STEPS

1. **Ctrl-P** or use the **up arrow** key
2. **Ctrl-N** or use the **down arrow** key
3. `show history`

**DETAILED STEPS**

	Command or Action	Purpose
<b>Step 1</b>	<b>Ctrl-P</b> or use the <b>up arrow</b> key	Recalls commands in the history buffer, beginning with the most recent command. Repeat the key sequence to recall successively older commands.
<b>Step 2</b>	<b>Ctrl-N</b> or use the <b>down arrow</b> key	Returns to more recent commands in the history buffer after recalling commands with <b>Ctrl-P</b> or the up arrow key. Repeat the key sequence to recall successively more recent commands.
<b>Step 3</b>	<b>show history</b>  <b>Example:</b> Switch# <b>show history</b>	Lists the last several commands that you just entered in privileged EXEC mode. The number of commands that appear is controlled by the setting of the <b>terminal history</b> global configuration command and the <b>history</b> line configuration command.

**Disabling the Command History Feature**

The command history feature is automatically enabled. You can disable it for the current terminal session or for the command line. This procedure is optional.

**SUMMARY STEPS**

1. **terminal no history**

**DETAILED STEPS**

	Command or Action	Purpose
<b>Step 1</b>	<b>terminal no history</b>  <b>Example:</b> Switch# <b>terminal no history</b>	Disables the feature during the current terminal session in privileged EXEC mode.

**Enabling and Disabling Editing Features**

Although enhanced editing mode is automatically enabled, you can disable it and reenable it.

**SUMMARY STEPS**

1. **terminal editing**
2. **terminal no editing**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>terminal editing</b>  <b>Example:</b> Switch# <code>terminal editing</code>	Reenables the enhanced editing mode for the current terminal session in privileged EXEC mode.
<b>Step 2</b>	<b>terminal no editing</b>  <b>Example:</b> Switch# <code>terminal no editing</code>	Disables the enhanced editing mode for the current terminal session in privileged EXEC mode.

## Editing Command Lines That Wrap

You can use a wraparound feature for commands that extend beyond a single line on the screen. When the cursor reaches the right margin, the command line shifts ten spaces to the left. You cannot see the first ten characters of the line, but you can scroll back and check the syntax at the beginning of the command. The keystroke actions are optional.

To scroll back to the beginning of the command entry, press **Ctrl-B** or the left arrow key repeatedly. You can also press **Ctrl-A** to immediately move to the beginning of the line.

**Note**

The arrow keys function only on ANSI-compatible terminals such as VT100s.

The following example shows how to wrap a command line that extends beyond a single line on the screen.

## SUMMARY STEPS

1. `access-list`
2. `Ctrl-A`
3. Return key

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>access-list</b>  <b>Example:</b> Switch(config)# <code>access-list 101 permit tcp 10.15.22.25 255.255.255.0 10.15.22.35</code> Switch(config)# <code>\$ 101 permit tcp 10.15.22.25 255.255.255.0 10.15.22.35 255.25</code> Switch(config)# <code>\$t tcp 10.15.22.25</code>	Displays the global configuration command entry that extends beyond one line.  When the cursor first reaches the end of the line, the line is shifted ten spaces to the left and redisplayed. The dollar sign (\$) shows that the line has been scrolled to the left. Each time the cursor reaches the end of the line, the line is again shifted ten spaces to the left.

	Command or Action	Purpose
	<pre>255.255.255.0 131.108.1.20 255.255.255.0 eq Switch(config)# \$15.22.25 255.255.255.0 10.15.22.35 255.255.255.0 eq 45</pre>	
<b>Step 2</b>	<p><b>Ctrl-A</b></p> <p><b>Example:</b>  <pre>Switch(config)# access-list 101 permit tcp 10.15.22.25 255.255.255.0 10.15.2\$</pre></p>	<p>Checks the complete syntax.</p> <p>The dollar sign (\$) appears at the end of the line to show that the line has been scrolled to the right.</p>
<b>Step 3</b>	<b>Return key</b>	<p>Execute the commands.</p> <p>The software assumes that you have a terminal screen that is 80 columns wide. If you have a different width, use the <b>terminal width</b> privileged EXEC command to set the width of your terminal.</p> <p>Use line wrapping with the command history feature to recall and modify previous complex command entries.</p>

## Editing Commands Through Keystrokes

The keystrokes help you to edit the command lines. These keystrokes are optional.



**Note**

The arrow keys function only on ANSI-compatible terminals such as VT100s.

**Table 3: Editing Commands**

Editing Commands	Description
<b>Ctrl-B</b> or use the <b>left arrow</b> key	Moves the cursor back one character.
<b>Ctrl-F</b> or use the <b>right arrow</b> key	Moves the cursor forward one character.
<b>Ctrl-A</b>	Moves the cursor to the beginning of the command line.
<b>Ctrl-E</b>	Moves the cursor to the end of the command line.
<b>Esc B</b>	Moves the cursor back one word.
<b>Esc F</b>	Moves the cursor forward one word.
<b>Ctrl-T</b>	Transposes the character to the left of the cursor with the character located at the cursor.

<b>Delete</b> or <b>Backspace</b> key	Erases the character to the left of the cursor.
<b>Ctrl-D</b>	Deletes the character at the cursor.
<b>Ctrl-K</b>	Deletes all characters from the cursor to the end of the command line.
<b>Ctrl-U</b> or <b>Ctrl-X</b>	Deletes all characters from the cursor to the beginning of the command line.
<b>Ctrl-W</b>	Deletes the word to the left of the cursor.
<b>Esc D</b>	Deletes from the cursor to the end of the word.
<b>Esc C</b>	Capitalizes at the cursor.
<b>Esc L</b>	Changes the word at the cursor to lowercase.
<b>Esc U</b>	Capitalizes letters from the cursor to the end of the word.
<b>Ctrl-V</b> or <b>Esc Q</b>	Designates a particular keystroke as an executable command, perhaps as a shortcut.
<b>Return</b> key	Scrolls down a line or screen on displays that are longer than the terminal screen can display.  <b>Note</b> The More prompt is used for any output that has more lines than can be displayed on the terminal screen, including <b>show</b> command output. You can use the <b>Return</b> and <b>Space</b> bar keystrokes whenever you see the More prompt.
<b>Space</b> bar	Scrolls down one screen.
<b>Ctrl-L</b> or <b>Ctrl-R</b>	Redisplays the current command line if the switch suddenly sends a message to your screen.

## Searching and Filtering Output of show and more Commands

You can search and filter the output for **show** and **more** commands. This is useful when you need to sort through large amounts of output or if you want to exclude output that you do not need to see. Using these commands is optional.

### SUMMARY STEPS

1. `{show | more} command | {begin | include | exclude} regular-expression`



## DETAILED STEPS

	Command or Action	Purpose
Step 1	<p>{<b>show</b>   <b>more</b>} <i>command</i>   {<b>begin</b>   <b>include</b>   <b>exclude</b>} <i>regular-expression</i></p> <p><b>Example:</b>  Switch# <b>show interfaces   include protocol</b>  Vlan1 is up, line protocol is up  Vlan10 is up, line protocol is down  GigabitEthernet1/0/1 is up, line protocol is down  GigabitEthernet1/0/2 is up, line protocol is up</p>	<p>Searches and filters the output.</p> <p>Expressions are case sensitive. For example, if you enter   <b>exclude output</b>, the lines that contain <b>output</b> are not displayed, but the lines that contain <b>output</b> appear.</p>

## Accessing the CLI on a Switch Stack

You can access the CLI through a console connection, through Telnet, a SSH, or by using the browser.

You manage the switch stack and the stack member interfaces through the active switchstack master. You cannot manage stack members on an individual switch basis. You can connect to the active switchstack master through the console port or the Ethernet management port of one or more stack members. Be careful with using multiple CLI sessions on the active switchstack master. Commands that you enter in one session are not displayed in the other sessions. Therefore, it is possible to lose track of the session from which you entered commands.

**Note**

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

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

## Accessing the CLI Through a Console Connection or Through Telnet

Before you can access the CLI, you must connect a terminal or a PC to the switch console or connect a PC to the Ethernet management port and then power on the switch, as described in the hardware installation guide that shipped with your switch.

If your switch is already configured, you can access the CLI through a local console connection or through a remote Telnet session, but your switch must first be configured for this type of access.

You can use one of these methods to establish a connection with the switch:

- Connect the switch console port to a management station or dial-up modem, or connect the Ethernet management port to a PC. For information about connecting to the console or Ethernet management port, see the switch hardware installation guide.
- Use any Telnet TCP/IP or encrypted Secure Shell (SSH) package from a remote management station. The switch must have network connectivity with the Telnet or SSH client, and the switch must have an enable secret password configured.

- The switch supports up to 16 simultaneous Telnet sessions. Changes made by one Telnet user are reflected in all other Telnet sessions.
- The switch supports up to five simultaneous secure SSH sessions.

After you connect through the console port, through the Ethernet management port, through a Telnet session or through an SSH session, the user EXEC prompt appears on the management station.



## CHAPTER 2

# Administering the System

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- [Information About Administering the Switch, page 13](#)
- [How to Administer the Switch, page 21](#)
- [Monitoring and Maintaining Administration of the Switch, page 43](#)
- [Configuration Examples for Switch Administration, page 45](#)
- [Additional References for Switch Administration , page 47](#)
- [Feature History and Information for Switch Administration, page 48](#)

## Information About Administering the Switch

### System Time and Date Management

You can manage the system time and date on your switch using automatic configuration methods (RTC and NTP), or manual configuration methods.



**Note**

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For complete syntax and usage information for the commands used in this section, see the *Cisco IOS Configuration Fundamentals Command Reference* on *Cisco.com*.

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### System Clock

The basis of the time service is the system clock. This clock runs from the moment the system starts up and keeps track of the date and time.

The system clock can then be set from these sources:

- RTC
- NTP

- Manual configuration

The system clock can provide time to these services:

- User **show** commands
- Logging and debugging messages

The system clock keeps track of time internally based on Coordinated Universal Time (UTC), also known as Greenwich Mean Time (GMT). You can configure information about the local time zone and summer time (daylight saving time) so that the time appears correctly for the local time zone.

The system clock keeps track of whether the time is *authoritative* or not (that is, whether it has been set by a time source considered to be authoritative). If it is not authoritative, the time is available only for display purposes and is not redistributed. For configuration information, see the *Configuring Time and Date Manually* section.

## Real Time Clock

A real-time clock (RTC) keeps track of the current time on the switch. The switch is shipped to you with RTC set to GMT time until you reconfigure clocking parameters.

The benefits of an RTC are:

- RTC is battery-powered.
- System time is retained during power outage and at system reboot.

The RTC and NTP clocks are integrated on the switch. When NTP is enabled, the RTC time is periodically synchronized to the NTP clock to maintain accuracy.

## Network Time Protocol

The NTP is designed to time-synchronize a network of devices. NTP runs over User Datagram Protocol (UDP), which runs over IP. NTP is documented in RFC 1305.

An NTP network usually gets its time from an authoritative time source, such as a radio clock or an atomic clock attached to a time server. NTP then distributes this time across the network. NTP is extremely efficient; no more than one packet per minute is necessary to synchronize two devices to within a millisecond of one another.

NTP uses the concept of a *stratum* to describe how many NTP hops away a device is from an authoritative time source. A stratum 1 time server has a radio or atomic clock directly attached, a stratum 2 time server receives its time through NTP from a stratum 1 time server, and so on. A device running NTP automatically chooses as its time source the device with the lowest stratum number with which it communicates through NTP. This strategy effectively builds a self-organizing tree of NTP speakers.

NTP avoids synchronizing to a device whose time might not be accurate by never synchronizing to a device that is not synchronized. NTP also compares the time reported by several devices and does not synchronize to a device whose time is significantly different than the others, even if its stratum is lower.

The communications between devices running NTP (known as associations) are usually statically configured; each device is given the IP address of all devices with which it should form associations. Accurate timekeeping is possible by exchanging NTP messages between each pair of devices with an association. However, in a

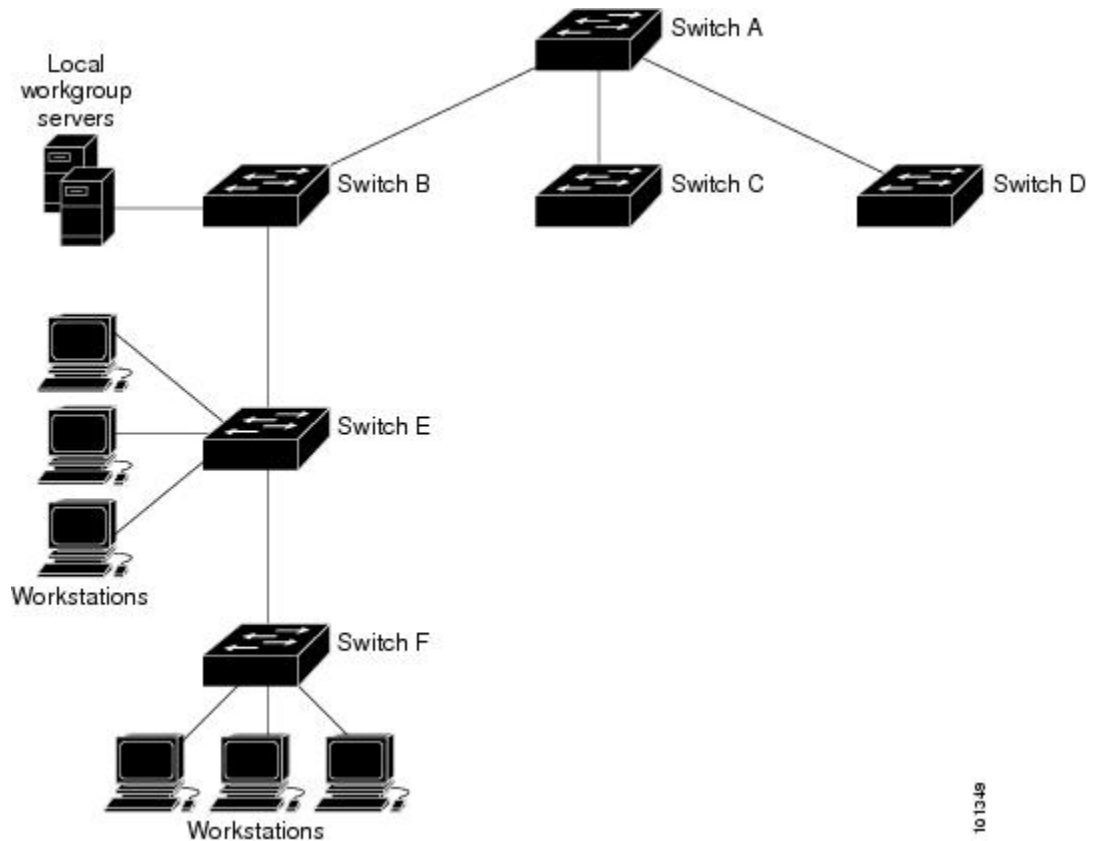
LAN environment, NTP can be configured to use IP broadcast messages instead. This alternative reduces configuration complexity because each device can simply be configured to send or receive broadcast messages. However, in that case, information flow is one-way only.

The time kept on a device is a critical resource; you should use the security features of NTP to avoid the accidental or malicious setting of an incorrect time. Two mechanisms are available: an access list-based restriction scheme and an encrypted authentication mechanism.

Cisco's implementation of NTP does not support stratum 1 service; it is not possible to connect to a radio or atomic clock. We recommend that the time service for your network be derived from the public NTP servers available on the IP Internet.

The Figure shows a typical network example using NTP. Switch A is the NTP master, with the Switch B, C, and D configured in NTP server mode, in server association with Switch A. Switch E is configured as an NTP peer to the upstream and downstream Switch, Switch B and Switch F, respectively.

**Figure 1: Typical NTP Network Configuration**



If the network is isolated from the Internet, Cisco's implementation of NTP allows a device to act as if it is synchronized through NTP, when in fact it has learned the time by using other means. Other devices then synchronize to that device through NTP.

When multiple sources of time are available, NTP is always considered to be more authoritative. NTP time overrides the time set by any other method.

Several manufacturers include NTP software for their host systems, and a publicly available version for systems running UNIX and its various derivatives is also available. This software allows host systems to be time-synchronized as well.

## NTP Stratum

NTP uses the concept of a *stratum* to describe how many NTP hops away a device is from an authoritative time source. A stratum 1 time server has a radio or atomic clock directly attached, a stratum 2 time server receives its time through NTP from a stratum 1 time server, and so on. A device running NTP automatically chooses as its time source the device with the lowest stratum number with which it communicates through NTP. This strategy effectively builds a self-organizing tree of NTP speakers.

NTP avoids synchronizing to a device whose time might not be accurate by never synchronizing to a device that is not synchronized. NTP also compares the time reported by several devices and does not synchronize to a device whose time is significantly different than the others, even if its stratum is lower.

## NTP Associations

The communications between devices running NTP (known as *associations*) are usually statically configured; each device is given the IP address of all devices with which it should form associations. Accurate timekeeping is possible by exchanging NTP messages between each pair of devices with an association. However, in a LAN environment, NTP can be configured to use IP broadcast messages instead. This alternative reduces configuration complexity because each device can simply be configured to send or receive broadcast messages. However, in that case, information flow is one-way only.

## NTP Security

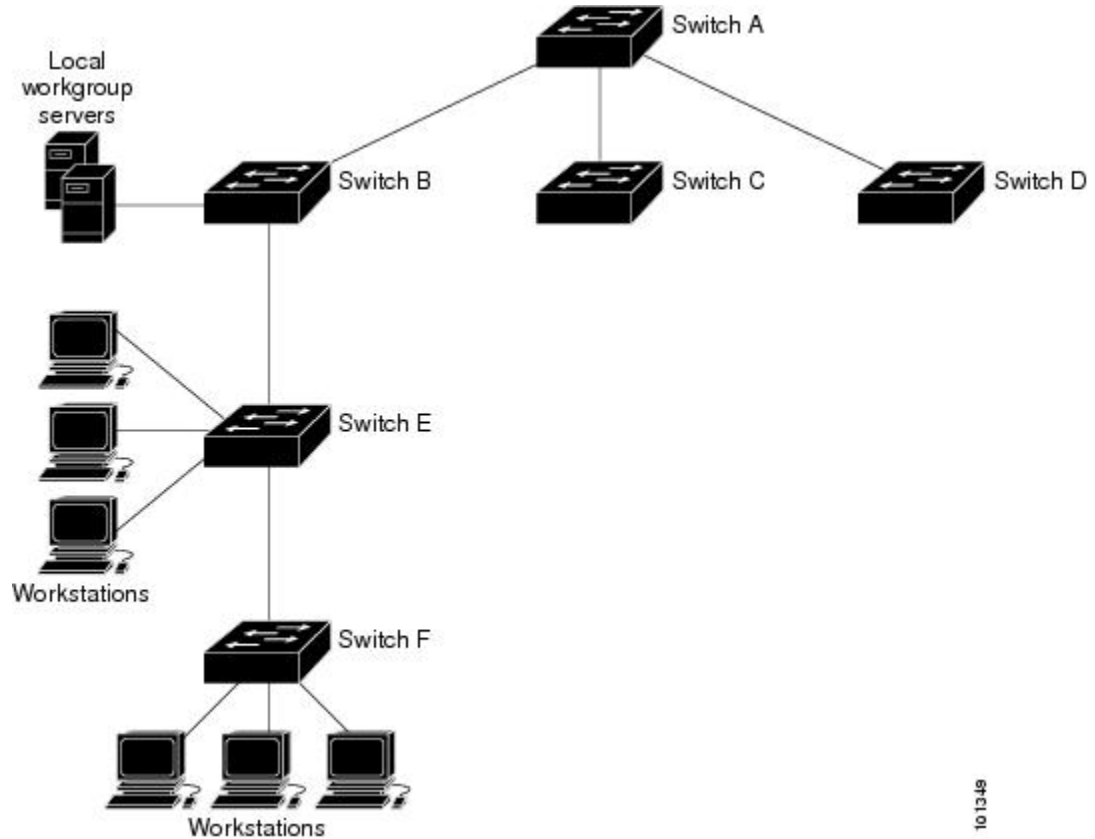
The time kept on a device is a critical resource; you should use the security features of NTP to avoid the accidental or malicious setting of an incorrect time. Two mechanisms are available: an access list-based restriction scheme and an encrypted authentication mechanism.

## NTP Implementation

Implementation of NTP does not support stratum 1 service; it is not possible to connect to a radio or atomic clock. We recommend that the time service for your network be derived from the public NTP servers available on the IP Internet.

The following figure shows a typical network example using NTP. Switch A is the NTP master, with the Switch B, C, and D configured in NTP server mode, in server association with Switch A. Switch E is configured as an NTP peer to the upstream and downstream switches, Switch B and Switch F, respectively.

**Figure 2: Typical NTP Network Configuration**



If the network is isolated from the Internet, NTP allows a device to act as if it is synchronized through NTP, when in fact it has learned the time by using other means. Other devices then synchronize to that device through NTP.

When multiple sources of time are available, NTP is always considered to be more authoritative. NTP time overrides the time set by any other method.

Several manufacturers include NTP software for their host systems, and a publicly available version for systems running UNIX and its various derivatives is also available. This software allows host systems to be time-synchronized as well.

## NTP Version 4

NTP version 4 is implemented on the switch. NTPv4 is an extension of NTP version 3. NTPv4 supports both IPv4 and IPv6 and is backward-compatible with NTPv3.

NTPv4 provides these capabilities:

- Support for IPv6.

- Improved security compared to NTPv3. The NTPv4 protocol provides a security framework based on public key cryptography and standard X509 certificates.
- Automatic calculation of the time-distribution hierarchy for a network. Using specific multicast groups, NTPv4 automatically configures the hierarchy of the servers to achieve the best time accuracy for the lowest bandwidth cost. This feature leverages site-local IPv6 multicast addresses.

For details about configuring NTPv4, see the *Implementing NTPv4 in IPv6* chapter of the *Cisco IOS IPv6 Configuration Guide, Release 12.4T*.

## System Name and Prompt

You configure the system name on the Switch to identify it. By default, the system name and prompt are Switch.

If you have not configured a system prompt, the first 20 characters of the system name are used as the system prompt. A greater-than symbol [>] is appended. The prompt is updated whenever the system name changes.

For complete syntax and usage information for the commands used in this section, see the *Cisco IOS Configuration Fundamentals Command Reference, Release 12.4* and the *Cisco IOS IP Command Reference, Volume 2 of 3: Routing Protocols, Release 12.4*.

## Stack System Name and Prompt

If you are accessing a stack member through the active switchstack master, you must use the **session stack-member-number** privileged EXEC command. The stack member number range is from 1 through 8. When you use this 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 switch stack is Switch.

## Default System Name and Prompt Configuration

The default switch system name and prompt is *Switch*.

## DNS

The DNS protocol controls the Domain Name System (DNS), a distributed database with which you can map hostnames to IP addresses. When you configure DNS on your switch, you can substitute the hostname for the IP address with all IP commands, such as **ping**, **telnet**, **connect**, and related Telnet support operations.

IP defines a hierarchical naming scheme that allows a device to be identified by its location or domain. Domain names are pieced together with periods (.) as the delimiting characters. For example, Cisco Systems is a commercial organization that IP identifies by a *com* domain name, so its domain name is *cisco.com*. A specific device in this domain, for example, the File Transfer Protocol (FTP) system is identified as *ftp.cisco.com*.

To keep track of domain names, IP has defined the concept of a domain name server, which holds a cache (or database) of names mapped to IP addresses. To map domain names to IP addresses, you must first identify the hostnames, specify the name server that is present on your network, and enable the DNS.



## Default DNS Settings

**Table 4: Default DNS Settings**

Feature	Default Setting
DNS enable state	Enabled.
DNS default domain name	None configured.
DNS servers	No name server addresses are configured.

## Login Banners

You can configure a message-of-the-day (MOTD) and a login banner. The MOTD banner is displayed on all connected terminals at login and is useful for sending messages that affect all network users (such as impending system shutdowns).

The login banner is also displayed on all connected terminals. It appears after the MOTD banner and before the login prompts.



**Note**

For complete syntax and usage information for the commands used in this section, see the *Cisco IOS Configuration Fundamentals Command Reference, Release 12.4*.

## Default Banner Configuration

The MOTD and login banners are not configured.

## MAC Address Table

The MAC address table contains address information that the switch uses to forward traffic between ports. All MAC addresses in the address table are associated with one or more ports. The address table includes these types of addresses:

- Dynamic address—A source MAC address that the switch learns and then ages when it is not in use.
- Static address—A manually entered unicast address that does not age and that is not lost when the switch resets.

The address table lists the destination MAC address, the associated VLAN ID, and port number associated with the address and the type (static or dynamic).

**Note**

For complete syntax and usage information for the commands used in this section, see the command reference for this release.

## MAC Address Table Creation

With multiple MAC addresses supported on all ports, you can connect any port on the switch to other network devices. The switch provides dynamic addressing by learning the source address of packets it receives on each port and adding the address and its associated port number to the address table. As devices are added or removed from the network, the switch updates the address table, adding new dynamic addresses and aging out those that are not in use.

The aging interval is globally configured. However, the switch maintains an address table for each VLAN, and STP can accelerate the aging interval on a per-VLAN basis.

The switch sends packets between any combination of ports, based on the destination address of the received packet. Using the MAC address table, the switch forwards the packet only to the port associated with the destination address. If the destination address is on the port that sent the packet, the packet is filtered and not forwarded. The switch always uses the store-and-forward method: complete packets are stored and checked for errors before transmission.

## MAC Addresses and VLANs

All addresses are associated with a VLAN. An address can exist in more than one VLAN and have different destinations in each. Unicast addresses, for example, could be forwarded to port 1 in VLAN 1 and ports 9, 10, and 1 in VLAN 5.

Each VLAN maintains its own logical address table. A known address in one VLAN is unknown in another until it is learned or statically associated with a port in the other VLAN.

## MAC Addresses and Switch Stacks

The MAC address tables on all stack members are synchronized. At any given time, each stack member has the same copy of the address tables for each VLAN. When an address ages out, the address is removed from the address tables on all stack members. When a Switch joins a switch stack, that Switch receives the addresses for each VLAN learned on the other stack members. When a stack member leaves the switch stack, the remaining stack members age out or remove all addresses learned by the former stack member.

## Default MAC Address Table Settings

The following table shows the default settings for the MAC address table.

**Table 5: Default Settings for the MAC Address**

Feature	Default Setting
Aging time	300 seconds
Dynamic addresses	Automatically learned

Feature	Default Setting
Static addresses	None configured

## ARP Table Management

To communicate with a device (over Ethernet, for example), the software first must learn the 48-bit MAC address or the local data link address of that device. The process of learning the local data link address from an IP address is called *address resolution*.

