

FlexConnect

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FlexConnect Overview

FlexConnect is a wireless solution for branch office and remote office deployments. It enables customers to configure and control access points (AP) in a branch or remote office from the corporate office through a wide area network (WAN) link without deploying a controller in each office. The FlexConnect access points can switch client data traffic locally and perform client authentication locally when their connection to the controller is lost. When they are connected to the controller, they can also send traffic back to the controller. In the connected mode, the FlexConnect access point can also perform local authentication.

A FlexConnect AP can, on a per-WLAN basis, either tunnel client data in CAPWAP to the controller (called Central Switching), or have client data egress at the AP's LAN port (called Local Switching). With Locally Switched WLANs, the AP can tag client traffic in separate VLANs, to segregate the traffic from its management interface.

For a Locally Switched WLAN, the client authentication can either be handled by the controller (Central Authentication) or by the AP (Local Authentication).

If a FlexConnect AP should lose its CAPWAP connection to its controller, it goes into Standalone mode. In Standalone mode, any Centrally Switched WLANs are down, but Locally Switched WLANs remain operational. If the Locally Switched WLAN is configured for Central Authentication, the associated clients remain connected when the AP goes into Standalone mode, but will be unable to form new associations. A Locally Switched WLAN that uses Local Authentication remains operational whether the AP is in Standalone or Connected mode.

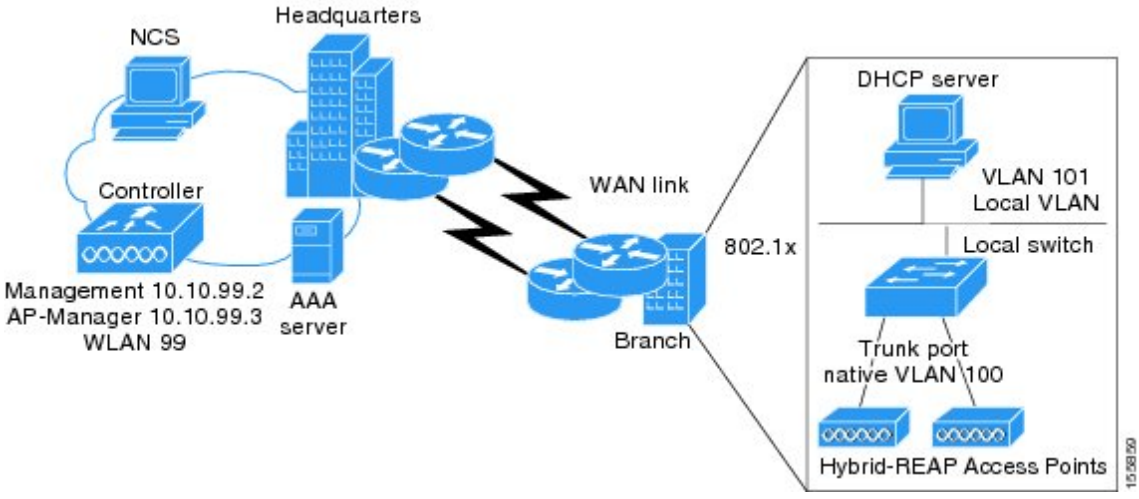
Note Beginning with Cisco Release 8.2.100.0, FlexConnect is partially supported on the Cisco Aironet 1830 Series and 1850 Series access points (APs). If these APs are part of a Cisco Mobility Express network, you can configure the supported FlexConnect features on the APs using the Cisco Mobility Express software.

The following FlexConnect features are currently supported on the Cisco Aironet 1830 Series and 1850 Series APs:

- Standalone client management
- WLAN-VLAN Mapping
- Web authentication
- AAA override ACL (L3 ACL)
- L2 ACL
- AAA override VLAN
- Central authentication (PSK and 802.1x)
- Local authentication
- QoS
- 802.11r
- OKC
- Upgrade, downgrade, and smart upgrade

Figure 1: FlexConnect Deployment

The figure below shows a typical FlexConnect deployment.



The controller software has a more robust fault tolerance methodology to FlexConnect access points. In previous releases, whenever a FlexConnect access point disassociates from a controller, it moves to the standalone mode. The clients that are centrally switched are disassociated. However, the FlexConnect access point continues to serve locally switched clients. When the FlexConnect access point rejoins the controller

(or a standby controller), all clients are disconnected and are authenticated again. This functionality has been enhanced and the connection between the clients and the FlexConnect access points are maintained intact and the clients experience seamless connectivity. When both the access point and the controller have the same configuration, the connection between the clients and APs is maintained.

After the client connection has been established, the controller does not restore the original attributes of the client. The client username, current rate and supported rates, and listen interval values are reset to the default values only after the session timer expires.

There is no deployment restriction on the number of FlexConnect access points per location. Multiple FlexConnect groups can be defined in a single location.

The controller can send multicast packets in the form of unicast or multicast packets to the access point. In FlexConnect mode, the access point can receive multicast packets only in unicast form.

FlexConnect access points support a 1-1 network address translation (NAT) configuration. They also support port address translation (PAT) for all features except true multicast. Multicast is supported across NAT boundaries when configured using the Unicast option. FlexConnect access points also support a many-to-one NAT/PAT boundary, except when you want true multicast to operate for all centrally switched WLANs.



Note Although NAT and PAT are supported for FlexConnect access points, they are not supported on the corresponding controller. Cisco does not support configurations in which the controller is behind a NAT/PAT boundary.

VPN and PPTP are supported for locally switched traffic if these security types are accessible locally at the access point.

FlexConnect access points support multiple SSIDs.

Workgroup bridges and Universal Workgroup bridges are supported on FlexConnect access points for locally switched clients.

FlexConnect supports IPv6 clients by bridging the traffic to local VLAN, similar to IPv4 operation. FlexConnect supports Client Mobility for a group of up to 100 access points.

When AP is changed from local mode to FlexConnect mode, the AP does not reboot. However, when the AP is changed from FlexConnect mode to local mode, the AP reboots and displays the following error message:

```
Warning: Changing AP Mode will reboot the AP and will rejoin the controller
after a few minutes. Are you sure you want to continue?
```

FlexConnect Authentication Process

When an access point boots up, it looks for a controller. If it finds one, it joins the controller, downloads the latest software image and configuration from the controller, and initializes the radio. It saves the downloaded configuration in nonvolatile memory for use in standalone mode.



Note Once the access point is rebooted after downloading the latest controller software, it must be converted to the FlexConnect mode.

Note 802.1X is not supported on the AUX port for Cisco 2700 series APs.

A FlexConnect access point can learn the controller IP address in one of these ways:

- If the access point has been assigned an IP address from a DHCP server, it can discover a controller through the regular CAPWAP or LWAPP discovery process.

Note OTAP is not supported.

- If the access point has been assigned a static IP address, it can discover a controller through any of the discovery process methods except DHCP option 43. If the access point cannot discover a controller through Layer 3 broadcast, we recommend DNS resolution. With DNS, any access point with a static IP address that knows of a DNS server can find at least one controller.
- If you want the access point to discover a controller from a remote network where CAPWAP or LWAPP discovery mechanisms are not available, you can use priming. This method enables you to specify (through the access point CLI) the controller to which the access point is to connect.

Note For more information about how access points find controllers, see the controller deployment guide at: http://www.cisco.com/c/en/us/td/docs/wireless/technology/controller/deployment/guide/dep.html.

When a FlexConnect access point can reach the controller (referred to as the connected mode), the controller assists in client authentication. When a FlexConnect access point cannot access the controller, the access point enters the standalone mode and authenticates clients by itself.

Note The LEDs on the access point change as the device enters different FlexConnect modes. See the hardware installation guide for your access point for information on LED patterns.

