



Module 13: WLAN Configuration

Switching, Routing, and
Wireless Essentials v7.0
(SRWE)



Module Objectives

Module Title: WLAN Configuration

Module Objective: Implement a WLAN using a wireless router and WLC.

Topic Title	Topic Objective
Remote Site WLAN Configuration	Configure a WLAN to support a remote site.
Configure a Basic WLAN on the WLC	Configure a WLC WLAN to use the management interface and WPA2 PSK authentication.
Configure a WPA2 Enterprise WLAN on the WLC	Configure a WLC WLAN to use a VLAN interface, a DHCP server, and WPA2 Enterprise authentication.
Troubleshoot WLAN Issues	Troubleshoot common wireless configuration issues.

13.1 Remote Site WLAN Configuration

Video – Configure a Wireless Network

This video will cover the following:

- Use the Wireless Router Web Page
- Change the Password
- Change the WAN and LAN settings
- Connect the Wireless Network

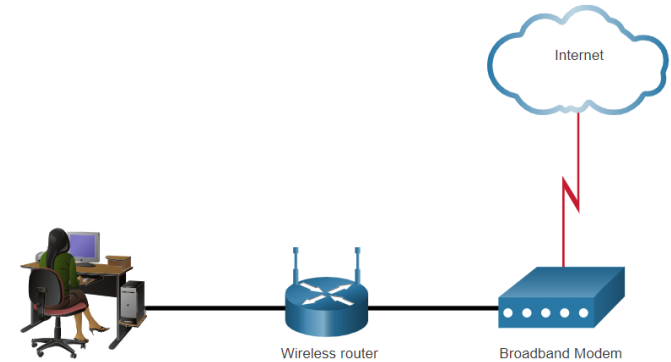
Remote Site WLAN Configuration

The Wireless Router

Remote workers, small branch offices, and home networks often use a small office and home router (= **SOHO-router**).

- These “**integrated**” **routers** typically include a switch for wired clients, a port for an internet connection (sometimes labeled “WAN”), and wireless components for wireless client access.
- These wireless routers typically provide WLAN security, DHCP services, integrated Name Address Translation (NAT), quality of service (QoS), as well as a variety of other features.
- The feature set will vary based on the router model.

Note: Cable or DSL modem configuration is usually done by the service provider’s representative either on-site or remotely.



Log in to the Wireless Router

Most wireless routers are **preconfigured** to be connected to the network and provide services.

- Wireless router **default IP addresses, usernames, and passwords** can easily be found on the **internet**.
- Therefore, your **first priority** should be to **change** these **defaults** for security reasons.

To gain access to the wireless router's configuration GUI

- Open a web browser and enter the default IP address for your wireless router.
- The default IP address can be found in the documentation that came with the wireless router or you can search the internet.
- The word **admin** is commonly used as the default username and password.

Remote Site WLAN Configuration

Basic Network Setup

Basic network setup includes the following steps (--> zie cursus voor afbeeldingen):

- Log in to the router from a web browser.
- Change the default administrative password.
- Log in with the new administrative password.
- Change the default DHCP IPv4 addresses.
- Renew the IP address.
- Log in to the router with the new IP address.

Remote Site WLAN Configuration

Basic Wireless Setup

Basic wireless setup includes the following steps (--> zie cursus voor afbeeldingen):

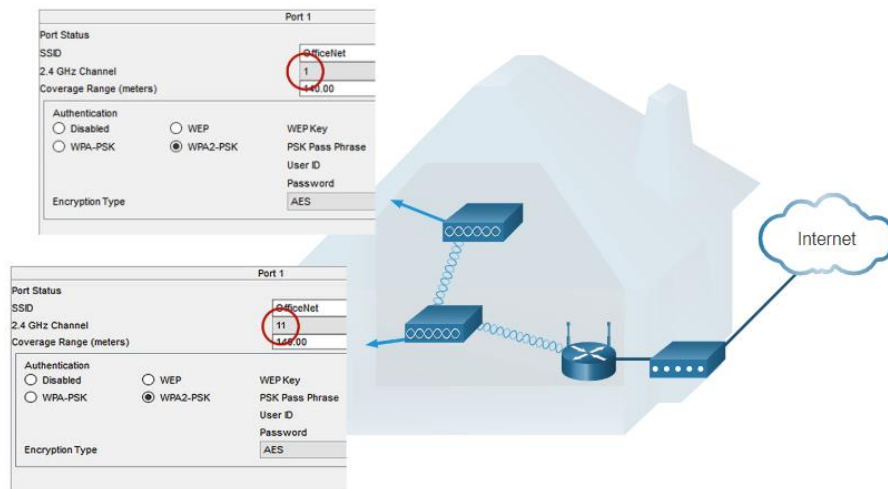
- View the WLAN defaults.
- Change the network mode, identifying which 802.11 standard is to be implemented.
- Configure the SSID.
- Configure the channel, ensuring there are no overlapping channels in use.
- Configure the security mode, selecting from Open, WPA, WPA2 Personal, WPA2 Enterprise, etc..
- Configure the passphrase, as required for the selected security mode.

Remote Site WLAN Configuration

Configure a Wireless Mesh Network

In a small office or home network, **one** wireless router may suffice to provide wireless access to all the clients.

- If you want to **extend** the **range** beyond approximately 45 meters indoors and 90 meters outdoors, you create a **wireless mesh**.
- Create the mesh **by adding access points** with the **same settings**, except using **different channels** to prevent interference.
- Extending a WLAN in a small office or home has become increasingly **easier**.
- Manufacturers have made **creating a wireless mesh network (WMN)** simple through smartphone apps.

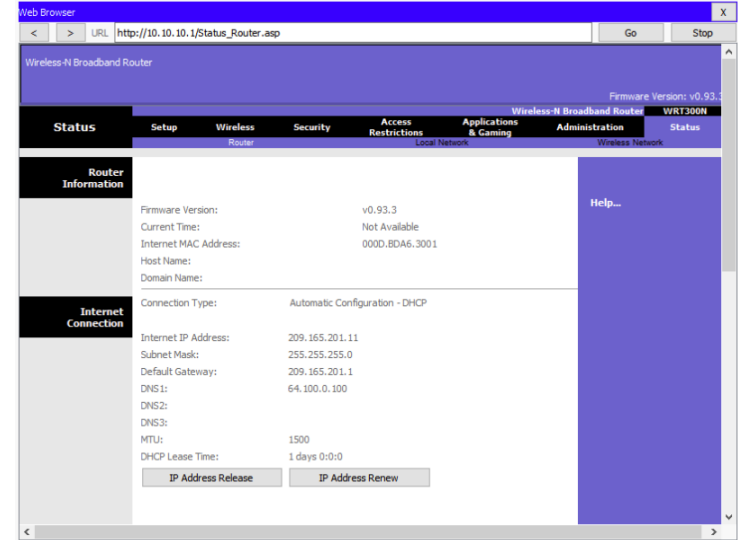


Remote Site WLAN Configuration

NAT for IPv4

Typically, the **wireless router** is assigned a **publicly routable address by the ISP** and **uses a private network address for addressing on the LAN**.

- To allow hosts on the LAN to communicate with the outside world, the router will use a process called **Network Address Translation (NAT)**.
- NAT **translates a private (local) source IPv4 address to a public (global) address** (the process is reversed for incoming packets).
- NAT makes **sharing one public IPv4 address possible by tracking the source port numbers** for every session established by a device.
- If your ISP has **IPv6** enabled, you will see a **unique IPv6 address for each device**.