The Address Resolution Protocol (ARP) associates a host IP address with the corresponding media or MAC addresses and the VLAN ID. Using an IP address, ARP finds the associated MAC address. When a MAC address is found, the IP-MAC address association is stored in an ARP cache for rapid retrieval. Then the IP datagram is encapsulated in a link-layer frame and sent over the network. Encapsulation of IP datagrams and ARP requests and replies on IEEE 802 networks other than Ethernet is specified by the Subnetwork Access Protocol (SNAP). By default, standard Ethernet-style ARP encapsulation (represented by the **arpa** keyword) is enabled on the IP interface.

ARP entries added manually to the table do not age and must be manually removed.

For CLI procedures, see the Cisco IOS Release 12.4 documentation on *Cisco.com*.

## How to Administer the Switch

### Configuring the Time and Date Manually

System time remains accurate through restarts and reboot, however, you can manually configure the time and date after the system is restarted.

We recommend that you use manual configuration only when necessary. If you have an outside source to which the switch can synchronize, you do not need to manually set the system clock.



#### Note

You must reconfigure this setting if you have manually configured the system clock before the active switchstack master fails and a different stack member assumes the role of active switchstack master.

### Setting the System Clock

If you have an outside source on the network that provides time services, such as an NTP server, you do not need to manually set the system clock.

Follow these steps to set the system clock:

**SUMMARY STEPS**

1. **enable**
2. Use one of the following:
  - **clock set** *hh:mm:ss day month year*
  - **clock set** *hh:mm:ss month day year*

**DETAILED STEPS**

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Switch> <b>enable</b>	Enables privileged EXEC mode. Enter your password if prompted.
<b>Step 2</b>	Use one of the following: <ul style="list-style-type: none"> <li>• <b>clock set</b> <i>hh:mm:ss day month year</i></li> <li>• <b>clock set</b> <i>hh:mm:ss month day year</i></li> </ul> <b>Example:</b> Switch# <b>clock set</b> 13:32:00 23 March 2013	Manually set the system clock using one of these formats: <ul style="list-style-type: none"> <li>• <i>hh:mm:ss</i>—Specifies the time in hours (24-hour format), minutes, and seconds. The time specified is relative to the configured time zone.</li> <li>• <i>day</i>—Specifies the day by date in the month.</li> <li>• <i>month</i>—Specifies the month by name.</li> <li>• <i>year</i>—Specifies the year (no abbreviation).</li> </ul>

**Configuring the Time Zone**

Follow these steps to manually configure the time zone:

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **clock timezone zone hours-offset [minutes-offset]**
4. **end**
5. **show running-config**
6. **copy running-config startup-config**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<p><b>enable</b></p> <p><b>Example:</b></p> <pre>Switch&gt; enable</pre>	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	<p><b>configure terminal</b></p> <p><b>Example:</b></p> <pre>Switch# configure terminal</pre>	Enters the global configuration mode.
Step 3	<p><b>clock timezone zone hours-offset</b> [minutes-offset]</p> <p><b>Example:</b></p> <pre>Switch(config)# clock timezone AST -3 30</pre>	<p>Sets the time zone.</p> <p>Internal time is kept in Coordinated Universal Time (UTC), so this command is used only for display purposes and when the time is manually set.</p> <ul style="list-style-type: none"> <li>• <i>zone</i>—Enters the name of the time zone to be displayed when standard time is in effect. The default is UTC.</li> <li>• <i>hours-offset</i>—Enters the hours offset from UTC.</li> <li>• (Optional) <i>minutes-offset</i>—Enters the minutes offset from UTC. This available where the local time zone is a percentage of an hour different from UTC.</li> </ul>
Step 4	<p><b>end</b></p> <p><b>Example:</b></p> <pre>Switch(config)# end</pre>	Returns to privileged EXEC mode.
Step 5	<p><b>show running-config</b></p> <p><b>Example:</b></p> <pre>Switch# show running-config</pre>	Verifies your entries.
Step 6	<p><b>copy running-config startup-config</b></p> <p><b>Example:</b></p> <pre>Switch# copy running-config startup-config</pre>	(Optional) Saves your entries in the configuration file.

## Configuring Summer Time (Daylight Saving Time)

To configure summer time (daylight saving time) in areas where it starts and ends on a particular day of the week each year, perform this task:

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **clock summer-time zone date date month year hh:mm date month year hh:mm [offset]**
4. **clock summer-time zone recurring [week day month hh:mm week day month hh:mm [offset]]**
5. **end**
6. **show running-config**
7. **copy running-config startup-config**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Switch> <b>enable</b>	Enables privileged EXEC mode. Enter your password if prompted.
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
<b>Step 3</b>	<b>clock summer-time zone date date month year hh:mm date month year hh:mm [offset]</b>  <b>Example:</b> Switch(config)# <b>clock summer-time PDT date 10 March 2013 2:00 3 November 2013 2:00</b>	Configures summer time to start and end on specified days every year.
<b>Step 4</b>	<b>clock summer-time zone recurring [week day month hh:mm week day month hh:mm [offset]]</b>  <b>Example:</b> Switch(config)# <b>clock summer-time PDT recurring 10 March 2013 2:00 3 November 2013 2:00</b>	Configures summer time to start and end on the specified days every year. All times are relative to the local time zone. The start time is relative to standard time.  The end time is relative to summer time. Summer time is disabled by default. If you specify <b>clock summer-time zone recurring</b> without parameters, the summer time rules default to the United States rules.  If the starting month is after the ending month, the system assumes that you are in the southern hemisphere.

	Command or Action	Purpose
		<ul style="list-style-type: none"> <li>• <i>zone</i>—Specifies the name of the time zone (for example, PDT) to be displayed when summer time is in effect.</li> <li>• (Optional) <i>week</i>— Specifies the week of the month (1 to 4, <b>first</b>, or <b>last</b>).</li> <li>• (Optional) <i>day</i>—Specifies the day of the week (Sunday, Monday...).</li> <li>• (Optional) <i>month</i>—Specifies the month (January, February...).</li> <li>• (Optional) <i>hh:mm</i>—Specifies the time (24-hour format) in hours and minutes.</li> <li>• (Optional) <i>offset</i>—Specifies the number of minutes to add during summer time. The default is 60.</li> </ul>
<b>Step 5</b>	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.
<b>Step 6</b>	<b>show running-config</b>  <b>Example:</b> Switch# <b>show running-config</b>	Verifies your entries.
<b>Step 7</b>	<b>copy running-config startup-config</b>  <b>Example:</b> Switch# <b>copy running-config startup-config</b>	(Optional) Saves your entries in the configuration file.

Follow these steps if summer time in your area does not follow a recurring pattern (configure the exact date and time of the next summer time events):

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **clock summer-time zone date** [ *month date year hh:mm month date year hh:mm [offset]* ] **or** **clock summer-time zone date** [ *date month year hh:mm date month year hh:mm [offset]* ]
4. **end**
5. **show running-config**
6. **copy running-config startup-config**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Switch> <b>enable</b>	Enables privileged EXEC mode. Enter your password if prompted.
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
<b>Step 3</b>	<b>clock summer-time zone date</b> [ <i>month date year hh:mm month date year hh:mm [offset]</i> ] <b>or</b> <b>clock summer-time zone date</b> [ <i>date month year hh:mm date month year hh:mm [offset]</i> ]	Configures summer time to start on the first date and end on the second date.  Summer time is disabled by default. <ul style="list-style-type: none"> <li>• For <i>zone</i>, specify the name of the time zone (for example, PDT) to be displayed when summer time is in effect.</li> <li>• (Optional) For <i>week</i>, specify the week of the month (1 to 5 or last).</li> <li>• (Optional) For <i>day</i>, specify the day of the week (Sunday, Monday...).</li> <li>• (Optional) For <i>month</i>, specify the month (January, February...).</li> <li>• (Optional) For <i>hh:mm</i>, specify the time (24-hour format) in hours and minutes.</li> <li>• (Optional) For <i>offset</i>, specify the number of minutes to add during summer time. The default is 60.</li> </ul>



	Command or Action	Purpose
<b>Step 4</b>	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.
<b>Step 5</b>	<b>show running-config</b>  <b>Example:</b> Switch# <b>show running-config</b>	Verifies your entries.
<b>Step 6</b>	<b>copy running-config startup-config</b>  <b>Example:</b> Switch# <b>copy running-config startup-config</b>	(Optional) Saves your entries in the configuration file.

## Configuring a System Name

Follow these steps to manually configure a system name:

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **hostname *name***
4. **end**
5. **show running-config**
6. **copy running-config startup-config**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Switch> <b>enable</b>	Enables privileged EXEC mode. Enter your password if prompted.

	Command or Action	Purpose
Step 2	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
Step 3	<b>hostname <i>name</i></b>  <b>Example:</b> Switch(config)# <b>hostname</b> <b>remote-users</b>	Configures a system name. When you set the system name, it is also used as the system prompt.  The default setting is Switch.  The name must follow the rules for ARPANET hostnames. They must start with a letter, end with a letter or digit, and have as interior characters only letters, digits, and hyphens. Names can be up to 63 characters.
Step 4	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.
Step 5	<b>show running-config</b>  <b>Example:</b> Switch# <b>show running-config</b>	Verifies your entries.
Step 6	<b>copy running-config startup-config</b>  <b>Example:</b> Switch# <b>copy running-config startup-config</b>	(Optional) Saves your entries in the configuration file.

## Setting Up DNS

If you use the switch IP address as its hostname, the IP address is used and no DNS query occurs. If you configure a hostname that contains no periods (.), a period followed by the default domain name is appended to the hostname before the DNS query is made to map the name to an IP address. The default domain name is the value set by the **ip domain-name** global configuration command. If there is a period (.) in the hostname, the Cisco IOS software looks up the IP address without appending any default domain name to the hostname.

Follow these steps to set up your switch to use the DNS:

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip domain-name** *name*
4. **ip name-server** *server-address1* [*server-address2* ... *server-address6*]
5. **ip domain-lookup** [**nsap** | **source-interface** *interface*]
6. **end**
7. **show running-config**
8. **copy running-config startup-config**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b>  <b>Example:</b> Switch> <b>enable</b>	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
Step 3	<b>ip domain-name</b> <i>name</i>  <b>Example:</b> Switch(config)# <b>ip domain-name</b> <b>Cisco.com</b>	<p>Defines a default domain name that the software uses to complete unqualified hostnames (names without a dotted-decimal domain name). Do not include the initial period that separates an unqualified name from the domain name.</p> <p>At boot time, no domain name is configured; however, if the switch configuration comes from a BOOTP or Dynamic Host Configuration Protocol (DHCP) server, then the default domain name might be set by the BOOTP or DHCP server (if the servers were configured with this information).</p>
Step 4	<b>ip name-server</b> <i>server-address1</i> [ <i>server-address2</i> ... <i>server-address6</i> ]  <b>Example:</b> Switch(config)# <b>ip</b> <b>name-server 192.168.1.100</b> <b>192.168.1.200 192.168.1.300</b>	<p>Specifies the address of one or more name servers to use for name and address resolution.</p> <p>You can specify up to six name servers. Separate each server address with a space. The first server specified is the primary server. The switch sends DNS queries to the primary server first. If that query fails, the backup servers are queried.</p>
Step 5	<b>ip domain-lookup</b> [ <b>nsap</b>   <b>source-interface</b> <i>interface</i> ]	(Optional) Enables DNS-based hostname-to-address translation on your switch. This feature is enabled by default.

	Command or Action	Purpose
	<b>Example:</b> Switch(config)# <b>ip domain-lookup</b>	If your network devices require connectivity with devices in networks for which you do not control name assignment, you can dynamically assign device names that uniquely identify your devices by using the global Internet naming scheme (DNS).
<b>Step 6</b>	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.
<b>Step 7</b>	<b>show running-config</b>  <b>Example:</b> Switch# <b>show running-config</b>	Verifies your entries.
<b>Step 8</b>	<b>copy running-config startup-config</b>  <b>Example:</b> Switch# <b>copy running-config startup-config</b>	(Optional) Saves your entries in the configuration file.

### What to Do Next

## Configuring a Message-of-the-Day Login Banner

You can create a single or multiline message banner that appears on the screen when someone logs in to the switch

Follow these steps to configure a MOTD login banner:

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **banner motd** *c message c*
4. **end**
5. **show running-config**
6. **copy running-config startup-config**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<p><b>enable</b></p> <p><b>Example:</b></p> <pre>Switch&gt; enable</pre>	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	<p><b>configure terminal</b></p> <p><b>Example:</b></p> <pre>Switch# configure terminal</pre>	Enters the global configuration mode.
Step 3	<p><b>banner motd <i>c message c</i></b></p> <p><b>Example:</b></p> <pre>Switch(config)# banner motd # This is a secure site. Only authorized users are allowed. For access, contact technical support. #</pre>	<p>Specifies the message of the day.</p> <p><i>c</i>—Enters the delimiting character of your choice, for example, a pound sign (#), and press the <b>Return</b> key. The delimiting character signifies the beginning and end of the banner text. Characters after the ending delimiter are discarded.</p> <p><i>message</i>—Enters a banner message up to 255 characters. You cannot use the delimiting character in the message.</p>
Step 4	<p><b>end</b></p> <p><b>Example:</b></p> <pre>Switch(config)# end</pre>	Returns to privileged EXEC mode.
Step 5	<p><b>show running-config</b></p> <p><b>Example:</b></p> <pre>Switch# show running-config</pre>	Verifies your entries.
Step 6	<p><b>copy running-config startup-config</b></p> <p><b>Example:</b></p> <pre>Switch# copy running-config startup-config</pre>	(Optional) Saves your entries in the configuration file.

## Configuring a Login Banner

You can configure a login banner to be displayed on all connected terminals. This banner appears after the MOTD banner and before the login prompt.

Follow these steps to configure a login banner:

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **banner login *c message c***
4. **end**
5. **show running-config**
6. **copy running-config startup-config**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Switch> <b>enable</b>	Enables privileged EXEC mode. Enter your password if prompted.
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
<b>Step 3</b>	<b>banner login <i>c message c</i></b>  <b>Example:</b> Switch(config)# <b>banner login \$</b> Access for authorized users only. Please enter your username and password. \$	Specifies the login message.  <i>c</i> — Enters the delimiting character of your choice, for example, a pound sign (#), and press the <b>Return</b> key. The delimiting character signifies the beginning and end of the banner text. Characters after the ending delimiter are discarded.  <i>message</i> —Enters a login message up to 255 characters. You cannot use the delimiting character in the message.
<b>Step 4</b>	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.
<b>Step 5</b>	<b>show running-config</b>  <b>Example:</b> Switch# <b>show running-config</b>	Verifies your entries.

	Command or Action	Purpose
<b>Step 6</b>	<b>copy running-config startup-config</b>  <b>Example:</b> Switch# <code>copy running-config startup-config</code>	(Optional) Saves your entries in the configuration file.

## Managing the MAC Address Table

### Changing the Address Aging Time

Follow these steps to configure the dynamic address table aging time:

#### SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `mac address-table aging-time [0 | 10-1000000] [routed-mac | vlan vlan-id]`
4. `end`
5. `show running-config`
6. `copy running-config startup-config`

#### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<code>enable</code>  <b>Example:</b> Switch> <code>enable</code>	Enables privileged EXEC mode. Enter your password if prompted.
<b>Step 2</b>	<code>configure terminal</code>  <b>Example:</b> Switch# <code>configure terminal</code>	Enters the global configuration mode.
<b>Step 3</b>	<code>mac address-table aging-time [0   10-1000000] [routed-mac   vlan <i>vlan-id</i>]</code>	Sets the length of time that a dynamic entry remains in the MAC address table after the entry is used or updated.

	Command or Action	Purpose
	<p><b>Example:</b></p> <pre>Switch(config)# mac address-table aging-time 500 vlan 2</pre>	<p>The range is 10 to 1000000 seconds. The default is 300. You can also enter 0, which disables aging. Static address entries are never aged or removed from the table.</p> <p><i>vlan-id</i>—Valid IDs are 1 to 4094.</p>
<b>Step 4</b>	<p><b>end</b></p> <p><b>Example:</b></p> <pre>Switch(config)# end</pre>	Returns to privileged EXEC mode.
<b>Step 5</b>	<p><b>show running-config</b></p> <p><b>Example:</b></p> <pre>Switch# show running-config</pre>	Verifies your entries.
<b>Step 6</b>	<p><b>copy running-config startup-config</b></p> <p><b>Example:</b></p> <pre>Switch# copy running-config startup-config</pre>	(Optional) Saves your entries in the configuration file.

## Configuring MAC Address Change Notification Traps

Follow these steps to configure the switch to send MAC address change notification traps to an NMS host:

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **snmp-server host *host-addr* *community-string* *notification-type* { informs | traps } {version {1 | 2c | 3}} {vrf *vrf instance name*}**
4. **snmp-server enable traps mac-notification change**
5. **mac address-table notification change**
6. **mac address-table notification change [interval *value*] [history-size *value*]**
7. **interface *interface-id***
8. **snmp trap mac-notification change {added | removed}**
9. **end**
10. **show running-config**
11. **copy running-config startup-config**



## DETAILED STEPS

	Command or Action	Purpose
Step 1	<p><b>enable</b></p> <p><b>Example:</b></p> <pre>Switch&gt; enable</pre>	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	<p><b>configure terminal</b></p> <p><b>Example:</b></p> <pre>Switch# configure terminal</pre>	Enters the global configuration mode.
Step 3	<p><b>snmp-server host</b> <i>host-addr</i> <i>community-string</i> <i>notification-type</i> { <b>informs</b>   <b>traps</b> } { <b>version</b> { <b>1</b>   <b>2c</b>   <b>3</b> } } { <b>vrf</b> <i>vrf instance name</i> }</p> <p><b>Example:</b></p> <pre>Switch(config)# snmp-server host 172.20.10.10 traps private mac-notification</pre>	<p>Specifies the recipient of the trap message.</p> <ul style="list-style-type: none"> <li>• <i>host-addr</i>—Specifies the name or address of the NMS.</li> <li>• <b>traps</b> (the default)—Sends SNMP traps to the host.</li> <li>• <b>informs</b>—Sends SNMP informs to the host.</li> <li>• <b>version</b>—Specifies the SNMP version to support. Version 1, the default, is not available with informs.</li> <li>• <i>community-string</i>—Specifies the string to send with the notification operation. Though you can set this string by using the <b>snmp-server host</b> command, we recommend that you define this string by using the <b>snmp-server community</b> command before using the <b>snmp-server host</b> command.</li> <li>• <i>notification-type</i>—Uses the <b>mac-notification</b> keyword.</li> <li>• <b>vrf</b> <i>vrf instance name</i>—Specifies the VPN routing/forwarding instance for this host.</li> </ul>
Step 4	<p><b>snmp-server enable traps mac-notification change</b></p> <p><b>Example:</b></p> <pre>Switch(config)# snmp-server enable traps mac-notification change</pre>	Enables the switch to send MAC address change notification traps to the NMS.
Step 5	<p><b>mac address-table notification change</b></p> <p><b>Example:</b></p> <pre>Switch(config)# mac address-table notification change</pre>	Enables the MAC address change notification feature.
Step 6	<p><b>mac address-table notification change</b> [<b>interval</b> <i>value</i>] [<b>history-size</b> <i>value</i>]</p>	Enters the trap interval time and the history table size.

	Command or Action	Purpose
	<p><b>Example:</b></p> <pre>Switch(config)# mac address-table notification change interval 123 Switch(config)# mac address-table notification change history-size 100</pre>	<ul style="list-style-type: none"> <li>• (Optional) <b>interval value</b>—Specifies the notification trap interval in seconds between each set of traps that are generated to the NMS. The range is 0 to 2147483647 seconds; the default is 1 second.</li> <li>• (Optional) <b>history-size value</b>—Specifies the maximum number of entries in the MAC notification history table. The range is 0 to 500; the default is 1.</li> </ul>
<b>Step 7</b>	<p><b>interface</b> <i>interface-id</i></p> <p><b>Example:</b></p> <pre>Switch(config)# interface gigabitethernet1/0/2</pre>	Enters interface configuration mode, and specifies the Layer 2 interface on which to enable the SNMP MAC address notification trap.
<b>Step 8</b>	<p><b>snmp trap mac-notification change</b> {<b>added</b>   <b>removed</b>};</p> <p><b>Example:</b></p> <pre>Switch(config-if)# snmp trap mac-notification change added</pre>	<p>Enables the MAC address change notification trap on the interface.</p> <ul style="list-style-type: none"> <li>• Enables the trap when a MAC address is <b>added</b> on this interface.</li> <li>• Enables the trap when a MAC address is <b>removed</b> from this interface.</li> </ul>
<b>Step 9</b>	<p><b>end</b></p> <p><b>Example:</b></p> <pre>Switch(config)# end</pre>	Returns to privileged EXEC mode.
<b>Step 10</b>	<p><b>show running-config</b></p> <p><b>Example:</b></p> <pre>Switch# show running-config</pre>	Verifies your entries.
<b>Step 11</b>	<p><b>copy running-config startup-config</b></p> <p><b>Example:</b></p> <pre>Switch# copy running-config startup-config</pre>	(Optional) Saves your entries in the configuration file.

## Configuring MAC Address Move Notification Traps

When you configure MAC-move notification, an SNMP notification is generated and sent to the network management system whenever a MAC address moves from one port to another within the same VLAN.

Follow these steps to configure the switch to send MAC address-move notification traps to an NMS host:

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **snmp-server host** *host-addr* {traps | informs} {version {1 | 2c | 3}} *community-string notification-type*
4. **snmp-server enable traps mac-notification move**
5. **mac address-table notification mac-move**
6. **end**
7. **show running-config**
8. **copy running-config startup-config**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Switch> <b>enable</b>	Enables privileged EXEC mode. Enter your password if prompted.
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
<b>Step 3</b>	<b>snmp-server host</b> <i>host-addr</i> {traps   informs} {version {1   2c   3}} <i>community-string</i> <i>notification-type</i>  <b>Example:</b> Switch(config)# <b>snmp-server host</b> <b>172.20.10.10 traps private mac-notification</b>	Specifies the recipient of the trap message. <ul style="list-style-type: none"> <li>• <i>host-addr</i>—Specifies the name or address of the NMS.</li> <li>• <b>traps</b> (the default)—Sends SNMP traps to the host.</li> <li>• <b>informs</b>—Sends SNMP informs to the host.</li> <li>• <b>version</b>—Specifies the SNMP version to support. Version 1, the default, is not available with informs.</li> <li>• <i>community-string</i>—Specifies the string to send with the notification operation. Though you can set this string by using the <b>snmp-server host</b> command, we recommend that you define this string by using the <b>snmp-server community</b> command before using the <b>snmp-server host</b> command.</li> <li>• <i>notification-type</i>—Uses the <b>mac-notification</b> keyword.</li> </ul>

	Command or Action	Purpose
<b>Step 4</b>	<b>snmp-server enable traps mac-notification move</b>  <b>Example:</b> <pre>Switch(config)# snmp-server enable traps mac-notification move</pre>	Enables the switch to send MAC address move notification traps to the NMS.
<b>Step 5</b>	<b>mac address-table notification mac-move</b>  <b>Example:</b> <pre>Switch(config)# mac address-table notification mac-move</pre>	Enables the MAC address move notification feature.
<b>Step 6</b>	<b>end</b>  <b>Example:</b> <pre>Switch(config)# end</pre>	Returns to privileged EXEC mode.
<b>Step 7</b>	<b>show running-config</b>  <b>Example:</b> <pre>Switch# show running-config</pre>	Verifies your entries.
<b>Step 8</b>	<b>copy running-config startup-config</b>  <b>Example:</b> <pre>Switch# copy running-config startup-config</pre>	(Optional) Saves your entries in the configuration file.

### What to Do Next

To disable MAC address-move notification traps, use the **no snmp-server enable traps mac-notification move** global configuration command. To disable the MAC address-move notification feature, use the **no mac address-table notification mac-move** global configuration command.

You can verify your settings by entering the **show mac address-table notification mac-move** privileged EXEC commands.

## Configuring MAC Threshold Notification Traps

When you configure MAC threshold notification, an SNMP notification is generated and sent to the network management system when a MAC address table threshold limit is reached or exceeded.

Follow these steps to configure the switch to send MAC address table threshold notification traps to an NMS host:

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **snmp-server host** *host-addr* {traps | informs} {version {1 | 2c | 3}} *community-string notification-type*
4. **snmp-server enable traps mac-notification threshold**
5. **mac address-table notification threshold**
6. **mac address-table notification threshold** [*limit percentage*] | [*interval time*]
7. **end**
8. **show running-config**
9. **copy running-config startup-config**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Switch> <b>enable</b>	Enables privileged EXEC mode. Enter your password if prompted.
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
<b>Step 3</b>	<b>snmp-server host</b> <i>host-addr</i> {traps   informs} {version {1   2c   3}} <i>community-string notification-type</i>  <b>Example:</b> Switch(config)# <b>snmp-server host</b> 172.20.10.10 <b>traps private</b> <b>mac-notification</b>	Specifies the recipient of the trap message. <ul style="list-style-type: none"> <li>• <i>host-addr</i>—Specifies the name or address of the NMS.</li> <li>• <b>traps</b> (the default)—Sends SNMP traps to the host.</li> <li>• <b>informs</b>—Sends SNMP informs to the host.</li> <li>• <b>version</b>—Specifies the SNMP version to support. Version 1, the default, is not available with informs.</li> <li>• <i>community-string</i>—Specifies the string to send with the notification operation. You can set this string by using the <b>snmp-server host</b> command, but we recommend that you define this string by using the <b>snmp-server community</b> command before using the <b>snmp-server host</b> command.</li> <li>• <i>notification-type</i>—Uses the <b>mac-notification</b> keyword.</li> </ul>

	Command or Action	Purpose
Step 4	<b>snmp-server enable traps mac-notification threshold</b>  <b>Example:</b> <pre>Switch(config)# snmp-server enable traps mac-notification threshold</pre>	Enables MAC threshold notification traps to the NMS.
Step 5	<b>mac address-table notification threshold</b>  <b>Example:</b> <pre>Switch(config)# mac address-table notification threshold</pre>	Enables the MAC address threshold notification feature.
Step 6	<b>mac address-table notification threshold [limit percentage]   [interval time]</b>  <b>Example:</b> <pre>Switch(config)# mac address-table notification threshold interval 123 Switch(config)# mac address-table notification threshold limit 78</pre>	Enters the threshold value for the MAC address threshold usage monitoring. <ul style="list-style-type: none"> <li>• (Optional) <b>limit percentage</b>—Specifies the percentage of the MAC address table use; valid values are from 1 to 100 percent. The default is 50 percent.</li> <li>• (Optional) <b>interval time</b>—Specifies the time between notifications; valid values are greater than or equal to 120 seconds. The default is 120 seconds.</li> </ul>
Step 7	<b>end</b>  <b>Example:</b> <pre>Switch(config)# end</pre>	Returns to privileged EXEC mode.
Step 8	<b>show running-config</b>  <b>Example:</b> <pre>Switch# show running-config</pre>	Verifies your entries.
Step 9	<b>copy running-config startup-config</b>  <b>Example:</b> <pre>Switch# copy running-config startup-config</pre>	(Optional) Saves your entries in the configuration file.

