

## Configuring Repeater and Standby Access Points and Workgroup Bridge Mode

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This chapter describes how to configure your access point as a repeater, as a hot standby unit, or as a workgroup bridge. This chapter contains these sections:

- [Understanding Repeater Access Points, page 18-2](#)
- [Configuring a Repeater Access Point, page 18-3](#)
- [Understanding Hot Standby, page 18-8](#)
- [Configuring a Hot Standby Access Point, page 18-8](#)
- [Understanding Workgroup Bridge Mode, page 18-11](#)
- [Configuring Workgroup Bridge Mode, page 18-13](#)

# Understanding Repeater Access Points

A repeater access point is not connected to the wired LAN; it is placed within radio range of an access point connected to the wired LAN to extend the range of your infrastructure or to overcome an obstacle that blocks radio communication. You can configure either the 2.4-GHz radio or the 5-GHz radio as a repeater. In access points with two radios, only one radio can be a repeater; the other radio must be configured as a root radio.

The repeater forwards traffic between wireless users and the wired LAN by sending packets to either another repeater or to an access point connected to the wired LAN. The data is sent through the route that provides the best performance for the client. When you configure an access point as a repeater, the access point's Ethernet port does not forward traffic.

You can set up a chain of several repeater access points, but throughput for client devices at the end of the repeater chain will be quite low. Because each repeater must receive and then re-transmit each packet on the same channel, throughput is cut in half for each repeater you add to the chain.

A repeater access point associates to the access point with which it has the best connectivity. However, you can specify the access point to which the repeater associates. Setting up a static, specific association between a repeater and a root access point improves repeater performance.

To set up repeaters, you must enable Aironet extensions on both the parent (root) access point and the repeater access points. Aironet extensions, which are enabled by default, improve the access point's ability to understand the capabilities of Cisco Aironet client devices associated with the access point. Disabling Aironet extensions sometimes improves the interoperability between the access point and non-Cisco client devices. Non-Cisco client devices might have difficulty communicating with repeater access points and the root access point to which repeaters are associated.

**Note**

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Because access points create a virtual interface for each radio interface, repeater access points associate to the root access point twice: once for the actual interface and once for the virtual interface.

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**Note**

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You cannot configure multiple VLANs on repeater access points. Repeater access points support only the native VLAN.

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Figure 18-1 shows an access point acting as a repeater.

*Figure 18-1 Access Point as a Repeater*



## Configuring a Repeater Access Point

This section provides instructions for setting up an access point as a repeater and includes these sections:

- [Default Configuration, page 18-4](#)
- [Guidelines for Repeaters, page 18-4](#)
- [Setting Up a Repeater, page 18-4](#)
- [Verifying Repeater Operation, page 18-5](#)
- [Setting Up a Repeater As a LEAP Client, page 18-6](#)
- [Setting Up a Repeater As a WPA Client, page 18-7](#)

## Default Configuration

Access points are configured as root units by default. [Table 18-1](#) shows the default values for settings that control the access point's role in the wireless LAN.

**Table 18-1 Default Settings for Role in Wireless LAN**

Feature	Default Setting
Station role	Root
Parent	none
Extensions	Aironet

## Guidelines for Repeaters

Follow these guidelines when configuring repeater access points:

- Use repeaters to serve client devices that do not require high throughput. Repeaters extend the coverage area of your wireless LAN, but they drastically reduce throughput.
- Use repeaters when most if not all client devices that associate with the repeaters are Cisco Aironet clients. Non-Cisco client devices sometimes have trouble communicating with repeater access points.
- Make sure that the data rates configured on the repeater access point match the data rates on the parent access point. For instructions on configuring data rates, see the [“Configuring Radio Data Rates” section on page 6-4](#).
- Repeater access points support only the native VLAN. You cannot configure multiple VLANs on a repeater access point.



### Note

Repeater access points running Cisco IOS software cannot associate to parent access points that do not run Cisco IOS software.



### Note

Repeater access points do not support wireless domain services (WDS). Do not configure a repeater access point as a WDS candidate, and do not configure a WDS access point to fall back to repeater mode in case of Ethernet failure.