When a client associates to a FlexConnect access point, the access point sends all authentication messages to the controller and either switches the client data packets locally (locally switched) or sends them to the controller (centrally switched), depending on the WLAN configuration. With respect to client authentication (open, shared, EAP, web authentication, and NAC) and data packets, the WLAN can be in any one of the following states depending on the configuration and state of controller connectivity:

- central authentication, central switching—In this state, the controller handles client authentication, and all client data is tunneled back to the controller. This state is valid only in connected mode.
- local authentication, local switching—In this state, the FlexConnect access point handles client authentication and switches client data packets locally. This state is valid in standalone mode and connected mode.

  In connected mode, the access point provides minimal information about the locally authenticated client to the controller. The following information is not available to the controller:

- Policy type
- Access VLAN
- VLAN name
- Supported rates
- Encryption cipher

  Local authentication is useful where you cannot maintain a remote office setup of a minimum bandwidth of 128 kbps with the round-trip latency no greater than 100 ms and the maximum transmission unit (MTU) no smaller than 576 bytes. In local authentication, the authentication capabilities are present in the access point itself. Local authentication reduces the latency requirements of the branch office.

- Notes about local authentication are as follows:
  - Guest authentication cannot be done on a FlexConnect local authentication-enabled WLAN.
  - Local RADIUS on the controller is not supported.
  - Once the client has been authenticated, roaming is only supported after the controller and the other FlexConnect access points in the group are updated with the client information.

- authentication down, switch down—In this state, the WLAN disassociates existing clients and stops sending beacon and probe requests. This state is valid in both standalone mode and connected mode.
- authentication down, local switching—In this state, the WLAN rejects any new clients trying to authenticate, but it continues sending beacon and probe responses to keep existing clients alive. This state is valid only in standalone mode.

When a FlexConnect access point enters standalone mode, WLANs that are configured for open, shared, WPA-PSK, or WPA2-PSK authentication enter the “local authentication, local switching” state and continue new client authentications. his configuration is also correct for WLANs that are configured for 802.1X, WPA-802.1X, WPA2-802.1X, or Cisco Centralized Key Management, but these authentication types require that an external RADIUS server be configured. You can also configure a local RADIUS server on a FlexConnect group to support 802.1X in a standalone mode or with local authentication.

Other WLANs enter either the “authentication down, switching down” state (if the WLAN was configured for central switching) or the “authentication down, local switching” state (if the WLAN was configured for local switching).

When FlexConnect access points are connected to the controller (rather than in standalone mode), the controller uses its primary RADIUS servers and accesses them in the order specified on the RADIUS Authentication Servers page or in the **config radius auth add** CLI command (unless the server order is overridden for a particular WLAN). However, to support 802.1X EAP authentication, FlexConnect access points in standalone mode need to have their own backup RADIUS server to authenticate clients.



Note A controller does not use a backup RADIUS server. The controller uses the backup RADIUS server in local authentication mode.

You can configure a backup RADIUS server for individual FlexConnect access points in standalone mode by using the controller CLI or for groups of FlexConnect access points in standalone mode by using either

the GUI or CLI. A backup server configured for an individual access point overrides the backup RADIUS server configuration for a FlexConnect.

When web-authentication is used on FlexConnect access points at a remote site, the clients get the IP address from the remote local subnet. To resolve the initial URL request, the DNS is accessible through the subnet's default gateway. In order for the controller to intercept and redirect the DNS query return packets, these packets must reach the controller at the data center through a CAPWAP connection. During the web-authentication process, the FlexConnect access points allows only DNS and DHCP messages; the access points forward the DNS reply messages to the controller before web-authentication for the client is complete. After web-authentication for the client is complete, all the traffic is switched locally.

When a FlexConnect access point enters into a standalone mode, the following occurs:

- The access point checks whether it is able to reach the default gateway via ARP. If so, it will continue to try and reach the controller.

If the access point fails to establish the ARP, the following occurs:

- The access point attempts to discover for five times and if it still cannot find the controller, it tries to renew the DHCP on the ethernet interface to get a new DHCP IP.
- The access point will retry for five times, and if that fails, the access point will renew the IP address of the interface again, this will happen for three attempts.
- If the three attempts fail, the access point will fall back to the static IP and will reboot (only if the access point is configured with a static IP).
- Reboot is done to remove the possibility of any unknown error the access point configuration.

Once the access point reestablishes a connection with the controller, it disassociates all clients, applies new configuration information from the controller, and allows client connectivity again.

FlexConnect Switching Modes

FlexConnect APs are capable of supporting the following switching modes concurrently, on a per-WLAN basis:

- **Local Switched**: Locally-switched WLANs map wireless user traffic to discrete VLANs via 802.1Q trunking, either to an adjacent router or switch. If so desired, one or more WLANs can be mapped to the same local 802.1Q VLAN.

  A branch user, who is associated to a local switched WLAN, has their traffic forwarded by the on-site router. Traffic destined off-site (to the central site) is forwarded as standard IP packets by the branch router. All AP control/management-related traffic is sent to the centralized controller separately via Control and Provisioning of Wireless Access Points protocol (CAPWAP).

- **Central Switched**: Central switched WLANs tunnel both the wireless user traffic and all control traffic via CAPWAP to the centralized controller where the user traffic is mapped to a dynamic interface/VLAN on the controller. This is the normal CAPWAP mode of operation.

  The traffic of a branch user, who is associated to a central switched WLAN, is tunneled directly to the centralized controller. If that user needs to communicate with computing resources within the branch (where that client is associated), their data is forwarded as standard IP packets back across the WAN link to the branch location. Depending on the WAN link bandwidth, this might not be desirable behavior.

IP Learning in FlexConnect Local Mode

In FlexConnext local switching scenarios, clients from the same sites may share the same address range, there is a possibility of multiple clients being allocated or registered with the same IP address. The controller receives IP address information from the AP, and if more than one client attempts to use the same IP address, the controller discards the last device trying to register an already-used address as an IP theft event, potentially resulting in client exclusion.

We recommend disabling IP learning in FlexConnect mode using the **config network ip-mac-binding disabled** command to ensure that no device tracking is done for clients, thus preventing the IP theft error.



Note This feature is applicable only for IPv4 addresses.

FlexConnect Operation Modes

FlexConnect APs can operate in the following modes:

- **Connected Mode**: The controller is reachable. In this mode, the FlexConnect AP has CAPWAP connectivity with its controller.
- **Standalone Mode**: The controller is unreachable. The FlexConnect AP has lost or failed to establish CAPWAP connectivity with its controller; for example, when there is a WAN link outage between a branch and its central site.

FlexConnect VLANs and ACLs

You can configure the LAN uplink interface of a FlexConnect AP as either an access port or as a trunk. If you configure the interface \as an access port, then the AP's management traffic and all client traffic, whether centrally or locally switched, will be in the same VLAN. For security and reliability reasons, we recommend that you segregate the client traffic from the management VLAN, and so to configure the AP's switchport as a trunk, with separately tagged VLANs for locally switched client traffic.



Note Do not confuse VLAN tagging for FlexConnect client VLANs with the management interface VLAN tagging feature, which is enabled under the **Advanced** tab for the AP configuration. Management interface VLAN tagging is configured independently of the AP's mode, and is not needed in order to tag client VLANs.

Central DHCP Server for FlexConnect

Ordinarily, a FlexConnect local switched WLAN will bridge client DHCP to the local VLAN. If a DHCP server or relay is not available on local VLANs, the Central DHCP Server feature can be used. For more information about configuring this feature, see https://www.cisco.com/c/en/us/support/docs/wireless-mobility/wireless-lan-wlan/211325-FlexConnect-Central-DHCP-Configuration-E.html

Restrictions for Central DHCP Server for FlexConnect

For WLANs with local switching and central DHCP feature enabled, clients with static IP addresses are not allowed. Enabling central DHCP will internally enable DHCP required option.