## What to Do Next

### Adding and Removing Static Address Entries

Follow these steps to add a static address:

#### SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `mac address-table static mac-addr vlan vlan-id interface interface-id`
4. `end`
5. `show running-config`
6. `copy running-config startup-config`

#### DETAILED STEPS

	Command or Action	Purpose
Step 1	<p><code>enable</code></p> <p><b>Example:</b></p> <pre>Switch&gt; enable</pre>	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	<p><code>configure terminal</code></p> <p><b>Example:</b></p> <pre>Switch# configure terminal</pre>	Enters the global configuration mode.
Step 3	<p><code>mac address-table static mac-addr vlan vlan-id interface interface-id</code></p> <p><b>Example:</b></p> <pre>Switch(config)# mac address-table static c2f3.220a.12f4 vlan 4 interface gigabitethernet 1/0/1</pre>	<p>Adds a static address to the MAC address table.</p> <ul style="list-style-type: none"> <li>• <i>mac-addr</i>—Specifies the destination MAC unicast address to add to the address table. Packets with this destination address received in the specified VLAN are forwarded to the specified interface.</li> <li>• <i>vlan-id</i>—Specifies the VLAN for which the packet with the specified MAC address is received. Valid VLAN IDs are 1 to 4094.</li> <li>• <i>interface-id</i>—Specifies the interface to which the received packet is forwarded. Valid interfaces include physical ports or port channels. For static multicast addresses, you can enter multiple interface IDs. For static unicast addresses, you can enter only one interface at a time, but you can enter the command multiple times with the same MAC address and VLAN ID.</li> </ul>

	Command or Action	Purpose
<b>Step 4</b>	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode. Alternatively, you can also press <b>Ctrl-Z</b> to exit global configuration mode.
<b>Step 5</b>	<b>show running-config</b>  <b>Example:</b> Switch# <b>show running-config</b>	Verifies your entries.
<b>Step 6</b>	<b>copy running-config startup-config</b>  <b>Example:</b> Switch# <b>copy running-config startup-config</b>	(Optional) Saves your entries in the configuration file.

## Configuring Unicast MAC Address Filtering

Follow these steps to configure the Switch to drop a source or destination unicast static address:

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **mac address-table static *mac-addr* vlan *vlan-id* drop**
4. **end**
5. **show running-config**
6. **copy running-config startup-config**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Switch> <b>enable</b>	Enables privileged EXEC mode. Enter your password if prompted.



	Command or Action	Purpose
Step 2	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
Step 3	<b>mac address-table static mac-addr vlan vlan-id drop</b>  <b>Example:</b> Switch(config)# <b>mac address-table static c2f3.220a.12f4 vlan 4 drop</b>	Enables unicast MAC address filtering and configure the switch to drop a packet with the specified source or destination unicast static address. <ul style="list-style-type: none"> <li>• <i>mac-addr</i>—Specifies a source or destination unicast MAC address (48-bit). Packets with this MAC address are dropped.</li> <li>• <i>vlan-id</i>—Specifies the VLAN for which the packet with the specified MAC address is received. Valid VLAN IDs are 1 to 4094.</li> </ul>
Step 4	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.
Step 5	<b>show running-config</b>  <b>Example:</b> Switch# <b>show running-config</b>	Verifies your entries.
Step 6	<b>copy running-config startup-config</b>  <b>Example:</b> Switch# <b>copy running-config startup-config</b>	(Optional) Saves your entries in the configuration file.

## Monitoring and Maintaining Administration of the Switch

Command	Purpose
<b>clear mac address-table dynamic</b>	Removes all dynamic entries.
<b>clear mac address-table dynamic address mac-address</b>	Removes a specific MAC address.

Command	Purpose
<b>clear mac address-table dynamic interface</b> <i>interface-id</i>	Removes all addresses on the specified physical port or port channel.
<b>clear mac address-table dynamic vlan</b> <i>vlan-id</i>	Removes all addresses on a specified VLAN.
<b>show clock</b> [ <i>detail</i> ]	Displays the time and date configuration.
<b>show ip igmp snooping groups</b>	Displays the Layer 2 multicast entries for all VLANs or the specified VLAN.
<b>show mac address-table address</b> <i>mac-address</i>	Displays MAC address table information for the specified MAC address.
<b>show mac address-table aging-time</b>	Displays the aging time in all VLANs or the specified VLAN.
<b>show mac address-table count</b>	Displays the number of addresses present in all VLANs or the specified VLAN.
<b>show mac address-table dynamic</b>	Displays only dynamic MAC address table entries.
<b>show mac address-table interface</b> <i>interface-name</i>	Displays the MAC address table information for the specified interface.
<b>show mac address-table move update</b>	Displays the MAC address table move update information.
<b>show mac address-table multicast</b>	Displays a list of multicast MAC addresses.
<b>show mac address-table notification</b> { <i>change</i>   <i>mac-move</i>   <i>threshold</i> }	Displays the MAC notification parameters and history table.
<b>show mac address-table secure</b>	Displays the secure MAC addresses.
<b>show mac address-table static</b>	Displays only static MAC address table entries.
<b>show mac address-table vlan</b> <i>vlan-id</i>	Displays the MAC address table information for the specified VLAN.

# Configuration Examples for Switch Administration

## Example: Setting the System Clock

This example shows how to manually set the system clock:

```
Switch# clock set 13:32:00 23 July 2013
```

## Examples: Configuring Summer Time

This example (for daylight savings time) shows how to specify that summer time starts on March 10 at 02:00 and ends on November 3 at 02:00:

```
Switch(config)# clock summer-time PDT recurring PST date  
10 March 2013 2:00 3 November 2013 2:00
```

This example shows how to set summer time start and end dates:

```
Switch(config)#clock summer-time PST date  
20 March 2013 2:00 20 November 2013 2:00
```

## Example: Configuring a MOTD Banner

This example shows how to configure a MOTD banner by using the pound sign (#) symbol as the beginning and ending delimiter:

```
Switch(config)# banner motd #  
  
This is a secure site. Only authorized users are allowed.  
For access, contact technical support.  
  
#  
  
Switch(config)#
```

This example shows the banner that appears from the previous configuration:

```
Unix> telnet 192.0.2.15  
Trying 192.0.2.15...  
Connected to 192.0.2.15.  
Escape character is '^]'.  
This is a secure site. Only authorized users are allowed.  
For access, contact technical support.  
User Access Verification  
Password:
```

## Example: Configuring a Login Banner

This example shows how to configure a login banner by using the dollar sign (\$) symbol as the beginning and ending delimiter:

```
Switch(config)# banner login $
Access for authorized users only. Please enter your username and password.
$
Switch(config)#
```

## Example: Configuring MAC Address Change Notification Traps

This example shows how to specify 172.20.10.10 as the NMS, enable MAC address notification traps to the NMS, enable the MAC address-change notification feature, set the interval time to 123 seconds, set the history-size to 100 entries, and enable traps whenever a MAC address is added on the specified port:

```
Switch(config)# snmp-server host 172.20.10.10 traps private mac-notification
Switch(config)# snmp-server enable traps mac-notification change
Switch(config)# mac address-table notification change
Switch(config)# mac address-table notification change interval 123
Switch(config)# mac address-table notification change history-size 100
Switch(config)# interface gigabitethernet1/2/1
Switch(config-if)# snmp trap mac-notification change added
```

## Example: Configuring MAC Threshold Notification Traps

This example shows how to specify 172.20.10.10 as the NMS, enable the MAC address threshold notification feature, set the interval time to 123 seconds, and set the limit to 78 per cent:

```
Switch(config)# snmp-server host 172.20.10.10 traps private mac-notification
Switch(config)# snmp-server enable traps mac-notification threshold
Switch(config)# mac address-table notification threshold
Switch(config)# mac address-table notification threshold interval 123
Switch(config)# mac address-table notification threshold limit 78
```

## Example: Adding the Static Address to the MAC Address Table

This example shows how to add the static address c2f3.220a.12f4 to the MAC address table. When a packet is received in VLAN 4 with this MAC address as its destination address, the packet is forwarded to the specified port:

```
Switch(config)# mac address-table static c2f3.220a.12f4 vlan 4 interface gigabitethernet1/1/1
```

## Example: Configuring Unicast MAC Address Filtering

This example shows how to enable unicast MAC address filtering and how to configure drop packets that have a source or destination address of c2f3.220a.12f4. When a packet is received in VLAN 4 with this MAC address as its source or destination, the packet is dropped:

```
Switch(config)# mac address-table static c2f3.220a.12f4 vlan 4 drop
```

## Additional References for Switch Administration

### Related Documents

Related Topic	Document Title
Switch administration commands	<i>Catalyst 2960-X Switch System Management Command Reference</i>
Network management configuration	<i>Catalyst 2960-X Switch Network Management Configuration Guide</i>
Layer 2 configuration	<i>Catalyst 2960-X Switch Layer 2 Configuration Guide</i>
VLAN configuration	<i>Catalyst 2960-X Switch VLAN Management Configuration Guide</i>
Platform-independent command references	<i>Cisco IOS 15.3M&amp;T Command References</i>
Platform-independent configuration information	<i>Cisco IOS 15.3M&amp;T Configuration Guides</i>

### Standards and RFCs

Standard/RFC	Title
None	—

### MIBs

MIB	MIBs Link
All supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:  <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

**Technical Assistance**

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<p><a href="http://www.cisco.com/support">http://www.cisco.com/support</a></p>

**Feature History and Information for Switch Administration**

Release	Modification
Cisco IOS 15.0(2)EX	This feature was introduced.



# CHAPTER 3

## Performing Switch Setup Configuration

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- [Information About Performing Switch Setup Configuration, page 49](#)
- [How to Perform Switch Setup Configuration, page 60](#)
- [Monitoring Switch Setup Configuration, page 73](#)
- [Configuration Examples for Performing Switch Setup, page 74](#)
- [Additional References for Performing Switch Setup, page 76](#)
- [Feature History and Information For Performing Switch Setup Configuration, page 78](#)

## Information About Performing Switch Setup Configuration

Review the sections in this module before performing your initial switch configuration tasks that include IP address assignments and DHCP autoconfiguration.

### Boot Process

To start your switch, you need to follow the procedures in the getting started guide or the hardware installation guide for installing and powering on the switch and setting up the initial switch configuration (IP address, subnet mask, default gateway, secret and Telnet passwords, and so forth).

The boot loader software performs the normal boot process and includes these activities:

- Locates the bootable (base) package in the bundle or installed package set.
- Performs low-level CPU initialization. It initializes the CPU registers, which control where physical memory is mapped, its quantity, its speed, and so forth.
- Performs power-on self-test (POST) for the CPU subsystem and tests the system DRAM.
- Initializes the file systems on the system board.
- Loads a default operating system software image into memory and boots up the switch.

The boot loader provides access to the flash file systems before the operating system is loaded. Normally, the boot loader is used only to load, decompress, and start the operating system. After the boot loader gives the operating system control of the CPU, the boot loader is not active until the next system reset or power-on.

The boot loader also provides trap-door access into the system if the operating system has problems serious enough that it cannot be used. The trap-door operation provides enough access to the system so that if it is necessary, you can format the flash file system, reinstall the operating system software image by using the Xmodem Protocol, recover from a lost or forgotten password, and finally restart the operating system.

Before you can assign switch information, make sure that you have connected a PC or terminal to the console port or a PC to the Ethernet management port, and make sure you have configured the PC or terminal-emulation software baud rate and character format to match that of the switch console port settings:

- Baud rate default is 9600.
- Data bits default is 8.




---

**Note** If the data bits option is set to 8, set the parity option to none.

---

- Stop bits default is 2 (minor).
- Parity settings default is none.

## Switches Information Assignment

You can assign IP information through the switch setup program, through a DHCP server, or manually.

Use the switch setup program if you want to be prompted for specific IP information. With this program, you can also configure a hostname and an enable secret password.

It gives you the option of assigning a Telnet password (to provide security during remote management) and configuring your switch as a command or member switch of a cluster or as a standalone switch.

Use a DHCP server for centralized control and automatic assignment of IP information after the server is configured.




---

**Note** If you are using DHCP, do not respond to any of the questions in the setup program until the switch receives the dynamically assigned IP address and reads the configuration file.

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If you are an experienced user familiar with the switch configuration steps, manually configure the switch. Otherwise, use the setup program described in the *Boot Process* section.

## Default Switch Information

**Table 6: Default Switch Information**

Feature	Default Setting
IP address and subnet mask	No IP address or subnet mask are defined.



Feature	Default Setting
Default gateway	No default gateway is defined.
Enable secret password	No password is defined.
Hostname	The factory-assigned default hostname is Switch.
Telnet password	No password is defined.
Cluster command switch functionality	Disabled.
Cluster name	No cluster name is defined.

## DHCP-Based Autoconfiguration Overview

DHCP provides configuration information to Internet hosts and internetworking devices. This protocol consists of two components: one for delivering configuration parameters from a DHCP server to a device and an operation for allocating network addresses to devices. DHCP is built on a client-server model, in which designated DHCP servers allocate network addresses and deliver configuration parameters to dynamically configured devices. The switch can act as both a DHCP client and a DHCP server.

During DHCP-based autoconfiguration, your switch (DHCP client) is automatically configured at startup with IP address information and a configuration file.

With DHCP-based autoconfiguration, no DHCP client-side configuration is needed on your switch. However, you need to configure the DHCP server for various lease options associated with IP addresses.

If you want to use DHCP to relay the configuration file location on the network, you might also need to configure a Trivial File Transfer Protocol (TFTP) server and a Domain Name System (DNS) server.



### Note

We recommend a redundant connection between a switch stack and the DHCP, DNS, and TFTP servers. This is to help ensure that these servers remain accessible in case one of the connected stack members is removed from the switch stack.

The DHCP server for your switch can be on the same LAN or on a different LAN than the switch. If the DHCP server is running on a different LAN, you should configure a DHCP relay device between your switch and the DHCP server. A relay device forwards broadcast traffic between two directly connected LANs. A router does not forward broadcast packets, but it forwards packets based on the destination IP address in the received packet.

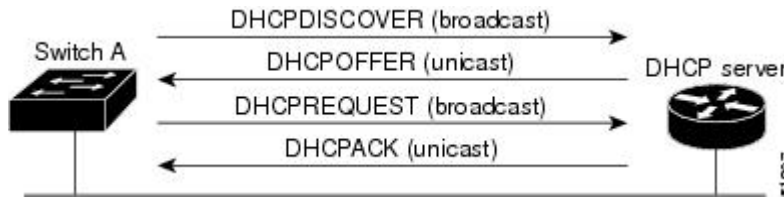
DHCP-based autoconfiguration replaces the BOOTP client functionality on your switch.

## DHCP Client Request Process

When you boot up your switch, the DHCP client is invoked and requests configuration information from a DHCP server when the configuration file is not present on the switch. If the configuration file is present and the configuration includes the **ip address dhcp** interface configuration command on specific routed interfaces, the DHCP client is invoked and requests the IP address information for those interfaces.

This is the sequence of messages that are exchanged between the DHCP client and the DHCP server.

**Figure 3: DHCP Client and Server Message Exchange**



The client, Switch A, broadcasts a DHCPDISCOVER message to locate a DHCP server. The DHCP server offers configuration parameters (such as an IP address, subnet mask, gateway IP address, DNS IP address, a lease for the IP address, and so forth) to the client in a DHCPOFFER unicast message.

In a DHCPREQUEST broadcast message, the client returns a formal request for the offered configuration information to the DHCP server. The formal request is broadcast so that all other DHCP servers that received the DHCPDISCOVER broadcast message from the client can reclaim the IP addresses that they offered to the client.

The DHCP server confirms that the IP address has been allocated to the client by returning a DHCPACK unicast message to the client. With this message, the client and server are bound, and the client uses configuration information received from the server. The amount of information the switch receives depends on how you configure the DHCP server.

If the configuration parameters sent to the client in the DHCPOFFER unicast message are invalid (a configuration error exists), the client returns a DHCPDECLINE broadcast message to the DHCP server.

The DHCP server sends the client a DHCPNAK denial broadcast message, which means that the offered configuration parameters have not been assigned, that an error has occurred during the negotiation of the parameters, or that the client has been slow in responding to the DHCPOFFER message (the DHCP server assigned the parameters to another client).

A DHCP client might receive offers from multiple DHCP or BOOTP servers and can accept any of the offers; however, the client usually accepts the first offer it receives. The offer from the DHCP server is not a guarantee that the IP address is allocated to the client; however, the server usually reserves the address until the client has had a chance to formally request the address. If the switch accepts replies from a BOOTP server and configures itself, the switch broadcasts, instead of unicasts, TFTP requests to obtain the switch configuration file.

The DHCP hostname option allows a group of switches to obtain hostnames and a standard configuration from the central management DHCP server. A client (switch) includes in its DHCPDISCOVER message an option 12 field used to request a hostname and other configuration parameters from the DHCP server. The configuration files on all clients are identical except for their DHCP-obtained hostnames.

If a client has a default hostname (the **hostname name** global configuration command is not configured or the **no hostname** global configuration command is entered to remove the hostname), the DHCP hostname option is not included in the packet when you enter the **ip address dhcp** interface configuration command. In this case, if the client receives the DHCP hostname option from the DHCP interaction while acquiring an IP address for an interface, the client accepts the DHCP hostname option and sets the flag to show that the system now has a hostname configured.

## DHCP-based Autoconfiguration and Image Update

You can use the DHCP image upgrade features to configure a DHCP server to download both a new image and a new configuration file to one or more switches in a network. Simultaneous image and configuration upgrade for all switches in the network helps ensure that each new switch added to a network receives the same image and configuration.

There are two types of DHCP image upgrades: DHCP autoconfiguration and DHCP auto-image update.

### Restrictions for DHCP-based Autoconfiguration

- The DHCP-based autoconfiguration with a saved configuration process stops if there is not at least one Layer 3 interface in an up state without an assigned IP address in the network.
- Unless you configure a timeout, the DHCP-based autoconfiguration with a saved configuration feature tries indefinitely to download an IP address.
- The auto-install process stops if a configuration file cannot be downloaded or if the configuration file is corrupted.
- The configuration file that is downloaded from TFTP is merged with the existing configuration in the running configuration but is not saved in the NVRAM unless you enter the **write memory** or **copy running-configuration startup-configuration** privileged EXEC command. If the downloaded configuration is saved to the startup configuration, the feature is not triggered during subsequent system restarts.

### DHCP Autoconfiguration

DHCP autoconfiguration downloads a configuration file to one or more switches in your network from a DHCP server. The downloaded configuration file becomes the running configuration of the switch. It does not over write the bootup configuration saved in the flash, until you reload the switch.

### DHCP Auto-Image Update

You can use DHCP auto-image upgrade with DHCP autoconfiguration to download both a configuration and a new image to one or more switches in your network. The switch (or switches) downloading the new configuration and the new image can be blank (or only have a default factory configuration loaded).

If the new configuration is downloaded to a switch that already has a configuration, the downloaded configuration is appended to the configuration file stored on the switch. (Any existing configuration is not overwritten by the downloaded one.)

To enable a DHCP auto-image update on the switch, the TFTP server where the image and configuration files are located must be configured with the correct option 67 (the configuration filename), option 66 (the DHCP server hostname) option 150 (the TFTP server address), and option 125 (description of the Cisco IOS image file) settings.

After you install the switch in your network, the auto-image update feature starts. The downloaded configuration file is saved in the running configuration of the switch, and the new image is downloaded and installed on the switch. When you reboot the switch, the configuration is stored in the saved configuration on the switch.

## DHCP Server Configuration Guidelines

Follow these guidelines if you are configuring a device as a DHCP server:

- You should configure the DHCP server with reserved leases that are bound to each switch by the switch hardware address.
- If you want the switch to receive IP address information, you must configure the DHCP server with these lease options:
  - IP address of the client (required)
  - Subnet mask of the client (required)
  - DNS server IP address (optional)
  - Router IP address (default gateway address to be used by the switch) (required)
- If you want the switch to receive the configuration file from a TFTP server, you must configure the DHCP server with these lease options:
  - TFTP server name (required)
  - Boot filename (the name of the configuration file that the client needs) (recommended)
  - Hostname (optional)
- Depending on the settings of the DHCP server, the switch can receive IP address information, the configuration file, or both.
- If you do not configure the DHCP server with the lease options described previously, it replies to client requests with only those parameters that are configured. If the IP address and the subnet mask are not in the reply, the switch is not configured. If the router IP address or the TFTP server name are not found, the switch might send broadcast, instead of unicast, TFTP requests. Unavailability of other lease options does not affect autoconfiguration.
- The switch can act as a DHCP server. By default, the Cisco IOS DHCP server and relay agent features are enabled on your switch but are not configured. (These features are not operational.)

### Purpose of the TFTP Server

Based on the DHCP server configuration, the switch attempts to download one or more configuration files from the TFTP server. If you configured the DHCP server to respond to the switch with all the options required for IP connectivity to the TFTP server, and if you configured the DHCP server with a TFTP server name, address, and configuration filename, the switch attempts to download the specified configuration file from the specified TFTP server.

If you did not specify the configuration filename, the TFTP server, or if the configuration file could not be downloaded, the switch attempts to download a configuration file by using various combinations of filenames and TFTP server addresses. The files include the specified configuration filename (if any) and these files: `network-config`, `cisconet.cfg`, `hostname.config`, or `hostname.cfg`, where *hostname* is the switch's current hostname. The TFTP server addresses used include the specified TFTP server address (if any) and the broadcast address (255.255.255.255).

For the switch to successfully download a configuration file, the TFTP server must contain one or more configuration files in its base directory. The files can include these files:

- The configuration file named in the DHCP reply (the actual switch configuration file).
- The network-config or the cisco.net.cfg file (known as the default configuration files).
- The router-config or the cisco.rtr.cfg file (These files contain commands common to all switches. Normally, if the DHCP and TFTP servers are properly configured, these files are not accessed.)

If you specify the TFTP server name in the DHCP server-lease database, you must also configure the TFTP server name-to-IP-address mapping in the DNS-server database.

If the TFTP server to be used is on a different LAN from the switch, or if it is to be accessed by the switch through the broadcast address (which occurs if the DHCP server response does not contain all the required information described previously), a relay must be configured to forward the TFTP packets to the TFTP server. The preferred solution is to configure the DHCP server with all the required information.

## Purpose of the DNS Server

The DHCP server uses the DNS server to resolve the TFTP server name to an IP address. You must configure the TFTP server name-to-IP address map on the DNS server. The TFTP server contains the configuration files for the switch.

You can configure the IP addresses of the DNS servers in the lease database of the DHCP server from where the DHCP replies will retrieve them. You can enter up to two DNS server IP addresses in the lease database.

The DNS server can be on the same LAN or on a different LAN from the switch. If it is on a different LAN, the switch must be able to access it through a router.

## How to Obtain Configuration Files

Depending on the availability of the IP address and the configuration filename in the DHCP reserved lease, the switch obtains its configuration information in these ways:

- The IP address and the configuration filename is reserved for the switch and provided in the DHCP reply (one-file read method).

The switch receives its IP address, subnet mask, TFTP server address, and the configuration filename from the DHCP server. The switch sends a unicast message to the TFTP server to retrieve the named configuration file from the base directory of the server and upon receipt, it completes its boot up process.

- The IP address and the configuration filename is reserved for the switch, but the TFTP server address is not provided in the DHCP reply (one-file read method).

The switch receives its IP address, subnet mask, and the configuration filename from the DHCP server. The switch sends a broadcast message to a TFTP server to retrieve the named configuration file from the base directory of the server, and upon receipt, it completes its boot-up process.

- Only the IP address is reserved for the switch and provided in the DHCP reply. The configuration filename is not provided (two-file read method).

The switch receives its IP address, subnet mask, and the TFTP server address from the DHCP server. The switch sends a unicast message to the TFTP server to retrieve the network-config or cisco.net.cfg default configuration file. (If the network-config file cannot be read, the switch reads the cisco.net.cfg file.)

The default configuration file contains the hostnames-to-IP-address mapping for the switch. The switch fills its host table with the information in the file and obtains its hostname. If the hostname is not found in the file, the switch uses the hostname in the DHCP reply. If the hostname is not specified in the DHCP reply, the switch uses the default *Switch* as its hostname.

After obtaining its hostname from the default configuration file or the DHCP reply, the switch reads the configuration file that has the same name as its hostname (*hostname-config* or *hostname.cfg*, depending on whether *network-config* or *cisconet.cfg* was read earlier) from the TFTP server. If the *cisconet.cfg* file is read, the filename of the host is truncated to eight characters.

If the switch cannot read the *network-config*, *cisconet.cfg*, or the hostname file, it reads the *router-config* file. If the switch cannot read the *router-config* file, it reads the *ciscorttr.cfg* file.

**Note**


---

The switch broadcasts TFTP server requests if the TFTP server is not obtained from the DHCP replies, if all attempts to read the configuration file through unicast transmissions fail, or if the TFTP server name cannot be resolved to an IP address.

---

## How to Control Environment Variables

With a normally operating switch, you enter the boot loader mode only through the console connection. Unplug the switch power cord, then reconnect the power cord. Hold down the **MODE** button until you see the boot loader switch prompt

The switch boot loader software provides support for nonvolatile environment variables, which can be used to control how the boot loader or any other software running on the system, functions. Boot loader environment variables are similar to environment variables that can be set on UNIX or DOS systems.

Environment variables that have values are stored in flash memory outside of the flash file system.

Each line in these files contains an environment variable name and an equal sign followed by the value of the variable. A variable has no value if it is not present; it has a value if it is listed even if the value is a null string. A variable that is set to a null string (for example, “ ”) is a variable with a value. Many environment variables are predefined and have default values.

Environment variables store two kinds of data:

- Data that controls code, which does not read the Cisco IOS configuration file. For example, the name of a boot loader helper file, which extends or patches the functionality of the boot loader can be stored as an environment variable.
- Data that controls code, which is responsible for reading the Cisco IOS configuration file. For example, the name of the Cisco IOS configuration file can be stored as an environment variable.

