Lightweight Access Point Configuration Guide, Cisco IOS XE Release 3E (Catalyst 3850 Switches)

First Published: 0,

Last Modified: 0,

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

Text Part Number: OL-32304-01

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Preface

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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 **^D** or **Ctrl-D** 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.)
bold font	Commands and keywords and user-entered text appear in **bold** font.
Italic font	Document titles, new or emphasized terms, and arguments for which you supply values are in *italic* font.
`Courier` font	Terminal sessions and information the system displays appear in `courier` font.
`Bold Courier` font	**`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.
[x | y]	Optional alternative keywords are grouped in brackets and separated by vertical bars.

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

Reader Alert Conventions

This document may use the following conventions for reader alerts:

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

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

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

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

Warning IMPORTANT SAFETY INSTRUCTIONS

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

SAVE THESE INSTRUCTIONS

Related Documentation

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

- Cisco Catalyst 3850 Switch documentation, located at:

  http://www.cisco.com/go/cat3850_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

- Cisco Validated Designs documents, located at:

  http://www.cisco.com/go/designzone

- Error Message Decoder, located at:

  https://www.cisco.com/cgi-bin/Support/Errordecoder/index.cgi

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/c/en/us/td/docs/general/whatsnew/whatsnew.html

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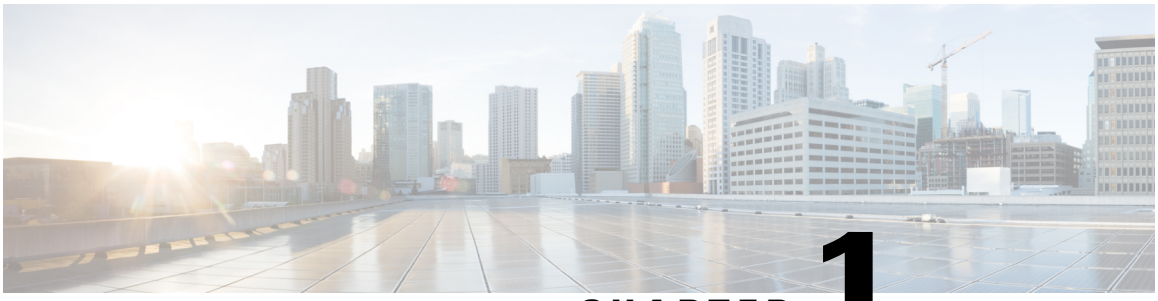


CHAPTER 1

Using the Command-Line Interface

- Information About Using the Command-Line Interface, page 1
- How to Use the CLI to Configure Features, page 6

Information About Using the Command-Line Interface

Command Modes

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

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

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

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

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

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

Table 1: Command Mode Summary

Mode	Access Method	Prompt	Exit Method	About This Mode
User EXEC	Begin a session using Telnet, SSH, or console.	`Switch>`	Enter **logout** or **quit**.	Use this mode to • Change terminal settings. • Perform basic tests. • Display system information.
Privileged EXEC	While in user EXEC mode, enter the **enable** command.	`Switch#`	Enter **disable** 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 **configure** command.	`Switch(config)#`	To exit to privileged EXEC mode, enter **exit** or **end**, or press **Ctrl-Z**.	Use this mode to configure parameters that apply to the entire switch.
VLAN configuration	While in global configuration mode, enter the **vlan** *vlan-id* command.	`Switch(config-vlan)#`	To exit to global configuration mode, enter the **exit** command. To return to privileged EXEC mode, press **Ctrl-Z** or enter **end**.	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 **interface** command (with a specific interface).	`Switch(config-if)#`		Use this mode to configure parameters for the Ethernet ports.

Mode	Access Method	Prompt	Exit Method	About This Mode
			To exit to global configuration mode, enter **exit**. To return to privileged EXEC mode, press **Ctrl-Z** or enter **end**.	
Line configuration	While in global configuration mode, specify a line with the **line vty** or **line console** command.	`Switch(config-line)#`	To exit to global configuration mode, enter **exit**. To return to privileged EXEC mode, press **Ctrl-Z** or enter **end**.	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
Step 1	**help** **Example:** `Switch# help`	Obtains a brief description of the help system in any command mode.

Step 2	*abbreviated-command-entry* **?**
	
	Example:
	`Switch# di?`
	`dir disable disconnect`
		Obtains a list of commands that begin with a particular character string.

Step 3	*abbreviated-command-entry* <Tab>
	
	Example:
	`Switch# sh conf<tab>`
	`Switch# show configuration`
		Completes a partial command name.

Step 4	**?** **Example:** `Switch> ?`	Lists all commands available for a particular command mode.
Step 5	*command* **?** **Example:** `Switch> show ?`	Lists the associated keywords for a command.

Step 6	*command keyword* **?**
	
	Example:
	`Switch(config)# cdp holdtime ?`
	`<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 (?) without any 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 of the keywords or values required by this command.	Reenter the command followed by a question mark (?) with a space between the command and the question mark. The possible keywords that you can enter with the command appear.
`% 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 of the commands that are available in this command mode. The possible keywords that you can enter with the command appear.

Configuration Logging

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

notification to registered applications whenever the configuration changes. You can choose to have the notifications sent to the syslog.

Note Only CLI or HTTP changes are logged.

How to Use the CLI to Configure Features

Configuring the Command History

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

Changing the Command History Buffer Size

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

SUMMARY STEPS

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

DETAILED STEPS

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

Recalling Commands

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

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

SUMMARY STEPS

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

DETAILED STEPS

	Command or Action	Purpose
Step 1	**Ctrl-P** or use the **up arrow** key	Recalls commands in the history buffer, beginning with the most recent command. Repeat the key sequence to recall successively older commands.
Step 2	**Ctrl-N** or use the **down arrow** key	Returns to more recent commands in the history buffer after recalling commands with **Ctrl-P** or the up arrow key. Repeat the key sequence to recall successively more recent commands.
Step 3	**show history** **Example:** `Switch# show history`	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 **terminal history** global configuration command and the **history** 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
Step 1	**terminal no history** **Example:** `Switch# terminal no history`	Disables the feature during the current terminal session in privileged EXEC mode.

Enabling and Disabling Editing Features

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

SUMMARY STEPS

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

DETAILED STEPS

	Command or Action	Purpose
Step 1	**terminal editing** **Example:** `Switch# terminal editing`	Reenables the enhanced editing mode for the current terminal session in privileged EXEC mode.
Step 2	**terminal no editing** **Example:** `Switch# terminal no editing`	Disables the enhanced editing mode for the current terminal session in 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
Ctrl-B or use the **left arrow** key	Moves the cursor back one character.
Ctrl-F or use the **right arrow** key	Moves the cursor forward one character.
Ctrl-A	Moves the cursor to the beginning of the command line.
Ctrl-E	Moves the cursor to the end of the command line.
Esc B	Moves the cursor back one word.
Esc F	Moves the cursor forward one word.
Ctrl-T	Transposes the character to the left of the cursor with the character located at the cursor.

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

SUMMARY STEPS

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

DETAILED STEPS

	Command or Action	Purpose

Step 1	**access-list**
	
	Example:
	`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`
		Displays the global configuration command entry that extends beyond one line.
		
		When the cursor first reaches the end of the line, the line is shifted ten spaces to the left and redisplayed. The dollar sign ($) shows that the line has been scrolled to the left. Each time the cursor reaches the end of the line, the line is again shifted ten spaces to the left.

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

Searching and Filtering Output of show and more Commands

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

SUMMARY STEPS

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

DETAILED STEPS

	Command or Action	Purpose

Step 1	{**show** | **more**} *command* | {**begin** | **include** | **exclude**} *regular-expression*
	
	Example:
	`Switch# show interfaces | include protocol`
	`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`
		Searches and filters the output.
		
		Expressions are case sensitive. For example, if you enter **| exclude output**, the lines that contain **output** are not displayed, but the lines that contain **output** appear.

Accessing the CLI on a Switch Stack

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

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

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

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

Accessing the CLI Through a Console Connection or Through Telnet

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

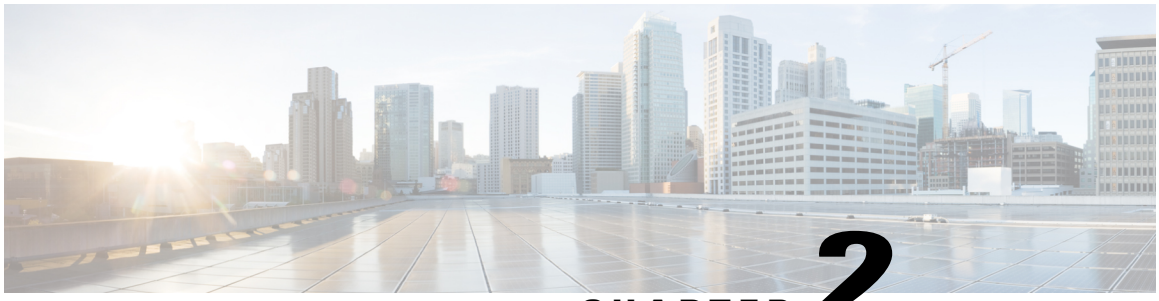
If your switch is already configured, you can access the CLI through a local console connection or through a remote Telnet session, but your switch must first be configured for this type of access.

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

- Connect the switch console port to a management station or dial-up modem, or connect the Ethernet management port to a PC. For information about connecting to the console or Ethernet management port, see the switch hardware installation guide.

- Use any Telnet TCP/IP or encrypted Secure Shell (SSH) package from a remote management station. The switch must have network connectivity with the Telnet or SSH client, and the switch must have an enable secret password configured.
    - The switch supports up to 16 simultaneous Telnet sessions. Changes made by one Telnet user are reflected in all other Telnet sessions.
    - The switch supports up to five simultaneous secure SSH sessions.

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



CHAPTER 2

Using the Web Graphical User Interface

- Prerequisites for Using the Web GUI, page 13
- Information About Using The Web GUI, page 13
- Connecting the Console Port of the Switch , page 15
- Logging On to the Web GUI, page 15
- Enabling Web and Secure Web Modes , page 15
- Configuring the Switch Web GUI, page 16

Prerequisites for Using the Web GUI

- The GUI must be used on a PC running Windows 7, Windows XP SP1 (or later releases), or Windows 2000 SP4 (or later releases).
- The switch GUI is compatible with Microsoft Internet Explorer version 10.x, Mozilla Firefox 20.x, or Google Chrome 26.x.

Information About Using The Web GUI

A web browser, or graphical user interface (GUI), is built into each switch.

You can use either the service port interface or the management interface to access the GUI. We recommend that you use the service-port interface. Click Help at the top of any page in the GUI to display online help. You might need to disable your browser's pop-up blocker to view the online help.

Web GUI Features

The switch web GUI supports the following:

The Configuration Wizard—After initial configuration of the IP address and the local username/password or auth via the authentication server (privilege 15 needed), the wizard provides a method to complete the initial

wireless configuration. Start the wizard through Configuration -> Wizard and follow the nine-step process to configure the following:

- Admin Users
- SNMP System Summary
- Management Port
- Wireless Management
- RF Mobility and Country code
- Mobility configuration
- WLANs
- 802.11 Configuration
- Set Time

The Monitor tab:

- Displays summary details of switch, clients, and access points.
- Displays all radio and AP join statistics.
- Displays air quality on access points.
- Displays list of all Cisco Discovery Protocol (CDP) neighbors on all interfaces and the CDP traffic information.
- Displays all rogue access points based on their classification-friendly, malicious, ad hoc, classified, and unclassified.

The Configuration tab:

- Enables you to configure the switch for all initial operation using the web Configuration Wizard. The wizard allows you to configure user details, management interface, and so on.
- Enables you to configure the system, internal DHCP server, management, and mobility management parameters.
- Enables you to configure the switch, WLAN, and radios.
- Enables you to configure and set security policies on your switch.
- Enables you to access the switch operating system software management commands.

The Administration tab enables you to configure system logs.

Connecting the Console Port of the Switch

Before You Begin

Before you can configure the switch for basic operations, you need to connect it to a PC that uses a VT-100 terminal emulation program (such as HyperTerminal, ProComm, Minicom, or Tip).

Step 1 Connect one end of a null-modem serial cable to the switch's RJ-45 console port and the other end to your PC's serial port.

Step 2 Plug the AC power cord into the switch and a grounded 100 to 240 VAC, 50/60-Hz electrical outlet. Turn on the power supply. The bootup script displays operating system software initialization (code download and power-on self-test verification) and basic configuration. If the switch passes the power-on self-test, the bootup script runs the configuration wizard, which prompts you for basic configuration input.

Step 3 Enter **yes**. Proceed with basic initial setup configuration parameters in the CLI setup wizard. Specify the IP address for the service port which is the gigabitethernet 0/0 interface.
After entering the configuration parameters in the configuration wizard, you can access the Web GUI. Now, the switch is configured with the IP address for service port.

Logging On to the Web GUI

Enter the switch IP address in your browser's address bar. For a secure connection, enter https://**ip-address**. For a less secure connection, enter http://**ip-address**.

Enabling Web and Secure Web Modes

Step 1 Choose **Configuration** > **Management** > **Protocol Management** > **HTTP-HTTPS**.

The **HTTP-HTTPS Configuration** page appears.

Step 2 To enable web mode, which allows users to access the switch GUI using "http://ip-address," choose Enabled from the HTTP Access drop-down list. Otherwise, choose Disabled. Web mode (HTTP) is not a secure connection.

Step 3 To enable secure web mode, which allows users to access the switch GUI using "https://ip-address," choose Enabled from the HTTPS Access drop-down list. Otherwise, choose Disabled. Secure web mode (HTTPS) is a secure connection.

Step 4 Choose to track the device in the IP Device Tracking check box.

Step 5 Choose to enable the trust point in the Enable check box.

Step 6 Choose the trustpoints from the Trustpoints drop-down list.

Step 7 Enter the amount of time, in seconds, before the web session times out due to inactivity in the HTTP Timeout-policy (1 to 600 sec) text box.
The valid range is from 1 to 600 seconds.

Step 8 Enter the server life time in the Server Life Time (1 to 86400 sec) text box.
The valid range is from1 to 86400 seconds.

Step 9 Enter the maximum number of connection requests that the server can accept in the Maximum number of Requests (1 to 86400) text box.
The valid range is from 1 to 86400 connections.

Step 10 Click **Apply**.

Step 11 Click **Save Configuration**.

Configuring the Switch Web GUI

The configuration wizard enables you to configure basic settings on the switch. You can run the wizard after you receive the switch from the factory or after the switch has been reset to factory defaults. The configuration wizard is available in both GUI and CLI formats.

Step 1 Connect your PC to the service port and configure an IPv4 address to use the same subnet as the switch. The switch is loaded with IOS XE image and the service port interface is configured as gigabitethernet 0/0.

Step 2 Start Internet Explorer 10 (or later), Firefox 2.0.0.11 (or later), or Google Chrome on your PC and enter the management interface IP address on the browser window. The management interface IP address is same as the gigabitethernet 0/0 (also known as service port interface). When you log in for the first time, you need to enter HTTP username and password. By default, the username is **admin** and the password is **cisco**.
You can use both HTTP and HTTPS when using the service port interface. HTTPS is enabled by default and HTTP can also be enabled.

When you log in for the first time, the **<Model Number> <Hostname>** page appears.

Step 3 On the page, click the **Wireless Web GUI** link to access switch web GUI **Home** page.

Step 4 Choose **Configuration** > **Wizard** to perform all steps that you need to configure the switch initially.
The **Admin Users** page appears.

Step 5 On the **Admin Users** page, enter the administrative username to be assigned to this switch in the User Name text box and the administrative password to be assigned to this switch in the Password and Confirm Password text boxes. Click **Next**.
The default username is **admin** and the default password is **cisco**. You can also create a new administrator user for the switch. You can enter up to 24 ASCII characters for username and password.

The **SNMP System Summary** page appears.

Step 6 On the **SNMP System Summary** page, enter the following SNMP system parameters for the switch, and click **Next**:

- Customer-definable switch location in the Location text box.
- Customer-definable contact details such as phone number with names in the Contact text box.
- Choose **enabled** to send SNMP notifications for various SNMP traps or **disabled** not to send SNMP notifications for various SNMP traps from the SNMP Global Trap drop-down list.
- Choose **enabled** to send system log messages or **disabled** not to send system log messages from the SNMP Logging drop-down list.