Remote Site WLAN Configuration

Port Forwarding

Wireless routers typically **block** TCP and UDP **ports** to prevent **unauthorized access** in and out of a LAN.

- However, there are situations when **specific ports** must be opened so that certain programs and applications can communicate with devices **on different networks**.
- **Port forwarding** is a **rule-based method** of directing traffic between devices on separate networks. (--> zie figuur in cursus)
- **Port triggering** allows the router to **temporarily forward data through inbound ports to a specific device**.
- You can use port triggering to forward data to a computer **only when a designated port range is used to make an outbound request**.

Remote Site WLAN Configuration

Quality of Service

Many wireless routers have an option for configuring **Quality of Service (QoS)**.

- By configuring QoS, you can guarantee that certain **traffic** types, such as voice and video, are **prioritized** over traffic that is not as time-sensitive, such as email and web browsing.
- On some wireless routers, traffic can also be prioritized on specific ports.

#	Qos Policy	Priority	Description
1	IP Phone	High	IP Phone applications
2	Counter Strike	High	Online Gaming Counter Strike
3	Netflix	High	Online Video Streaming Netflix
4	FTP	Medium	FTP Applications
5	WWW	Medium	WWW Applications
6	Gnutella	Low	Gnutella Applications
7	SMTP	Medium	SMTP Applications

13.2 Configure a Basic WLAN on the WLC

Video – Configure a Basic WLAN on the WLC

This video will cover the following:

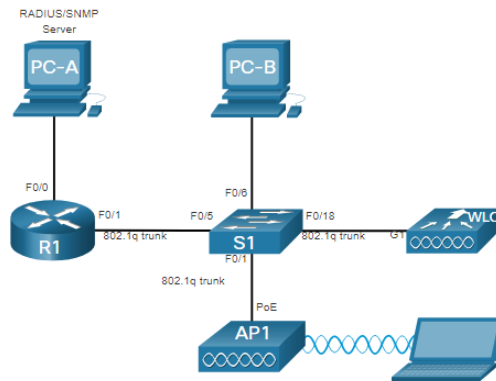
- Review the topology
- Access the GUI for the WLAN controller
- Information about the wireless network on the Network summary screen
- Configure a new WLAN
- Secure the new WLAN

Configure a Basic WLAN on the WLC

WLC Topology

The topology and addressing scheme used for this topic are shown in the figure and the table.

- The access point (AP) is a controller-based AP as opposed to an autonomous AP, so it requires no initial configuration and is often called lightweight APs (LAPs).
- LAPs use the Lightweight Access Point Protocol (LWAPP) to communicate with a WLAN controller (WLC).
- Controller-based APs are useful in situations where many APs are required in the network.
- As more APs are added, each AP is automatically configured and managed by the WLC.



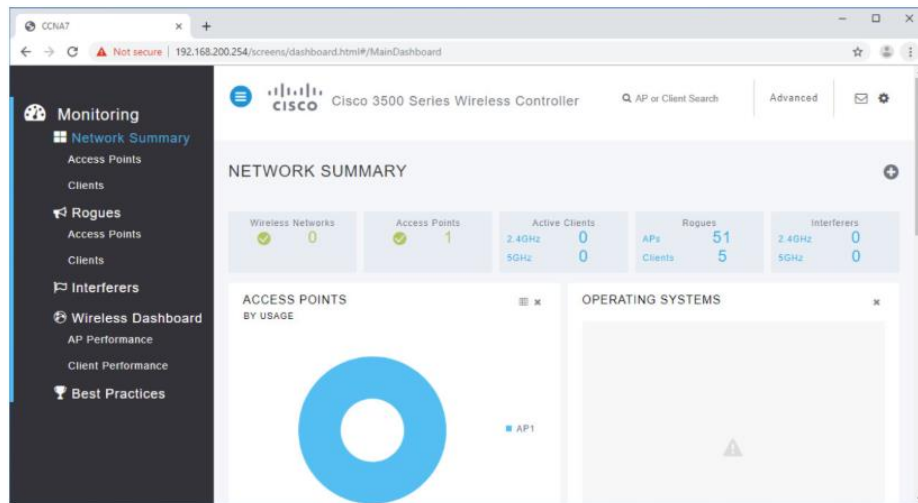
Device	Interface	IP Address	Subnet Mask
R1	F0/0	172.16.1.1	255.255.255.0
R1	F0/1.1	192.168.200.1	255.255.255.0
S1	VLAN 1	DHCP	
WLC	Management	192.168.200.254	255.255.255.0
AP1	Wired 0	192.168.200.3	255.255.255.0
PC-A	NIC	172.16.1.254	255.255.255.0
PC-B	NIC	DHCP	
Wireless Laptop	NIC	DHCP	

Configure a Basic WLAN on the WLC

Log in to the WLC

Configuring a wireless LAN controller (WLC) is not that much different from configuring a wireless router. The WLC controls APs and provides more services and management capabilities.

- The user logs into the WLC using credentials that were configured during initial setup.
- The **Network Summary** page is a dashboard that provides a quick overview of configured wireless networks, associated access points (APs), and active clients.
- You can also see the number of rogue access points and clients.



Configure a Basic WLAN on the WLC

View AP Information

Click **Access Points** from the left menu to view an overall picture of the AP's system information and performance.

- The AP is using IP address 192.168.200.3.
- Because Cisco Discovery Protocol (CDP) is active on this network, the WLC knows that the AP is connected to the FastEthernet 0/1 port on the switch.
- This AP in the topology is a Cisco Aironet 1815i which means you can use the command-line and a limited set of familiar IOS commands.

The screenshot shows the 'ACCESS POINT VIEW' for AP1. The left sidebar contains a navigation menu with the following items: Monitoring, Network Summary, Access Points, Clients, Rogues, Interferers, Wireless Dashboard, AP Performance, Client Performance, and Best Practices. The main content area is divided into two sections: 'GENERAL' and 'PERFORMANCE SUMMARY'.

GENERAL

AP Name: AP1
Location: default location

MAC Address: 2c:4f:52:60:37:e8
IP Address: 192.168.200.3
CDP / LLDP: Switch, FastEthernet0/1
Ethernet Speed: 100 Mbps
Model / Domain: AIR-CT5502-K9 / 802.11a-B
Power status: PoE/Full Power
Serial Number: FCW2320NGDH
Groups: AP Group: default-group, Flex Group: default-flex-group
Mode / Sub-mode: Local / Not Configured
Max Capabilities: 802.11n 2.4GHz, 802.11ac 5GHz
Spatial Streams: 2 (2.4GHz), 2 (5.0GHz)
Max. Data Rate: 144 Mbps (2.4GHz), 867 Mbps (5.0GHz)
Fabric: Disabled