You can change the settings of the environment variables by accessing the boot loader or by using Cisco IOS commands. Under normal circumstances, it is not necessary to alter the setting of the environment variables.

## Common Environment Variables

This table describes the function of the most common environment variables.

Table 7: Common Environment Variables

Variable	Boot Loader Command	Cisco IOS Global Configuration Command
BOOT	<p><b>set BOOT</b> <i>filesystem</i> <i>:/file-url ...</i></p> <p>A semicolon-separated list of executable files to try to load and execute when automatically booting. If the BOOT environment variable is not set, the system attempts to load and execute the first executable image it can find by using a recursive, depth-first search through the flash file system. If the BOOT variable is set but the specified images cannot be loaded, the system attempts to boot the first bootable file that it can find in the flash file system.</p>	<p><b>boot system</b> <i>{filesystem : /file-url ...</i></p> <p>Specifies the Cisco IOS image to load during the next boot cycle and the stack members on which the image is loaded. This command changes the setting of the BOOT environment variable.</p>
MANUAL_BOOT	<p><b>set MANUAL_BOOT</b> <b>yes</b></p> <p>Decides whether the switch automatically or manually boots.</p> <p>Valid values are 1, yes, 0, and no. If it is set to no or 0, the boot loader attempts to automatically boot up the system. If it is set to anything else, you must manually boot up the switch from the boot loader mode.</p>	<p><b>boot manual</b></p> <p>Enables manually booting the switch during the next boot cycle and changes the setting of the MANUAL_BOOT environment variable.</p> <p>The next time you reboot the system, the switch is in boot loader mode. To boot up the system, use the <b>boot flash:</b> <i>filesystem :/file-url</i> boot loader command, and specify the name of the bootable image.</p>

Variable	Boot Loader Command	Cisco IOS Global Configuration Command
CONFIG_FILE	<b>set CONFIG_FILE</b> <b>flash:/file-url</b> Changes the filename that Cisco IOS uses to read and write a nonvolatile copy of the system configuration.	<b>boot config-file flash:/file-url</b> Specifies the filename that Cisco IOS uses to read and write a nonvolatile copy of the system configuration. This command changes the CONFIG_FILE environment variable.
SWITCH_NUMBER	<b>set</b> <b>SWITCH_NUMBER</b> <i>stack-member-number</i> Changes the member number of a stack member.	<b>switch current-stack-member-number</b> <b>renumber new-stack-member-number</b> Changes the member number of a stack member.
SWITCH_PRIORITY	<b>set</b> <b>SWITCH_PRIORITY</b> <i>stack-member-number</i> Changes the priority value of a stack member.	<b>switch stack-member-number priority</b> <i>priority-number</i> Changes the priority value of a stack member.
BAUD	<b>set BAUD</b> <i>baud-rate</i>	<b>line console 0</b> <b>speed</b> <i>speed-value</i> Configures the baud rate.
ENABLE_BREAK	<b>set</b> <b>ENABLE_BREAK</b> <b>yes/no</b>	<b>boot enable-break switch yes/no</b> This command can be issued when the flash filesystem is initialized when <b>ENABLE_BREAK</b> is set to <b>yes</b> .

## Environment Variables for TFTP

When the switch is connected to a PC through the Ethernet management port, you can download or upload a configuration file to the boot loader by using TFTP. Make sure the environment variables in this table are configured.



**Table 8: Environment Variables for TFTP**

Variable	Description
MAC_ADDR	Specifies the MAC address of the switch.  <b>Note</b> We recommend that you do not modify this variable. However, if you modify this variable after the boot loader is up or the value is different from the saved value, enter this command before using TFTP.
IP_ADDR	Specifies the IP address and the subnet mask for the associated IP subnet of the switch.
DEFAULT_ROUTER	Specifies the IP address and subnet mask of the default gateway.

## Scheduled Reload of the Software Image

You can schedule a reload of the software image to occur on the switch at a later time (for example, late at night or during the weekend when the switch is used less), or you can synchronize a reload network-wide (for example, to perform a software upgrade on all switches in the network).


**Note**

A scheduled reload must take place within approximately 24 days.

You have these reload options:

- Reload of the software to take affect in the specified minutes or hours and minutes. The reload must take place within approximately 24 hours. You can specify the reason for the reload in a string up to 255 characters in length.
- Reload of the software to take place at the specified time (using a 24-hour clock). If you specify the month and day, the reload is scheduled to take place at the specified time and date. If you do not specify the month and day, the reload takes place at the specified time on the current day (if the specified time is later than the current time) or on the next day (if the specified time is earlier than the current time). Specifying 00:00 schedules the reload for midnight.

The **reload** command halts the system. If the system is not set to manually boot up, it reboots itself.

If your switch is configured for manual booting, do not reload it from a virtual terminal. This restriction prevents the switch from entering the boot loader mode and then taking it from the remote user's control.

If you modify your configuration file, the switch prompts you to save the configuration before reloading. During the save operation, the system requests whether you want to proceed with the save if the CONFIG\_FILE environment variable points to a startup configuration file that no longer exists. If you proceed in this situation, the system enters setup mode upon reload.

To cancel a previously scheduled reload, use the **reload cancel** privileged EXEC command.

# How to Perform Switch Setup Configuration

Using DHCP to download a new image and a new configuration to a switch requires that you configure at least two switches. One switch acts as a DHCP and TFTP server and the second switch (client) is configured to download either a new configuration file or a new configuration file and a new image file.

## Configuring DHCP Autoconfiguration (Only Configuration File)

This task describes how to configure DHCP autoconfiguration of the TFTP and DHCP settings on an existing switch in the network so that it can support the autoconfiguration of a new switch.

### SUMMARY STEPS

1. **configure terminal**
2. **ip dhcp pool** *poolname*
3. **boot** *filename*
4. **network** *network-number mask prefix-length*
5. **default-router** *address*
6. **option 150** *address*
7. **exit**
8. **tftp-server flash:***filename.text*
9. **interface** *interface-id*
10. **no switchport**
11. **ip address** *address mask*
12. **end**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters global configuration mode.
Step 2	<b>ip dhcp pool</b> <i>poolname</i>  <b>Example:</b> Switch(config)# <b>ip dhcp pool pool</b>	Creates a name for the DHCP server address pool, and enters DHCP pool configuration mode.

	Command or Action	Purpose
<b>Step 3</b>	<p><b>boot</b> <i>filename</i></p> <p><b>Example:</b></p> <pre>Switch(dhcp-config) # boot config-boot.text</pre>	Specifies the name of the configuration file that is used as a boot image.
<b>Step 4</b>	<p><b>network</b> <i>network-number mask prefix-length</i></p> <p><b>Example:</b></p> <pre>Switch(dhcp-config) # network 10.10.10.0 255.255.255.0</pre>	<p>Specifies the subnet network number and mask of the DHCP address pool.</p> <p><b>Note</b> The prefix length specifies the number of bits that comprise the address prefix. The prefix is an alternative way of specifying the network mask of the client. The prefix length must be preceded by a forward slash (/).</p>
<b>Step 5</b>	<p><b>default-router</b> <i>address</i></p> <p><b>Example:</b></p> <pre>Switch(dhcp-config) # default-router 10.10.10.1</pre>	Specifies the IP address of the default router for a DHCP client.
<b>Step 6</b>	<p><b>option 150</b> <i>address</i></p> <p><b>Example:</b></p> <pre>Switch(dhcp-config) # option 150 10.10.10.1</pre>	Specifies the IP address of the TFTP server.
<b>Step 7</b>	<p><b>exit</b></p> <p><b>Example:</b></p> <pre>Switch(dhcp-config) # exit</pre>	Returns to global configuration mode.
<b>Step 8</b>	<p><b>tftp-server flash:</b><i>filename.text</i></p> <p><b>Example:</b></p> <pre>Switch(config) # tftp-server flash:config-boot.text</pre>	Specifies the configuration file on the TFTP server.
<b>Step 9</b>	<p><b>interface</b> <i>interface-id</i></p> <p><b>Example:</b></p> <pre>Switch(config) # interface gigabitethernet1/0/4</pre>	Specifies the address of the client that will receive the configuration file.

	Command or Action	Purpose
<b>Step 10</b>	<b>no switchport</b>  <b>Example:</b> Switch(config-if)# <b>no switchport</b>	Puts the interface into Layer 3 mode.
<b>Step 11</b>	<b>ip address <i>address mask</i></b>  <b>Example:</b> Switch(config-if)# <b>ip address 10.10.10.1 255.255.255.0</b>	Specifies the IP address and mask for the interface.
<b>Step 12</b>	<b>end</b>  <b>Example:</b> Switch(config-if)# <b>end</b>	Returns to privileged EXEC mode.

#### Related Topics

[Example: Configuring a Switch as a DHCP Server, on page 74](#)

## Configuring DHCP Auto-Image Update (Configuration File and Image)

This task describes DHCP autoconfiguration to configure TFTP and DHCP settings on an existing switch to support the installation of a new switch.

#### Before You Begin

You must first create a text file (for example, `autoinstall_dhcp`) that will be uploaded to the switch. In the text file, put the name of the image that you want to download (forexample, `c3750e-ipservices-mz.122-44.3.SE.tar``c3750x-ipservices-mz.122-53.3.SE2.tar`). This image must be a tar and not a bin file.

## SUMMARY STEPS

1. **configure terminal**
2. **ip dhcp pool** *poolname*
3. **boot** *filename*
4. **network** *network-number mask prefix-length*
5. **default-router** *address*
6. **option 150** *address*
7. **option 125** *hex*
8. **copy tftp flash** *filename.txt*
9. **copy tftp flash** *imagename.bin*
10. **exit**
11. **tftp-server flash:** *config.txt*
12. **tftp-server flash:** *imagename.bin*
13. **tftp-server flash:** *filename.txt*
14. **interface** *interface-id*
15. **no switchport**
16. **ip address** *address mask*
17. **end**
18. **copy running-config startup-config**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters global configuration mode.
<b>Step 2</b>	<b>ip dhcp pool</b> <i>poolname</i>  <b>Example:</b> Switch(config)# <b>ip dhcp pool pool1</b>	Creates a name for the DHCP server address pool and enter DHCP pool configuration mode.
<b>Step 3</b>	<b>boot</b> <i>filename</i>  <b>Example:</b> Switch(dhcp-config)# <b>boot config-boot.txt</b>	Specifies the name of the file that is used as a boot image.

	Command or Action	Purpose
<b>Step 4</b>	<p><b>network</b> <i>network-number mask prefix-length</i></p> <p><b>Example:</b></p> <pre>Switch(dhcp-config)# network 10.10.10.0 255.255.255.0</pre>	<p>Specifies the subnet network number and mask of the DHCP address pool.</p> <p><b>Note</b> The prefix length specifies the number of bits that comprise the address prefix. The prefix is an alternative way of specifying the network mask of the client. The prefix length must be preceded by a forward slash (/).</p>
<b>Step 5</b>	<p><b>default-router</b> <i>address</i></p> <p><b>Example:</b></p> <pre>Switch(dhcp-config)# default-router 10.10.10.1</pre>	Specifies the IP address of the default router for a DHCP client.
<b>Step 6</b>	<p><b>option 150</b> <i>address</i></p> <p><b>Example:</b></p> <pre>Switch(dhcp-config)# option 150 10.10.10.1</pre>	Specifies the IP address of the TFTP server.
<b>Step 7</b>	<p><b>option 125</b> <i>hex</i></p> <p><b>Example:</b></p> <pre>Switch(dhcp-config)# option 125 hex 0000.0009.0a05.08661.7574.6f69.6e73.7461.6c6c.5f64.686370</pre>	Specifies the path to the text file that describes the path to the image file.
<b>Step 8</b>	<p><b>copy tftp flash</b> <i>filename.txt</i></p> <p><b>Example:</b></p> <pre>Switch(config)# copy tftp flash image.bin</pre>	Uploads the text file to the switch.
<b>Step 9</b>	<p><b>copy tftp flash</b> <i>imagenamename.bin</i></p> <p><b>Example:</b></p> <pre>Switch(config)# copy tftp flash image.bin</pre>	Uploads the tar file for the new image to the switch.
<b>Step 10</b>	<p><b>exit</b></p> <p><b>Example:</b></p> <pre>Switch(dhcp-config)# exit</pre>	Returns to global configuration mode.

	Command or Action	Purpose
<b>Step 11</b>	<b>tftp-server flash:</b> <i>config.text</i>  <b>Example:</b> Switch(config)# <b>tftp-server flash:config-boot.text</b>	Specifies the Cisco IOS configuration file on the TFTP server.
<b>Step 12</b>	<b>tftp-server flash:</b> <i>imagename.bin</i>  <b>Example:</b> Switch(config)# <b>tftp-server flash:image.bin</b>	Specifies the image name on the TFTP server.
<b>Step 13</b>	<b>tftp-server flash:</b> <i>filename.txt</i>  <b>Example:</b> Switch(config)# <b>tftp-server flash:boot-config.text</b>	Specifies the text file that contains the name of the image file to download
<b>Step 14</b>	<b>interface</b> <i>interface-id</i>  <b>Example:</b> Switch(config)# <b>interface gigabitEthernet1/0/4</b>	Specifies the address of the client that will receive the configuration file.
<b>Step 15</b>	<b>no switchport</b>  <b>Example:</b> Switch(config-if)# <b>no switchport</b>	Puts the interface into Layer 3 mode.
<b>Step 16</b>	<b>ip address</b> <i>address mask</i>  <b>Example:</b> Switch(config-if)# <b>ip address 10.10.10.1 255.255.255.0</b>	Specifies the IP address and mask for the interface.
<b>Step 17</b>	<b>end</b>  <b>Example:</b> Switch(config-if)# <b>end</b>	Returns to privileged EXEC mode.
<b>Step 18</b>	<b>copy running-config startup-config</b>  <b>Example:</b> Switch(config-if)# <b>end</b>	(Optional) Saves your entries in the configuration file.

**Related Topics**

[Example: Configuring DHCP Auto-Image Update, on page 75](#)

**Configuring the Client to Download Files from DHCP Server**

**Note** You should only configure and enable the Layer 3 interface. Do not assign an IP address or DHCP-based autoconfiguration with a saved configuration.

**SUMMARY STEPS**

1. **configure terminal**
2. **boot host dhcp**
3. **boot host retry timeout** *timeout-value*
4. **banner config-save** ^C *warning-message* ^C
5. **end**
6. **show boot**

**DETAILED STEPS**

	<b>Command or Action</b>	<b>Purpose</b>
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters global configuration mode.
<b>Step 2</b>	<b>boot host dhcp</b>  <b>Example:</b> Switch(conf)# <b>boot host dhcp</b>	Enables autoconfiguration with a saved configuration.
<b>Step 3</b>	<b>boot host retry timeout</b> <i>timeout-value</i>  <b>Example:</b> Switch(conf)# <b>boot host retry timeout 300</b>	(Optional) Sets the amount of time the system tries to download a configuration file.  <b>Note</b> If you do not set a timeout, the system will try indefinitely to obtain an IP address from the DHCP server.
<b>Step 4</b>	<b>banner config-save</b> ^C <i>warning-message</i> ^C  <b>Example:</b> Switch(conf)# <b>banner config-save ^C Caution - Saving Configuration File to NVRAM May Cause You to No longer Automatically</b>	(Optional) Creates warning messages to be displayed when you try to save the configuration file to NVRAM.



	Command or Action	Purpose
	Download Configuration Files at Reboot^C	
<b>Step 5</b>	<b>end</b>  <b>Example:</b> Switch(config-if) # <b>end</b>	Returns to privileged EXEC mode.
<b>Step 6</b>	<b>show boot</b>  <b>Example:</b> Switch# <b>show boot</b>	Verifies the configuration.

### Related Topics

[Example: Configuring a Switch to Download Configurations from a DHCP Server, on page 75](#)

## Manually Assigning IP Information to Multiple SVIs

This task describes how to manually assign IP information to multiple switched virtual interfaces (SVIs):

### SUMMARY STEPS

1. **configure terminal**
2. **interface vlan *vlan-id***
3. **ip address *ip-address subnet-mask***
4. **exit**
5. **ip default-gateway *ip-address***
6. **end**
7. **show interfaces vlan *vlan-id***
8. **show ip redirects**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters global configuration mode.

	Command or Action	Purpose
<b>Step 2</b>	<b>interface vlan</b> <i>vlan-id</i>  <b>Example:</b> Switch(config)# <b>interface vlan 99</b>	Enters interface configuration mode, and enter the VLAN to which the IP information is assigned. The range is 1 to 4094.
<b>Step 3</b>	<b>ip address</b> <i>ip-address subnet-mask</i>  <b>Example:</b> Switch(config-vlan)# <b>ip address 10.10.10.2 255.255.255.0</b>	Enters the IP address and subnet mask.
<b>Step 4</b>	<b>exit</b>  <b>Example:</b> Switch(config-vlan)# <b>exit</b>	Returns to global configuration mode.
<b>Step 5</b>	<b>ip default-gateway</b> <i>ip-address</i>  <b>Example:</b> Switch(config)# <b>ip default-gateway 10.10.10.1</b>	<p>Enters the IP address of the next-hop router interface that is directly connected to the switch where a default gateway is being configured. The default gateway receives IP packets with unresolved destination IP addresses from the switch.</p> <p>Once the default gateway is configured, the switch has connectivity to the remote networks with which a host needs to communicate.</p> <p><b>Note</b> When your switch is configured to route with IP, it does not need to have a default gateway set.</p>
<b>Step 6</b>	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.
<b>Step 7</b>	<b>show interfaces vlan</b> <i>vlan-id</i>  <b>Example:</b> Switch# <b>show interfaces vlan 99</b>	Verifies the configured IP address.
<b>Step 8</b>	<b>show ip redirects</b>  <b>Example:</b> Switch# <b>show ip redirects</b>	Verifies the configured default gateway.

## Configuring the NVRAM Buffer Size

The default NVRAM buffer size is 512 KB. In some cases, the configuration file might be too large to save to NVRAM. Typically, this occurs when you have many switches in a switch stack. You can configure the size of the NVRAM buffer to support larger configuration files. The new NVRAM buffer size is synced to all current and new member switches.


**Note**

After you configure the NVRAM buffer size, reload the switch or switch stack.

When you add a switch to a stack and the NVRAM size differs, the new switch syncs with the stack and reloads automatically.

### SUMMARY STEPS

1. **configure terminal**
2. **boot buffersize** *size*
3. **end**
4. **show boot**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters global configuration mode.
Step 2	<b>boot buffersize</b> <i>size</i>  <b>Example:</b> Switch(config)# <b>boot buffersize 524288</b>	Configures the NVRAM buffersize in KB. The valid range for <i>size</i> is from 4096 to 1048576.
Step 3	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.
Step 4	<b>show boot</b>  <b>Example:</b> Switch# <b>show boot</b>	Verifies the configuration.

**Related Topics**

[Example: Configuring NVRAM Buffer Size, on page 76](#)

## Modifying the Switch Startup Configuration

### Specifying the Filename to Read and Write the System Configuration

By default, the Cisco IOS software uses the `config.text` file to read and write a nonvolatile copy of the system configuration. However, you can specify a different filename, which will be loaded during the next boot cycle.

**Before You Begin**

Use a standalone switch for this task.

**SUMMARY STEPS**

1. `configure terminal`
2. `boot flash:/file-url`
3. `end`
4. `show boot`
5. `copy running-config startup-config`

**DETAILED STEPS**

	Command or Action	Purpose
<b>Step 1</b>	<p><code>configure terminal</code></p> <p><b>Example:</b></p> <pre>Switch# configure terminal</pre>	Enters global configuration mode.
<b>Step 2</b>	<p><code>boot flash:/file-url</code></p> <p><b>Example:</b></p> <pre>Switch(config)# boot flash:config.text</pre>	<p>Specifies the configuration file to load during the next boot cycle.</p> <p><i>file-url</i>—The path (directory) and the configuration filename. Filenames and directory names are case-sensitive.</p>
<b>Step 3</b>	<p><code>end</code></p> <p><b>Example:</b></p> <pre>Switch(config)# end</pre>	Returns to privileged EXEC mode.

	Command or Action	Purpose
<b>Step 4</b>	<b>show boot</b>  <b>Example:</b> Switch# <code>show boot</code>	Verifies your entries.  The <b>boot</b> global configuration command changes the setting of the CONFIG_FILE environment variable.
<b>Step 5</b>	<b>copy running-config startup-config</b>  <b>Example:</b> Switch# <code>copy running-config startup-config</code>	(Optional) Saves your entries in the configuration file.

## Manually Booting the Switch

By default, the switch automatically boots up; however, you can configure it to manually boot up.

### Before You Begin

Use a standalone switch for this task.

### SUMMARY STEPS

1. **configure terminal**
2. **boot manual**
3. **end**
4. **show boot**
5. **copy running-config startup-config**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <code>configure terminal</code>	Enters global configuration mode.
<b>Step 2</b>	<b>boot manual</b>  <b>Example:</b> Switch(config)# <code>boot manual</code>	Enables the switch to manually boot up during the next boot cycle.

	Command or Action	Purpose
<b>Step 3</b>	<b>end</b>  <b>Example:</b> Switch(config) # <b>end</b>	Returns to privileged EXEC mode.
<b>Step 4</b>	<b>show boot</b>  <b>Example:</b> Switch# <b>show boot</b>	Verifies your entries.  The <b>boot manual</b> global command changes the setting of the MANUAL_BOOT environment variable.  The next time you reboot the system, the switch is in boot loader mode, shown by the <i>switch:</i> prompt. To boot up the system, use the <b>boot filesystem:/file-url</b> boot loader command. <ul style="list-style-type: none"> <li>• <i>filesystem:</i>—Uses flash: for the system board flash device. switch: <b>boot flash:</b></li> <li>• For <i>file-url</i>—Specifies the path (directory) and the name of the bootable image.</li> </ul> Filenames and directory names are case-sensitive.
<b>Step 5</b>	<b>copy running-config startup-config</b>  <b>Example:</b> Switch# <b>copy running-config startup-config</b>	(Optional) Saves your entries in the configuration file.

## Configuring a Scheduled Software Image Reload

This task describes how to configure your switch to reload the software image at a later time.

### SUMMARY STEPS

1. **configure terminal**
2. **copy running-config startup-config**
3. **reload in** [*hh:*]*mm* [*text*]
4. **reload at** *hh: mm* [*month day* | *day month*] [*text*]
5. **reload cancel**
6. **show reload**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters global configuration mode.
Step 2	<b>copy running-config startup-config</b>  <b>Example:</b> <b>copy running-config startup-config</b>	Saves your switch configuration information to the startup configuration before you use the <b>reload</b> command.
Step 3	<b>reload in [hh:]mm [text]</b>  <b>Example:</b> Switch(config)# <b>reload in 12</b>  System configuration has been modified. Save? [yes/no]: <b>y</b>	Schedules a reload of the software to take affect in the specified minutes or hours and minutes. The reload must take place within approximately 24 days. You can specify the reason for the reload in a string up to 255 characters in length.
Step 4	<b>reload at hh: mm [month day   day month] [text]</b>  <b>Example:</b> Switch(config)# <b>reload at 14:00</b>	Specifies the time in hours and minutes for the reload to occur.  <b>Note</b> Use the <b>at</b> keyword only if the switch system clock has been set (through Network Time Protocol (NTP), the hardware calendar, or manually). The time is relative to the configured time zone on the switch. To schedule reloads across several switches to occur simultaneously, the time on each switch must be synchronized with NTP.
Step 5	<b>reload cancel</b>  <b>Example:</b> Switch(config)# <b>reload cancel</b>	Cancels a previously scheduled reload.
Step 6	<b>show reload</b>  <b>Example:</b> <b>show reload</b>	Displays information about a previously scheduled reload or identifies if a reload has been scheduled on the switch.