Note The SNMP trap server, must be reachable through the distribution ports (and not through the gigabitethernet0/0 service or management interface).

The **Management Port** page appears.

Step 7 In the **Management Port** page, enter the following parameters for the management port interface (gigabitethernet 0/0) and click **Next**.

- Interface IP address that you assigned for the service port in the IP Address text box.
- Network mask address of the management port interface in the Netmask text box.
- The IPv4 Dynamic Host Configuration Protocol (DHCP) address for the selected port in the IPv4 DHCP Server text box.

The **Wireless Management** page appears.

Step 8 In the **Wireless Management** page, enter the following wireless interface management details, and click **Next**.

- Choose the interface—VLAN, or Ten Gigabit Ethernet from the Select Interface drop-down list.
- VLAN tag identifier, or 0 for no VLAN tag in the VLAN id text box.
- IP address of wireless management interface where access points are connected in the IP Address text box.
- Network mask address of the wireless management interface in the Netmask text box.
- DHCP IPv4 IP address in the IPv4 DHCP Server text box.

When selecting VLAN as interface, you can specify the ports as –Trunk or Access ports from the selected list displayed in the Switch Port Configuration text box.

The **RF Mobility and Country Code** page appears.

Step 9 In the **RF Mobility and Country Code** page, enter the RF mobility domain name in the RF Mobility text box, choose current country code from the Country Code drop-down list, and click **Next**. From the GUI, you can select only one country code.

Note Before configuring RF grouping parameters and mobility configuration, ensure that you refer to the relevant conceptual content and then proceed with the configuration.

The **Mobility Configuration** page with mobility global configuration settings appears.

Step 10 In the **Mobility Configuration** page, view and enter the following mobility global configuration settings, and click **Next**.

- Choose **Mobility Controller** or **Mobility Agent** from the Mobility Role drop-down list:

- If Mobility Agent is chosen, enter the mobility controller IP address in the Mobility Controller IP Address text box and mobility controller IP address in the Mobility Controller Public IP Address text box.
- If Mobility Controller is chosen, then the mobility controller IP address and mobility controller public IP address are displayed in the respective text boxes.

- Displays mobility protocol port number in the Mobility Protocol Port text box.
- Displays the mobility switch peer group name in the Mobility Switch Peer Group Name text box.
- Displays whether DTLS is enabled in the DTLS Mode text box.

  DTLS is a standards-track Internet Engineering Task Force (IETF) protocol based on TLS.
- Displays mobility domain identifier for 802.11 radios in the Mobility Domain ID for 802.11 radios text box.
- The amount of time (in seconds) between each ping request sent to an peer switch in the Mobility Keepalive Interval (1-30)sec text box.

  Valid range is from 1 to 30 seconds, and the default value is 10 seconds.
- Number of times a ping request is sent to an peer switch before the peer is considered to be unreachable in the Mobility Keepalive Count (3-20) text box.

  The valid range is from 3 to 20, and the default value is 3.
- The DSCP value that you can set for the mobility switch in the Mobility Control Message DSCP Value (0-63) text box.

  The valid range is 0 to 63, and the default value is 0.
- Displays the number of mobility switch peer group member configured in the Switch Peer Group Members Configured text box.

The **WLANs** page appears.

Step 11 In the **WLANs** page, enter the following WLAN configuration parameters, and click **Next**.

- WLAN identifier in the WLAN ID text box.
- SSID of the WLAN that the client is associated with in the SSID text box.
- Name of the WLAN used by the client in the Profile Name text box.

The **802.11 Configuration** page appears.

Step 12 In the **802.11 Configuration** page, check either one or both 802.11a/n/ac and 802.11b/g/n check boxes to enable the 802.11 radios, and click **Next**.
The **Set Time** page appears.

Step 13 In the **Set Time** page, you can configure the time and date on the switch based on the following parameters, and click **Next**.

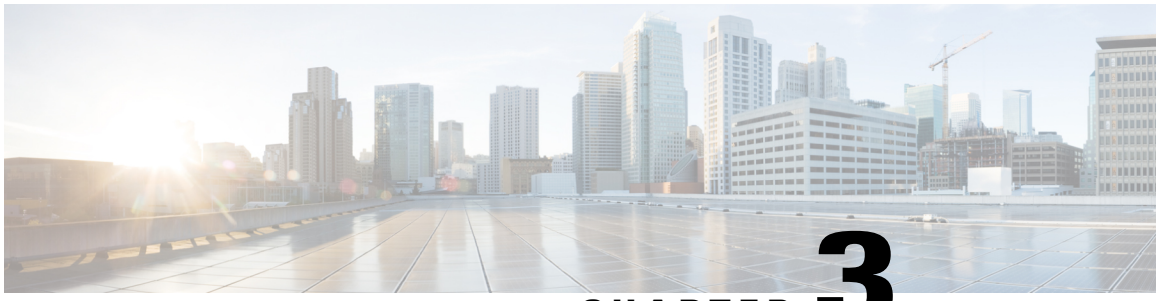
- Displays current timestamp on the switch in the Current Time text box.
- Choose either Manual or NTP from the Mode drop-down list.

  On using the NTP server, all access points connected to the switch, synchronizes its time based on the NTP server settings available.

- Choose date on the switch from the Year, Month, and Day drop-down list.
- Choose time from the Hours, Minutes, and Seconds drop-down list.
- Enter the time zone in the Zone text box and select the off setting required when compared to the current time configured on the switch from the Offset drop-down list.

The **Save Wizard** page appears.

Step 14 In the **Save Wizard** page, you can review the configuration settings performed on the switch using these steps, and if you wish to change any configuration value, click **Previous** and navigate to that page.
You can save the switch configuration created using the wizard only if a success message is displayed for all the wizards. If the **Save Wizard** page displays errors, you must recreate the wizard for initial configuration of the switch.



CHAPTER 3

Configuring the Switch for Access Point Discovery

- Finding Feature Information, page 21
- Prerequisites for Configuring the Switch for Access Point Discovery, page 21
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Finding Feature Information

Prerequisites for Configuring the Switch for Access Point Discovery

- Ensure that the Control and Provisioning of Wireless Access Points (CAPWAP) UDP ports 5246 and 5247 (similar to the Lightweight Access Point Protocol (LWAPP) UDP ports 12222 and 12223) are enabled and are not blocked by an intermediate device that could prevent an access point from joining the switch.
- If access control lists (ACLs) are in the control path between the switch and its access points, you must open new protocol ports to prevent access points from being stranded.
- If an access point is in the UP state and its IP address changes, the access point tears down the existing CAPWAP tunnel and rejoins the switch.
- Access points must be discovered by a switch before they can become an active part of the network. The lightweight access points support the following switch discovery processes:

- Layer 3 CAPWAP discovery—You can enable this feature on different subnets from the access point. This feature uses IP addresses and UDP packets rather the MAC addresses used by Layer 2 discovery.
- Locally stored switch IP address discovery—If the access point was previously associated to a switch, the IP addresses of the primary, secondary, and tertiary switchs are stored in the access point's nonvolatile memory. This process of storing switch IP addresses on an access point for later deployment is called *priming the access point*.
- DHCP server discovery—This feature uses DHCP option 43 to provide switch IP addresses to the access points. Cisco switches support a DHCP server option that is typically used for this capability.
- DNS discovery—The access point can discover switchs through your domain name server (DNS). You must configure your DNS to return switch IP addresses in response to CISCO-CAPWAP-CONTROLLER.*localdomain*, where *localdomain* is the access point domain name. When an access point receives an IP address and DNS information from a DHCP server, it contacts the DNS to resolve CISCO-CAPWAP-CONTROLLER.*localdomain*. When the DNS sends a list of switch IP addresses, the access point sends discovery requests to the switchs.

Restrictions for Configuring the Switch for Access Point Discovery

- Ensure that the switchs are configured with the correct date and time. If the date and time configured on the switch precedes the creation and installation date of certificates on the access points, the access point fails to join the switch.
- During the discovery process, access points that are supported by the Cisco switch, such as the 1140, 1260, 3500, 1040,1600, 2600, or 3600 query only for Cisco switchs.

Information About Configuring the Switch for Access Point Discovery

In a CAPWAP environment, a lightweight access point discovers a switch by using CAPWAP discovery mechanisms and then sends a CAPWAP join request to the switch. The switch sends a CAPWAP join response to the access point that allows the access point to join the switch. When the access point joins the switch, the switch manages its configuration, firmware, control transactions, and data transactions.

Access Point Communication Protocols

Cisco lightweight access points use the IETF standard CAPWAP to communicate with the switch and other lightweight access points on the network.

CAPWAP, which is based on LWAPP, is a standard, interoperable protocol that enables a switch to manage a collection of wireless access points. CAPWAP is implemented in switch for these reasons:

- To provide an upgrade path from Cisco products that use LWAPP to next-generation Cisco products that use CAPWAP
- To manage RFID readers and similar devices
- To enable switchs to interoperate with third-party access points in the future

Viewing Access Point Join Information

Join statistics for an access point that sends a CAPWAP discovery request to the switch at least once are maintained on the switch even if the access point is rebooted or disconnected. These statistics are removed only when the switch is rebooted or when you choose to clear the statistics.

Troubleshooting the Access Point Join Process

Access points can fail to join a switch for many reasons such as a RADIUS authorization is pending, self-signed certificates are not enabled on the switch, the access point and switch's regulatory domains do not match, and so on.

You can configure the access points to send all CAPWAP-related errors to a syslog server. You do not need to enable any debug commands on the switch because all of the CAPWAP error messages can be viewed from the syslog server itself.

The state of the access point is not maintained on the switch until it receives a CAPWAP join request from the access point, so it can be difficult to determine why the CAPWAP discovery request from a certain access point was rejected. In order to troubleshoot such joining issues without enabling CAPWAP debug commands on the switch, the switch collects information for all access points that send a discovery message to this switch and maintains information for any access points that have successfully joined this switch.

The switch collects all join-related information for each access point that sends a CAPWAP discovery request to the switch. Collection begins when the first discovery message is received from the access point and ends when the last configuration payload is sent from the switch to the access point.

When the switch is maintaining join-related information for the maximum number of access points, it does not collect information for any more access points.

You can also configure a DHCP server to return a syslog server IP address to the access point using option 7 on the server. The access point then starts sending all syslog messages to this IP address.

You can configure the syslog server IP address through the access point CLI, if the access point is not connected to the switch by entering the **capwap ap log-server** *syslog_server_IP_address* command.

When the access point joins a switch for the first time, the switch pushes the global syslog server IP address (the default is 255.255.255.255) to the access point. After that, the access point sends all syslog messages to this IP address, until it is overridden by one of the following scenarios:

- The access point is still connected to the same switch, and you changed the global syslog server IP address configuration on the switch by using the **ap syslog host** *Syslog_Server_IP_Address* command. In this case, the switch pushes the new global syslog server IP address to the access point.
- The access point is still connected to the same switch, and you configured a specific syslog server IP address for the access point on the switch by using the **ap name** *Cisco_AP* **syslog host** *Syslog_Host_IP_Address* command. In this case, the switch pushes the new specific syslog server IP address to the access point.

- The access point gets disconnected from the switch, and you configured the syslog server IP address from the access point CLI by using the **capwap ap log-server** *syslog_server_IP_address* command. This command works only if the access point is not connected to any switch.
- The access point gets disconnected from the switch and joins another switch. In this case, the new switch pushes its global syslog server IP address to the access point.

Whenever a new syslog server IP address overrides the existing syslog server IP address, the old address is erased from persistent storage, and the new address is stored in its place. The access point also starts sending all syslog messages to the new IP address, if the access point can reach the syslog server IP address.

How to Configure Access Point Discovery

Configuring the Syslog Server for Access Points (GUI)

Step 1 Choose **Configuration** > **Wireless** > **Access Points** > **All APs**.
The **All APs** page is displayed showing a list of access points that are associated with the switch and their current settings.

Step 2 From the **Show** drop-down list, choose **Quick Filter**.
The filter options (text boxes) appear in each of the column header in the table.

Step 3 Enter a keyword in the corresponding text boxes to specify the filter criteria based on which you want to search, and click the **Filter** icon.

Configuring the Syslog Server for Access Points (CLI)

SUMMARY STEPS

1. **show ap config global**
2. **show ap name** *Cisco_AP* **config general**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**show ap config global** **Example:** `Switch# show ap config global`	Displays the global syslog server settings for all access points that join the switch.

	Command or Action	Purpose
Step 2	**show ap name** *Cisco_AP* **config general** **Example:** `Switch# show ap name AP03 config general`	Displays the syslog server settings for a specific access point.

Monitoring Access Point Join Information (CLI)

Note The procedure to perform this task using the switch GUI is not currently available.

SUMMARY STEPS

1. **enable**
2. **show ap join stats summary**
3. **show ap mac-address** *mac_address* **join stats summary**
4. **show ap mac-address** *mac_address* **join stats detailed**
5. **clear ap join statistics**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Switch# enable`	Enters privileged EXEC mode.
Step 2	**show ap join stats summary** **Example:** `Switch# show ap join stats summary`	Displays the MAC addresses of all the access points that are joined to the switch or that have tried to join.
Step 3	**show ap mac-address** *mac_address* **join stats summary** **Example:** `Switch# show ap mac-address 000.2000.0400 join stats summary`	Displays all the statistics for the AP including the last join error detail.
Step 4	**show ap mac-address** *mac_address* **join stats detailed** **Example:** `Switch# show ap mac-address 000.2000.0400 join stats detailed`	Displays all join-related statistics collected for a specific access point.

	Command or Action	Purpose
Step 5	**clear ap join statistics** **Example:** `Switch# clear ap join statistics`	Clears the join statistics for all access points. **Note** To clear the join statistics that correspond to specific access points, enter the **clear ap mac-address** *mac_address* **join statistics** command.

Searching for Access Point Radios (GUI)

Step 1 Choose **Monitor** > **Wireless** > **Access Points** and click **802.11a/n/ac Statistics** or **802.11b/g/n Statistics**.
The 802.11 Radio pages are displayed. These pages show all of the 802.11a/n/ac or 802.11b/g/n access point radios that are associated with the switch and their current settings.

Note In a Cisco converged access environment, the 802.11a/n/ac and 802.11b/g/n radios should not be differentiated based on their Base Radio MAC addresses, because they might have the same addresses. Instead, the radios should be differentiated based on their physical addresses.

Step 2 From the **Show** drop-down list, choose **Quick Filter**.
The filter options (text boxes) appear in each of the column header in the table.

Step 3 Enter a keyword in the corresponding text boxes to specify the filter criteria based on which you want to search, and click the **Filter** icon.

Monitoring the Interface Details (GUI)

Step 1 Choose **Configuration** > **Wireless** > **Access Points** > **All APs**.
The **All APs** page is displayed showing a list of access points that are associated with the switch.

Step 2 Click the access point name.
The **AP > Edit** page is displayed.

Step 3 Click the **Interface** tab.
The interface details are displayed.