## Setting Up a Repeater

Beginning in Privileged Exec mode, follow these steps to configure an access point as a repeater:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>interface dot11radio { 0   1 }</b>	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.

	Command	Purpose
Step 3	<code>ssid ssid-string</code>	Create the SSID that the repeater uses to associate to a root access point; in the next step designate this SSID as an infrastructure SSID. If you created an infrastructure SSID on the root access point, create the same SSID on the repeater, also.
Step 4	<code>infrastructure-ssid [optional]</code>	Designate the SSID as an infrastructure SSID. The repeater uses this SSID to associate to the root access point. Infrastructure devices must associate to the repeater access point using this SSID unless you also enter the <b>optional</b> keyword.
Step 5	<code>exit</code>	Exit SSID configuration mode and return to radio interface configuration mode.
Step 6	<code>station-role repeater</code>	Set the access point's role in the wireless LAN to repeater.
Step 7	<code>dot11 extensions aironet</code>	If Aironet extensions are disabled, enable Aironet extensions.
Step 8	<code>parent {1-4} mac-address [timeout]</code>	(Optional) Enter the MAC address for the access point to which the repeater should associate. <ul style="list-style-type: none"> <li>You can enter MAC addresses for up to four parent access points. The repeater attempts to associate to MAC address 1 first; if that access point does not respond, the repeater tries the next access point in its parent list.</li> <li>(Optional) You can also enter a timeout value in seconds that determines how long the repeater attempts to associate to a parent access point before trying the next parent in the list. Enter a timeout value from 0 to 65535 seconds.</li> </ul>
Step 9	<code>end</code>	Return to privileged EXEC mode.
Step 10	<code>copy running-config startup-config</code>	(Optional) Save your entries in the configuration file.

This example shows how to set up a repeater access point with three potential parents:

```
AP# configure terminal
AP(config)# interface dot11radio 0
AP(config-if)# ssid chicago
AP(config-ssid)# infrastructure-ssid
AP(config-ssid)# exit
AP(config-if)# station-role repeater
AP(config-if)# dot11 extensions aironet
AP(config-if)# parent 1 0987.1234.h345 900
AP(config-if)# parent 2 7809.b123.c345 900
AP(config-if)# parent 3 6543.a456.7421 900
AP(config-if)# end
```

## Verifying Repeater Operation

After you set up the repeater, check the LEDs on top of the repeater access point. If your repeater is functioning correctly, the LEDs on the repeater and the root access point to which it is associated behave like this:

- The status LED on the root access point is steady green, indicating that at least one client device is associated with it (in this case, the repeater).

- The status LED on the repeater access point is steady green when it is associated with the root access point and the repeater has client devices associated to it. The repeater's status LED flashes (steady green for 7/8 of a second and off for 1/8 of a second) when it is associated with the root access point but the repeater has no client devices associated to it.

The repeater access point should also appear as associated with the root access point in the root access point's Association Table.

## Setting Up a Repeater As a LEAP Client

You can set up a repeater access point to authenticate to your network like other wireless client devices. After you provide a network username and password for the repeater access point, it authenticates to your network using LEAP, Cisco's wireless authentication method, and receives and uses dynamic WEP keys.

Setting up a repeater as a LEAP client requires three major steps:

- Create an authentication username and password for the repeater on your authentication server.
- Configure LEAP authentication on the root access point to which the repeater associates. The access point to which the repeater associates is called the parent access point. See [Chapter 10, "Configuring Authentication Types,"](#) for instructions on setting up authentication.



**Note** On the repeater access point, you must enable the same cipher suite or WEP encryption method and WEP features that are enabled on the parent access point.