Guidelines and Restrictions on FlexConnect

- You can deploy a FlexConnect access point with either a static IP address or a DHCP address. In the case of DHCP, a DHCP server must be available locally and must be able to provide the IP address for the access point at bootup.
- FlexConnect supports up to four fragmented packets or a minimum 576-byte maximum transmission unit (MTU) WAN link.
- Round-trip latency must not exceed 300 milliseconds (ms) between the access point and the controller, and CAPWAP control packets must be prioritized over all other traffic. In cases where you cannot achieve the 300 milliseconds round-trip latency, you can configure the access point to perform local authentication.
- Client connections are restored only for locally switched clients that are in the RUN state when the access point moves from standalone mode to connected mode.
- The configuration on the controller must be the same between the time the access point went into standalone mode and the time the access point came back to connected mode. Similarly, if the access point is falling back to a secondary or backup controller, the configuration between the primary and secondary or backup controller must be the same.
- A newly connected access point cannot be booted in FlexConnect mode.
- Cisco FlexConnect mode requires that the client send traffic before learning the client's IPv6 address. Compared to in local mode where the controller learns the IPv6 address by snooping the packets during Neighbor Discovery to update the IPv6 address of the client.
- 802.11r fast transition roaming is not supported on the Cisco Aironet 1830 Series and 1850 Series APs while they operate with local authentication.
- NAC out-of-band integration is supported only on WLANs configured for FlexConnect central switching. It is not supported for use on WLANs configured for FlexConnect local switching.
- The primary and secondary controllers for a FlexConnect access point must have the same configuration. Otherwise, the access point might lose its configuration, and certain features (such as WLAN overrides, VLANs, static channel number, and so on) might not operate correctly. In addition, make sure to duplicate the SSID of the FlexConnect access point and its index number on both controllers.
- When you change the WLAN profile name, then FlexConnect APs (using AP-specific VLAN mapping) will become WLAN-specific. If FlexConnect Groups are properly configured, the VLAN mapping will become Group-specific.
- Do not enable IEEE 802.1X Fast Transition on Flex Local Authentication enabled WLAN, as client association is not supported with Fast Transition 802.1X key management.
- If you configure a FlexConnect access point with a syslog server configured on the access point, after the access point is reloaded and the native VLAN other than 1, at time of initialization, few syslog packets from the access point are tagged with VLAN ID 1. This is a known issue.

- MAC Filtering is not supported on FlexConnect access points in standalone mode. However, MAC Filtering is supported on FlexConnect access points in connected mode with local switching and central authentication. Also, Open SSID, MAC Filtering, and RADIUS NAC for a locally switched WLAN with FlexConnect access points is a valid configuration where MAC is checked by ISE.
- FlexConnect does not support IPv6 ACLs, neighbor discovery caching, and DHCPv6 snooping of IPv6 NDP packets.
- FlexConnect does not display any IPv6 client addresses within the client detail page.
- FlexConnect Access Points with Locally Switched WLAN cannot perform IP Source Guard and prevent ARP spoofing. For Centrally Switched WLAN, the wireless controller performs the IP Source Guard and ARP Spoofing.
- To prevent ARP spoofing attacks in FlexConnect AP with Local Switching, we recommend that you use ARP Inspection.
- When you enable local switching on WLAN for the FlexConnect APs, then APs perform local switching. However, for the APs in local mode, central switching is performed.

  A scenario where the roaming of a client between FlexConnect mode AP and Local mode AP is not supported. The client may not get correct IP address due to VLAN difference after the move. Also, L2 and L3 roaming between FlexConnect mode AP and Local mode AP are not supported.
- Cisco AP in FlexConnect mode loses the VLAN mapping after every reboot.
- For Wi-Fi Protected Access version 2 (WPA2) in FlexConnect standalone mode or local-auth in connected mode or CCKM fast-roaming in connected mode, only Advanced Encryption Standard (AES) is supported.
- For Wi-Fi Protected Access (WPA) in FlexConnect standalone mode or local-auth in connected mode or CCKM fast-roaming in connected mode, only Temporal Key Integrity Protocol (TKIP) is supported.
- WPA2 with TKIP and WPA with AES is not supported in standalone mode, local-auth in connected mode, and CCKM fast-roaming in connected mode.
- Only open and WPA (PSK and 802.1x) authentication is supported on the Cisco Aironet 1830 Series and 1850 Series APs.
- Only 802.11r fast transition roaming is supported on the Cisco Aironet 1830 Series and 1850 Series APs.
- AVC on locally switched WLANs is supported on Second-Generation APs.
- Local authentication fall back is not supported when user is not available in the external RADIUS server.
- For WLAN configured for the FlexConnect AP in the local switching and local authentication, synchronization of dot11 clients information is supported.
- It is not possible for the controller to detect if an AP has dissociated and with that whether the radio is in operational state or non-operational state.

  When a FlexConnect AP dissociates from the controller, the AP can still serve the clients with the radios being operational; however, with all other AP modes, the radios go into non-operational state.
- DNS override is not supported on the Cisco Aironet 1830 Series and 1850 Series APs.
- The Cisco Aironet 1830 Series and 1850 Series APs do not support IPv6. However, a wireless client can pass IPv6 traffic across these APs.

- When you apply a configuration change to a locally switched WLAN, the access point resets the radio, causing associated client devices to disassociate (including the clients that are not associated with the modified WLAN). However, this behavior does not occur if the modified WLAN is centrally switched. We recommend that you modify the configuration only during a maintenance window. This is also applicable when a centrally switched WLAN is changed to a locally switched WLAN.
- ACL override is not supported in TKIP encrypted clients.
- IRCM is not supported in FlexConnect deployments.
- The Cisco Wave 2 APs in FlexConnect mode attempt discovery of the controller 18 times before renewing the DHCP on the Ethernet interface to get a new DHCP IP address. In a non-FlexConnect mode, the Cisco Wave 2 APs attempt discovery five times before renewing the IP address.

Configuring FlexConnect



Note The configuration tasks must be performed in the order in which they are listed.

Configuring the Switch at a Remote Site

Procedure

Step 1 Attach the AP that will be enabled for FlexConnect to a trunk or access port on the switch.

Note
The sample configuration in this procedure shows the FlexConnect AP connected to a trunk port on the switch.

Step 2 See the sample configuration in this procedure to configure the switch to support the FlexConnect AP.

In this sample configuration, the FlexConnect AP is connected to trunk interface FastEthernet 1/0/2 with native VLAN 100. The AP needs IP connectivity on the native VLAN. The remote site has local servers/resources on VLAN 101. A DHCP pool is created in the local switch for both VLANs in the switch. The first DHCP pool (NATIVE) is used by the FlexConnect AP, and the second DHCP pool (LOCAL-SWITCH) is used by the clients when they associate to a WLAN that is locally switched. The bolded text in the sample configuration shows these settings.

A sample local switch configuration is as follows:

```
ip dhcp pool NATIVE
   network 192.168.200.224 255.255.255.224
   default-router 192.168.200.225
   dns-server 192.168.100.167
!
ip dhcp pool LOCAL-SWITCH
   network 192.168.201.224 255.255.255.224
   default-router 192.168.201.225
   dns-server 192.168.100.167
!
```

```
interface GigabitEthernet1/0/2
 description the Access Point port
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 100
 switchport trunk allowed vlan 101
 switchport mode trunk
!
interface Vlan100
 ip address 192.168.200.225 255.255.255.224
!
interface Vlan101
 ip address 192.168.201.226 255.255.255.229
end
!
```

Configuring the Controller for FlexConnect

You can configure the controller for FlexConnect in two environments:

- Centrally switched WLAN
- Locally switched WLAN

The controller configuration for FlexConnect consists of creating centrally switched and locally switched WLANs. This table shows three WLAN scenarios.