Configuration Examples for Configuring the Switch for Access Point Discovery

Displaying the MAC Addresses of all Access Points: Example

This example shows how to display MAC addresses of all the access points that are joined to the switch:

```
Switch# show ap join stats summary
Number of APs.......................................... 4

Base Mac          EthernetMac       AP Name IP Address    Status
----------------- ----------------- ------- ------------- ----------
00:0b:85:57:bc:c0 00:0b:85:57:bc:c0 AP1130  10.10.163.217 Joined
00:1c:0f:81:db:80 00:1c:63:23:ac:a0 AP1140  10.10.163.216 Not joined
00:1c:0f:81:fc:20 00:1b:d5:9f:7d:b2 AP1     10.10.163.215 Joined
00:21:1b:ea:36:60 00:0c:d4:8a:6b:c1 AP2     10.10.163.214 Not joined
```

This example shows how to display the last join error details for a specific access point:

```
Switch# show ap mac-address 000.2000.0400 join stats summary
Is the AP currently connected to controller..... Yes
Time at which the AP joined this
controller last time.................................. Aug 21 12:50:36.061
Type of error
that occurred last.................. AP got or has been disconnected
Reason for error
that occurred last........... The AP has been reset by the controller
Time at which the last join error occurred......... Aug 21 12:50:34.374
```

This example shows how to display all join-related statistics collected for a specific access point:

```
Switch# show ap mac-address 000.2000.0400 join stats detailed
Discovery phase statistics
- Discovery requests received.......................... 2
- Successful discovery responses sent.................. 2
- Unsuccessful discovery request processing.......... 0
- Reason for last unsuccessful discovery attempt..... Not applicable
- Time at last successful discovery attempt.......... Aug 21 12:50:23.335
- Time at last unsuccessful discovery attempt........ Not applicable

Join phase statistics
- Join requests received............................... 1
- Successful join responses sent....................... 1
- Unsuccessful join request processing................. 1
- Reason for last unsuccessful join attempt.....      RADIUS authorization
                                                      is pending
                                                      for the AP
- Time at last successful join attempt................ Aug 21 12:50:34.481
- Time at last unsuccessful join attempt.............. Aug 21 12:50:34.374

Configuration phase statistics
- Configuration requests received...................... 1
- Successful configuration responses sent.............. 1
- Unsuccessful configuration request processing....... 0
- Reason for last unsuccessful configuration attempt.. Not applicable
- Time at last successful configuration attempt....... Aug 21 12:50:34.374
- Time at last unsuccessful configuration attempt..... Not applicable

Last AP message decryption failure details
- Reason for last message decryption failure.......... Not applicable

Last AP disconnect details
- Reason for last AP connection failure............... The AP has been reset by
                                                      the controller
Last join error summary
```

```
- Type of error that occurred last..................... AP got or has been
                                                        disconnected
- Reason for error that occurred last.................. The AP has been reset
                                                        by the controller
- Time at which the last join error occurred.......... Aug 21 12:50:34.374
```

DHCP Option 43 for Lightweight Cisco Aironet Access Points Configuration Example

For more information about the AP join process, see *DHCP OPTION 43 for Lightweight Cisco Aironet Access Points Configuration Example* at http://www.cisco.com/en/US/tech/tk722/tk809/technologies_configuration_example09186a00808714fe.shtml.

Configuring AP Pass Through

Information About AP Pass Through

AP pass through allows all the access points connected to Cisco Catalyst 3850 Series Switches and Cisco Catalyst 3650 Series Switches to join another controller on the network.

Prior to this release, all access points connected Cisco Catalyst 3850 Series Switches and Cisco Catalyst 3650 Series Switches would be terminated on the switch when the wireless management vlan is turned on. Unsupported access points connected to the switch were unable join a controller on a different vlan. AP pass through allows the connected AP to join another wireless controller on the network by assigning different vlan.

The advantages of AP pass through are:

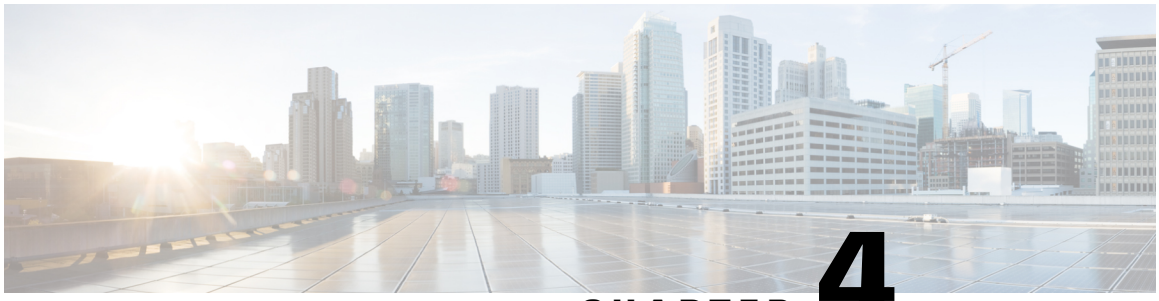
- Allows partial deployment of Cisco New Generation Wireless Controllers where some APs are connected to Cisco Catalyst 3850 Series Switches and Cisco Catalyst 3650 Series Switches but other APs continue to join other controllers on the network.
- The APs that are not supported on the Cisco Catalyst 3850 Series Switches and Cisco Catalyst 3650 Series Switches are allowed to join other controllers on the network.
- The wireless LAN controller is used to provide access to both wired and wireless guests. AP Pass through allows the AP to pass through Cisco Catalyst 3850 Series Switches and Cisco Catalyst 3650 Series Switches to join any other controller when wired guest accessing is turned on.

Configuring AP Pass Through

All access points on VLANs other than the one with supported access points will be put into the AP pass-through mode and will not terminate on theSwitch.

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 2	**wireless management interface vlan** *vlan_id* **Example:** `Switch(config)# wireless management interface vlan10`	Configures the ports that are connected to the supported access points with the wireless management VLAN
Step 3	**interface GigabitEthernet1/0/1** **Example:** `Switch(config)# interface TenGigabitEthernet1/0/1`	Sets the 10-Gigbit Ethernet interface. The command prompt changes from (config)# to (config-if)#.
Step 4	**description Supported AP switchport access** *vlan_id* **Example:** `Switch(config-if)# switchport access vlan10`	Specifies the VLAN for which this access port will carry traffic
Step 5	**description Unsupported AP switchport access** *vlan_id* **Example:** `Switch(config-if)# switchport access vlan20`	Configures the ports that are connected to the unsupported access points with a vlan other than the wireless management VLAN.



CHAPTER 4

Configuring Data Encryption

- Finding Feature Information, page 31
- Prerequisites for Configuring Data Encryption, page 31
- Restrictions for Configuring Data Encryption, page 31
- Information About Data Encryption, page 32
- How to Configure Data Encryption, page 32
- Configuration Examples for Configuring Data Encryption, page 33

Finding Feature Information

Prerequisites for Configuring Data Encryption

- Cisco 1260, 3500, 3600, 801, 1140, 1310, and 1520 series access points support Datagram Transport Layer Security (DTLS) data encryption.
- You can use the switch to enable or disable DTLS data encryption for a specific access point or for all access points.
- Non-Russian customers who use the Cisco switch do not need a data DTLS license.

Restrictions for Configuring Data Encryption

- Encryption limits throughput at both the switch and the access point, and maximum throughput is desired for most enterprise networks.
- If your switch does not have a data DTLS license and if the access point associated with the switch has DTLS enabled, the data path will be unencrypted.
- In images that do not have a DTLS license, the DTLS commands are not available.

Information About Data Encryption

The switch enables you to encrypt Control and Provisioning of Wireless Access Points (CAPWAP) control packets (and optionally, CAPWAP data packets) that are sent between the access point and the switch using DTLS. DTLS is a standards-track Internet Engineering Task Force (IETF) protocol based on TLS. CAPWAP control packets are management packets exchanged between a switch and an access point while CAPWAP data packets encapsulate forwarded wireless frames. CAPWAP control and data packets are sent over separate UDP ports: 5246 (control) and 5247 (data). If an access point does not support DTLS data encryption, DTLS is enabled only for the control plane, and a DTLS session for the data plane is not established.

How to Configure Data Encryption

Configuring Data Encryption (CLI)

SUMMARY STEPS

1. **configure terminal**
2. **ap link-encryption**
3. **end**
4. **show ap link-encryption**
5. **show wireless dtls connections**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 2	**ap link-encryption** **Example:** `Switch(config)# ap link-encryption`	Enables data encryption for all access points or a specific access point by entering this command. The default value is disabled. Changing the data encryption mode requires the access points to rejoin the switch.
Step 3	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.
Step 4	**show ap link-encryption** **Example:** `Switch# show ap link-encryption`	Displays the encryption state of all access points or a specific access point. This command also shows authentication errors, which track the number of integrity check failures and replay errors. Relay errors help in tracking the number of times the access point receives the same packet.

	Command or Action	Purpose
Step 5	**show wireless dtls connections** **Example:** `Switch# show wireless dtls connections`	Displays a summary of all active DTLS connections. **Note** If you experience any problems with DTLS data encryption, enter the **debug dtls ap** {**all** | **event** | **trace**} command to debug all DTLS messages, events, or traces.

Configuring Data Encryption (GUI)

Step 1 Choose **Configuration** > **Wireless** > **Access Points** > **All APs**.
The All APs page is displayed.

Step 2 Click the name of the access point for which you want to enable data encryption.
The **AP > Edit** page is displayed.

Step 3 Click the **Advanced** tab.

Step 4 Select or unselect the **Data Encryption** check box.

Note Changing the data encryption mode requires the access points to reassociate with the switch.

Step 5 Click **Apply**.

Step 6 Click **Save Configuration**.

Configuration Examples for Configuring Data Encryption

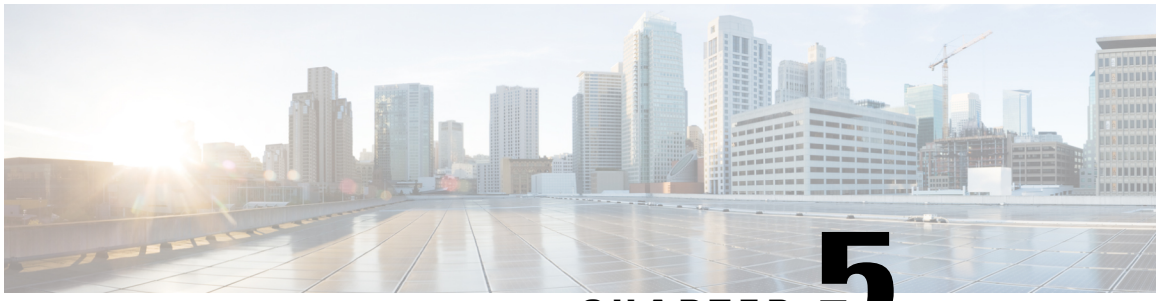
Displaying Data Encryption States for all Access Points: Examples

This example shows how to display the encryption state of all access points or a specific access point. This command also shows authentication errors, which track the number of integrity check failures and replay errors. Relay errors help in tracking the number of times the access point receives the same packet:

```
Switch# show ap link-encryption
                    Encryption  Dnstream  Upstream    Last
AP Name                  State     Count     Count  Update
------------------  ----------  --------  --------  ------
3602a                  Enabled         0         0   Never
```

This example shows how to display a summary of all active DTLS connections:

```
Switch# show wireless dtls connections
AP Name         Local Port   Peer IP       Peer Port  Ciphersuite
--------------- ------------ ------------- ---------- --------------------
3602a           Capwap_Ctrl  10.10.21.213  46075      TLS_RSA_WITH_AES_128_CBC_SHA
3602a           Capwap_Data  10.10.21.213  46075      TLS_RSA_WITH_AES_128_CBC_SHA
```



CHAPTER 5

Configuring Retransmission Interval and Retry Count

- Finding Feature Information, page 35
- Prerequisites for Configuring the Access Point Retransmission Interval and Retry Count, page 35
- Information About Retransmission Interval and Retry Count, page 35
- How to Configure Access Point Retransmission Interval and Retry Count, page 36
- Viewing CAPWAP Maximum Transmission Unit Information (CLI), page 38
- Viewing CAPWAP Maximum Transmission Unit Information (GUI), page 38
- Configuration Examples for Configuring Access Point Retransmission Interval and Retry Count, page 39

Finding Feature Information

Prerequisites for Configuring the Access Point Retransmission Interval and Retry Count

- You can configure the retransmission intervals and retry count both at a global and a specific access point level. A global configuration applies these configuration parameters to all the access points. Alternatively, when you configure the retransmission level and retry count at a specific access point level, the values are applied to that particular access point. The access point specific configuration has a higher precedence than the global configuration.

Information About Retransmission Interval and Retry Count

The switch and the access points exchange packets using the Control and Provisioning of Wireless Access Points (CAPWAP) reliable transport protocol. For each request, a response is defined. This response is used

to acknowledge the receipt of the request message. Response messages are not explicitly acknowledged; therefore, if a response message is not received, the original request message is retransmitted after the retransmit interval. If the request is not acknowledged after a maximum number of retransmissions, the session is closed and the access points reassociate with another switch.

How to Configure Access Point Retransmission Interval and Retry Count

Configuring the Access Point Retransmission Interval and Retry Count (CLI)

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ap capwap retransmit interval** *interval_time*
4. **ap capwap retransmit count** *count_value*
5. **end**
6. **ap name** *Cisco_AP* **capwap retransmit interval** *interval_time*
7. **ap name** *Cisco_AP* **capwap retransmit count** *count_value*
8. **show ap capwap retransmit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Switch# enable`	Enters privileged EXEC mode.
Step 2	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 3	**ap capwap retransmit interval** *interval_time* **Example:** `Switch(config)# ap capwap retransmit interval 2`	Configures the control packet retransmit interval for all access points globally. **Note** The range for the interval parameter is from 2 to 5.
Step 4	**ap capwap retransmit count** *count_value* **Example:** `Switch(config)# ap capwap retransmit count 3`	Configures the control packet retry count for all access points globally. **Note** The range for the count is from 3 to 8.

	Command or Action	Purpose
Step 5	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.
Step 6	**ap name** *Cisco_AP* **capwap retransmit interval** *interval_time* **Example:** `Switch# ap name AP02 capwap retransmit interval 2`	Configures the control packet retransmit interval for the individual access point that you specify. **Note** The range for the interval is from 2 to 5. **Note** You must be in privileged EXEC mode to use the **ap name** commands.
Step 7	**ap name** *Cisco_AP* **capwap retransmit count** *count_value* **Example:** `Switch# ap name AP02 capwap retransmit count 3`	Configures the control packet retry count for the individual access point that you specify. **Note** The range for the retry count is from 3 to 8.
Step 8	**show ap capwap retransmit** **Example:** `Switch# show ap capwap retransmit`	Displays the CAPWAP retransmit details.

Configuring the Access Point Retransmission Interval and Retry Count (GUI)

- Global configuration applicable to all APs:
  a) Choose **Configuration** > **Wireless** > **Access Points** > **Global AP Configuration**.
  The **Global Configuration** page is displayed.
  b) In the **AP Retransmit Config Parameters** area, enter the values for the following parameters:
     - **AP Retransmit Count—**Number of times you want the access point to retransmit the request to the switch. The valid range is between 3 and 8.
     - **AP Retransmit Interval—**Duration between the retransmission of requests. The valid range is between 2 and 5.
  c) Click **Apply**.
  d) Click **Save Configuration**.
- Configuration that is applicable to a specific AP:
  a) Choose **Configuration** > **Wireless** > **Access Points** > **All APs**.
  The **All APs** page is displayed with a list of access points.
  b) Click the access point name.
  The **AP > Edit** page is displayed.

c) Click the **Advanced** tab.
d) In the **AP Retransmit Config Parameters** area, enter the values for the following **AP Retransmit Count** and **AP Retransmit Interval** parameters:

- **AP Retransmit Count—**Number of times you want the access point to retransmit the request to the switch. The valid range is between 3 and 8.
- **AP Retransmit Interval—**Duration between the retransmission of requests. The valid range is between 2 and 5.

e) Click **Apply**.
f) Click **Save Configuration**.

Viewing CAPWAP Maximum Transmission Unit Information (CLI)

SUMMARY STEPS

1. **enable**
2. **show ap name** *Cisco_AP* **config general**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Switch# enable`	Enters privileged EXEC mode.
Step 2	**show ap name** *Cisco_AP* **config general** **Example:** `Switch# show ap name Maria-1250 config general | include MTU`	Displays the maximum transmission unit (MTU) for the CAPWAP path on the switch. The MTU specifies the maximum size of any packet (in bytes) in a transmission.

Viewing CAPWAP Maximum Transmission Unit Information (GUI)

Step 1 Choose **Configuration** > **Wireless** > **Access Points** > **All APs**.

The **All APs** page is displayed.

Step 2 Click the AP name.
The **AP > Edit** page is displayed.

Step 3 Click the **Advanced** tab.
The **CAPWAP MTU** field shows the CAPWAP maximum retransmission unit information.