- Configure the repeater to act as a LEAP client. Beginning in Privileged Exec mode, follow these instructions to set up the repeater as a LEAP client:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>interface dot11radio { 0   1 }</b>	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
Step 3	<b>ssid <i>ssid-string</i></b>	Create an SSID and enter SSID configuration mode for the new SSID. The SSID can consist of up to 32 alphanumeric characters, but they should not include spaces. SSIDs are case-sensitive.
Step 4	<b>authentication network-eap <i>list-name</i></b>	Enable LEAP authentication on the repeater so that LEAP-enabled client devices can authenticate through the repeater. For <i>list-name</i> , specify the list name you want to use for EAP authentication. You define list names for EAP and for MAC addresses using the <b>aaa authentication login</b> command. These lists define the authentication methods activated when a user logs in and indirectly identify the location where the authentication information is stored.
Step 5	<b>authentication client username <i>username</i> password <i>password</i></b>	Configure the username and password that the repeater uses when it performs LEAP authentication. This username and password must match the username and password that you set up for the repeater on the authentication server.

	Command	Purpose
Step 6	<b>infrastructure ssid [optional]</b>	(Optional) Designate the SSID as the SSID that other access points and workgroup bridges use to associate to this access point. If you do not designate an SSID as the infrastructure SSID, infrastructure devices can associate to the access point using any SSID. If you designate an SSID as the infrastructure SSID, infrastructure devices must associate to the access point using that SSID unless you also enter the <b>optional</b> keyword.
Step 7	<b>end</b>	Return to privileged EXEC mode.
Step 8	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

## Setting Up a Repeater As a WPA Client

WPA key management uses a combination of encryption methods to protect communication between client devices and the access point. You can set up a repeater access point to authenticate to your network like other WPA-enabled client devices.

Beginning in Privileged Exec mode, follow these steps to set up the repeater as a WPA client:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>interface dot11radio { 0   1 }</b>	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
Step 3	<b>ssid <i>ssid-string</i></b>	Create an SSID and enter SSID configuration mode for the new SSID. The SSID can consist of up to 32 alphanumeric characters. SSIDs are case sensitive.
Step 4	<b>authentication open</b>	Enable open authentication for the SSID.
Step 5	<b>authentication key-management wpa</b>	Enable WPA authenticated key management for the SSID.
Step 6	<b>infrastructure ssid</b>	Designate the SSID as the SSID that the repeater uses to associate to other access points.
Step 7	<b>wpa-psk { hex   ascii } [ 0   7 ] <i>encryption-key</i></b>	Enter a pre-shared key for the repeater.  Enter the key using either hexadecimal or ASCII characters. If you use hexadecimal, you must enter 64 hexadecimal characters to complete the 256-bit key. If you use ASCII, you must enter from 8 to 63 ASCII characters, and the access point expands the key for you.
Step 8	<b>end</b>	Return to privileged EXEC mode.
Step 9	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

# Understanding Hot Standby

Hot Standby mode designates an access point as a backup for another access point. The standby access point is placed near the access point it monitors, configured exactly the same as the monitored access point. The standby access point associates with the monitored access point as a client and sends IAPP queries to the monitored access point through both the Ethernet and the radio ports. If the monitored access point fails to respond, the standby access point comes online and takes the monitored access point's place in the network.

Except for the IP address, the standby access point's settings should be identical to the settings on the monitored access point. If the monitored access point goes offline and the standby access point takes its place in the network, matching settings ensures that client devices can switch easily to the standby access point.

The standby access point monitors another access point in a device-to-device relationship, not in an interface-to-interface relationship. For example, you cannot configure the standby access point's 5-GHz radio to monitor the 5-GHz radio in access point alpha and the standby's 2.4-GHz radio to monitor the 2.4-GHz radio in access point bravo. You also cannot configure one radio in a dual-radio access point as a standby radio and configure the other radio to serve client devices.

Hot standby mode is disabled by default.

**Note**

If the monitored access point malfunctions and the standby access point takes its place, repeat the hot standby setup on the standby access point when you repair or replace the monitored access point. The standby access point does not revert to standby mode automatically.

## Configuring a Hot Standby Access Point

When you set up the standby access point, you must enter the MAC address of the access point that the standby unit will monitor. Record the MAC address of the monitored access point before you configure the standby access point.