Table 1: WLANs Example

WLAN	Security	Authentication	Switching	Interface Mapping (VLAN)
employee	WPA1+WPA2	Central	Central	management (centrally switched VLAN)
employee-local	WPA1+WPA2 (PSK)	Local	Local	101 (locally switched VLAN)
guest-central	Web authentication	Central	Central	management (centrally switched VLAN)
employee -local-auth	WPA1+WPA2	Local	Local	101 (locally switched VLAN)

Configuring the Controller for FlexConnect for a Centrally Switched WLAN Used for Guest Access

Before you begin

You must have created guest user accounts. For more information about creating guest user accounts, see the *Cisco Wireless LAN Controller System Management Guide*.

Procedure

Step 1 Choose **WLANs** to open the **WLANs** page.

Step 2 From the drop-down list, choose **Create New** and click **Go** to open the **WLANs > New page** .

Step 3 From the **Type** drop-down list, choose **WLAN**.

Step 4 In the **Profile Name** text box, enter **guest-central**.

Step 5 In the **WLAN SSID** text box, enter **guest-central**.

Step 6 From the **WLAN ID** drop-down list, choose an ID for the WLAN.

Step 7 Click **Apply**. The **WLANs > Edit** page appears.

Step 8 In the **General** tab, select the **Status** check box to enable the WLAN.

Step 9 In the **Security > Layer 2** tab, choose **None** from the **Layer 2 Security** drop-down list.

Step 10 In the **Security > Layer 3** tab:

a) Choose **None** from the **Layer 3 Security** drop-down list.

b) Choose the **Web Policy** check box.

c) Choose **Authentication**.

If you are using an external web server, you must configure a preauthentication access control list (ACL) on the WLAN for the server and then choose this ACL as the WLAN preauthentication ACL on the Layer 3 tab.

Step 11 Click **Apply**.

Step 12 Click **Save Configuration**.

Configuring the Controller for FlexConnect (GUI)

Procedure

Step 1 Choose **WLANs** to open the WLANs page.

Step 2 From the drop-down list, choose **Create New** and click **Go** to open the **WLANs > New** page.

Step 3 From the **Type** drop-down list, choose **WLAN**.

Step 4 In the **Profile Name** field, enter a unique profile name for the WLAN.

Step 5 In the **WLAN SSID** field, enter a name for the WLAN.

Step 6 From the **WLAN ID** drop-down list, choose the ID number for this WLAN.

Step 7 Click **Apply**.
The **WLANs > Edit** page is displayed.

Step 8 You can configure the controller for FlexConnect in both centrally switched and locally switched WLANs:

Note
Do not enable ip-learn on FlexConnect local switched WLAN. When several sites use similar local subnets or overlapping subnets that are terminated on the same controller, you will see ip-theft false positives. If

ip-theft exclusion is enabled on the controller, the clients might be put in a blocked list or a similar message is displayed to convey the feature behavior.

To configure the controller for FlexConnect in a centrally switched WLAN:

a) In the **General** tab, check the **Status** check box to enable the WLAN.
b) If you have enabled NAC and have created a quarantined VLAN and want to use it for this WLAN, select the interface from the Interface/Interface Group(G) drop-down list in the **General** tab.
c) In the **Security > Layer 2** tab, choose **WPA+WPA2** from the **Layer 2 Security** drop-down list and then set the WPA+WPA2 parameters as required.

To configure the controller for FlexConnect in a locally switched WLAN:

a) In the **General** tab, check the **Status** check box to enable the WLAN.
b) If you have enabled NAC and have created a quarantined VLAN and want to use it for this WLAN, select the interface from the Interface/Interface Group(G) drop-down list in the General tab.
c) In the **Security** > **Layer2** tab, choose **WPA+WPA2** from the **Layer 2 Security** drop-down list and then set the WPA+WPA2 parameters as required.
d) In the **Advanced** tab:

- Check or uncheck the **FlexConnect Local Switching** check box to enable or disable local switching of client data associated with the APs in FlexConnect mode.

  Note
  The guidelines and limitations for this feature are as follows:

  - When you enable local switching, any FlexConnect access point that advertises this WLAN is able to locally switch data packets (instead of tunneling them to the controller).
  - For FlexConnect access points, the interface mapping at the controller for WLANs that is configured for FlexConnect Local Switching is inherited at the access point as the default VLAN tagging. This mapping can be changed per SSID and per FlexConnect access point. Non-FlexConnect access points tunnel all traffic back to the controller, and VLAN tagging is determined by each WLAN's interface mapping.

- Check or uncheck the **FlexConnect Local Auth** check box to enable or disable local authentication for the WLAN.
- Check or uncheck the **Learn Client IP Address** check box to enable or disable the IP address of the client to be learned.
- Check or uncheck the **VLAN based Central Switching** check box to enable or disable central switching on a locally switched WLAN based on AAA overridden VLAN. For more information see https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/FlexConnect_DG.html#pgfId-43615.

  Note
  These are the guidelines and limitations for this feature:

  - VLAN based central switching is not supported by mac filter.
  - Multicast on overridden interfaces is not supported.
  - This feature is available only on a per-WLAN basis, where the WLAN is locally switched.
  - IPv6 ACLs, CAC, NAC, and IPv6 are not supported.

- IPv4 ACLs are supported only with VLAN-based central switching enabled and applicable only to central switching clients on the WLAN.
- This feature is applicable to APs in FlexConnect mode in locally switched WLANs.
- This feature is not applicable to APs in Local mode.
- This feature is not supported on APs in FlexConnect mode in centrally switched WLANs.
- This feature is supported on central authentication only.
- This features is not supported on web authentication security clients.
- Layer 3 roaming for local switching clients is not supported.

- Check or uncheck the **Central DHCP Processing** check box to enable or disable the feature. When you enable this feature, the DHCP packets received from AP are centrally switched to the controller and then forwarded to the corresponding VLAN based on the AP and the SSID.
- Check or uncheck the **Override DNS** check box to enable or disable the overriding of the DNS server address on the interface assigned to the locally switched WLAN. When you override DNS in centrally switched WLANs, the clients get their DNS server IP address from the AP, not from the controller.
- Check or uncheck the **NAT-PAT** check box to enable or disable Network Address Translation (NAT) and Port Address Translation (PAT) on locally switched WLANs. You must enable Central DHCP Processing to enable NAT and PAT.
- Check or uncheck the **Central Assoc** check box to enable or disable client reassociation and security key caching on the controller. The PMIPv6 MAG on AP feature requires that the client reassociation be handled centrally at the controller in large-scale deployments of Cisco APs, to support fast roaming.

  Configuration of central association with local authentication is not supported for the WLAN. After the PMIPv6 tunnel is set up, all data traffic from the PMIPv6 clients are forwarded from the Cisco AP to the local mobility anchor (LMA) in the Generic Routing Encapsulation (GRE) tunnel. If the connectivity between the Cisco AP and the controller is lost, the data traffic for the existing PMIPv6 clients continues to flow until the connectivity between the Cisco AP and the client is lost. When the AP is in stand-alone mode, no new client associations are accepted on the PMIPv6-enabled WLAN.

Step 9 Save the configuration.

Related Topics

Configuring IP-MAC Context Distribution For FlexConnect Local Switching Clients (GUI)

Configuring the Controller for FlexConnect (CLI)

Procedure

Step 1 **config wlan flexconnect local-switching** *wlan_id* **enable**—Configures the WLAN for local switching.

Note

When a WLAN is locally switched (LS), you must use the **config wlan flexconnect learn-ipaddr** *wlan-id* {**enable** | **disable**} command. When the WLAN is centrally switched (CS), you must use the **config wlan learn-ipaddr-cswlan** *wlan-id* {**enable** | **disable**} command.

