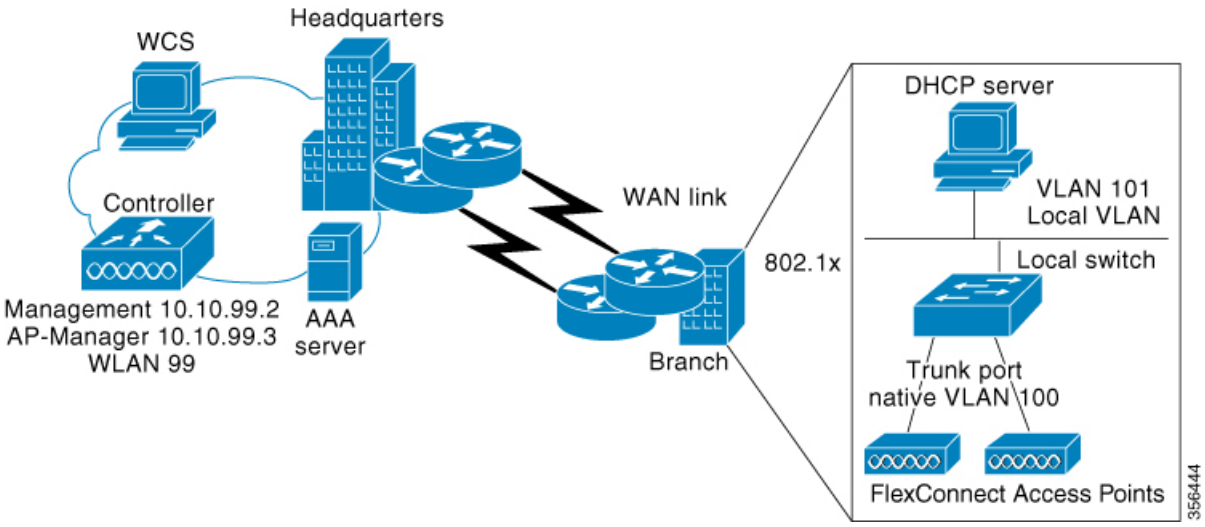
FlexConnect

Information About FlexConnect

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 also 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. FlexConnect access points support multiple SSIDs. In the connected mode, the FlexConnect access point can also perform local authentication.

Figure 1: 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 the 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 is 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 or new configured values only after the session timer expires.

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

In Cisco Catalyst 9800 Series Wireless Controller, you can define a flex connect site. A flex connect site can have a flex connect profile associate with it. You can have a maximum of 100 access points for each flex connect site.

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 or PAT boundary, except when you want true multicast to operate for all centrally switched WLANs.

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 an IPv4 operation. FlexConnect supports Client Mobility for a group of up to 100 access points.

An access point does not have to reboot when moving from local mode to FlexConnect mode and vice-versa.

FlexConnect Authentication

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 Aironet 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 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:

Note For the FlexConnect local switching, central authentication deployments, whenever passive client is enabled, the IP Learn timeout is disabled by default.

- 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.

- central authentication, local switching—In this state, the controller handles client authentication, and the FlexConnect access point switches data packets locally. After the client authenticates successfully, the controller sends a configuration command with a new payload to instruct the FlexConnect access point to start switching data packets locally. This message is sent per client. This state is applicable 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. This 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.

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.

Guidelines and Restrictions for FlexConnect

- FlexConnect mode can support only 16 VLANs per AP.
- You can deploy a FlexConnect access point with either a static IP address or a DHCP address. In the context 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 4 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 scenarios where you cannot achieve the 300-ms round-trip latency, 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. After the access point moves, the access point's radio is also reset.
- When multiple APs come from standalone mode to connected mode on FlexConnect and all the APs send the client entry in hybrid-REAP payload to the controller. In this scenario, the controller sends disassociation messages to the WLAN client. However, the WLAN client comes back successfully and joins the controller.
- When APs are in standalone mode, if a client roams to another AP, the source AP cannot determine whether the client has roamed or is just idle. So, the client entry at source AP will not be deleted until idle timeout.
- 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 the secondary or backup controller must be the same.
- A newly connected access point cannot be booted in FlexConnect mode.
- 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 APs operating in local authentication.
- 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 you duplicate the SSID of the FlexConnect access point and its index number on both controllers.
- 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 the time of initialization, a few syslog packets from the access point are tagged with VLAN ID 1.
- 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 Cisco ISE.
- FlexConnect does not display any IPv6 client addresses in the Client Detail window.
- FlexConnect access points with locally switched WLANs cannot perform IP source guard and prevent ARP spoofing. For centrally switched WLANs, the wireless controller performs IP source guard and ARP spoofing.
- To prevent ARP spoofing attacks in FlexConnect APs with local switching, we recommend that you use ARP inspection.
- Proxy ARP for VM clients (with any wireless host) does not work since the client includes many IP addresses for the same MAC. To avoid this issue, disable the ARP-caching option in the Flex profile.

- When you enable local switching on policy profile for FlexConnect APs, the APs perform local switching. However, for the APs in local mode, central switching is performed.

  In a scenario where the roaming of a client between FlexConnect mode AP and Local mode AP is not supported, the client may not get the 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.

  FlexConnect local switching is not supported on Cisco Aironet Cisco 1810T and 1815T (Teleworker) Access Points.

- Cisco Centralized Key Management (CCKM) is not supported in FlexConnect standalone mode. Hence, CCKM enabled client will not be able to connect when AP is in FlexConnect standalone mode.
- For Wi-Fi Protected Access Version 2 (WPA2) in FlexConnect standalone mode or local authentication in connected mode or Cisco Centralized Key Management 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 Cisco Centralized Key Management 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 Cisco Centralized Key Management fast-roaming in connected mode.
- Only open, WPA (PSK and 802.1x), and WPA2 (AES) 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 fallback is not supported when a user is not available in the external RADIUS server.
- For WLANs configured for FlexConnect APs in local switching and local authentication, synchronization of dot11 client information is supported.
- 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.
- VLAN group is not supported in Flex mode under flex-profile.
- Configuring maximum number of allowed media streams on individual client or radio is not supported in FlexConnect mode.
- The WLAN client association limit will not work when the AP is in FlexConnect mode (connected or standalone) and is performing local switching and local authentication.
- A local switching client on FlexConnect mode will not get IP address for RLAN profile on the Cisco Aironet 1810 Series AP.
- Standard ACL is not supported on FlexConnect AP mode.
- IPv6 RADIUS Server is not configurable for FlexConnect APs. Only IPv4 configuration is supported.
- In Flex mode, IPv4 ACLs configured on WLAN gets pushed to AP but IPv6 ACLs does not.

- The client delete reason counters that are a part of the **show wireless stats client delete reasons** command, will be incremented only when the client record entry persists for join.

  For example, when an AP in the FlexConnect mode performs local authentication with ACL mismatch, then the AP deletes the client, and the controller does not create any client record.

- Cisco Centralized Key Management (CCKM) is supported in wave 1 APs in FlexConnect when you use local association.

- If the client roams from one AP to another and the roaming is successful, the following occurs:

  - The client does not send any traffic to the new AP.
  - The client's state is IP LEARN pending.
  - The client is deauthenticated after 180 seconds, if there is no traffic for the entire duration. In case the DHCP Required flag is set, the deauthentication occurs after 60 seconds.

- Using custom VLANs under the policy profile of the FlexConnect locally switched WLANs stops the SSID broadcast. In such scenarios, run the **shut** and **no shut** commands on the policy profile to start the SSID broadcast.

  SSIDs are broadcasted when you:

  - Perform VLAN name to id mapping under FlexConnect profile and map the custom VLAN name under the policy profile.
  - Use VLAN id or standard VLAN name, for example, VLANxxxx.

- In the FlexConnect mode, the group temporal key (GTK) timer is set to 3600 seconds by default on Cisco Wave 2 AP, and this value cannot be reconfigured.

- When FlexConnect AP sends CAPWAP discovery request and the FlexConnect AP does not get any response after 18 CAPWAP discovery requests, the AP performs DHCP renew.

Note The clients must not disconnect when AP performs DHCP renew.

- For Flex mode deployments, local association configured policy profiles are not supported at a given time on the WLAN. Only the local association command must be enabled.