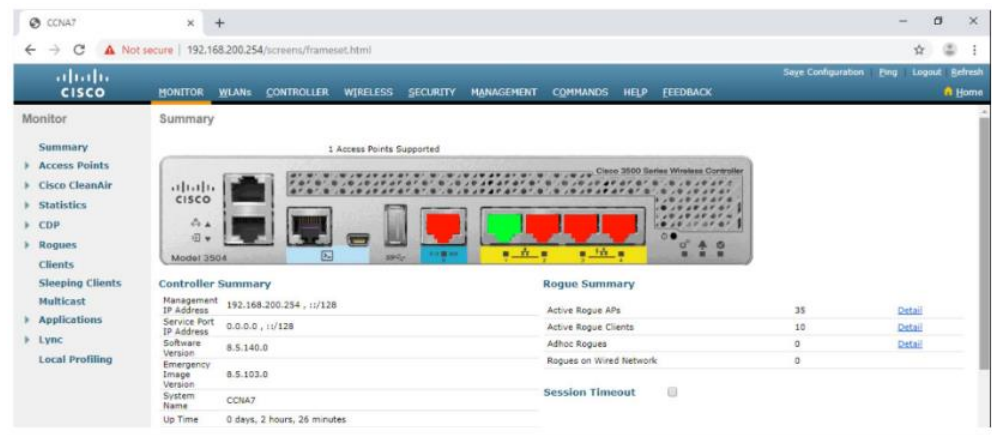
PERFORMANCE SUMMARY

	2.4GHz	5GHz
Number of clients	1	0
Channels	11	(100, 104, 108, 112)
Configured Rate	Min: 1 Mbps, Max: 144 Mbps	Min: 6 Mbps, Max: 867 Mbps
Usage Traffic	709.4 MB	231.1 KB
Throughput	2.1 KB	0
Transmit Power	20 dBm	20 dBm
Noise	-90	-93 -95 -95 -95
Channel Utilization	9%	1%
Interference	7%	1%
Traffic	2%	0%
Air Quality	-	-
Admin Status	Enabled	Enabled
Clean Air Status	Not applicable	Not applicable

Configure a Basic WLAN on the WLC Advanced Settings

Most WLC will come with some basic settings and menus that users can quickly access to implement a variety of common configurations.

- However, as a network administrator, you will typically access the advanced settings.
- For the Cisco 3504 Wireless Controller, click **Advanced** in the upper right-hand corner to access the advanced **Summary** page.
- From here, you can access all the features of the WLC.



Configure a Basic WLAN on the WLC

Configure a WLAN

Wireless LAN Controllers have Layer 2 switch ports and virtual interfaces that are created in software and are very similar to VLAN interfaces.

- Each physical port can support many APs and WLANs.
- The ports on the WLC are essentially trunk ports that can carry traffic from multiple VLANs to a switch for distribution to multiple APs.
- Each AP can support multiple WLANs.



Configure a Basic WLAN on the WLC

Configure a WLAN (Cont.)

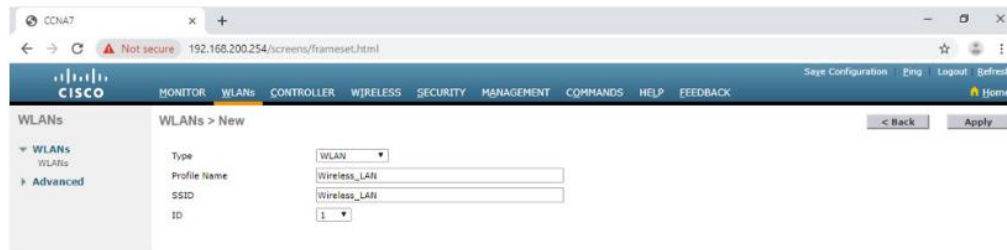
Basic WLAN configuration on the WLC includes the following steps:

1. Create the WLAN
2. Apply and Enable the WLAN
3. Select the Interface
4. Secure the WLAN
5. Verify the WLAN is Operational
6. Monitor the WLAN
7. View Wireless Client Information

Configure a Basic WLAN on the WLC

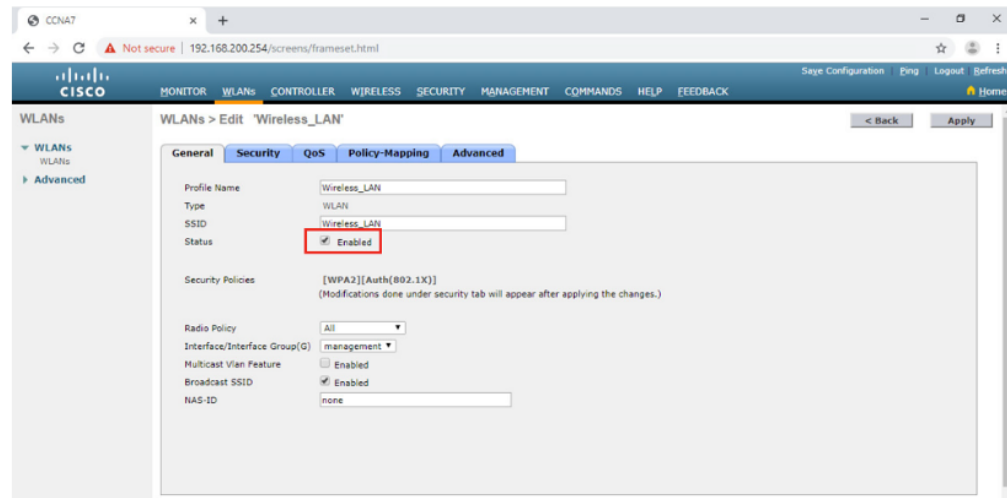
Configure a WLAN (Cont.)

1. **Create the WLAN:** In the figure, a new WLAN with an SSID name **Wireless_LAN** is created.



The screenshot shows the 'WLANs > New' configuration page in the Cisco WLC GUI. The 'Type' is set to 'WLAN'. The 'Profile Name' and 'SSID' are both set to 'Wireless_LAN'. The 'ID' is set to '1'. The 'Apply' button is visible in the top right corner.

2. **Apply and Enable the WLAN:** Next the WLAN is enabled the WLAN settings are configured.

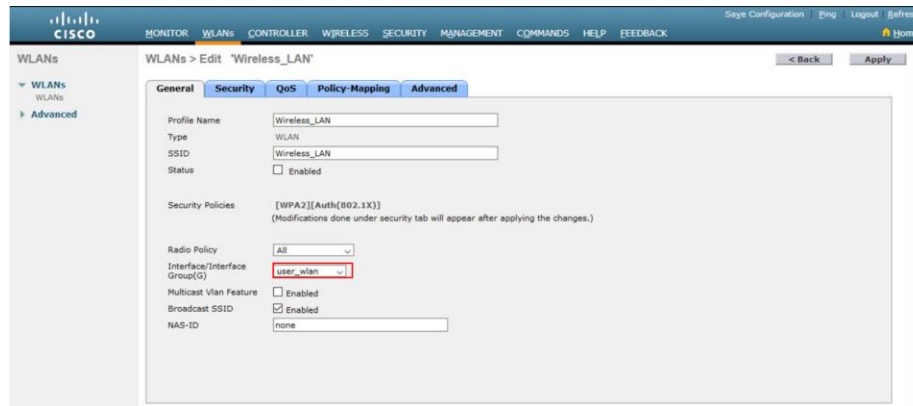


The screenshot shows the 'WLANs > Edit 'Wireless_LAN'' configuration page in the Cisco WLC GUI. The 'General' tab is selected. The 'Profile Name' is 'Wireless_LAN', 'Type' is 'WLAN', and 'SSID' is 'Wireless_LAN'. The 'Status' is set to 'Enabled', which is highlighted with a red box. The 'Security Policies' are set to '[WPA2][Auth(802.1X)]'. The 'Radio Policy' is set to 'All', and the 'Interface/Interface Group(G)' is set to 'management'. The 'Multicast Vlan Feature' is set to 'Enabled', and the 'Broadcast SSID' is set to 'Enabled'. The 'NAS-ID' is set to 'none'. The 'Apply' button is visible in the top right corner.