Step 2 **config wlan flexconnect local-switching** *wlan_id* {**enable** | **disable**}—Configures the WLAN for central switching.

Step 3 **config wlan flexconnect vlan-central-switching** *wlan_id* {**enable** | **disable**}—Configures central switching on a locally switched WLAN based on an AAA overridden VLAN.

The guidelines and limitations for this feature are as follows:

- VLAN based central switching is not supported by mac filter.
- Multicast on overridden interfaces is not supported.
- This feature is available only on a per-WLAN basis, where the WLAN is locally switched.
- IPv6 ACLs, CAC, NAC, and IPv6 are not supported.
- IPv4 ACLs are supported only with VLAN-based central switching enabled and applicable only to central switching clients on the WLAN.
- This feature is applicable to APs in FlexConnect mode in locally switched WLANs.
- This feature is not applicable to APs in Local mode.
- This feature is not supported on APs in FlexConnect mode in centrally switched WLANs.
- This feature is supported on central authentication only.
- This features is not supported on web authentication security clients.
- Layer 3 roaming for local switching clients is not supported.

Additional Reference: https://www.cisco.com/c/en/us/td/docs/wireless/controller/technotes/8-8/FlexConnect_DG.html#pgfId-43615

Step 4 **config wlan flexconnect central-assoc** *wlan-id* {**enable** | **disable**}— Informs the Cisco AP in FlexConnect mode to handle client association and reassociation and security key caching for the clients on the WLAN by the controller. The PMIPv6 MAG on AP feature requires that the client reassociation be handled centrally at the controller in large-scale deployments of Cisco APs, to support fast roaming.

By default, the client association and reassociation and security key caching are handled by the Cisco AP in FlexConnect mode.

Configuration of central association with local authentication is not supported for the WLAN. After the PMIPv6 tunnel is set up, all data traffic from the PMIPv6 clients are forwarded from the Cisco AP to the local mobility anchor (LMA) in the Generic Routing Encapsulation (GRE) tunnel. If the connectivity between the Cisco AP and the controller is lost, the data traffic for the existing PMIPv6 clients continue to flow until the connectivity between the Cisco AP and the client is lost. When the AP is in stand-alone mode, no new client associations are accepted on the PMIPv6 enabled WLAN.

Step 5 Use these commands to get FlexConnect information:

- **show ap config general** *Cisco_AP*—Shows VLAN configurations.
- **show wlan** *wlan_id*—Shows whether the WLAN is locally or centrally switched.
- **show client detail** *client_mac*—Shows whether the client is locally or centrally switched.

Step 6 Use these commands to obtain debug information:

- **debug flexconnect aaa** {**event** | **error**} {**enable** | **disable**}—Enables or disables debugging of FlexConnect backup RADIUS server events or errors.
- **debug flexconnect cckm** {**enable** | **disable**}—Enables or disables debugging of FlexConnect CCKM.
- **debug flexconnect** {**enable** | **disable**}—Enables or disables debugging of FlexConnect Groups.
- **debug pem state** {**enable** | **disable**}—Enables or disables debugging of the policy manager state machine.
- **debug pem events** {**enable** | **disable**}—Enables or disables debugging of policy manager events.

Configuring an Access Point for FlexConnect

Configuring an Access Point for FlexConnect (GUI)

Note For instructions on how to configure Layer 2 ACLs on the AP, see the Configuring Layer 2 Access Control Lists (GUI) section.

Before you begin

Ensure that the access point has been physically added to your network.

Note The AP will reboot when you change the AP behavior from Flexconnect to Local.

Procedure

Step 1 Choose **Wireless** to open the All APs page.

Step 2 Click the name of the desired access point. The **All APs** > > **Details** page appears.

Step 3 From the **AP Mode** drop-down list, choose **FlexConnect** to enable FlexConnect for this access point.

Note
The last parameter in the **Inventory** tab indicates whether the access point can be configured for FlexConnect.

Step 4 Click **Apply** to commit your changes and to cause the access point to reboot.

Step 5 Choose the **FlexConnect** tab to open the **All APs > Details for (FlexConnect)** page.

If the access point belongs to a FlexConnect group, the name of the group appears in the **FlexConnect Name** text box.

Step 6 To configure WLAN VLAN mapping, choose from the following options in the drop-down list:

- **Make AP Specific**

- **Remove AP Specific**

Step 7 Select the **VLAN Support** check box and enter the number of the native VLAN on the remote network (such as 100) in the Native VLAN ID text box.

Note
By default, a VLAN is not enabled on the FlexConnect access point. After FlexConnect is enabled, the access point inherits the VLAN ID associated to the WLAN. This configuration is saved in the access point and received after the successful join response. By default, the native VLAN is 1. One native VLAN must be configured per FlexConnect access point in a VLAN-enabled domain. Otherwise, the access point cannot send and receive packets to and from the controller.

Note
If PMIPv6 MAG on FlexConnect AP is configured, VLAN Support can be checked or unchecked on the FlexConnect AP. If you check the VLAN Support check box, enter the number of the native VLAN on the remote network in the Native VLAN ID text box.

Note
To preserve the VLAN mappings in the access point after an upgrade or downgrade, it is necessary that the access point join is restricted to the controller for which it is primed. That is, no other discoverable controller with a different configuration should be available by other means. Similarly, at the time the access point joins, if it moves across controllers that have different VLAN mappings, the VLAN mappings at the access point may get mismatched.

Step 8 Click **Apply**. The access point temporarily loses its connection to the controller while its Ethernet port is reset.

Step 9 Click the name of the same access point and then click the **FlexConnect** tab.

Step 10 Click **VLAN Mappings** to open the **All APs** > *Access Point Name* > **VLAN Mappings** page.

Step 11 Enter the number of the VLAN from which the clients will get an IP address when doing local switching (VLAN 101, in this example) in the **VLAN ID** text box.

Step 12 To configure Web Authentication ACLs, do the following:

a) Click the **External WebAuthentication ACLs** link to open the ACL mappings page. The ACL Mappings page lists details of WLAN ACL mappings and web policy ACLs.
b) In the **WLAN Id** box, enter the WLAN ID.
c) From the **WebAuth ACL** drop-down list, choose the FlexConnect ACL.

Note
To create a FlexConnect ACL, choose **Wireless > FlexConnect Groups > FlexConnect ACLs**, click **New**, enter the FlexConnect ACL name, and click **Apply**.

d) Click **Add**.
e) Click **Apply**.

Step 13 To map a locally switched WLAN with a WebAuth ACL, follow these steps:

a) In the **WLAN Id** box, enter the WLAN ID.
b) From the **WebAuth ACL** drop-down list, choose the FlexConnect ACL.

Note
To create a FlexConnect ACL, choose **Wireless > FlexConnect Groups > FlexConnect ACLs**, click **New**, enter the FlexConnect ACL name, and click **Apply**.

c) Click **Add**.

Note
The FlexConnect ACLs that are specific to an AP have the highest priority. The FlexConnect ACLs that are specific to WLANs have the lowest priority.

Step 14 From the **WebPolicy ACL** drop-down list, choose a FlexConnect ACL and then click **Add** to configure the FlexConnect ACL as a web policy.

Note
You can configure up to 16 Web Policy ACLs that are specific to an access point.

Step 15 Click **Apply**.

Step 16 Click **Save Configuration**.

Note
Repeat this procedure for any additional access points that need to be configured for FlexConnect at the remote site.

Configuring an Access Point for FlexConnect (CLI)

Note The AP will reboot when you change the AP behavior from Flexconnect to Local.

Note For instructions on how to configure Layer 2 ACLs on the AP, see the Configuring Layer 2 Access Control Lists (CLI) section.