The standby access point also must duplicate several key settings on the monitored access point. These settings are:

- Primary SSID (as well as additional SSIDs configured on the monitored access point)
- Default IP Subnet Mask
- Default Gateway
- Data rates
- WEP settings
- Authentication types and authentication servers

Check the monitored access point and record these settings before you set up the standby access point.

**Note**

Wireless client devices associated to the standby access point lose their connections during the hot standby setup process.

**Tip**

To quickly duplicate the monitored access point's settings on the standby access point, save the monitored access point configuration and load it on the standby access point. See the [“Working with Configuration Files”](#) section on page 19-8 for instructions on uploading and downloading configuration files.

Beginning in Privileged Exec mode, follow these steps to enable hot standby mode on an access point:

	<b>Command</b>	<b>Purpose</b>
<b>Step 1</b>	<b>configure terminal</b>	Enter global configuration mode.
<b>Step 2</b>	<b>iapp standby</b> <i>mac-address</i>	Puts the access point into standby mode and specifies the MAC address of radio on the monitored access point.  <b>Note</b> When you configure a 1200 Series access point with two radios to monitor a 1200 Series access point with two radios, you must enter the MAC addresses of both the monitored 2.4-GHz and 5-GHz radios. Enter the 2.4-GHz radio MAC address first, followed by the 5-GHz radio MAC address.
<b>Step 3</b>	<b>interface dot11radio</b> { <b>0</b>   <b>1</b> }	Enter interface configuration mode for the radio interface. The 2.4-GHz radio is radio 0, and the 5-GHz radio is radio 1.
<b>Step 4</b>	<b>ssid</b> <i>ssid-string</i>	Create the SSID that the standby access point uses to associate to the monitored access point; in the next step designate this SSID as an infrastructure SSID. If you created an infrastructure SSID on the monitored access point, create the same SSID on the standby access point, also.
<b>Step 5</b>	<b>infrastructure-ssid</b> [ <b>optional</b> ]	Designate the SSID as an infrastructure SSID. The standby uses this SSID to associate to the monitored access point. If the standby access point takes the place of the monitored access point, infrastructure devices must associate to the standby access point using this SSID unless you also enter the <b>optional</b> keyword.
<b>Step 6</b>	<b>authentication client username</b> <i>username</i> <b>password</b> <i>password</i>	If the monitored access point is configured to require LEAP authentication, configure the username and password that the standby access point uses when it performs LEAP authentication. This username and password must match the username and password that you set up for the standby access point on the authentication server.
<b>Step 7</b>	<b>exit</b>	Exit SSID configuration mode and return to radio interface configuration mode.
<b>Step 8</b>	<b>iapp standby poll-frequency</b> <i>seconds</i>	Sets the number of seconds between queries that the standby access point sends to the monitored access point's radio and Ethernet ports. The default poll frequency is 2 seconds.

	Command	Purpose
Step 9	<b>iapp standby timeout</b> <i>seconds</i>	Sets the number of seconds the standby access point waits for a response from the monitored access point before it assumes that the monitored access point has malfunctioned. The default timeout is 20 seconds.  <b>Note</b> You should increase the standby timeout setting if the bridged path between the standby and monitored access points can be lost for periods greater than 20 seconds (during spanning tree recalculation, for example).
Step 10	<b>iapp standby primary-shutdown</b>	(Optional) Configures the standby access point to send a Dumb Device Protocol (DDP) message to the monitored access point to disable the radios of the monitored access point when the standby unit becomes active. This feature prevents client devices that are associated to the monitored access point from remaining associated to the malfunctioning unit.
Step 11	<b>show iapp standby-parms</b>	Verify your entries. If the access point is in standby mode, this command displays the standby parameters, including the MAC address of the monitored access point and the poll-frequency and timeout values. If the access point is not in standby mode, <i>no iapp standby mac-address</i> appears.
Step 12	<b>end</b>	Return to privileged EXEC mode.
Step 13	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

After you enable standby mode, configure the settings that you recorded from the monitored access point to match on the standby access point.

## Verifying Standby Operation

Use this command to check the status of the standby access point:

**show iapp standby-status**

This command displays the status of the standby access point. [Table 18-2](#) lists the standby status messages that can appear.

