



## **Catalyst 2960-X Switch Network Management Configuration Guide, Cisco IOS Release 15.0(2)EX**

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## Preface

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This preface contains the following topics:

- [Document Conventions, page vii](#)
- [Related Documentation, page ix](#)
- [Obtaining Documentation and Submitting a Service Request, page ix](#)

## 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>	Bold Courier font 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.

Convention	Description
[x   y]	Optional alternative keywords are grouped in brackets and separated by vertical bars.
{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 uses 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

Means *reader be warned*. In this situation, you might perform an action that could result in bodily injury.

## Related Documentation

**Note**

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

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- Catalyst 2960-X Switch documentation, 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)
- Cisco Validated Designs documents, located at:  
<http://www.cisco.com/go/designzone>

## Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

<http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html>

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# Using the Command-Line Interface

This chapter contains the following topics:

- [Information About Using the Command-Line Interface, page 1](#)
- [How to Use the CLI to Configure Features, page 5](#)

## Information About Using the Command-Line Interface

This section describes the Cisco IOS command-line interface (CLI) and how to use it to configure your switch.

### 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</b> <i>vlan-id</i> 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)#	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 Ethernet ports.

Mode	Access Method	Prompt	Exit Method	About This Mode
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.

## 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
<b>Step 1</b>	<b>help</b>  <b>Example:</b> Switch# <b>help</b>	Obtains a brief description of the help system in any command mode.
<b>Step 2</b>	<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.
<b>Step 3</b>	<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.

	Command or Action	Purpose
<b>Step 4</b>	?  <b>Example:</b> Switch> ?	Lists all commands available for a particular command mode.
<b>Step 5</b>	<i>command</i> ?  <b>Example:</b> Switch> <b>show</b> ?	Lists the associated keywords for a command.
<b>Step 6</b>	<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.

## 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 reenable 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
% Ambiguous command: "show con"	You did not enter enough characters for your switch to recognize the 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.
% Incomplete command.	You did not enter all 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.
% Invalid input detected at '^' marker.	You entered the command incorrectly. The caret (^) marks the point of the error.	Enter a question mark (?) to display all 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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## 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
<b>Step 1</b>	<b>terminal history</b> [ <i>size number-of-lines</i> ]  <b>Example:</b> Switch# <b>terminal history size 200</b>	Changes the number of command lines that the switch records during the current terminal session in the privileged EXEC mode. You can configure the size from 0 through 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.

	Command or Action	Purpose
<b>Step 3</b>	<b>show history</b>  <b>Example:</b> Switch# <code>show history</code>	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# <code>terminal no history</code>	Disables the feature during the current terminal session in the 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 the privileged EXEC mode.

	Command or Action	Purpose
<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 the privileged EXEC mode.

## 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.

## 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 extend 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> <pre>Switch(config)# access-list 101 permit tcp  10.15.22.25 255.255.255.0 10.15.22.35 Switch(config)# \$ 101 permit tcp 10.15.22.25 255.255.255.0 10.15.22.35 255.25 Switch(config)# \$t tcp 10.15.22.25 255.255.255.0 131.108.1.20 255.255.255.0 eq Switch(config)# \$15.22.25 255.255.255.0 10.15.22.35 255.255.255.0 eq 45</pre>	<p>Displays the global configuration command entry that extends beyond one line.</p> <p>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.</p>
<b>Step 2</b>	<b>Ctrl-A</b>  <b>Example:</b> <pre>Switch(config)# access-list 101 permit tcp 10.15.22.25 255.255.255.0 10.15.25\$</pre>	<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>

## 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
<b>Step 1</b>	<code>{show   more} command   {begin   include   exclude} regular-expression</code>	Searches and filters the output.

	Command or Action	Purpose
	<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>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 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.





## Configuring Cisco IOS Configuration Engine

This chapter describes how to configure the Cisco IOS Configuration Engine.

- [Finding Feature Information, page 13](#)
- [Prerequisites for Configuring the Configuration Engine, page 13](#)
- [Restrictions for Configuring the Configuration Engine, page 14](#)
- [Information About Configuring the Configuration Engine, page 14](#)
- [How to Configure the Configuration Engine, page 20](#)
- [Monitoring CNS Configurations, page 31](#)
- [Additional References, page 32](#)
- [Feature History and Information for the Configuration Engine, page 32](#)

### Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release.

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.

### Prerequisites for Configuring the Configuration Engine

- Obtain the name of the configuration engine instance to which you are connecting.
- Because the CNS uses both the event bus and the configuration server to provide configurations to devices, you must define both ConfigID and Device ID for each configured switch.
- All switches configured with the **cns config partial** global configuration command must access the event bus. The DeviceID, as originated on the switch, must match the DeviceID of the corresponding switch definition in the Cisco Configuration Engine. You must know the hostname of the event bus to which you are connecting.

**Related Topics**

[Cisco Networking Services IDs and Device Hostnames](#), on page 16  
[DeviceID](#), on page 17

## Restrictions for Configuring the Configuration Engine

- Within the scope of a single instance of the configuration server, no two configured switches can share the same value for ConfigID.
- Within the scope of a single instance of the event bus, no two configured switches can share the same value for DeviceID.

**Related Topics**

[Cisco Networking Services IDs and Device Hostnames](#), on page 16

## Information About Configuring the Configuration Engine

### Cisco Configuration Engine Software

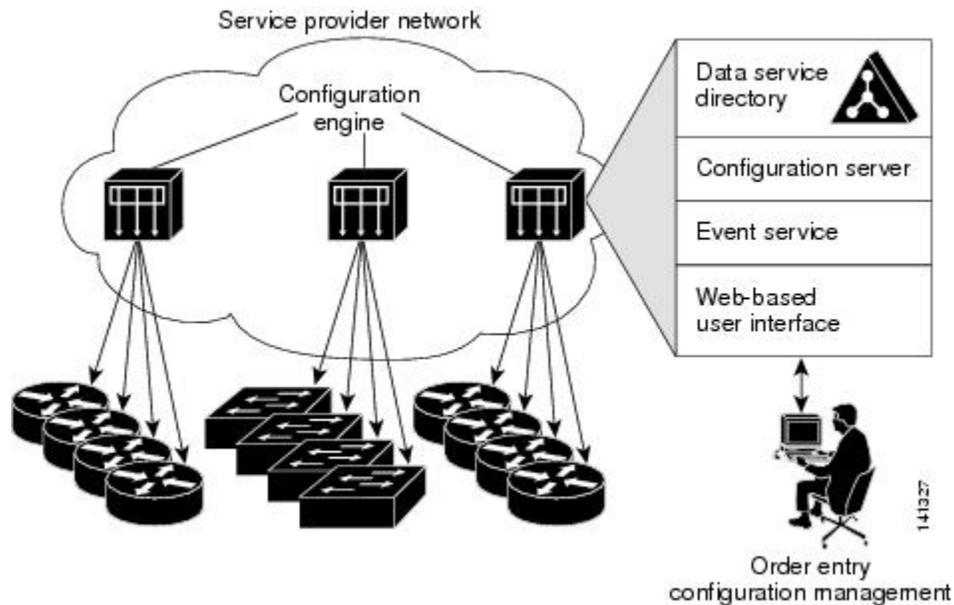
The Cisco Configuration Engine is network management utility software that acts as a configuration service for automating the deployment and management of network devices and services. Each Cisco Configuration Engine manages a group of Cisco devices (switches and routers) and the services that they deliver, storing their configurations and delivering them as needed. The Cisco Configuration Engine automates initial configurations and configuration updates by generating device-specific configuration changes, sending them to the device, executing the configuration change, and logging the results.

The Cisco Configuration Engine supports standalone and server modes and has these Cisco Networking Services (CNS) components:

- Configuration service:
  - Web server
  - File manager
  - Namespace mapping server
- Event service (event gateway)
- Data service directory (data models and schema)

In standalone mode, the Cisco Configuration Engine supports an embedded directory service. In this mode, no external directory or other data store is required. In server mode, the Cisco Configuration Engine supports the use of a user-defined external directory.

**Figure 1: Cisco Configuration Engine Architectural Overview**



## Configuration Service

The Configuration Service is the core component of the Cisco Configuration Engine. It consists of a Configuration Server that works with Cisco IOS CNS agents on the switch. The Configuration Service delivers device and service configurations to the switch for initial configuration and mass reconfiguration by logical groups. Switches receive their initial configuration from the Configuration Service when they start up on the network for the first time.

The Configuration Service uses the CNS Event Service to send and receive configuration change events and to send success and failure notifications.

The Configuration Server is a web server that uses configuration templates and the device-specific configuration information stored in the embedded (standalone mode) or remote (server mode) directory.

Configuration templates are text files containing static configuration information in the form of CLI commands. In the templates, variables are specified by using Lightweight Directory Access Protocol (LDAP) URLs that reference the device-specific configuration information stored in a directory.

The Cisco IOS agent can perform a syntax check on received configuration files and publish events to show the success or failure of the syntax check. The configuration agent can either apply configurations immediately or delay the application until receipt of a synchronization event from the configuration server.

## Event Service

The Cisco Configuration Engine uses the Event Service for receipt and generation of configuration events. The Event Service consists of an event agent and an event gateway. The event agent is on the switch and facilitates the communication between the switch and the event gateway on the Cisco Configuration Engine.

The Event Service is a highly capable publish-and-subscribe communication method. The Event Service uses subject-based addressing to send messages to their destinations. Subject-based addressing conventions define a simple, uniform namespace for messages and their destinations.

### Related Topics

[Enabling the CNS Event Agent, on page 20](#)

## NameSpace Mapper

The Cisco Configuration Engine includes the NameSpace Mapper (NSM) that provides a lookup service for managing logical groups of devices based on application, device or group ID, and event.

Cisco IOS devices recognize only event subject-names that match those configured in Cisco IOS software; for example, `cisco.cns.config.load`. You can use the namespace mapping service to designate events by using any desired naming convention. When you have populated your data store with your subject names, NSM changes your event subject-name strings to those known by Cisco IOS.

For a subscriber, when given a unique device ID and event, the namespace mapping service returns a set of events to which to subscribe. Similarly, for a publisher, when given a unique group ID, device ID, and event, the mapping service returns a set of events on which to publish.

## Cisco Networking Services IDs and Device Hostnames

The Cisco Configuration Engine assumes that a unique identifier is associated with each configured switch. This unique identifier can take on multiple synonyms, where each synonym is unique within a particular namespace. The event service uses namespace content for subject-based addressing of messages.

The Cisco Configuration Engine intersects two namespaces, one for the event bus and the other for the configuration server. Within the scope of the configuration server namespace, the term *ConfigID* is the unique identifier for a device. Within the scope of the event bus namespace, the term *DeviceID* is the CNS unique identifier for a device.

### Related Topics

[Prerequisites for Configuring the Configuration Engine, on page 13](#)

[Restrictions for Configuring the Configuration Engine, on page 14](#)

## ConfigID

Each configured switch has a unique ConfigID, which serves as the key into the Cisco Configuration Engine directory for the corresponding set of switch CLI attributes. The ConfigID defined on the switch must match the ConfigID for the corresponding switch definition on the Cisco Configuration Engine.

The ConfigID is fixed at startup time and cannot be changed until the device restarts, even if the switch hostname is reconfigured.

## DeviceID

Each configured switch participating on the event bus has a unique DeviceID, which is analogous to the switch source address so that the switch can be targeted as a specific destination on the bus.

The origin of the DeviceID is defined by the Cisco IOS hostname of the switch. However, the DeviceID variable and its usage reside within the event gateway adjacent to the switch.

The logical Cisco IOS termination point on the event bus is embedded in the event gateway, which in turn functions as a proxy on behalf of the switch. The event gateway represents the switch and its corresponding DeviceID to the event bus.

The switch declares its hostname to the event gateway immediately after the successful connection to the event gateway. The event gateway couples the DeviceID value to the Cisco IOS hostname each time this connection is established. The event gateway retains this DeviceID value for the duration of its connection to the switch.

### Related Topics

[Prerequisites for Configuring the Configuration Engine, on page 13](#)

## Hostname and DeviceID

The DeviceID is fixed at the time of the connection to the event gateway and does not change even when the switch hostname is reconfigured.

When changing the switch hostname on the switch, the only way to refresh the DeviceID is to break the connection between the switch and the event gateway. For instructions on refreshing DeviceIDs, see "Related Topics."

When the connection is reestablished, the switch sends its modified hostname to the event gateway. The event gateway redefines the DeviceID to the new value.



### Caution

---

When using the Cisco Configuration Engine user interface, you must first set the DeviceID field to the hostname value that the switch acquires *after*, not *before*, and you must reinitialize the configuration for your Cisco IOS CNS agent. Otherwise, subsequent partial configuration command operations may malfunction.

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### Related Topics

[Refreshing DeviceIDs, on page 28](#)

## Hostname, DeviceID, and ConfigID

In standalone mode, when a hostname value is set for a switch, the configuration server uses the hostname as the DeviceID when an event is sent on hostname. If the hostname has not been set, the event is sent on the cn=<value> of the device.

In server mode, the hostname is not used. In this mode, the unique DeviceID attribute is always used for sending an event on the bus. If this attribute is not set, you cannot update the switch.

These and other associated attributes (tag value pairs) are set when you run **Setup** on the Cisco Configuration Engine.

## Cisco IOS CNS Agents

The CNS event agent feature allows the switch to publish and subscribe to events on the event bus and works with the Cisco IOS CNS agent. These agents, embedded in the switch Cisco IOS software, allow the switch to be connected and automatically configured.

### Initial Configuration

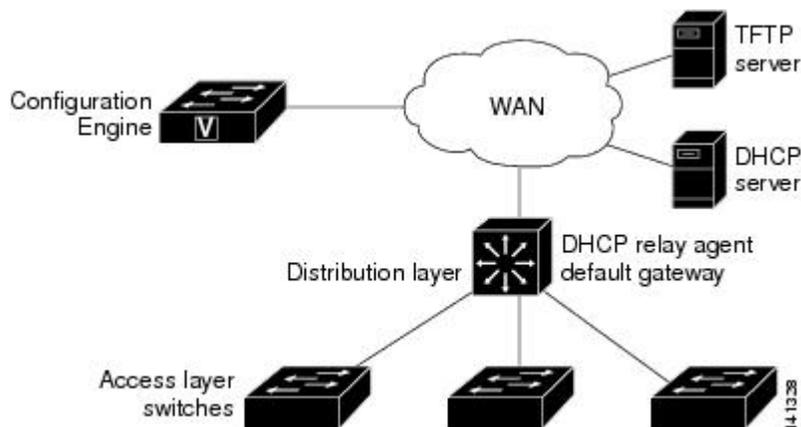
When the switch first comes up, it attempts to get an IP address by broadcasting a Dynamic Host Configuration Protocol (DHCP) request on the network. Assuming there is no DHCP server on the subnet, the distribution switch acts as a DHCP relay agent and forwards the request to the DHCP server. Upon receiving the request, the DHCP server assigns an IP address to the new switch and includes the Trivial File Transfer Protocol (TFTP) server Internet Protocol (IP) address, the path to the bootstrap configuration file, and the default gateway IP address in a unicast reply to the DHCP relay agent. The DHCP relay agent forwards the reply to the switch.

The switch automatically configures the assigned IP address on interface VLAN 1 (the default) and downloads the bootstrap configuration file from the TFTP server. Upon successful download of the bootstrap configuration file, the switch loads the file in its running configuration.

The Cisco IOS CNS agents initiate communication with the Configuration Engine by using the appropriate ConfigID and EventID. The Configuration Engine maps the Config ID to a template and downloads the full configuration file to the switch.

The following figure shows a sample network configuration for retrieving the initial bootstrap configuration file by using DHCP-based autoconfiguration.

**Figure 2: Initial Configuration**



### Related Topics

[Automated CNS Configuration, on page 19](#)

## Incremental (Partial) Configuration

After the network is running, new services can be added by using the Cisco IOS CNS agent. Incremental (partial) configurations can be sent to the switch. The actual configuration can be sent as an event payload by way of the event gateway (push operation) or as a signal event that triggers the switch to initiate a pull operation.

The switch can check the syntax of the configuration before applying it. If the syntax is correct, the switch applies the incremental configuration and publishes an event that signals success to the configuration server. If the switch does not apply the incremental configuration, it publishes an event showing an error status. When the switch has applied the incremental configuration, it can write it to nonvolatile random-access memory (NVRAM) or wait until signaled to do so.

## Synchronized Configuration

When the switch receives a configuration, it can defer application of the configuration upon receipt of a write-signal event. The write-signal event tells the switch not to save the updated configuration into its NVRAM. The switch uses the updated configuration as its running configuration. This ensures that the switch configuration is synchronized with other network activities before saving the configuration in NVRAM for use at the next reboot.

## Automated CNS Configuration

To enable automated CNS configuration of the switch, you must first complete the prerequisites listed in this topic. When you complete them, power on the switch. At the **setup** prompt, do nothing; the switch begins the initial configuration. When the full configuration file is loaded on your switch, you do not need to do anything else.

For more information on what happens during initial configuration, see "Related Topics."

**Table 4: Prerequisites for Enabling Automatic Configuration**

Device	Required Configuration
Access switch	Factory default (no configuration file)
Distribution switch	<ul style="list-style-type: none"> <li>• IP helper address</li> <li>• Enable DHCP relay agent<sup>1</sup></li> <li>• IP routing (if used as default gateway)</li> </ul>
DHCP server	<ul style="list-style-type: none"> <li>• IP address assignment</li> <li>• TFTP server IP address</li> <li>• Path to bootstrap configuration file on the TFTP server</li> <li>• Default gateway IP address</li> </ul>

Device	Required Configuration
TFTP server	<ul style="list-style-type: none"> <li>• A bootstrap configuration file that includes the CNS configuration commands that enable the switch to communicate with the Configuration Engine</li> <li>• The switch configured to use either the switch MAC address or the serial number (instead of the default hostname) to generate the ConfigID and EventID</li> <li>• The CNS event agent configured to push the configuration file to the switch</li> </ul>
CNS Configuration Engine	One or more templates for each type of device, with the ConfigID of the device mapped to the template.

<sup>1</sup> A DHCP Relay is needed only when the DHCP Server is on a different subnet from the client.

### Related Topics

[Initial Configuration, on page 18](#)

# How to Configure the Configuration Engine

## Enabling the CNS Event Agent



### Note

You must enable the CNS event agent on the switch before you enable the CNS configuration agent.

Beginning in privileged EXEC mode, follow these steps to enable the CNS event agent on the switch.

### SUMMARY STEPS

1. **configure terminal**
2. **cns event** {hostname | ip-address} [port-number] [ [keepalive seconds retry-count] [failover-time seconds] [reconnect-time time] | backup]
3. **end**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<p><b>configure terminal</b></p> <p><b>Example:</b></p> <pre>Switch# configure terminal</pre>	Enters the global configuration mode.
Step 2	<p><b>cns event</b> {<i>hostname</i>   <i>ip-address</i>} [<i>port-number</i>] [ [<b>keepalive</b> <i>seconds</i> <i>retry-count</i>] [<b>failover-time</b> <i>seconds</i> ] [<b>reconnect-time</b> <i>time</i>]   <b>backup</b>]</p> <p><b>Example:</b></p> <pre>Switch(config)# <b>cns event</b> 10.180.1.27 <b>keepalive</b> 120 10</pre>	<p>Enables the event agent, and enters the gateway parameters.</p> <ul style="list-style-type: none"> <li>• For {<i>hostname</i>   <i>ip-address</i>}, enter either the hostname or the IP address of the event gateway.</li> <li>• (Optional) For <i>port number</i>, enter the port number for the event gateway. The default port number is 11011.</li> <li>• (Optional) For <b>keepalive</b> <i>seconds</i>, enter how often the switch sends keepalive messages. For <i>retry-count</i>, enter the number of unanswered keepalive messages that the switch sends before the connection is terminated. The default for each is 0.</li> <li>• (Optional) For <b>failover-time</b> <i>seconds</i>, enter how long the switch waits for the primary gateway route after the route to the backup gateway is established.</li> <li>• (Optional) For <b>reconnect-time</b> <i>time</i>, enter the maximum time interval that the switch waits before trying to reconnect to the event gateway.</li> <li>• (Optional) Enter <b>backup</b> to show that this is the backup gateway. (If omitted, this is the primary gateway.)</li> </ul> <p><b>Note</b> Though visible in the command-line help string, the <b>encrypt</b> and the <b>clock-timeout</b> <i>time</i> keywords are not supported.</p>
Step 3	<p><b>end</b></p> <p><b>Example:</b></p> <pre>Switch(config)# <b>end</b></pre>	Returns to privileged EXEC mode.