- From Cisco IOS XE Amsterdam 17.1.1 release onwards, the police rate per client in the flex connect APs in the controller, is represented as **rate_out** for Ingress (input) and **rate_in** for Egress (output). To verify police rate on the flex AP, use the **show rate-limit client** command.

- FlexConnect APs do not forward the DHCP packets after Change of Authorization (CoA) and change of VLANs using 802.1X encryption. You must disconnect the client from the WLAN and reconnect the client to enable the client to get an IP address in the second VLAN.

- Cisco Wave 2 and Catalyst Wi-Fi6 APs in FlexConnect local switching mode do not support Layer2(PSK, 802.1X) + Layer3(LWA, CWA, redirection-based posturing) + Dynamic AAA override + NAC.

- In Cisco Catalyst 9136I APs, in FlexConnect local authentication, the ongoing session timeout for a client gets reset after every roam.

- Network access control (NAC) is not supported in FlexConnect local authentication.

- Multicast traffic on an AAA overridden VLAN is not supported. Using this configuration may result in potential traffic leaks between VLANs.

Configuring a Site Tag

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless tag site** *site-name* **Example:** `Device(config)# wireless tag site default-site-tag`	Configures site tag and enters site tag configuration mode.
Step 3	**flex-profile** *flex-profile-name* **Example:** `Device(config-site-tag)# flex-profile rr-xyz-flex-profile`	Maps a flex profile to a site tag.
Step 4	**ap-profile** *ap-profile* **Example:** `Device(config-site-tag)# ap-profile xyz-ap-profile`	Assigns an AP profile to the wireless site.
Step 5	**description** *site-tag-name* **Example:** `Device(config-site-tag)# description "default site tag"`	Adds a description for the site tag.
Step 6	**no local-site** **Example:** `Device(config-site-tag)# no local-site`	Moves the access point to FlexConnect mode.
Step 7	**end** **Example:** `Device(config-site-tag)# end`	Saves the configuration, exits the configuration mode, and returns to privileged EXEC mode.
Step 8	**show wireless tag site summary** **Example:** `Device# show wireless tag site summary`	(Optional) Displays the summary of site tags.

Configuring a Policy Tag (CLI)

Follow the procedure given below to configure a policy tag:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**wireless tag policy** *policy-tag-name* **Example:** `Device(config-policy-tag)# wireless tag policy default-policy-tag`	Configures policy tag and enters policy tag configuration mode. **Note** When performing LWA, the clients connected to a controller gets disconnected intermittently before session timeout.
Step 4	**description** *description* **Example:** `Device(config-policy-tag)# description "default-policy-tag"`	Adds a description to a policy tag.
Step 5	**remote-lan** *name* **policy** *profile-policy-name* {**ext-module**| **port-id** } **Example:** `Device(config-policy-tag)# remote-lan rr-xyz-rlan-aa policy rr-xyz-rlan-policy1 port-id 2`	Maps a remote-LAN profile to a policy profile.
Step 6	**wlan** *wlan-name* **policy** *profile-policy-name* **Example:** `Device(config-policy-tag)# wlan rr-xyz-wlan-aa policy rr-xyz-policy-1`	Maps a policy profile to a WLAN profile.
Step 7	**end** **Example:** `Device(config-policy-tag)# end`	Exits policy tag configuration mode, and returns to privileged EXEC mode.
Step 8	**show wireless tag policy summary** **Example:**	(Optional) Displays the configured policy tags.

	Command or Action	Purpose
	`Device# show wireless tag policy summary`	**Note** To view detailed information about a policy tag, use the **show wireless tag policy detailed** *policy-tag-name* command.

Attaching a Policy Tag and a Site Tag to an Access Point (GUI)

Procedure

Step 1 Choose **Configuration** > **Wireless** > **Access Points**.
Step 2 Click the **Access Point** name.
Step 3 Go to the **Tags** section.
Step 4 Choose the **Policy Tag** from the **Policy** drop-down list.
Step 5 Choose the **Site Tag** from the **Site** drop-down list.
Step 6 Click **Update and Apply to Device**.

Attaching Policy Tag and Site Tag to an AP (CLI)

Follow the procedure given below to attach a policy tag and a site tag to an AP:

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**ap** *mac-address* **Example:** `Device(config)# ap F866.F267.7DFB`	Configures a Cisco AP and enters AP profile configuration mode. **Note** The *mac-address* should be a wired mac address.
Step 3	**policy-tag** *policy-tag-name* **Example:** `Device(config-ap-tag)# policy-tag rr-xyz-policy-tag`	Maps a policy tag to the AP.
Step 4	**site-tag** *site-tag-name* **Example:**	Maps a site tag to the AP.

	Command or Action	Purpose
	`Device(config-ap-tag)# site-tag rr-xyz-site`	
Step 5	**rf-tag** *rf-tag-name* **Example:** `Device(config-ap-tag)# rf-tag rf-tag1`	Associates the RF tag.
Step 6	**end** **Example:** `Device(config-ap-tag)# end`	Saves the configuration, exits configuration mode, and returns to privileged EXEC mode.
Step 7	**show ap tag summary** **Example:** `Device# show ap tag summary`	(Optional) Displays AP details and the tags associated to it.
Step 8	**show ap name** <*ap-name*> **tag info** **Example:** `Device# show ap name ap-name tag info`	(Optional) Displays the AP name with tag information.
Step 9	**show ap name** <*ap-name*> **tag detail** **Example:** `Device# show ap name ap-name tag detail`	(Optional) Displays the AP name with tag details.

Linking an ACL Policy to the Defined ACL (GUI)

Procedure

Step 1 Choose **Configuration** > **Tags & Profiles** > **Flex**.

Step 2 Click **Add**.

Step 3 In the **General** tab, enter the **Name** of the Flex Profile. The name can be ASCII characters from 32 to 126, without leading and trailing spaces.

Step 4 In the **Policy ACL** tab, click **Add**.

Step 5 Select the ACL from the **ACL Name** drop-down list and click **Save**.

Step 6 Click **Apply to Device**.

Applying ACLs on FlexConnect

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless profile flex** *flex-profile-name* **Example:** `Device(config)# wireless profile flex Flex-profile-1`	Configures a wireless flex profile and enters wireless flex profile configuration mode.
Step 3	**acl-policy** *acl-policy-name* **Example:** `Device(config-wireless-flex-profile)# acl-policy ACL1`	Configures an ACL policy. Access control lists (ACLs) perform packet filtering to control the movement of packets through a network.
Step 4	**exit** **Example:** `Device(config-wireless-flex-profile-acl)# exit`	Returns to wireless flex profile configuration mode.
Step 5	**native-vlan-id** **Example:** `Device(config-wireless-flex-profile)# native-vlan-id 25`	Configures native vlan-id information.
Step 6	**vlan** *vlan-name* **Example:** `Device(config-wireless-flex-profile)# vlan-name VLAN0169`	Configures a VLAN.
Step 7	**acl** *acl-name* **Example:** `Device(config-wireless-flex-profile-vlan)# acl ACL1`	Configures an ACL for the interface.
Step 8	**vlan-id***vlan-id* **Example:** `Device(config-wireless-flex-profile-vlan)# vlan-id 169`	Configures VLAN information.

Configuring FlexConnect

Configuring a Switch at a Remote Site

Procedure

Step 1 Attach the access point, which will be enabled for FlexConnect, to a trunk or access port on the switch.

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

Step 2 The following example configuration shows you how to configure a switch to support a FlexConnect access point.