**Table 18-2 Standby Status Messages**

Message	Description
IAPP Standby is Disabled	The access point is not configured for standby mode.
IAPP—AP is in standby mode	The access point is in standby mode.
IAPP—AP is operating in active mode	The standby access point has taken over for the monitored access point and is functioning as a root access point.
IAPP—AP is operating in repeater mode	The standby access point has taken over for the monitored access point and is functioning as a repeater access point.
Standby status: Initializing	The standby access point is initializing link tests with the monitored access point.

**Table 18-2 Standby Status Messages (continued)**

Message	Description
Standby status: Takeover	The standby access point has transitioned to active mode.
Standby status: Stopped	Standby mode has been stopped by a configuration command.
Standby status: Ethernet Linktest Failed	An Ethernet link test failed from the standby access point to the monitored access point.
Standby status: Radio Linktest Failed	A radio link test failed from the standby access point to the monitored access point.
Standby status: Standby Error	An undefined error occurred.
Standby State: Init	The standby access point is initializing link tests with the monitored access point.
Standby State: Running	The standby access point is operating in standby mode and is running link tests to the monitored access point.
Standby State: Stopped	Standby mode has been stopped by a configuration command.
Standby State: Not Running	The access point is not in standby mode.

Use this command to check the standby configuration:

**show iapp standby-parms**

This command displays the MAC address of the standby access point, the standby timeout, and the poll-frequency values. If no standby access point is configured, this message appears:

```
no iapp standby mac-address
```

If a standby access point takes over for the monitored access point, you can use the **show iapp statistics** command to help determine the reason that the standby access point took over.

## Understanding Workgroup Bridge Mode

You can configure 1100 series access points as workgroup bridges. In workgroup bridge mode, the unit associates to another access point as a client and provides a network connection for the devices connected to its Ethernet port. For example, if you need to provide wireless connectivity for a group of network printers, you can connect the printers to a hub, connect the hub to the access point Ethernet port, and configure the access point as a workgroup bridge. The workgroup bridge associates to an access point on your network.



**Caution**

An access point in workgroup bridge mode can introduce a bridge loop if you connect its Ethernet port to your wired LAN. To avoid a bridge loop on your network, disconnect the workgroup bridge from your wired LAN before or soon after you configure it as a workgroup bridge.



**Note**

An access point in workgroup bridge mode can associate only to a Cisco Aironet access point or bridge.

Figure 18-2 shows an access point in workgroup bridge mode.

*Figure 18-2 Access Point in Workgroup Bridge Mode*

## Treating Workgroup Bridges as Infrastructure Devices or as Client Devices

The access point to which a workgroup bridge associates can treat the workgroup bridge as an infrastructure device or as a simple client device. By default, access points and bridges treat workgroup bridges as client devices.

For increased reliability, you can configure access points and bridges to treat workgroup bridges not as client devices but as infrastructure devices, like access points or bridges. Treating a workgroup bridge as an infrastructure device means that the access point reliably delivers multicast packets, including Address Resolution Protocol (ARP) packets, to the workgroup bridge. You use the **infrastructure-client** configuration interface command to configure access points and bridges to treat workgroup bridges as infrastructure devices.

Configuring access points and bridges to treat a workgroup bridge as a client device allows more workgroup bridges to associate to the same access point, or to associate using an SSID that is not an infrastructure SSID. The performance cost of reliable multicast delivery—duplication of each multicast packet sent to each workgroup bridge—limits the number of infrastructure devices, including workgroup bridges, that can associate to an access point or bridge. To increase beyond 20 the number of workgroup bridges that can associate to the access point, the access point must reduce the delivery reliability of

multicast packets to workgroup bridges. With reduced reliability, the access point cannot confirm whether multicast packets reach the intended workgroup bridge, so workgroup bridges at the edge of the access point's coverage area might lose IP connectivity. When you treat workgroup bridges as client devices, you increase performance but reduce reliability. You use the **no infrastructure client** configuration interface command to configure access points and bridges to treat workgroup bridges as simple client devices. This is the default setting.