This example shows how to enable the CNS event agent, set the IP address gateway to 10.180.1.27, set 120 seconds as the keepalive interval, and set 10 as the retry count.

```
Switch(config)# cns event 10.180.1.27 keepalive 120 10
```

**What to Do Next**

To verify information about the event agent, use the **show cns event connections** command in privileged EXEC mode.

To disable the CNS event agent, use the **no cns event** { *ip-address* | *hostname* } global configuration command.

**Related Topics**

[Event Service](#), on page 16

## Enabling the Cisco IOS CNS Agent

Beginning in privileged EXEC mode, follow these steps to enable the Cisco IOS CNS agent on the switch.

**Before You Begin**

You must enable the CNS event agent on the switch before you enable this agent.

**SUMMARY STEPS**

1. **configure terminal**
2. **cns config initial** {hostname | ip-address} [port-number]
3. **cns config partial** {hostname | ip-address} [port-number]
4. **end**
5. Start the Cisco IOS CNS agent on the switch.

**DETAILED STEPS**

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
<b>Step 2</b>	<b>cns config initial</b> {hostname   ip-address} [port-number]  <b>Example:</b> Switch(config)# <b>cns config initial</b> 10.180.1.27 10	Enables the Cisco IOS CNS agent, and enters the configuration server parameters. <ul style="list-style-type: none"> <li>• For {hostname   ip-address}, enter either the hostname or the IP address of the configuration server.</li> <li>• (Optional) For <i>port number</i>, enter the port number for the configuration server.</li> </ul> This command enables the Cisco IOS CNS agent and initiates an initial configuration on the switch.
<b>Step 3</b>	<b>cns config partial</b> {hostname   ip-address} [port-number]  <b>Example:</b> Switch(config)# <b>cns config partial</b> 10.180.1.27 10	Enables the Cisco IOS CNS agent, and enters the configuration server parameters. <ul style="list-style-type: none"> <li>• For {hostname   ip-address}, enter either the hostname or the IP address of the configuration server.</li> <li>• (Optional) For <i>port number</i>, enter the port number for the configuration server.</li> </ul>

	Command or Action	Purpose
		Enables the Cisco IOS CNS agent and initiates a partial configuration on the switch.
<b>Step 4</b>	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.
<b>Step 5</b>	Start the Cisco IOS CNS agent on the switch.	

### What to Do Next

You can now use the Cisco Configuration Engine to remotely send incremental configurations to the switch.

### Related Topics

[Refreshing DeviceIDs, on page 28](#)

## Enabling an Initial Configuration for Cisco IOS CNS Agent

Beginning in privileged EXEC mode, follow these steps to enable the CNS configuration agent and initiate an initial configuration on the switch.

## SUMMARY STEPS

1. **configure terminal**
2. **cns template connect** *name*
3. **cli** *config-text*
4. Repeat Steps 2 to 3 to configure another CNS connect template.
5. **exit**
6. **cns connect** *name* [**retries** *number*] [**retry-interval** *seconds*] [**sleep** *seconds*] [**timeout** *seconds*]
7. **discover** {**controller** *controller-type* | **dcli** [**subinterface** *subinterface-number*] | **interface** [*interface-type*] | **line** *line-type*}
8. **template** *name* [... *name*]
9. Repeat Steps 7 to 8 to specify more interface parameters and CNS connect templates in the CNS connect profile.
10. **exit**
11. **hostname** *name*
12. **ip route** *network-number*
13. **cns id** *interface num* {**dns-reverse** | **ipaddress** | **mac-address**} [**event**] [**image**]
14. **cns id** {**hardware-serial** | **hostname** | **string** *string* | **udi**} [**event**] [**image**]
15. **cns config initial** {*hostname* | *ip-address*} [*port-number*] [**event**] [**no-persist**] [**page** *page*] [**source** *ip-address*] [**syntax-check**]
16. **end**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
<b>Step 2</b>	<b>cns template connect</b> <i>name</i>  <b>Example:</b> Switch(config)# <b>cns template connect</b> <b>template-dhcp</b>	Enters CNS template connect configuration mode, and specifies the name of the CNS connect template.
<b>Step 3</b>	<b>cli</b> <i>config-text</i>  <b>Example:</b> Switch(config-templ-conn)# <b>cli ip</b> <b>address dhcp</b>	Enters a command line for the CNS connect template. Repeat this step for each command line in the template.
<b>Step 4</b>	Repeat Steps 2 to 3 to configure another CNS connect template.	

	Command or Action	Purpose
Step 5	<p><b>exit</b></p> <p><b>Example:</b></p> <pre>Switch(config)# exit</pre>	Returns to global configuration mode.
Step 6	<p><b>cns connect</b> <i>name</i> [<b>retries</b> <i>number</i>] [<b>retry-interval</b> <i>seconds</i>] [<b>sleep</b> <i>seconds</i>] [<b>timeout</b> <i>seconds</i>]</p> <p><b>Example:</b></p> <pre>Switch(config)# cns connect dhcp</pre>	<p>Enters CNS connect configuration mode, specifies the name of the CNS connect profile, and defines the profile parameters. The switch uses the CNS connect profile to connect to the Configuration Engine.</p> <ul style="list-style-type: none"> <li>• Enter the <i>name</i> of the CNS connect profile.</li> <li>• (Optional) For <b>retries</b> <i>number</i>, enter the number of connection retries. The range is 1 to 30. The default is 3.</li> <li>• (Optional) For <b>retry-interval</b> <i>seconds</i>, enter the interval between successive connection attempts to the Configuration Engine. The range is 1 to 40 seconds. The default is 10 seconds.</li> <li>• (Optional) For <b>sleep</b> <i>seconds</i>, enter the amount of time before which the first connection attempt occurs. The range is 0 to 250 seconds. The default is 0.</li> <li>• (Optional) For <b>timeout</b> <i>seconds</i>, enter the amount of time after which the connection attempts end. The range is 10 to 2000 seconds. The default is 120.</li> </ul>
Step 7	<p><b>discover</b> {<b>controller</b> <i>controller-type</i>   <b>dlci</b> [<b>subinterface</b> <i>subinterface-number</i>]   <b>interface</b> [<i>interface-type</i>]   <b>line</b> <i>line-type</i>}</p> <p><b>Example:</b></p> <pre>Switch(config-cns-conn)# discover interface gigabitethernet</pre>	<p>Specifies the interface parameters in the CNS connect profile.</p> <ul style="list-style-type: none"> <li>• For <b>controller</b> <i>controller-type</i>, enter the controller type.</li> <li>• For <b>dlci</b>, enter the active data-link connection identifiers (DLCIs). (Optional) For <b>subinterface</b> <i>subinterface-number</i>, specify the point-to-point subinterface number that is used to search for active DLCIs.</li> <li>• For <b>interface</b> [<i>interface-type</i>], enter the type of interface.</li> <li>• For <b>line</b> <i>line-type</i>, enter the line type.</li> </ul>
Step 8	<p><b>template</b> <i>name</i> [... <i>name</i>]</p> <p><b>Example:</b></p> <pre>Switch(config-cns-conn)# template template-dhcp</pre>	Specifies the list of CNS connect templates in the CNS connect profile to be applied to the switch configuration. You can specify more than one template.
Step 9	Repeat Steps 7 to 8 to specify more interface parameters and CNS connect templates in the CNS connect profile.	

	Command or Action	Purpose
Step 10	<b>exit</b>  <b>Example:</b> Switch(config-cns-conn) # <b>exit</b>	Returns to global configuration mode.
Step 11	<b>hostname name</b>  <b>Example:</b> Switch(config) # <b>hostname device1</b>	Enters the hostname for the switch.
Step 12	<b>ip route network-number</b>  <b>Example:</b> RemoteSwitch(config) # <b>ip route</b> <b>172.28.129.22 255.255.255.255</b> <b>11.11.11.1</b>	(Optional) Establishes a static route to the Configuration Engine whose IP address is <i>network-number</i> .
Step 13	<b>cns id interface num {dns-reverse   ipaddress   mac-address} [event] [image]</b>  <b>Example:</b> RemoteSwitch(config) # <b>cns id</b> <b>GigabitEthernet1/0/1 ipaddress</b>	<p>(Optional) Sets the unique EventID or ConfigID used by the Configuration Engine. If you enter this command, do not enter the <b>cns id {hardware-serial   hostname   string string   udi} [event] [image]</b> command.</p> <ul style="list-style-type: none"> <li>For <i>interface num</i>, enter the type of interface. For example, ethernet, group-async, loopback, or virtual-template. This setting specifies from which interface the IP or MAC address should be retrieved to define the unique ID.</li> <li>For <b>{dns-reverse   ipaddress   mac-address}</b>, enter <b>dns-reverse</b> to retrieve the hostname and assign it as the unique ID, enter <b>ipaddress</b> to use the IP address, or enter <b>mac-address</b> to use the MAC address as the unique ID.</li> <li>(Optional) Enter <b>event</b> to set the ID to be the event-id value used to identify the switch.</li> <li>(Optional) Enter <b>image</b> to set the ID to be the image-id value used to identify the switch.</li> </ul> <p><b>Note</b> If both the <b>event</b> and <b>image</b> keywords are omitted, the image-id value is used to identify the switch.</p>
Step 14	<b>cns id {hardware-serial   hostname   string string   udi} [event] [image]</b>  <b>Example:</b> RemoteSwitch(config) # <b>cns id</b> <b>hostname</b>	<p>(Optional) Sets the unique EventID or ConfigID used by the Configuration Engine. If you enter this command, do not enter the <b>cns id interface num {dns-reverse   ipaddress   mac-address} [event] [image]</b> command.</p> <ul style="list-style-type: none"> <li>For <b>{ hardware-serial   hostname   string string   udi }</b>, enter <b>hardware-serial</b> to set the switch serial number as the unique ID, enter <b>hostname</b> (the default) to select the switch hostname as the unique ID, enter an arbitrary text string for <b>string string</b> as the unique ID, or enter <b>udi</b> to set the unique device identifier (UDI) as the unique ID.</li> </ul>

	Command or Action	Purpose
Step 15	<p><b>cns config initial</b> {hostname   ip-address} [port-number] [event] [no-persist] [page page] [source ip-address] [syntax-check]</p> <p><b>Example:</b></p> <pre>RemoteSwitch(config)# <b>cns config initial 10.1.1.1 no-persist</b></pre>	<p>Enables the Cisco IOS agent, and initiates an initial configuration.</p> <ul style="list-style-type: none"> <li>For {hostname   ip-address}, enter the hostname or the IP address of the configuration server.</li> <li>(Optional) For <i>port-number</i>, enter the port number of the configuration server. The default port number is 80.</li> <li>(Optional) Enable <b>event</b> for configuration success, failure, or warning messages when the configuration is finished.</li> <li>(Optional) Enable <b>no-persist</b> to suppress the automatic writing to NVRAM of the configuration pulled as a result of entering the <b>cns config initial</b> global configuration command. If the <b>no-persist</b> keyword is not entered, using the <b>cns config initial</b> command causes the resultant configuration to be automatically written to NVRAM.</li> <li>(Optional) For <b>page page</b>, enter the web page of the initial configuration. The default is /Config/config/asp.</li> <li>(Optional) Enter <b>source ip-address</b> to use for source IP address.</li> <li>(Optional) Enable <b>syntax-check</b> to check the syntax when this parameter is entered.</li> </ul> <p><b>Note</b> Though visible in the command-line help string, the <b>encrypt</b>, <b>status url</b>, and <b>inventory</b> keywords are not supported.</p>
Step 16	<p><b>end</b></p> <p><b>Example:</b></p> <pre>RemoteSwitch(config)# <b>end</b></pre>	<p>Returns to privileged EXEC mode.</p>

This example shows how to configure an initial configuration on a remote switch when the switch configuration is unknown (the CNS Zero Touch feature).

```
Switch(config)# cns template connect template-dhcp
Switch(config-tmpl-conn)# cli ip address dhcp
Switch(config-tmpl-conn)# exit
Switch(config)# cns template connect ip-route
Switch(config-tmpl-conn)# cli ip route 0.0.0.0 0.0.0.0 ${next-hop}
Switch(config-tmpl-conn)# exit
Switch(config)# cns connect dhcp
Switch(config-cns-conn)# discover interface gigabitethernet
Switch(config-cns-conn)# template template-dhcp
Switch(config-cns-conn)# template ip-route
Switch(config-cns-conn)# exit
Switch(config)# hostname RemoteSwitch
RemoteSwitch(config)# cns config initial 10.1.1.1 no-persist
```

This example shows how to configure an initial configuration on a remote switch when the switch IP address is known. The Configuration Engine IP address is 172.28.129.22.

```
Switch(config)# cns template connect template-dhcp
Switch(config-tmpl-conn)# cli ip address dhcp
Switch(config-tmpl-conn)# exit
Switch(config)# cns template connect ip-route
Switch(config-tmpl-conn)# cli ip route 0.0.0.0 0.0.0.0 ${next-hop}
Switch(config-tmpl-conn)# exit
Switch(config)# cns connect dhcp
Switch(config-cns-conn)# discover interface gigabitethernet
Switch(config-cns-conn)# template template-dhcp
Switch(config-cns-conn)# template ip-route
Switch(config-cns-conn)# exit
Switch(config)# hostname RemoteSwitch
RemoteSwitch(config)# ip route 172.28.129.22 255.255.255.255 11.11.11.1
RemoteSwitch(config)# cns id ethernet 0 ipaddress
RemoteSwitch(config)# cns config initial 172.28.129.22 no-persist
```

### What to Do Next

To verify information about the configuration agent, use the **show cns config connections** command in privileged EXEC mode.

To disable the CNS Cisco IOS agent, use the **no cns config initial { ip-address | hostname }** global configuration command.

## Refreshing DeviceIDs

Beginning in privileged EXEC mode, follow these steps to refresh a DeviceID when changing the hostname on the switch.

### SUMMARY STEPS

1. **show cns config connections**
2. Make sure that the CNS event agent is properly connected to the event gateway.
3. **show cns event connections**
4. Record from the output of Step 3 the information for the currently connected connection listed below. You will be using the IP address and port number in subsequent steps of these instructions.
5. **configure terminal**
6. **no cns event ip-address port-number**
7. **cns event ip-address port-number**
8. **end**
9. Make sure that you have reestablished the connection between the switch and the event connection by examining the output from **show cns event connections**.

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<p><b>show cns config connections</b></p> <p><b>Example:</b></p> <pre>Switch# show cns config connections</pre>	Displays whether the CNS event agent is connecting to the gateway, connected, or active, and the gateway used by the event agent, its IP address and port number.
<b>Step 2</b>	Make sure that the CNS event agent is properly connected to the event gateway.	<p>Examine the output of <b>show cns config connections</b> for the following:</p> <ul style="list-style-type: none"> <li>• Connection is active.</li> <li>• Connection is using the currently configured switch hostname. The DeviceID will be refreshed to correspond to the new hostname configuration using these instructions.</li> </ul>
<b>Step 3</b>	<p><b>show cns event connections</b></p> <p><b>Example:</b></p> <pre>Switch# show cns event connections</pre>	Displays the event connection information for your switch.
<b>Step 4</b>	Record from the output of Step 3 the information for the currently connected connection listed below. You will be using the IP address and port number in subsequent steps of these instructions.	
<b>Step 5</b>	<p><b>configure terminal</b></p> <p><b>Example:</b></p> <pre>Switch# configure terminal</pre>	Enters global configuration mode.
<b>Step 6</b>	<p><b>no cns event ip-address port-number</b></p> <p><b>Example:</b></p> <pre>Switch(config)# no cns event 172.28.129.22 2012</pre>	<p>Specifies the IP address and port number that you recorded in Step 4 in this command.</p> <p>This command breaks the connection between the switch and the event gateway. It is necessary to first break, then reestablish, this connection to refresh the DeviceID.</p>
<b>Step 7</b>	<p><b>cns event ip-address port-number</b></p> <p><b>Example:</b></p> <pre>Switch(config)# cns event 172.28.129.22 2012</pre>	<p>Specifies the IP address and port number that you recorded in Step 4 in this command.</p> <p>This command reestablishes the connection between the switch and the event gateway.</p>
<b>Step 8</b>	<p><b>end</b></p> <p><b>Example:</b></p> <pre>Switch(config)# end</pre>	Returns to privileged EXEC mode.

	Command or Action	Purpose
<b>Step 9</b>	Make sure that you have reestablished the connection between the switch and the event connection by examining the output from <b>show cns event connections</b> .	

### Related Topics

[Enabling the Cisco IOS CNS Agent, on page 22](#)

[Hostname and DeviceID, on page 17](#)

## Enabling a Partial Configuration for Cisco IOS CNS Agent

Beginning in privileged EXEC mode, follow these steps to enable the Cisco IOS CNS agent and to initiate a partial configuration on the switch.

### SUMMARY STEPS

1. **configure terminal**
2. **cns config partial** *{ip-address | hostname}* [*port-number*] [**source ip-address**]
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 the global configuration mode.
<b>Step 2</b>	<b>cns config partial</b> <i>{ip-address   hostname}</i> [ <i>port-number</i> ] [ <b>source ip-address</b> ]  <b>Example:</b> Switch(config)# <b>cns config partial</b> <b>172.28.129.22 2013</b>	Enables the configuration agent, and initiates a partial configuration. <ul style="list-style-type: none"> <li>• For <i>{ip-address   hostname}</i>, enter the IP address or the hostname of the configuration server.</li> <li>• (Optional) For <i>port-number</i>, enter the port number of the configuration server. The default port number is 80.</li> <li>• (Optional) Enter <b>source ip-address</b> to use for the source IP address.</li> </ul> <p><b>Note</b> Though visible in the command-line help string, the <b>encrypt</b> keyword is not supported.</p>

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

### What to Do Next

To verify information about the configuration agent, use either the **show cns config stats** or the **show cns config outstanding** command in privileged EXEC mode.

To disable the Cisco IOS agent, use the **no cns config partial** { *ip-address* | *hostname* } global configuration command. To cancel a partial configuration, use the **cns config cancel** global configuration command.

## Monitoring CNS Configurations

*Table 5: CNS show Commands*

Command	Purpose
<b>show cns config connections</b>  Switch# <b>show cns config connections</b>	Displays the status of the CNS Cisco IOS CNS agent connections.
<b>show cns config outstanding</b>  Switch# <b>show cns config outstanding</b>	Displays information about incremental (partial) CNS configurations that have started but are not yet completed.
<b>show cns config stats</b>  Switch# <b>show cns config stats</b>	Displays statistics about the Cisco IOS CNS agent.
<b>show cns event connections</b>  Switch# <b>show cns event connections</b>	Displays the status of the CNS event agent connections.
<b>show cns event gateway</b>  Switch# <b>show cns event gateway</b>	Displays the event gateway information for your switch.
<b>show cns event stats</b>  Switch# <b>show cns event stats</b>	Displays statistics about the CNS event agent.
<b>show cns event subject</b>  Switch# <b>show cns event subject</b>	Displays a list of event agent subjects that are subscribed to by applications.