- **config ap mode flexconnect** *Cisco_AP*—Enables FlexConnect for this access point.
- **config ap flexconnect radius auth set** {**primary | secondary**} *ip_address auth_port secret Cisco_AP*—Configures a primary or secondary RADIUS server for a specific FlexConnect access point.

Note Only the Session Timeout RADIUS attribute is supported in standalone mode. All other attributes as well as RADIUS accounting are not supported.

Note To delete a RADIUS server that is configured for a FlexConnect access point, enter the **config ap flexconnect radius auth delete** {**primary | secondary**} *Cisco_AP* command.

- **config ap flexconnect vlan wlan** *wlan_id vlan-id Cisco_AP*—Enables you to assign a VLAN ID to this FlexConnect access point. By default, the access point inherits the VLAN ID associated to the WLAN.
- **config ap flexconnect vlan** {**enable | disable**} *Cisco_AP*—Enables or disables VLAN tagging for this FlexConnect access point. By default, VLAN tagging is not enabled. After VLAN tagging is enabled on

the FlexConnect access point, WLANs that are enabled for local switching inherit the VLAN assigned at the controller.

- **config ap flexconnect vlan native** *vlan-id Cisco_AP*—Enables you to configure a native VLAN for this FlexConnect access point. By default, no VLAN is set as the native VLAN. One native VLAN must be configured per FlexConnect access point (when VLAN tagging is enabled). Make sure the switch port to which the access point is connected has a corresponding native VLAN configured as well. If the FlexConnect access point's native VLAN setting and the upstream switch port native VLAN do not match, the access point cannot transmit packets to and from the controller.



Note To save the VLAN mappings in the access point after an upgrade or downgrade, you should restrict the access point to join the controller for which it is primed. No other discoverable controller with a different configuration should be available by other means. Similarly, at the time the access point joins, if it moves across controllers that have different VLAN mappings, the VLAN mappings at the access point might get mismatched.

- Configure the mapping of a Web-Auth or a Web Passthrough ACL to a WLAN for an access point in FlexConnect mode by entering this command:

  config ap flexconnect web-auth wlan *wlan_id cisco_ap acl_name* {**enable** | **disable**}



Note The FlexConnect ACLs that are specific to an AP have the highest priority. The FlexConnect ACLs that are specific to WLANs have the lowest priority.

- Configure a Web Policy ACL on an AP in FlexConnect mode by entering this command:

  config ap flexconnect web-policy policy acl {**add** | **delete**} *acl_name cisco_ap*



Note You can configure up to 16 Web Policy ACLs that are specific to an access point.

- To configure local split tunneling on a per-AP basis, enter this command:

  config ap local-split {**enable** | **disable**} *wlan-id* **acl** *acl-name ap-name*

- Configure central DHCP on the AP per WLAN by entering this command:

  config ap flexconnect central-dhcp *wlan-id ap-name* {**enable override dns** | **disable** | **delete**}



Note The gratuitous ARP for the gateway is sent by the access point to the client, which obtained an IP address from the central site. This is performed to proxy the gateway by the access point.

Use these commands on the FlexConnect access point to get status information:

- **show flexconnect status**—Shows the status of the FlexConnect access point (connected or standalone).

- **show flexconnect client**—Shows the list of clients associated with this access point and their SSIDs.
- **show flexconnect wlan**—Displays WLAN configuration details.
- **show flexconnect cckm**—Displays CCKM cache entries.
- **show flexconnect dot11r**—Displays 802.11r cache entries.
- **show controller d**{**0** | **1**} **wlan**—Shows running WLAN state.
- **show flexconnect client exclusion-list**—Displays the list of clients which are in the exclusion list of the Wave 2 AP's locally.

Use these commands on the FlexConnect access point to get the mac addresses of the client:

- **show flexconnect client counter vlan-central-switching**—Shows the mac addresses of the vlan centrally switched client and its corresponding centrally and locally switched counters of the packets.
- **show flexconnect client local-switching**—Shows the mac addresses of the locally switched client and its corresponding centrally and locally switched counters of the packets.



Note These commands can be entered on the AP console only. If you enter these commands on the AP console, the commands are not communicated to the controller.

- **debug flexconnect wlan-vlan** {**enable** | **disable**}—Enables or disables debugging of FlexConnect wlan-vlan.

Use the following commands on the Cisco Aironet 1830 Series and 1850 Series FlexConnect APs to get debug information:

- **debug arp [errors|events|packets]**—Shows ARP cache details.
- **debug capwap client flexconnect**—Shows FlexConnect AP configuration and events.
- **debug flexconnect cckm**—Shows FlexConnect payload's CCKM details.
- **debug flexconnect dot11r**—Shows payload's DOT11R events.
- **debug capwap client payload**—Shows payload activities.
- **debug capwap client flexconnect**—Shows management details.
- **debug flexconnect pmk**—Shows payload PMK events.
- **debug flexconnect vlan**—Shows WLAN-VLAN mapping details.
- **debug flexconnect event**—Shows WCP configuration and state events.
- **debug authentication interface** *interface_name* **radius**—Shows hostapd RADIUS module per interface.
- **debug authentication interface** *interface_name* **dot1x**—Shows hostapd 802.1x module per interface.
- **debug authentication interface** *interface_name* **dot11**—Shows hostapd 802.11 module per interface.
- **debug authentication interface** *interface_name* **driver**—Shows hostapd driver module per interface.
- **debug authentication interface** *interface_name* **wpa**—Shows hostapd WPA module per interface.

- **debug authentication interface** *interface_name* **others**—Shows details of non-modular parts per interface.
- **debug authentication interface** *interface_name* **all**—Shows details of all hostapd parts per interface.

Configuring an Access Point for Local Authentication on a WLAN (GUI)

Procedure

Step 1 Choose **WLANs** to open the WLANs page.

Step 2 Click the ID of the WLAN. The **WLANs > Edit** page appears.

Step 3 Clicked the **Advanced** tab to open the **WLANs** > **Edit (WLAN Name)** page.

Step 4 Select the **FlexConnect Local Switching** check box to enable FlexConnect local switching.

Step 5 Select the **FlexConnect Local Auth** check box to enable FlexConnect local authentication.

Step 6 Click **Apply** to commit your changes.

Configuring an Access Point for Local Authentication on a WLAN (CLI)

Before you begin

Before you begin, you must have enabled local switching on the WLAN where you want to enable local authentication for an access point. For instructions on how to enable local switching on the WLAN, see the Configuring the Controller for FlexConnect (CLI) section.

Procedure

- **config wlan flexconnect ap-auth** *wlan_id* {**enable** | **disable**}—Configures the access point to enable or disable local authentication on a WLAN.
- **show wlan** *wlan-id* —Displays the configuration for the WLAN. If local authentication is enabled, the following information appears:

```
. . .
. . .
Web Based Authentication..................... Disabled
   Web-Passthrough.............................. Disabled
   Conditional Web Redirect..................... Disabled
   Splash-Page Web Redirect..................... Disabled
   Auto Anchor.................................. Disabled
   FlexConnect Local Switching.................. Enabled
   FlexConnect Local Authentication............. Enabled
   FlexConnect Learn IP Address................. Enabled
   Client MFP................................... Optional
   Tkip MIC Countermeasure Hold-down Timer..... 60
Call Snooping................................... Disabled
Roamed Call Re-Anchor Policy.................... Disabled
. . .
. . .
```

- **show flexconnect pmk**—Displays the PMK cache information like the example below:

```
. . .
. . .
Total number of PMK cache entries: 1
HW Address        Life Time(s) BSSID             vlanOverride
6C:88:14:D3:0F:58 27661        38:ED:18:CF:84:6E N/A
. . .
. . .
```

- **show authentication interface** *interface-name* **client**—Displays the client hostapd authentication information for the specified interface.
- **show authentication interface** *interface-name* **configuration**—Displays the authentication configuration information for the specified interface.
- **debug authentication interface** *interface-name* {**all** | **dot11** | **dot1x** | **driver** | **others** | **radius** | **wpa**}—Enables and displays requested hostapd authentication debug details for the specified client interface.
- **debug flexconnect pmk**—Enables and displays hostapd debug information related to FlexConnect PMK.