## Monitoring Switch Setup Configuration

### Example: Verifying the Switch Running Configuration

```
Switch# show running-config
```

```

Building configuration...

Current configuration: 1363 bytes
!
version 12.4
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Stack1
!
enable secret 5 $1$ej9.$DMUvAUnZOAmvmgqBEzIxEO
!
.
<output truncated>
.
interface gigabitethernet6/0/2
mvr type source

<output truncated>

...!
interface VLAN1
 ip address 172.20.137.50 255.255.255.0
 no ip directed-broadcast
!
 ip default-gateway 172.20.137.1 !
!
 snmp-server community private RW
 snmp-server community public RO
 snmp-server community private@es0 RW
 snmp-server community public@es0 RO
 snmp-server chassis-id 0x12
!
end

```

## Examples: Displaying Software Install

This example displays software bootup in install mode:

```
switch# boot flash:/c2960x-universalk9-mz-150-2.EX/c2960x-universalk9-mz-150-2.EX.bin
```

# Configuration Examples for Performing Switch Setup

## Example: Configuring a Switch as a DHCP Server

```

Switch# configure terminal
Switch(config)# ip dhcp pool pool1
Switch(dhcp-config)# network 10.10.10.0 255.255.255.0
Switch(dhcp-config)# boot config-boot.text
Switch(dhcp-config)# default-router 10.10.10.1
Switch(dhcp-config)# option 150 10.10.10.1
Switch(dhcp-config)# exit
Switch(config)# tftp-server flash:config-boot.text
Switch(config)# interface gigabitethernet1/0/4
Switch(config-if)# no switchport
Switch(config-if)# ip address 10.10.10.1 255.255.255.0
Switch(config-if)# end

```



**Related Topics**

[Configuring DHCP Autoconfiguration \(Only Configuration File\), on page 60](#)

**Example: Configuring DHCP Auto-Image Update**

```
Switch# configure terminal
Switch(config)# ip dhcp pool pool1
Switch(dhcp-config)# network 10.10.10.0 255.255.255.0
Switch(dhcp-config)# boot config-boot.text
Switch(dhcp-config)# default-router 10.10.10.1
Switch(dhcp-config)# option 150 10.10.10.1
Switch(dhcp-config)# option 125 hex 0000.0009.0a05.08661.7574.6f69.6e73.7461.6c6c.5f64.686370

Switch(dhcp-config)# exit
Switch(config)# tftp-server flash:config-boot.text
Switch(config)# tftp-server flash:image_name
Switch(config)# tftp-server flash:boot-config.text
Switch(config)# tftp-server flash:autoinstall_dhcp
Switch(config)# interface gigabitethernet1/0/4
Switch(config-if)# ip address 10.10.10.1 255.255.255.0
Switch(config-if)# end
```

**Related Topics**

[Configuring DHCP Auto-Image Update \(Configuration File and Image\), on page 62](#)

**Example: Configuring a Switch to Download Configurations from a DHCP Server**

This example uses a Layer 3 SVI interface on VLAN 99 to enable DHCP-based autoconfiguration with a saved configuration:

```
Switch# configure terminal
Switch(config)# boot host dhcp
Switch(config)# boot host retry timeout 300
Switch(config)# banner config-save ^C Caution - Saving Configuration File to NVRAM May Cause
  You to No longer Automatically Download Configuration Files at Reboot^C
Switch(config)# vlan 99
Switch(config-vlan)# interface vlan 99
Switch(config-if)# no shutdown
Switch(config-if)# end
Switch# show boot
BOOT path-list:
Config file:          flash:/config.text
Private Config file:  flash:/private-config.text
Enable Break:         no
Manual Boot:          no
HELPER path-list:
NVRAM/Config file
  buffer size:        32768
Timeout for Config
  Download:           300 seconds
Config Download
  via DHCP:           enabled (next boot: enabled)
Switch#
```

**Related Topics**

[Configuring the Client to Download Files from DHCP Server, on page 66](#)

**Example: Configuring NVRAM Buffer Size**

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# boot buffersize 600000
Switch(config)# end
Switch# show boot
BOOT path-list      :
Config file         : flash:/config.text
Private Config file : flash:/private-config.text
Enable Break        : no
Manual Boot         : no
HELPER path-list    :
Auto upgrade        : yes
Auto upgrade path   :
NVRAM/Config file
  buffer size:      600000
Timeout for Config
  Download:         300 seconds
Config Download
  via DHCP:         enabled (next boot: enabled)
Switch#
```

**Related Topics**

[Configuring the NVRAM Buffer Size, on page 69](#)

**Additional References for Performing Switch Setup****Related Documents**

Related Topic	Document Title
Switch setup commands Boot loader commands	<i>Catalyst 2960-X Switch System Management Command Reference</i>
USB flash devices	<i>Catalyst 2960-X Switch Interface and Hardware Component Configuration Guide</i> <i>Catalyst 2960-X Switch Managing Cisco IOS Image Files Configuration Guide</i>
Hardware installation	<i>Catalyst 2960-X Switch Hardware Installation Guide</i>
Platform-independent command references	<i>Cisco IOS 15.3M&amp;T Command References</i>

Related Topic	Document Title
Platform-independent configuration information	<i>Cisco IOS 15.3M&amp;T Configuration Guides</i>

### Standards and RFCs

Standard/RFC	Title
None	—

### MIBs

MIB	MIBs Link
All supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

### Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<a href="http://www.cisco.com/support">http://www.cisco.com/support</a>

# Feature History and Information For Performing Switch Setup Configuration

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS 15.0(2)EX	This feature was introduced.



## CHAPTER 4

# Configuring SDM Templates

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- [Finding Feature Information, page 79](#)
- [Information About Configuring SDM Templates, page 79](#)
- [How to Configure SDM Templates, page 82](#)
- [Configuration Examples for SDM Templates, page 83](#)
- [Additional References for SDM Templates, page 85](#)
- [Feature History and Information for Configuring SDM Templates, page 86](#)

## Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to <http://www.cisco.com/go/cfn>. An account on Cisco.com is not required.

## Information About Configuring SDM Templates

### Restrictions for SDM Templates

The following are restrictions when using SDM templates:

- The default template is the only template supported on switches running the LAN Lite image.
- The LAN Base default template is used with switches in a homogeneous stack.
- The LAN Base routing template is supported only on switches running the LAN Base image.
- The LAN Base routing template is used with switches in a mixed stack.

- The switch supports homogeneous stacking and mixed stacking. Mixed stacking is supported only with the Catalyst 2960-S switches. A homogenous stack can have up to eight stack members, while a mixed stack can have up to four stack members. All switches in a switch stack must be running the LAN Base image.

## SDM Templates

You can use Switch Database Management (SDM) templates to configure system resources to optimize support for specific features, depending on how your device is used in the network. You can select a template to provide maximum system usage for some functions.

To allocate ternary content addressable memory (TCAM) resources for different usages, the switch SDM templates prioritize system resources to optimize support for certain features. These templates are supported on your device:

- Default—The default template gives balance to all functions.
- LAN Base default—The LAN Base default template is to be used with switches in a homogeneous stack.
- LAN Base routing—The LAN Base routing template supports IPv4 unicast routes for static routing SVI configuration.

The LAN Base routing template prevents other features from using the memory allocated to unicast routing. Routing must be enabled on your switch before you can use the routing template.

For more information about homogeneous and mixed stacks, see the *Catalyst 2960-X Switch Stacking Configuration Guide*.

After you change the template and the system reboots, you can use the **show sdm prefer** privileged EXEC command to verify the new template configuration. If you enter the **show sdm prefer** command before you enter the **reload** privileged EXEC command, the **show sdm prefer** command shows the template currently in use and the template that becomes active after a reload.

## Default and LAN Base Templates

- Default and LAN Base routing templates—Optimizes the resources in the switch to support feature level for no routed interfaces and 255 VLANs.
- LAN Base default—Optimizes the resources in the switch to support feature level for no routed interfaces and 1024 VLANs.

**Table 9: Approximate Number of Feature Resources Allowed by Templates**

Resource	Default	LAN Base Default	LAN Base Routing	LAN Lite
Unicast MAC addresses	8 K	16 k	4 K	16 k
Active VLANs/VLAN IDs	255/4096	255/1024	255/4096	64/4096

Resource	Default	LAN Base Default	LAN Base Routing	LAN Lite
NetFlow Entries	16 K	—	—	—
IPv4 IGMP groups	.375 K	1 K	.375 K	1 K
IPv4 unicast routes	0	3 K	.875 K	0
• Directly connected hosts	0	2 K	.875 K	0
• Indirect routes	0	1 K	80	0
IPv4 policy based routing ACEs	0	0	0	0
IPv6 multicast groups:	.25 K	1 K	.25 K	0
• Directly connected IPv6 addresses	.25 K	2 K	.75 K	0
• Indirect IPv6 unicast routes	32	1 K	32	0
IPv6 policy based routing ACEs	0	0	0	0
IPv4 MAC QoS ACEs	.375 K	.5 K	.375 K	.256 K
IPv4 MAC security ACEs	.375 K	.625 K	.375 K	.256 K
IPv6 policy based routing ACEs	0	0	0	0
IPv6 QoS ACEs	60	.5 K	.125 K	0

Resource	Default	LAN Base Default	LAN Base Routing	LAN Lite
IPv6 security ACEs	.125 K	.625 K	.25	0

### Related Topics

[Examples: Displaying SDM Templates, on page 83](#)

[Setting the SDM Template, on page 82](#)

## SDM Templates and Switch Stacks

All stack members use the same SDM template that is stored on the stack master. When a new switch is added to a stack, as with the switch configuration and VLAN database files, the SDM configuration that is stored on the stack master overrides the template configured on an individual switch.

Version-mismatch (VM) mode has priority over SDM-mismatch mode. If a VM mode condition and an SDM-mismatch mode exist, the switch stack first attempts to resolve the VM-mode condition. You can use the **show switch** privileged EXEC command to see if any stack members are in SDM-mismatch mode.

## How to Configure SDM Templates

### Setting the SDM Template

Follow these steps to use the SDM template to maximize feature usage:

#### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **sdm prefer { default | lanbase-default | lanbase-routing }**
4. **end**
5. **reload**

#### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b>  <b>Example:</b> Switch> <b>enable</b>	Enables privileged EXEC mode. Enter your password if prompted.



	Command or Action	Purpose
Step 2	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
Step 3	<b>sdm prefer { default   lanbase-default   lanbase-routing }</b>  <b>Example:</b> Switch(config)# <b>sdm prefer lanbase-routing</b>	Specifies the SDM template to be used on the switch. The keywords have these meanings: <ul style="list-style-type: none"> <li>• <b>default</b> —The default template provides balance for all Layer 2, IPv4 and IPv6 functionality.</li> <li>• <b>lanbase-default</b> —The LAN Base default template provides both IPv4 and IPv6 static routing functionality.</li> <li>• <b>lanbase-routing</b> —The LAN Base routing templates provides both IPv4 and IPv6 static routing functionality.</li> </ul> Use the <b>no sdm prefer</b> command to set the switch to the default template. The default template balances the use of system resources.
Step 4	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.
Step 5	<b>reload</b>  <b>Example:</b> Switch# <b>reload</b>	Reloads the operating system.

## Configuration Examples for SDM Templates

### Examples: Displaying SDM Templates

This is an example output showing the default template information.

```
Switch# show sdm prefer default

"default" template:
The selected template optimizes the resources in
the switch to support this level of features for
0 routed interfaces and 255 VLANs.

number of unicast mac addresses:                8K
```

```

number of IPv4 IGMP groups + multicast routes: 0.375k
number of IPv4 unicast routes: 0
number of IPv6 multicast groups: 0.25K
number of directly-connected IPv6 addresses: 0.25K
number of indirect IPv6 unicast routes: 32
number of IPv4 policy based routing aces: 0
number of IPv4/MAC qos aces: 0.375k
number of IPv4/MAC security aces: 0.375k
number of IPv6 policy based routing aces: 0
number of IPv6 qos aces: 60
number of IPv6 security aces: 0.125k

```

Switch#

This is an example output showing the LAN Base default template information.

Switch# **show sdm prefer lanbase-default**

```

"lanbase-default" template:
The selected template optimizes the resources in
the switch to support this level of features for
0 routed interfaces and 1024 VLANs.

```

```

number of unicast mac addresses: 16K
number of IPv4 IGMP groups + multicast routes: 1K
number of IPv4 unicast routes: 3K
  number of directly-connected IPv4 hosts: 2K
  number of indirect IPv4 routes: 1K
number of IPv6 multicast groups: 1K
number of directly-connected IPv6 addresses: 2K
number of indirect IPv6 unicast routes: 1K
number of IPv4 policy based routing aces: 0
number of IPv4/MAC qos aces: 0.5K
number of IPv4/MAC security aces: 0.625k
number of IPv6 policy based routing aces: 0
number of IPv6 qos aces: 0.5K
number of IPv6 security aces: 0.625k

```

Switch#

This is an example output showing the LAN Base routing template information.

Switch# **show sdm prefer lanbase-routing**

```

"lanbase-routing" template:
The selected template optimizes the resources in
the switch to support this level of features for
0 routed interfaces and 255 VLANs.

```

```

number of unicast mac addresses: 4K
number of IPv4 IGMP groups + multicast routes: 0.375k
number of IPv4 unicast routes: 0.875k
  number of directly-connected IPv4 hosts: 0.875k
  number of indirect IPv4 routes: 80
number of IPv6 multicast groups: 0.25K
number of directly-connected IPv6 addresses: 0.75K
number of indirect IPv6 unicast routes: 32
number of IPv4 policy based routing aces: 0
number of IPv4/MAC qos aces: 0.375k
number of IPv4/MAC security aces: 0.375k
number of IPv6 policy based routing aces: 0
number of IPv6 qos aces: 0.125k
number of IPv6 security aces: 0.25K

```

Switch#

## Examples: Configuring SDM Templates

This example shows how to configure the VLAN template:

```
Switch(config)# sdm prefer lanbase-routing
Switch(config)# exit
Switch# reload
Proceed with reload? [confirm]
```

## Additional References for SDM Templates

### Related Documents

Related Topic	Document Title
SDM commands	<i>Catalyst 2960-X Switch System Management Command Reference</i>

### Standards and RFCs

Standard/RFC	Title
None	—

### MIBs

MIB	MIBs Link
All supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:  <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

**Technical Assistance**

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<p><a href="http://www.cisco.com/support">http://www.cisco.com/support</a></p>

**Feature History and Information for Configuring SDM Templates**

Release	Modification
Cisco IOS 15.0(2)EX	This feature was introduced.



## Configuring System Message Logs

- [Information About Configuring System Message Logs, page 87](#)
- [How to Configure System Message Logs, page 90](#)
- [Monitoring and Maintaining System Message Logs, page 99](#)
- [Configuration Examples for System Message Logs, page 99](#)
- [Additional References for System Message Logs, page 101](#)
- [Feature History and Information For System Message Logs, page 102](#)

### Information About Configuring System Message Logs

#### System Message Logging

By default, a switch sends the output from system messages and **debug** privileged EXEC commands to a logging process. Stack members can trigger system messages. A stack member that generates a system message appends its hostname in the form of hostname-n, where n is a switch range from 1 to 8, and redirects the output to the logging process on the active switchstack master. Though the active switchstack master is a stack member, it does not append its hostname to system messages. The logging process controls the distribution of logging messages to various destinations, such as the logging buffer, terminal lines, or a UNIX syslog server, depending on your configuration. The process also sends messages to the console.

When the logging process is disabled, messages are sent only to the console. The messages are sent as they are generated, so message and debug output are interspersed with prompts or output from other commands. Messages appear on the active consoles after the process that generated them has finished.

You can set the severity level of the messages to control the type of messages displayed on the consoles and each of the destinations. You can time-stamp log messages or set the syslog source address to enhance real-time debugging and management. For information on possible messages, see the system message guide for this release.

You can access logged system messages by using the switch command-line interface (CLI) or by saving them to a properly configured syslog server. The switch software saves syslog messages in an internal buffer on a standalone switch, and in the case of a switch stack, on the active switchstack master. If a standalone switch or the stack master fails, the log is lost unless you had saved it to flash memory.

You can remotely monitor system messages by viewing the logs on a syslog server or by accessing the switch through Telnet, through the console port, or through the Ethernet management port. In a switch stack, all stack member consoles provide the same console output.



**Note** The syslog format is compatible with 4.3 BSD UNIX.

## System Log Message Format

System log messages can contain up to 80 characters and a percent sign (%), which follows the optional sequence number or time-stamp information, if configured. Depending on the switch, messages appear in one of these formats:

- *seq no:timestamp: %facility-severity-MNEMONIC:description (hostname-n)*
- *seq no:timestamp: %facility-severity-MNEMONIC:description*

The part of the message preceding the percent sign depends on the setting of these global configuration commands:

- **service sequence-numbers**
- **service timestamps log datetime**
- **service timestamps log datetime [localtime] [msec] [show-timezone]**
- **service timestamps log uptime**

**Table 10: System Log Message Elements**

Element	Description
<i>seq no:</i>	Stamps log messages with a sequence number only if the <b>service sequence-numbers</b> global configuration command is configured.
<i>timestamp</i> formats: <i>mm/dd h h:mm:ss</i> or <i>hh:mm:ss</i> (short uptime) or <i>d h</i> (long uptime)	Date and time of the message or event. This information appears only if the <b>service timestamps log [datetime   log]</b> global configuration command is configured.
<i>facility</i>	The facility to which the message refers (for example, SNMP, SYS, and so forth).
<i>severity</i>	Single-digit code from 0 to 7 that is the severity of the message.

Element	Description
<i>MNEMONIC</i>	Text string that uniquely describes the message.
<i>description</i>	Text string containing detailed information about the event being reported.
<i>hostname-n</i>	Hostname of a stack member and its switch number in the stack. Though the active switchstack master is a stack member, it does <i>not</i> append its hostname to system messages.

## Default System Message Logging Settings

**Table 11: Default System Message Logging Settings**

Feature	Default Setting
System message logging to the console	Enabled.
Console severity	Debugging.
Logging file configuration	No filename specified.
Logging buffer size	4096 bytes.
Logging history size	1 message.
Time stamps	Disabled.
Synchronous logging	Disabled.
Logging server	Disabled.
Syslog server IP address	None configured.
Server facility	Local7
Server severity	Informational.

## Syslog Message Limits

If you enabled syslog message traps to be sent to an SNMP network management station by using the **snmp-server enable trap** global configuration command, you can change the level of messages sent and

stored in the switch history table. You also can change the number of messages that are stored in the history table.

Messages are stored in the history table because SNMP traps are not guaranteed to reach their destination. By default, one message of the level **warning** and numerically lower levels are stored in the history table even if syslog traps are not enabled.

When the history table is full (it contains the maximum number of message entries specified with the **logging history size** global configuration command), the oldest message entry is deleted from the table to allow the new message entry to be stored.

The history table lists the level keywords and severity level. For SNMP usage, the severity level values increase by 1. For example, *emergencies* equal 1, not 0, and *critical* equals 3, not 2.

# How to Configure System Message Logs

## Setting the Message Display Destination Device

If message logging is enabled, you can send messages to specific locations in addition to the console.

This task is optional.

### SUMMARY STEPS

1. **configure terminal**
2. **logging buffered** *[size]*
3. **logging** *host*
4. **logging file flash:** *filename* *[max-file-size [min-file-size]]* *[severity-level-number | type]*
5. **end**
6. **terminal monitor**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters global configuration mode.
<b>Step 2</b>	<b>logging buffered</b> <i>[size]</i>  <b>Example:</b> Switch(config)# <b>logging buffered 8192</b>	Logs messages to an internal buffer on the switch or on a standalone switch or, in the case of a switch stack, on the active switchstack master. The range is 4096 to 2147483647 bytes. The default buffer size is 4096 bytes.  If a standalone switch or the active switchstack master fails, the log file is lost unless you previously saved it to flash memory. See Step 4.



	Command or Action	Purpose
		<p><b>Note</b> Do not make the buffer size too large because the switch could run out of memory for other tasks. Use the <b>show memory</b> privileged EXEC command to view the free processor memory on the switch. However, this value is the maximum available, and the buffer size should <i>not</i> be set to this amount.</p>
<b>Step 3</b>	<p><b>logging</b> <i>host</i></p> <p><b>Example:</b></p> <pre>Switch(config)# logging 125.1.1.100</pre>	<p>Logs messages to a UNIX syslog server host.</p> <p><i>host</i> specifies the name or IP address of the host to be used as the syslog server.</p> <p>To build a list of syslog servers that receive logging messages, enter this command more than once.</p>
<b>Step 4</b>	<p><b>logging file flash:</b> <i>filename</i>  [<i>max-file-size</i> [<i>min-file-size</i>]]  [<i>severity-level-number</i>   <i>type</i>]</p> <p><b>Example:</b></p> <pre>Switch(config)# logging file flash:log_msg.txt 40960 4096 3</pre>	<p>Stores log messages in a file in flash memory on a standalone switch or, in the case of a switch stack, on the active switchstack master.</p> <ul style="list-style-type: none"> <li>• <i>filename</i>—Enters the log message filename.</li> <li>• (Optional) <b>max-file-size</b> —Specifies the maximum logging file size. The range is 4096 to 2147483647. The default is 4096 bytes.</li> <li>• (Optional) <i>min-file-size</i>—Specifies the minimum logging file size. The range is 1024 to 2147483647. The default is 2048 bytes.</li> <li>• (Optional) <i>severity-level-number</i>   <i>type</i>—Specifies either the logging severity level or the logging type. The severity range is 0 to 7.</li> </ul>
<b>Step 5</b>	<p><b>end</b></p> <p><b>Example:</b></p> <pre>Switch(config)# end</pre>	<p>Returns to privileged EXEC mode.</p>
<b>Step 6</b>	<p><b>terminal monitor</b></p> <p><b>Example:</b></p> <pre>Switch# terminal monitor</pre>	<p>Logs messages to a nonconsole terminal during the current session.</p> <p>Terminal parameter-setting commands are set locally and do not remain in effect after the session has ended. You must perform this step for each session to see the debugging messages.</p>

## Synchronizing Log Messages

You can synchronize unsolicited messages and **debug** privileged EXEC command output with solicited device output and prompts for a specific console port line or virtual terminal line. You can identify the types of messages to be output asynchronously based on the level of severity. You can also configure the maximum number of buffers for storing asynchronous messages for the terminal after which messages are dropped.

When synchronous logging of unsolicited messages and **debug** command output is enabled, unsolicited device output appears on the console or printed after solicited device output appears or is printed. Unsolicited messages

and **debug** command output appears on the console after the prompt for user input is returned. Therefore, unsolicited messages and **debug** command output are not interspersed with solicited device output and prompts. After the unsolicited messages appear, the console again displays the user prompt.

This task is optional.

## SUMMARY STEPS

1. **configure terminal**
2. **line** [**console** | **vty**] *line-number* [*ending-line-number*]
3. **logging synchronous** [**level** [*severity-level* | **all**] | **limit** *number-of-buffers*]
4. **end**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters global configuration mode.
<b>Step 2</b>	<b>line</b> [ <b>console</b>   <b>vty</b> ] <i>line-number</i> [ <i>ending-line-number</i> ]  <b>Example:</b> Switch(config)# <b>line console</b>	Specifies the line to be configured for synchronous logging of messages. <ul style="list-style-type: none"> <li>• <b>console</b>—Specifies configurations that occur through the switch console port or the Ethernet management port.</li> <li>• <b>line vty</b> <i>line-number</i>—Specifies which vty lines are to have synchronous logging enabled. You use a vty connection for configurations that occur through a Telnet session. The range of line numbers is from 0 to 15.</li> </ul> <p>You can change the setting of all 16 vty lines at once by entering:</p> <pre>line vty 0 15</pre> <p>You can also change the setting of the single vty line being used for your current connection. For example, to change the setting for vty line 2, enter:</p> <pre>line vty 2</pre> <p>When you enter this command, the mode changes to line configuration.</p>
<b>Step 3</b>	<b>logging synchronous</b> [ <b>level</b> [ <i>severity-level</i>   <b>all</b> ]   <b>limit</b> <i>number-of-buffers</i> ]  <b>Example:</b> Switch(config)# <b>logging synchronous level 3 limit 1000</b>	Enables synchronous logging of messages. <ul style="list-style-type: none"> <li>• (Optional) <b>level</b> <i>severity-level</i>—Specifies the message severity level. Messages with a severity level equal to or higher than this value are printed asynchronously. Low numbers mean greater severity and high numbers mean lesser severity. The default is 2.</li> <li>• (Optional) <b>level all</b>—Specifies that all messages are printed asynchronously regardless of the severity level.</li> </ul>

	Command or Action	Purpose
		<ul style="list-style-type: none"> <li>(Optional) <b>limit number-of-buffers</b>—Specifies the number of buffers to be queued for the terminal after which new messages are dropped. The range is 0 to 2147483647. The default is 20.</li> </ul>
<b>Step 4</b>	<b>end</b>  <b>Example:</b>  Switch(config)# <b>end</b>	Returns to privileged EXEC mode.

## Disabling Message Logging

Message logging is enabled by default. It must be enabled to send messages to any destination other than the console. When enabled, log messages are sent to a logging process, which logs messages to designated locations asynchronously to the processes that generated the messages.

Disabling the logging process can slow down the switch because a process must wait until the messages are written to the console before continuing. When the logging process is disabled, messages appear on the console as soon as they are produced, often appearing in the middle of command output.

The **logging synchronous** global configuration command also affects the display of messages to the console. When this command is enabled, messages appear only after you press **Return**.

To reenable message logging after it has been disabled, use the **logging on** global configuration command.

This task is optional.

### SUMMARY STEPS

1. **configure terminal**
2. **no logging console**
3. **end**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b>  Switch# <b>configure terminal</b>	Enters global configuration mode.

	Command or Action	Purpose
<b>Step 2</b>	<b>no logging console</b>  <b>Example:</b> Switch(config)# <b>no logging console</b>	Disables message logging.
<b>Step 3</b>	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.

## Enabling and Disabling Time Stamps on Log Messages

By default, log messages are not time-stamped.

This task is optional.

### SUMMARY STEPS

- 1. configure terminal**
- Use one of these commands:
  - **service timestamps log uptime**
  - **service timestamps log datetime[msec | localtime | show-timezone]**
- 3. end**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters global configuration mode.
<b>Step 2</b>	Use one of these commands: <ul style="list-style-type: none"> <li>• <b>service timestamps log uptime</b></li> <li>• <b>service timestamps log datetime[msec   localtime   show-timezone]</b></li> </ul>	Enables log time stamps. <ul style="list-style-type: none"> <li>• <b>log uptime</b>—Enables time stamps on log messages, showing the time since the system was rebooted.</li> <li>• <b>log datetime</b>—Enables time stamps on log messages. Depending on the options selected, the time stamp can</li> </ul>

	Command or Action	Purpose
	<b>Example:</b> Switch(config)# <b>service timestamps log uptime</b>  or Switch(config)# <b>service timestamps log datetime</b>	include the date, time in milliseconds relative to the local time zone, and the time zone name.
<b>Step 3</b>	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.

## Enabling and Disabling Sequence Numbers in Log Messages

If there is more than one log message with the same time stamp, you can display messages with sequence numbers to view these messages. By default, sequence numbers in log messages are not displayed.

This task is optional.

### SUMMARY STEPS

1. **configure terminal**
2. **service sequence-numbers**
3. **end**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters global configuration mode.
<b>Step 2</b>	<b>service sequence-numbers</b>  <b>Example:</b> Switch(config)# <b>service sequence-numbers</b>	Enables sequence numbers.

	Command or Action	Purpose
Step 3	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.

## Defining the Message Severity Level

Limit messages displayed to the selected device by specifying the severity level of the message.

This task is optional.

### SUMMARY STEPS

1. **configure terminal**
2. **logging console *level***
3. **logging monitor *level***
4. **logging trap *level***
5. **end**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters global configuration mode.
Step 2	<b>logging console <i>level</i></b>  <b>Example:</b> Switch(config)# <b>logging console 3</b>	Limits messages logged to the console.  By default, the console receives debugging messages and numerically lower levels.
Step 3	<b>logging monitor <i>level</i></b>  <b>Example:</b> Switch(config)# <b>logging monitor 3</b>	Limits messages logged to the terminal lines.  By default, the terminal receives debugging messages and numerically lower levels.
Step 4	<b>logging trap <i>level</i></b>	Limits messages logged to the syslog servers.

	Command or Action	Purpose
	<b>Example:</b> <pre>Switch(config)# logging trap 3</pre>	By default, syslog servers receive informational messages and numerically lower levels.
<b>Step 5</b>	<b>end</b>  <b>Example:</b> <pre>Switch(config)# end</pre>	Returns to privileged EXEC mode.

## Limiting Syslog Messages Sent to the History Table and to SNMP

This task explains how to limit syslog messages that are sent to the history table and to SNMP.

This task is optional.

### SUMMARY STEPS

1. **configure terminal**
2. **logging history *level***
3. **logging history size *number***
4. **end**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> <pre>Switch# configure terminal</pre>	Enters global configuration mode.
<b>Step 2</b>	<b>logging history <i>level</i></b>  <b>Example:</b> <pre>Switch(config)# logging history 3</pre>	<p>Changes the default level of syslog messages stored in the history file and sent to the SNMP server.</p> <p>By default, <b>warnings</b>, <b>errors</b>, <b>critical</b>, <b>alerts</b>, and <b>emergencies</b> messages are sent.</p>

	Command or Action	Purpose
<b>Step 3</b>	<b>logging history size</b> <i>number</i>  <b>Example:</b> Switch(config)# <b>logging history size 200</b>	Specifies the number of syslog messages that can be stored in the history table.  The default is to store one message. The range is 0 to 500 messages.
<b>Step 4</b>	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.

## Logging Messages to a UNIX Syslog Daemon

This task is optional.



### Note

Some recent versions of UNIX syslog daemons no longer accept by default syslog packets from the network. If this is the case with your system, use the UNIX **man syslogd** command to decide what options must be added to or removed from the syslog command line to enable logging of remote syslog messages.

### Before You Begin

- Log in as root.
- Before you can send system log messages to a UNIX syslog server, you must configure the syslog daemon on a UNIX server.

### SUMMARY STEPS

1. Add a line to the file `/etc/syslog.conf`.
2. Enter these commands at the UNIX shell prompt.
3. Make sure the syslog daemon reads the new changes.

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	Add a line to the file <code>/etc/syslog.conf</code> .	• <b>local7</b> —Specifies the logging facility.



	Command or Action	Purpose
	<p><b>Example:</b></p> <pre>local17.debug /usr/adm/logs/cisco.log</pre>	<ul style="list-style-type: none"> <li><b>debug</b>—Specifies the syslog level. The file must already exist, and the syslog daemon must have permission to write to it.</li> </ul>
<b>Step 2</b>	<p>Enter these commands at the UNIX shell prompt.</p> <p><b>Example:</b></p> <pre>\$ touch /var/log/cisco.log \$ chmod 666 /var/log/cisco.log</pre>	Creates the log file. The syslog daemon sends messages at this level or at a more severe level to this file.
<b>Step 3</b>	<p>Make sure the syslog daemon reads the new changes.</p> <p><b>Example:</b></p> <pre>\$ kill -HUP `cat /etc/syslog.pid`</pre>	For more information, see the <b>man syslog.conf</b> and <b>man syslogd</b> commands on your UNIX system.

## Monitoring and Maintaining System Message Logs

### Monitoring Configuration Archive Logs

Command	Purpose
<pre>show archive log config {all   number [end-number]   user username [session number] number [end-number]   statistics} [provisioning]</pre>	Displays the entire configuration log or the log for specified parameters.

## Configuration Examples for System Message Logs

### Example: Stacking System Message

This example shows a partial switch system message for active switchstack master and a stack member (hostname *Switch-2*):