## Additional References

### Related Documents

Related Topic	Document Title
Configuration Engine Setup	<i>Cisco Configuration Engine Installation and Setup Guide, 1.5 for Linux</i> <a href="http://www.cisco.com/en/US/docs/net_mgmt/configuration_engine/1.5/installation_linux/guide/setup_1.html">http://www.cisco.com/en/US/docs/net_mgmt/configuration_engine/1.5/installation_linux/guide/setup_1.html</a>

### MIBs

MIB	MIBs Link
	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 the Configuration Engine

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



## Configuring the Cisco Discovery Protocol

This chapter describes the configuration of the Cisco Discovery Protocol (CDP).

- [Finding Feature Information, page 33](#)
- [Information About CDP, page 33](#)
- [How to Configure CDP, page 34](#)
- [Monitoring and Maintaining CDP, page 40](#)
- [Additional References, page 41](#)
- [Feature History and Information for Cisco Discovery Protocol, page 42](#)

### Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release.

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 CDP

#### CDP Overview

CDP is a device discovery protocol that runs over Layer 2 (the data-link layer) on all Cisco-manufactured devices (routers, bridges, access servers, controllers, and switches) and allows network management applications to discover Cisco devices that are neighbors of already known devices. With CDP, network management applications can learn the device type and the Simple Network Management Protocol (SNMP) agent address of neighboring devices running lower-layer, transparent protocols. This feature enables applications to send SNMP queries to neighboring devices.

CDP runs on all media that support Subnetwork Access Protocol (SNAP). Because CDP runs over the data-link layer only, two systems that support different network-layer protocols can learn about each other.

Each CDP-configured device sends periodic messages to a multicast address, advertising at least one address at which it can receive SNMP messages. The advertisements also contain time-to-live, or holdtime information, which is the length of time a receiving device holds CDP information before discarding it. Each device also listens to the messages sent by other devices to learn about neighboring devices.

On the switch, CDP enables Network Assistant to display a graphical view of the network. The switch uses CDP to find cluster candidates and maintain information about cluster members and other devices up to three cluster-enabled devices away from the command switch by default.

## CDP and Stacks

A switch stack appears as a single switch in the network. Therefore, CDP discovers the switch stack, not the individual stack members. The switch stack sends CDP messages to neighboring network devices when there are changes to the switch stack membership, such as stack members being added or removed.

## Default CDP Configuration

This table shows the default CDP configuration.

Feature	Default Setting
CDP global state	Enabled
CDP interface state	Enabled
CDP timer (packet update frequency)	60 seconds
CDP holdtime (before discarding)	180 seconds
CDP Version-2 advertisements	Enabled

## How to Configure CDP

### Configuring CDP Characteristics

You can configure these CDP characteristics:

- Frequency of CDP updates
- Amount of time to hold the information before discarding it
- Whether or not to send Version-2 advertisements



#### Note

Steps 2 through 4 are all optional and can be performed in any order.

Beginning in privileged EXEC mode, follow these steps to configure these characteristics.

## SUMMARY STEPS

1. **configure terminal**
2. **cdp timer *seconds***
3. **cdp holdtime *seconds***
4. **cdp advertise-v2**
5. **end**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
<b>Step 2</b>	<b>cdp timer <i>seconds</i></b>  <b>Example:</b> Switch(config)# <b>cdp timer 20</b>	(Optional) Sets the transmission frequency of CDP updates in seconds.  The range is 5 to 254; the default is 60 seconds.
<b>Step 3</b>	<b>cdp holdtime <i>seconds</i></b>  <b>Example:</b> Switch(config)# <b>cdp holdtime 60</b>	(Optional) Specifies the amount of time a receiving device should hold the information sent by your device before discarding it.  The range is 10 to 255 seconds; the default is 180 seconds.
<b>Step 4</b>	<b>cdp advertise-v2</b>  <b>Example:</b> Switch(config)# <b>cdp advertise-v2</b>	(Optional) Configures CDP to send Version-2 advertisements.  This is the default state.
<b>Step 5</b>	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.

### Example

The following example shows how to configure CDP characteristics:

```
Switch# configure terminal
Switch(config)# cdp timer 50
Switch(config)# cdp holdtime 120
```

```
Switch(config)# cdp advertise-v2
Switch(config)# end
```

### What to Do Next

Use the **no** form of the CDP commands to return to the default settings.

### Related Topics

[Monitoring and Maintaining CDP, on page 40](#)

## Disabling CDP

CDP is enabled by default.



#### Note

Switch clusters and other Cisco devices (such as Cisco IP Phones) regularly exchange CDP messages. Disabling CDP can interrupt cluster discovery and device connectivity.

Beginning in privileged EXEC mode, follow these steps to disable the CDP device discovery capability.

### SUMMARY STEPS

1. **configure terminal**
2. **no cdp run**
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 the global configuration mode.
<b>Step 2</b>	<b>no cdp run</b>  <b>Example:</b> Switch(config)# <b>no cdp run</b>	Disables CDP.
<b>Step 3</b>	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.

**What to Do Next**

You must reenable CDP to use it.

**Related Topics**

[Enabling CDP, on page 37](#)

## Enabling CDP

CDP is enabled by default.

**Note**

Switch clusters and other Cisco devices (such as Cisco IP Phones) regularly exchange CDP messages. Disabling CDP can interrupt cluster discovery and device connectivity.

Beginning in privileged EXEC mode, follow these steps to enable CDP when it has been disabled.

**Before You Begin**

CDP must be disabled, or it cannot be enabled.

### SUMMARY STEPS

1. **configure terminal**
2. **cdp run**
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 the global configuration mode.
<b>Step 2</b>	<b>cdp run</b>  <b>Example:</b> Switch(config)# <b>cdp run</b>	Enables CDP if it has been disabled.
<b>Step 3</b>	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.

**Example**

The following example shows how to enable CDP if it has been disabled:

```
Switch# configure terminal
Switch(config)# cdp run
Switch(config)# end
```

**What to Do Next**

Use the **show run all** command to show that CDP has been enabled. If you enter only **show run**, the enabling of CDP may not be displayed.

**Related Topics**

[Disabling CDP, on page 36](#)

## Disabling CDP on an Interface

CDP is enabled by default on all supported interfaces to send and to receive CDP information.

**Note**

Switch clusters and other Cisco devices (such as Cisco IP Phones) regularly exchange CDP messages. Disabling CDP can interrupt cluster discovery and device connectivity.

Beginning in privileged EXEC mode, follow these steps to disable CDP on a port.

**SUMMARY STEPS**

1. **configure terminal**
2. **interface** *interface-id*
3. **no cdp enable**
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 the global configuration mode.
<b>Step 2</b>	<b>interface</b> <i>interface-id</i>  <b>Example:</b> Switch(config)# <b>interface</b> gigabitethernet1/0/1	Specifies the interface on which you are disabling CDP, and enters interface configuration mode.

	Command or Action	Purpose
Step 3	<b>no cdp enable</b>  <b>Example:</b> Switch(config-if)# <b>no cdp enable</b>	Disables CDP on the interface specified in Step 2.
Step 4	<b>end</b>  <b>Example:</b> Switch(config-if)# <b>end</b>	Returns to privileged EXEC mode.

### Related Topics

[Enabling CDP on an Interface, on page 39](#)

## Enabling CDP on an Interface

CDP is enabled by default on all supported interfaces to send and to receive CDP information.



### Note

Switch clusters and other Cisco devices (such as Cisco IP Phones) regularly exchange CDP messages. Disabling CDP can interrupt cluster discovery and device connectivity.

Beginning in privileged EXEC mode, follow these steps to enable CDP on a port on which it has been disabled.

### Before You Begin

CDP must be disabled on the port that you are trying to CDP enable on, or it cannot be enabled.

### SUMMARY STEPS

1. **configure terminal**
2. **interface *interface-id***
3. **cdp enable**
4. **end**

### DETAILED STEPS

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

	Command or Action	Purpose
<b>Step 2</b>	<code>interface <i>interface-id</i></code>  <b>Example:</b> Switch(config)# <code>interface gigabitethernet1/0/1</code>	Specifies the interface on which you are enabling CDP, and enters interface configuration mode.
<b>Step 3</b>	<code>cdp enable</code>  <b>Example:</b> Switch(config-if)# <code>cdp enable</code>	Enables CDP on a disabled interface.
<b>Step 4</b>	<code>end</code>  <b>Example:</b> Switch(config-if)# <code>end</code>	Returns to privileged EXEC mode.

**Example**

The following example shows how to enable CDP on a disabled port:

```
Switch# configure terminal
Switch(config)# interface gigabitethernet1/0/1
Switch(config-if)# cdp enable
Switch(config-if)# end
```

**Related Topics**

[Disabling CDP on an Interface, on page 38](#)

## Monitoring and Maintaining CDP

*Table 6: Commands for Displaying CDP Information*

Command	Description
<code>clear cdp counters</code>	Resets the traffic counters to zero.
<code>clear cdp table</code>	Deletes the CDP table of information about neighbors.
<code>show cdp</code>	Displays global information, such as frequency of transmissions and the holdtime for packets being sent.

Command	Description
<b>show cdp entry</b> <i>entry-name</i> [version] [protocol]	Displays information about a specific neighbor. You can enter an asterisk (*) to display all CDP neighbors, or you can enter the name of the neighbor about which you want information.  You can also limit the display to information about the protocols enabled on the specified neighbor or information about the version of software running on the device.
<b>show cdp interface</b> [ <i>interface-id</i> ]	Displays information about interfaces where CDP is enabled. You can limit the display to the interface about which you want information.
<b>show cdp neighbors</b> [ <i>interface-id</i> ] [ <i>detail</i> ]	Displays information about neighbors, including device type, interface type and number, holdtime settings, capabilities, platform, and port ID.  You can limit the display to neighbors of a specific interface or expand the display to provide more detailed information.
<b>show cdp traffic</b>	Displays CDP counters, including the number of packets sent and received and checksum errors.

**Related Topics**

[Configuring CDP Characteristics, on page 34](#)

## Additional References

**Related Documents**

Related Topic	Document Title
System Management Commands	<i>Cisco IOS Configuration Fundamentals Command Reference, Cisco IOS XE Release 3S (Catalyst 3850 Switches)</i>

**MIBs**

MIB	MIBs Link
	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 Cisco Discovery Protocol**

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



# Configuring Simple Network Management Protocol

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This chapter describes the Simple Network Management Protocol (SNMP) configuration.

- [Finding Feature Information, page 43](#)
- [Prerequisites for SNMP, page 43](#)
- [Restrictions for SNMP, page 46](#)
- [Information About SNMP, page 46](#)
- [How to Configure SNMP, page 50](#)
- [Monitoring SNMP Status, page 62](#)
- [SNMP Examples, page 63](#)
- [Feature History and Information for Simple Network Management Protocol, page 64](#)

## Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release.

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.

## Prerequisites for SNMP

### Supported SNMP Versions

This software release supports the following SNMP versions:

- SNMPv1—The Simple Network Management Protocol, a Full Internet Standard, defined in RFC 1157.

- SNMPv2C replaces the Party-based Administrative and Security Framework of SNMPv2Classic with the community-string-based Administrative Framework of SNMPv2C while retaining the bulk retrieval and improved error handling of SNMPv2Classic. It has these features:
  - SNMPv2—Version 2 of the Simple Network Management Protocol, a Draft Internet Standard, defined in RFCs 1902 through 1907.
  - SNMPv2C—The community-string-based Administrative Framework for SNMPv2, an Experimental Internet Protocol defined in RFC 1901.
- SNMPv3—Version 3 of the SNMP is an interoperable standards-based protocol defined in RFCs 2273 to 2275. SNMPv3 provides secure access to devices by authenticating and encrypting packets over the network and includes these security features:
  - Message integrity—Ensures that a packet was not tampered with in transit.
  - Authentication—Determines that the message is from a valid source.
  - Encryption—Mixes the contents of a package to prevent it from being read by an unauthorized source.

**Note**


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To select encryption, enter the **priv** keyword.

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Both SNMPv1 and SNMPv2C use a community-based form of security. The community of managers able to access the agent's MIB is defined by an IP address access control list and password.

SNMPv2C includes a bulk retrieval function and more detailed error message reporting to management stations. The bulk retrieval function retrieves tables and large quantities of information, minimizing the number of round-trips required. The SNMPv2C improved error-handling includes expanded error codes that distinguish different kinds of error conditions; these conditions are reported through a single error code in SNMPv1. Error return codes in SNMPv2C report the error type.

SNMPv3 provides for both security models and security levels. A security model is an authentication strategy set up for a user and the group within which the user resides. A security level is the permitted level of security within a security model. A combination of the security level and the security model determine which security method is used when handling an SNMP packet. Available security models are SNMPv1, SNMPv2C, and SNMPv3.

The following table identifies characteristics and compares different combinations of security models and levels:

**Table 7: SNMP Security Models and Levels**

Model	Level	Authentication	Encryption	Result
SNMPv1	noAuthNoPriv	Community string	No	Uses a community string match for authentication.
SNMPv2C	noAuthNoPriv	Community string	No	Uses a community string match for authentication.

Model	Level	Authentication	Encryption	Result
SNMPv3	noAuthNoPriv	Username	No	Uses a username match for authentication.
SNMPv3	authNoPriv	Message Digest 5 (MD5) or Secure Hash Algorithm (SHA)	No	Provides authentication based on the HMAC-MD5 or HMAC-SHA algorithms.
SNMPv3	authPriv	MD5 or SHA	Data Encryption Standard (DES) or Advanced Encryption Standard (AES)	<p>Provides authentication based on the HMAC-MD5 or HMAC-SHA algorithms.</p> <p>Allows specifying the User-based Security Model (USM) with these encryption algorithms:</p> <ul style="list-style-type: none"> <li>• DES 56-bit encryption in addition to authentication based on the CBC-DES (DES-56) standard.</li> <li>• 3DES 168-bit encryption</li> <li>• AES 128-bit, 192-bit, or 256-bit encryption</li> </ul>

You must configure the SNMP agent to use the SNMP version supported by the management station. Because an agent can communicate with multiple managers, you can configure the software to support communications using SNMPv1, SNMPv2C, or SNMPv3.

# Restrictions for SNMP

## Version Restrictions

- SNMPv1 does not support informs.

# Information About SNMP

## SNMP Overview

SNMP is an application-layer protocol that provides a message format for communication between managers and agents. The SNMP system consists of an SNMP manager, an SNMP agent, and a management information base (MIB). The SNMP manager can be part of a network management system (NMS) such as Cisco Prime Infrastructure. The agent and MIB reside on the switch. To configure SNMP on the switch, you define the relationship between the manager and the agent.

The SNMP agent contains MIB variables whose values the SNMP manager can request or change. A manager can get a value from an agent or store a value into the agent. The agent gathers data from the MIB, the repository for information about device parameters and network data. The agent can also respond to a manager's requests to get or set data.

An agent can send unsolicited traps to the manager. Traps are messages alerting the SNMP manager to a condition on the network. Traps can mean improper user authentication, restarts, link status (up or down), MAC address tracking, closing of a TCP connection, loss of connection to a neighbor, or other significant events.

The active switch handles the SNMP requests and traps for the whole switch stack. The active switch transparently manages any requests or traps that are related to all stack members. When a new active switch is elected, the new active switch continues to handle SNMP requests and traps as configured on the previous active switch, assuming that IP connectivity to the SNMP management stations is still in place after the new active switch has taken control.

## SNMP Manager Functions

The SNMP manager uses information in the MIB to perform the operations described in the following table:

**Table 8: SNMP Operations**

Operation	Description
get-request	Retrieves a value from a specific variable.
get-next-request	Retrieves a value from a variable within a table. <sup>2</sup>
get-bulk-request <sup>3</sup>	Retrieves large blocks of data, such as multiple rows in a table, that would otherwise require the transmission of many small blocks of data.
get-response	Replies to a get-request, get-next-request, and set-request sent by an NMS.

Operation	Description
set-request	Stores a value in a specific variable.
trap	An unsolicited message sent by an SNMP agent to an SNMP manager when some event has occurred.

- 2 With this operation, an SNMP manager does not need to know the exact variable name. A sequential search is performed to find the needed variable from within a table.
- 3 The get-bulk command only works with SNMPv2 or later.

## SNMP Agent Functions

The SNMP agent responds to SNMP manager requests as follows:

- Get a MIB variable—The SNMP agent begins this function in response to a request from the NMS. The agent retrieves the value of the requested MIB variable and responds to the NMS with that value.
- Set a MIB variable—The SNMP agent begins this function in response to a message from the NMS. The SNMP agent changes the value of the MIB variable to the value requested by the NMS.

The SNMP agent also sends unsolicited trap messages to notify an NMS that a significant event has occurred on the agent. Examples of trap conditions include, but are not limited to, when a port or module goes up or down, when spanning-tree topology changes occur, and when authentication failures occur.

## SNMP Community Strings

SNMP community strings authenticate access to MIB objects and function as embedded passwords. In order for the NMS to access the switch, the community string definitions on the NMS must match at least one of the three community string definitions on the switch.

A community string can have one of the following attributes:

- Read-only (RO)—Gives all objects in the MIB except the community strings read access to authorized management stations, but does not allow write access.
- Read-write (RW)—Gives all objects in the MIB read and write access to authorized management stations, but does not allow access to the community strings.
- When a cluster is created, the command switch manages the exchange of messages among member switches and the SNMP application. The Network Assistant software appends the member switch number (@esN, where N is the switch number) to the first configured RW and RO community strings on the command switch and propagates them to the member switches.

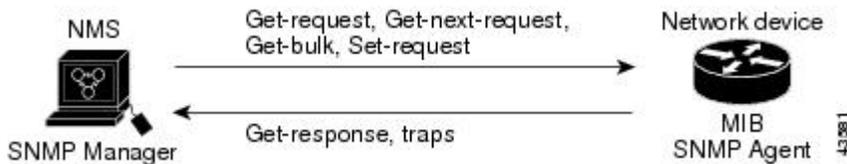
## SNMP MIB Variables Access

An example of an NMS is the Cisco Prime Infrastructure network management software. Cisco Prime Infrastructure 2.0 software uses the switch MIB variables to set device variables and to poll devices on the network for specific information. The results of a poll can be displayed as a graph and analyzed to troubleshoot

internetworking problems, increase network performance, verify the configuration of devices, monitor traffic loads, and more.

As shown in the figure, the SNMP agent gathers data from the MIB. The agent can send traps, or notification of certain events, to the SNMP manager, which receives and processes the traps. Traps alert the SNMP manager to a condition on the network such as improper user authentication, restarts, link status (up or down), MAC address tracking, and so forth. The SNMP agent also responds to MIB-related queries sent by the SNMP manager in get-request, get-next-request, and set-request format.

**Figure 3: SNMP Network**



## SNMP Notifications

SNMP allows the switch to send notifications to SNMP managers when particular events occur. SNMP notifications can be sent as traps or inform requests. In command syntax, unless there is an option in the command to select either traps or informs, the keyword traps refers to either traps or informs, or both. Use the `snmp-server` host command to specify whether to send SNMP notifications as traps or informs.



### Note

SNMPv1 does not support informs.

Traps are unreliable because the receiver does not send an acknowledgment when it receives a trap, and the sender cannot determine if the trap was received. When an SNMP manager receives an inform request, it acknowledges the message with an SNMP response protocol data unit (PDU). If the sender does not receive a response, the inform request can be sent again. Because they can be resent, informs are more likely than traps to reach their intended destination.