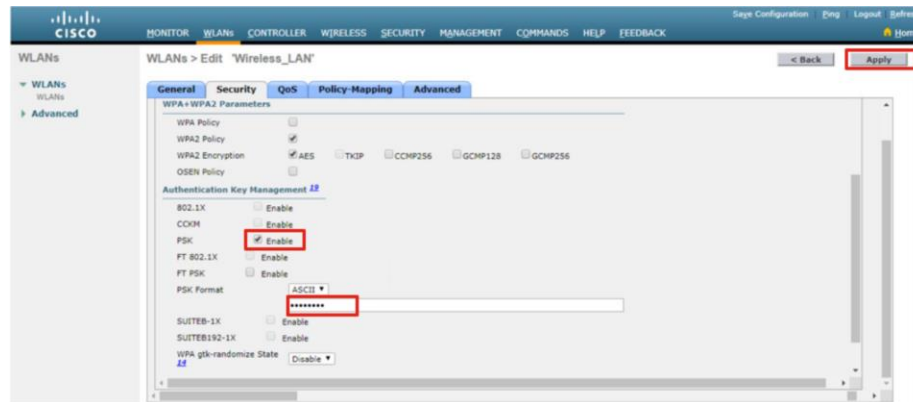
Configure a Basic WLAN on the WLC

Configure a WLAN (Cont.)

- 3. Select the Interface:** The interface that will carry the WLAN traffic must be selected.



- 4. Secure the WLAN:** The Security tab is used to access all the available options for securing the LAN.



Configure a Basic WLAN on the WLC

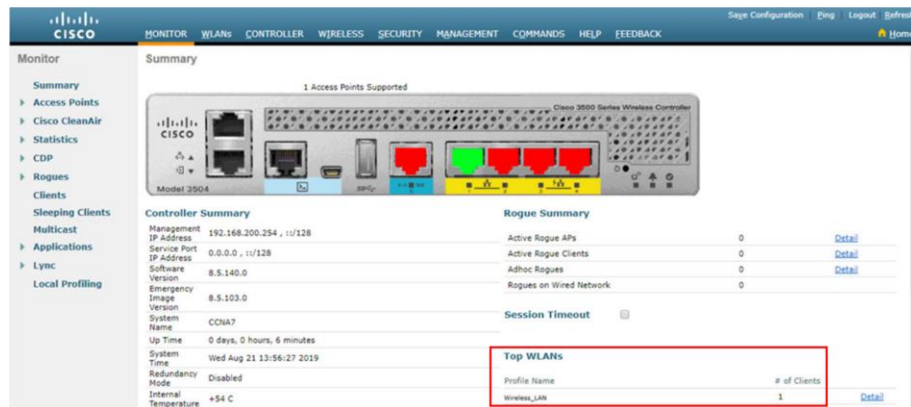
Configure a WLAN (Cont.)

5. Verify the WLAN is Operational:

The **WLANs** menu on the left is used to view the newly configured WLAN and its settings.



6. Monitor the WLAN: The Monitor tab is used to access the advanced Summary page and confirm that the **Wireless_LAN** now has one client using its services.



Configure a Basic WLAN on the WLC

Configure a WLAN (Cont.)

7. View Wireless Client Details:

Click **Clients** in the left menu to view more information about the clients connected to the WLAN.



The screenshot shows the Cisco WLC Monitor page with the 'Clients' tab selected. The left sidebar contains a 'Monitor' menu with options: Summary, Access Points, Cisco CleanAir, Statistics, CDP, Rogues, and Clients (highlighted with a red box). The main content area displays a table of connected clients. The table has columns for Client MAC Addr, IP Address(Ipv4/Ipv6), AP Name, WLAN Profile, and WLAN SSID. A single client is listed with MAC address 00:12:ac:57:7c:57, IP address 192.168.5.2, AP name AP1, WLAN profile Wireless_LAN, and WLAN SSID Wireless_LAN. Above the table, there is a 'Current Filter' section set to 'None' with links to '[Change Filter]' and '[Clear Filter]'. The top right of the page shows navigation links: 'Save Configuration', 'Eng', 'Logout', and 'Refresh'.

Client MAC Addr	IP Address(Ipv4/Ipv6)	AP Name	WLAN Profile	WLAN SSID
00:12:ac:57:7c:57	192.168.5.2	AP1	Wireless_LAN	Wireless_LAN

13.3 Configure a WPA2 Enterprise WLAN on the WLC

Video – Define an SNMP and RADIUS Server on the WLC

This video will cover the following:

- Configure the WLAN controller to send SNMP traps to an external server
- Configure the WLAN controller to use an external RADIUS server to authenticate WLAN users
- Verify connectivity with the RADIUS server

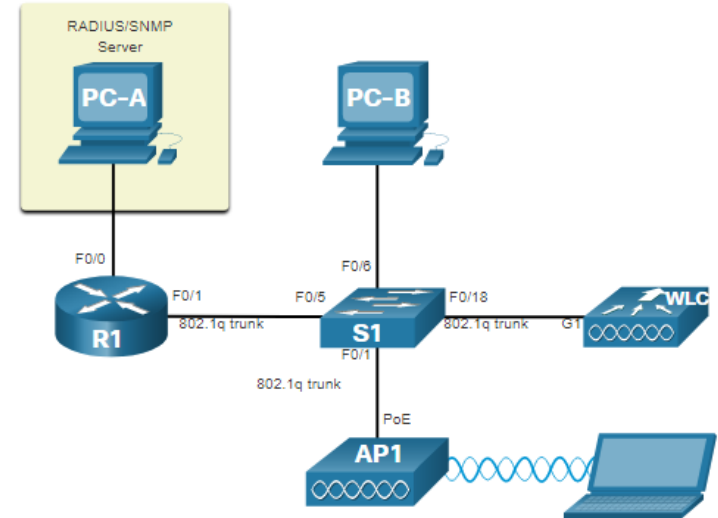
Configure a WPA2 Enterprise WLAN on the WLC

SNMP and RADIUS

PC-A is running Simple Network Management Protocol (SNMP) and Remote Authentication Dial-In User Service (RADIUS) server software.

- The network administrator wants the WLC to forward all SNMP log messages (i.e., traps) to the SNMP server.
- The network administrator wants to use a RADIUS server for authentication, authorization, and accounting (AAA) services.
- Users will enter their username and password credentials which will be verified by the RADIUS server.
- The RADIUS server is required for WLANs that are using WPA2 Enterprise authentication.

Note: SNMP server and RADIUS server configuration is beyond the scope of this module.

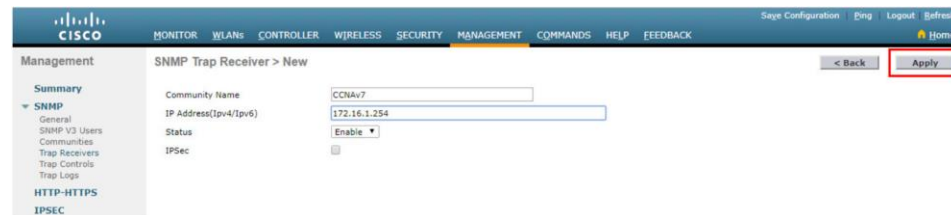
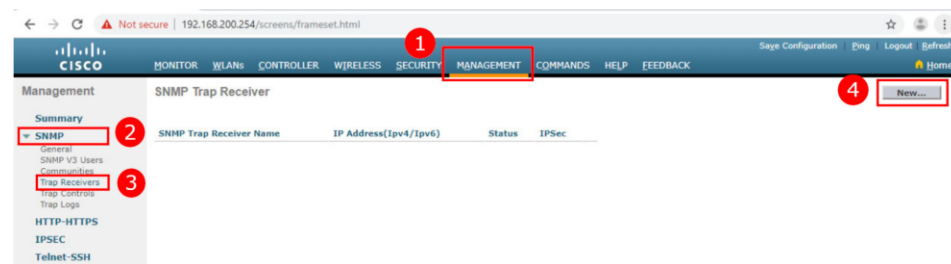


Configure a WPA2 Enterprise WLAN on the WLC

Configure SNMP Server Information

To enable SNMP and configure settings:

1. Click the **MANAGEMENT** tab to access a variety of management features.
 2. Click **SNMP** to expand the sub-menus.
 3. Click **Trap Receivers**.
 4. Click **New...** to configure a new SNMP trap receiver.
- Enter the SNMP Community name and the IP address (IPv4 or IPv6) for the SNMP server and then click **Apply**.
 - The WLC will now forward SNMP log messages to the SNMP server.