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

```
.
.
.
ip dhcp pool NATIVE
   network 209.165.200.224 255.255.255.224
   default-router 209.165.200.225
   dns-server 192.168.100.167
!
ip dhcp pool LOCAL-SWITCH
   network 209.165.201.224 255.255.255.224
   default-router 209.165.201.225
   dns-server 192.168.100.167
!
interface Gig1/0/1
 description Uplink port
 no switchport
 ip address 209.165.202.225 255.255.255.224
!
interface Gig1/0/2
 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 209.165.200.225 255.255.255.224
!
interface Vlan101
 ip address 209.165.201.225 255.255.255.224
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: WLAN Scenarios

WLAN	Security	Authentication	Switching	Interface Mapping (GUEST VLAN)
Employee	WPA1+WPA2	Central	Central	Management (centrally switched GUEST VLAN)
Employee-local	WPA1+WPA2 (PSK)	Local	Local	101 (locally switched GUEST VLAN)
Guest-central	Web authentication	Central	Central	Management (centrally switched GUEST VLAN)
Employee-local-auth	WPA1+WPA2	Local	Local	101 (locally switched VLAN)

Configuring Local Switching in FlexConnect Mode (GUI)

Procedure

Step 1 Choose **Configuration** > **Tags & Profiles** > **Policy**.

Step 2 On the **Policy Profile** page, click the name of a policy profile to edit it or click **Add** to create a new one.

Step 3 In the **Add/Edit Policy Profile** window that is displayed, uncheck the **Central Switching** check box.

Step 4 Click **Update & Apply to Device**.

Configuring Local Switching in FlexConnect Mode (CLI)

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless profile policy** *profile-policy* **Example:** `Device(config)# wireless profile policy rr-xyz-policy-1`	Configures WLAN policy profile and enters the wireless policy configuration mode.
Step 3	**no central switching** **Example:** `Device(config-wireless-policy)# no central switching`	Configures the WLAN for local switching.
Step 4	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.

Configuring Central Switching in FlexConnect Mode (GUI)

Before you begin

Ensure that the policy profile is configured. If the policy profile is not configured, see *Configuring a Policy Profile (GUI)* section.

Procedure

Step 1 Choose **Configuration** > **Tags & Profiles** > **Policy**.

Step 2 On the **Policy Profile** page, select a policy.

Step 3 In the **Edit Policy Profile** window, in General Tab, use the slider to enable or disable **Central Switching**.

Step 4 Click **Update & Apply to Device**.

Configuring Central Switching in FlexConnect Mode

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless profile policy** *profile-policy* **Example:** `Device(config)# wireless profile policy rr-xyz-policy-1`	Configures WLAN policy profile and enters the wireless policy configuration mode.
Step 3	**central switching** **Example:** `Device(config-wireless-policy)# central switching`	Configures the WLAN for central switching.
Step 4	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.

Configuring an Access Point for FlexConnect

For more information, see *Configuring a Site Tag (CLI)* topic in New Configuration Model chapter.

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

Procedure

Step 1 Choose **Configuration** > **Tags & Profiles** > **Policy**.

Step 2 In the **Policy Profile** page, select a policy profile name. The **Edit Policy Profile** window is displayed.

Step 3 In the General tab, deselect **Central Authentication** check box.

Step 4 Click **Update & Apply to Device**.

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

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless profile policy** *profile-policy* **Example:** `Device(config)# wireless profile policy rr-xyz-policy-1`	Configures WLAN policy profile and enters the wireless policy configuration mode.
Step 3	**no central authentication** **Example:** `Device(config-wireless-policy)# no central authentication`	Configures the WLAN for local authentication.
Step 4	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.

Connecting Client Devices to WLANs

Follow the instructions for your client device to create profiles to connect to the WLANs you created, as specified in the #unique_408 .

In the example scenarios (see #unique_408), there are three profiles on the client:

1. To connect to the *employee* WLAN, create a client profile that uses WPA or WPA2 with PEAP-MSCHAPV2 authentication. After the client is authenticated, the client is allotted an IP address by the management VLAN of the controller .
2. To connect to the *local-employee* WLAN, create a client profile that uses WPA or WPA2 authentication. After the client is authenticated, the client is allotted an IP address by VLAN 101 on the local switch.
3. To connect to the *guest-central* WLAN, create a client profile that uses open authentication. After the client is authenticated, the client is allocated an IP address by VLAN 101 on the network local to the access point. After the client connects, a local user can enter any HTTP address in the web browser. The user is automatically directed to the controller to complete the web authentication process. When the web login window appears, the user should enter the username and password.

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.

Configuring FlexConnect Ethernet Fallback

Before you begin

This feature is not applicable to APs with multiple ports.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless profile flex** *flex-profile-name* **Example:** `Device(config)# wireless profile flex test`	Configures a wireless flex profile and enters wireless flex profile configuration mode.
Step 3	**fallback-radio-shut** **Example:** `Device(config-wireless-flex-profile)# fallback-radio-shut`	Enables radio interface shutdown.
Step 4	**end** **Example:** `Device(config-wireless-flex-profile)# end`	Exits configuration mode and returns to privileged EXEC mode.
Step 5	**show wireless profile flex detailed** *flex-profile-name* **Example:** `Device# show wireless profile flex detailed test`	(Optional) Displays detailed information about the selected profile.

Flex AP Local Authentication (GUI)

Procedure

Step 1 Choose **Configuration** > **Tags & Profiles** > **Flex**.

Step 2 In the **Flex** page, click the name of the **Flex Profile** or click **Add** to create a new one.

Step 3 In the **Add/Edit Flex Profile** window that is displayed, click the **Local Authentication** tab.

When local authentication and association is enabled in Access Point with Flex mode, the following occurs:

- AP handles the authentication.
- AP handles the rejection of client joins (in Mobility).

Note The controller does not increment statistics when AP rejects client association.

Step 4 Choose the server group from the **RADIUS Server Group** drop-down list.

Step 5 Use the **Local Accounting Radius Server Group** drop down to select the RADIUS server group.

Step 6 Check the **Local Client Roaming** check box to enable client roaming.

Step 7 Choose the profile from the **EAP Fast Profile** drop-down list.

Step 8 Choose to enable or disable the following:

- LEAP: Lightweight Extensible Authentication Protocol (LEAP) is an 802.1X authentication type for wireless LANs and supports strong mutual authentication between the client and a RADIUS server using a logon password as the shared secret. It provides dynamic per-user, per-session encryption keys.
- PEAP: Protected Extensible Authentication Protocol (PEAP) is a protocol that encapsulates the Extensible Authentication Protocol (EAP) within an encrypted and authenticated Transport Layer Security (TLS) tunnel.
- TLS: Transport Layer Security (TLS) is a cryptographic protocol that provide communications security over a computer network.
- RADIUS: Remote Authentication Dial-In User Service (RADIUS) is a networking protocol that provides centralized Authentication, Authorization, and Accounting (AAA or Triple A) management for users who connect and use a network service.

Step 9 In the **Users** section, click **Add**.

Step 10 Enter username and password details and click **Save**.

Step 11 Click **Save & Apply to Device**.

Flex AP Local Authentication (CLI)

Note The Cisco Catalyst 9800 Series Wireless Controller + FlexConnect local authentication + AP acting as RADIUS are not supported on Cisco COS and IOS APs.

Procedure

	Command or Action	Purpose
Step 1	**aaa new-model** **Example:** `Device(config)# aaa new-model`	Creates a AAA authentication model.
Step 2	**aaa session-id common** **Example:** `Device(config)# aaa session-id common`	Ensures that all the session IDs information that is sent out from the RADIUS group for a given call are identical.
Step 3	**dot1x system-auth-control** **Example:** `Device(config)# dot1x system-auth-control`	Enables system authorization control for the RADIUS group.
Step 4	**eap profile** *name* **Example:** `Device(config)# eap profile aplocal-test`	Creates an EAP profile.
Step 5	**method fast** **Example:** `Device(config-eap-profile)# method fast`	Configures the FAST method on the profile.
Step 6	**exit** **Example:** `Device(config-radius-server)# exit`	Returns to configuration mode.
Step 7	**wireless profile flex** *flex-profile* **Example:** `Device(config)# wireless profile flex default-flex-profile`	Configures the flex policy.
Step 8	**local-auth ap eap-fast** *name* **Example:** `Device(config-wireless-flex-profile)# local-auth ap eap-fast aplocal-test`	Configures EAP-FAST profile details.

	Command or Action	Purpose
Step 9	**local-auth ap leap** **Example:** `Device(config-wireless-flex-profile)# local-auth ap leap`	Configures the LEAP method.
Step 10	**local-auth ap peap** **Example:** `Device(config-wireless-flex-profile)# local-auth ap peap`	Configures the PEAP method.
Step 11	**local-auth ap username** *username* **Example:** `Device(config-wireless-flex-profile)# local-auth ap username test1 test1`	Configures username and password.