The characteristics that make informs more reliable than traps also consume more resources in the switch and in the network. Unlike a trap, which is discarded as soon as it is sent, an inform request is held in memory until a response is received or the request times out. Traps are sent only once, but an inform might be resent or retried several times. The retries increase traffic and contribute to a higher overhead on the network. Therefore, traps and informs require a trade-off between reliability and resources. If it is important that the SNMP manager receive every notification, use inform requests. If traffic on the network or memory in the switch is a concern and notification is not required, use traps.

## SNMP ifIndex MIB Object Values

In an NMS, the IF-MIB generates and assigns an interface index (ifIndex) object value that is a unique number greater than zero to identify a physical or a logical interface. When the switch reboots or the switch software is upgraded, the switch uses this same value for the interface. For example, if the switch assigns a port 2 an ifIndex value of 10003, this value is the same after the switch reboots.

The switch uses one of the values in the following table to assign an ifIndex value to an interface:

**Table 9: ifIndex Values**

Interface Type	ifIndex Range
SVI <sup>4</sup>	1–4999
EtherChannel	5001–5048
Tunnel	5078–5142
Physical (such as Gigabit Ethernet or SFP <sup>5</sup> -module interfaces) based on type and port numbers	10000–14500
Null	14501
Loopback and Tunnel	24567+

<sup>4</sup> SVI = switch virtual interface

<sup>5</sup> SFP = small form-factor pluggable

## Default SNMP Configuration

Feature	Default Setting
SNMP agent	Disabled <sup>6</sup> .
SNMP trap receiver	None configured.
SNMP traps	None enabled except the trap for TCP connections (tty).
SNMP version	If no version keyword is present, the default is Version 1.
SNMPv3 authentication	If no keyword is entered, the default is the <b>noauth</b> (noAuthNoPriv) security level.
SNMP notification type	If no type is specified, all notifications are sent.

<sup>6</sup> This is the default when the switch starts and the startup configuration does not have any **snmp-server** global configuration commands.

## SNMP Configuration Guidelines

If the switch starts and the switch startup configuration has at least one **snmp-server** global configuration command, the SNMP agent is enabled.

An SNMP *group* is a table that maps SNMP users to SNMP views. An SNMP *user* is a member of an SNMP group. An SNMP *host* is the recipient of an SNMP trap operation. An SNMP *engine ID* is a name for the local or remote SNMP engine.

When configuring SNMP, follow these guidelines:

- When configuring an SNMP group, do not specify a notify view. The **snmp-server host** global configuration command auto-generates a notify view for the user and then adds it to the group associated with that user. Modifying the group's notify view affects all users associated with that group.

- To configure a remote user, specify the IP address or port number for the remote SNMP agent of the device where the user resides.
- Before you configure remote users for a particular agent, configure the SNMP engine ID, using the **snmp-server engineID** global configuration command with the **remote** option. The remote agent's SNMP engine ID and user password are used to compute the authentication and privacy digests. If you do not configure the remote engine ID first, the configuration command fails.
- When configuring SNMP informs, you need to configure the SNMP engine ID for the remote agent in the SNMP database before you can send proxy requests or informs to it.
- If a local user is not associated with a remote host, the switch does not send informs for the **auth** (authNoPriv) and the **priv** (authPriv) authentication levels.
- Changing the value of the SNMP engine ID has significant results. A user's password (entered on the command line) is converted to an MD5 or SHA security digest based on the password and the local engine ID. The command-line password is then destroyed, as required by RFC 2274. Because of this deletion, if the value of the engine ID changes, the security digests of SNMPv3 users become invalid, and you need to reconfigure SNMP users by using the **snmp-server user username** global configuration command. Similar restrictions require the reconfiguration of community strings when the engine ID changes.

## How to Configure SNMP

### Disabling the SNMP Agent

The **no snmp-server** global configuration command disables all running versions (Version 1, Version 2C, and Version 3) of the SNMP agent on the device. You reenables all versions of the SNMP agent by the first **snmp-server** global configuration command that you enter. There is no Cisco IOS command specifically designated for enabling SNMP.

Beginning in privileged EXEC mode, follow these steps to disable the SNMP agent.

#### Before You Begin

The SNMP Agent must be enabled before it can be disabled. The SNMP agent is enabled by the first **snmp-server** global configuration command entered on the device.

#### SUMMARY STEPS

1. **configure terminal**
2. **no snmp-server**
3. **end**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
Step 2	<b>no snmp-server</b>  <b>Example:</b> Switch(config)# <b>no snmp-server</b>	Disables the SNMP agent operation.
Step 3	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.

## Configuring Community Strings

You use the SNMP community string to define the relationship between the SNMP manager and the agent. The community string acts like a password to permit access to the agent on the switch. Optionally, you can specify one or more of these characteristics associated with the string:

- An access list of IP addresses of the SNMP managers that are permitted to use the community string to gain access to the agent
- A MIB view, which defines the subset of all MIB objects accessible to the given community
- Read and write or read-only permission for the MIB objects accessible to the community

Beginning in privileged EXEC mode, follow these steps to configure a community string on the switch.

## SUMMARY STEPS

1. **configure terminal**
2. **snmp-server community** *string* [**view** *view-name*] [**ro** | **rw**] [*access-list-number*]
3. **access-list** *access-list-number* {**deny** | **permit**} *source* [*source-wildcard*]
4. **end**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<p><b>configure terminal</b></p> <p><b>Example:</b></p> <pre>Switch# configure terminal</pre>	Enters the global configuration mode.
Step 2	<p><b>snmp-server community string</b> [view <i>view-name</i>] [ro   rw] [<i>access-list-number</i>]</p> <p><b>Example:</b></p> <pre>Switch(config)# snmp-server community comaccess ro 4</pre>	<p>Configures the community string.</p> <p><b>Note</b> The @ symbol is used for delimiting the context information. Avoid using the @ symbol as part of the SNMP community string when configuring this command.</p> <ul style="list-style-type: none"> <li>For <i>string</i>, specify a string that acts like a password and permits access to the SNMP protocol. You can configure one or more community strings of any length.</li> <li>(Optional) For <i>view-name</i>, specify the view record accessible to the community.</li> <li>(Optional) Specify either read-only (<b>ro</b>) if you want authorized management stations to retrieve MIB objects, or specify read-write (<b>rw</b>) if you want authorized management stations to retrieve and modify MIB objects. By default, the community string permits read-only access to all objects.</li> <li>(Optional) For <i>access-list-number</i>, enter an IP standard access list numbered from 1 to 99 and 1300 to 1999.</li> </ul>
Step 3	<p><b>access-list access-list-number {deny   permit} source [source-wildcard]</b></p> <p><b>Example:</b></p> <pre>Switch(config)# access-list 4 deny any</pre>	<p>(Optional) If you specified an IP standard access list number in Step 2, then create the list, repeating the command as many times as necessary.</p> <ul style="list-style-type: none"> <li>For <i>access-list-number</i>, enter the access list number specified in Step 2.</li> <li>The <b>deny</b> keyword denies access if the conditions are matched. The <b>permit</b> keyword permits access if the conditions are matched.</li> <li>For <i>source</i>, enter the IP address of the SNMP managers that are permitted to use the community string to gain access to the agent.</li> <li>(Optional) For <i>source-wildcard</i>, enter the wildcard bits in dotted decimal notation to be applied to the source. Place ones in the bit positions that you want to ignore.</li> </ul> <p>Recall that the access list is always terminated by an implicit deny statement for everything.</p>
Step 4	<p><b>end</b></p> <p><b>Example:</b></p> <pre>Switch(config)# end</pre>	Returns to privileged EXEC mode.

This example shows how to assign the comaccess string to SNMP, to allow read-only access, and to specify that IP access list 4 can use the community string to gain access to the switch SNMP agent:

```
Switch(config)# snmp-server community comaccess ro 4
```

### What to Do Next

To disable access for an SNMP community, set the community string for that community to the null string (do not enter a value for the community string).

To remove a specific community string, use the **no snmp-server** community string global configuration command.

You can specify an identification name (engine ID) for the local or remote SNMP server engine on the switch. You can configure an SNMP server group that maps SNMP users to SNMP views, and you can add new users to the SNMP group.

## Configuring SNMP Groups and Users

You can specify an identification name (engine ID) for the local or remote SNMP server engine on the switch. You can configure an SNMP server group that maps SNMP users to SNMP views, and you can add new users to the SNMP group.

Beginning in privileged EXEC mode, follow these steps to configure SNMP groups and users on the switch.

### SUMMARY STEPS

1. **configure terminal**
2. **snmp-server engineID** {local *engineid-string* | remote *ip-address* [**udp-port** *port-number*] *engineid-string*}
3. **snmp-server group** *group-name* {v1 | v2c | v3 {**auth** | **noauth** | **priv**}} [**read** *readview*] [**write** *writeview*] [**notify** *notifyview*] [**access** *access-list*]
4. **snmp-server user** *username group-name* {remote *host* [**udp-port** *port*]} {v1 [**access** *access-list*] | v2c [**access** *access-list*] | v3 [**encrypted**] [**access** *access-list*] [**auth** {**md5** | **sha**} *auth-password*] } [**priv** {**des** | **3des** | **aes** {**128** | **192** | **256**}} *priv-password*]
5. **end**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
Step 2	<b>snmp-server engineID</b> {local <i>engineid-string</i>   remote <i>ip-address</i> }	Configures a name for either the local or remote copy of SNMP.

	Command or Action	Purpose
	<p>[<b>udp-port</b> <i>port-number</i>] <i>engineid-string</i>}]</p> <p><b>Example:</b></p> <pre>Switch(config)# snmp-server engineID local 1234</pre>	<ul style="list-style-type: none"> <li>The <i>engineid-string</i> is a 24-character ID string with the name of the copy of SNMP. You need not specify the entire 24-character engine ID if it has trailing zeros. Specify only the portion of the engine ID up to the point where only zeros remain in the value. The Step Example configures an engine ID of 123400000000000000000000.</li> <li>If you select <b>remote</b>, specify the <i>ip-address</i> of the device that contains the remote copy of SNMP and the optional User Datagram Protocol (UDP) port on the remote device. The default is 162.</li> </ul>
<b>Step 3</b>	<p><b>snmp-server group</b> <i>group-name</i> {<b>v1</b>   <b>v2c</b>   <b>v3</b> {<b>auth</b>   <b>noauth</b>   <b>priv</b>}} [<b>read</b> <i>readview</i>] [<b>write</b> <i>writeview</i>] [<b>notify</b> <i>notifyview</i>] [<b>access</b> <i>access-list</i>]</p> <p><b>Example:</b></p> <pre>Switch(config)# snmp-server group public v2c access lmnop</pre>	<p>Configures a new SNMP group on the remote device.</p> <p>For <i>group-name</i>, specify the name of the group.</p> <p>Specify one of the following security models:</p> <ul style="list-style-type: none"> <li><b>v1</b> is the least secure of the possible security models.</li> <li><b>v2c</b> is the second least secure model. It allows transmission of informs and integers twice the normal width.</li> <li><b>v3</b>, the most secure, requires you to select one of the following authentication levels: <ul style="list-style-type: none"> <li><b>auth</b>—Enables the Message Digest 5 (MD5) and the Secure Hash Algorithm (SHA) packet authentication.</li> <li><b>noauth</b>—Enables the noAuthNoPriv security level. This is the default if no keyword is specified.</li> <li><b>priv</b>—Enables Data Encryption Standard (DES) packet encryption (also called privacy).</li> </ul> </li> </ul> <p>(Optional) Enter <b>read</b> <i>readview</i> with a string (not to exceed 64 characters) that is the name of the view in which you can only view the contents of the agent.</p> <p>(Optional) Enter <b>write</b> <i>writeview</i> with a string (not to exceed 64 characters) that is the name of the view in which you enter data and configure the contents of the agent.</p> <p>(Optional) Enter <b>notify</b> <i>notifyview</i> with a string (not to exceed 64 characters) that is the name of the view in which you specify a notify, inform, or trap.</p> <p>(Optional) Enter <b>access</b> <i>access-list</i> with a string (not to exceed 64 characters) that is the name of the access list.</p>
<b>Step 4</b>	<p><b>snmp-server user</b> <i>username</i> <i>group-name</i> {<b>remote</b> <i>host</i> [<b>udp-port</b> <i>port</i>]} {<b>v1</b> [<b>access</b> <i>access-list</i>]   <b>v2c</b> [<b>access</b> <i>access-list</i>]   <b>v3</b> [<b>encrypted</b>] [<b>access</b> <i>access-list</i>] [<b>auth</b> {<b>md5</b>   <b>sha</b>} <i>auth-password</i>]} [<b>priv</b> {<b>des</b>   <b>3des</b>   <b>aes</b> {<b>128</b>   <b>192</b>   <b>256</b>}}] <i>priv-password</i>]</p>	<p>Adds a new user for an SNMP group.</p> <p>The <i>username</i> is the name of the user on the host that connects to the agent.</p> <p>The <i>group-name</i> is the name of the group to which the user is associated.</p> <p>Enter <b>remote</b> to specify a remote SNMP entity to which the user belongs and the hostname or IP address of that entity with the optional UDP port number. The default is 162.</p>

	Command or Action	Purpose
	<p><b>Example:</b></p> <pre>Switch(config)# snmp-server user Pat public v2c</pre>	<p>Enter the SNMP version number (<b>v1</b>, <b>v2c</b>, or <b>v3</b>). If you enter <b>v3</b>, you have these additional options:</p> <ul style="list-style-type: none"> <li>• <b>encrypted</b> specifies that the password appears in encrypted format. This keyword is available only when the <b>v3</b> keyword is specified.</li> <li>• <b>auth</b> is an authentication level setting session that can be either the HMAC-MD5-96 (<b>md5</b>) or the HMAC-SHA-96 (<b>sha</b>) authentication level and requires a password string <i>auth-password</i> (not to exceed 64 characters).</li> </ul> <p>If you enter <b>v3</b> you can also configure a private (<b>priv</b>) encryption algorithm and password string <i>priv-password</i> using the following keywords (not to exceed 64 characters):</p> <ul style="list-style-type: none"> <li>• <b>priv</b> specifies the User-based Security Model (USM).</li> <li>• <b>des</b> specifies the use of the 56-bit DES algorithm.</li> <li>• <b>3des</b> specifies the use of the 168-bit DES algorithm.</li> <li>• <b>aes</b> specifies the use of the DES algorithm. You must select either 128-bit, 192-bit, or 256-bit encryption.</li> </ul> <p>(Optional) Enter <b>access</b> <i>access-list</i> with a string (not to exceed 64 characters) that is the name of the access list.</p>
<b>Step 5</b>	<p><b>end</b></p> <p><b>Example:</b></p> <pre>Switch(config)# end</pre>	Returns to privileged EXEC mode.

## Configuring SNMP Notifications

A trap manager is a management station that receives and processes traps. Traps are system alerts that the switch generates when certain events occur. By default, no trap manager is defined, and no traps are sent. Switches running this Cisco IOS release can have an unlimited number of trap managers.



### Note

Many commands use the word **traps** in the command syntax. Unless there is an option in the command to select either traps or informs, the keyword **traps** refers to traps, informs, or both. Use the **snmp-server host** global configuration command to specify whether to send SNMP notifications as traps or informs.

You can use the **snmp-server host** global configuration command for a specific host to receive the notification types listed in the following table. You can enable any or all of these traps and configure a trap manager to receive them.

Table 10: Device Notification Types

Notification Type Keyword	Description
<b>bgp</b>	Generates Border Gateway Protocol (BGP) state change traps. This option is only available when the IP services feature set is enabled.
<b>bridge</b>	Generates STP bridge MIB traps.
<b>cluster</b>	Generates a trap when the cluster configuration changes.
<b>config</b>	Generates a trap for SNMP configuration changes.
<b>copy-config</b>	Generates a trap for SNMP copy configuration changes.
<b>cpu threshold</b>	Allow CPU-related traps.
<b>entity</b>	Generates a trap for SNMP entity changes.
<b>envmon</b>	Generates environmental monitor traps. You can enable any or all of these environmental traps: fan, shutdown, status, supply, temperature.
<b>flash</b>	Generates SNMP FLASH notifications. In a switch stack, you can optionally enable notification for flash insertion or removal, which would cause a trap to be issued whenever a switch in the stack is removed or inserted (physical removal, power cycle, or reload).
<b>fru-ctrl</b>	Generates entity field-replaceable unit (FRU) control traps. In the switch stack, this trap refers to the insertion or removal of a switch in the stack.
<b>hsrp</b>	Generates a trap for Hot Standby Router Protocol (HSRP) changes.
<b>ipmulticast</b>	Generates a trap for IP multicast routing changes.
<b>mac-notification</b>	Generates a trap for MAC address notifications.
<b>msdp</b>	Generates a trap for Multicast Source Discovery Protocol (MSDP) changes.
<b>ospf</b>	Generates a trap for Open Shortest Path First (OSPF) changes. You can enable any or all of these traps: Cisco specific, errors, link-state advertisement, rate limit, retransmit, and state changes.
<b>pim</b>	Generates a trap for Protocol-Independent Multicast (PIM) changes. You can enable any or all of these traps: invalid PIM messages, neighbor changes, and rendezvous point (RP)-mapping changes.

Notification Type Keyword	Description
<b>port-security</b>	<p>Generates SNMP port security traps. You can also set a maximum trap rate per second. The range is from 0 to 1000; the default is 0, which means that there is no rate limit.</p> <p><b>Note</b> When you configure a trap by using the notification type <b>port-security</b>, configure the port security trap first, and then configure the port security trap rate:</p> <ol style="list-style-type: none"> <li><b>snmp-server enable traps port-security</b></li> <li><b>snmp-server enable traps port-security trap-rate <i>rate</i></b></li> </ol>
<b>rtr</b>	Generates a trap for the SNMP Response Time Reporter (RTR).
<b>snmp</b>	Generates a trap for SNMP-type notifications for authentication, cold start, warm start, link up or link down.
<b>storm-control</b>	Generates a trap for SNMP storm-control. You can also set a maximum trap rate per minute. The range is from 0 to 1000; the default is 0 (no limit is imposed; a trap is sent at every occurrence).
<b>stpx</b>	Generates SNMP STP Extended MIB traps.
<b>syslog</b>	Generates SNMP syslog traps.
<b>tty</b>	Generates a trap for TCP connections. This trap is enabled by default.
<b>vlan-membership</b>	Generates a trap for SNMP VLAN membership changes.
<b>vlancreate</b>	Generates SNMP VLAN created traps.
<b>vlandelete</b>	Generates SNMP VLAN deleted traps.
<b>vtp</b>	Generates a trap for VLAN Trunking Protocol (VTP) changes.

Beginning in privileged EXEC mode, follow these steps to configure the switch to send traps or informs to a host.