Configure a WPA2 Enterprise WLAN on the WLC

Configure RADIUS Server Information

To configure the WLC with the RADIUS server information:

1. Click **SECURITY**.
 2. Click **RADIUS**
 3. Click **Authentication**
 4. Click **New...** to add PC-A as the RADIUS server.
- Enter the IPv4 address for PC-A and the shared secret that will be used between the WLC and the RADIUS server (not for users!) and then click Apply.

The first screenshot shows the 'RADIUS Authentication Servers' configuration page. The left sidebar has 'SECURITY' selected (1), 'RADIUS' selected (2), and 'Authentication' selected (3). The 'New...' button is highlighted (4). The main area shows fields for 'Auth Called Station ID Type' (AP MAC Address:SSID), 'Use AES Key Wrap' (unchecked), 'MAC Delimiter' (Hyphen), and 'Framed MTU' (1300). A table at the bottom lists existing servers.

The second screenshot shows the 'RADIUS Authentication Servers > New' form. The left sidebar shows 'Authentication' selected (3) and 'New...' selected (4). The form fields include: 'Server Index (Priority)' (1), 'Server IP Address (IPv4/IPv6)' (172.16.1.254), 'Shared Secret Format' (ASCII), 'Shared Secret' (masked), 'Confirm Shared Secret' (masked), 'Apply Cisco ISE Default settings' (unchecked), 'Key Wrap' (unchecked), 'Port Number' (1812), 'Server Status' (Enabled), 'Support for CoA' (Disabled), 'Server Timeout' (5 seconds), 'Network User' (checked), 'Management' (checked), and 'Management Retransmit Timeout' (5 seconds). The 'Apply' button is highlighted.

Configure a WPA2 Enterprise WLAN on the WLC

Configure RADIUS Server Information (Cont.)

After clicking **Apply**, the list of configured **RADIUS Authentication Servers** refreshes with the new server listed.



The screenshot shows the Cisco WLC configuration interface for RADIUS Authentication Servers. The left sidebar shows the navigation menu with 'RADIUS' expanded. The main content area shows the configuration for a single RADIUS server. The 'Auth Called Station ID Type' is set to 'AP MAC Address:SSID'. The 'Use AES Key Wrap' checkbox is unchecked. The 'MAC Delimiter' is set to 'Hyphen'. The 'Framed MTU' is set to '1300'. Below the configuration fields is a table with the following data:

Network User	Management	Tunnel Proxy	Server Index	Server Address(Ipv4/Ipv6)	Port	IPSec	Admin Status
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	172.16.1.254	1812	Disabled	Enabled

Configure a WPA2 Enterprise WLAN on the WLC

Video – Configure a VLAN for a New WLAN

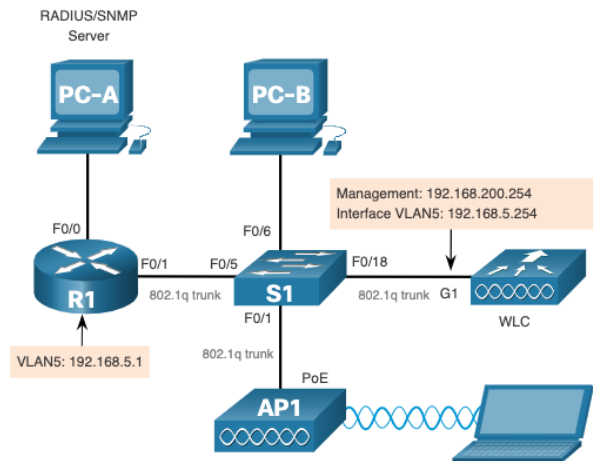
This video will cover the following:

- Review the topology
- Deploy a new VLAN interface
- Associate the new VLAN interface with a WLAN

Configure a WPA2 Enterprise WLAN on the WLC Topology with VLAN 5 Addressing

Each WLAN configured on the WLC needs its own virtual interface.

- The WLC has five physical data ports that can be configured to support multiple WLANs, each on his own virtual interface.
- The new WLAN will use interface VLAN 5 and network 192.168.5.0/24 and therefore R1 has been configured for VLAN 5 as shown in the topology and **show ip interface brief** output.



```
R1# show ip interface brief
Interface                IP-Address      OK? Method Status      Protocol
FastEthernet0/0          172.16.1.1      YES manual up          up
FastEthernet0/1          unassigned      YES unset up          up
FastEthernet0/1.1        192.168.200.1   YES manual up          up
FastEthernet0/1.5        192.168.5.254   YES manual up          up
(output omitted)
R1#
```

192.168.5.1

Configure a WPA2 Enterprise WLAN on the WLC

Configure a New Interface

VLAN interface configuration on the WLC includes the following steps:

1. Create a new interface.
2. Configure the VLAN name and ID.
3. Configure the port and interface address.
4. Configure the DHCP server address.
5. Apply and Confirm.
6. Verify Interfaces.

Configure a WPA2 Enterprise WLAN on the WLC

Configure a New Interface (Cont.)

1. **Create a new interface:**
Click **CONTROLLER** >
Interfaces > **New...**



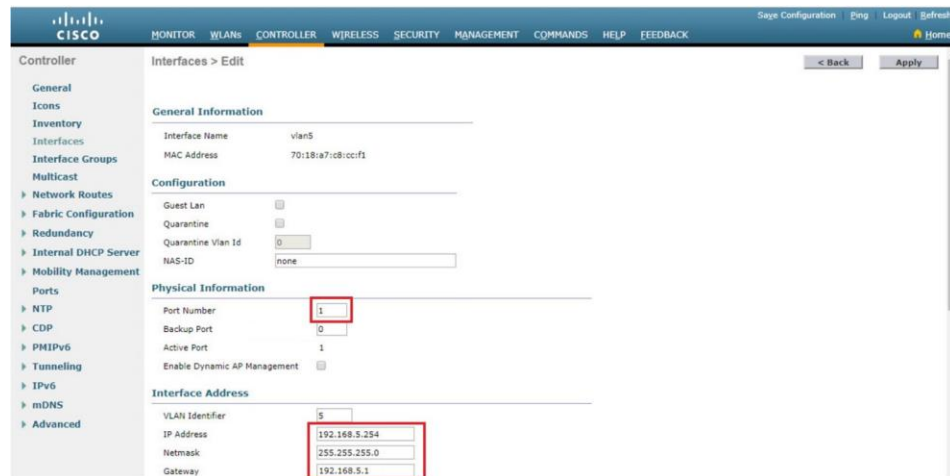
2. **Configure the VLAN name and ID:** In the example, the new interface is named **vlan5**, the VLAN ID is **5**, and applied.



Configure a WPA2 Enterprise WLAN on the WLC

Configure a New Interface (Cont.)