Configuring FlexConnect Ethernet Fallback

Information About FlexConnect Ethernet Fallback

You can configure an AP to shut down its radio when the Ethernet link is not operational. When the Ethernet link comes back to operational state, you can configure the AP to set its radio back to operational state. This feature is independent of the AP being in connected or standalone mode. When the radios are shut down, the AP does not broadcast the WLANs, and therefore, the clients cannot connect to the AP, either through first association or through roaming.

To prevent radios from flapping when there is flapping of the Ethernet interface, a delay timer, which you can configure, is provided.

Restrictions for FlexConnect Ethernet Fallback

- The carrier delay that you configure on the Ethernet interface shuts down and reloads the interface based on hysteresis. Therefore, the delay that you configure might not be the exact delay before the Ethernet and 802.11 interfaces are shut down and reloaded.

Configuring FlexConnect Ethernet Fallback (GUI)

Procedure

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

The **Global Configuration** page is displayed.

Step 2 In the **FlexConnect Ethernet Fallback** area, select or unselect the **Radio Interface Shutdown** check box.

Step 3 If you select the **Radio Interface Shutdown** check box, enter the delay or the Ethernet interface downtime, in seconds, after which the AP radio interface must be shut down. The default delay is 0 seconds.

Note
You can enter the delay only if you select the **Radio Interface Shutdown** check box.

Step 4 In the **FlexConnect Ethernet Fallback** area, select the **FlexConnect Arp-Cache** check box to add ARP entry for a client with locally switched WLAN on FlexConnect APs.

Note
This step enables the broadcast of ARP requests and the APs respond on behalf of the client.

Step 5 Click **Apply**.

Step 6 Click **Save Configuration**.

Configuring FlexConnect Ethernet Fallback (CLI)

Procedure

Step 1 Configure the radio interface by entering this command:
config flexconnect fallback-radio-shut {**disable** | **enable delay** *time-in-seconds*}

Step 2 See the status of the FlexConnect Ethernet Fallback feature configuration by entering this command:
show flexconnect summary

Step 3 Add proxy ARP with locally switched WLAN on FlexConnect APs by entering this command:
config flexconnect arp-cache.

VideoStream for FlexConnect

Information About VideoStream for FlexConnect

For FlexConnect Access Points, the controller configures both centrally switched WLANs and locally switched WLANs. FlexConnect APs support multicast-to-unicast video traffic in the Local switching mode. In this mode, the WLANs are configured to bridge the data from the client to the wired interface of the FlexConnect APs.

A wireless client subscribes to an IP multicast stream by sending an Internet Group Management Protocol (IGMP) packet or JOIN message. The AP eBridge module receives the IGMP packets.

The IGMP packets are forwarded to the IGMP snooping module for processing.

The IGMP snooping module searches the VideoStream configuration table. If the destination group address is configured as a multicast-to-unicast stream, the module adds a record to the multicast-to-unicast list in the group-tracking table. Otherwise, it adds the record to the multicast-only list. The module tracks the hosts, groups, and group memberships for each radio in the database.

When downstream multicast packets arrive at the AP from the locally switched WLANs, the packet handler searches the mgroup table.

If the VideoStream exists on an AP and the locally switched WLAN has the Multicast Direct feature enabled, and streams are provided for the IP addresses, all the clients on the WLAN for the stream have the Multicast-to-Unicast feature enabled. In all scenarios, only the Multicast Direct feature is enabled.

The VideoStream feature makes the IP multicast stream delivery reliable over air, by converting a multicast frame to a unicast frame over air.

Configuring VideoStream for FlexConnect (GUI)

The Internet Group Management Protocol (IGMP) module analyzes the multicast packets and places packet information into the host and group-tracking databases. On the basis of the controller configuration, the IGMP module admits the video multicast-to-unicast stream.

IGMP snooping and multicast forwarding is enabled on the local switch. The VideoStream group IP address is configured on controller and the index is less than 100. controller has an On/Off switch for the Multicast-to-Unicast feature at the global level, and per WLAN.

Each WLAN maps to a VLAN for a FlexConnect access point (AP). Therefore, a WLAN is equal to the On/Off switch. When the feature is turned on for a VLAN, it is only applied to provisioned media stream groups.

Before you begin

Before you configure VideoStream for FlexConnect, enable the multicast mode and the IGMP snooping as follows:

1. Choose **Controller** > **Multicast** to open the Multicast page.
2. Check the **Enable Global Multicast Mode** check box to configure the sending multicast packets task. (The check box is disabled by default.)
3. Click **Save Configuration** to save your changes.

Note VideoStream for FlexConnect configuration does not support IPv6 and the Multicast Listener Discovery (MLD) snooping.

Note See the section Configuring the Controller for FlexConnect for information about configuring the controller for FlexConnect in a locally switched WLAN.

Procedure

Step 1 Choose **Wireless** > **Media Stream** > **Streams** to open the Media Stream page.

Step 2 Click **Add New** to configure a new media stream. The **Media Streams** page is displayed.

Step 3 In the **Stream Name** text box, enter the media stream name. The stream name can be up to 64 characters.

Step 4 In the **Multicast Destination Start IP Address** text box, enter the start IPv4 address of the multicast media stream.

Step 5 In the **Multicast Destination End IP Address** text box, enter the end IPv4 address of the multicast media stream.

Note

For the resource reservation control, only the start and end IP addresses are important.

Step 6 Click **Apply**.

Because of the CAPWAP payload length limit, only the first 100 media streams are pushed from the controller to the corresponding AP.

The media stream configurations are pushed to the AP, after the AP joins the controller.

Note
Roaming is not supported in the standalone mode of the FlexConnect AP feature.

What to do next

Verify that the clients are associated by performing these steps:

1. Choose **Monitor** > **Multicast**.

   The Multicast Groups page is displayed.

2. View the details in the FlexConnect Multicast Media Stream Clients table.

Configuring VideoStream for FlexConnect (CLI)

Procedure

Step 1 Configure the Multicast feature on the WLANs media stream by entering the **config wlan media-stream multicast-direct** {**wlan_id** | **all**} {**enable** | **disable**} command.

Step 2 Enable or disable the Multicast feature by entering the **config media-stream multicast-direct** {**enable** | **disable**} command.

Step 3 Configure the various message-configuration parameters by entering the **config media-stream message** {**state** [**enable** | **disable**] | **url** *url* | **email** *email* | **phone** *phone _number* | **note** *note*} command.

Step 4 Save your changes by entering the **save config** command.

Step 5 Configure various global media-stream configurations by entering the **config media-stream add multicast-direct** *media_stream_name start_IP end_IP* [**template** {**very-coarse** | **coarse** | **ordinary** | **low-resolution** | **med-resolution** | **high-resolution**} | **detail** {*max_bandwidth avg-packet-size* | {**periodic** | **initial**}} *qos usage-priority* {**drop** | **fallback**} command.

The Resource Reservation Control (RRC) parameters are assigned with the predefined values based on the values assigned to the template.

The following templates can be used to assign RRC parameters to the media stream:

- Very Coarse (below 3000 Kbps)
- Coarse (below 500 Kbps)
- Ordinary (below 750 Kbps)
- Low Resolution (below 1 Mbps)
- Medium Resolution (below 3 Mbps)

- High Resolution (below 5 Mbps)

Step 6 Delete a media stream by entering the **config media-stream delete** *media_stream_name* command.

Step 7 Save your changes by entering the **save config** command.