## SUMMARY STEPS

1. **configure terminal**
2. **snmp-server engineID remote** *ip-address engineid-string*
3. **snmp-server user** *username group-name* {**remote** *host* [**udp-port** *port*]} {**v1** [**access** *access-list*] | **v2c** [**access** *access-list*] | **v3** [**encrypted**] [**access** *access-list*] [**auth** {**md5** | **sha**} *auth-password*] }
4. **snmp-server group** *group-name* {**v1** | **v2c** | **v3** {**auth** | **noauth** | **priv**}} [**read** *readview*] [**write** *writeview*] [**notify** *notifyview*] [**access** *access-list*]
5. **snmp-server host** *host-addr* [**informs** | **traps**] [**version** {**1** | **2c** | **3** {**auth** | **noauth** | **priv**}}] *community-string* [*notification-type*]
6. **snmp-server enable traps** *notification-types*
7. **snmp-server trap-source** *interface-id*
8. **snmp-server queue-length** *length*
9. **snmp-server trap-timeout** *seconds*
10. **end**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
Step 2	<b>snmp-server engineID remote</b> <i>ip-address engineid-string</i>  <b>Example:</b> Switch(config)# <b>snmp-server engineID remote</b> <b>192.180.1.27 00000063000100a1c0b4011b</b>	Specifies the engine ID for the remote host.
Step 3	<b>snmp-server user</b> <i>username group-name</i> { <b>remote</b> <i>host</i> [ <b>udp-port</b> <i>port</i> ]} { <b>v1</b> [ <b>access</b> <i>access-list</i> ]   <b>v2c</b> [ <b>access</b> <i>access-list</i> ]   <b>v3</b> [ <b>encrypted</b> ] [ <b>access</b> <i>access-list</i> ] [ <b>auth</b> { <b>md5</b>   <b>sha</b> } <i>auth-password</i> ] }  <b>Example:</b> Switch(config)# <b>snmp-server user</b> <b>Pat</b> <b>public v2c</b>	Configures an SNMP user to be associated with the remote host created in Step 2.  <b>Note</b> You cannot configure a remote user for an address without first configuring the engine ID for the remote host. Otherwise, you receive an error message, and the command is not executed.
Step 4	<b>snmp-server group</b> <i>group-name</i> { <b>v1</b>   <b>v2c</b>   <b>v3</b> { <b>auth</b>   <b>noauth</b>   <b>priv</b> }} [ <b>read</b> <i>readview</i> ] [ <b>write</b> <i>writeview</i> ] [ <b>notify</b> <i>notifyview</i> ] [ <b>access</b> <i>access-list</i> ]  <b>Example:</b> Switch(config)# <b>snmp-server group</b> <b>public v2c access lmnop</b>	Configures an SNMP group.

	Command or Action	Purpose
<b>Step 5</b>	<p><b>snmp-server host</b> <i>host-addr</i> [<b>informs</b>   <b>traps</b>] [<b>version</b> {<b>1</b>   <b>2c</b>   <b>3</b> {<b>auth</b>   <b>noauth</b>   <b>priv</b>}}] <i>community-string</i> [<i>notification-type</i>]</p> <p><b>Example:</b> Switch(config)# <b>snmp-server host</b> 203.0.113.1 comaccess snmp</p>	<p>Specifies the recipient of an SNMP trap operation.</p> <p>For <i>host-addr</i>, specify the name or Internet address of the host (the targeted recipient).</p> <p>(Optional) Specify <b>traps</b> (the default) to send SNMP traps to the host. Specify <b>informs</b> to send SNMP informs to the host.</p> <p>(Optional) Specify the SNMP <b>version</b> (<b>1</b>, <b>2c</b>, or <b>3</b>). SNMPv1 does not support informs.</p> <p>(Optional) For Version 3, select authentication level <b>auth</b>, <b>noauth</b>, or <b>priv</b>.</p> <p>For <i>community-string</i>, when <b>version 1</b> or <b>version 2c</b> is specified, enter the password-like community string sent with the notification operation. When <b>version 3</b> is specified, enter the SNMPv3 username.</p> <p>The @ symbol is used for delimiting the context information. Avoid using the @ symbol as part of the SNMP community string when configuring this command.</p> <p>(Optional) For <i>notification-type</i>, use the keywords listed in the table above. If no type is specified, all notifications are sent.</p>
<b>Step 6</b>	<p><b>snmp-server enable traps</b> <i>notification-types</i></p> <p><b>Example:</b> Switch(config)# <b>snmp-server enable traps</b> snmp</p>	<p>Enable the switch to send traps or informs and specify the type of notifications to be sent. For a list of notification types, see the table above, or enter <b>snmp-server enable traps ?</b></p> <p>To enable multiple types of traps, you must enter a separate <b>snmp-server enable traps</b> command for each trap type.</p> <p><b>Note</b> When you configure a trap by using the notification type port-security, configure the port security trap first, and then configure the port security trap rate:</p> <ol style="list-style-type: none"> <li><b>snmp-server enable traps port-security</b></li> <li><b>snmp-server enable traps port-security trap-rate</b> <i>rate</i></li> </ol>
<b>Step 7</b>	<p><b>snmp-server trap-source</b> <i>interface-id</i></p> <p><b>Example:</b> Switch(config)# <b>snmp-server trap-source</b> GigabitEthernet1/0/1</p>	<p>(Optional) Specify the source interface, which provides the IP address for the trap message. This command also sets the source IP address for informs.</p>
<b>Step 8</b>	<p><b>snmp-server queue-length</b> <i>length</i></p> <p><b>Example:</b> Switch(config)# <b>snmp-server queue-length</b> 20</p>	<p>(Optional) Establish the message queue length for each trap host. The range is 1 to 1000; the default is 10.</p>

	Command or Action	Purpose
<b>Step 9</b>	<b>snmp-server trap-timeout</b> <i>seconds</i>  <b>Example:</b> Switch(config)# <b>snmp-server trap-timeout</b> 60	(Optional) Define how often to resend trap messages. The range is 1 to 1000; the default is 30 seconds.
<b>Step 10</b>	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.

### What to Do Next

The **snmp-server host** command specifies which hosts receive the notifications. The **snmp-server enable trap** command globally enables the method for the specified notification (for traps and informs). To enable a host to receive an inform, you must configure an **snmp-server host informs** command for the host and globally enable informs by using the **snmp-server enable traps** command.

To remove the specified host from receiving traps, use the **no snmp-server host** *host* global configuration command. The **no snmp-server host** command with no keywords disables traps, but not informs, to the host. To disable informs, use the **no snmp-server host informs** global configuration command. To disable a specific trap type, use the **no snmp-server enable traps** *notification-types* global configuration command.

## Setting the Agent Contact and Location Information

Beginning in privileged EXEC mode, follow these steps to set the system contact and location of the SNMP agent so that these descriptions can be accessed through the configuration file.

### SUMMARY STEPS

1. **configure terminal**
2. **snmp-server contact** *text*
3. **snmp-server location** *text*
4. **end**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
Step 2	<b>snmp-server contact text</b>  <b>Example:</b> Switch(config)# <b>snmp-server contact Dial System Operator at beeper 21555</b>	Sets the system contact string.
Step 3	<b>snmp-server location text</b>  <b>Example:</b> Switch(config)# <b>snmp-server location Building 3/Room 222</b>	Sets the system location string.
Step 4	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.

## Limiting TFTP Servers Used Through SNMP

Beginning in privileged EXEC mode, follow these steps to limit the TFTP servers used for saving and loading configuration files through SNMP to the servers specified in an access list.

## SUMMARY STEPS

1. **configure terminal**
2. **snmp-server tftp-server-list access-list-number**
3. **access-list access-list-number {deny | permit} source [source-wildcard]**
4. **end**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<p><b>configure terminal</b></p> <p><b>Example:</b></p> <pre>Switch# configure terminal</pre>	Enters the global configuration mode.
Step 2	<p><b>snmp-server tftp-server-list</b> <i>access-list-number</i></p> <p><b>Example:</b></p> <pre>Switch(config)# snmp-server tftp-server-list 44</pre>	<p>Limits the TFTP servers used for configuration file copies through SNMP to the servers in the access list.</p> <p>For <i>access-list-number</i>, enter an IP standard access list numbered from 1 to 99 and 1300 to 1999.</p>
Step 3	<p><b>access-list</b> <i>access-list-number</i> {<b>deny</b>   <b>permit</b>} <i>source</i> [<i>source-wildcard</i>]</p> <p><b>Example:</b></p> <pre>Switch(config)# access-list 44 permit 10.1.1.2</pre>	<p>Creates a standard access list, repeating the command as many times as necessary.</p> <p>For <i>access-list-number</i>, enter the access list number specified in Step 2.</p> <p>The <b>deny</b> keyword denies access if the conditions are matched. The <b>permit</b> keyword permits access if the conditions are matched.</p> <p>For <i>source</i>, enter the IP address of the TFTP servers that can access the switch.</p> <p>(Optional) For <i>source-wildcard</i>, enter the wildcard bits, in dotted decimal notation, to be applied to the source. Place ones in the bit positions that you want to ignore.</p> <p>The access list is always terminated by an implicit deny statement for everything.</p>
Step 4	<p><b>end</b></p> <p><b>Example:</b></p> <pre>Switch(config)# end</pre>	Returns to privileged EXEC mode.

## Monitoring SNMP Status

To display SNMP input and output statistics, including the number of illegal community string entries, errors, and requested variables, use the **show snmp** privileged EXEC command. You also can use the other privileged EXEC commands listed in the table to display SNMP information.

**Table 11: Commands for Displaying SNMP Information**

Feature	Default Setting
<b>show snmp</b>	Displays SNMP statistics.
<b>show snmp engineID</b>	Displays information on the local SNMP engine and all remote engines that have been configured on the device.
<b>show snmp group</b>	Displays information on each SNMP group on the network.
<b>show snmp pending</b>	Displays information on pending SNMP requests.
<b>show snmp sessions</b>	Displays information on the current SNMP sessions.
<b>show snmp user</b>	<p>Displays information on each SNMP user name in the SNMP users table.</p> <p><b>Note</b> You must use this command to display SNMPv3 configuration information for <b>auth</b>   <b>noauth</b>   <b>priv</b> mode. This information is not displayed in the <b>show running-config</b> output.</p>

## SNMP Examples

This example shows how to enable all versions of SNMP. The configuration permits any SNMP manager to access all objects with read-only permissions using the community string *public*. This configuration does not cause the switch to send any traps.

```
Switch(config)# snmp-server community public
```

This example shows how to permit any SNMP manager to access all objects with read-only permission using the community string *public*. The switch also sends VTP traps to the hosts 192.180.1.111 and 192.180.1.33 using SNMPv1 and to the host 192.180.1.27 using SNMPv2C. The community string *public* is sent with the traps.

```
Switch(config)# snmp-server community public
Switch(config)# snmp-server enable traps vtp
Switch(config)# snmp-server host 192.180.1.27 version 2c public
Switch(config)# snmp-server host 192.180.1.111 version 1 public
Switch(config)# snmp-server host 192.180.1.33 public
```

This example shows how to allow read-only access for all objects to members of access list 4 that use the *comaccess* community string. No other SNMP managers have access to any objects. SNMP Authentication Failure traps are sent by SNMPv2C to the host *cisco.com* using the community string *public*.

```
Switch(config)# snmp-server community comaccess ro 4
Switch(config)# snmp-server enable traps snmp authentication
Switch(config)# snmp-server host cisco.com version 2c public
```

This example shows how to send Entity MIB traps to the host *cisco.com*. The community string is restricted. The first line enables the switch to send Entity MIB traps in addition to any traps previously enabled. The

second line specifies the destination of these traps and overwrites any previous **snmp-server** host commands for the host *cisco.com*.

```
Switch(config)# snmp-server enable traps entity
Switch(config)# snmp-server host cisco.com restricted entity
```

This example shows how to enable the switch to send all traps to the host *myhost.cisco.com* using the community string *public*:

```
Switch(config)# snmp-server enable traps
Switch(config)# snmp-server host myhost.cisco.com public
```

This example shows how to associate a user with a remote host and to send **auth** (authNoPriv) authentication-level informs when the user enters global configuration mode:

```
Switch(config)# snmp-server engineID remote 192.180.1.27 00000063000100a1c0b4011b
Switch(config)# snmp-server group authgroup v3 auth
Switch(config)# snmp-server user authuser authgroup remote 192.180.1.27 v3 auth md5 mypassword
Switch(config)# snmp-server user authuser authgroup v3 auth md5 mypassword
Switch(config)# snmp-server host 192.180.1.27 informs version 3 auth authuser config
Switch(config)# snmp-server enable traps
Switch(config)# snmp-server inform retries 0
```

## Feature History and Information for Simple Network Management Protocol

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



## Configuring SPAN and RSPAN

This chapter describes how to configure Switched Port Analyzer (SPAN) and Remote SPAN (RSPAN). Unless otherwise noted, the term switch refers to a standalone switch or a switch stack.

- [Finding Feature Information, page 65](#)
- [Prerequisites for SPAN and RSPAN, page 65](#)
- [Restrictions for SPAN and RSPAN, page 66](#)
- [Information About SPAN and RSPAN, page 67](#)
- [How to Configure SPAN and RSPAN, page 78](#)
- [Monitoring SPAN and RSPAN Operations, page 92](#)
- [SPAN and RSPAN Configuration Examples, page 93](#)
- [Additional References, page 95](#)
- [Feature History and Information for SPAN and RSPAN, page 96](#)

### Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release.

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.

### Prerequisites for SPAN and RSPAN

#### SPAN

- You can limit SPAN traffic to specific VLANs by using the **filter vlan** keyword. If a trunk port is being monitored, only traffic on the VLANs specified with this keyword is monitored. By default, all VLANs are monitored on a trunk port.

## RSPAN

- We recommend that you configure an RSPAN VLAN before you configure an RSPAN source or a destination session.

# Restrictions for SPAN and RSPAN

## SPAN

The restrictions for SPAN are as follows:

- On each switch, you can configure a maximum of 4 (2 if switch is stacked with Catalyst 2960-S switches) source sessions and 64 RSPAN destination sessions. A source session is either a local SPAN session or an RSPAN source session.
- For SPAN sources, you can monitor traffic for a single port or VLAN or a series or range of ports or VLANs for each session. You cannot mix source ports and source VLANs within a single SPAN session.
- The destination port cannot be a source port; a source port cannot be a destination port.
- You cannot have two SPAN sessions using the same destination port.
- When you configure a switch port as a SPAN destination port, it is no longer a normal switch port; only monitored traffic passes through the SPAN destination port.
- Entering SPAN configuration commands does not remove previously configured SPAN parameters. You must enter the **no monitor session** {*session\_number* | **all** | **local** | **remote**} global configuration command to delete configured SPAN parameters.
- For local SPAN, outgoing packets through the SPAN destination port carry the original encapsulation headers—untagged, ISL, or IEEE 802.1Q—if the **encapsulation replicate** keywords are specified. If the keywords are not specified, the packets are sent in native form.
- You can configure a disabled port to be a source or destination port, but the SPAN function does not start until the destination port and at least one source port or source VLAN are enabled.
- You cannot mix source VLANs and filter VLANs within a single SPAN session.

Traffic monitoring in a SPAN session has the following restrictions:

- Sources can be ports or VLANs, but you cannot mix source ports and source VLANs in the same session.
- The switch supports up to four local SPAN or RSPAN source sessions. However if this switch is stacked with Catalyst 2960-S switches, you are limited to 2 local SPAN or RSPAN source sessions.
  - You can run both a local SPAN and an RSPAN source session in the same switch or switch stack. The switch or switch stack supports a total of 64 source and RSPAN destination sessions.
  - You can configure two separate SPAN or RSPAN source sessions with separate or overlapping sets of SPAN source ports and VLANs. Both switched and routed ports can be configured as SPAN sources and destinations.
- You can have multiple destination ports in a SPAN session, but no more than 64 destination ports per switch stack.

- SPAN sessions do not interfere with the normal operation of the switch. However, an oversubscribed SPAN destination, for example, a 10-Mb/s port monitoring a 100-Mb/s port, can result in dropped or lost packets.
- When SPAN or RSPAN is enabled, each packet being monitored is sent twice, once as normal traffic and once as a monitored packet. Monitoring a large number of ports or VLANs could potentially generate large amounts of network traffic.
- You can configure SPAN sessions on disabled ports; however, a SPAN session does not become active unless you enable the destination port and at least one source port or VLAN for that session.
- The switch does not support a combination of local SPAN and RSPAN in a single session.
  - An RSPAN source session cannot have a local destination port.
  - An RSPAN destination session cannot have a local source port.
  - An RSPAN destination session and an RSPAN source session that are using the same RSPAN VLAN cannot run on the same switch or switch stack.

## RSPAN

The restrictions for RSPAN are as follows:

- RSPAN does not support BPDU packet monitoring or other Layer 2 switch protocols.
- The RSPAN VLAN is configured only on trunk ports and not on access ports. To avoid unwanted traffic in RSPAN VLANs, make sure that the VLAN remote-span feature is supported in all the participating switches.
- RSPAN VLANs are included as sources for port-based RSPAN sessions when source trunk ports have active RSPAN VLANs. RSPAN VLANs can also be sources in SPAN sessions. However, since the switch does not monitor spanned traffic, it does not support egress spanning of packets on any RSPAN VLAN identified as the destination of an RSPAN source session on the switch.
- If you enable VTP and VTP pruning, RSPAN traffic is pruned in the trunks to prevent the unwanted flooding of RSPAN traffic across the network for VLAN IDs that are lower than 1005.
- To use RSPAN, the switch must be running the LAN Base image.

# Information About SPAN and RSPAN

## SPAN and RSPAN

You can analyze network traffic passing through ports or VLANs by using SPAN or RSPAN to send a copy of the traffic to another port on the switch or on another switch that has been connected to a network analyzer or other monitoring or security device. SPAN copies (or mirrors) traffic received or sent (or both) on source ports or source VLANs to a destination port for analysis. SPAN does not affect the switching of network traffic on the source ports or VLANs. You must dedicate the destination port for SPAN use. Except for traffic that is required for the SPAN or RSPAN session, destination ports do not receive or forward traffic.

Only traffic that enters or leaves source ports or traffic that enters or leaves source VLANs can be monitored by using SPAN; traffic routed to a source VLAN cannot be monitored. For example, if incoming traffic is

being monitored, traffic that gets routed from another VLAN to the source VLAN cannot be monitored; however, traffic that is received on the source VLAN and routed to another VLAN can be monitored.

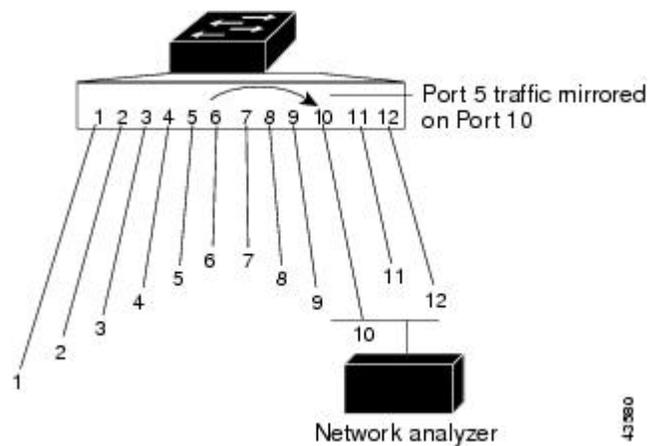
You can use the SPAN or RSPAN destination port to inject traffic from a network security device. For example, if you connect a Cisco Intrusion Detection System (IDS) sensor appliance to a destination port, the IDS device can send TCP reset packets to close down the TCP session of a suspected attacker.

## Local SPAN

Local SPAN supports a SPAN session entirely within one switch; all source ports or source VLANs and destination ports are in the same switch or switch stack. Local SPAN copies traffic from one or more source ports in any VLAN or from one or more VLANs to a destination port for analysis.