3. **Configure the port and interface address:** On the interface **Edit** page, configure the physical port number (i.e., the WLC G1 interface is Port Number 1 on the WLC), the VLAN 5 interface addressing (i.e., 192.168.5.254/24), and the default gateway (i.e., 192.168.5.1)



The screenshot displays the Cisco WLC configuration interface for editing an interface. The left sidebar shows the navigation menu with 'Controller' selected. The main content area is titled 'Interfaces > Edit' and contains the following sections:

- General Information:** Interface Name (vlan5), MAC Address (70:18:a7:c8:cc:f1).
- Configuration:** Guest Lan (checkbox), Quarantine (checkbox), Quarantine Vlan Id (0), NAS-ID (none).
- Physical Information:** Port Number (1), Backup Port (0), Active Port (1), Enable Dynamic AP Management (checkbox).
- Interface Address:** VLAN Identifier (5), IP Address (192.168.5.254), Netmask (255.255.255.0), Gateway (192.168.5.1).

Red boxes highlight the Port Number (1), VLAN Identifier (5), IP Address (192.168.5.254), Netmask (255.255.255.0), and Gateway (192.168.5.1) fields.

Configure a WPA2 Enterprise WLAN on the WLC

Configure a New Interface (Cont.)

4. **Configure the DHCP server address:** The example configures a primary DHCP server at IPv4 address 192.168.5.1 which is the default gateway router address which is enabled as a DHCP server.

The screenshot shows the Cisco WLC configuration page for a new interface. The 'CONTROLLER' tab is selected. Under 'Interface Address', the following values are entered: VLAN Identifier: 5, IP Address: 192.168.5.254, Netmask: 255.255.255.0, Gateway: 192.168.5.1, IPv6 Address: ::, Prefix Length: 128, IPv6 Gateway: ::, and Link Local IPv6 Address: fe80::7218:a7ff:fedb:ccf0/64. Under 'DHCP Information', the Primary DHCP Server is set to 192.168.5.1 (highlighted with a red box), and the Secondary DHCP Server is empty. The DHCP Proxy Mode is set to Global. The 'Enable DHCP Option 82' and 'Enable DHCP Option 6 OpenDNS' checkboxes are unchecked.

5. **Apply and Confirm:** Scroll to the top and click **Apply** and then click **OK** for the warning message.

The screenshot shows the Cisco WLC configuration page with a warning message displayed. The warning message states: '192.168.200.254 says: Changing the interface parameters causes the WLANs to be temporarily disabled and thus may result in loss of connectivity for some clients.' The 'Apply' button is highlighted, and the 'OK' button is also visible.

Configure a WPA2 Enterprise WLAN on the WLC Configure a New Interface (Cont.)

6. **Verify Interfaces:** Click **Interfaces** to verify that the new **vlan5** interface is shown in the list of interfaces with its IPv4 address.



The screenshot shows the Cisco WLC Controller Configuration page. The 'CONTROLLER' tab is selected in the top navigation bar. On the left, the 'Controller' menu is expanded, and 'Interfaces' is selected. The main area displays a table of interfaces. The table has columns for Interface Name, VLAN Identifier, IP Address, Interface Type, Dynamic AP Management, and IPv6 Address. The 'vlan5' interface is highlighted in blue, showing it is a dynamic interface with IP address 192.168.5.254.

Interface Name	VLAN Identifier	IP Address	Interface Type	Dynamic AP Management	IPv6 Address
management	untagged	192.168.200.254	Static	Enabled	::/128
redundancy-management	untagged	0.0.0.0	Static	Not Supported	
redundancy-port	untagged	0.0.0.0	Static	Not Supported	
service-port	N/A	0.0.0.0	DHCP	Disabled	::/128
user_vlan	10	192.168.10.254	Dynamic	Disabled	::/128
virtual	N/A	1.1.1.1	Static	Not Supported	
vlan5	5	192.168.5.254	Dynamic	Disabled	::/128

Configure a WPA2 Enterprise WLAN on the WLC

Video – Configure a DHCP Scope

This video will cover the following:

- Review the topology
- Explain the role of the WLC DHCP server
- Create a new DHCP scope

Configure a WPA2 Enterprise WLAN on the WLC

Configure a DHCP Scope

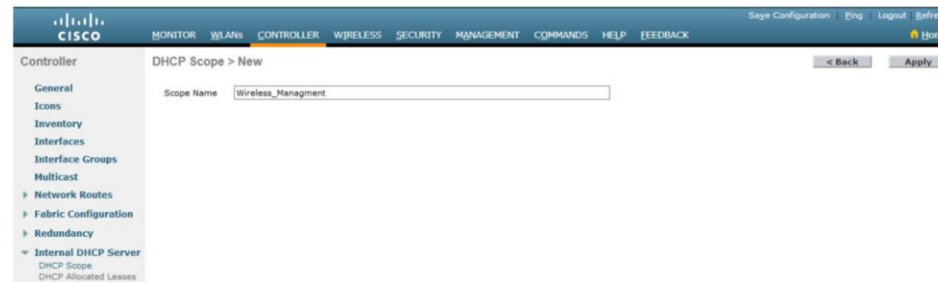
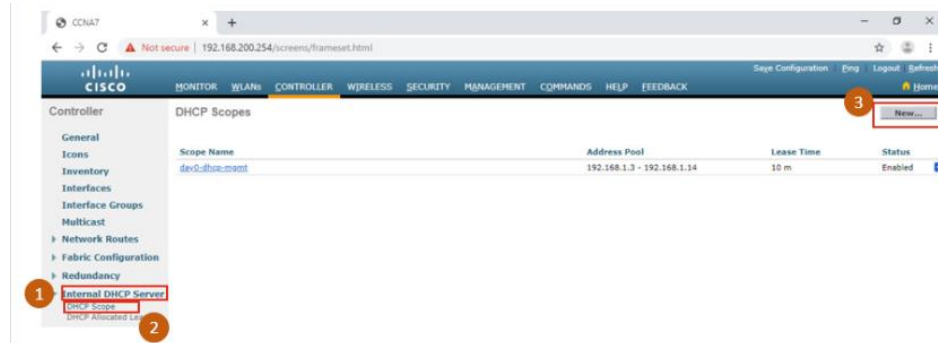
DHCP scope configuration includes the following steps:

1. Create a new DHCP scope.
2. Name the DHCP scope.
3. Verify the new DHCP scope.
4. Configure and enable the new DHCP scope.
5. Verify the enable DHCP scope

Configure a WPA2 Enterprise WLAN on the WLC

Configure a DHCP Scope (Cont.)

1. **Create a new DHCP scope:** To configure a new DHCP scope, click **Internal DHCP Server > DHCP Scope > New....**
2. **Name the DHCP scope:** The scope is named **Wireless_Management** and then applied.



Configure a WPA2 Enterprise WLAN on the WLC

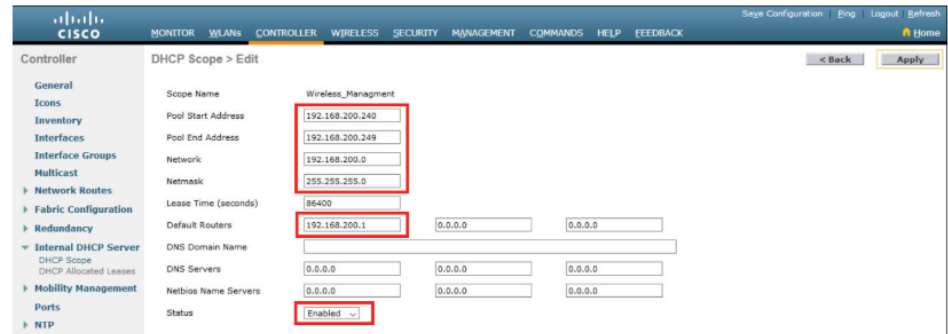
Configure a DHCP Scope (Cont.)