Configuration Examples for Configuring Access Point Retransmission Interval and Retry Count

Viewing the CAPWAP Retransmission Details: Example

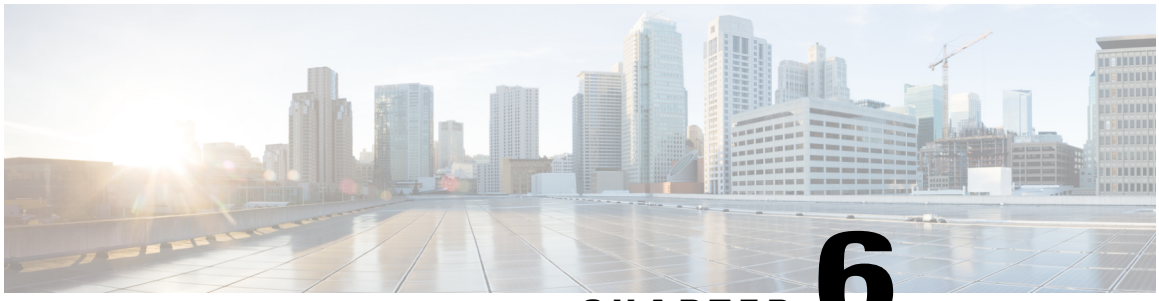
Enter the following command:

```
Switch# show ap capwap retransmit
Global control packet retransmit interval : 3
Global control packet retransmit count : 5

AP Name                          Retransmit Interval             Retransmit Count

-------------------------------- --------------------------------
--------------------------------
3602a                            5                               3
```

Viewing Maximum Transmission Unit Information: Example

This example shows how to view the maximum transmission unit (MTU) for the CAPWAP path on the switch. The MTU specifies the maximum size of any packet (in bytes) in a transmission:

```
Switch# show ap name cisco-ap-name config general | include MTU
CAPWAP Path MTU..................................... 1500
```



CHAPTER 6

Configuring Adaptive Wireless Intrusion Prevention System

- Finding Feature Information, page 41
- Prerequisites for Configuring wIPS, page 41
- How to Configure wIPS on Access Points, page 42
- Monitoring wIPS Information, page 44
- Configuration Examples for Configuring wIPS on Access Points, page 45

Finding Feature Information

Prerequisites for Configuring wIPS

- The regular local mode access point has been extended with a subset of Wireless Intrusion Prevention System (wIPS) capabilities. This feature enables you to deploy your access points to provide protection without needing a separate overlay network.

How to Configure wIPS on Access Points

Configuring wIPS on an Access Point (CLI)

SUMMARY STEPS

1. **ap name** *Cisco_AP* **mode local**
2. **ap name** *Cisco_AP* **dot11 5ghz shutdown**
3. **ap name** *Cisco_AP* **dot11 24ghz shutdown**
4. **ap name** *Cisco_AP* **mode monitor submode wips**
5. **ap name** *Cisco_AP* **monitor-mode wips-optimized**
6. **show ap dot11 24ghz monitor**
7. **ap name** *Cisco_AP* **no dot11 5ghz shutdown**
8. **ap name** *Cisco_AP* **no dot11 24ghz shutdown**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**ap name** *Cisco_AP* **mode local** **Example:** `Switch# ap name AP01 mode local`	Configures an access point for monitor mode. A message appears that indicates that changing the AP's mode causes the access point to reboot. This message also displays a prompt that enables you to specify whether or not you want to continue with changing the AP mode. Enter **y** at the prompt to continue.
Step 2	**ap name** *Cisco_AP* **dot11 5ghz shutdown** **Example:** `Switch# ap name AP01 dot11 5ghz shutdown`	Disables the 802.11a radio on the access point.
Step 3	**ap name** *Cisco_AP* **dot11 24ghz shutdown** **Example:** `Switch# ap name AP02 dot11 24ghz shutdown`	Disables the 802.11b radio on the access point.
Step 4	**ap name** *Cisco_AP* **mode monitor submode wips** **Example:** `Switch# ap name AP01 mode monitor submode wips`	Configures the wIPS submode on the access point. **Note** To disable wIPS on the access point, enter the **ap name** *Cisco_AP* **modemonitor submode none** command.
Step 5	**ap name** *Cisco_AP* **monitor-mode wips-optimized**	Enables wIPS optimized channel scanning for the access point.

	Command or Action	Purpose
	Example: `Switch# ap name AP01 monitor-mode wips-optimized`	The access point scans each channel for 250 milliseconds. It derives the list of channels to be scanned from the monitor configuration. You can choose the following options: • **All—**All channels supported by the access point's radio. • **Country—**Only the channels supported by the access point's country of operation. • **DCA—**Only the channel set used by the dynamic channel assignment (DCA) algorithm, which by default includes all of the nonoverlapping channels allowed in the access point's country of operation.
Step 6	**show ap dot11 24ghz monitor** **Example:** `Switch# show ap dot11 24ghz monitor`	Displays the monitor configuration channel set. **Note** The 802.11b Monitor Channels value in the output of the command indicates the monitor configuration channel set.
Step 7	**ap name** *Cisco_AP* **no dot11 5ghz shutdown** **Example:** `Switch# ap name AP01 no dot11 5ghz shutdown`	Enables the 802.11a radio on the access point.
Step 8	**ap name** *Cisco_AP* **no dot11 24ghz shutdown** **Example:** `Switch# ap name AP01 no dot11 24ghz shutdown`	Enables the 802.11b radio on the access point.

Configuring wIPS on an Access Point (GUI)

Step 1 Choose **Configuration** > **Wireless** > **Access Points** > **All APs**
The **All APs** page is displayed.

Step 2 Click the access point name.
The **AP > Edit** page is displayed.

Step 3 From the **AP Mode** drop-down list, choose one of the following options to configure the AP mode parameters:

- **Local**

- **Monitor**

Step 4 From the **AP Sub Mode** drop-down list, choose **WIPS**.

Step 5 Click **Apply**.

Step 6 Click **Save Configuration**.

Monitoring wIPS Information

Note The procedure to perform this task using the switch GUI is not currently available.

SUMMARY STEPS

1. **show ap name** *Cisco_AP* **config general**
2. **show ap monitor-mode summary**
3. **show wireless wps wips summary**
4. **show wireless wps wips statistics**
5. **clear wireless wips statistics**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**show ap name** *Cisco_AP* **config general** **Example:** `Switch# show ap name AP01 config general`	Displays information on the wIPS submode on the access point.
Step 2	**show ap monitor-mode summary** **Example:** `Switch# show ap monitor-mode summary`	Displays the wIPS optimized channel scanning configuration on the access point.
Step 3	**show wireless wps wips summary** **Example:** `Switch# show wireless wps wips summary`	Displays the wIPS configuration forwarded by NCS or Prime to the switch.
Step 4	**show wireless wps wips statistics** **Example:** `Switch# show wireless wps wips statistics`	Displays the current state of wIPS operation on the switch.

	Command or Action	Purpose
Step 5	**clear wireless wips statistics** **Example:** `Switch# clear wireless wips statistics`	Clears the wIPS statistics on the switch.

Configuration Examples for Configuring wIPS on Access Points

Displaying the Monitor Configuration Channel Set: Example

This example shows how to display the monitor configuration channel set:

```
Switch# show ap dot11 24ghz monitor
Default 802.11b AP monitoring
802.11b Monitor Mode.......................... enable
802.11b Monitor Channels...................... Country channels
802.11b AP Coverage Interval.................. 180 seconds
802.11b AP Load Interval...................... 60 seconds
802.11b AP Noise Interval..................... 180 seconds
802.11b AP Signal Strength Interval............ 60 seconds
```

Displaying wIPS Information: Examples

This example shows how to display information on the wIPS submode on the access point:

```
Switch# show ap name AP01 config general
Cisco AP Identifier.............. 3
Cisco AP Name.................... AP1131:46f2.98ac
...
AP Mode ......................... Monitor
Public Safety ................... Disabled Disabled
AP SubMode ...................... WIPS
```

This example shows how to display the wIPS optimized channel scanning configuration on the access point:

```
Switch# show ap monitor-mode summary
AP Name       Ethernet MAC   Status   Scanning
                                      Channel
                                      List
------------ -------------- -------- ---------
AP1131:4f2.9a 00:16:4:f2:9:a WIPS     1,6,NA,NA
```

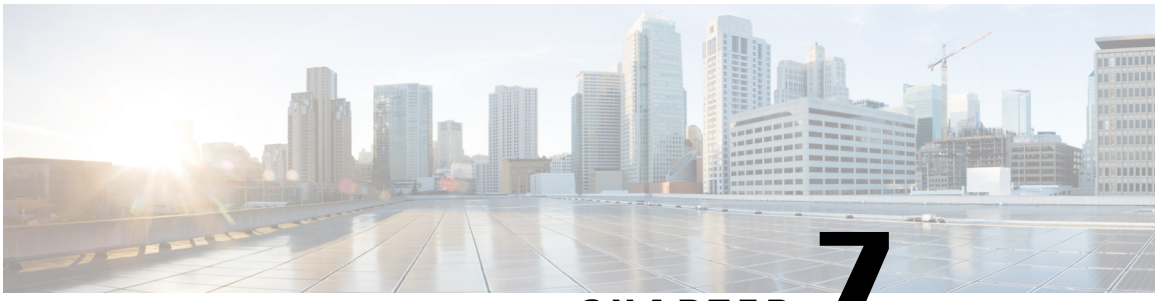
This example shows how to display the wIPS configuration forwarded by WCS to the switch:

```
Switch# show wireless wps wips summary
Policy Name.............. Default
Policy Version........... 3
```

This example shows how to display the current state of wIPS operation on the switch:

```
Switch# show wireless wps wips statistics
Policy Assignment Requests............ 1
Policy Assignment Responses........... 1
Policy Update Requests................ 0
Policy Update Responses............... 0
Policy Delete Requests................ 0
Policy Delete Responses............... 0
```

```
Alarm Updates..................... 13572
Device Updates.................... 8376
Device Update Requests............ 0
Device Update Responses........... 0
Forensic Updates.................. 1001
Invalid WIPS Payloads............. 0
Invalid Messages Received......... 0
CAPWAP Enqueue Failed............. 0
NMSP Enqueue Failed............... 0
NMSP Transmitted Packets.......... 22950
NMSP Transmit Packets Dropped..... 0
NMSP Largest Packet............... 1377
```



CHAPTER 7

Configuring Authentication for Access Points

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- Restrictions for Configuring Authentication for Access Points, page 48
- Information about Configuring Authentication for Access Points, page 48
- How to Configure Authentication for Access Points, page 48
- Configuration Examples for Configuring Authentication for Access Points, page 55

Finding Feature Information

Prerequisites for Configuring Authentication for Access Points

- You can set a global username, password, and enable password for all access points that are currently joined to the switch and any that join in the future inherit as they join the switch. If desired, you can override the global credentials and assign a unique username, password, and enable password for a specific access point.
- After an access point joins the switch, the access point enables console port security, and you are prompted for your username and password whenever you log into the access point's console port. When you log in, you are in nonprivileged mode, and you must enter the enable password in order to use the privileged mode.
- The global credentials that you configure on the switch are retained across switch and access point reboots. They are overwritten only if the access point joins a new switch that is configured with a global username and password. If the new switch is not configured with global credentials, the access point retains the global username and password configured for the first switch.
- You must track the credentials used by the access points. Otherwise, you might not be able to log into an access point's console port. If you need to return the access points to the default *Cisco/Cisco* username and password, you must clear the switch's configuration and the access point's configuration to return them to factory-default settings. To reset the default access point configuration, enter the **ap name**

Cisco_AP **mgmtuser username** *Cisco* **password** *Cisco* command. Entering the command does not clear the static IP address of the access point. Once the access point rejoins a switch, it adopts the default *Cisco/Cisco* username and password.

- You can configure global authentication settings for all access points that are currently joined to the switch and any that join in the future. If desired, you can override the global authentication settings and assign unique authentication settings for a specific access point.
- This feature is supported on the following hardware:
  - All Cisco switches that support authentication.
  - Cisco Aironet 1140, 1260, 1310, 1520, 1600, 2600, 3500, and 3600 access points

Restrictions for Configuring Authentication for Access Points

- The switch name in the AP configuration is case sensitive. Therefore, make sure to configure the exact system name on the AP configuration. Failure to do this results in the AP fallback not working.

Information about Configuring Authentication for Access Points

Cisco IOS access points are shipped from the factory with *Cisco* as the default enable password. This password allows users to log into the nonprivileged mode and enter the **show** and **debug** commands that pose a security threat to your network. You must change the default enable password to prevent unauthorized access and to enable users to enter configuration commands from the access point's console port.

You can configure 802.1X authentication between a lightweight access point and a Cisco switch. The access point acts as an 802.1X supplicant and is authenticated by the switch where it uses EAP-FAST with anonymous PAC provisioning.

How to Configure Authentication for Access Points

Configuring Global Credentials for Access Points (CLI)

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ap mgmtuser username** *user_name* **password 0** *passsword* **secret 0** *secret_value*
4. **end**
5. **ap name** *Cisco_AP* **mgmtuser username** *user_name* **password** *password* **secret** *secret*
6. **show ap summary**
7. **show ap name** *Cisco_AP* **config general**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Switch# enable`	Enters privileged EXEC mode.
Step 2	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 3	**ap mgmtuser username** *user_name* **password 0** *passsword* **secret 0** *secret_value* **Example:** `Switch(config)# ap mgmtuser apusr1 password appass 0 secret 0 appass1`	Configures the global username and password and enables the password for all access points that are currently joined to the switch and any access points that join the switch in the future. In the command, the parameter 0 specifies that an unencrypted password will follow and 8 specifies that an AES encrypted password will follow.
Step 4	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.
Step 5	**ap name** *Cisco_AP* **mgmtuser username** *user_name* **password** *password* **secret** *secret* **Example:** `Switch(config)# ap name TSIM_AP-2 mgmtuser apusr1 password appass secret secret`	Overrides the global credentials for a specific access point and assigns a unique username and password and enables password to this access point. The credentials that you enter in this command are retained across switch and access point reboots and if the access point joins a new switch. **Note** If you want to force this access point to use the switch's global credentials, enter the **ap name** *Cisco_AP* **no mgmtuser** command. The following message appears after you execute this command: "AP reverted to global username configuration."
Step 6	**show ap summary** **Example:** `Switch# show ap summary`	Displays a summary of all connected Cisco APs.
Step 7	**show ap name** *Cisco_AP* **config general** **Example:** `Switch# show ap name AP02 config general`	Displays the global credentials configuration for a specific access point. **Note** If this access point is configured for global credentials, the AP User Mode text boxes shows "Automatic." If the global credentials have been overwritten for this access point, the AP User Mode text box shows "Customized."

Configuring Global Credentials for Access Points (GUI)

Step 1 Choose **Configuration** > **Wireless** > **Access Points** > **Global AP Configuration**.
The **Global Configuration** page is displayed.

Step 2 In the **Login Credentials** area, enter the following parameters:

- **User Name**
- **Password**
- **Confirm Password**
- **Secret Password**
- **Confirm Secret Password**

The password should contain characters from at least three of the following classes: lowercase letters, uppercase letters, digits, and special characters. No character in the password can be repeated more than three times consecutively. The password should not contain the management username or the reverse of the username. The password should not contain words like Cisco, oscic, admin, nimda or any variant obtained by changing the capitalization of letters by substituting 1, |, or ! or substituting 0 for o or substituting $ for s.

Step 3 Click **Apply**.
The global username and password are applied to all the access points that are associated with the switches

Step 4 Click **Save Configuration**.

Step 5 (Optional) You can override the global credentials for a specific access point and assign a unique username and password by following these steps:

a) Choose **Configuration** > **Wireless** > **Access Points** > **All APs**.
The **All APs** page is displayed.

b) Click the name of an access point.
The **AP > Edit** page is displayed.

c) Click the **Credentials** tab.

d) In the **Login Credentials** area, select the **Over-ride Global Credentials** check box.

e) Enter the values for the following parameters:

- **Username**
- **Password**
- **Enable Password**

f) Click **Apply**.

g) Click **Save Configuration**.