What to do next

To view the FlexConnect summary, use the following commands:

- **show capwap mcast flexconnect clients**
- **show running b | i mcuc**
- **show capwap mcast flexconnect groups**
- **show media-stream client flexconnect summary**

The following is the output **show media-stream client flexconnect summary** of command:

```
Client Mac    Stream-Name  Multicast-IP AP-Name   VLAN
----------     -----------  -----------  ----    ------
media-stream client FlexConnect <Media Stream Name>

Media Stream Name.............................. test
IP Multicast Destination Address (start)......... 224.0.0.1
IP Multicast Destination Address (end)........... 224.0.0.50
```

Viewing and Debugging Media Streams

Use these commands on a FlexConnect AP to get debug information:

Procedure

Step 1 **debug capwap mcast**
Shows general multicast activities.

Step 2 **debug ip igmp snooping group**
Shows the IGMP snooping group.

Step 3 **debug ip igmp snooping timer**
Shows IGMP snooping timer.

Step 4 **debug ip igmp snooping host**
Shows IGMP snooping host.

What to do next

- View a summary of the media stream and client information by entering the **show media-stream group summary** command.

- View details about a particular media stream group by entering **show media-stream group detail media_stream_name** command.
- Enable debugging of the media stream history by entering **debug media-stream history {enable | disable}** command.

FlexConnect+Bridge Mode

Information about Flex+Bridge Mode

A Control and Provisioning of Wireless Access Points protocol (CAPWAP) Access Point (AP) can be configured to operate in two different modes:

- FlexConnect mode
- Bridge/Mesh mode

The following are the bridging features for Flex+Bridge mode:

- The Flex+Bridge mode supports the centrally switched 802.11 WLAN. Traffic for this tunneled WLAN is forwarded to and from a CAPWAP controller over an IP tunnel.
- The Flex+Bridge mode supports the Root Ethernet VLAN Bridging. A root AP bridges the traffic for bridged 802.11 WLANs and secondary Ethernet LANs to a local Ethernet LAN over its root Ethernet port.
- The Flex+Bridge mode bridging is supported on Secondary Ethernet Access Ports and Secondary Ethernet VLAN Trunk Ports.
- Fault Tolerant Resilient Mode enables an AP to continue bridging traffic when the connection to the CAPWAP controller is lost. Both mesh and non-mesh root APs continue to bridge traffic. A child mesh AP (MAP) maintains its link to a parent AP and continues to bridge traffic till the parent link is lost. A child mesh AP cannot establish a new parent or child link till it reconnects to the CAPWAP controller. Existing wireless clients on the locally switching WLAN can stay connected with their AP in this mode. Their traffic will continue to flow through the Mesh and wired network. No new or disconnected wireless client can associate to the Mesh AP in this mode.
- You can configure a separate set of security ACLs for each VLAN that is configured for an Ethernet root port. In a mesh network, only root APs (RAPs) have an Ethernet root port.
- VLAN transparent bridging is not supported on Flex+Bridge mode. You must enter a set of allowed VLAN IDs for each secondary Ethernet trunk port.
- Path Control Protocol to create or delete path instances is supported on the Flex+Bridge mode.
- In a mesh network, a child mesh AP (MAP) inherits local WLAN/VLAN ID bindings, for bridged WLANs, and local secondary Ethernet access port/VLAN ID bindings. The bindings are inherited from the root AP (RAP) via path control messages. Bindings are required in a multi-hop mesh links to support FlexConnect capabilities in Mesh APs.



Note We recommend that you configure all Flex+Bridge APs in a mesh tree (in the same sector) in the same AP group and the same FlexConnect group, to inherit the WLAN-VLAN mappings properly.

Restrictions on Flex+Bridge Mode

- An AP needs to be restarted, with a different bridging sub system, after bridge mode is changed.
- The FlexConnect and mesh modes are incompatible. A child mesh AP can only attach to another mesh AP; a child mesh AP cannot attach to a FlexConnect AP.
- A FlexConnect WLAN cannot be configured on a mesh AP.
- From 8.0 release onwards, Flex+Bridge mode allows the FlexConnect functionality across mesh APs. Flex+Bridge mode is used to enable FlexConnect capabilities on Mesh (Bridge mode) APs. Mesh APs inherit VLANs from the root AP that it is connected to it.
- You can enable or disable the VLAN trunking and configure a native VLAN ID, on each AP, for any of the following modes:
  - FlexConnect
  - Flex+Bridge (FlexConnect+Mesh)
- For the Flex+Bridge mode, control plane supports:
  - Connected (CAPWAP connected, controller is reachable.)
  - Standalone (CAPWAP disconnected, controller is not reachable.)
- For the Flex+Bridge mode, data plane supports:
  - Centralized (split MAC) - Data traffic via controller
  - Local (local MAC) - Data traffic by local switching from Root AP
- Starting in Release 8.8, ARP caching is not supported in APs operating in Flex+Bridge mode. For more information, see https://bst.cloudapps.cisco.com/bugsearch/bug/CSCvm83632.
- A maximum of eight mesh hops are supported when operating in Flex+Bridge mode. The maximum number of Mesh APs per Root AP is 32.
- IRCM is not supported in FlexConnect+Bridge mode.
- Cisco TrustSec is not supported in Cisco Wave 2 APs that are in Flex+Bridge mode.
- Starting in Release 8.8, ARP caching is not supported in APs operating in Flex+Bridge mode. For more information, see https://bst.cloudapps.cisco.com/bugsearch/bug/CSCvm83632.

For more information about Flex+Bridge, see the *Mesh Deployment Modes* chapter in the Mesh Deployment Guide.

Configuring Flex+Bridge Mode (GUI)

Procedure

Step 1 Choose **Wireless** > **Access Points** > **All APs** to open the All APs page.

Step 2 Click an AP name from the list of AP names and then click the **General** tab.

Step 3 From the AP mode drop-down list, choose **Flex+Bridge** mode.

Step 4 From the AP Sub mode drop-down list, choose none.

Step 5 Click **Apply**.

Step 6 Click **Save Configuration**.

Step 7 Resilient mode is enabled by default. To disable the resilient mode, click the **FlexConnect** tab and uncheck the **Resilient Mode (Standalone mode support)** check-box.

Step 8 To push the root AP or FlexConnect WLAN to VLAN mapping to the other mesh APs, check the **Install mapping on radio backhaul** check box.

In a Flex+Bridge deployment, after you enable Backhaul Client Access globally, for the 5-GHz radios to beacon as expected, you must enable the **Install mapping on radio backhaul** option for the root APs operating in Flex+Bridge mode.

To enable Backhaul Client Access globally on the controller GUI, choose **Wireless** > **Mesh** to navigate to the **Mesh** page and then check the **Backhaul Client Access** check box.

Related Topics

Configuring Backhaul Client Access (GUI)

Configuring Flex+Bridge Mode (CLI)

Procedure

Step 1 Configure the Flex+Bridge mode by entering this command:

config ap mode flex+bridge

Step 2 Configure the Flex+Bridge sub mode by entering this command:

config ap mode flex+bridge submode

Step 3 Configure no sub mode by entering this command:

config ap mode flex+bridge submode none

Step 4 Enable or disable resilient Flex + Bridge mode by entering this command:

config ap flexconnect bridge resilient *ap-name* {**enable** | **disable**}

Step 5 Enable WLAN to VLAN mapping between the root APs and mesh APs by entering this command:

config ap flexconnect bridge backhaul-wlan *ap-name* {**enable** | **disable**}

Note
In a Flex+Bridge deployment, after you enable Backhaul Client Access globally, for the 5-GHz radios to beacon as expected, you must enable the **config ap flexconnect bridge backhaul-wlan** option for the root AP.

To enable Backhaul Client Access globally, enter this command: **config mesh client-access enable**

Related Topics

Configuring Backhaul Client Access (CLI)