- Verify the new DHCP scope:** In the **DHCP Scopes** page click the new Scope Name to configure the DHCP scope.
- Configure and enable the new DHCP scope:** On the Edit screen for the **Wireless_Management** scope, configure a pool of addresses (i.e., 192.168.200.240/24 to .249), the default router IPv4 address (i.e., 192.168.200.1), then **Enabled** and **Apply**.



The screenshot shows the Cisco WLC interface with the 'CONTROLLER' tab selected. The 'DHCP Scopes' page is displayed, showing a table of configured scopes. The table has columns for Scope Name, Address Pool, Lease Time, and Status. Two scopes are listed: 'Wireless_Management' and 'day0-dhcp-mgmt'.

Scope Name	Address Pool	Lease Time	Status
Wireless_Management	0.0.0.0 - 0.0.0.0	1 d	Dis
day0-dhcp-mgmt	192.168.1.3 - 192.168.1.14	1 d	En



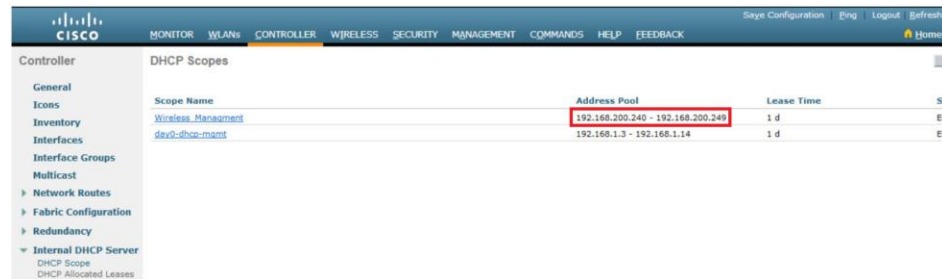
The screenshot shows the 'DHCP Scope > Edit' page for the 'Wireless_Management' scope. The page contains various configuration fields for the DHCP scope, including address pool, network, netmask, lease time, and default routers. The 'Status' field is set to 'Enabled'.

Field	Value
Scope Name	Wireless_Management
Pool Start Address	192.168.200.240
Pool End Address	192.168.200.249
Network	192.168.200.0
Netmask	255.255.255.0
Lease Time (seconds)	86400
Default Routers	192.168.200.1
DNS Domain Name	
DNS Servers	0.0.0.0, 0.0.0.0, 0.0.0.0
Netbios Name Servers	0.0.0.0, 0.0.0.0, 0.0.0.0
Status	Enabled

Configure a WPA2 Enterprise WLAN on the WLC

Configure a DHCP Scope (Cont.)

5. **Verify the enable DHCP scope:** The network administrator is returned to the **DHCP Scopes** page and can verify the scope is ready to be allocated to a new WLAN.



Scope Name	Address Pool	Lease Time	Status
Wireless_Management	192.168.200.240 - 192.168.200.249	1 d	Enabled
dau0-dhcc-mgmt	192.168.1.3 - 192.168.1.14	1 d	Enabled

Video – Configure a WPA2 Enterprise WLAN

This video will cover the following:

- Review the topology
- Create a WLAN
- Configure the WLC to use the RADIUS server
- Secure the new WLAN with WPA2-Enterprise
- Verify WPA2-Enterprise Security

Configure a WPA2 Enterprise WLAN on the WLC

Configure a WPA2 Enterprise WLAN

By default, all newly created WLANs on the WLC will use WPA2 with Advanced Encryption System (AES).

- 802.1X is the default key management protocol used to communicate with the RADIUS server.
- Next, create a new WLAN to use interface **vlan5**.

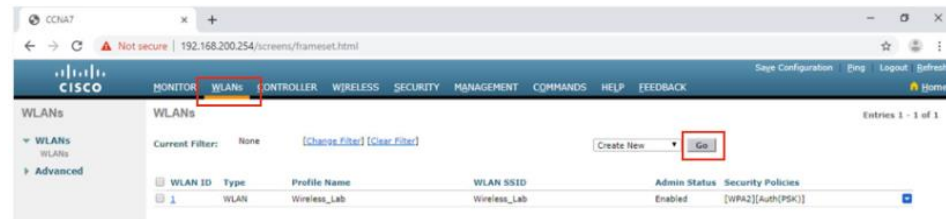
Configuring a new WLAN on the WLC includes the following steps:

1. Create a new WLAN.
2. Configure the WLAN name and SSID.
3. Enable the WLAN for VLAN 5.
4. Verify AES and 802.1X defaults.
5. Configure WLAN security to use the RADIUS server.
6. Verify the new WLAN is available.

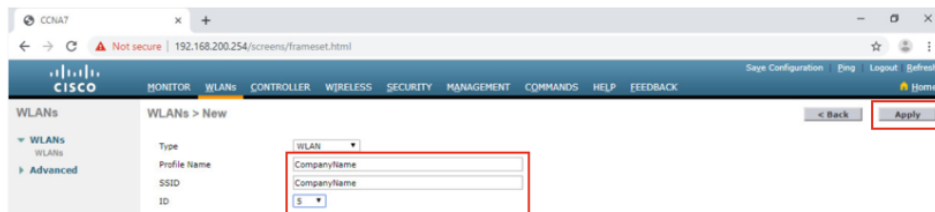
Configure a WPA2 Enterprise WLAN on the WLC

Configure a WPA2 Enterprise WLAN (Cont.)

1. **Create a new WLAN:** Click the **WLANs** tab and then **Go** to create a new WLAN.



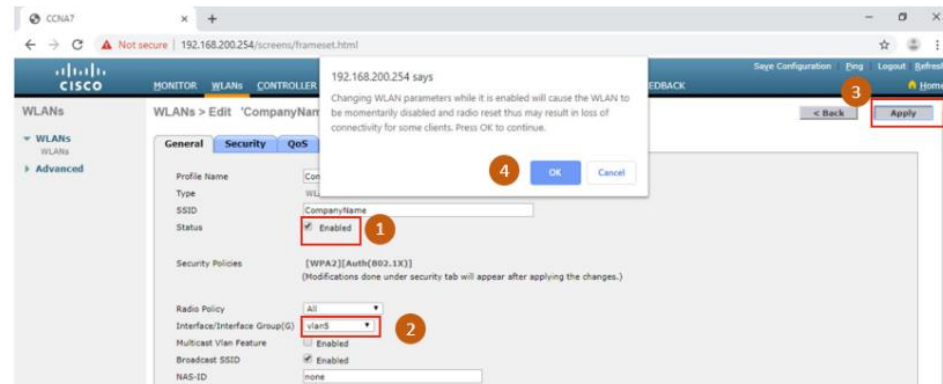
2. **Configure the WLAN name and SSID:** Enter the profile name and SSID, choose an ID of **5**, and then click **Apply** to create the new WLAN.