```
00:00:46: %LINK-3-UPDOWN: Interface Port-channell, changed state to up
00:00:47: %LINK-3-UPDOWN: Interface GigabitEthernet1/0/1, changed state to up
```

## Example: Switch System Message

```

00:00:47: %LINK-3-UPDOWN: Interface GigabitEthernet1/0/2, changed state to up
00:00:48: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to down
00:00:48: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed
state to down 2
*Mar  1 18:46:11: %SYS-5-CONFIG_I: Configured from console by vty2 (10.34.195.36)
18:47:02: %SYS-5-CONFIG_I: Configured from console by vty2 (10.34.195.36)
*Mar  1 18:48:50.483 UTC: %SYS-5-CONFIG_I: Configured from console by vty2 (10.34.195.36)

00:00:46: %LINK-3-UPDOWN: Interface Port-channell1, changed state to up (Switch-2)
00:00:47: %LINK-3-UPDOWN: Interface GigabitEthernet2/0/1, changed state to up (Switch-2)
00:00:47: %LINK-3-UPDOWN: Interface GigabitEthernet2/0/2, changed state to up (Switch-2)
00:00:48: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to down
(Switch-2)
00:00:48: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet2/0/1, changed
state to down 2 (Switch-2)

```

## Example: Switch System Message

This example shows a partial switch system message on a switch:

```

00:00:46: %LINK-3-UPDOWN: Interface Port-channell1, changed state to up
00:00:47: %LINK-3-UPDOWN: Interface GigabitEthernet0/1, changed state to up
00:00:47: %LINK-3-UPDOWN: Interface GigabitEthernet0/2, changed state to up
00:00:48: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to down
00:00:48: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state
to down 2
*Mar  1 18:46:11: %SYS-5-CONFIG_I: Configured from console by vty2 (10.34.195.36)
18:47:02: %SYS-5-CONFIG_I: Configured from console by vty2 (10.34.195.36)
*Mar  1 18:48:50.483 UTC: %SYS-5-CONFIG_I: Configured from console by vty2 (10.34.195.36)

```

## Examples: Displaying Service Timestamps Log

This example shows part of a logging display with the **service timestamps log datetime** global configuration command enabled:

```

*Mar  1 18:46:11: %SYS-5-CONFIG_I: Configured from console by vty2 (10.34.195.36)
(Switch-2)

```

This example shows part of a logging display with the **service timestamps log uptime** global configuration command enabled:

```

00:00:46: %LINK-3-UPDOWN: Interface Port-channell1, changed state to up (Switch-2)

```

This example shows part of a logging display with the sequence numbers enabled.

```

000019: %SYS-5-CONFIG_I: Configured from console by vty2 (10.34.195.36) (Switch-2)

```

## Additional References for System Message Logs

### Related Documents

Related Topic	Document Title
System message log commands	<i>Catalyst 2960-X Switch System Management Command Reference</i>
Platform-independent command references	<i>Cisco IOS 15.3M&amp;T Command References</i>
Platform-independent configuration information	<i>Cisco IOS 15.3M&amp;T Configuration Guides</i>

### Standards and RFCs

Standard/RFC	Title
None	—

### MIBs

MIB	MIBs Link
All supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

### Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<a href="http://www.cisco.com/support">http://www.cisco.com/support</a>

## Feature History and Information For System Message Logs

Release	Modification
Cisco IOS 15.0(2)EX	This feature was introduced.



## CHAPTER 6

# Configuring Online Diagnostics

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- [How to Configure Online Diagnostics](#), page 104
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- [Configuration Examples for Online Diagnostic Tests](#), page 109
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## Information About Configuring Online Diagnostics

### Online Diagnostics

With online diagnostics, you can test and verify the hardware functionality of the Switch while the Switch is connected to a live network.

The online diagnostics contain packet switching tests that check different hardware components and verify the data path and the control signals.

The online diagnostics detect problems in these areas:

- Hardware components
- Interfaces (Ethernet ports and so forth)
- Solder joints

Online diagnostics are categorized as on-demand, scheduled, or health-monitoring diagnostics. On-demand diagnostics run from the CLI; scheduled diagnostics run at user-designated intervals or at specified times when the Switch is connected to a live network; and health-monitoring runs in the background with user-defined intervals. By default, the health-monitoring test runs for every 30 seconds.

After you configure online diagnostics, you can manually start diagnostic tests or display the test results. You can also see which tests are configured for the Switch or switch stack and the diagnostic tests that have already run.

# How to Configure Online Diagnostics

## Starting Online Diagnostic Tests

After you configure diagnostic tests to run on the switch, use the **diagnostic start** privileged EXEC command to begin diagnostic testing.

After starting the tests, you cannot stop the testing process.

Use this privileged EXEC command to manually start online diagnostic testing.

### SUMMARY STEPS

1. **diagnostic start switch *number* test {*name* | *test-id* | *test-id-range* | **all** | **basic** | **non-disruptive** }**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>diagnostic start switch <i>number</i> test {<i>name</i>   <i>test-id</i>   <i>test-id-range</i>   <b>all</b>   <b>basic</b>   <b>non-disruptive</b> }</b>  <b>Example:</b>  <pre>Switch# diagnostic start switch 2 test basic</pre>	Starts the diagnostic tests.  The <b>switch <i>number</i></b> keyword is supported only on stacking switches. The range is from 1 to 8.  You can specify the tests by using one of these options: <ul style="list-style-type: none"> <li>• <b><i>name</i></b>—Enters the name of the test.</li> <li>• <b><i>test-id</i></b>—Enters the ID number of the test.</li> <li>• <b><i>test-id-range</i></b>—Enters the range of test IDs by using integers separated by a comma and a hyphen.</li> <li>• <b><b>all</b></b>—Starts all of the tests.</li> <li>• <b><b>basic</b></b>— Starts the basic test suite.</li> <li>• <b><b>non-disruptive</b></b>—Starts the non-disruptive test suite.</li> </ul>

## Configuring Online Diagnostics

You must configure the failure threshold and the interval between tests before enabling diagnostic monitoring.

## Scheduling Online Diagnostics

You can schedule online diagnostics to run at a designated time of day or on a daily, weekly, or monthly basis for a switch. Use the **no** form of this command to remove the scheduling.

## SUMMARY STEPS

1. **configure terminal**
2. **diagnostic schedule switch** *number* **test** {*name* | *test-id* | *test-id-range* | **all** | **basic** | **non-disruptive** } {**daily** | **on** *mm dd yyyy hh:mm* | **weekly** *day-of-week hh:mm*}

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b>  <b>Example:</b>  Switch# <b>configure terminal</b>	Enters global configuration mode.
Step 2	<b>diagnostic schedule switch</b> <i>number</i> <b>test</b> { <i>name</i>   <i>test-id</i>   <i>test-id-range</i>   <b>all</b>   <b>basic</b>   <b>non-disruptive</b> } { <b>daily</b>   <b>on</b> <i>mm dd yyyy hh:mm</i>   <b>weekly</b> <i>day-of-week hh:mm</i> }  <b>Example:</b>  Switch(config)# <b>diagnostic schedule switch 1 test 1-5 on July 3 2013 23:10</b>	<p>Schedules on-demand diagnostic tests for a specific day and time.</p> <p>The <b>switch</b> <i>number</i> keyword is supported only on stacking switches. The range is from 1 to 8.</p> <p>When specifying the tests to be scheduled, use these options:</p> <ul style="list-style-type: none"> <li>• <i>name</i>—Name of the test that appears in the <b>show diagnostic content</b> command output.</li> <li>• <i>test-id</i>—ID number of the test that appears in the <b>show diagnostic content</b> command output.</li> <li>• <i>test-id-range</i>—ID numbers of the tests that appear in the <b>show diagnostic content</b> command output.</li> <li>• <b>all</b>—All test IDs.</li> <li>• <b>basic</b>—Starts the basic on-demand diagnostic tests.</li> <li>• <b>non-disruptive</b>—Starts the non-disruptive test suite.</li> </ul> <p>You can schedule the tests as follows:</p> <ul style="list-style-type: none"> <li>• <b>Daily</b>—Use the <b>daily</b> <i>hh:mm</i> parameter.</li> <li>• <b>Specific day and time</b>—Use the <b>on</b> <i>mm dd yyyy hh:mm</i> parameter.</li> <li>• <b>Weekly</b>—Use the <b>weekly</b> <i>day-of-week hh:mm</i> parameter.</li> </ul>

## Configuring Health-Monitoring Diagnostics

You can configure health-monitoring diagnostic testing on a Switch while it is connected to a live network. You can configure the execution interval for each health-monitoring test, enable the Switch to generate a syslog message because of a test failure, and enable a specific test.

Use the **no** form of this command to disable testing.

By default, health monitoring is disabled, but the Switch generates a syslog message when a test fails.

Follow these steps to configure and enable the health-monitoring diagnostic tests:

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **diagnostic monitor interval switch** *number* **test** {*name* | *test-id* | *test-id-range* | **all**} *hh:mm:ss milliseconds* *day*
4. **diagnostic monitor syslog**
5. **diagnostic monitor threshold switch** *number* **test** {*name* | *test-id* | *test-id-range* | **all**} **failure count** *count*
6. **diagnostic monitor switch** *number* **test** {*name* | *test-id* | *test-id-range* | **all**}
7. **end**
8. **show running-config**
9. **copy running-config startup-config**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Switch> <b>enable</b>	Enables privileged EXEC mode. Enter your password if prompted.
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
<b>Step 3</b>	<b>diagnostic monitor interval switch</b> <i>number</i> <b>test</b> { <i>name</i>   <i>test-id</i>   <i>test-id-range</i>   <b>all</b> } <i>hh:mm:ss milliseconds</i> <i>day</i>  <b>Example:</b> Switch(config)# <b>diagnostic monitor interval switch</b> 2 <b>test</b> 1 12:30:00 750 5	Configures the health-monitoring interval of the specified tests. The <b>switch</b> <i>number</i> keyword is supported only on stacking switches. When specifying the tests, use one of these parameters: <ul style="list-style-type: none"> <li>• <i>name</i>—Name of the test that appears in the <b>show diagnostic content</b> command output.</li> <li>• <i>test-id</i>—ID number of the test that appears in the <b>show diagnostic content</b> command output.</li> <li>• <i>test-id-range</i>—ID numbers of the tests that appear in the <b>show diagnostic content</b> command output.</li> <li>• <b>all</b>—All of the diagnostic tests.</li> </ul> When specifying the interval, set these parameters:



	Command or Action	Purpose
		<ul style="list-style-type: none"> <li>• <i>hh:mm:ss</i>—Monitoring interval in hours, minutes, and seconds. The range for <i>hh</i> is 0 to 24, and the range for <i>mm</i> and <i>ss</i> is 0 to 60.</li> <li>• <i>milliseconds</i>—Monitoring interval in milliseconds (ms). The range is from 0 to 999.</li> <li>• <i>day</i>—Monitoring interval in the number of days. The range is from 0 to 20.</li> </ul>
<b>Step 4</b>	<p><b>diagnostic monitor syslog</b></p> <p><b>Example:</b></p> <pre>Switch(config)# diagnostic monitor syslog</pre>	<p>(Optional) Configures the switch to generate a syslog message when a health-monitoring test fails.</p>
<b>Step 5</b>	<p><b>diagnostic monitor threshold switch</b> <i>number test {name   test-id   test-id-range   all} failure count count</i></p> <p><b>Example:</b></p> <pre>Switch(config)# diagnostic monitor threshold switch 2 test 1 failure count 20</pre>	<p>(Optional) Sets the failure threshold for the health-monitoring tests. The <b>switch number</b> keyword is supported only on stacking switches. The range is from 1 to 8.</p> <p>When specifying the tests, use one of these parameters:</p> <ul style="list-style-type: none"> <li>• <i>name</i>—Name of the test that appears in the <b>show diagnostic content</b> command output.</li> <li>• <i>test-id</i>—ID number of the test that appears in the <b>show diagnostic content</b> command output.</li> <li>• <i>test-id-range</i>—ID numbers of the tests that appear in the <b>show diagnostic content</b> command output.</li> <li>• <b>all</b>—All of the diagnostic tests.</li> </ul> <p>The range for the failure threshold <i>count</i> is 0 to 99.</p>
<b>Step 6</b>	<p><b>diagnostic monitor switch number test</b> <i>{name   test-id   test-id-range   all}</i></p> <p><b>Example:</b></p> <pre>Switch(config)# diagnostic monitor switch 2 test 1</pre>	<p>Enables the specified health-monitoring tests. The <b>switch number</b> keyword is supported only on stacking switches. The range is from 1 to 9.</p> <p>When specifying the tests, use one of these parameters:</p> <ul style="list-style-type: none"> <li>• <i>name</i>—Name of the test that appears in the <b>show diagnostic content</b> command output.</li> <li>• <i>test-id</i>—ID number of the test that appears in the <b>show diagnostic content</b> command output.</li> <li>• <i>test-id-range</i>—ID numbers of the tests that appear in the <b>show diagnostic content</b> command output.</li> <li>• <b>all</b>—All of the diagnostic tests.</li> </ul>

	Command or Action	Purpose
Step 7	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.
Step 8	<b>show running-config</b>  <b>Example:</b> Switch# <b>show running-config</b>	Verifies your entries.
Step 9	<b>copy running-config startup-config</b>  <b>Example:</b> Switch# <b>copy running-config startup-config</b>	(Optional) Saves your entries in the configuration file.

### What to Do Next

Use the **no diagnostic monitor interval test***test-id | test-id-range* } global configuration command to change the interval to the default value or to zero. Use the **no diagnostic monitor syslog** command to disable generation of syslog messages when a health-monitoring test fails. Use the **diagnostic monitor threshold test***test-id | test-id-range* } **failure count** command to remove the failure threshold.

## Monitoring and Maintaining Online Diagnostics

### Displaying Online Diagnostic Tests and Test Results

You can display the online diagnostic tests that are configured for the Switch or Switch stack and check the test results by using the privileged EXEC **show** commands in this table:

**Table 12: Commands for Diagnostic Test Configuration and Results**

Command	Purpose
<b>show diagnostic content switch</b> [ <i>number</i>   <b>all</b> ]	Displays the online diagnostics configured for a switch.  The <b>switch</b> [ <i>number</i>   <b>all</b> ] parameter is supported only on stacking switches.
<b>show diagnostic status</b>	Displays the currently running diagnostic tests.

Command	Purpose
<b>show diagnostic result switch</b> [ <i>number</i>   <b>all</b> ] [ <b>detail</b>   <b>test</b> { <i>name</i>   <i>test-id</i>   <i>test-id-range</i>   <b>all</b> } [ <b>detail</b> ]]	Displays the online diagnostics test results. The <b>switch</b> [ <i>number</i>   <b>all</b> ] parameter is supported only on stacking switches.
<b>show diagnostic switch</b> [ <i>number</i>   <b>all</b> ] [ <b>detail</b> ]	Displays the online diagnostics test results. The <b>switch</b> [ <i>number</i>   <b>all</b> ] parameter is supported only on stacking switches.
<b>show diagnostic schedule switch</b> [ <i>number</i>   <b>all</b> ]	Displays the online diagnostics test schedule. The <b>switch</b> [ <i>number</i>   <b>all</b> ] parameter is supported only on stacking switches.
<b>show diagnostic post</b>	Displays the POST results. (The output is the same as the <b>show post</b> command output.)

## Configuration Examples for Online Diagnostic Tests

### Starting Online Diagnostic Tests

After you configure diagnostic tests to run on the switch, use the **diagnostic start** privileged EXEC command to begin diagnostic testing.

After starting the tests, you cannot stop the testing process.

Use this privileged EXEC command to manually start online diagnostic testing.

#### SUMMARY STEPS

1. **diagnostic start switch** *number* **test** {*name* | *test-id* | *test-id-range* | **all** | **basic** | **non-disruptive** }

#### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>diagnostic start switch</b> <i>number</i> <b>test</b> { <i>name</i>   <i>test-id</i>   <i>test-id-range</i>   <b>all</b>   <b>basic</b>   <b>non-disruptive</b> }  <b>Example:</b>  <pre>Switch# diagnostic start switch 2 test basic</pre>	Starts the diagnostic tests.  The <b>switch</b> <i>number</i> keyword is supported only on stacking switches. The range is from 1 to 8.  You can specify the tests by using one of these options: <ul style="list-style-type: none"> <li>• <i>name</i>—Enters the name of the test.</li> <li>• <i>test-id</i>—Enters the ID number of the test.</li> </ul>

	Command or Action	Purpose
		<ul style="list-style-type: none"> <li>• <i>test-id-range</i>—Enters the range of test IDs by using integers separated by a comma and a hyphen.</li> <li>• <b>all</b>—Starts all of the tests.</li> <li>• <b>basic</b>— Starts the basic test suite.</li> <li>• <b>non-disruptive</b>—Starts the non-disruptive test suite.</li> </ul>

## Example: Configure a Health Monitoring Test

This example shows how to configure a health-monitoring test:

```
Switch(config)# diagnostic monitor threshold switch 1 test 1 failure count 50
Switch(config)# diagnostic monitor interval switch 1 test TestPortAsicStackPortLoopback
```

## Examples: Schedule Diagnostic Test

This example shows how to schedule diagnostic testing for a specific day and time on a specific switch:

```
Switch(config)# diagnostic schedule test DiagThermalTest on June 3 2013 22:25
```

This example shows how to schedule diagnostic testing to occur weekly at a certain time on a specific switch:

```
Switch(config)# diagnostic schedule switch 1 test 1,2,4-6 weekly saturday 10:30
```

## Displaying Online Diagnostics: Examples

This example shows how to display the online diagnostic detailed information on a specific switch:

```
Switch# show diagnostic switch 1 detail

Switch 1: SerialNo :

Overall Diagnostic Result for Switch 1 : UNTESTED

Test results: (. = Pass, F = Fail, U = Untested)

-----

1) TestPortAsicStackPortLoopback ---> U

Error code -----> 3 (DIAG_SKIPPED)
Total run count -----> 0
Last test testing type -----> n/a
Last test execution time ----> n/a
First test failure time -----> n/a
```

```

Last test failure time -----> n/a
Last test pass time -----> n/a
Total failure count -----> 0
Consecutive failure count ---> 0
-----

2) TestPortAsicLoopback -----> U

Error code -----> 3 (DIAG_SKIPPED)
Total run count -----> 0
Last test testing type -----> n/a
Last test execution time ----> n/a
First test failure time -----> n/a
Last test failure time -----> n/a
Last test pass time -----> n/a
Total failure count -----> 0
Consecutive failure count ---> 0
-----

3) TestPortAsicCam -----> U

Error code -----> 3 (DIAG_SKIPPED)
Total run count -----> 0
Last test testing type -----> n/a
Last test execution time ----> n/a
First test failure time -----> n/a
Last test failure time -----> n/a
Last test pass time -----> n/a
Total failure count -----> 0
Consecutive failure count ---> 0
-----

4) TestPortAsicMem -----> U

Error code -----> 3 (DIAG_SKIPPED)
Total run count -----> 0
Last test testing type -----> n/a
Last test execution time ----> n/a
First test failure time -----> n/a
Last test failure time -----> n/a
Last test pass time -----> n/a
Total failure count -----> 0
Consecutive failure count ---> 0
-----

5) TestInlinePwrCtrlr -----> U

Error code -----> 3 (DIAG_SKIPPED)
Total run count -----> 0
Last test testing type -----> n/a
Last test execution time ----> n/a
First test failure time -----> n/a
Last test failure time -----> n/a
Last test pass time -----> n/a
Total failure count -----> 0
Consecutive failure count ---> 0
-----

```

This example shows how to display the online diagnostics that are configured on a specific switch:

```

Switch# show diagnostic content switch 3

Switch 1:
Diagnostics test suite attributes:
  B/* - Basic ondemand test / NA
  P/V/* - Per port test / Per device test / NA
  D/N/* - Disruptive test / Non-disruptive test / NA
  S/* - Only applicable to standby unit / NA
  X/* - Not a health monitoring test / NA
  F/* - Fixed monitoring interval test / NA

```

```

E/* - Always enabled monitoring test / NA
A/I - Monitoring is active / Monitoring is inactive
R/* - Switch will reload after test list completion / NA
P/* - will partition stack / NA

```

ID	Test Name	Attributes	Test Interval day hh:mm:ss.ms	Thre- day shold
1)	TestPortAsicStackPortLoopback	B*N***I**	not configured	n/a
2)	TestPortAsicLoopback	B*D*X**IR*	not configured	n/a
3)	TestPortAsicCam	B*D*X**IR*	not configured	n/a
4)	TestPortAsicRingLoopback	B*D*X**IR*	not configured	n/a
5)	TestMicRingLoopback	B*D*X**IR*	not configured	n/a
6)	TestPortAsicMem	B*D*X**IR*	not configured	n/a

This example shows how to display the online diagnostic results for a switch:

```

Switch# show diagnostic result

Switch 1: SerialNo :
Overall diagnostic result: PASS
Test results: (. = Pass, F = Fail, U = Untested)
1) TestPortAsicStackPortLoopback ---> .
2) TestPortAsicLoopback -----> .
3) TestPortAsicCam -----> .
4) TestPortAsicRingLoopback -----> .
5) TestMicRingLoopback -----> .
6) TestPortAsicMem -----> .

```

This example shows how to display the online diagnostic test status:

```

Switch# show diagnostic status

<BU> - Bootup Diagnostics, <HM> - Health Monitoring Diagnostics,
<OD> - OnDemand Diagnostics, <SCH> - Scheduled Diagnostics
=====
Card   Description                               Current Running Test           Run by
-----
1      N/A                                         N/A                             N/A
2      TestPortAsicStackPortLoopback             <OD>                             <OD>
      TestPortAsicLoopback                     <OD>                             <OD>
      TestPortAsicCam                           <OD>                             <OD>
      TestPortAsicRingLoopback                 <OD>                             <OD>
      TestMicRingLoopback                     <OD>                             <OD>
      TestPortAsicMem                           <OD>                             <OD>
3      N/A                                         N/A                             N/A
4      N/A                                         N/A                             N/A
=====
Switch#

```

This example shows how to display the online diagnostic test schedule for a switch:

```

Switch# show diagnostic schedule switch 1

Current Time = 14:39:49 PST Tue May 5 2013
Diagnostic for Switch 1:
Schedule #1:
To be run daily 12:00
Test ID(s) to be executed: 1.

```

# Additional References for Online Diagnostics

## Related Documents

Related Topic	Document Title
Online diagnostics commands	<i>Catalyst 2960-X Switch System Management Command Reference</i>
Platform-independent command references	<i>Cisco IOS 15.3M&amp;T Command References</i>
Platform-independent configuration information	<i>Cisco IOS 15.3M&amp;T Configuration Guides</i>

## Standards and RFCs

Standard/RFC	Title
None	—

## MIBs

MIB	MIBs Link
All supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

## Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<a href="http://www.cisco.com/support">http://www.cisco.com/support</a>

## Feature History and Information for Configuring Online Diagnostics

Release	Modification
Cisco IOS 15.0(2)EX	This feature was introduced.





## Troubleshooting the Software Configuration

---

This chapter describes how to identify and resolve software problems related to the Cisco IOS software on the switch. Depending on the nature of the problem, you can use the command-line interface (CLI), Device Manager, or Network Assistant to identify and solve problems.

Additional troubleshooting information, such as LED descriptions, is provided in the hardware installation guide.

- [Information About Troubleshooting the Software Configuration, page 115](#)
- [How to Troubleshoot the Software Configuration, page 122](#)
- [Verifying Troubleshooting of the Software Configuration, page 137](#)
- [Scenarios for Troubleshooting the Software Configuration, page 140](#)
- [Configuration Examples for Troubleshooting Software, page 143](#)
- [Additional References for Troubleshooting Software Configuration, page 145](#)
- [Feature History and Information for Troubleshooting Software Configuration, page 146](#)

## Information About Troubleshooting the Software Configuration

### Software Failure on a Switch

Switch software can be corrupted during an upgrade by downloading the incorrect file to the switch, and by deleting the image file. In all of these cases, the switch does not pass the power-on self-test (POST), and there is no connectivity.

#### Related Topics

[Recovering from a Software Failure](#)

## Lost or Forgotten Password on a Switch

The default configuration for the switch allows an end user with physical access to the switch to recover from a lost password by interrupting the boot process during power-on and by entering a new password. These recovery procedures require that you have physical access to the switch.

**Note**

On these switches, a system administrator can disable some of the functionality of this feature by allowing an end user to reset a password only by agreeing to return to the default configuration. If you are an end user trying to reset a password when password recovery has been disabled, a status message reminds you to return to the default configuration during the recovery process.

**Related Topics**

[Recovering from a Lost or Forgotten Password](#)

## Power over Ethernet Ports

A Power over Ethernet (PoE) switch port automatically supplies power to one of these connected devices if the switch detects that there is no power on the circuit:

- a Cisco pre-standard powered device (such as a Cisco IP Phone or a Cisco Aironet Access Point)
- an IEEE 802.3af-compliant powered device
- an IEEE 802.3at-compliant powered device

A powered device can receive redundant power when it is connected to a PoE switch port and to an AC power source. The device does not receive redundant power when it is only connected to the PoE port.

After the switch detects a powered device, the switch determines the device power requirements and then grants or denies power to the device. The switch can also detect the real-time power consumption of the device by monitoring and policing the power usage.

For more information, see the "Configuring PoE" chapter in the *Catalyst 2960-X Switch Interface and Hardware Component Configuration Guide*.

**Related Topics**

[Scenarios to Troubleshoot Power over Ethernet \(PoE\), on page 140](#)

## Disabled Port Caused by Power Loss

If a powered device (such as a Cisco IP Phone 7910) that is connected to a PoE Switch port and powered by an AC power source loses power from the AC power source, the device might enter an error-disabled state. To recover from an error-disabled state, enter the **shutdown** interface configuration command, and then enter the **no shutdown** interface command. You can also configure automatic recovery on the Switch to recover from the error-disabled state.

On a Switch, the **errdisable recovery cause loopback** and the **errdisable recovery interval seconds** global configuration commands automatically take the interface out of the error-disabled state after the specified period of time.

## Monitoring PoE Port Status

- **show controllers power inline** privileged EXEC command
- **show power inline** EXEC command
- **debug ilpower** privileged EXEC command

## Disabled Port Caused by False Link-Up

If a Cisco powered device is connected to a port and you configure the port by using the **power inline never** interface configuration command, a false link-up can occur, placing the port into an error-disabled state. To take the port out of the error-disabled state, enter the **shutdown** and the **no shutdown** interface configuration commands.

You should not connect a Cisco powered device to a port that has been configured with the **power inline never** command.

## Ping

The Switch supports IP ping, which you can use to test connectivity to remote hosts. Ping sends an echo request packet to an address and waits for a reply. Ping returns one of these responses:

- Normal response—The normal response (*hostname is alive*) occurs in 1 to 10 seconds, depending on network traffic.
- Destination does not respond—If the host does not respond, a *no-answer* message is returned.
- Unknown host—If the host does not exist, an *unknown host* message is returned.
- Destination unreachable—If the default gateway cannot reach the specified network, a *destination-unreachable* message is returned.
- Network or host unreachable—If there is no entry in the route table for the host or network, a *network or host unreachable* message is returned.

### Related Topics

[Executing Ping](#), on page 133

[Example: Pinging an IP Host](#), on page 143

## Layer 2 Traceroute

The Layer 2 traceroute feature allows the switch to identify the physical path that a packet takes from a source device to a destination device. Layer 2 traceroute supports only unicast source and destination MAC addresses. Traceroute finds the path by using the MAC address tables of the Switch in the path. When the Switch detects a device in the path that does not support Layer 2 traceroute, the Switch continues to send Layer 2 trace queries and lets them time out.

The Switch can only identify the path from the source device to the destination device. It cannot identify the path that a packet takes from source host to the source device or from the destination device to the destination host.

## Layer 2 Traceroute Guidelines

- Cisco Discovery Protocol (CDP) must be enabled on all the devices in the network. For Layer 2 traceroute to function properly, do not disable CDP.  
If any devices in the physical path are transparent to CDP, the switch cannot identify the path through these devices.
- A Switch is reachable from another Switch when you can test connectivity by using the **ping** privileged EXEC command. All Switch in the physical path must be reachable from each other.
- The maximum number of hops identified in the path is ten.
- You can enter the **traceroute mac** or the **traceroute mac ip** privileged EXEC command on a Switch that is not in the physical path from the source device to the destination device. All Switch in the path must be reachable from this switch.
- The **traceroute mac** command output shows the Layer 2 path only when the specified source and destination MAC addresses belong to the same VLAN. If you specify source and destination MAC addresses that belong to different VLANs, the Layer 2 path is not identified, and an error message appears.
- If you specify a multicast source or destination MAC address, the path is not identified, and an error message appears.
- If the source or destination MAC address belongs to multiple VLANs, you must specify the VLAN to which both the source and destination MAC addresses belong. If the VLAN is not specified, the path is not identified, and an error message appears.
- The **traceroute mac ip** command output shows the Layer 2 path when the specified source and destination IP addresses belong to the same subnet. When you specify the IP addresses, the Switch uses the Address Resolution Protocol (ARP) to associate the IP addresses with the corresponding MAC addresses and the VLAN IDs.
  - If an ARP entry exists for the specified IP address, the Switch uses the associated MAC address and identifies the physical path.
  - If an ARP entry does not exist, the Switch sends an ARP query and tries to resolve the IP address. If the IP address is not resolved, the path is not identified, and an error message appears.
- When multiple devices are attached to one port through hubs (for example, multiple CDP neighbors are detected on a port), the Layer 2 traceroute feature is not supported. When more than one CDP neighbor is detected on a port, the Layer 2 path is not identified, and an error message appears.
- This feature is not supported in Token Ring VLANs.

## IP Traceroute

You can use IP traceroute to identify the path that packets take through the network on a hop-by-hop basis. The command output displays all network layer (Layer 3) devices, such as routers, that the traffic passes through on the way to the destination.

Your Switch can participate as the source or destination of the **traceroute** privileged EXEC command and might or might not appear as a hop in the **traceroute** command output. If the Switch is the destination of the traceroute, it is displayed as the final destination in the traceroute output. Intermediate Switch do not show up in the traceroute output if they are only bridging the packet from one port to another within the same VLAN. However, if the intermediate Switch is a multilayer Switch that is routing a particular packet, this Switch shows up as a hop in the traceroute output.

The **traceroute** privileged EXEC command uses the Time To Live (TTL) field in the IP header to cause routers and servers to generate specific return messages. Traceroute starts by sending a User Datagram Protocol (UDP) datagram to the destination host with the TTL field set to 1. If a router finds a TTL value of 1 or 0, it drops the datagram and sends an Internet Control Message Protocol (ICMP) time-to-live-exceeded message to the sender. Traceroute finds the address of the first hop by examining the source address field of the ICMP time-to-live-exceeded message.

To identify the next hop, traceroute sends a UDP packet with a TTL value of 2. The first router decrements the TTL field by 1 and sends the datagram to the next router. The second router sees a TTL value of 1, discards the datagram, and returns the time-to-live-exceeded message to the source. This process continues until the TTL is incremented to a value large enough for the datagram to reach the destination host (or until the maximum TTL is reached).

To learn when a datagram reaches its destination, traceroute sets the UDP destination port number in the datagram to a very large value that the destination host is unlikely to be using. When a host receives a datagram destined to itself containing a destination port number that is unused locally, it sends an ICMP *port-unreachable* error to the source. Because all errors except port-unreachable errors come from intermediate hops, the receipt of a port-unreachable error means that this message was sent by the destination port.

### Related Topics

[Executing IP Traceroute, on page 135](#)

[Example: Performing a Traceroute to an IP Host, on page 143](#)

## Time Domain Reflector Guidelines

You can use the Time Domain Reflector (TDR) feature to diagnose and resolve cabling problems. When running TDR, a local device sends a signal through a cable and compares the reflected signal to the initial signal.

TDR is supported only on 10/100/1000 copper Ethernet ports. It is not supported on 10-Gigabit Ethernet ports and on SFP module ports.

TDR can detect these cabling problems:

- Open, broken, or cut twisted-pair wires—The wires are not connected to the wires from the remote device.
- Shorted twisted-pair wires—The wires are touching each other or the wires from the remote device. For example, a shorted twisted pair can occur if one wire of the twisted pair is soldered to the other wire.

If one of the twisted-pair wires is open, TDR can find the length at which the wire is open.

Use TDR to diagnose and resolve cabling problems in these situations:

- Replacing a Switch
- Setting up a wiring closet
- Troubleshooting a connection between two devices when a link cannot be established or when it is not operating properly

When you run TDR, the Switch reports accurate information in these situations:

- The cable for the gigabit link is a solid-core cable.
- The open-ended cable is not terminated.

When you run TDR, the Switch does not report accurate information in these situations:

- The cable for the gigabit link is a twisted-pair cable or is in series with a solid-core cable.
- The link is a 10-megabit or a 100-megabit link.
- The cable is a stranded cable.
- The link partner is a Cisco IP Phone.
- The link partner is not IEEE 802.3 compliant.

## Debug Commands



### Caution

Because debugging output is assigned high priority in the CPU process, it can render the system unusable. For this reason, use **debug** commands only to troubleshoot specific problems or during troubleshooting sessions with Cisco technical support staff. It is best to use **debug** commands during periods of lower network traffic and fewer users. Debugging during these periods decreases the likelihood that increased **debug** command processing overhead will affect system use.

All **debug** commands are entered in privileged EXEC mode, and most **debug** commands take no arguments.

### Related Topics

[Redirecting Debug and Error Message Output, on page 135](#)

[Example: Enabling All System Diagnostics, on page 144](#)

## Onboard Failure Logging on the Switch

You can use the onboard failure logging (OBFL) feature to collect information about the Switch. The information includes uptime, temperature, and voltage information and helps Cisco technical support representatives to troubleshoot Switch problems. We recommend that you keep OBFL enabled and do not erase the data stored in the flash memory.

By default, OBFL is enabled. It collects information about the Switch and small form-factor pluggable (SFP) modules. The Switch stores this information in the flash memory:

- CLI commands—Record of the OBFL CLI commands that are entered on a standalone Switch or a switch stack member.
- Environment data—Unique device identifier (UDI) information for a standalone Switch or a stack member and for all the connected FRU devices: the product identification (PID), the version identification (VID), and the serial number.
- Message—Record of the hardware-related system messages generated by a standalone Switch or a stack member.
- Power over Ethernet (PoE)—Record of the power consumption of PoE ports on a standalone Switch or a stack member.
- Temperature—Temperature of a standalone Switch or a stack member.
- Uptime data—Time when a standalone Switch or a stack member starts, the reason the Switch restarts, and the length of time the Switch has been running since it last restarted.
- Voltage—System voltages of a standalone Switch or a stack member.

You should manually set the system clock or configure it by using Network Time Protocol (NTP).

When the Switch is running, you can retrieve the OBFL data by using the **show logging onboard** privileged EXEC commands. If the Switch fails, contact your Cisco technical support representative to find out how to retrieve the data.

When an OBFL-enabled Switch is restarted, there is a 10-minute delay before logging of new data begins.

#### Related Topics

[Configuring OBFL, on page 136](#)

[Displaying OBFL Information](#)

## Possible Symptoms of High CPU Utilization

Excessive CPU utilization might result in these symptoms, but the symptoms might also result from other causes:

- Spanning tree topology changes
- EtherChannel links brought down due to loss of communication
- Failure to respond to management requests (ICMP ping, SNMP timeouts, slow Telnet or SSH sessions)
- UDLD flapping
- IP SLAs failures because of SLAs responses beyond an acceptable threshold
- DHCP or IEEE 802.1x failures if the switch does not forward or respond to requests



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#### Note

# How to Troubleshoot the Software Configuration

## Recovering from a Software Failure

Switch software can be corrupted during an upgrade by downloading the wrong file to the switch, and by deleting the image file. In all of these cases, the switch does not pass the power-on self-test (POST), and there is no connectivity.

This procedure uses the Xmodem Protocol to recover from a corrupt or wrong image file. There are many software packages that support the Xmodem Protocol, and this procedure is largely dependent on the emulation software that you are using.

This recovery procedure requires that you have physical access to the switch.

- 
- Step 1** From your PC, download the software image tar file (*image\_filename.tar*) from Cisco.com. The Cisco IOS image is stored as a bin file in a directory in the tar file. For information about locating the software image files on Cisco.com, see the release notes.
- Step 2** Extract the bin file from the tar file. If you are using Windows, use a zip program that can read a tar file. Use the zip program to navigate. If you are using Windows, use a zip program that can read a tar file. Use the zip program to navigate. If you are using UNIX, follow these steps:
- Display the contents of the tar file by using the `tar -tvf <image_filename.tar>` UNIX command.
 

**Example:**

```
unix-1% tar -tvf image_filename.tar
```
  - Locate the bin file, and extract it by using the `tar -xvf <image_filename.tar> <image_filename.bin>` UNIX command.
 

**Example:**

```
unix-1% tar -xvf image_filename.tar image_filename.bin
x c2960x-universalk9-mz-150-2.EX1/c2960x-universalk9-mz-150-2.EX1.bin, 2928176 bytes, 5720
tape blocks
```
  - Verify that the bin file was extracted by using the `ls -l <image_filename.bin>` UNIX command.
 

**Example:**

```
unix-1% ls -l image_filename.bin
-rw-r--r--  1 bobab  2928176 Apr 21 12:01
c2960x-universalk9-mz.150-2.0.66.UCP/c2960x-universalk9-mz.150-2.0.66.UCP.bin
```
- Step 3** Connect your PC with terminal-emulation software supporting the Xmodem Protocol to the switch console port.
- Step 4** Set the line speed on the emulation software to 9600 baud.
- Step 5** Unplug the switch power cord.
- Step 6** Press the **Mode** button, and at the same time reconnect the power cord to the switch. You can release the Mode button a second or two after the LED above port 1 goes off. Several lines of information about the software appear along with instructions.



**Example:**

The system has been interrupted prior to initializing the flash file system. The following commands will initialize the flash file system, and finish loading the operating system software#

```
flash_init
load_helper
boot
```

**Step 7** Initialize the flash file system.

**Example:**

```
switch: flash_init
```

**Step 8** If you had set the console port speed to any speed other than 9600, it has been reset to that particular speed. Change the emulation software line speed to match that of the switch console port.

**Step 9** Load any helper files.

**Example:**

```
switch: load_helper
```

**Step 10** Start the file transfer by using the Xmodem Protocol.

**Example:**

```
switch: copy xmodem: flash:image_filename.bin
```

**Step 11** After the Xmodem request appears, use the appropriate command on the terminal-emulation software to start the transfer and to copy the software image into flash memory.

**Step 12** Boot the newly downloaded Cisco IOS image.

**Example:**

```
switch: boot flash:image_filename.bin
```

**Step 13** Use the **archive download-sw** privileged EXEC command to download the software image to the switch or to the switch stack.

**Step 14** Use the **reload** privileged EXEC command to restart the switch and to verify that the new software image is operating properly.

**Step 15** Delete the **flash:image\_filename.bin** file from the switch.

## Recovering from a Lost or Forgotten Password

The default configuration for the switch allows an end user with physical access to the switch to recover from a lost password by interrupting the boot process during power-on and by entering a new password. These recovery procedures require that you have physical access to the switch.

**Note**

On these switches, a system administrator can disable some of the functionality of this feature by allowing an end user to reset a password only by agreeing to return to the default configuration. If you are an end user trying to reset a password when password recovery has been disabled, a status message shows this during the recovery process.

You enable or disable password recovery by using the **service password-recovery** global configuration command. When you enter the **service password-recovery** or **no service password-recovery** command on the active switchstack master. It is propagated throughout the stack and applied to all switches in the stack.

The switch supports homogeneous stacking and mixed stacking. Mixed stacking is supported only with the Catalyst 2960-S switches. A homogenous stack can have up to eight stack members, while a mixed stack can have up to four stack members. All switches in a switch stack must be running the LAN Base image.

- 
- Step 1** Connect a terminal or PC to the switch.
- Connect a terminal or a PC with terminal-emulation software to the switch console port. If you are recovering the password for a switch stack, connect to the console port of the active switchstack master.
- Or
- Connect a PC to the Ethernet management port. If you are recovering the password for a switch stack, connect to the Ethernet management port of a stack member.
- Step 2** Set the line speed on the emulation software to 9600 baud.
- Step 3** On a switch, power off the standalone switch or the entire switch stack. On a switch, power off the switch.
- Step 4** Reconnect the power cord to the or the active switchstack master. Within 15 seconds, press the **Mode** button while the System LED is still flashing green. Continue pressing the **Mode** button until all the system LEDs turn on and remain solid, then release the **Mode** button.
- Several lines of information about the software appear with instructions, informing you if the password recovery procedure has been disabled or not.
- If you see a message that begins with this statement:
 

```
The system has been interrupted prior to initializing the flash file system. The following
commands will initialize the flash file system
```

proceed to the "Procedure with Password Recovery Enabled" section, and follow the steps.
  - If you see a message that begins with this statement:
 

```
The password-recovery mechanism has been triggered, but is currently disabled.
```

proceed to the "Procedure with Password Recovery Disabled" section, and follow the steps.
- Step 5** After recovering the password, reload the switch or the active switchstack master.
- On a switch:
- ```
Switch> reload
Proceed with reload? [confirm] y
```

On the switch or active switchstack master:

```
Switch> reload slot <stack-master-member-number>
Proceed with reload? [confirm] y
```

**Step 6** Power on the remaining switches in the stack.

---

## Procedure with Password Recovery Enabled

If the password-recovery operation is enabled, this message appears:

```
The system has been interrupted prior to initializing the flash file system. The following
  commands will initialize the flash file system, and finish loading the operating system
  software:
```

```
flash_init
load_helper
boot
```

**Step 1** Initialize the flash file system.

```
Switch: flash_init
```

**Step 2** If you had set the console port speed to any number other than 9600, it has been reset to that particular speed. Change the emulation software line speed to match that of the switch console port.

**Step 3** Load any helper files.

```
Switch: load_helper
```

**Step 4** Display the contents of flash memory.

```
Switch: dir: flash:
Directory of flash:
  13 drwx          192  Mar 01 2013 22:30:48
c2960x-universalk9-mz-150-2.EX1/c2960x-universalk9-mz-150-2.EX1.bin
  11 -rwx          5825  Mar 01 2013 22:31:59 config.text

16128000 bytes total (10003456 bytes free)
```

**Step 5** Rename the configuration file to config.text.old

This file contains the password definition.

```
Switch: rename flash: config.text flash: config.text.old
```

**Step 6** Boot up the system.

```
Switch: boot
```

You are prompted to start the setup program. Enter N at the prompt.

```
Continue with the configuration dialog?? [yes/no]: No
```

**Step 7** At the switch prompt, enter privileged EXEC mode.

```
Switch> enable
Switch#
```

**Step 8** Rename the configuration file to its original name.

```
Switch# rename flash: config.text.old flash: config.text
```

**Note** Before continuing to Step 9, power on any connected stack members and wait until they have completely initialized. Failure to follow this step can result in a lost configuration depending on how your switch is set up.

**Step 9** Copy the configuration file into memory

```
Switch# copy flash: config.text system: running-config
Source filename [config.text]?
Destination filename [running-config]?
```

Press **Return** in response to the confirmation prompts. The configuration file is now reloaded, and you can change the password.

**Step 10** Enter global configuration mode.

```
Switch# configure terminal
```

**Step 11** Change the password.

```
Switch(config)# enable secret password
```

The secret password can be from 1 to 25 alphanumeric characters, can start with a number, is case sensitive, and allows spaces but ignores leading spaces.

**Step 12** Return to privileged EXEC mode.

```
Switch(config)# exit
Switch#
```

**Step 13** Write the running configuration to the startup configuration file.

```
Switch# copy running-config startup-config
```

The new password is now in the startup configuration.

**Note** This procedure is likely to leave your switch virtual interface in a shutdown state. You can see which interface is in this state by entering the **show running-config** privileged EXEC command. To reenabling the interface, enter the **interface vlan *vlan-id*** global configuration command, and specify the VLAN ID of the shutdown interface. With the switch in interface configuration mode, enter the **no shutdown** command.

**Step 14** Boot the switch with the *packages.conf* file from flash.

```
Switch: boot flash:packages.conf
```

**Step 15** Reload the switch stack.

```
Switch# reload
```



## Procedure with Password Recovery Disabled

If the password-recovery mechanism is disabled, this message appears:

```
The password-recovery mechanism has been triggered, but
is currently disabled. Access to the boot loader prompt
through the password-recovery mechanism is disallowed at
this point. However, if you agree to let the system be
reset back to the default system configuration, access
to the boot loader prompt can still be allowed.
```

```
Would you like to reset the system back to the default configuration (y/n)?
```



**Caution**

Returning the Switch to the default configuration results in the loss of all existing configurations. We recommend that you contact your system administrator to verify if there are backup Switch and VLAN configuration files.

- If you enter **n** (no), the normal boot process continues as if the **Mode** button had not been pressed; you cannot access the boot loader prompt, and you cannot enter a new password. You see the message:

```
Press Enter to continue.....
```

- If you enter **y** (yes), the configuration file in flash memory and the VLAN database file are deleted. When the default configuration loads, you can reset the password.

**Step 1** Choose to continue with password recovery and delete the existing configuration:

```
Would you like to reset the system back to the default configuration (y/n)? y
```

**Step 2** Display the contents of flash memory:

```
Switch: dir flash:
```

The Switch file system appears.

```
Directory of flash:
 13 drwx          192  Mar 01 2013 22:30:48  c2960x-universalk9-mz.150-2.0.63.UCP.bin
16128000 bytes total (10003456 bytes free)
```

**Step 3** Boot up the system:

```
Switch: boot
```

You are prompted to start the setup program. To continue with password recovery, enter **N** at the prompt:

```
Continue with the configuration dialog? [yes/no]: N
```

**Step 4** At the Switch prompt, enter privileged EXEC mode:  
Switch> **enable**

**Step 5** Enter global configuration mode:  
Switch# **configure terminal**

**Step 6** Change the password:  
Switch(config)# **enable secret password**

The secret password can be from 1 to 25 alphanumeric characters, can start with a number, is case sensitive, and allows spaces but ignores leading spaces.

**Step 7** Return to privileged EXEC mode:  
Switch(config)# **exit**  
Switch#

**Note** Before continuing to Step 9, power on any connected stack members and wait until they have completely initialized. The stacking feature is supported on Switch running the LAN Base image.

**Step 8** Write the running configuration to the startup configuration file:

```
Switch# copy running-config startup-config
```

The new password is now in the startup configuration.

**Step 9** You must now reconfigure the Switch. If the system administrator has the backup Switch and VLAN configuration files available, you should use those.

## Recovering from a Command Switch Failure

This section describes how to recover from a failed command switch. You can configure a redundant command switch group by using the Hot Standby Router Protocol (HSRP).

If you have not configured a standby command switch, and your command switch loses power or fails in some other way, management contact with the member switches is lost, and you must install a new command switch. However, connectivity between switches that are still connected is not affected, and the member switches forward packets as usual. You can manage the members as standalone switches through the console port, or, if they have IP addresses, through the other management interfaces.

You can prepare for a command switch failure by assigning an IP address to a member switch or another switch that is command-capable, making a note of the command-switch password, and cabling your cluster to provide redundant connectivity between the member switches and the replacement command switch. These sections describe two solutions for replacing a failed command switch:

- Replacing a Failed Command Switch with a Cluster Member
- Replacing a Failed Command Switch with Another Switch

These recovery procedures require that you have physical access to the switch. For information on command-capable switches, see the release notes.

## Replacing a Failed Command Switch with a Cluster Member

To replace a failed command switch with a command-capable member in the same cluster, follow these steps

- 
- Step 1** Disconnect the command switch from the member switches, and physically remove it from the cluster.
- Step 2** Insert the member switch in place of the failed command switch, and duplicate its connections to the cluster members.
- Step 3** Start a CLI session on the new command switch.  
You can access the CLI by using the console port or, if an IP address has been assigned to the switch, by using Telnet. For details about using the console port, see *Catalyst 2960-X Switch Hardware Installation Guide*.
- Step 4** At the switch prompt, enter privileged EXEC mode.
- Example:**  
Switch> **enable**  
Switch#
- Step 5** Enter the password of the *failed command switch*.
- Step 6** Enter global configuration mode.
- Example:**  
Switch# **configure terminal**
- Enter configuration commands, one per line. End with CNTL/Z.
- Step 7** Remove the member switch from the cluster.
- Example:**  
Switch(config)# **no cluster commander-address**
- Step 8** Return to privileged EXEC mode.
- Example:**  
Switch(config)# **end**  
Switch#
- Step 9** Use the setup program to configure the switch IP information. This program prompts you for IP address information and passwords. From privileged EXEC mode, enter EXEC mode, enter **setup**, and press **Return**.

**Example:**  
Switch# **setup**

```
--- System Configuration Dialog ---
Continue with configuration dialog? [yes/no]: y
At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '[]'.
Basic management setup configures only enough connectivity
for management of the system, extended setup will ask you
to configure each interface on the system
```

Would you like to enter basic management setup? [yes/no]:

**Step 10** Enter **Y** at the first prompt.

**Example:**

The prompts in the setup program vary depending on the member switch that you selected to be the command switch:

Continue with configuration dialog? [yes/no]: **y**

or

Configuring global parameters:

If this prompt does not appear, enter **enable**, and press **Return**. Enter **setup**, and press **Return** to start the setup program.

- Step 11** Respond to the questions in the setup program.  
When prompted for the hostname, it is limited to 28 characters and 31 characters on a member switch. Do not use *-n*, where *n* is a number, as the last characters in a hostname for any switch. When prompted for the Telnet (virtual terminal) password, it is 1 to 25 alphanumeric characters, is case sensitive, allows spaces, but ignores leading spaces.
- Step 12** When prompted for the **enable secret** and **enable** passwords, enter the passwords of the *failed command switch* again.
- Step 13** When prompted, make sure to enable the switch as the cluster command switch, and press **Return**.
- Step 14** When prompted, assign a name to the cluster, and press **Return**.  
The cluster name can be 1 to 31 alphanumeric characters, dashes, or underscores.
- Step 15** After the initial configuration displays, verify that the addresses are correct.
- Step 16** If the displayed information is correct, enter **Y**, and press **Return**.  
If this information is not correct, enter **N**, press **Return**, and begin again at Step 9.
- Step 17** Start your browser, and enter the IP address of the new command switch.
- Step 18** From the Cluster menu, select **Add to Cluster** to display a list of candidate switches to add to the cluster.
- 

## Replacing a Failed Command Switch with Another Switch

To replace a failed command switch with a switch that is command-capable but not part of the cluster, follow these steps:

- 
- Step 1** Insert the new switch in place of the failed command switch, and duplicate its connections to the cluster members.
- Step 2** You can access the CLI by using the console port or, if an IP address has been assigned to the switch, by using Telnet. For details about using the console port, see the switch hardware installation guide.
- Step 3** At the switch prompt, enter privileged EXEC mode.



**Example:**