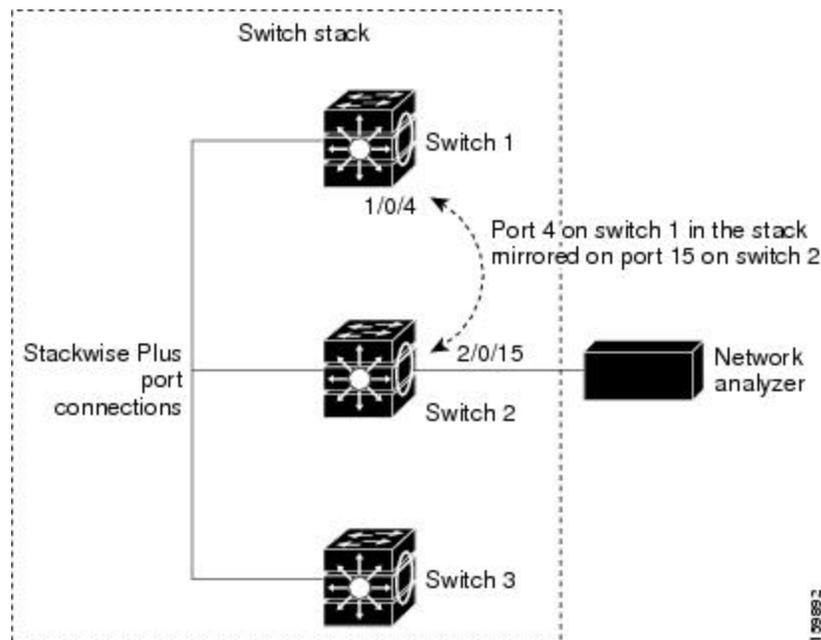
All traffic on port 5 (the source port) is mirrored to port 10 (the destination port). A network analyzer on port 10 receives all network traffic from port 5 without being physically attached to port 5.

**Figure 4: Example of Local SPAN Configuration on a Single Device**



This is an example of a local SPAN in a switch stack, where the source and destination ports reside on different stack members.

**Figure 5: Example of Local SPAN Configuration on a Device Stack**



### Related Topics

[Creating a Local SPAN Session, on page 78](#)

[Creating a Local SPAN Session and Configuring Incoming Traffic, on page 80](#)

[Example: Configuring Local SPAN, on page 93](#)

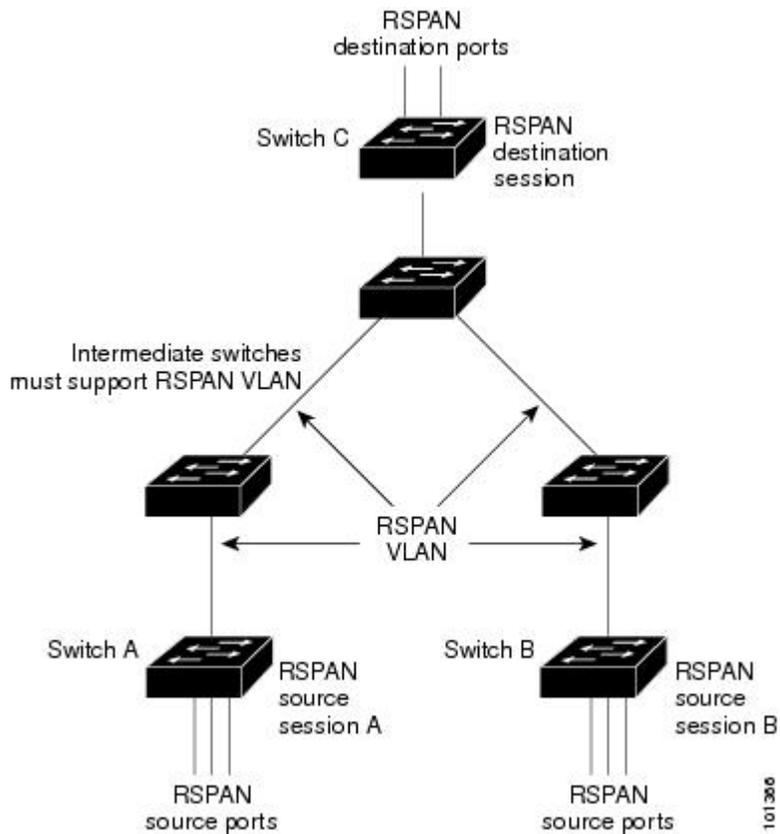
## Remote SPAN

RSPAN supports source ports, source VLANs, and destination ports on different switches (or different switch stacks), enabling remote monitoring of multiple switches across your network.

The figure below shows source ports on Switch A and Switch B. The traffic for each RSPAN session is carried over a user-specified RSPAN VLAN that is dedicated for that RSPAN session in all participating switches. The RSPAN traffic from the source ports or VLANs is copied into the RSPAN VLAN and forwarded over trunk ports carrying the RSPAN VLAN to a destination session monitoring the RSPAN VLAN. Each RSPAN

source switch must have either ports or VLANs as RSPAN sources. The destination is always a physical port, as shown on Switch C in the figure.

**Figure 6: Example of RSPAN Configuration**



### Related Topics

- [Creating an RSPAN Source Session, on page 85](#)
- [Creating an RSPAN Destination Session, on page 88](#)
- [Creating an RSPAN Destination Session and Configuring Incoming Traffic, on page 90](#)
- [Examples: Creating an RSPAN VLAN, on page 94](#)

## SPAN and RSPAN Concepts and Terminology

- [SPAN Sessions](#)
- [Monitored Traffic](#)
- [Source Ports](#)
- [Source VLANs](#)
- [VLAN Filtering](#)
- [Destination Port](#)
- [RSPAN VLAN](#)

## SPAN Sessions

SPAN sessions (local or remote) allow you to monitor traffic on one or more ports, or one or more VLANs, and send the monitored traffic to one or more destination ports.

A local SPAN session is an association of a destination port with source ports or source VLANs, all on a single network device. Local SPAN does not have separate source and destination sessions. Local SPAN sessions gather a set of ingress and egress packets specified by the user and form them into a stream of SPAN data, which is directed to the destination port.

RSPAN consists of at least one RSPAN source session, an RSPAN VLAN, and at least one RSPAN destination session. You separately configure RSPAN source sessions and RSPAN destination sessions on different network devices. To configure an RSPAN source session on a device, you associate a set of source ports or source VLANs with an RSPAN VLAN. The output of this session is the stream of SPAN packets that are sent to the RSPAN VLAN. To configure an RSPAN destination session on another device, you associate the destination port with the RSPAN VLAN. The destination session collects all RSPAN VLAN traffic and sends it out the RSPAN destination port.

An RSPAN source session is very similar to a local SPAN session, except for where the packet stream is directed. In an RSPAN source session, SPAN packets are relabeled with the RSPAN VLAN ID and directed over normal trunk ports to the destination switch.

An RSPAN destination session takes all packets received on the RSPAN VLAN, strips off the VLAN tagging, and presents them on the destination port. The session presents a copy of all RSPAN VLAN packets (except Layer 2 control packets) to the user for analysis.

More than one source session and more than one destination session can be active in the same RSPAN VLAN. Intermediate switches also can separate the RSPAN source and destination sessions. These switches are unable to run RSPAN, but they must respond to the requirements of the RSPAN VLAN.

Traffic monitoring in a SPAN session has these restrictions:

- Sources can be ports or VLANs, but you cannot mix source ports and source VLANs in the same session.
- The switch supports up to two local SPAN or RSPAN source sessions.
  - You can run both a local SPAN and an RSPAN source session in the same switch or switch stack. The switch or switch stack supports a total of 64 source and RSPAN destination sessions.
  - You can configure two separate SPAN or RSPAN source sessions with separate or overlapping sets of SPAN source ports and VLANs. Both switched and routed ports can be configured as SPAN sources and destinations.
- You can have multiple destination ports in a SPAN session, but no more than 64 destination ports per switch stack.
- SPAN sessions do not interfere with the normal operation of the switch. However, an oversubscribed SPAN destination, for example, a 10-Mb/s port monitoring a 100-Mb/s port, can result in dropped or lost packets.
- When SPAN or RSPAN is enabled, each packet being monitored is sent twice, once as normal traffic and once as a monitored packet. Therefore monitoring a large number of ports or VLANs could potentially generate large amounts of network traffic.
- You can configure SPAN sessions on disabled ports; however, a SPAN session does not become active unless you enable the destination port and at least one source port or VLAN for that session.
- The switch does not support a combination of local SPAN and RSPAN in a single session.

- An RSPAN source session cannot have a local destination port.
- An RSPAN destination session cannot have a local source port.
- An RSPAN destination session and an RSPAN source session that are using the same RSPAN VLAN cannot run on the same switch or switch stack.

### Related Topics

[Creating a Local SPAN Session, on page 78](#)

[Creating a Local SPAN Session and Configuring Incoming Traffic, on page 80](#)

[Example: Configuring Local SPAN, on page 93](#)

### Monitored Traffic

SPAN sessions can monitor these traffic types:

- Receive (Rx) SPAN—Receive (or ingress) SPAN monitors as much as possible all of the packets received by the source interface or VLAN before any modification or processing is performed by the switch. A copy of each packet received by the source is sent to the destination port for that SPAN session.

Packets that are modified because of routing or quality of service (QoS)—for example, modified Differentiated Services Code Point (DSCP)—are copied before modification.

Features that can cause a packet to be dropped during receive processing have no effect on ingress SPAN; the destination port receives a copy of the packet even if the actual incoming packet is dropped. These features include IP standard and extended input access control lists (ACLs), ingress QoS policing, VLAN ACLs, and egress QoS policing.

- Transmit (Tx) SPAN—Transmit (or egress) SPAN monitors as much as possible all of the packets sent by the source interface after all modification and processing is performed by the switch. A copy of each packet sent by the source is sent to the destination port for that SPAN session. The copy is provided after the packet is modified.

Packets that are modified because of routing (for example, with modified time-to-live (TTL), MAC address, or QoS values) are duplicated (with the modifications) at the destination port.

Features that can cause a packet to be dropped during transmit processing also affect the duplicated copy for SPAN. These features include IP standard and extended output ACLs and egress QoS policing.

- Both—In a SPAN session, you can also monitor a port or VLAN for both received and sent packets. This is the default.

The default configuration for local SPAN session ports is to send all packets untagged. SPAN also does not normally monitor bridge protocol data unit (BPDU) packets and Layer 2 protocols, such as Cisco Discovery Protocol (CDP), VLAN Trunk Protocol (VTP), Dynamic Trunking Protocol (DTP), Spanning Tree Protocol (STP), and Port Aggregation Protocol (PAgP). However, when you enter the **encapsulation replicate** keywords when configuring a destination port, these changes occur:

- Packets are sent on the destination port with the same encapsulation (untagged, Inter-Switch Link (ISL), or IEEE 802.1Q) that they had on the source port.
- Packets of all types, including BPDU and Layer 2 protocol packets, are monitored.

Therefore, a local SPAN session with **encapsulation replicate** enabled can have a mixture of untagged, ISL, and IEEE 802.1Q tagged packets appear on the destination port.

Switch congestion can cause packets to be dropped at ingress source ports, egress source ports, or SPAN destination ports. In general, these characteristics are independent of one another. For example:

- A packet might be forwarded normally but dropped from monitoring due to an oversubscribed SPAN destination port.
- An ingress packet might be dropped from normal forwarding, but still appear on the SPAN destination port.
- An egress packet dropped because of switch congestion is also dropped from egress SPAN.

In some SPAN configurations, multiple copies of the same source packet are sent to the SPAN destination port. For example, a bidirectional (both Rx and Tx) SPAN session is configured for the Rx monitor on port A and Tx monitor on port B. If a packet enters the switch through port A and is switched to port B, both incoming and outgoing packets are sent to the destination port. Both packets are the same unless a Layer 3 rewrite occurs, in which case the packets are different because of the packet modification.

## Source Ports

A source port (also called a monitored port) is a switched or routed port that you monitor for network traffic analysis. In a local SPAN session or RSPAN source session, you can monitor source ports or VLANs for traffic in one or both directions. The switch supports any number of source ports (up to the maximum number of available ports on the switch) and any number of source VLANs (up to the maximum number of VLANs supported). However, the switch supports a maximum of (local or RSPAN) with source ports or VLANs. You cannot mix ports and VLANs in a single session.

A source port has these characteristics:

- It can be monitored in multiple SPAN sessions.
- Each source port can be configured with a direction (ingress, egress, or both) to monitor.
- It can be any port type (for example, EtherChannel, Gigabit Ethernet, and so forth).
- For EtherChannel sources, you can monitor traffic for the entire EtherChannel or individually on a physical port as it participates in the port channel.
- It can be an access port, trunk port, routed port, or voice VLAN port.
- It cannot be a destination port.
- Source ports can be in the same or different VLANs.
- You can monitor multiple source ports in a single session.

## Source VLANs

VLAN-based SPAN (VSPAN) is the monitoring of the network traffic in one or more VLANs. The SPAN or RSPAN source interface in VSPAN is a VLAN ID, and traffic is monitored on all the ports for that VLAN.

VSPAN has these characteristics:

- All active ports in the source VLAN are included as source ports and can be monitored in either or both directions.
- On a given port, only traffic on the monitored VLAN is sent to the destination port.
- If a destination port belongs to a source VLAN, it is excluded from the source list and is not monitored.

- If ports are added to or removed from the source VLANs, the traffic on the source VLAN received by those ports is added to or removed from the sources being monitored.
- You cannot use filter VLANs in the same session with VLAN sources.
- You can monitor only Ethernet VLANs.

## VLAN Filtering

When you monitor a trunk port as a source port, by default, all VLANs active on the trunk are monitored. You can limit SPAN traffic monitoring on trunk source ports to specific VLANs by using VLAN filtering.

- VLAN filtering applies only to trunk ports or to voice VLAN ports.
- VLAN filtering applies only to port-based sessions and is not allowed in sessions with VLAN sources.
- When a VLAN filter list is specified, only those VLANs in the list are monitored on trunk ports or on voice VLAN access ports.
- SPAN traffic coming from other port types is not affected by VLAN filtering; that is, all VLANs are allowed on other ports.
- VLAN filtering affects only traffic forwarded to the destination SPAN port and does not affect the switching of normal traffic.

## Destination Port

Each local SPAN session or RSPAN destination session must have a destination port (also called a monitoring port) that receives a copy of traffic from the source ports or VLANs and sends the SPAN packets to the user, usually a network analyzer.

A destination port has these characteristics:

- For a local SPAN session, the destination port must reside on the same switch or switch stack as the source port. For an RSPAN session, it is located on the switch containing the RSPAN destination session. There is no destination port on a switch or switch stack running only an RSPAN source session.
- When a port is configured as a SPAN destination port, the configuration overwrites the original port configuration. When the SPAN destination configuration is removed, the port reverts to its previous configuration. If a configuration change is made to the port while it is acting as a SPAN destination port, the change does not take effect until the SPAN destination configuration had been removed.




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**Note** When QoS is configured on the SPAN destination port, QoS takes effect immediately.

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- If the port was in an EtherChannel group, it is removed from the group while it is a destination port. If it was a routed port, it is no longer a routed port.
- It can be any Ethernet physical port.
- It cannot be a secure port.
- It cannot be a source port.
- It cannot be an EtherChannel group or a VLAN.

- It can participate in only one SPAN session at a time (a destination port in one SPAN session cannot be a destination port for a second SPAN session).
- When it is active, incoming traffic is disabled. The port does not transmit any traffic except that required for the SPAN session. Incoming traffic is never learned or forwarded on a destination port.
- If ingress traffic forwarding is enabled for a network security device, the destination port forwards traffic at Layer 2.
- It does not participate in any of the Layer 2 protocols (STP, VTP, CDP, DTP, PagP).
- A destination port that belongs to a source VLAN of any SPAN session is excluded from the source list and is not monitored.
- The maximum number of destination ports in a switch or switch stack is 64.

Local SPAN and RSPAN destination ports function differently with VLAN tagging and encapsulation:

- For local SPAN, if the **encapsulation replicate** keywords are specified for the destination port, these packets appear with the original encapsulation (untagged, ISL, or IEEE 802.1Q). If these keywords are not specified, packets appear in the untagged format. Therefore, the output of a local SPAN session with **encapsulation replicate** enabled can contain a mixture of untagged, ISL, or IEEE 802.1Q-tagged packets.
- For RSPAN, the original VLAN ID is lost because it is overwritten by the RSPAN VLAN identification. Therefore, all packets appear on the destination port as untagged.

## RSPAN VLAN

The RSPAN VLAN carries SPAN traffic between RSPAN source and destination sessions. RSPAN VLAN has these special characteristics:

- All traffic in the RSPAN VLAN is always flooded.
- No MAC address learning occurs on the RSPAN VLAN.
- RSPAN VLAN traffic only flows on trunk ports.
- RSPAN VLANs must be configured in VLAN configuration mode by using the **remote-span** VLAN configuration mode command.
- STP can run on RSPAN VLAN trunks but not on SPAN destination ports.
- An RSPAN VLAN cannot be a private-VLAN primary or secondary VLAN.

For VLANs 1 to 1005 that are visible to VLAN Trunking Protocol (VTP), the VLAN ID and its associated RSPAN characteristic are propagated by VTP. If you assign an RSPAN VLAN ID in the extended VLAN range (1006 to 4094), you must manually configure all intermediate switches.

It is normal to have multiple RSPAN VLANs in a network at the same time with each RSPAN VLAN defining a network-wide RSPAN session. That is, multiple RSPAN source sessions anywhere in the network can contribute packets to the RSPAN session. It is also possible to have multiple RSPAN destination sessions throughout the network, monitoring the same RSPAN VLAN and presenting traffic to the user. The RSPAN VLAN ID separates the sessions.

### Related Topics

[Creating an RSPAN Source Session, on page 85](#)

[Creating an RSPAN Destination Session, on page 88](#)

[Creating an RSPAN Destination Session and Configuring Incoming Traffic](#), on page 90  
[Examples: Creating an RSPAN VLAN](#), on page 94

## SPAN and RSPAN Interaction with Other Features

SPAN interacts with these features:

- **Routing**—SPAN does not monitor routed traffic. VSPAN only monitors traffic that enters or exits the switch, not traffic that is routed between VLANs. For example, if a VLAN is being Rx-monitored and the switch routes traffic from another VLAN to the monitored VLAN, that traffic is not monitored and not received on the SPAN destination port.
- **STP**—A destination port does not participate in STP while its SPAN or RSPAN session is active. The destination port can participate in STP after the SPAN or RSPAN session is disabled. On a source port, SPAN does not affect the STP status. STP can be active on trunk ports carrying an RSPAN VLAN.
- **CDP**—A SPAN destination port does not participate in CDP while the SPAN session is active. After the SPAN session is disabled, the port again participates in CDP.
- **VTP**—You can use VTP to prune an RSPAN VLAN between switches.
- **VLAN and trunking**—You can modify VLAN membership or trunk settings for source or destination ports at any time. However, changes in VLAN membership or trunk settings for a destination port do not take effect until you remove the SPAN destination configuration. Changes in VLAN membership or trunk settings for a source port immediately take effect, and the respective SPAN sessions automatically adjust accordingly.

- **EtherChannel**—You can configure an EtherChannel group as a source port but not as a SPAN destination port. When a group is configured as a SPAN source, the entire group is monitored.

If a physical port is added to a monitored EtherChannel group, the new port is added to the SPAN source port list. If a port is removed from a monitored EtherChannel group, it is automatically removed from the source port list.

A physical port that belongs to an EtherChannel group can be configured as a SPAN source port and still be a part of the EtherChannel. In this case, data from the physical port is monitored as it participates in the EtherChannel. However, if a physical port that belongs to an EtherChannel group is configured as a SPAN destination, it is removed from the group. After the port is removed from the SPAN session, it rejoins the EtherChannel group. Ports removed from an EtherChannel group remain members of the group, but they are in the inactive or suspended state.

If a physical port that belongs to an EtherChannel group is a destination port and the EtherChannel group is a source, the port is removed from the EtherChannel group and from the list of monitored ports.

- **Multicast traffic** can be monitored. For egress and ingress port monitoring, only a single unedited packet is sent to the SPAN destination port. It does not reflect the number of times the multicast packet is sent.
- A **private-VLAN** port cannot be a SPAN destination port.
- A **secure** port cannot be a SPAN destination port.