Configuring Authentication for Access Points (CLI)

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ap dot1x username** *user_name_value* **password 0** *password_value*
4. **end**
5. **ap name** *Cisco_AP* **dot1x-user username** *username_value* **password** *password_value*
6. **configure terminal**
7. **no ap dot1x username** *user_name_value* **password 0** *password_value*
8. **end**
9. **show ap summary**
10. **show ap name** *Cisco_AP* **config general**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Switch# enable`	Enters privileged EXEC mode.
Step 2	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 3	**ap dot1x username** *user_name_value* **password 0** *password_value* **Example:** `Switch(config)# ap dot1x username AP3 password 0 password`	Configures the global authentication username and password for all access points that are currently joined to the switch and any access points that join the switch in the future. This command contains the following keywords and arguments: • **username—**Specifies an 802.1X username for all access points. • *user-id***—**Username. • **password—**Specifies an 802.1X password for all access points. • **0—**Specifies an unencrypted password. • **8—**Specifies an AES encrypted password. • *passwd***—**Password. **Note** You must enter a strong password for the password parameter. Strong passwords are at least eight characters long, contain a combination of uppercase and lowercase letters, numbers, and symbols, and are not a word in any language.

	Command or Action	Purpose
Step 4	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.
Step 5	**ap name** *Cisco_AP* **dot1x-user username** *username_value* **password** *password_value* **Example:** `Switch# ap name AP03 dot1x-user username apuser1 password appass`	Overrides the global authentication settings and assigns a unique username and password to a specific access point. This command contains the following keywords and arguments: • **username—**Specifies to add a username. • *user-id***—**Username. • **password—**Specifies to add a password. • **0—**Specifies an unencrypted password. • **8—**Specifies an AES encrypted password. • *passwd***—**Password. **Note** You must enter a strong password for the password parameter. See the note in Step 2 for the characteristics of strong passwords. The authentication settings that you enter in this command are retained across switch and access point reboots and whenever the access point joins a new switch.
Step 6	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 7	**no ap dot1x username** *user_name_value* **password 0** *password_value* **Example:** `Switch(config)# no ap dot1x username dot1xusr password 0 dot1xpass`	Disables 802.1X authentication for all access points or for a specific access point. The following message appears after you execute this command: "AP reverted to global username configuration." **Note** You can disable 802.1X authentication for a specific access point only if global 802.1X authentication is not enabled. If global 802.1X authentication is enabled, you can disable 802.1X for all access points only.
Step 8	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.
Step 9	**show ap summary** **Example:** `Switch# show ap summary`	Displays the authentication settings for all access points that join the switch. **Note** If global authentication settings are not configured, the Global AP Dot1x User Name text box shows "Not Configured."
Step 10	**show ap name** *Cisco_AP* **config general**	Displays the authentication settings for a specific access point.

	Command or Action	Purpose
	Example: `Switch# show ap name AP02 config general`	**Note** If this access point is configured for global authentication, the AP Dot1x User Mode text boxes shows "Automatic." If the global authentication settings have been overwritten for this access point, the AP Dot1x User Mode text box shows "Customized."

Configuring Authentication for Access Points (GUI)

Step 1 Choose **Configuration** > **Wireless** > **Access Points** > **Global AP Configuration**.
The **Global Configuration** page is displayed.

Step 2 In the **802.1x Supplicant Credentials** area, select the **Credentials Required** check box.

Step 3 Enter the username and password details.

Note You must enter a strong password in these text boxes. Strong passwords have the following characteristics:

- They are at least eight characters long
- They contain a combination of uppercase and lowercase letters, numbers, and symbols
- They are not a word in any language

Step 4 Click **Apply**.

Step 5 Click **Save Configuration**.

Step 6 (Optional) You can override the global configuration and assign a unique username and password to a specific access point by following these steps:

a) Choose **Configuration** > **Wireless** > **Access Points** > **All APs**.
The **All APs** page is displayed.

Step 7 Click the name of an access point.
The **AP > Edit** is displayed.

Step 8 Click the **Credentials** tab.

Step 9 In the **802.1x Supplicant Credentials** area, select the **Over-ride Global Credentials** check box.

Step 10 Enter the username and password details.

Step 11 Click **Apply**.

Step 12 Click **Save Configuration**.

Configuring the Switch for Authentication (CLI)

Note The procedure to perform this task using the switch GUI is not currently available.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **dot1x system-auth-control**
4. **aaa new-model**
5. **aaa authentication dot1x default group radius**
6. **radius-server host** *host_ip_adress* **acct-port** *port_number* **auth-port** *port_number* **key 0** *unencryptied_server_key*
7. **interface TenGigabitEthernet1/0/1**
8. **switch mode access**
9. **dot1x pae authenticator**
10. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Switch# enable`	Enters privileged EXEC mode.
Step 2	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 3	**dot1x system-auth-control** **Example:** `Switch(config)# dot1x system-auth-control`	Enables system authentication control.
Step 4	**aaa new-model** **Example:** `Switch(config)# aaa new-model`	Enables new access control commands and functions.
Step 5	**aaa authentication dot1x default group radius** **Example:** `Switch(config)# aaa authentication dot1x default group radius`	Sets the default authentications lists for IEEE 802.1X by using all the radius hosts in a server group.

	Command or Action	Purpose
Step 6	**radius-server host** *host_ip_adress* **acct-port** *port_number* **auth-port** *port_number* **key 0** *unencryptied_server_key* **Example:** `Switch(config)# radius-server host 10.1.1.1 acct-port 1813 auth-port 6225 key 0 encryptkey`	Sets a clear text encryption key for the RADIUS authentication server.
Step 7	**interface TenGigabitEthernet1/0/1** **Example:** `Switch(config)# interface TenGigabitEthernet1/0/1`	Sets the 10-Gigbit Ethernet interface. The command prompt changes from Controller(config)# to Controller(config-if)#.
Step 8	**switch mode access** **Example:** `Switch(config-if)# switch mode access`	Sets the unconditional truncking mode access to the interface.
Step 9	**dot1x pae authenticator** **Example:** `Switch(config-if)# dot1x pae authenticator`	Sets the 802.1X interface PAE type as the authenticator.
Step 10	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.

Configuration Examples for Configuring Authentication for Access Points

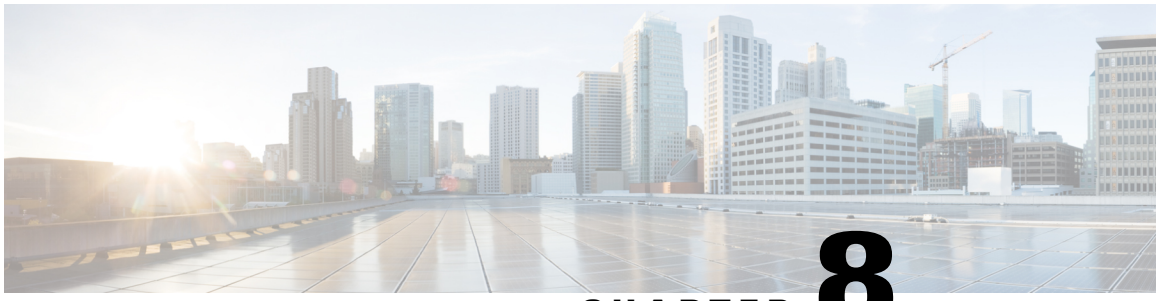
Displaying the Authentication Settings for Access Points: Examples

This example shows how to display the authentication settings for all access points that join the switch:

```
Switch# show ap summary
Number of APs.................................. 1
Global AP User Name............................ globalap
Global AP Dot1x User Name...................... globalDot1x
```

This example shows how to display the authentication settings for a specific access point:

```
Switch# show ap name AP02 config dot11 24ghz general
Cisco AP Identifier............................ 0
Cisco AP Name.................................. TSIM_AP2
...
AP Dot1x User Mode............................. AUTOMATIC
AP Dot1x User Name............................. globalDot1x
```



CHAPTER 8

Converting Autonomous Access Points to Lightweight Mode

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Finding Feature Information

Prerequisites for Converting Autonomous Access Points to Lightweight Mode

- Access points that are converted to lightweight mode do not support Wireless Domain Services (WDS). Converted access points communicate only with Cisco wireless LAN switchs and cannot communicate with WDS devices. However, the switch provides functionality that is equivalent to WDS when the access point associates to it.

- All Cisco lightweight access points support 16 Basic Service Set Identifiers (BSSIDs) per radio and a total of 16 wireless LANs per access point. When a converted access point associates to a switch, only wireless LANs with IDs 1 through 16 are pushed to the access point unless the access point is a member of an access point group.
- Access points that are converted to lightweight mode must get an IP address and discover the switch using DHCP, DNS, or IP subnet broadcast.

Information About Autonomous Access Points Converted to Lightweight Mode

You can convert autonomous Cisco Aironet access points to lightweight mode. When you upgrade the access points to lightweight mode, the access point communicates with the switch and receives a configuration and software image from the switch.

See the *Upgrading Autonomous Cisco Aironet Access Points to Lightweight Mode* document for instructions to upgrade an autonomous access point to lightweight mode:

http://www.cisco.com/en/US/docs/wireless/access_point/conversion/lwapp/upgrade/guide/lwapnote.html

Reverting from Lightweight Mode to Autonomous Mode

After you convert an autonomous access point to lightweight mode, you can convert the access point from a lightweight unit back to an autonomous unit by loading a Cisco IOS release that supports autonomous mode (Cisco IOS Release 12.3(7)JA or earlier releases). If the access point is associated with a switch, you can use the switch to load the Cisco IOS release. If the access point is not associated to a switch, you can load the Cisco IOS release using TFTP. In either method, the access point must be able to access a TFTP server that contains the Cisco IOS release to be loaded.

Using DHCP Option 43 and DHCP Option 60

Cisco Aironet access points use the type-length-value (TLV) format for DHCP option 43. You must program the DHCP servers to return the option based on the access point's DHCP Vendor Class Identifier (VCI) string (DHCP option 60).

For more information about DHCP VCI strings of access points, see http://www.cisco.com/en/US/tech/tk722/tk809/technologies_configuration_example09186a00808714fe.shtml.

See the product documentation for your DHCP server for instructions on configuring DHCP option 43. The *Upgrading Autonomous Cisco Aironet Access Points to Lightweight Mode* document contains example steps for configuring option 43 on a DHCP server.

If the access point is ordered with the Service Provider Option - AIR-OPT60-DHCP selected, the VCI string for that access point will be different than those strings listed in the previous table. The VCI string has the following suffix: ServiceProvider. For example, a 1260 with this option returns this VCI string: Cisco AP c1260-ServiceProvider.

Note The switch IP address that you obtain from the DHCP server should be a unicast IP address. Do not configure the switch IP address as a multicast address when configuring DHCP option 43.

How Converted Access Points Send Crash Information to the Switch

When a converted access point unexpectedly reboots, the access point stores a crash file on its local flash memory at the time of the crash. After the unit reboots, it sends the reason for the reboot to the switch. If the unit rebooted because of a crash, the switch pulls up the crash file using existing CAPWAP messages and stores it in the switch flash memory. The crash information copy is removed from the access point flash memory when the switch pulls it from the access point.

Uploading Memory Core Dumps from Converted Access Points

By default, access points converted to lightweight mode do not send memory core dumps to the switch. This section provides instructions to upload access point core dumps using the switch GUI or CLI.

Displaying MAC Addresses for Converted Access Points

There are some differences in the way that controllers display the MAC addresses of converted access points on information pages in the controller GUI:

- On the AP Summary page, the controller lists the Ethernet MAC addresses of converted access points.
- On the AP Detail page, the controller lists the BSS MAC addresses and Ethernet MAC addresses of converted access points.
- On the Radio Summary page, the switch lists converted access points by the radio MAC address.

Configuring a Static IP Address for a Lightweight Access Point

If you want to specify an IP address for an access point rather than having one assigned automatically by a DHCP server, you can use the controller GUI or CLI to configure a static IP address for the access point. Static IP addresses are generally used only for deployments with a limited number of users.

An access point cannot discover the switch using domain name system (DNS) resolution if a static IP address is configured for the access point, unless you specify a DNS server and the domain to which the access point belongs. You can configure these parameters using either the switch CLI or the GUI.

Note If you configure an access point to use a static IP address that is not on the same subnet on which the access point's previous DHCP address was, the access point falls back to a DHCP address after the access point reboots. If the access point falls back to a DHCP address, enter the **show ap config general** *Cisco_AP* CLI command to show that the access point is using a fallback IP address. However, the GUI shows both the static IP address and the DHCP address, but it does not identify the DHCP address as a fallback address.

How to Convert a Lightweight Access Point Back to an Autonomous Access Point

Converting a Lightweight Access Point Back to an Autonomous Access Point (CLI)

SUMMARY STEPS

1. **enable**
2. **ap name** *Cisco_AP* **tftp-downgrade** *tftp_server_ip_address tftp_server_image_filename*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Switch# enable`	Enters privileged EXEC mode.
Step 2	**ap name** *Cisco_AP* **tftp-downgrade** *tftp_server_ip_address tftp_server_image_filename* **Example:** `Switch# ap name AP02 tftp-downgrade 10.0.0.1 tsrvname`	Converts the lightweight access point back to autonomous mode. **Note** After entering this command, you must wait until the access point reboots and then reconfigure the access point using the CLI or GUI.

Converting a Lightweight Access Point Back to an Autonomous Access Point (Using the Mode Button and a TFTP Server)

Step 1 Configure the PC on which your TFTP server software runs with a static IP address in the range of 10.0.0.2 to 10.0.0.30.

Step 2 Make sure that the PC contains the access point image file (such as *c1140-k9w7-tar.123-7.JA.tar* for a 1140 series access point) in the TFTP server folder and that the TFTP server is activated.

Step 3 Rename the access point image file in the TFTP server folder to **c1140-k9w7-tar.default** for a 1140 series access point.

Step 4 Connect the PC to the access point using a Category 5 (CAT5) Ethernet cable.

Step 5 Disconnect power from the access point.

Step 6 Press and hold the **MODE** button while you reconnect power to the access point.

Note The **MODE** button on the access point must be enabled.

Step 7 Hold the **MODE** button until the status LED turns red (approximately 20 to 30 seconds), and release the MODE button.

Step 8 Wait until the access point reboots as indicated by all LEDs turning green followed by the Status LED blinking green.

Step 9 After the access point reboots, reconfigure the access point using the GUI or the CLI.

Authorizing Access Points (CLI)

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ap auth-list ap-policy authorize-ap**
4. **username** *user_name* **mac aaa attribute list** *list_name*
5. **aaa new-model**
6. **aaa authorization credential-download** *auth_list* **local**
7. **aaa attribute list** *list*
8. **aaa session-id common**
9. **aaa local authentication default authorization default**
10. **show ap name** *Cisco_AP* **config general**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Switch# enable`	Enters privileged EXEC mode.
Step 2	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 3	**ap auth-list ap-policy authorize-ap** **Example:** `Switch(config)# ap auth-list ap-policy authorize-ap`	Configures an access point authorization policy.

	Command or Action	Purpose
Step 4	**username** *user_name* **mac aaa attribute list** *list_name* **Example:** `Switch(config)# username aaa.bbb.ccc mac aaa attribute list attrlist`	Configures the MAC address of an access point locally.
Step 5	**aaa new-model** **Example:** `Switch(config)# aaa new-model`	Enables new access control commands and functions.
Step 6	**aaa authorization credential-download** *auth_list* **local** **Example:** `Switch(config)# aaa authorization credential-download auth_download local`	Downloads EAP credentials from the local server.
Step 7	**aaa attribute list** *list* **Example:** `Switch(config)# aaa attribute list alist`	Configures AAA attribute list definitions.
Step 8	**aaa session-id common** **Example:** `Switch(config)# aaa session-id common`	Configures the AAA common session ID.
Step 9	**aaa local authentication default authorization default** **Example:** `Switch(config)# aaa local authentication default authorization default`	Configures the local authentication method list.
Step 10	**show ap name** *Cisco_AP* **config general** **Example:** `Switch(config)# show ap name AP01 config general`	Displays the configuration information that corresponds to a specific access point.

Authorizing Access Points (GUI)

Step 1 Choose **Configuration** > **Security** > **AAA** > **AP Policy**.
The **AP Policy** page is displayed.