Step 12	**local-auth ap username** *username password* **Example:** `Device(config-wireless-flex-profile)# local-auth ap username test2 test2`	Configures another username and password.
Step 13	**exit** **Example:** `Device(config-wireless-flex-profile)# exit`	Returns to configuration mode.
Step 14	**wireless profile policy** *policy-profile* **Example:** `Device(config)# wireless profile policy default-policy-profile`	Configures profile policy.
Step 15	**shutdown** **Example:** `Device(config-wireless-policy)# shutdown`	Disables the policy profile.
Step 16	**no central authentication** **Example:** `Device(config)# no central authentication`	Disables central (controller) authentication.
Step 17	**vlan-id** *vlan-id* **Example:** `Device(config)# vlan-id 54`	Configures VLAN name or VLAN ID.
Step 18	**no shutdown** **Example:** `Device(config)# no shutdown`	Enables the configuration.

Flex AP Local Authentication with External Radius Server

In this mode, an access point handles client authentication and switches client data packets locally. This state is valid in standalone mode and connected mode.

Procedure

	Command or Action	Purpose
Step 1	**aaa new-model** **Example:** `Device(config)# aaa new-model`	Creates a AAA authentication model.
Step 2	**aaa session-id common** **Example:** `Device(config)# aaa session-id common`	Ensures that all the session ID's information that is sent out, from the RADIUS group for a given call are identical.
Step 3	**dot1x system-auth-control** **Example:** `Device(config)# dot1x system-auth-control`	Enables the system authorization control for the RADIUS group.
Step 4	**radius server** *server-name* **Example:** `Device(config)# radius server Test-SERVER1`	Specifies the RADIUS server name. **Note** To authenticate clients with freeradius over RADSEC, you should generate an RSA key longer than 1024 bit. Use the **crypto key generate rsa general-keys exportable label** *name* command to achieve this. Do not configure **key-wrap** option under the radius server and radius server group, as it may lead to clients getting stuck in authentication state.

Step 5	**address {ipv4 | ipv6}** *ip address* {**auth-port** *port-number* | **acct-port** *port-number* }
	Example:
	`Device(config-radius-server)# address ipv4 124.3.50.62 auth-port 1112 acct-port 1113`
	`Device(config-radius-server)# address ipv6 2001:DB8:0:20::15 auth-port 1812 acct-port 1813`
		Specifies the primary RADIUS server parameters.

	Command or Action	Purpose
Step 6	**key** *string* **Example:** `Device(config-radius-server)# key test123`	Specifies the authentication and encryption key used between the device and the RADIUS daemon running on the RADIUS server. **Note** The maximum number of characters allowed for the shared secret is 63.
Step 7	**radius server** *server-name* **Example:** `Device(config)# radius server Test-SERVER2`	Specifies the RADIUS server name.

Step 8	**address {ipv4 | ipv6}** *ip address* {**auth-port** *port-number* | **acct-port** *port-number* }
	Example:
	`Device(config-radius-server)# address ipv4 124.3.52.62 auth-port 1112 acct-port 1113`
	`Device(config-radius-server)# address ipv6 2001:DB8:0:21::15 auth-port 1812 acct-port 1813`
		Specifies the secondary RADIUS server parameters.

Step 9	**key** *string* **Example:** `Device(config-radius-server)# key test113`	Specifies the authentication and encryption key used between the device and the RADIUS daemon running on the RADIUS server.
Step 10	**exit** **Example:** `Device(config-radius-server)# exit`	Returns to configuration mode.
Step 11	**aaa group server radius** *server-group* **Example:** `Device(config)# aaa group server radius aaa_group_name`	Creates a RADIUS server group identification. **Note** *server-group* refers to the server group name. The valid range is from 1 to 32 alphanumeric characters.
Step 12	**radius server** *server-name* **Example:** `Device(config)# radius server Test-SERVER1`	Specifies the RADIUS server name.
Step 13	**radius server** *server-name* **Example:** `Device(config-radius-server)# radius server Test-SERVER2`	Specifies the RADIUS server name.

	Command or Action	Purpose
Step 14	**exit** **Example:** `Device(config-radius-server)# exit`	Exit from RADIUS server configuration mode.
Step 15	**wireless profile flex** *flex-profile* **Example:** `Device(config)# wireless profile flex default-flex-profile`	Creates a new flex policy.
Step 16	**local-auth radius-server-group** *server-group* **Example:** `Device(config-wireless-flex-profile)# local-auth radius-server-group aaa_group_name`	Configures the authentication server group name.
Step 17	**exit** **Example:** `Device(config-wireless-flex-profile)# exit`	Returns to configuration mode.
Step 18	**wireless profile policy** *policy-profile* **Example:** `Device(config)# wireless profile policy default-policy-profile`	Configures a WLAN policy profile.
Step 19	**shutdown** **Example:** `Device(config-wireless-policy)# shutdown`	Disables a policy profile.
Step 20	**no central authentication** **Example:** `Device(config-wireless-policy)# no central authentication`	Disables central (controller) authentication.
Step 21	**vlan-id** *vlan-id* **Example:** `Device(config-wireless-policy)# vlan-id 54`	Configures a VLAN name or VLAN Id.
Step 22	**no shutdown** **Example:** `Device(config-wireless-policy)# no shutdown`	Enables the configuration.

Configuration Example: FlexConnect with Central and Local Authentication

To see configuration example on how to configure a controller for FlexConnect central and local authentication, see the FlexConnect Configuration with Central and Local Authentication on Catalyst 9800 Wireless Controllers document.

NAT-PAT for FlexConnect

If you want to use a central DHCP server to service clients across remote sites, NAT-PAT should be enabled.

An AP translates the traffic coming from a client and replaces the client's IP address with its own IP address.

Note You must enable local switching, central DHCP, and DHCP required using the (**ipv4 dhcp required**) command to enable NAT and PAT.

Configuring NAT-PAT for a WLAN or a Remote LAN

Creating a WLAN

Follow the steps given here to create a WLAN.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wlan** *wlan-name wlan-id SSID-name* **Example:** `Device(config)# wlan wlan-demo 1 ssid-demo`	Enters the WLAN configuration sub-mode. • *wlan-name*—Enter the profile name. The range is from 1 to 32 alphanumeric characters. • *wlan-id*—Enter the WLAN ID. The range is from 1 to 512. • *SSID-name*—Enter the Service Set Identifier (SSID) for this WLAN. If the SSID is not specified, the WLAN profile name is set as the SSID.

	Command or Action	Purpose
		Note If you have already configured WLAN, enter *wlan wlan-name* command.
Step 3	**no shutdown** **Example:** `Device(config-wlan)# no shutdown`	Shut down the WLAN.
Step 4	**end** **Example:** `Device(config-wlan)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.

Configuring a Wireless Profile Policy and NAT-PAT (GUI)

Procedure

Step 1 Choose **Configuration** > **Tags & Profiles** > **Policy**.
Step 2 Click **Add**.
Step 3 In the **General** tab, enter the **Name** of the policy.
Step 4 Disable the **Central Switching** toggle button.
Step 5 Enable the **Central DHCP** toggle button.
Step 6 Enable the **Flex NAT/PAT** toggle button.
Step 7 In the **Advanced** tab, under the **DHCP** Settings, check the **IPv4 DHCP Required** check box.
Step 8 Click **Apply to Device**.

Configuring a Wireless Profile Policy and NAT-PAT

Follow the procedure given below to configure a wireless profile policy and NAT-PAT:

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless profile policy** *profile-policy* **Example:** `Device(config)# wireless profile policy nat-enabled-policy`	Configures the policy profile for NAT.

	Command or Action	Purpose
Step 3	**no central switching** **Example:** `Device(config-wireless-policy)# no central switching`	Configures the WLAN for local switching.
Step 4	**ipv4 dhcp required** **Example:** `Device(config-wireless-policy)# ipv4 dhcp required`	Configures the DHCP parameters for WLAN.
Step 5	**central dhcp** **Example:** `Device(config-wireless-policy)# central dhcp`	Configures the central DHCP for locally switched clients.
Step 6	**flex nat-pat** **Example:** `Device(config-wireless-policy)# flex nat-pat`	Enables NAT-PAT.
Step 7	**no shutdown** **Example:** `Device(config-wireless-policy)# no shutdown`	Enables policy profile.
Step 8	**end** **Example:** `Device(config-wireless-policy)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.

Mapping a WLAN to a Policy Profile

Follow the procedure given below to map a WLAN to a policy profile:

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless tag policy** *policy-tag-name* **Example:** `Device(config)# wireless tag policy demo-tag`	Configures a policy tag and enters policy tag configuration mode.

	Command or Action	Purpose
Step 3	**wlan** *wlan-name* **policy** *profile-policy-name* **Example:** `Device(config-policy-tag)# wlan wlan-demo policy nat-enabled-policy`	Maps a policy profile to a WLAN profile.
Step 4	**end** **Example:** `Device(config-policy-tag)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.

Configuring a Site Tag

Follow the procedure given below to configure a site tag:

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless tag site** *site-name* **Example:** `Device(config)# wireless tag site flex-site`	Configures a site tag and enters site tag configuration mode.
Step 3	**no local-site** **Example:** `Device(config-site-tag)# no local-site`	Moves an access point to FlexConnect mode.
Step 4	**end** **Example:** `Device(config-site-tag)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.

Attaching a Policy Tag and a Site Tag to an Access Point (GUI)

Procedure

Step 1 Choose **Configuration** > **Wireless** > **Access Points**.
Step 2 Click the **Access Point** name.