For SPAN sessions, do not enable port security on ports with monitored egress when ingress forwarding is enabled on the destination port. For RSPAN source sessions, do not enable port security on any ports with monitored egress.

- An **IEEE 802.1x** port can be a SPAN source port. You can enable IEEE 802.1x on a port that is a SPAN destination port; however, IEEE 802.1x is disabled until the port is removed as a SPAN destination.

For SPAN sessions, do not enable IEEE 802.1x on ports with monitored egress when ingress forwarding is enabled on the destination port. For RSPAN source sessions, do not enable IEEE 802.1x on any ports that are egress monitored.

## SPAN and RSPAN and Device Stacks

Because the stack of switches represents one logical switch, local SPAN source ports and destination ports can be in different switches in the stack. Therefore, the addition or deletion of switches in the stack can affect a local SPAN session, as well as an RSPAN source or destination session. An active session can become inactive when a switch is removed from the stack or an inactive session can become active when a switch is added to the stack.

## Default SPAN and RSPAN Configuration

**Table 12: Default SPAN and RSPAN Configuration**

Feature	Default Setting
SPAN state (SPAN and RSPAN)	Disabled.
Source port traffic to monitor	Both received and sent traffic ( <b>both</b> ).
Encapsulation type (destination port)	Native form (untagged packets).
Ingress forwarding (destination port)	Disabled.
VLAN filtering	On a trunk interface used as a source port, all VLANs are monitored.
RSPAN VLANs	None configured.

## Configuration Guidelines

### SPAN Configuration Guidelines

- To remove a source or destination port or VLAN from the SPAN session, use the **no monitor session session\_number source {interface interface-id | vlan vlan-id}** global configuration command or the **no monitor session session\_number destination interface interface-id** global configuration command. For destination interfaces, the **encapsulation** options are ignored with the **no** form of the command.
- To monitor all VLANs on the trunk port, use the **no monitor session session\_number filter** global configuration command.

#### Related Topics

[Creating a Local SPAN Session, on page 78](#)

[Creating a Local SPAN Session and Configuring Incoming Traffic](#), on page 80  
[Example: Configuring Local SPAN](#), on page 93

## RSPAN Configuration Guidelines

- All the SPAN configuration guidelines apply to RSPAN.
- As RSPAN VLANs have special properties, you should reserve a few VLANs across your network for use as RSPAN VLANs; do not assign access ports to these VLANs.
- You can apply an output ACL to RSPAN traffic to selectively filter or monitor specific packets. Specify these ACLs on the RSPAN VLAN in the RSPAN source switches.
- For RSPAN configuration, you can distribute the source ports and the destination ports across multiple switches in your network.
- Access ports (including voice VLAN ports) on the RSPAN VLAN are put in the inactive state.
- You can configure any VLAN as an RSPAN VLAN as long as these conditions are met:
  - The same RSPAN VLAN is used for an RSPAN session in all the switches.
  - All participating switches support RSPAN.

### Related Topics

[Creating an RSPAN Source Session](#), on page 85

[Creating an RSPAN Destination Session](#), on page 88

[Creating an RSPAN Destination Session and Configuring Incoming Traffic](#), on page 90

[Examples: Creating an RSPAN VLAN](#), on page 94

# How to Configure SPAN and RSPAN

## Creating a Local SPAN Session

Beginning in privileged EXEC mode, follow these steps to create a SPAN session and specify the source (monitored) ports or VLANs and the destination (monitoring) ports.

### SUMMARY STEPS

1. **configure terminal**
2. **no monitor session** *{session\_number | all | local | remote}*
3. **monitor session** *session\_number* **source** **{interface** *interface-id* **| vlan** *vlan-id***}** **[, | -]** **[both | rx | tx]**
4. **monitor session** *session\_number* **destination** **{interface** *interface-id* **[, | -]** **[encapsulation replicate]}**
5. **end**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<p><b>configure terminal</b></p> <p><b>Example:</b></p> <pre>Switch# configure terminal</pre>	Enters the global configuration mode.
Step 2	<p><b>no monitor session</b> {<i>session_number</i>   <b>all</b>   <b>local</b>   <b>remote</b>}</p> <p><b>Example:</b></p> <pre>Switch(config)# no monitor session all</pre>	<p>Removes any existing SPAN configuration for the session.</p> <ul style="list-style-type: none"> <li>For <i>session_number</i>, the range is 1 to 66.</li> <li><b>all</b>—Removes all SPAN sessions.</li> <li><b>local</b>—Removes all local sessions.</li> <li><b>remote</b>—Removes all remote SPAN sessions.</li> </ul>
Step 3	<p><b>monitor session</b> <i>session_number</i> <b>source</b> {<b>interface</b> <i>interface-id</i>   <b>vlan</b> <i>vlan-id</i>} [,   -] [<b>both</b>   <b>rx</b>   <b>tx</b>]</p> <p><b>Example:</b></p> <pre>Switch(config)# monitor session 1 source interface gigabitethernet1/0/1</pre>	<p>Specifies the SPAN session and the source port (monitored port).</p> <ul style="list-style-type: none"> <li>For <i>session_number</i>, the range is 1 to 66.</li> <li>For <i>interface-id</i>, specify the source port or the source VLAN to monitor.</li> <li>For source <i>interface-id</i>, specify the source port to monitor. Only physical interfaces are valid.</li> <li>For <i>vlan-id</i>, specify the source VLAN to monitor. The range is 1 to 4094 (excluding the RSPAN VLAN).</li> </ul> <p><b>Note</b> A single session can include multiple sources (ports or VLANs) defined in a series of commands, but you cannot combine source ports and source VLANs in one session.</p> <ul style="list-style-type: none"> <li>(Optional) [,   -] Specifies a series or range of interfaces. Enter a space before and after the comma; enter a space before and after the hyphen.</li> <li>(Optional) Specifies the direction of traffic to monitor. If you do not specify a traffic direction, the SPAN monitors both sent and received traffic.</li> <li><b>both</b>—Monitors both sent and received traffic. This is the default.</li> <li><b>rx</b>—Monitors received traffic.</li> <li><b>tx</b>—Monitors sent traffic.</li> </ul> <p><b>Note</b> You can use the <b>monitor session</b> <i>session_number</i> <b>source</b> command multiple times to configure multiple source ports.</p>
Step 4	<p><b>monitor session</b> <i>session_number</i> <b>destination</b> {<b>interface</b> <i>interface-id</i> [,   -] [<b>encapsulation replicate</b>]}</p>	<p>Specifies the SPAN session and the destination port (monitoring port).</p> <p><b>Note</b> For local SPAN, you must use the same session number for the source and destination interfaces.</p>

	Command or Action	Purpose
	<p><b>Example:</b></p> <pre>Switch(config)# monitor session 1 destination interface gigabitethernet1/0/2 encapsulation replicate</pre>	<ul style="list-style-type: none"> <li>For <i>session_number</i>, specify the session number entered in step 3.</li> <li>For <i>interface-id</i>, specify the destination port. The destination interface must be a physical port; it cannot be an EtherChannel, and it cannot be a VLAN.</li> <li>(Optional) [, -] Specifies a series or range of interfaces. Enter a space before and after the comma; enter a space before and after the hyphen.</li> </ul> <p>(Optional) <b>encapsulation replicate</b> specifies that the destination interface replicates the source interface encapsulation method. If not selected, the default is to send packets in native form (untagged).</p> <p><b>Note</b> You can use <b>monitor session <i>session_number</i> destination</b> command multiple times to configure multiple destination ports.</p>
<b>Step 5</b>	<p><b>end</b></p> <p><b>Example:</b></p> <pre>Switch(config)# end</pre>	Returns to privileged EXEC mode.

### Related Topics

- [Local SPAN, on page 68](#)
- [SPAN Sessions, on page 71](#)
- [SPAN Configuration Guidelines, on page 77](#)

## Creating a Local SPAN Session and Configuring Incoming Traffic

Beginning in privileged EXEC mode, follow these steps to create a SPAN session, to specify the source ports or VLANs and the destination ports, and to enable incoming traffic on the destination port for a network security device (such as a Cisco IDS Sensor Appliance).

### SUMMARY STEPS

1. **configure terminal**
2. **no monitor session** {*session\_number* | **all** | **local** | **remote**}
3. **monitor session** *session\_number* **source** {**interface** *interface-id* | **vlan** *vlan-id*} [,|-] [**both** | **rx** | **tx**]
4. **monitor session** *session\_number* **destination** {**interface** *interface-id* [,|-] [**encapsulation replicate**] [**ingress** {**dot1q** **vlan** *vlan-id* | **isl** | **untagged** **vlan** *vlan-id* | **vlan** *vlan-id*}]}
5. **end**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
<b>Step 2</b>	<b>no monitor session</b> { <i>session_number</i>   <b>all</b>   <b>local</b>   <b>remote</b> }  <b>Example:</b> Switch(config)# <b>no monitor session all</b>	Removes any existing SPAN configuration for the session. <ul style="list-style-type: none"> <li>• For <i>session_number</i>, the range is 1 to 66.</li> <li>• <b>all</b>—Removes all SPAN sessions.</li> <li>• <b>local</b>—Removes all local sessions.</li> <li>• <b>remote</b>—Removes all remote SPAN sessions.</li> </ul>
<b>Step 3</b>	<b>monitor session</b> <i>session_number</i> <b>source</b> { <b>interface</b> <i>interface-id</i>   <b>vlan</b> <i>vlan-id</i> } [,   -] [ <b>both</b>   <b>rx</b>   <b>tx</b> ]  <b>Example:</b> Switch(config)# <b>monitor session 2 source gigabitethernet1/0/1 rx</b>	Specifies the SPAN session and the source port (monitored port).
<b>Step 4</b>	<b>monitor session</b> <i>session_number</i> <b>destination</b> { <b>interface</b> <i>interface-id</i> [,   -] [ <b>encapsulation</b> <b>replicate</b> ] [ <b>ingress</b> { <b>dot1q vlan</b> <i>vlan-id</i>   <b>isl</b>   <b>untagged vlan</b> <i>vlan-id</i>   <b>vlan</b> <i>vlan-id</i> }] }  <b>Example:</b> Switch(config)# <b>monitor session 2 destination interface gigabitethernet1/0/2 encapsulation replicate ingress dot1q vlan 6</b>	Specifies the SPAN session, the destination port, the packet encapsulation, and the ingress VLAN and encapsulation. <ul style="list-style-type: none"> <li>• For <i>session_number</i>, specify the session number entered in Step 3.</li> <li>• For <i>interface-id</i>, specify the destination port. The destination interface must be a physical port; it cannot be an EtherChannel, and it cannot be a VLAN.</li> <li>• (Optional) [,   -] Specify a series or range of interfaces. Enter a space before and after the comma or hyphen.</li> <li>• (Optional) <b>encapsulation replicate</b> specifies that the destination interface replicates the source interface encapsulation method. If not selected, the default is to send packets in native form (untagged).</li> <li>• <b>ingress</b> enables forwarding of incoming traffic on the destination port and to specify the encapsulation type: <ul style="list-style-type: none"> <li>◦ <b>dot1q vlan</b> <i>vlan-id</i>—Accepts incoming packets with IEEE 802.1Q encapsulation with the specified VLAN as the default VLAN.</li> <li>◦ <b>isl</b>—Forwards ingress packets with ISL encapsulation.</li> <li>◦ <b>untagged vlan</b> <i>vlan-id</i> or <b>vlan</b> <i>vlan-id</i>—Accepts incoming packets with untagged encapsulation type with the specified VLAN as the default VLAN.</li> </ul> </li> </ul>

	Command or Action	Purpose
		<ul style="list-style-type: none"> <li>• <b>dot1q vlan</b> <i>vlan-id</i>—Accept incoming packets with IEEE 802.1Q encapsulation with the specified VLAN as the default VLAN.</li> <li>• <b>isl</b>—Forward ingress packets with ISL encapsulation.</li> <li>• <b>untagged vlan</b> <i>vlan-id</i> or <b>vlan</b> <i>vlan-id</i>—Accept incoming packets with untagged encapsulation type with the specified VLAN as the default VLAN.</li> </ul>
<b>Step 5</b>	<b>end</b>  <b>Example:</b>  Switch(config)# <b>end</b>	Returns to privileged EXEC mode.

### Related Topics

[Local SPAN, on page 68](#)

[SPAN Sessions, on page 71](#)

[SPAN Configuration Guidelines, on page 77](#)

[Example: Configuring Local SPAN, on page 93](#)

## Specifying VLANs to Filter

Beginning in privileged EXEC mode, follow these steps to limit SPAN source traffic to specific VLANs.

### SUMMARY STEPS

1. **configure terminal**
2. **no monitor session** {*session\_number* | **all** | **local** | **remote**}
3. **monitor session** *session\_number* **source interface** *interface-id*
4. **monitor session** *session\_number* **filter vlan** *vlan-id* [, | -]
5. **monitor session** *session\_number* **destination** {**interface** *interface-id* [, | -] [**encapsulation replicate**]}
6. **end**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<p><b>configure terminal</b></p> <p><b>Example:</b></p> <pre>Switch# configure terminal</pre>	Enters the global configuration mode.
Step 2	<p><b>no monitor session</b> {<i>session_number</i>   <b>all</b>   <b>local</b>   <b>remote</b>}</p> <p><b>Example:</b></p> <pre>Switch(config)# no monitor session all</pre>	<p>Removes any existing SPAN configuration for the session.</p> <ul style="list-style-type: none"> <li>• For <i>session_number</i>, the range is 1 to 66.</li> <li>• <b>all</b>—Removes all SPAN sessions.</li> <li>• <b>local</b>—Removes all local sessions.</li> <li>• <b>remote</b>—Removes all remote SPAN sessions.</li> </ul>
Step 3	<p><b>monitor session</b> <i>session_number</i> <b>source interface</b> <i>interface-id</i></p> <p><b>Example:</b></p> <pre>Switch(config)# monitor session 2 source interface gigabitethernet1/0/2 rx</pre>	<p>Specifies the characteristics of the source port (monitored port) and SPAN session.</p> <ul style="list-style-type: none"> <li>• For <i>session_number</i>, the range is 1 to 66.</li> <li>• For <i>interface-id</i>, specify the source port to monitor. The interface specified must already be configured as a trunk port.</li> </ul>
Step 4	<p><b>monitor session</b> <i>session_number</i> <b>filter vlan</b> <i>vlan-id</i> [,   -]</p> <p><b>Example:</b></p> <pre>Switch(config)# monitor session 2 filter vlan 1 - 5 , 9</pre>	<p>Limits the SPAN source traffic to specific VLANs.</p> <ul style="list-style-type: none"> <li>• For <i>session_number</i>, enter the session number specified in Step 3.</li> <li>• For <i>vlan-id</i>, the range is 1 to 4094.</li> <li>• (Optional) Use a comma (,) to specify a series of VLANs, or use a hyphen (-) to specify a range of VLANs. Enter a space before and after the comma; enter a space before and after the hyphen.</li> </ul>
Step 5	<p><b>monitor session</b> <i>session_number</i> <b>destination</b> {<b>interface</b> <i>interface-id</i> [,   -] [<b>encapsulation replicate</b>]}</p> <p><b>Example:</b></p> <pre>Switch(config)# monitor session 2 destination interface gigabitethernet1/0/1</pre>	<p>Specifies the SPAN session and the destination port (monitoring port).</p> <ul style="list-style-type: none"> <li>• For <i>session_number</i>, specify the session number entered in Step 3.</li> <li>• For <i>interface-id</i>, specify the destination port. The destination interface must be a physical port; it cannot be an EtherChannel, and it cannot be a VLAN.</li> <li>• (Optional) [,   -] Specifies a series or range of interfaces. Enter a space before and after the comma; enter a space before and after the hyphen.</li> <li>• (Optional) <b>encapsulation replicate</b> specifies that the destination interface replicates the source interface encapsulation method. If not selected, the default is to send packets in native form (untagged).</li> </ul>

	Command or Action	Purpose
Step 6	<b>end</b>  <b>Example:</b> Switch(config)# <b>end</b>	Returns to privileged EXEC mode.

## Configuring a VLAN as an RSPAN VLAN

First create a new VLAN to be the RSPAN VLAN for the RSPAN session.

Beginning in privileged EXEC mode, follow these steps to create a new VLAN, then configure it to be the RSPAN VLAN for the RSPAN session.

### SUMMARY STEPS

1. **configure terminal**
2. **vlan *vlan-id***
3. **remote-span**
4. **end**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
Step 2	<b>vlan <i>vlan-id</i></b>  <b>Example:</b> Switch(config)# <b>vlan 100</b>	Enters a VLAN ID to create a VLAN, or enters the VLAN ID of an existing VLAN, and enter VLAN configuration mode. The range is 2 to 1001 and 1006 to 4094.  The RSPAN VLAN cannot be VLAN 1 (the default VLAN) or VLAN IDs 1002 through 1005 (reserved for Token Ring and FDDI VLANs).
Step 3	<b>remote-span</b>  <b>Example:</b> Switch(config-vlan)# <b>remote-span</b>	Configures the VLAN as an RSPAN VLAN.

	Command or Action	Purpose
Step 4	<b>end</b>  <b>Example:</b> Switch(config-vlan)# <b>end</b>	Returns to privileged EXEC mode.

### What to Do Next

You must create the RSPAN VLAN in all switches that will participate in RSPAN. If the RSPAN VLAN-ID is in the normal range (lower than 1005) and VTP is enabled in the network, you can create the RSPAN VLAN in one switch, and VTP propagates it to the other switches in the VTP domain. For extended-range VLANs (greater than 1005), you must configure RSPAN VLAN on both source and destination switches and any intermediate switches.

Use VTP pruning to get an efficient flow of RSPAN traffic, or manually delete the RSPAN VLAN from all trunks that do not need to carry the RSPAN traffic.

To remove the remote SPAN characteristic from a VLAN and convert it back to a normal VLAN, use the **no remote-span** VLAN configuration command.

To remove a source port or VLAN from the SPAN session, use the **no monitor session session\_number source {interface interface-id | vlan vlan-id}** global configuration command. To remove the RSPAN VLAN from the session, use the **no monitor session session\_number destination remote vlan vlan-id**.

## Creating an RSPAN Source Session

Beginning in privileged EXEC mode, follow these steps to create and start an RSPAN source session and to specify the monitored source and the destination RSPAN VLAN.