You should use a workgroup bridge as an infrastructure device if the devices connected to the workgroup bridge require network reliability equivalent to that of an access point or a bridge. You should use a workgroup bridge as a client device if these conditions are true:

- More than 20 workgroup bridges associate to the same access point or bridge
- The workgroup bridge associates using an SSID that is not an infrastructure SSID
- The workgroup bridge is mobile

## Configuring a Workgroup Bridge for Roaming

If your workgroup bridge is mobile, you can configure it to scan for a better radio connection to a parent access point or bridge. Use this command to configure the workgroup bridge as a mobile station:

```
ap(config)# mobile station
```

When you enable this setting, the workgroup bridge scans for a new parent association when it encounters a poor Received Signal Strength Indicator (RSSI), excessive radio interference, or a high frame-loss percentage. Using these criteria, a workgroup bridge configured as a mobile station searches for a new parent association and roams to a new parent before it loses its current association. When the mobile station setting is disabled (the default setting) the workgroup bridge does not search for a new association until it loses its current association.

## Configuring a Client VLAN

If the devices connected to the workgroup bridge's Ethernet port should all be assigned to a particular VLAN, you can configure a VLAN for the connected devices. Enter this command on the workgroup bridge:

```
ap(config)# workgroup-bridge client-vlan vlan-id
```

All the devices connected to the workgroup bridge's Ethernet port are assigned to that VLAN.

## Configuring Workgroup Bridge Mode

Beginning in privileged EXEC mode, follow these steps to configure an 1100 series access point as a workgroup bridge:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>dot11 ssid</b> <i>ssid-string</i>	Create a global SSID.

	Command	Purpose
Step 3	<b>authentication client</b> <b>username</b> <i>username</i> <b>password</b> <i>password</i>	(Optional) If the parent access point is configured to require LEAP authentication, configure the username and password that the workgroup bridge uses when it performs LEAP authentication. This username and password must match the username and password that you set up for the workgroup bridge on the authentication server.
Step 4	<b>exit</b>	Exit the dot11 SSID configuration mode and return to the global configuration mode.
Step 5	<b>interface dot11radio 0</b>	Enter interface configuration mode for the radio interface.
Step 6	<b>station-role workgroup-bridge</b>	Set the access point role to workgroup bridge.
Step 7	<b>ssid</b> <i>ssid-string</i>	Create the SSID that the workgroup bridge uses to associate to a parent access point or bridge.
Step 8	<b>infrastructure-ssid</b>	(Optional) Designate the SSID as an infrastructure SSID.
Step 9	<b>exit</b>	Exit radio configuration mode and return to global configuration mode.
Step 10	<b>workgroup-bridge client-vlan</b> <i>vlan-id</i>	(Optional) Specify the VLAN to which the devices that are connected to the workgroup bridge's Ethernet port are assigned.
Step 11	<b>mobile station</b>	(Optional) Configure the workgroup bridge as a mobile station. When you enable this setting, the workgroup bridge scans for a new parent association when it encounters a poor Received Signal Strength Indicator (RSSI), excessive radio interference, or a high frame-loss percentage. When this setting is disabled (the default setting) the workgroup bridge does not search for a new association until it loses its current association.
Step 12	<b>end</b>	Return to privileged EXEC mode.
Step 13	<b>copy running-config</b> <b>startup-config</b>	(Optional) Save your entries in the configuration file.

This example shows how to configure an 1100 series access point as a workgroup bridge. In this example, the workgroup bridge uses the configured username and password to perform LEAP authentication, and the devices attached to its Ethernet port are assigned to VLAN 22:

```
AP# configure terminal
AP(config)# dot11 ssid infra
AP(config-ssid)# authentication client username wgb1 password cisco123
AP(config-ssid)# exit
AP(config)# interface dot11radio 0
AP(config-if)# station-role workgroup-bridge
AP(config-if)# ssid infra
AP(config-if)# infrastructure-ssid
AP(config-if)# exit
AP(config)# workgroup-bridge client-vlan 22
AP(config)# end
```