Step 3 Go to the **Tags** section.
Step 4 Choose the **Policy Tag** from the **Policy** drop-down list.
Step 5 Choose the **Site Tag** from the **Site** drop-down list.

Step 6 Click **Update and Apply to Device**.

Attaching a Policy Tag and a Site Tag to an Access Point

Follow the procedure given below to attach a policy tag and a site tag to an access point:

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**ap** *mac-address* **Example:** `Device(config)# ap F866.F267.7DFB`	Configures Cisco APs and enters ap-tag configuration mode.
Step 3	**policy-tag** *policy-tag-name* **Example:** `Device(config-ap-tag)# policy-tag demo-tag`	Maps a policy tag to the AP.
Step 4	**site-tag** *site-tag-name* **Example:** `Device(config-ap-tag)# site-tag flex-site`	Maps a site tag to the AP.
Step 5	**end** **Example:** `Device(config-ap-tag)# end`	Returns to privileged EXEC mode.

Split Tunneling for FlexConnect

If a client that connects over a WAN link that is associated with a centrally switched WLAN has to send traffic to a device present in the local site, this traffic should be sent over CAPWAP to the controller, and the same traffic is sent back to the local site either over CAPWAP or with the help of some off-band connectivity.

This process consumes WAN link bandwidth unnecessarily. To avoid this, you can use the Split Tunneling feature, which allows the traffic sent by a client to be classified based on the packet contents. The matching packets are locally switched and the rest of the traffic is centrally switched. The traffic that is sent by the client that matches the IP address of the device present in the local site can be classified as locally switched traffic, and the rest of the traffic as centrally switched.

To configure local split tunneling on an AP, ensure that you have enabled DCHP Required on the policy profile using the (**ipv4 dhcp required**) command. This ensures that the client that is associating with the split WLAN does DHCP.

Note Apple iOS clients need option 6 (DNS) to be set in DHCP offer for split tunneling to work.

Note

- FlexConnect split tunneling (vlan-based central switching for FlexConnect) on auto-anchor deployment is not supported.
- Split tunneling does not work on RLAN clients. When the **split-tunnel** option is enabled on RLAN, traffic denied by the split tunnel ACL is not translated based on the IP address, instead the traffic is sent back to the controller through CAPWAP.
- URL filter must not be configured with wildcard URLs such as * and *.*

Configuring Split Tunneling for a WLAN or Remote LAN

Defining an Access Control List for Split Tunneling (GUI)

Procedure

Step 1 Choose **Configuration** > **Security** > **ACL**.

Step 2 Click **Add**.

Step 3 In the **Add ACL Setup** dialog box, enter the **ACL Name**.

Step 4 Choose the ACL type from the **ACL Type** drop-down list.

Step 5 Under the **Rules** settings, enter the **Sequence** number and choose the **Action** as either **permit** or **deny**.

Step 6 Choose the required source type from the **Source Type** drop-down list.

a) If you choose the source type as **Host**, then you must enter the **Host Name/IP**.

b) If you choose the source type as **Network**, then you must specify the **Source IP** address and **Source Wildcard** mask.

Step 7 Check the **Log** check box if you want the logs.

Step 8 Click **Add**.

Step 9 Add the rest of the rules and click **Apply to Device**.

Defining an Access Control List for Split Tunneling

Follow the procedure given below to define an Access Control List (ACL) for split tunneling:

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**ip access-list extended** *name* **Example:** `Device(config)# ip access-list extended split_mac_acl`	Defines an extended IPv4 access list using a name, and enters access-list configuration mode.
Step 3	**deny ip any host** *hostname* **Example:** `Device(config-ext-nacl)# deny ip any host 9.9.2.21`	Allows the traffic to switch centrally.
Step 4	**permit ip any any** **Example:** `Device(config-ext-nacl)# permit ip any any`	Allows the traffic to switch locally.
Step 5	**end** **Example:** `Device(config-ext-nacl)# end`	Exits configuration mode and returns to privileged EXEC mode.

Linking an ACL Policy to the Defined ACL

Follow the procedure given below to link an ACL policy to the defined ACL:

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless profile flex** *flex-profile* **Example:** `Device(config)# wireless profile flex flex-profile`	Configures the Flex profile and enters flex profile configuration mode.
Step 3	**acl-policy** *acl policy name* **Example:** `Device(config-wireless-flex-profile)# acl-policy split_mac_acl`	Configures an ACL policy for the defined ACL.

	Command or Action	Purpose
Step 4	**end** **Example:** `Device(config-wireless-flex-profile)# end`	Exits configuration mode and returns to privileged EXEC mode.

Creating a WLAN

Follow the procedure given below to create a WLAN.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wlan** *wlan-name wlan-id SSID-name* **Example:** `Device(config)# wlan wlan-demo 1 ssid-demo`	Specifies the WLAN name and ID: • *wlan-name*—Enter the profile name. The range is from 1 to 32 alphanumeric characters. • *wlan-id*—Enter the WLAN ID. The range is from 1 to 512. • *SSID-name*—Enter the Service Set Identifier (SSID) for this WLAN. If the SSID is not specified, the WLAN profile name is set as the SSID.
Step 3	**no shutdown** **Example:** `Device(config-wlan)# no shutdown`	Enables the WLAN.
Step 4	**end** **Example:** `Device(config-wlan)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.

Configuring a Wireless Profile Policy and a Split MAC ACL Name (GUI)

Procedure

Step 1 Choose **Configuration** > **Tags & Profiles** > **Policy**.

Step 2 Click **Add**.

Step 3 In the **General** tab, enter the **Name** of the policy.

Step 4 Enable the **Central Switching** toggle button.

Step 5 Enable the **Central DHCP** toggle button.

Step 6 In the **Advanced** tab, under the **DHCP** settings, check the **IPv4 DHCP Required** check box and enter the **DHCP Server IP Address**.

Step 7 Under the **WLAN Flex Policy** settings, choose the split MAC ACL from the **Split MAC ACL** drop-down list.

Step 8 Click **Apply to Device**.

Configuring a Wireless Profile Policy and a Split MAC ACL Name

Follow the procedure given below to configure a wireless profile policy and a split MAC ACL name:

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless profile policy** *profile-policy* **Example:** `Device(config)# wireless profile policy split-tunnel-enabled-policy`	Configures a WLAN policy profile and enters wireless policy configuration mode.
Step 3	**flex split-mac-acl** *split-mac-acl-name* **Example:** `Device(config-wireless-policy)# flex split-mac-acl split_mac_acl`	Configures a split MAC ACL name. **Note** You should use the same ACL name for linking the flex and the policy profile.
Step 4	**central switching** **Example:** `Device(config-wireless-policy)# central switching`	Configures WLAN for central switching.
Step 5	**central dhcp** **Example:** `Device(config-wireless-policy)# central dhcp`	Enables central DHCP for centrally switched clients.
Step 6	**ipv4 dhcp required** **Example:** `Device(config-wireless-policy)# ipv4 dhcp required`	Configures the DHCP parameters for a WLAN.
Step 7	**ipv4 dhcp server** *ip_address* **Example:**	Configures the override IP address of the DHCP server.

	Command or Action	Purpose
	`Device(config-wireless-policy)# ipv4 dhcp server 9.1.0.100`	
Step 8	**no shutdown** **Example:** `Device(config-wireless-policy)# no shutdown`	Enables a policy profile.

Mapping a WLAN to a Policy Profile (GUI)

Procedure

Step 1 Choose **Configuration** > **Tags & Profiles** > **Tags**.
Step 2 Click **Add**.
Step 3 Enter the **Name** of the Tag Policy.
Step 4 Under **WLAN-POLICY Maps** tab, click **Add** .
Step 5 Choose the WLAN Profile from the **WLAN Profile** drop-down list.
Step 6 Choose the Policy Profile from the **Policy Profile** drop-down list.
Step 7 Click the **Tick** Icon .
Step 8 Click **Apply to Device**.

Mapping WLAN to a Policy Profile

Follow the procedure given below to map WLAN to a policy profile.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless tag policy** *policy-tag-name* **Example:** `Device(config)# wireless tag policy split-tunnel-enabled-tag`	Configures a policy tag and enters policy tag configuration mode.
Step 3	**wlan** *wlan-name* **policy** *profile-policy-name* **Example:** `Device(config-policy-tag)# wlan wlan-demo policy split-tunnel-enabled-policy`	Maps a policy profile to a WLAN profile.

	Command or Action	Purpose
Step 4	**end** **Example:** `Device(config-policy-tag)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.

Configuring a Site Tag

Follow the procedure given below to configure a site tag:

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless tag site** *site-name* **Example:** `Device(config)# wireless tag site flex-site`	Configures a site tag and enters site tag configuration mode.
Step 3	**no local-site** **Example:** `Device(config-site-tag)# no local-site`	**Local site** is not configured on the site tag.
Step 4	**flex-profile** *flex-profile-name* **Example:** `Device(config-site-tag)# flex-profile flex-profile`	Configures a flex profile.
Step 5	**end** **Example:** `Device(config-site-tag)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.

Attaching a Policy Tag and Site Tag to an Access Point

Follow the procedure given below to attach a policy tag and site tag to an access point.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 2	**ap** *ethernet-mac-address* **Example:** `Device(config)# ap 188b.9dbe.6eac`	Configures an AP and enters ap tag configuration mode.
Step 3	**policy-tag** *policy-tag-name* **Example:** `Device(config-ap-tag)# policy-tag split-tunnel-enabled-tag`	Maps a policy tag to an AP.