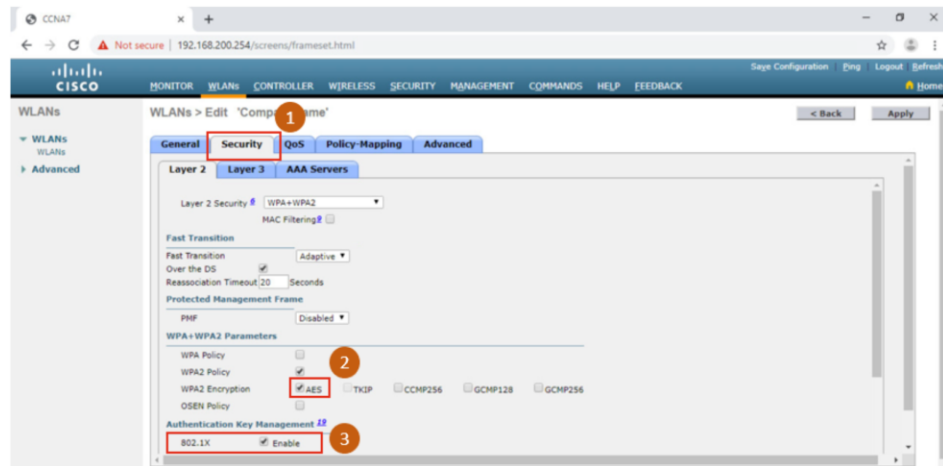
Configure a WPA2 Enterprise WLAN on the WLC

Configure a WPA2 Enterprise WLAN (Cont.)

- 3. Enable the WLAN for VLAN 5:** Once the WLAN, change the status to **Enabled**, choose **vlan5** from the Interface/Interface Group(G) dropdown list, and then click **Apply** and click **OK** to accept the popup message.



- 4. Verify AES and 802.1X defaults:** Click the **Security** tab to view the default security configuration for the new WLAN.



Configure a WPA2 Enterprise WLAN on the WLC

Configure a WPA2 Enterprise WLAN (Cont.)

5. **Configure the RADIUS server:** To select the RADIUS server that will be used to authenticate WLAN users, click the **AAA Servers** tab and in the dropdown box, select the RADIUS server that was configured on the WLC previously, and then **Apply** your changes.

The screenshot shows the 'WLANs > Edit 'CompanyName'' configuration page. The 'AAA Servers' tab is selected and highlighted with a red box. A red circle with the number '2' is around the 'Authenticating Servers' checkbox, which is checked. Another red circle with the number '1' is around the 'Policy-Mapping' tab. A red box with the number '3' is around the 'Apply' button in the top right corner. The 'RADIUS Servers' section shows a table with columns for Server ID, Name, IP Address, Port, and Status. Server 1 is configured with IP 172.16.1.254 and Port 1812. Servers 2 through 6 are set to 'None'. The 'RADIUS Server Accounting' section shows 'Interim Update' checked and 'Interim Interval' set to 0 seconds.

6. **Verify that the new WLAN is available:** To verify that the new WLAN is listed and enabled click on the **WLANs** submenu.

The screenshot shows the 'WLANs' configuration page. The 'WLANs' submenu is highlighted with a red box. The table below lists the configured WLANs.

WLAN ID	Type	Profile Name	WLAN SSID	Admin Status	Security Policies
1	WLAN	Wireless_LAN	Wireless_LAN	Enabled	[WPA2][Auth(PSK)]
5	WLAN	CompanyName	CompanyName	Enabled	[WPA2][Auth(802.1X)]

13.4 Troubleshoot WLAN Issues

Troubleshooting Approaches

Network problems can be simple or complex, and can result from a **combination of hardware, software, and connectivity issues**.

- Technicians must be able to **analyze** the problem and determine the **cause** of the error before they can resolve the network issue.
- This process is called **troubleshooting**.

Troubleshooting any sort of network problem should follow a **systematic approach**.

A common and efficient troubleshooting methodology is based on the scientific method and can be broken into the **six main steps** shown in the table on the next slide.

Troubleshooting Approaches (Cont.)

Step	Title	Description
1	Identify the Problem	The first step in the troubleshooting process is to identify the problem. While tools can be used in this step, a conversation with the user is often very helpful.
2	Establish a Theory of Probable Causes	After you have talked to the user and identified the problem, you can try and establish a theory of probable causes. This step often yields more than a few probable causes to the problem.
3	Test the Theory to Determine Cause	Based on the probable causes, test your theories to determine which one is the cause of the problem. A technician will often apply a quick procedure to test and see if it solves the problem. If a quick procedure does not correct the problem, you might need to research the problem further to establish the exact cause.
4	Establish a Plan of Action to Resolve the Problem and Implement the Solution	After you have determined the exact cause of the problem, establish a plan of action to resolve the problem and implement the solution.
5	Verify Full System Functionality and Implement Preventive Measures	After you have corrected the problem, verify full functionality and, if applicable, implement preventive measures.
6	Document Findings, Actions, and Outcomes	In the final step of the troubleshooting process, document your findings, actions, and outcomes. This is very important for future reference.

Wireless Client Not Connecting

If there is no connectivity, check the following:

- Confirm the network configuration on the PC using the **ipconfig** command.
- Confirm that the device can connect to the wired network. Ping a known IP address.
- If needed, reload drivers as appropriate for the client or try a different wireless NIC.
- If the wireless NIC of the client is working, check the security mode and encryption settings on the client.

If the PC is operational but the wireless connection is performing poorly, check the following:

- Is the PC out of the planned coverage area (BSA)?
- Check the channel settings on the wireless client.
- Check for interference with the 2.4 GHz band.

Wireless Client Not Connecting (Cont.)

Next, ensure that all the devices are actually in place.

- Consider a possible physical security issue.
- Is there power to all devices and are they powered on?

Finally, inspect links between cabled devices looking for bad connectors or damaged or missing cables.

- If the physical plant is in place, verify the wired LAN by pinging devices, including the AP.
- If connectivity still fails at this point, perhaps something is wrong with the AP or its configuration.
- When the user PC is eliminated as the source of the problem, and the physical status of devices is confirmed, begin investigating the performance of the AP.
- Check the power status of the AP.

Troubleshooting When the Network Is Slow

To optimize and increase the bandwidth of 802.11 dual-band routers and APs, either:

- **Upgrade your wireless clients** - Older 802.11b, 802.11g, and even 802.11n devices can slow the entire WLAN. For the best performance, all wireless devices should support the same highest acceptable standard.
- **Split the traffic** - The easiest way to improve wireless performance is to split the wireless traffic between the 802.11n 2.4 GHz band and the 5 GHz band. Therefore, 802.11n (or better) can use the two bands as two separate wireless networks to help manage the traffic.

There are several reasons for using a split-the-traffic approach:

- The 2.4 GHz band may be suitable for basic Internet traffic that is not time-sensitive.
- The bandwidth may still be shared with other nearby WLANs.
- The 5 GHz band is much less crowded than the 2.4 GHz band; ideal for streaming multimedia.
- The 5 GHz band has more channels; therefore, the channel chosen is likely interference-free.

Troubleshooting When the Network Is Slow (Cont.)

By default, dual-band routers and APs use the same network name on both the 2.4 GHz band and the 5 GHz band.

- It may be useful to segment the traffic.
- The simplest way to segment traffic is to rename one of the wireless networks.

To improve the range of a wireless network, ensure the wireless router or AP location is free of obstructions, such as furniture, fixtures (= armaturen), and tall appliances (= hoge apparaten).

- These block the signal, which shortens the range of the WLAN.
- If this still does not solve the problem, then a Wi-Fi Range Extender or deploying the Powerline wireless technology may be used.

Troubleshoot WLAN Issues

Updating Firmware

Most wireless routers and APs offer upgradable firmware that should be periodically verified.

On a WLC, there will most likely be the ability to upgrade the firmware on all APs that the WLC controls.

- In the figure, the firmware image that will be used to upgrade all the APs is downloaded.
- On a Cisco 3504 Wireless Controller, click **WIRELESS > Access Points > Global Configuration** and then scroll to the bottom of the page for the AP Image Pre-download section.