Step 2 In the Policy Configuration area, enable or disable the following parameters:

- **Authorize LSC APs against Auth-List**
- **AP with Self-Signed Certificate**

- **Authorize MIC APs against AAA**
- **AP with Manufacturing Installed Certificate**

Step 3 Click **Apply**.

Step 4 Click **Save Configuration**.

Disabling the Reset Button on Converted Access Points (CLI)

You can enable or disable the Reset button on access points that are converted to lightweight mode. The Reset button is labeled MODE on the outside of the access point.

Note The procedure to perform this task using the controller GUI is not currently available.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **no ap reset-button**
4. **end**
5. **ap name** *Cisco_AP* **reset-button**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Switch# enable`	Enters privileged EXEC mode.
Step 2	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 3	**no ap reset-button** **Example:** `Switch(config)# no ap reset-button`	Disables the Reset buttons on all converted access points that are associated to the switch. **Note** To enable the Reset buttons on all converted access points that are associated to the switch, enter the **ap reset-button** command.

	Command or Action	Purpose
Step 4	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.
Step 5	**ap name** *Cisco_AP* **reset-button** **Example:** `Switch# ap name AP02 reset-button`	Enables the Reset button on the converted access point that you specify.

Monitoring the AP Crash Log Information

Note The procedure to perform this task using the switch GUI is not currently available.

SUMMARY STEPS

1. **enable**
2. **show ap crash-file**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Switch# enable`	Enters privileged EXEC mode.
Step 2	**show ap crash-file** **Example:** `Switch# show ap crash-file`	Verifies whether the crash file is downloaded to the switch.

How to Configure a Static IP Address on an Access Point

Configuring a Static IP Address on an Access Point (CLI)

SUMMARY STEPS

1. **enable**
2. **ap name** *Cisco_AP* **static-ip ip-address** *static_ap_address* **netmask** *static_ip_netmask* **gateway** *static_ip_gateway*
3. **enable**
4. **configure terminal**
5. **ap static-ip name-server** *nameserver_ip_address*
6. **ap static-ip domain** *static_ip_domain*
7. **end**
8. **show ap name** *Cisco_AP* **config general**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Switch# enable`	Enters privileged EXEC mode.
Step 2	**ap name** *Cisco_AP* **static-ip ip-address** *static_ap_address* **netmask** *static_ip_netmask* **gateway** *static_ip_gateway* **Example:** `Switch# ap name AP03 static-ip ip-address 9.9.9.16 netmask 255.255.0.0 gateway 9.9.9.2`	Configures a static IP address on the access point. This command contains the following keywords and arguments: • **ip-address—** Specifies the Cisco access point static IP address. • *ip-address—* Cisco access point static IP address. • **netmask—**Specifies the Cisco access point static IP netmask. • *netmask—* Cisco access point static IP netmask. • **gateway—**Specifies the Cisco access point gateway. • *gateway—* IP address of the Cisco access point gateway. The access point reboots and rejoins the switch, and the static IP address that you specify is pushed to the access point. After the static IP address has been sent to the access point, you can configure the DNS server IP address and domain name. You must perform Steps 3 and 4 after the access points reboot.

	Command or Action	Purpose
Step 3	**enable** **Example:** `Switch# enable`	Enters privileged EXEC mode.
Step 4	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 5	**ap static-ip name-server** *nameserver_ip_address* **Example:** `Switch(config)# ap static-ip name-server 10.10.10.205`	Configures a DNS server so that a specific access point or all access points can discover the switch using DNS resolution. **Note** To undo the DNS server configuration, enter the **no ap static-ip name-server** *nameserver_ip_address* command.
Step 6	**ap static-ip domain** *static_ip_domain* **Example:** `Switch(config)# ap static-ip domain domain1`	Configures the domain to which a specific access point or all access points belong. **Note** To undo the domain name configuration, enter the **no ap static-ip domain** *static_ip_domain* command.
Step 7	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.
Step 8	**show ap name** *Cisco_AP* **config general** **Example:** `Switch# show ap name AP03 config general`	Displays the IP address configuration for the access point.

Configuring a Static IP Address on an Access Point (GUI)

Step 1 Choose **Configuration** > **Wireless** > **Access Points** > **All APs**.
The **All APs** page is displayed.

Step 2 Click the name of the access point.
The **AP > Edit** page is displayed.

Step 3 In the **General** tab, in the **IP Config** area, select the **Static IP** check box if you want to assign a static IP address to the access point.

Step 4 Enter the following details:

- **Static IP**

- **Netmask**
- **Gateway**

Step 5 Click **Apply**.
The access point reboots and rejoins the switch, and the static IP address that you specified is sent to the access point.

Step 6 After the static IP address has been sent to the access point, configure the **DNS IP Address** and **Domain Name**.

Step 7 Click **Apply**.

Step 8 Click **Save Configuration**.

Recovering the Access Point Using the TFTP Recovery Procedure

Step 1 Download the required recovery image from Cisco.com (ap3g2-k9w8-tar.152-2.JA.tar) and install it in the root directory of your TFTP server.

Step 2 Connect the TFTP server to the same subnet as the target access point and power-cycle the access point. The access point boots from the TFTP image and then joins the switch to download the oversized access point image and complete the upgrade procedure.

Step 3 After the access point has been recovered, you can remove the TFTP server.

Configuration Examples for Converting Autonomous Access Points to Lightweight Mode

Displaying the IP Address Configuration for Access Points: Example

This example shows how to display the IP address configuration for the access point:

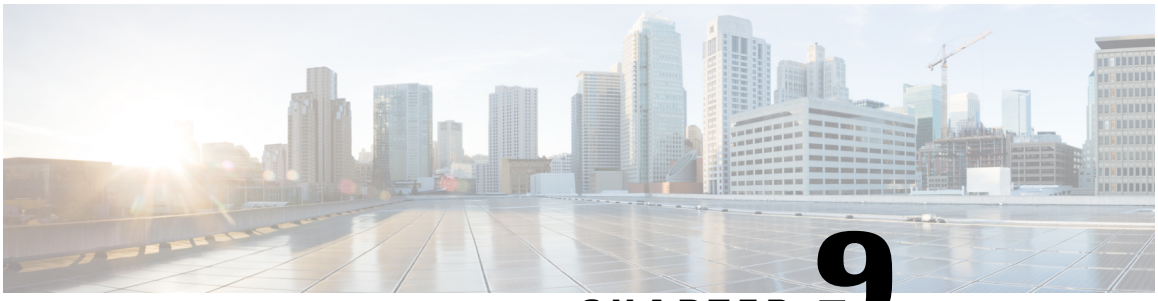
```
Switch# show ap name AP03 dot11 24ghz config general
Cisco AP Identifier.............. 4
Cisco AP Name............................ AP6
IP Address Configuration................. Static IP assigned
IP Address............................... 10.10.10.118
IP NetMask............................... 255.255.255.0
Gateway IP Addr.......................... 10.10.10.1
Domain................................... Domain1
Name Server.............................. 10.10.10.205
...
```

Displaying Access Point Crash File Information: Example

This example shows how to display access point crash file information. Using this command, you can verify whether the file is downloaded to the switch:

```
Switch# show ap crash-file
Local Core Files:
lrad_AP1130.rdump0 (156)

The number in parentheses indicates the size of the file. The size should
be greater than zero if a core dump file is available.
```



CHAPTER 9

Using Cisco Workgroup Bridges

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- Information About Cisco Workgroup Bridges and non-Cisco Workgroup bridges, page 69
- Monitoring the Status of Workgroup Bridges, page 70
- Debugging WGB Issues (CLI), page 70
- Configuration Examples for Configuring Workgroup Bridges, page 72

Finding Feature Information

Information About Cisco Workgroup Bridges and non-Cisco Workgroup bridges

A WGB is a mode that can be configured on an autonomous Cisco IOS access point to provide wireless connectivity to a lightweight access point on behalf of clients that are connected by Ethernet to the WGB access point. A WGB connects a wired network over a single wireless segment by learning the MAC addresses of its wired clients on the Ethernet interface and reporting them to the lightweight access point using Internet Access Point Protocol (IAPP) messaging. The WGB provides wireless access connectivity to wired clients by establishing a single wireless connection to the lightweight access point.

When a Cisco WGB is used, the WGB informs the access points of all the clients that it is associated with. The switch is aware of the clients that are associated with the access point. When non-Cisco WGBs are used, the switch has no information about the IP address of the clients on the wired segment behind the WGB. Without this information, the switch drops the following types of messages:

- ARP REQ from the distribution system for the WGB client.
- ARP RPLY from the WGB client.
- DHCP REQ from the WGB client.
- DHCP RPLY for the WGB client.

Monitoring the Status of Workgroup Bridges

Note The procedure to perform this task using the switch GUI is not currently available.

SUMMARY STEPS

1. **enable**
2. **show wireless wgb summary**
3. **show wireless wgb mac-address** *wgb_mac_address* **detail**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Switch# enable`	Enters privileged EXEC mode.
Step 2	**show wireless wgb summary** **Example:** `Switch# show wireless wgb summary`	Displays the WGBs on your network.
Step 3	**show wireless wgb mac-address** *wgb_mac_address* **detail** **Example:** `Switch# show wireless wgb mac-address 00:0d:ed:dd:25:82 detail`	Displays the details of any wired clients that are connected to a particular WGB.

Debugging WGB Issues (CLI)

Note The procedure to perform this task using the switch GUI is not currently available.

SUMMARY STEPS

1. **enable**
2. **debug iapp all**
3. **debug iapp error**
4. **debug iapp packet**
5. **debug mobility handoff** [**switch** *switch_number*]
6. **debug dhcp**
7. **debug dot11 mobile**
8. **debug dot11 state**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Switch# enable`	Enters privileged EXEC mode.
Step 2	**debug iapp all** **Example:** `Switch# debug iapp all`	Enables debugging for IAPP messages.
Step 3	**debug iapp error** **Example:** `Switch# debug iapp error`	Enables debugging for IAPP error events.
Step 4	**debug iapp packet** **Example:** `Switch# debug iapp packet`	Enables debugging for IAPP packets.
Step 5	**debug mobility handoff** [**switch** *switch_number*] **Example:** `Switch# debug mobility handoff`	Enables debugging for any roaming issues.
Step 6	**debug dhcp** **Example:** `Switch# debug dhcp`	Debug an IP assignment issue when DHCP is used.
Step 7	**debug dot11 mobile** **Example:** `Switch# debug dot11 mobile`	Enables dot11/mobile debugging. Debug an IP assignment issue when static IP is used.

	Command or Action	Purpose
Step 8	**debug dot11 state** **Example:** `Switch# debug dot11 state`	Enables dot11/state debugging. Debug an IP assignment issue when static IP is used.

Configuration Examples for Configuring Workgroup Bridges

WGB Configuration: Example

This example shows how to configure a WGB access point using static WEP with a 40-bit WEP key:

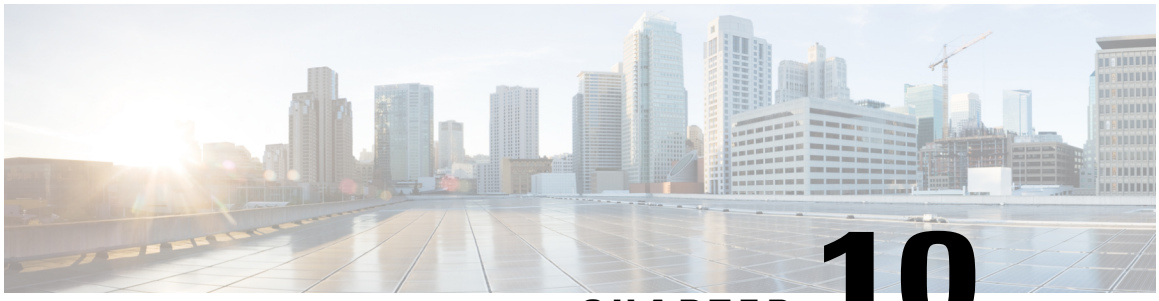
```
Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)# dot11 ssid WGB_with_static_WEP
Switch(config-ssid)# authentication open
Switch(config-ssid)# guest-mode
Switch(config-ssid)# exit
Switch(config)# interface  dot11Radio 0
Switch(config)# station-role workgroup-bridge
Switch(config-if)# encry mode wep 40
Switch(config-if)# encry key 1 size 40 0 1234567890
Switch(config-if)# ssid WGB_with_static_WEP
Switch(config-if)# end
```

Verify that the WGB is associated to an access point by entering this command on the WGB:

show dot11 association

Information similar to the following appears:

```
Switch# show dot11 associations
802.11 Client Stations on Dot11Radio0:
SSID [FCVTESTING] :
MAC Address    IP address      Device        Name            Parent         State
000b.8581.6aee 10.11.12.1      WGB-client    map1            -              Assoc
ap#
```



CHAPTER 10

Configuring Probe Request Forwarding

- Finding Feature Information, page 73
- Information About Configuring Probe Request Forwarding, page 73
- How to Configure Probe Request Forwarding (CLI), page 73

Finding Feature Information

Information About Configuring Probe Request Forwarding

Probe requests are 802.11 management frames that are sent by clients to request information about the capabilities of Service Set Identifiers (SSIDs). By default, access points forward acknowledged probe requests to the switch for processing. Acknowledged probe requests are probe requests for SSIDs that are supported by the access point. If desired, you can configure access points to forward both acknowledged and unacknowledged probe requests to the switch. The switch can use the information from unacknowledged probe requests to improve the location accuracy.

How to Configure Probe Request Forwarding (CLI)

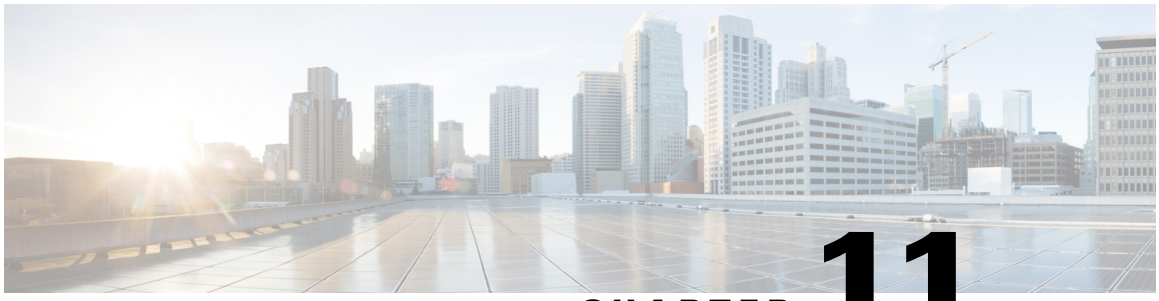
Note The procedure to perform this task using the switch GUI is not currently available.

SUMMARY STEPS

1. **configure terminal**
2. **wireless probe filter**
3. **wireless probe filter** *num_probes interval*
4. **end**
5. **show wireless probe**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 2	**wireless probe filter** **Example:** `Switch(config)# wireless probe filter`	Enables or disables the filtering of probe requests forwarded from an access point to the switch. **Note** If you enable probe filtering, the default filter setting, the access point forwards only acknowledged probe requests to the switch. If you disable probe filtering, the access point forwards both acknowledged and unacknowledged probe requests to the switch.
Step 3	**wireless probe filter** *num_probes interval* **Example:** `Switch(config)# wireless probe filter 5 5`	Limits the number of probe requests sent to the switch per client per access point radio in a given interval. You must specify the following arguments with this command: • *num_probes*—Number of probe requests forwarded to the switch per client per access point radio in a given interval. The range is from 1 to 100. • *interval*—Probe limit interval in milliseconds. The range is from 100 to 10000.
Step 4	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.
Step 5	**show wireless probe** **Example:** `Switch# show wireless probe`	Displays the advanced probe request configuration.



CHAPTER 11

Optimizing RFID Tracking

- Finding Feature Information, page 75
- Optimizing RFID Tracking on Access Points, page 75
- How to Optimize RFID Tracking on Access Points, page 75
- Configuration Examples for Optimizing RFID Tracking, page 76

Finding Feature Information

Optimizing RFID Tracking on Access Points

To optimize the monitoring and location calculation of RFID tags, you can enable tracking optimization on up to four channels within the 2.4-GHz band of an 802.11b/g access point radio. This feature allows you to scan only the channels on which tags are usually programmed to operate (such as channels 1, 6, and 11).