Step 4	**site-tag** *site-tag-name* **Example:** `Device(config-ap-tag)# site-tag flex-site`	Maps a site tag to an AP.
Step 5	**end** **Example:** `Device(config-ap-tag)# end`	Returns to privileged EXEC mode. Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.

VLAN-based Central Switching for FlexConnect

In FlexConnect local switching, if the VLAN definition is not available in an access point, the corresponding client does not pass traffic. This scenario is applicable when the AAA server returns the VLAN as part of client authentication.

When a WLAN is locally switched in flex and a VLAN is configured on the AP side, the traffic is switched locally. When a VLAN is not defined in an AP, the VLAN drops the packet.

When VLAN-based central switching is enabled, the corresponding AP tunnels the traffic back to the controller. The controller then forwards the traffic to its corresponding VLAN.

Note

- For VLAN-based central switching, ensure that VLAN is defined on the controller.
- VLAN-based central switching is not supported by mac filter.
- For local switching, ensure that VLAN is defined on the policy profile and FlexConnect profile.
- VLAN-based central switching with central web authentication enabled in Flex profile is not supported.

Configuring VLAN-based Central Switching (GUI)

Procedure

Step 1 Choose **Configuration** > **Tags & Profiles** > **Policy**.

Step 2 Click the name of the policy profile.

Step 3 In the **Edit Policy Profile** window, perform these tasks:

a) Set **Central Switching** to **Disabled** state.

b) Set **Central DHCP** to **Disabled** state.

c) Set **Central Authentication** to **Enabled** state.

Step 4 Click the **Advanced** tab.

Step 5 Under **AAA Policy**, check the **Allow AAA Override** check box to enable AAA override.

Step 6 Under **WLAN Flex Policy**, check the **VLAN Central Switching** check box, to enable VLAN-based central switching on the policy profile.

Step 7 Click **Update & Apply to Device**.

Configuring VLAN-based Central Switching (CLI)

Follow the procedure given below to configure VLAN-based central switching.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless profile policy** *profile-policy* **Example:** `Device(config)# wireless profile policy default-policy-profile`	Configures a wireless policy profile.
Step 3	**no central switching** **Example:** `Device(config-wireless-policy)# no central switching`	Configures a WLAN for local switching.
Step 4	**no central dhcp** **Example:** `Device(config-wireless-policy)# no central dhcp`	Configures local DHCP mode, where the DHCP is performed in an AP.
Step 5	**central authentication** **Example:** `Device(config-wireless-policy)# central authentication`	Configures a WLAN for central authentication.
Step 6	**aaa-override** **Example:**	Configures AAA policy override.

	Command or Action	Purpose
	`Device(config-wireless-policy)# aaa-override`	
Step 7	**flex vlan-central-switching** **Example:** `Device(config-wireless-policy)# flex vlan-central-switching`	Configures VLAN-based central switching.
Step 8	**end** **Example:** `Device(config-wireless-policy)# end`	Returns to privileged EXEC mode.
Step 9	**show wireless profile policy detailed** *default-policy-profile* **Example:** `Device# show wireless profile policy detailed default-policy-profile`	(Optional) Displays detailed information of the policy profile.

OfficeExtend Access Points for FlexConnect

A Cisco OfficeExtend access point (OEAP) provides secure communications from a controller to a Cisco AP at a remote location, seamlessly extending the corporate WLAN over the Internet to an employee's residence. A user's experience at the home office is exactly the same as it would be at the corporate office. Datagram Transport Layer Security (DTLS) encryption between an access point and the controller ensures that all communications have the highest level of security.

Note Preconfigure the controller IP for a zero-touch deployment with OEAP. All other home users can use the same access point to connect for home use by configuring the local SSID from AP.

Note In releases prior to Cisco IOS XE Amsterdam 17.3.2, when an AP is converted to OEAP, the local DHCP server on the AP is enabled by default. If the DHCP server on home router has a similar configuration, a network conflict occurs and AP will not be able to join back to the controller. In such a scenario, we recommend that you change the default DHCP server on the Cisco AP using OEAP GUI.

Note For OEAP, when configuration changes are made from the OEAP GUI to the following: Radio Status, Radio Interface Status, 802.11 n-mode, 802.11 ac-mode, Bandwidth, and Channel Selection (2.4 GHz or 5 GHz), CAPWAP should be restarted for the configuration sync to take place between the AP and the controller. During this interval, the AP GUI may not respond until the AP rejoins the controller. We recommend that you wait for the AP to rejoin the controller (for about 1-2 minutes), before you make further changes from the OEAP GUI.

Note In Cisco OfficeExtend access point (Cisco OEAP), if the OEAP local DHCP server is enabled and the user configures DNS IP from OEAP GUI, the wireless and wired clients connected to Cisco OEAP will receive that IP as DNS server IP in DHCP ACK.

Configuring OfficeExtend Access Points

Follow the procedure given below to configure OfficeExtend access points.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless profile flex** *flex-profile-name* **Example:** `Device(config)# wireless profile flex test`	Configures a wireless flex profile and enters wireless flex profile configuration mode.
Step 3	**office-extend** **Example:** `Device(config-wireless-flex-profile)# office-extend`	Enables the OfficeExtend AP mode for a FlexConnect AP.
Step 4	**end** **Example:** `Device(config-wireless-flex-profile)# end`	Exits configuration mode and returns to privileged EXEC mode. **Note** After creating a flex profile, ensure that OEAP is in flex connect mode and mapped to its corresponding site tag. OfficeExtend is disabled by default. To clear the access point's configuration and return it to the factory-defaults, use the **clear ap config** *cisco-ap* command.

Disabling OfficeExtend Access Point

Follow the procedure given below to disable an OfficeExtend access point.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless profile flex** *flex-profile-name* **Example:** `Device(config)# wireless profile flex test`	Configures a wireless flex profile and enters wireless flex profile configuration mode.
Step 3	**no office-extend** **Example:** `Device(config-wireless-flex-profile)# no office-extend`	Disables OfficeExtend AP mode for a FlexConnect AP.
Step 4	**end** **Example:** `Device(config-wireless-flex-profile)# end`	Exits configuration mode and returns to privileged EXEC mode.

Support for OEAP Personal SSID

Information About OEAP Personal SSID Support

The Cisco OfficeExtend Access Point supports personal SSID. This enables a local home client to use the same OfficeExtend Access Point for local networking and internet connectivity. With the help of the OEAP personal SSID feature, you can enable or disable personal SSID, enable or disable Datagram Transport Layer Security (DTLS) encryption between an access point and the controller, and enable rogue detection, using the knobs that are present on the AP profile page in the GUI. The local network access and DTLS encryption are enabled by default. The configurations described in this chapter is applicable for OEAP or for APs in the OEAP mode.

Configuring OEAP Personal SSID (GUI)

Procedure

Step 1 Choose **Configuration** > **AP Tags & Profiles** > **AP Join**.

The **AP Join Profile** section displays all the AP Join profiles.

Step 2 To edit the configuration details of an AP Join profile, select APs in the OEAP mode.
The **Edit AP Join Profile** window is displayed.

Step 3 In the **General** tab, under the **OfficeExtend AP Configuration** section, configure the following:

a) Check the **Local Access** check box to enable the local network. By default, **Local Access** is enabled. After the AP joins the controller using AP join profile where local access is enabled, the AP will not

broadcast the default personal SSID. Since the local access is enabled, you can login to the AP GUI and configure the personal SSID.

b) Check the **Link Encryption** check box to enable data DTLS. By default, **Link Encryption** is enabled.

c) Check the **Rogue Detection** check box to enable rogue detection. Rogue detection is disabled by default for OfficeExtend APs because these APs, deployed in a home environment, are likely to detect a large number of rogue devices.

Configuring OEAP Personal SSID (CLI)

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**ap profile** *ap-profile* **Example:** `Device(config)# ap profile ap-profile`	Configures an AP profile and enters the AP profile configuration mode.
Step 3	**[no] oeap local-access** **Example:** `Device(config-ap-profile)# oeap local-access`	Enables the local access to AP. Local access consist of local AP GUI, LAN ports and personal SSID. The **no** form of this command disables the feature. If the local access is disabled, you will not be able to access the AP GUI, the local LAN port will be disabled, and personal SSID will not be broadcasted.
Step 4	**[no] oeap link-encryption** **Example:** `Device(config-ap-profile)# oeap link-encryption`	Enables DTLS encryption for OEAP APs or APs moving to the OEAP mode. The **no** form of this command disables the feature. This feature is enabled by default.
Step 5	**[no] oeap rogue-detection** **Example:** `Device(config-ap-profile)# no oeap rogue-detection`	Enables OEAP DTLS encryption in the AP profile configuration mode. This feature is disabled by default.

Viewing OEAP Personal SSID Configuration

To view the OEAP personal SSID configuration, run the following command.