```
Switch> enable
Switch#
```

**Step 4** Enter the password of the *failed command switch*.

**Step 5** Use the setup program to configure the switch IP information. This program prompts you for IP address information and passwords. From privileged EXEC mode, enter EXEC mode, enter **setup**, and press **Return**.

**Example:**

```
Switch# setup

--- System Configuration Dialog ---
Continue with configuration dialog? [yes/no]: y
At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '[]'.
Basic management setup configures only enough connectivity
for management of the system, extended setup will ask you
to configure each interface on the system
Would you like to enter basic management setup? [yes/no]:
```

**Step 6** Enter **Y** at the first prompt.

**Example:**

```
The prompts in the setup program vary depending on the member switch that you selected to be the
command switch:
Continue with configuration dialog? [yes/no]: y

or

Configuring global parameters:
```

If this prompt does not appear, enter **enable**, and press **Return**. Enter **setup**, and press **Return** to start the setup program.

**Step 7** Respond to the questions in the setup program.

When prompted for the hostname, it is limited to 28 characters and 31 characters on a member switch. Do not use *-n*, where *n* is a number, as the last characters in a hostname for any switch. When prompted for the Telnet (virtual terminal) password, it is 1 to 25 alphanumeric characters, is case sensitive, allows spaces, but ignores leading spaces.

**Step 8** When prompted for the **enable secret** and **enable** passwords, enter the passwords of the *failed command switch* again.

**Step 9** When prompted, make sure to enable the switch as the cluster command switch, and press **Return**.

**Step 10** When prompted, assign a name to the cluster, and press **Return**.  
The cluster name can be 1 to 31 alphanumeric characters, dashes, or underscores.

**Step 11** After the initial configuration displays, verify that the addresses are correct.

**Step 12** If the displayed information is correct, enter **Y**, and press **Return**.  
If this information is not correct, enter **N**, press **Return**, and begin again at Step 9.

**Step 13** Start your browser, and enter the IP address of the new command switch.

**Step 14** From the Cluster menu, select **Add to Cluster** to display a list of candidate switches to add to the cluster.

## Preventing Switch Stack Problems

To prevent switch stack problems, you should do the following:

- Make sure that the Switch that you add to or remove from the switch stack are powered off. For all powering considerations in switch stacks, see the “Switch Installation” chapter in the hardware installation guide.
- Press the **Mode** button on a stack member until the Stack mode LED is on. The last two port LEDs on the Switch should be green. Depending on the Switch model, the last two ports are either 10/100/1000 ports or small form-factor pluggable (SFP) module. If one or both of the last two port LEDs are not green, the stack is not operating at full bandwidth.
- We recommend using only one CLI session when managing the switch stack. Be careful when using multiple CLI sessions to the active switchstack 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.
- Manually assigning stack member numbers according to the placement of the Switch in the stack can make it easier to remotely troubleshoot the switch stack. However, you need to remember that the Switch have manually assigned numbers if you add, remove, or rearrange Switch later. Use the **switch current-stack-member-number renumber new-stack-member-number** global configuration command to manually assign a stack member number.

If you replace a stack member with an identical model, the new Switch functions with the exact same configuration as the replaced Switch. This is also assuming the new Switch is using the same member number as the replaced Switch.

Removing powered-on stack members causes the switch stack to divide (partition) into two or more switch stacks, each with the same configuration. If you want the switch stacks to remain separate, change the IP address or addresses of the newly created switch stacks. To recover from a partitioned switch stack, follow these steps:

- 1 Power off the newly created switch stacks.
- 2 Reconnect them to the original switch stack through their StackWise Plus ports.
- 3 Power on the Switch.

For the commands that you can use to monitor the switch stack and its members, see the *Displaying Switch Stack Information* section.

## Preventing Autonegotiation Mismatches

The IEEE 802.3ab autonegotiation protocol manages the Switch settings for speed (10 Mb/s, 100 Mb/s, and 1000 Mb/s, excluding SFP module ports) and duplex (half or full). There are situations when this protocol can incorrectly align these settings, reducing performance. A mismatch occurs under these circumstances:

- A manually set speed or duplex parameter is different from the manually set speed or duplex parameter on the connected port.
- A port is set to autonegotiate, and the connected port is set to full duplex with no autonegotiation.

To maximize Switch performance and ensure a link, follow one of these guidelines when changing the settings for duplex and speed:

- Let both ports autonegotiate both speed and duplex.
- Manually set the speed and duplex parameters for the ports on both ends of the connection.

**Note**

If a remote device does not autonegotiate, configure the duplex settings on the two ports to match. The speed parameter can adjust itself even if the connected port does not autonegotiate.

## Troubleshooting SFP Module Security and Identification

Cisco small form-factor pluggable (SFP) modules have a serial EEPROM that contains the module serial number, the vendor name and ID, a unique security code, and cyclic redundancy check (CRC). When an SFP module is inserted in the Switch, the Switch software reads the EEPROM to verify the serial number, vendor name and vendor ID, and recompute the security code and CRC. If the serial number, the vendor name or vendor ID, the security code, or CRC is invalid, the software generates a security error message and places the interface in an error-disabled state.

**Note**

The security error message references the GBIC\_SECURITY facility. The Switch supports SFP modules and does not support GBIC modules. Although the error message text refers to GBIC interfaces and modules, the security messages actually refer to the SFP modules and module interfaces.

If you are using a non-Cisco SFP module, remove the SFP module from the Switch, and replace it with a Cisco module. After inserting a Cisco SFP module, use the **errdisable recovery cause gbic-invalid** global configuration command to verify the port status, and enter a time interval for recovering from the error-disabled state. After the elapsed interval, the Switch brings the interface out of the error-disabled state and retries the operation. For more information about the **errdisable recovery** command, see the command reference for this release.

If the module is identified as a Cisco SFP module, but the system is unable to read vendor-data information to verify its accuracy, an SFP module error message is generated. In this case, you should remove and reinsert the SFP module. If it continues to fail, the SFP module might be defective.

### Monitoring SFP Module Status

You can check the physical or operational status of an SFP module by using the **show interfaces transceiver** privileged EXEC command. This command shows the operational status, such as the temperature and the current for an SFP module on a specific interface and the alarm status. You can also use the command to check the speed and the duplex settings on an SFP module. For more information, see the **show interfaces transceiver** command in the command reference for this release.

## Executing Ping

If you attempt to ping a host in a different IP subnetwork, you must define a static route to the network or have IP routing configured to route between those subnets.

IP routing is disabled by default on all Switch.



**Note** Though other protocol keywords are available with the **ping** command, they are not supported in this release.

Use this command to ping another device on the network from the Switch:

| Command                                                                            | Purpose                                                                                |
|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| <p><b>ping ip</b> <i>host</i>   <i>address</i></p> <p>Switch# ping 172.20.52.3</p> | <p>Pings a remote host through IP or by supplying the hostname or network address.</p> |

**Related Topics**

[Ping, on page 117](#)

[Example: Pinging an IP Host, on page 143](#)

## Monitoring Temperature

The Switch monitors the temperature conditions and uses the temperature information to control the fans.

Use the **show env temperature status** privileged EXEC command to display the temperature value, state, and thresholds. The temperature value is the temperature in the Switch (not the external temperature). You can configure only the yellow threshold level (in Celsius) by using the **system env temperature threshold yellow** *value* global configuration command to set the difference between the yellow and red thresholds. You cannot configure the green or red thresholds. For more information, see the command reference for this release.

## Monitoring the Physical Path

You can monitor the physical path that a packet takes from a source device to a destination device by using one of these privileged EXEC commands:

**Table 13: Monitoring the Physical Path**

| Command                                                                                                                                                                                                                                                                 | Purpose                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>tracetroute mac</b> [<b>interface</b> <i>interface-id</i>]<br/>                     {<i>source-mac-address</i>} [<b>interface</b> <i>interface-id</i>]<br/>                     {<i>destination-mac-address</i>} [<b>vlan</b> <i>vlan-id</i>] [<b>detail</b>]</p> | <p>Displays the Layer 2 path taken by the packets from the specified source MAC address to the specified destination MAC address.</p>                       |
| <p><b>tracetroute mac ip</b> {<i>source-ip-address</i>  <br/> <i>source-hostname</i>} {<i>destination-ip-address</i>  <br/> <i>destination-hostname</i>} [<b>detail</b>]</p>                                                                                            | <p>Displays the Layer 2 path taken by the packets from the specified source IP address or hostname to the specified destination IP address or hostname.</p> |

## Executing IP Traceroute



**Note** Though other protocol keywords are available with the **traceroute** privileged EXEC command, they are not supported in this release.

| Command                                                                | Purpose                                                |
|------------------------------------------------------------------------|--------------------------------------------------------|
| <b>traceroute ip</b> <i>host</i><br>Switch# traceroute ip 192.51.100.1 | Traces the path that packets take through the network. |

### Related Topics

[IP Traceroute](#), on page 119

[Example: Performing a Traceroute to an IP Host](#), on page 143

## Running TDR and Displaying the Results

To run TDR, enter the **test cable-diagnostics tdr interface** *interface-id* privileged EXEC command.

To display the results, enter the **show cable-diagnostics tdr interface** *interface-id* privileged EXEC command.

## Redirecting Debug and Error Message Output

By default, the network server sends the output from **debug** commands and system error messages to the console. If you use this default, you can use a virtual terminal connection to monitor debug output instead of connecting to the console port or the Ethernet management port.

Possible destinations include the console, virtual terminals, internal buffer, and UNIX hosts running a syslog server. The syslog format is compatible with 4.3 Berkeley Standard Distribution (BSD) UNIX and its derivatives.



**Note** Be aware that the debugging destination you use affects system overhead. When you log messages to the console, very high overhead occurs. When you log messages to a virtual terminal, less overhead occurs. Logging messages to a syslog server produces even less, and logging to an internal buffer produces the least overhead of any method.

For more information about system message logging, see *Configuring System Message Logging*.

### Related Topics

[Debug Commands](#), on page 120

## Using the show platform forward Command

The output from the **show platform forward** privileged EXEC command provides some useful information about the forwarding results if a packet entering an interface is sent through the system. Depending upon the parameters entered about the packet, the output provides lookup table results and port maps used to calculate forwarding destinations, bitmaps, and egress information.

Most of the information in the output from the command is useful mainly for technical support personnel, who have access to detailed information about the Switch application-specific integrated circuits (ASICs). However, packet forwarding information can also be helpful in troubleshooting.

## Configuring OBFL



### Caution

---

We recommend that you do not disable OBFL and that you do not remove the data stored in the flash memory.

---

- To enable OBFL, use the **hw-switch switch** [*switch-number*] **logging onboard** [**message level** *level*] global configuration command. On switches, the range for *switch-number* is from 1 to 9. Use the **message level** *level* parameter to specify the severity of the hardware-related messages that the switch generates and stores in the flash memory.
- To copy the OBFL data to the local network or a specific file system, use the **copy onboard switch** *switch-number* **url** *url-destination* privileged EXEC command.
- To disable OBFL, use the **no hw-switch switch** [*switch-number*] **logging onboard** [**message level**] global configuration command.
- To clear all the OBFL data in the flash memory except for the uptime and CLI command information, use the **clear onboard switch** *switch-number* privileged EXEC command.
- In a switch stack, you can enable OBFL on a standalone switch or on all stack members by using the **hw-switch switch** [*switch-number*] **logging onboard** [**message level** *level*] global configuration command.
- You can enable or disable OBFL on a member switch from the active switchstack master.

For more information about the commands in this section, see the command reference for this release.

### Related Topics

- [Onboard Failure Logging on the Switch, on page 120](#)
- [Displaying OBFL Information](#)

# Verifying Troubleshooting of the Software Configuration

## Displaying OBFL Information

*Table 14: Commands for Displaying OBFL Information*

| Command                                                                                                                                     | Purpose                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>show logging onboard [module[switch-number ]]clilog</b><br/>                     Switch# show logging onboard 1 clilog</p>            | <p>Displays the OBFL CLI commands that were entered on a standalone switch or the specified stack members.</p>                                                                                                                                                                         |
| <p><b>show logging onboard [module[switch-number ]] environment</b><br/>                     Switch# show logging onboard 1 environment</p> | <p>Displays the UDI information for a standalone switch or the specified stack members and for all the connected FRU devices: the PID, the VID, and the serial number.</p>                                                                                                             |
| <p><b>show logging onboard [module[switch-number ]] message</b><br/>                     Switch# show logging onboard 1 message</p>         | <p>Displays the hardware-related messages generated by a standalone switch or the specified stack members.</p>                                                                                                                                                                         |
| <p><b>show logging onboard [module[switch-number ]] poe</b><br/>                     Switch# show logging onboard 1 poe</p>                 | <p>Displays the power consumption of PoE ports on a standalone switch or the specified stack members.</p>                                                                                                                                                                              |
| <p><b>show logging onboard [module[switch-number ]] temperature</b><br/>                     Switch# show logging onboard 1 temperature</p> | <p>Displays the temperature of a standalone switch or the specified switch stack members.</p>                                                                                                                                                                                          |
| <p><b>show logging onboard [module[switch-number ]] uptime</b><br/>                     Switch# show logging onboard 1 uptime</p>           | <p>Displays the time when a standalone switch or the specified stack members start, the reason the standalone switch or specified stack members restart, and the length of time that the standalone switch or specified stack members have been running since they last restarted.</p> |

| Command                                                                                                                      | Purpose                                                                                 |
|------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| <b>show logging onboard [module][switch-number ]] voltage</b><br>Switch# show logging onboard 1 voltage                      | Displays the system voltages of a standalone switch or the specified stack members.     |
| <b>show logging onboard [module][switch-number ]] continuous</b><br>Switch# show logging onboard 1 continuous                | Displays the data in the continuous file.                                               |
| <b>show logging onboard [module][switch-number ]] detail</b><br>Switch# show logging onboard 1 detail                        | Displays both the continuous and summary data .                                         |
| <b>show logging onboard [module][switch-number ]] endhh:mm:ss</b><br>Switch# show logging onboard 1<br>end 13:00:15 jul 2013 | Displays end time and date on a standalone switch or the specified stack members.       |
| <b>show logging onboard [module][switch-number ]]</b><br>Switch# show logging<br>onboard 1                                   | Displays OBFL information about the specified switches in the system.                   |
| <b>show logging onboard [module][switch-number ]] raw</b><br>Switch# show logging<br>onboard 1 raw                           | Displays the raw information on a standalone switch or the specified stack members.     |
| <b>show logging onboard [module][switch-number ]] start</b><br>Switch# show logging<br>onboard 1 start 13:00:10 jul 2013     | Displays the start time and date on a standalone switch or the specified stack members. |
| <b>show logging onboard [module][switch-number ]] status</b><br>Switch# show logging onboard 1 status                        | Displays status information on a standalone switch or the specified stack members.      |
| <b>show logging onboard [module][switch-number ]] summary</b><br>Switch# show logging onboard 1 summary                      | Displays both the data in the summary file                                              |

For more information, see the *Catalyst 2960-X Switch System Management Command Reference*.

## Example: Verifying the Problem and Cause for High CPU Utilization

To determine if high CPU utilization is a problem, enter the **show processes cpu sorted** privileged EXEC command. Note the underlined information in the first line of the output example.

```
Switch# show processes cpu sorted
CPU utilization for five seconds: 8%/0%; one minute: 7%; five minutes: 8%
PID Runtime(ms) Invoked uSecs 5Sec 1Min 5Min TTY Process
309 42289103 752750 56180 1.75% 1.20% 1.22% 0 RIP Timers
140 8820183 4942081 1784 0.63% 0.37% 0.30% 0 HRPC qos request
100 3427318 16150534 212 0.47% 0.14% 0.11% 0 HRPC pm-counters
192 3093252 14081112 219 0.31% 0.14% 0.11% 0 Spanning Tree
```



```
143 8 37 216 0.15% 0.01% 0.00% 0 Exec
...
<output truncated>
```

This example shows normal CPU utilization. The output shows that utilization for the last 5 seconds is 8%/0%, which has this meaning:

- The total CPU utilization is 8 percent, including both time running Cisco IOS processes and time spent handling interrupts.
- The time spent handling interrupts is zero percent.

**Table 15: Troubleshooting CPU Utilization Problems**

| Type of Problem                                                                  | Cause                                                                                                                           | Corrective Action                                                                                                                              |
|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Interrupt percentage value is almost as high as total CPU utilization value.     | The CPU is receiving too many packets from the network.                                                                         | Determine the source of the network packet. Stop the flow, or change the switch configuration. See the section on “Analyzing Network Traffic.” |
| Total CPU utilization is greater than 50% with minimal time spent on interrupts. | One or more Cisco IOS process is consuming too much CPU time. This is usually triggered by an event that activated the process. | Identify the unusual event, and troubleshoot the root cause. See the section on “Debugging Active Processes.”                                  |

# Scenarios for Troubleshooting the Software Configuration

## Scenarios to Troubleshoot Power over Ethernet (PoE)

*Table 16: Power over Ethernet Troubleshooting Scenarios*

| Symptom or Problem                                                                                                                                                 | Possible Cause and Solution                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Only one port does not have PoE.</p> <p>Trouble is on only one switch port.</p> <p>PoE and non-PoE devices do not work on this port, but do on other ports.</p> | <p>Verify that the powered device works on another PoE port.</p> <p>Use the <b>show run</b>, or <b>show interface status</b> user EXEC commands to verify that the port is not shut down or error-disabled.</p> <p><b>Note</b> Most switches turn off port power when the port is shut down, even though the IEEE specifications make this optional.</p> <p>Verify that the Ethernet cable from the powered device to the switch port is good: Connect a known good non-PoE Ethernet device to the Ethernet cable, and make sure that the powered device establishes a link and exchanges traffic with another host.</p> <p>Verify that the total cable length from the switch front panel to the powered device is not more than 100 meters.</p> <p>Disconnect the Ethernet cable from the switch port. Use a short Ethernet cable to connect a known good Ethernet device directly to this port on the switch front panel (not on a patch panel). Verify that it can establish an Ethernet link and exchange traffic with another host, or ping the port VLAN SVI. Next, connect a powered device to this port, and verify that it powers on.</p> <p>If a powered device does not power on when connected with a patch cord to the switch port, compare the total number of connected powered devices to the switch power budget (available PoE). Use the <b>show inline power</b> command to verify the amount of available power.</p> |

| Symptom or Problem                                                                                                                                                                                        | Possible Cause and Solution                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>No PoE on all ports or a group of ports.</p> <p>Trouble is on all switch ports.</p> <p>Nonpowered Ethernet devices cannot establish an Ethernet link on any port, and PoE devices do not power on.</p> | <p>If there is a continuous, intermittent, or reoccurring alarm related to power, replace the power supply if possible it is a field-replaceable unit. Otherwise, replace the switch.</p> <p>If the problem is on a consecutive group of ports but not all ports, the power supply is probably not defective, and the problem could be related to PoE regulators in the switch.</p> <p>Use the <b>show log</b> privileged EXEC command to review alarms or system messages that previously reported PoE conditions or status changes.</p> <p>If there are no alarms, use the <b>show interface status</b> command to verify that the ports are not shut down or error-disabled. If ports are error-disabled, use the <b>shut</b> and <b>no shut</b> interface configuration commands to reenab the ports.</p> <p>Use the <b>show env power</b> and <b>show power inline</b> privileged EXEC commands to review the PoE status and power budget (available PoE).</p> <p>Review the running configuration to verify that <b>power inline never</b> is not configured on the ports.</p> <p>Connect a nonpowered Ethernet device directly to a switch port. Use only a short patch cord. Do not use the existing distribution cables. Enter the <b>shut</b> and <b>no shut</b> interface configuration commands, and verify that an Ethernet link is established. If this connection is good, use a short patch cord to connect a powered device to this port and verify that it powers on. If the device powers on, verify that all intermediate patch panels are correctly connected.</p> <p>Disconnect all but one of the Ethernet cables from switch ports. Using a short patch cord, connect a powered device to only one PoE port. Verify the powered device does not require more power than can be delivered by the switch port.</p> <p>Use the <b>show power inline</b> privileged EXEC command to verify that the powered device can receive power when the port is not shut down. Alternatively, watch the powered device to verify that it powers on.</p> <p>If a powered device can power on when only one powered device is connected to the switch, enter the <b>shut</b> and <b>no shut</b> interface configuration commands on the remaining ports, and then reconnect the Ethernet cables one at a time to the switch PoE ports. Use the <b>show interface status</b> and <b>show power inline</b> privileged EXEC commands to monitor inline power statistics and port status.</p> <p>If there is still no PoE at any port, a fuse might be open in the PoE section of the power supply. This normally produces an alarm. Check the log again for alarms reported earlier by system messages.</p> |

| Symptom or Problem                                                                                                                                                                                                                    | Possible Cause and Solution                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Cisco IP Phone disconnects or resets.</p> <p>After working normally, a Cisco phone or wireless access point intermittently reloads or disconnects from PoE.</p>                                                                    | <p>Verify all electrical connections from the switch to the powered device. Any unreliable connection results in power interruptions and irregular powered device functioning such as erratic powered device disconnects and reloads.</p> <p>Verify that the cable length is not more than 100 meters from the switch port to the powered device.</p> <p>Notice what changes in the electrical environment at the switch location or what happens at the powered device when the disconnect occurs.</p> <p>Notice whether any error messages appear at the same time a disconnect occurs. Use the <b>show log</b> privileged EXEC command to review error messages.</p> <p>Verify that an IP phone is not losing access to the Call Manager immediately before the reload occurs. (It might be a network problem and not a PoE problem.)</p> <p>Replace the powered device with a non-PoE device, and verify that the device works correctly. If a non-PoE device has link problems or a high error rate, the problem might be an unreliable cable connection between the switch port and the powered device.</p> |
| <p>Non-Cisco powered device does not work on Cisco PoE switch.</p> <p>A non-Cisco powered device is connected to a Cisco PoE switch, but never powers on or powers on and then quickly powers off. Non-PoE devices work normally.</p> | <p>Use the <b>show power inline</b> command to verify that the switch power budget (available PoE) is not depleted before or after the powered device is connected. Verify that sufficient power is available for the powered device type before you connect it.</p> <p>Use the <b>show interface status</b> command to verify that the switch detects the connected powered device.</p> <p>Use the <b>show log</b> command to review system messages that reported an overcurrent condition on the port. Identify the symptom precisely: Does the powered device initially power on, but then disconnect? If so, the problem might be an initial surge-in (or <i>inrush</i>) current that exceeds a current-limit threshold for the port.</p>                                                                                                                                                                                                                                                                                                                                                                    |

**Related Topics**

[Power over Ethernet Ports, on page 116](#)

# Configuration Examples for Troubleshooting Software

## Example: Pinging an IP Host

This example shows how to ping an IP host:

```
Switch# ping 172.20.52.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 172.20.52.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
Switch#
```

**Table 17: Ping Output Display Characters**

| Character | Description                                                               |
|-----------|---------------------------------------------------------------------------|
| !         | Each exclamation point means receipt of a reply.                          |
| .         | Each period means the network server timed out while waiting for a reply. |
| U         | A destination unreachable error PDU was received.                         |
| C         | A congestion experienced packet was received.                             |
| I         | User interrupted test.                                                    |
| ?         | Unknown packet type.                                                      |
| &         | Packet lifetime exceeded.                                                 |

To end a ping session, enter the escape sequence (**Ctrl-^ X** by default). Simultaneously press and release the **Ctrl**, **Shift**, and **6** keys and then press the **X** key.

### Related Topics

- [Ping, on page 117](#)
- [Executing Ping, on page 133](#)

## Example: Performing a Traceroute to an IP Host

This example shows how to perform a **traceroute** to an IP host:

```
Switch# traceroute ip 192.0.2.10

Type escape sequence to abort.
Tracing the route to 192.0.2.10
```

```

1 192.0.2.1 0 msec 0 msec 4 msec
2 192.0.2.203 12 msec 8 msec 0 msec
3 192.0.2.100 4 msec 0 msec 0 msec
4 192.0.2.10 0 msec 4 msec 0 msec

```

The display shows the hop count, the IP address of the router, and the round-trip time in milliseconds for each of the three probes that are sent.

**Table 18: Traceroute Output Display Characters**

| Character | Description                                                                                       |
|-----------|---------------------------------------------------------------------------------------------------|
| *         | The probe timed out.                                                                              |
| ?         | Unknown packet type.                                                                              |
| A         | Administratively unreachable. Usually, this output means that an access list is blocking traffic. |
| H         | Host unreachable.                                                                                 |
| N         | Network unreachable.                                                                              |
| P         | Protocol unreachable.                                                                             |
| Q         | Source quench.                                                                                    |
| U         | Port unreachable.                                                                                 |

To end a trace in progress, enter the escape sequence (**Ctrl-^ X** by default). Simultaneously press and release the **Ctrl**, **Shift**, and **6** keys and then press the **X** key.

#### Related Topics

[IP Traceroute](#), on page 119

[Executing IP Traceroute](#), on page 135

## Example: Enabling All System Diagnostics



#### Caution

Because debugging output takes priority over other network traffic, and because the **debug all** privileged EXEC command generates more output than any other **debug** command, it can severely diminish switch performance or even render it unusable. In virtually all cases, it is best to use more specific **debug** commands.

This command disables all-system diagnostics:

```
Switch# debug all
```

The **no debug all** privileged EXEC command disables all diagnostic output. Using the **no debug all** command is a convenient way to ensure that you have not accidentally left any **debug** commands enabled.

**Related Topics**

[Debug Commands, on page 120](#)

# Additional References for Troubleshooting Software Configuration

**Related Documents**

| Related Topic                                  | Document Title                                                                     |
|------------------------------------------------|------------------------------------------------------------------------------------|
| Troubleshooting commands                       | <i>Catalyst 2960-X Switch System Management Command Reference</i>                  |
| Interface and hardware component configuration | <i>Catalyst 2960-X Switch Interface and Hardware Component Configuration Guide</i> |
| Platform-independent command references        | <i>Cisco IOS 15.3M&amp;T Command References</i>                                    |
| Platform-independent configuration information | <i>Cisco IOS 15.3M&amp;T Configuration Guides</i>                                  |

**Standards and RFCs**

| Standard/RFC | Title |
|--------------|-------|
| None         | —     |

**MIBs**

| MIB                                  | MIBs Link                                                                                                                                                                                                              |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| All supported MIBs for this release. | To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:<br><a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a> |

**Technical Assistance**

| Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Link                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| <p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p> | <p><a href="http://www.cisco.com/support">http://www.cisco.com/support</a></p> |

## Feature History and Information for Troubleshooting Software Configuration

| Release             | Modification                 |
|---------------------|------------------------------|
| Cisco IOS 15.0(2)EX | This feature was introduced. |





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