How to Optimize RFID Tracking on Access Points

Optimizing RFID Tracking on Access Points (CLI)

SUMMARY STEPS

1. **ap name** *Cisco_AP* **mode monitor submode none**
2. **ap name** *Cisco_AP* **dot11 24ghz shutdown**
3. **ap name** *Cisco_AP* **monitor-mode tracking-opt**
4. **ap name** *Cisco_AP* **monitor-mode dot11b** {**fast-channel** [*first_channel second_channel third_channel fourth_channel*]}
5. **ap name** *Cisco_AP* **no dot11 24ghz shutdown**
6. **show ap monitor-mode summary**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**ap name** *Cisco_AP* **mode monitor submode none** **Example:** `Switch# ap name 3602a mode monitor submode none`	Specifies the monitor submode for the access point as none. **Note** A warning message indicates that changing the access point's mode will cause the access point to reboot and prompts you to specify whether you want to continue by entering **Y**. After you enter **Y**, the access point reboots.
Step 2	**ap name** *Cisco_AP* **dot11 24ghz shutdown** **Example:** `Switch# ap name AP01 dot11 24ghz shutdown`	Disables the access point radio.
Step 3	**ap name** *Cisco_AP* **monitor-mode tracking-opt** **Example:** `Switch# ap name TSIM_AP1 monitor-mode tracking-opt`	Configures the access point to scan only the Dynamic Channel Assignment (DCA) channels supported by its country of operation. **Note** To disable tracking optimization for an access point, enter the **ap name** *Cisco_AP* **monitor-mode tracking-opt no-optimization** command.
Step 4	**ap name** *Cisco_AP* **monitor-mode dot11b** {**fast-channel** [*first_channel second_channel third_channel fourth_channel*]} **Example:** `Switch# ap name AP01 monitor-mode dot11b fast-channel 1 2 3 4`	Chooses up to four specific 802.11b channels to be scanned by the access point. **Note** In the United States, you can assign any value from 1 to 11 (inclusive) to the channel variable. Other countries support additional channels. You must assign at least one channel.
Step 5	**ap name** *Cisco_AP* **no dot11 24ghz shutdown** **Example:** `Switch# ap name AP01 no dot11 24ghz shutdown`	Enables the access point radio.
Step 6	**show ap monitor-mode summary** **Example:** `Switch# show ap monitor-mode summary`	Displays all the access points in monitor mode.

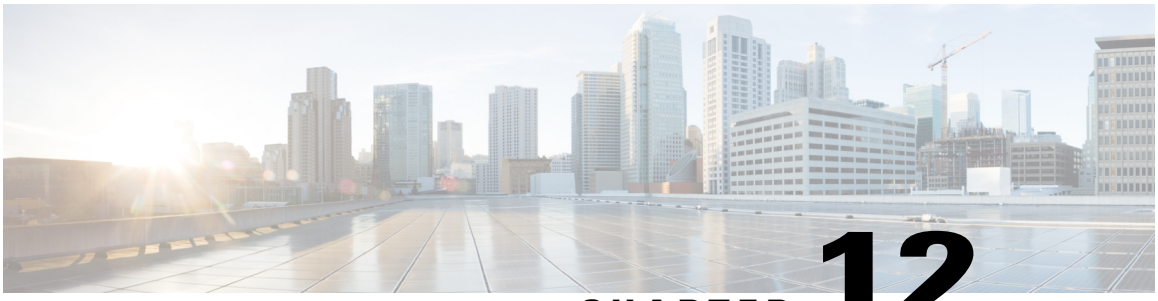
Configuration Examples for Optimizing RFID Tracking

Displaying all the Access Points in Monitor Mode: Example

This example shows how to display all the access points in monitor mode:

```
Switch# show ap monitor-mode summary
```

```
AP Name       Ethernet MAC   Status   Scanning
                                      Channel
                                      List
------------- -------------- -------- ---------
AP1131:4f2.9a 00:16:4:f2:9:a Tracking 1,6,NA,NA
```



CHAPTER 12

Configuring Country Codes

- Finding Feature Information, page 79
- Prerequisites for Configuring Country Codes, page 79
- Information About Configuring Country Codes, page 80
- How to Configure Country Codes (CLI), page 80
- Configuration Examples for Configuring Country Codes, page 83

Finding Feature Information

Prerequisites for Configuring Country Codes

- Generally, you configure one country code per switch; you configure one code that matches the physical location of the switch and its access points. You can configure up to 20 country codes per switch. This multiple-country support enables you to manage access points in various countries from a single switch.
- When the multiple-country feature is used, all switchs that are going to join the same RF group must be configured with the same set of countries, configured in the same order.
- Access points are capable of using all the available legal frequencies. However, access points are assigned to the frequencies that are supported in their relevant domains.
- The country list configured on the RF group leader determines which channels the members would operate on. This list is independent of which countries have been configured on the RF group members.
- For switchs in the Japan regulatory domain, you must have had one or more Japan country codes (JP, J2, or J3) configured on your switch at the time you last booted your switch.
- For switchs in the Japan regulatory domain, you must have at least one access point with a -J regulatory domain joined to your switch.

Information About Configuring Country Codes

Controllers and access points are designed for use in many countries with varying regulatory requirements. The radios within the access points are assigned to a specific regulatory domain at the factory (such as -E for Europe), but the country code enables you to specify a particular country of operation (such as FR for France or ES for Spain). Configuring a country code ensures that each radio's broadcast frequency bands, interfaces, channels, and transmit power levels are compliant with country-specific regulations.

Information About Japanese Country Codes

Country codes define the channels that can be used legally in each country. These country codes are available for Japan:

- JP—Allows only -J radios to join the controller
- J2—Allows only -P radios to join the controller
- J3—Uses the -U frequencies but allows -U, -P and -Q (other than 1550/1600/2600/3600) radios to join the controller
- J4—Allows 2.4G JPQU and 5G PQU to join the controller.

Note The 1550, 1600, 2600, and 3600 APs require J4.

See the *Channels and Maximum Power Settings for Cisco Aironet Lightweight Access Points* document for the list of channels and power levels supported by access points in the Japanese regulatory domains.

How to Configure Country Codes (CLI)

Note The procedure to perform this task using the switch GUI is not currently available.

SUMMARY STEPS

1. **enable**
2. **show wireless country supported**
3. **configure terminal**
4. **ap dot11 24ghz shutdown**
5. **ap dot11 5ghz shutdown**
6. **ap country** *country_code*
7. **end**
8. **show wireless country channels**
9. **configure terminal**
10. **no ap dot11 5ghz shutdown**
11. **no ap dot11 24ghz shutdown**
12. **end**
13. **ap name** *Cisco_AP* **shutdown**
14. **configure terminal**
15. **ap country** *country_code*
16. **end**
17. **ap name** *Cisco_AP* **no shutdown**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Switch# enable`	Enters privileged EXEC mode.
Step 2	**show wireless country supported** **Example:** `Switch# show wireless country supported`	Displays a list of all available country codes.
Step 3	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 4	**ap dot11 24ghz shutdown** **Example:** `Switch(config)# ap dot11 5ghz shutdown`	Disables the 802.11a network.
Step 5	**ap dot11 5ghz shutdown** **Example:** `Switch(config)# ap dot11 24ghz shutdown`	Disables the 802.11b/g network.

	Command or Action	Purpose
Step 6	**ap country** *country_code* **Example:** `Switch(config)# ap country IN`	Assigns access points to a specific country. **Note** Make sure that the country code you choose is compatible with the regulatory domain of at least one of the access point's radios.
Step 7	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.
Step 8	**show wireless country channels** **Example:** `Switch# show wireless country channels`	Displays the list of available channels for the country codes configured on your switch. **Note** Perform Steps 9 through 17 only if you have configured multiple country codes in Step 6.
Step 9	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 10	**no ap dot11 5ghz shutdown** **Example:** `Switch(config)# no ap dot11 5ghz shutdown`	Enables the 802.11a network.
Step 11	**no ap dot11 24ghz shutdown** **Example:** `Switch(config)# no ap dot11 24ghz shutdown`	Enables the 802.11b/g network.
Step 12	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.
Step 13	**ap name** *Cisco_AP* **shutdown** **Example:** `Switch# ap name AP02 shutdown`	Disables the access point. **Note** Ensure that you disable only the access point for which you are configuring country codes.
Step 14	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 15	**ap country** *country_code* **Example:** `Switch# ap country IN`	Assigns an access point to a specific country. **Note** Ensure that the country code that you choose is compatible with the regulatory domain of at least one of the access point's radios. **Note** If you enabled the networks and disabled some access points and then enter the **ap country** *country_code* command, the specified country code is configured on only the disabled access points. All other access points are ignored.
Step 16	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.
Step 17	**ap name** *Cisco_AP* **no shutdown** **Example:** `Switch# ap name AP02 no shutdown`	Enables the access point.

Configuration Examples for Configuring Country Codes

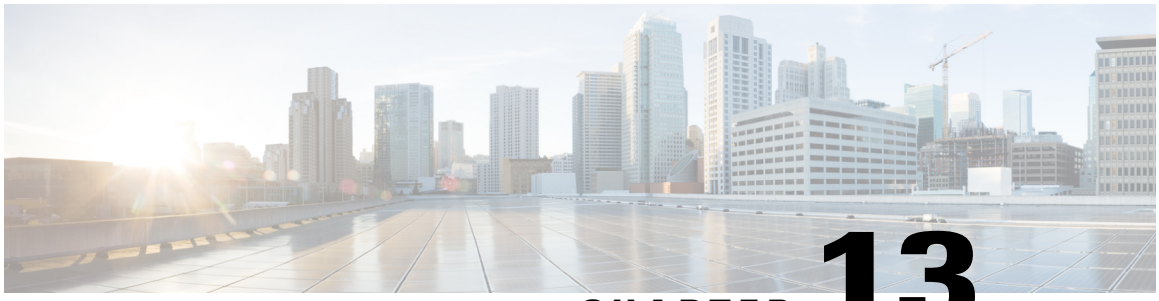
Displaying Channel List for Country Codes: Example

This example shows how to display the list of available channels for the country codes configured on your switch:

```
Switch# show wireless country channels

Configured Country.......................: US - United States
KEY: * = Channel is legal in this country and may be configured manually.
A = Channel is the Auto-RF default in this country.
. = Channel is not legal in this country.
C = Channel has been configured for use by Auto-RF.
x = Channel is available to be configured for use by Auto-RF.
(-,-) = (indoor, outdoor) regulatory domain allowed by this country.
-----------------:+-+-+-+-+-+-+-+-+-+-+-+-+-+-
802.11bg :
Channels : 1 1 1 1 1
: 1 2 3 4 5 6 7 8 9 0 1 2 3 4
-----------------:+-+-+-+-+-+-+-+-+-+-+-+-+-+-
(-A ,-AB ) US : A * * * * A * * * * A . . .
Auto-RF : . . . . . . . . . . . . . .
-----------------:+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
802.11a : 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Channels : 3 3 3 4 4 4 4 4 5 5 6 6 0 0 0 1 1 2 2 2 3 3 4 4 5 5 6 6
: 4 6 8 0 2 4 6 8 2 6 0 4 0 4 8 2 6 0 4 8 2 6 0 9 3 7 1 5
-----------------:+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
(-A ,-AB ) US : . A . A . A . A A A A A * * * * * . . . * * * A A A A
*
Auto-RF : . . . . . . . . . . . . . . . . . . . . . . . . . . . .
-----------------:+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
```

```
4.9GHz 802.11a :
Channels : 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2
: 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6
-----------------:+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
US (-A ,-AB ): * * * * * * * * * * * * * * * * * * * * A * * * * * A
Auto-RF : . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
-----------------:+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
```



CHAPTER 13

Configuring Link Latency

- Finding Feature Information, page 85
- Prerequisites for Configuring Link Latency, page 85
- Restrictions for Configuring Link Latency, page 85
- Information About Configuring Link Latency, page 86
- How to Configure Link Latency, page 87
- How to Configure TCP MSS, page 90
- Performing a Link Test (CLI), page 91
- Configuration Examples for Configuring Link Latency, page 92

Finding Feature Information

Prerequisites for Configuring Link Latency

- The switch displays the current round-trip time as well as a running minimum and maximum round-trip time. The minimum and maximum times continue to run as long as the switch is up or can be cleared and allowed to restart.
- You can configure link latency for a specific access point using the switch GUI or CLI or for all access points joined to the switch using the CLI.

Restrictions for Configuring Link Latency

- Link latency calculates the Control and Provisioning of Wireless Access Points (CAPWAP) response time between the access point and the switch. It does not measure network latency or ping responses.

Information About Configuring Link Latency

You can configure link latency on the switch to measure the link between an access point and the switch. You can use this feature with all access points that are joined to the switch where the link can be a slow or unreliable WAN connection.

TCP MSS

If the client's maximum segment size (MSS) in a Transmission Control Protocol (TCP) three-way handshake is greater than the maximum transmission unit can handle, the client might experience reduced throughput and the fragmentation of packets. To avoid this problem, you can specify the MSS for all access points that are joined to the switch or for a specific access point.

When you enable this feature, the access point selects the MSS for TCP packets to and from wireless clients in its data path. If the MSS of these packets is greater than the value that you configured or greater than the default value for the CAPWAP tunnel, the access point changes the MSS to the new configured value.

Link Tests

A link test is used to determine the quality of the radio link between two devices. Two types of link-test packets are transmitted during a link test: request and response. Any radio receiving a link-test request packet fills in the appropriate text boxes and echoes the packet back to the sender with the response type set.

The radio link quality in the client-to-access point direction can differ from that in the access point-to-client direction due to the asymmetrical distribution of the transmit power and receive sensitivity on both sides. Two types of link tests can be performed: a ping test and a CCX link test.

With the *ping link test*, the controller can test link quality only in the client-to-access point direction. The RF parameters of the ping reply packets received by the access point are polled by the controller to determine the client-to-access point link quality.

With the *CCX link test*, the switch can also test the link quality in the access point-to-client direction. The switch issues link-test requests to the client, and the client records the RF parameters (received signal strength indicator [RSSI], signal-to-noise ratio [SNR], and so on) of the received request packet in the response packet. Both the link-test requestor and responder roles are implemented on the access point and switch. Not only can the access point or switch initiate a link test to a CCX v4 or v5 client, but a CCX v4 or v5 client can initiate a link test to the access point or switch.

The switch shows the link-quality metrics for CCX link tests in both directions (out— the access point to the client; in— the client to the access point):

- Signal strength in the form of RSSI (minimum, maximum, and average)
- Signal quality in the form of SNR (minimum, maximum, and average)
- Total number of packets that are retried
- Maximum retry count for a single packet
- Number of lost packets
- Data rate of a successfully transmitted packet

The controller shows this metric regardless of direction:

- Link test request/reply round-trip time (minimum, maximum, and average)

The controller software supports CCX versions 1 through 5. CCX support is enabled automatically for every WLAN on the controller and cannot be disabled. The controller stores the CCX version of the client in its client database and uses it to limit the features for this client. If a client does not support CCXv4 or v5, the controller performs a ping link test on the client. If a client supports CCXv4 or v5, the controller performs a CCX link test on the client. If a client times out during a CCX link test, the controller switches to the ping link test automatically.

How to Configure Link Latency

Configuring Link Latency (CLI)

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ap link-latency**
4. **ap tcp-adjust-mss size** *size*
5. **show ap name** *Cisco_AP* **config general**
6. **ap name** *Cisco_AP* **link-latency** [**reset**]
7. **show ap name** *Cisco_AP* **config general**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Switch# enable`	Enters privileged EXEC mode.
Step 2	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 3	**ap link-latency** **Example:** `Switch(config)# ap link-latency`	Enables link latency for all access points that are currently associated with the switch. **Note** To disable link latency for all the access points that are associated with the switch, use the **no ap link-latency** command. **Note** These commands enable or disable link latency only for access points that are currently joined to the switch. You have to enable or disable link latency for the access points that join in the future.