### SUMMARY STEPS

1. **configure terminal**
2. **no monitor session {session\_number | all | local | remote}**
3. **monitor session session\_number source {interface interface-id | vlan vlan-id} [, | -] [both | rx | tx]**
4. **monitor session session\_number destination remote vlan vlan-id**
5. **end**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<p><b>configure terminal</b></p> <p><b>Example:</b></p> <pre>Switch# configure terminal</pre>	Enters the global configuration mode.
<b>Step 2</b>	<p><b>no monitor session</b> {<i>session_number</i>   <b>all</b>   <b>local</b>   <b>remote</b>}</p> <p><b>Example:</b></p> <pre>Switch(config)# no monitor session 1</pre>	<p>Removes any existing SPAN configuration for the session.</p> <ul style="list-style-type: none"> <li>• For <i>session_number</i>, the range is 1 to 66.</li> <li>• <b>all</b>—Removes all SPAN sessions.</li> <li>• <b>local</b>—Removes all local sessions.</li> <li>• <b>remote</b>—Removes all remote SPAN sessions.</li> </ul>
<b>Step 3</b>	<p><b>monitor session</b> <i>session_number</i> <b>source</b> {<b>interface</b> <i>interface-id</i>   <b>vlan</b> <i>vlan-id</i>} [,   -] [<b>both</b>   <b>rx</b>   <b>tx</b>]</p> <p><b>Example:</b></p> <pre>Switch(config)# monitor session 1 source interface gigabitethernet1/0/1 tx</pre>	<p>Specifies the RSPAN session and the source port (monitored port).</p> <ul style="list-style-type: none"> <li>• For <i>session_number</i>, the range is 1 to 66.</li> <li>• Enter a source port or source VLAN for the RSPAN session: <ul style="list-style-type: none"> <li>◦ For <i>interface-id</i>, specifies the source port to monitor. Valid interfaces include physical interfaces and port-channel logical interfaces (<b>port-channel</b> <i>port-channel-number</i>). Valid port-channel numbers are 1 to 48.</li> <li>◦ For <i>vlan-id</i>, specifies the source VLAN to monitor. The range is 1 to 4094 (excluding the RSPAN VLAN).</li> </ul> </li> </ul> <p>A single session can include multiple sources (ports or VLANs), defined in a series of commands, but you cannot combine source ports and source VLANs in one session.</p> <ul style="list-style-type: none"> <li>• (Optional) [,   -] Specifies a series or range of interfaces. Enter a space before and after the comma; enter a space before and after the hyphen.</li> <li>• (Optional) <b>both</b>   <b>rx</b>   <b>tx</b> Specifies the direction of traffic to monitor. If you do not specify a traffic direction, the source interface sends both sent and received traffic. <ul style="list-style-type: none"> <li>◦ <b>both</b>—Monitors both received and sent traffic.</li> <li>◦ <b>rx</b>—Monitors received traffic.</li> <li>◦ <b>tx</b>—Monitors sent traffic.</li> </ul> </li> </ul>
<b>Step 4</b>	<p><b>monitor session</b> <i>session_number</i> <b>destination remote vlan</b> <i>vlan-id</i></p>	Specifies the RSPAN session, the destination RSPAN VLAN, and the destination-port group.

	Command or Action	Purpose
	<p><b>Example:</b></p> <pre>Switch(config)# monitor session 1 destination remote vlan 100</pre>	<ul style="list-style-type: none"> <li>• For <i>session_number</i>, enter the number defined in Step 3.</li> <li>• For <i>vlan-id</i>, specify the source RSPAN VLAN to monitor.</li> </ul>
<b>Step 5</b>	<p><b>end</b></p> <p><b>Example:</b></p> <pre>Switch(config)# end</pre>	Returns to privileged EXEC mode.

### Related Topics

[Remote SPAN, on page 69](#)

[RSPAN VLAN, on page 75](#)

[RSPAN Configuration Guidelines, on page 78](#)

## Specifying VLANs to Filter

Beginning in privileged EXEC mode, follow these steps to configure the RSPAN source session to limit RSPAN source traffic to specific VLANs.

### SUMMARY STEPS

1. **configure terminal**
2. **no monitor session** {*session\_number* | **all** | **local** | **remote**}
3. **monitor session** *session\_number* **source interface** *interface-id*
4. **monitor session** *session\_number* **filter vlan** *vlan-id* [, |-]
5. **monitor session** *session\_number* **destination remote vlan** *vlan-id*
6. **end**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<p><b>configure terminal</b></p> <p><b>Example:</b></p> <pre>Switch# configure terminal</pre>	Enters the global configuration mode.
<b>Step 2</b>	<p><b>no monitor session</b> {<i>session_number</i>   <b>all</b>   <b>local</b>   <b>remote</b>}</p>	Removes any existing SPAN configuration for the session.

	Command or Action	Purpose
	<p><b>Example:</b></p> <pre>Switch(config)# no monitor session 2</pre>	<ul style="list-style-type: none"> <li>For <i>session_number</i>, the range is 1 to 66.</li> <li><b>all</b>—Removes all SPAN sessions.</li> <li><b>local</b>—Removes all local sessions.</li> <li><b>remote</b>—Removes all remote SPAN sessions.</li> </ul>
<b>Step 3</b>	<p><b>monitor session</b> <i>session_number</i> <b>source interface</b> <i>interface-id</i></p> <p><b>Example:</b></p> <pre>Switch(config)# monitor session 2 source interface gigabitethernet1/0/2 rx</pre>	<p>Specifies the characteristics of the source port (monitored port) and SPAN session.</p> <ul style="list-style-type: none"> <li>For <i>session_number</i>, the range is 1 to 66.</li> <li>For <i>interface-id</i>, specify the source port to monitor. The interface specified must already be configured as a trunk port.</li> </ul>
<b>Step 4</b>	<p><b>monitor session</b> <i>session_number</i> <b>filter vlan</b> <i>vlan-id</i> [,   -]</p> <p><b>Example:</b></p> <pre>Switch(config)# monitor session 2 filter vlan 1 - 5 , 9</pre>	<p>Limits the SPAN source traffic to specific VLANs.</p> <ul style="list-style-type: none"> <li>For <i>session_number</i>, enter the session number specified in step 3.</li> <li>For <i>vlan-id</i>, the range is 1 to 4094.</li> <li>(Optional) ,   - Use a comma (,) to specify a series of VLANs or use a hyphen (-) to specify a range of VLANs. Enter a space before and after the comma; enter a space before and after the hyphen.</li> </ul>
<b>Step 5</b>	<p><b>monitor session</b> <i>session_number</i> <b>destination remote vlan</b> <i>vlan-id</i></p> <p><b>Example:</b></p> <pre>Switch(config)# monitor session 2 destination remote vlan 902</pre>	<p>Specifies the RSPAN session and the destination remote VLAN (RSPAN VLAN).</p> <ul style="list-style-type: none"> <li>For <i>session_number</i>, enter the session number specified in Step 3.</li> <li>For <i>vlan-id</i>, specify the RSPAN VLAN to carry the monitored traffic to the destination port.</li> </ul>
<b>Step 6</b>	<p><b>end</b></p> <p><b>Example:</b></p> <pre>Switch(config)# end</pre>	<p>Returns to privileged EXEC mode.</p>

## Creating an RSPAN Destination Session

You configure an RSPAN destination session on a different switch or switch stack; that is, not the switch or switch stack on which the source session was configured.

Beginning in privileged EXEC mode, follow these steps to define the RSPAN VLAN on that switch, to create an RSPAN destination session, and to specify the source RSPAN VLAN and the destination port.

## SUMMARY STEPS

1. **configure terminal**
2. **vlan *vlan-id***
3. **remote-span**
4. **exit**
5. **no monitor session** *{session\_number | all | local | remote}*
6. **monitor session** *session\_number* **source remote vlan** *vlan-id*
7. **monitor session** *session\_number* **destination interface** *interface-id*
8. **end**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
<b>Step 2</b>	<b>vlan <i>vlan-id</i></b>  <b>Example:</b> Switch(config)# <b>vlan 901</b>	Specifies the VLAN ID of the RSPAN VLAN created from the source switch, and enters VLAN configuration mode.  If both switches are participating in VTP and the RSPAN VLAN ID is from 2 to 1005, Steps 2 through 4 are not required because the RSPAN VLAN ID is propagated through the VTP network.
<b>Step 3</b>	<b>remote-span</b>  <b>Example:</b> Switch(config-vlan)# <b>remote-span</b>	Identifies the VLAN as the RSPAN VLAN.
<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>no monitor session</b> <i>{session_number   all   local   remote}</i>  <b>Example:</b> Switch(config)# <b>no monitor session 1</b>	Removes any existing SPAN configuration for the session. <ul style="list-style-type: none"> <li>• For <i>session_number</i>, the range is 1 to 66.</li> <li>• <b>all</b>—Removes all SPAN sessions.</li> <li>• <b>local</b>—Removes all local sessions.</li> <li>• <b>remote</b>—Removes all remote SPAN sessions.</li> </ul>

	Command or Action	Purpose
<b>Step 6</b>	<p><b>monitor session</b> <i>session_number</i> <b>source remote vlan</b> <i>vlan-id</i></p> <p><b>Example:</b></p> <pre>Switch(config)# monitor session 1 source remote vlan 901</pre>	<p>Specifies the RSPAN session and the source RSPAN VLAN.</p> <ul style="list-style-type: none"> <li>For <i>session_number</i>, the range is 1 to 66.</li> <li>For <i>vlan-id</i>, specify the source RSPAN VLAN to monitor.</li> </ul>
<b>Step 7</b>	<p><b>monitor session</b> <i>session_number</i> <b>destination interface</b> <i>interface-id</i></p> <p><b>Example:</b></p> <pre>Switch(config)# monitor session 1 destination interface gigabitethernet2/0/1</pre>	<p>Specifies the RSPAN session and the destination interface.</p> <ul style="list-style-type: none"> <li>For <i>session_number</i>, enter the number defined in Step 6.</li> <li>In an RSPAN destination session, you must use the same session number for the source RSPAN VLAN and the destination port.</li> <li>For <i>interface-id</i>, specify the destination interface. The destination interface must be a physical interface.</li> <li>Though visible in the command-line help string, <b>encapsulation replicate</b> is not supported for RSPAN. The original VLAN ID is overwritten by the RSPAN VLAN ID, and all packets appear on the destination port as untagged.</li> </ul>
<b>Step 8</b>	<p><b>end</b></p> <p><b>Example:</b></p> <pre>Switch(config)# end</pre>	<p>Returns to privileged EXEC mode.</p>

### Related Topics

[Remote SPAN, on page 69](#)

[RSPAN VLAN, on page 75](#)

[RSPAN Configuration Guidelines, on page 78](#)

## Creating an RSPAN Destination Session and Configuring Incoming Traffic

Beginning in privileged EXEC mode, follow these steps to create an RSPAN destination session, to specify the source RSPAN VLAN and the destination port, and to enable incoming traffic on the destination port for a network security device (such as a Cisco IDS Sensor Appliance).

## SUMMARY STEPS

1. **configure terminal**
2. **no monitor session** *{session\_number | all | local | remote}*
3. **monitor session** *session\_number* **source remote vlan** *vlan-id*
4. **monitor session** *session\_number* **destination** *{interface interface-id [, | -] [ingress {dot1q vlan vlan-id | isl | untagged vlan vlan-id | vlan vlan-id}]}*
5. **end**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> Switch# <b>configure terminal</b>	Enters the global configuration mode.
<b>Step 2</b>	<b>no monitor session</b> <i>{session_number   all   local   remote}</i>  <b>Example:</b> Switch(config)# <b>no monitor session</b> 2	Removes any existing SPAN configuration for the session. <ul style="list-style-type: none"> <li>• For <i>session_number</i>, the range is 1 to 66.</li> <li>• <b>all</b>—Removes all SPAN sessions.</li> <li>• <b>local</b>—Removes all local sessions.</li> <li>• <b>remote</b>—Removes all remote SPAN sessions.</li> </ul>
<b>Step 3</b>	<b>monitor session</b> <i>session_number</i> <b>source remote vlan</b> <i>vlan-id</i>  <b>Example:</b> Switch(config)# <b>monitor session</b> 2 <b>source remote vlan</b> 901	Specifies the RSPAN session and the source RSPAN VLAN. <ul style="list-style-type: none"> <li>• For <i>session_number</i>, the range is 1 to 66.</li> <li>• For <i>vlan-id</i>, specify the source RSPAN VLAN to monitor.</li> </ul>
<b>Step 4</b>	<b>monitor session</b> <i>session_number</i> <b>destination</b> <i>{interface interface-id [,   -] [ingress {dot1q vlan vlan-id   isl   untagged vlan vlan-id   vlan vlan-id}]}</i>  <b>Example:</b> Switch(config)# <b>monitor session</b> 2 <b>destination interface</b> gigabitethernet1/0/2 <b>ingress vlan</b> 6	Specifies the SPAN session, the destination port, the packet encapsulation, and the incoming VLAN and encapsulation. <ul style="list-style-type: none"> <li>• For <i>session_number</i>, enter the number defined in Step 4. In an RSPAN destination session, you must use the same session number for the source RSPAN VLAN and the destination port.</li> <li>• For <i>interface-id</i>, specify the destination interface. The destination interface must be a physical interface.</li> <li>• Though visible in the command-line help string, <b>encapsulation replicate</b> is not supported for RSPAN. The original VLAN ID is overwritten by the RSPAN VLAN ID, and all packets appear on the destination port as untagged.</li> </ul>

	Command or Action	Purpose
		<ul style="list-style-type: none"> <li>• (Optional) [,   -] Specifies a series or range of interfaces. Enter a space before and after the comma; enter a space before and after the hyphen.</li> <li>• Enter <b>ingress</b> with additional keywords to enable forwarding of incoming traffic on the destination port and to specify the encapsulation type: <ul style="list-style-type: none"> <li>◦ <b>dot1q vlan</b> <i>vlan-id</i>—Forwards incoming packets with IEEE 802.1Q encapsulation with the specified VLAN as the default VLAN.</li> <li>◦ <b>isl</b>—Forwards ingress packets with ISL encapsulation.</li> <li>◦ <b>untagged vlan</b> <i>vlan-id</i> or <b>vlan</b> <i>vlan-id</i>—Forwards incoming packets with untagged encapsulation type with the specified VLAN as the default VLAN.</li> </ul> </li> </ul>
<b>Step 5</b>	<b>end</b>  <b>Example:</b>  Switch(config)# <b>end</b>	Returns to privileged EXEC mode.

### Related Topics

[Remote SPAN, on page 69](#)

[RSPAN VLAN, on page 75](#)

[RSPAN Configuration Guidelines, on page 78](#)

[Examples: Creating an RSPAN VLAN, on page 94](#)

## Monitoring SPAN and RSPAN Operations

The following table describes the command used to display SPAN and RSPAN operations configuration and results to monitor operations:

**Table 13: Monitoring SPAN and RSPAN Operations**

<b>show monitor</b>	Displays the current SPAN, RSPAN, FSPAN, or FRSPAN configuration
---------------------	--

# SPAN and RSPAN Configuration Examples

## Example: Configuring Local SPAN

This example shows how to set up SPAN session 1 for monitoring source port traffic to a destination port. First, any existing SPAN configuration for session 1 is deleted, and then bidirectional traffic is mirrored from source Gigabit Ethernet port 1 to destination Gigabit Ethernet port 2, retaining the encapsulation method.

```
Switch(config)# no monitor session 1
Switch(config)# monitor session 1 source interface gigabitethernet1/0/1
Switch(config)# monitor session 1 destination interface gigabitethernet1/0/2
encapsulation replicate
Switch(config)# end
```

This example shows how to remove port 1 as a SPAN source for SPAN session 1:

```
Switch(config)# no monitor session 1 source interface gigabitethernet1/0/1
Switch(config)# end
```

This example shows how to disable received traffic monitoring on port 1, which was configured for bidirectional monitoring:

```
Switch(config)# no monitor session 1 source interface gigabitethernet1/0/1 rx
```

The monitoring of traffic received on port 1 is disabled, but traffic sent from this port continues to be monitored.

This example shows how to remove any existing configuration on SPAN session 2, configure SPAN session 2 to monitor received traffic on all ports belonging to VLANs 1 through 3, and send it to destination Gigabit Ethernet port 2. The configuration is then modified to also monitor all traffic on all ports belonging to VLAN 10.

```
Switch(config)# no monitor session 2
Switch(config)# monitor session 2 source vlan 1 - 3 rx
Switch(config)# monitor session 2 destination interface gigabitethernet1/0/2
Switch(config)# monitor session 2 source vlan 10
Switch(config)# end
```

This example shows how to remove any existing configuration on SPAN session 2, configure SPAN session 2 to monitor received traffic on Gigabit Ethernet source port 1, and send it to destination Gigabit Ethernet port 2 with the same egress encapsulation type as the source port, and to enable ingress forwarding with IEEE 802.1Q encapsulation and VLAN 6 as the default ingress VLAN:

```
Switch(config)# no monitor session 2
Switch(config)# monitor session 2 source gigabitethernet1/0/1 rx
Switch(config)# monitor session 2 destination interface gigabitethernet1/0/2 encapsulation
replicate ingress dot1q vlan 6
Switch(config)# end
```

This example shows how to remove any existing configuration on SPAN session 2, configure SPAN session 2 to monitor traffic received on Gigabit Ethernet trunk port 2, and send traffic for only VLANs 1 through 5 and VLAN 9 to destination Gigabit Ethernet port 1:

```
Switch(config)# no monitor session 2
Switch(config)# monitor session 2 source interface gigabitethernet1/0/2 rx
Switch(config)# monitor session 2 filter vlan 1 - 5 , 9
Switch(config)# monitor session 2 destination interface gigabitethernet1/0/1
Switch(config)# end
```

**Related Topics**

[Creating a Local SPAN Session and Configuring Incoming Traffic, on page 80](#)

[Local SPAN, on page 68](#)

[SPAN Sessions, on page 71](#)

[SPAN Configuration Guidelines, on page 77](#)

**Examples: Creating an RSPAN VLAN**

This example shows how to create the RSPAN VLAN 901:

```
Switch(config)# vlan 901
Switch(config-vlan)# remote span
Switch(config-vlan)# end
```

This example shows how to remove any existing RSPAN configuration for session 1, configure RSPAN session 1 to monitor multiple source interfaces, and configure the destination as RSPAN VLAN 901:

```
Switch(config)# no monitor session 1
Switch(config)# monitor session 1 source interface gigabitethernet1/0/1 tx
Switch(config)# monitor session 1 source interface gigabitethernet1/0/2 rx
Switch(config)# monitor session 1 source interface port-channel 2
Switch(config)# monitor session 1 destination remote vlan 901
Switch(config)# end
```

This example shows how to remove any existing configuration on RSPAN session 2, configure RSPAN session 2 to monitor traffic received on trunk port 2, and send traffic for only VLANs 1 through 5 and 9 to destination RSPAN VLAN 902:

```
Switch(config)# no monitor session 2
Switch(config)# monitor session 2 source interface gigabitethernet1/0/2 rx
Switch(config)# monitor session 2 filter vlan 1 - 5 , 9
Switch(config)# monitor session 2 destination remote vlan 902
Switch(config)# end
```

This example shows how to configure VLAN 901 as the source remote VLAN and port 1 as the destination interface:

```
Switch(config)# monitor session 1 source remote vlan 901
Switch(config)# monitor session 1 destination interface gigabitethernet2/0/1
Switch(config)# end
```

This example shows how to configure VLAN 901 as the source remote VLAN in RSPAN session 2, to configure Gigabit Ethernet source port 2 as the destination interface, and to enable forwarding of incoming traffic on the interface with VLAN 6 as the default receiving VLAN:

```
Switch(config)# monitor session 2 source remote vlan 901
Switch(config)# monitor session 2 destination interface gigabitethernet1/0/2 ingress vlan 6
Switch(config)# end
```

**Related Topics**

[Creating an RSPAN Destination Session and Configuring Incoming Traffic, on page 90](#)

[Remote SPAN, on page 69](#)

[RSPAN VLAN, on page 75](#)

[RSPAN Configuration Guidelines, on page 78](#)

# Additional References

## Related Documents

Related Topic	Document Title

## Standards and RFCs

Standard/RFC	Title

## MIBs

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

## 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 SPAN and RSPAN

Release	Modification
Cisco IOS 15.0(2)EX	<p>Switch Port Analyzer (SPAN): Allows monitoring of switch traffic on a port or VLAN using a sniffer/analyzer or RMON probe.</p> <p>This feature was introduced.</p>
Cisco IOS 15.0(2)EX	<p>SPAN destination port support on EtherChannels: Provides the ability to configure a SPAN destination port on an EtherChannel.</p> <p>This feature was introduced.</p>
Cisco IOS 15.0(2)EX	<p>Switch Port Analyzer (SPAN) - distributed egress SPAN: Provides distributed egress SPAN functionality onto line cards in conjunction with ingress SPAN already been distributed to line cards. By distributing egress SPAN functionalities onto line cards, the performance of the system is improved.</p> <p>This feature was introduced.</p>



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