	Command or Action	Purpose
		Note To enable or disable link latency for specific access points that are associated with the switch, enter the following commands in Priveleged EXEC mode: • **ap name** *Cisco_AP* **link-latency—**Enables link latency. • **ap name** *Cisco_AP* **no link-latency—**Disables link latency.
Step 4	**ap tcp-adjust-mss size** *size* **Example:** `Switch(config)# ap tcp-adjust-mss size 537`	Configures TCP MSS adjust size for all access points. The range is from 536 to 1363.
Step 5	**show ap name** *Cisco_AP* **config general** **Example:** `Switch(config)# show ap name AP02 config general`	Displays the general configuration details of the access point. These configuration details contain the link latency results that correspond to the access point that you specify in the command. The output of this command contains the following link latency results: • Current Delay—The current round-trip time (in milliseconds) of CAPWAP heartbeat packets from the access point to the switch and back. • Maximum Delay—Since the time that link latency has been enabled or reset, the maximum round-trip time (in milliseconds) of CAPWAP heartbeat packets from the access point to the switch and back. • Minimum Delay—Since the time that link latency has been enabled or reset, the minimum round-trip time (in milliseconds) of CAPWAP heartbeat packets from the access point to the switch and back.
Step 6	**ap name** *Cisco_AP* **link-latency** [**reset**] **Example:** `Switch(config)# ap name AP02 link-latency reset`	Clears the current, minimum, and maximum link latency statistics on the switch for a specific access point.
Step 7	**show ap name** *Cisco_AP* **config general** **Example:** `Switch(config)# show ap name AP02 config general`	Displays the general configuration details of the access point. Use this command to see the result of the reset operation.

Configuring Link Latency (GUI)

Step 1 Choose **Configuration** > **Wireless** > **Access Points** > **All APs**.
The **All APs** page appears with a list of access points.

Step 2 Click the name of the access point.
The **AP > Edit** page appears.

Step 3 Click the **Advanced** tab.

Step 4 In the **Link Latency** area, select or unselect the **Enable Link Latency** check box.

Note You can select the **Enable Link Latency** check box to enable link latency for this access point or unselect it to prevent the access point from sending the round-trip time to the switch after every echo response is received. The default state is unselected.

Step 5 Click **Apply**.

Step 6 When a message box appears that indicates that AP Parameters are modified successfully, click **OK**.

Step 7 When the **All APs** page is displayed, click the access point that you have modified earlier.
The **AP > Edit** page appears.

Step 8 Click the **Advanced** tab.
In the **Link Latency** area, the following link latency and data latency results are displayed:

- **Current(mSec)—**The current round-trip time (in milliseconds) of CAPWAP heartbeat packets or data packets from the access point to the switch and back.
- **Minimum(mSec)—**Since the time that link latency has been enabled or reset, the minimum round-trip time (in milliseconds) of CAPWAP heartbeat packets or data packets from the access point to the switch and back.
- **Maximum(mSec)—**Since the time that link latency has been enabled or reset, the maximum round-trip time (in milliseconds) of CAPWAP heartbeat packets or data packets from the access point to the switch and back.

Step 9 Click **Reset Link Latency** to clear the current, minimum, and maximum link latency and data latency statistics on the switch for this access point.

Note After the page refreshes and the **All APs** page is displayed again, click the **Advanced** tab. The updated statistics appear in the **Minimum** and **Maximum** text boxes.

How to Configure TCP MSS

Configuring TCP MSS (CLI)

SUMMARY STEPS

1. **configure terminal**
2. **ap tcp-adjust-mss size** *size_value*
3. **reload**
4. **show ap tcp-adjust-mss**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 2	**ap tcp-adjust-mss size** *size_value* **Example:** `Switch(config)# ap tcp-adjust-mss size 537`	Enables the TCP MSS on the particular access point that you specify. **Note** To enable TCP MSS on all the access points that are associated with the switch, enter the **ap tcp-adjust-mss size** *size_value* command, where the size parameter is from 536 to 1363 bytes. The default value varies for different clients.
Step 3	**reload** **Example:** `Switch# reload`	Reboots the switch in order for your change to take effect.
Step 4	**show ap tcp-adjust-mss** **Example:** `Switch# show ap tcp-adjust-mss`	Displays the current TCP MSS setting for all the access points that are associated with the switch. **Note** To display the TCP MSS settings that correspond to a specific access point, enter the **show ap name** *Cisco_AP* **tcp-adjust-mss** command.

Configuring TCP MSS (GUI)

Step 1 Choose **Configuration** > **Wireless** > **Access Points** > **Global AP Configuration**.

The **Global Configuration** page is displayed.

Step 2 In the **TCP MSS** area, select the **Global TCP Adjust MSS** check box and set the MSS for all access points that are associated with the switch. The valid range is from 536 to 1363 bytes.

Step 3 Click **Apply**.

Step 4 Click **Save Configuration**.

Performing a Link Test (CLI)

Note The procedure to perform this task using the switch GUI is not currently available.

SUMMARY STEPS

1. **test wireless linktest** *mac_address*
2. **configure terminal**
3. **wireless linktest frame-size** *frame_size*
4. **wireless linktest number-of-frames** *number_of_frames*
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**test wireless linktest** *mac_address* **Example:** `Switch# test wireless linktest 00:0d:88:c5:8a:d1`	Runs a link test.
Step 2	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 3	**wireless linktest frame-size** *frame_size* **Example:** `Switch(config)# wireless linktest frame-size 41`	Configures the link test frame size for each packet.
Step 4	**wireless linktest number-of-frames** *number_of_frames* **Example:** `Switch(config)# wireless linktest number-of-frames 50`	Configures the number of frames to send for the link test.

	Command or Action	Purpose
Step 5	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.

Configuration Examples for Configuring Link Latency

Running a Link Test: Example

This example shows how to run a link test:

```
Switch# test wireless linktest 6470.0227.ca55
Switch# show wireless linktest statistic

Link Test to 64700227CA55 with 500 frame-size.
Client MAC Address                          : 6470.0227.ca55
AP Mac Address                              : 44e4.d901.19c0
Link Test Packets Sent                      : 20
Link Test Packets Received                  : 20
Link Test Pkts Lost(Total/AP->Clnt/Clnt->AP) : 0/0/0
Link Test Pkts round trip time (min/max/avg) : 9ms/31ms/14ms
RSSI at AP (min/max/average)                : -53dBm/-51dBm/-52dBm
RSSI at Client (min/max/average)            : -48dBm/-40dBm/-44dBm
```

Displaying Link Latency Information: Example

This example shows how to display general configuration details of the access point. These configuration details contain the link latency results that correspond to the access point that you specify in the command.

```
Switch# show ap name AP01 config general

Cisco AP Name                                   : AP01
Cisco AP Identifier                             : 55
Country Code                                    : US  - United States
Regulatory Domain Allowed by Country            : 802.11bg:-A     802.11a:-A
AP Country Code                                 : US  - United States
AP Regulatory Domain                            : Unconfigured
Switch Port Number                              : Te1/0/1
MAC Address                                     : 0000.2000.03f0
IP Address Configuration                        : Static IP assigned
IP Address                                      : 9.9.9.16
IP Netmask                                      : 255.255.0.0
Gateway IP Address                              : 9.9.9.2
Fallback IP Address Being Used                  : 9.9.9.16
Domain                                          : Cisco
Name Server                                     : 0.0.0.0
CAPWAP Path MTU                                 : 1485
Telnet State                                    : Enabled
SSH State                                       : Disabled
Cisco AP Location                               : default-location
Cisco AP Group Name                             : default-group
Primary Cisco Controller Name                   : CAPWAP Controller
Primary Cisco Controller IP Address             : 9.9.9.2
```

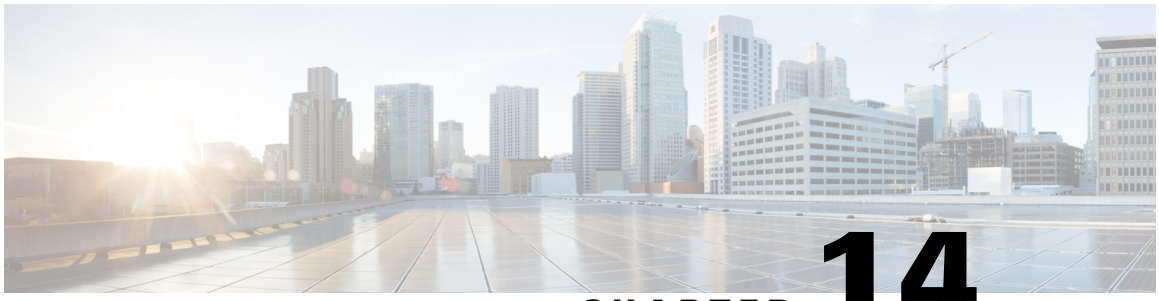
```
Secondary Cisco Controller Name                 :
Secondary Cisco Controller IP Address           : Not Configured
Tertiary Cisco Controller Name                  :
Tertiary Cisco Controller IP Address            : Not Configured
Administrative State                            : Enabled
Operation State                                 : Registered
AP Mode                                         : Local
AP Submode                                      : Not Configured
Remote AP Debug                                 : Disabled
Logging Trap Severity Level                     : informational
Software Version                                : 7.4.0.5
Boot Version                                    : 7.4.0.5
Stats Reporting Period                          : 180
LED State                                       : Enabled
PoE Pre-Standard Switch                         : Disabled
PoE Power Injector MAC Address                  : Disabled
Power Type/Mode                                 : Power Injector/Normal Mode
Number of Slots                                 : 2
AP Model                                        : 3502E
AP Image                                        : C3500-K9W8-M
IOS Version                                     :
Reset Button                                    :
AP Serial Number                                : SIM1140K002
AP Certificate Type                             : Manufacture Installed
Management Frame Protection Validation          : Disabled
AP User Mode                                    : Customized
AP User Name                                    : Not Configured
AP 802.1X User Mode                             : Not Configured
AP 802.1X User Name                             : Not Configured
Cisco AP System Logging Host                    : 255.255.255.255
AP Up Time                                      : 16 days 3 hours 14 minutes 1 s
econd
AP CAPWAP Up Time                               : 33 minutes 15 seconds
Join Date and Time                              : 01/02/2013 22:41:47
Join Taken Time                                 : 16 days 2 hours 40 minutes 45
seconds
Join Priority                                   : 1
Ethernet Port Duplex                            : Auto
Ethernet Port Speed                             : Auto
AP Link Latency                                 : Enabled
Current Delay                                   : 0
Maximum Delay                                   : 0
Minimum Delay                                   : 0
Last Updated (based on AP up time)              : 0 seconds
Rogue Detection                                 : Disabled
AP TCP MSS Adjust                               : Disabled
AP TCP MSS Size                                 : 536
```

Displaying TCP MSS Settings: Example

This example shows how to display the current TCP MSS setting for all the access points that are associated with the switch:

```
Switch# show ap tcp-adjust-mss

AP Name                     TCP State        MSS Size
-------------------------------------------------------
AP01                        Disabled         6146
AP02                        Disabled         536
AP03                        Disabled         6146
AP04                        Disabled         6146
AP05                        Disabled         6146
```



CHAPTER 14

Configuring Power over Ethernet

- Finding Feature Information, page 95
- Information About Configuring Power over Ethernet, page 95
- How to Configure Power over Ethernet, page 95
- Configuration Examples for Configuring Power over Ethernet, page 97

Finding Feature Information

Information About Configuring Power over Ethernet

When an access point that has been converted to lightweight mode (such as an AP1262) access point is powered by a power injector that is connected to a Cisco pre-Intelligent Power Management (pre-IPM) switch, you must configure Power over Ethernet (PoE), which is also known as *inline power*.

How to Configure Power over Ethernet

Configuring Power over Ethernet (CLI)

SUMMARY STEPS

1. **ap name** *Cisco_AP* **power injector installed**
2. **ap name** *Cisco_AP* **power injector override**
3. **ap name** *Cisco_AP* **power injector switch-mac-address** *switch_mac_address*
4. **show ap name** *Cisco_AP* **config general**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**ap name** *Cisco_AP* **power injector installed** **Example:** `Switch# ap name AP02 power injector installed`	Enables the PoE power injector state. The access point remembers that a power injector is connected to this particular switch port. If you relocate the access point, you must reenter this command after the presence of a new power injector is verified. **Note** Enter this command if your network contains any older Cisco 6-W switches that could be accidentally overloaded if connected directly to a 12-W access point. Make sure that the Cisco Discovery Protocol (CDP) is enabled before entering this command. Otherwise, this command will fail.
Step 2	**ap name** *Cisco_AP* **power injector override** **Example:** `Switch# ap name AP02 power injector override`	Removes the safety checks and allows the access point to be connected to any switch port. You can use this command if your network does not contain any older Cisco 6-W switches that could be overloaded if connected directly to a 12-W access point. The access point assumes that a power injector is always connected. If you relocate the access point, it continues to assume that a power injector is present.
Step 3	**ap name** *Cisco_AP* **power injector switch-mac-address** *switch_mac_address* **Example:** `Switch# ap name AP02 power injector switch-mac-address 10a.2d.5c.3d`	Sets the MAC address of the switch port that has a power injector. **Note** Enter this command if you know the MAC address of the connected switch port and do not want to automatically detect it using the installed option.
Step 4	**show ap name** *Cisco_AP* **config general** **Example:** `Switch# show ap name AP02 config general`	Displays common information that includes the PoE settings for a specific access point. **Note** The Power Type/Mode text box shows “degraded mode” if the access point is not operating at full power.

Configuring Power over Ethernet (GUI)

Step 1 Choose **Configuration** > **Wireless** > **Access Points** > **All APs**.
The **All APs** page appears with a list of access points that are associated with the switch.

Step 2 Click the name of the access point.
The **AP > Edit** page appears.

Step 3 Click the **Advanced** tab.

Step 4 In the **Power Over Ethernet Settings** area, select the **Pre-Standard 802.3af Switches** check box.
Select this check box if the access point is being powered by a high-power 802.3af Cisco switch. This switch provides more than the traditional 6 Watts of power but does not support the intelligent power management (IPM) feature.

Note Unselect the **Pre-standard 802.3af Switches** check box if power is being provided by a power injector. This is the default value.

Step 5 Select the **Power Injector State** check box.
Select this check box if the attached switch does not support IPM and a power injector is being used. If the attached switch supports IPM, you do not need to select this check box.

The **Power Injector Selection** drop-down list is displayed that contains parameters that enable you to protect your switch port from an accidental overload if the power injector is inadvertently bypassed.

Step 6 From the **Power Injector Selection** drop-down list, choose an option to specify the desired level of protection.
You can choose any one of the following three options:

- **Installed—**Examines and remembers the MAC address of the currently connected switch port and assumes that a power injector is connected. Choose this option if your network contains older Cisco 6-Watt switches and you want to avoid possible overloads by forcing a double-check of any relocated access points.

  If you want to configure the switch MAC address, enter the MAC address in the **Injector Switch MAC Address** text box. If you want the access point to find the switch MAC address, leave the **Injector Switch MAC Address** text box blank.

  Note Each time that an access point is relocated, the MAC address of the new switch port fails to match the remembered MAC address, and the access point remains in low-power mode. You must then physically verify the existence of a power injector and reselect this option to cause the new MAC address to be remembered.

- **Override—**Allows the access point to operate in high-power mode without first verifying a matching MAC address. You can use this option if your network does not contain any older Cisco 6-W switches that could be overloaded if connected directly to a 12-W access point. The advantage of this option is that if you relocate the access point, it continues to operate in high-power mode without any further configuration. The disadvantage of this option is that if the access point is connected directly to a 6-W switch, an overload occurs.

Step 7 Click **Apply**.

Step 8 Click **Save Configuration**.

What to Do Next

Manually reset the access point in order for the change to take effect.

Configuration Examples for Configuring Power over Ethernet

Displaying Power over Ethernet Information: Example

This example shows how to display common information that includes the PoE settings for a specific access point:

```
Switch# show ap name AP01 config general

Cisco AP Identifier.............. 1
Cisco AP Name.................... AP1
...
PoE Pre-Standard Switch.......... Enabled
```

```
PoE Power Injector MAC Addr....... Disabled
Power Type/Mode................... PoE/Low Power (degraded mode)
...
```

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