```
Device# show ap profile name default-ap-profile detailed
.
.
.
OEAP Mode Config
Link Encryption : ENABLED
```

```
Rogue Detection : DISABLED
Local Access : ENABLED
```

Clearing Personal SSID from an OfficeExtend Access Point

To clear the personal SSID from an access point, run the following command:

ap name *Cisco_AP* **clear-personal-ssid**

Example: Viewing OfficeExtend Configuration

This example displays an OfficeExtend configuration:

```
Device# show ap config general

Cisco AP Name   : ap_name
================================================

Cisco AP Identifier                             : 70db.986d.a860
Country Code                                    : Multiple Countries : US,IN
Regulatory Domain Allowed by Country            : 802.11bg:-A   802.11a:-ABDN
AP Country Code                                 : US  - United States
AP Regulatory Domain
  Slot 0                                        : -A
  Slot 1                                        : -D
MAC Address                                     : 002c.c899.7b84
IP Address Configuration                        : DHCP
IP Address                                      : 9.9.48.51
IP Netmask                                      : 255.255.255.0
Gateway IP Address                              : 9.9.48.1
CAPWAP Path MTU                                 : 1485
Telnet State                                    : Disabled
SSH State                                       : Disabled
Jumbo MTU Status                                : Disabled
Cisco AP Location                               : default location
Site Tag Name                                   : flex-site
RF Tag Name                                     : default-rf-tag
Policy Tag Name                                 : split-tunnel-enabled-tag
AP join Profile                                 : default-ap-profile
Primary Cisco Controller Name                   : uname-controller
Primary Cisco Controller IP Address             : 9.9.48.34
Secondary Cisco Controller Name                 : uname-controller1
Secondary Cisco Controller IP Address           : 0.0.0.0
Tertiary Cisco Controller Name                  : uname-ewlc2
Tertiary Cisco Controller IP Address            : 0.0.0.0
Administrative State                            : Enabled
Operation State                                 : Registered
AP Mode                                         : FlexConnect
AP Submode                                      : Not Configured
Office Extend Mode                              : Enabled
Remote AP Debug                                 : Disabled
Logging Trap Severity Level                     : information
Software Version                                : 16.8.1.1
Boot Version                                    : 1.1.2.4
Mini IOS Version                                : 0.0.0.0
Stats Reporting Period                          : 0
LED State                                       : Enabled
PoE Pre-Standard Switch                         : Disabled
PoE Power Injector MAC Address                  : Disabled
Power Type/Mode                                 : PoE/Full Power (normal mode)
```

Proxy ARP

Proxy address resolution protocol (ARP) is the most common method for learning about MAC address through a proxy device. Enabling Proxy ARP known as ARP caching in Cisco Catalyst 9800 Series Wireless Controller means that the AP owning client is the destination of the ARP request, replies on behalf of that client and therefore does not send the ARP request to the client over the air. Access points not owning the destination client and receiving an ARP request through their wired connection will drop the ARP request. When the ARP caching is disabled, the APs bridge the ARP requests from wired-to-wireless and vice-versa increasing the air time usage and broadcasts over wireless.

The AP acts as an ARP proxy to respond to ARP requests on behalf of the wireless clients.

Enabling Proxy ARP for FlexConnect APs (GUI)

Procedure

Step 1 Choose **Configuration** > **Tags & Profiles** > **Flex**.

Step 2 Click **Add**.

Step 3 In the **General** tab, enter the **Name** of the Flex Profile and check the **ARP Caching** check box. The name can be ASCII characters from 32 to 126, without leading and trailing spaces.

Step 4 Click **Apply to Device**.

Enabling Proxy ARP for FlexConnect APs

Follow the procedure given below to configure proxy ARP for FlexConnect APs.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless profile flex** *flex-policy* **Example:** `Device(config)# wireless profile flex flex-test`	Configures WLAN policy profile and enters wireless flex profile configuration mode.
Step 3	**arp-caching** **Example:** `Device(config-wireless-flex-profile)# arp-caching`	Enables ARP caching. **Note** Use the **no arp-caching** command to disable ARP caching.

	Command or Action	Purpose
Step 4	**end** **Example:** `Device(config-wireless-flex-profile)# end`	Returns to privileged EXEC mode.
Step 5	**show running-config | section wireless profile flex** **Example:** `Device# show running-config | section wireless profile flex`	Displays ARP configuration information.
Step 6	**show wireless profile flex detailed** *flex-profile-name* **Example:** `Device# show wireless profile flex detailed flex-test`	(Optional) Displays detailed information of the flex profile.
Step 7	**show arp summary** **Example:** `Device# show arp summary`	(Optional) Displays ARP summary.

Overlapping Client IP Address in Flex Deployment

Overview of Overlapping Client IP Address in Flex Deployment

In flex deployments, you can use cookie cutter configuration across sites and branches which also includes local DHCP servers configured with the same subnet. In this topology, controllers detect multiple client sessions with the same IP as IP THEFT and clients are put in blocked list.

The Overlapping Client IP Address in Flex Deployment feature offers overlapping IP address across various flex sites and provides all the functionalities that are supported in flex deployments.

Enabling Overlapping Client IP Address in Flex Deployment (GUI)

Procedure

Step 1 Choose **Configuration** > **Tags & Profiles** > **Flex** and click **Add**.

Step 2 On the **Add Flex Profile** window and **General** tab.

Step 3 Check the **IP Overlap** check box to enable overlapping client IP Address in Flex deployment.

Step 4 Click **Apply to Device**.

Enabling Overlapping Client IP Address in Flex Deployment

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless profile flex** *flex-profile* **Example:** `Device(config)# wireless profile flex flex1`	Configures a Flex profile and enters Flex profile configuration mode.
Step 3	[**no**] **ip overlap** **Example:** `Device(config-wireless-flex-profile)# [no] ip overlap`	Enables overlapping client IP address in flex deployment. **Note** By default, the configuration is disabled.

Verifying Overlapping Client IP Address in Flex Deployment (GUI)

Procedure

Step 1 Choose **Monitoring** > **Wireless** > **Clients**.

Step 2 Click the client in the table to view properties and statistics for each client.

Step 3 On the **Client** window and **General** tab, click **Client Statistics** tab to view the following details:

- Number of Bytes Received from Client
- Number of Bytes Sent to Client
- Number of Packets Received from Client
- Number of Packets Sent to Client
- Number of Policy Errors
- Radio Signal Strength Indicator
- Signal to Noise Ratio
- IP - Zone ID Mapping

Step 4 Click **OK**.

Verifying Overlapping Client IP Address in Flex Deployment

To verify if the overlapping client IP address in Flex deployment feature is enabled or not, use the following command:

```
Device# show wireless profile flex detailed flex1
Fallback Radio shut            : DISABLED
ARP caching                    : ENABLED
Efficient Image Upgrade        : ENABLED
OfficeExtend AP                : DISABLED
Join min latency               : DISABLED
IP overlap status              : DISABLED
```

To view additional details about the overlapping client IP address in Flex deployment feature, use the following command:

```
Device# show wireless device-tracking database ip

IP                                          ZONE-ID       STATE      DISCOVERY   MAC
-----------------------------------------------------------------------------------------------

  9.91.59.154                               0x00000002  Reachable   IPv4 Packet
6038.e0dc.3182
  1000:1:2:3:90d8:dd1a:11ab:23c0            0x00000002  Reachable   IPv6 Packet
58ef.680d.c6c3
  1000:1:2:3:f9b5:3074:d0da:f93b            0x00000002  Reachable   IPv6 Packet
58ef.680d.c6c3
  2001:9:3:59:90d8:dd1a:11ab:23c0           0x00000002  Reachable   IPv6 NDP
58ef.680d.c6c3
  2001:9:3:59:f9b5:3074:d0da:f93b           0x00000002  Reachable   IPv6 NDP
58ef.680d.c6c3
  fe80::f9b5:3074:d0da:f93b                 0x80000001  Reachable   IPv6 NDP
58ef.680d.c6c3
```

To view APs in various site tags, use the following command:

```
Device# show ap tag summary
Number of APs: 5

AP Name AP Mac Site Tag Name Policy Tag Name RF Tag Name Misconfigured Tag Source
-----------------------------------------------------------------------------------------------------------------------
AP3802 70b3.17f6.37aa flex_ip_overlap-site-tag-auto-3 flex_ip_overlap_policy_tag_1
default-rf-tag No Static
AP-9117AX 0cd0.f894.0f8c default-site-tag default-policy-tag default-rf-tag No Default
AP1852JJ9 38ed.18ca.2b48 flex_ip_overlap-site-tag-auto-2 flex_ip_overlap_policy_tag_2
default-rf-tag No Static
AP1852I 38ed.18cc.61c0 flex_ip_overlap-site-tag-auto-1 flex_ip_overlap_policy_tag_1
default-rf-tag No Static
AP1542JJ9 700f.6a84.1b30 flex_ip_overlap-site-tag-auto-2 flex_ip_overlap_policy_tag_2
default-rf-tag No Static
```

To view APs in FlexConnect mode, use the following command:

```
Device# show ap status
AP Name     Status      Mode        Country
-------------------------------------------------------------------------
AP3802      Disabled   FlexConnect   IN
AP1852I     Enabled    FlexConnect   US
AP-9117AX   Enabled    FlexConnect   IN
AP1542JJ9   Disabled   FlexConnect   US
AP1852JJ9   Enabled    FlexConnect   US
```

Troubleshooting Overlapping Client IP Address in Flex Deployment

To verify the WNCD instance for each of the APs, use the following command:

```
Device# show wireless loadbalance ap affinity wncd 0
AP Mac          Discovery Timestamp    Join Timestamp          Tag
------------------------------------------------------------------------------
0cd0.f894.0f8c   10/27/20 22:11:05    10/27/20 22:11:14    default-site-tag
38ed.18ca.2b48   10/27/20 22:06:09    10/27/20 22:06:19    flex_ip_overlap-site-tag-auto-2
700f.6a84.1b30   10/27/20 22:25:03    10/27/20 22:25:13    flex_ip_overlap-site-tag-auto-2
```

Lawful Interception

Lawful Interception of Traffic

Using the Cisco wireless solution, it is possible to lawfully intercept the flow of traffic for monitoring purposes.

Cisco APs create syslog records for traffic and send the records to the controller. Traffic from both IPv4 and IPv6 protocols is recorded. The AP sends the syslog records at configured intervals to the controller and the controller forwards these records to the syslog server, as soon as they are received from AP.

Restrictions on Lawful Interception of Traffic

- To support IPv6 protocol, enable IPv6 on the controller.
- This feature is supported on Cisco Wave 2 APs operating in Flex + Bridge mode and Cisco Wave 2 APs operating in Flex mode.
- Supports Cisco Wave 2 APs.

Configuring Lawful Interception

By default the **lawful-interception** command is disabled. Follow the procedure given below to enable the command:

Procedure

	Command or Action	Purpose
Step 1	**Configure Terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless lawful-interception host** {*ipv4 addr* | *ipv6 addr*} **Example:** `Device(config)# wireless lawful-interception host X:X:X:X::X`	Enables lawful-interception on the controller, and configures the IP address of the LI server; on IPv4 and IPv6 host.

	Command or Action	Purpose
Step 3	**ap profile** <*ap-profile-name*> **Example:** `Device(config)# ap profile ap-profile-name`	Configures the AP profile.
Step 4	**[no] lawful-interception** **Example:** `Device(config-ap-profile)# [no] lawful-interception`	Enables the lawful-interception feature. Use the **no** form of the command to disable the feature. By default lawful interception feature is disabled.
Step 5	**lawful-interception timer** *timer-value* **Example:** `Device(config-ap-profile)#lawful-interception timer 70`	Configures the lawful interception report interval in seconds. By default the timer is 60 seconds.

Verifying the Status of Lawful Interception

To verify the status of lawful interception, use the following **show** command:

```
Device#show wireless lawful-interception status
-----------------------------------------------
Number AP profiles with LI enabled:     1
-----------------------------------------------
Last Nexthop MAC address resolution state: Resolved
SRC IP address:             9.9.71.51
LI host IP address:         9.9.71.98
Ingress SRC MAC address:    0000.0002.0001
Egress SRC MAC address:     001e.7a9a.e9ff
Nexthop MAC address:        0050.56a0.80f4

--------------------------
LI Internal Data
--------------------------
Egress Vlan:     9
Plumb Ifid:      4026531841
Recent LI history (most recent on top):
Timestamp                           Event                          Context
-------------------------   -------------------------
-------------------------------06/21/2018 12:47:05.594163     NH_MAC_ADDR_RESULT
 next_hop mac:0050.56a0.80f4
06/21/2018 12:47:05.594081    CPP_PLUMB               egress src mac:001e.7a9a.e9ff,vlan:9
06/21/2018 12:47:05.593739     NH_MAC_ADDR_RESULT         next_hop mac:0050.56a0.80f4
06/21/2018 12:47:05.590337    CPP_UNPLUMB              egress src mac:001e.7a9a.e9ff,vlan:9
06/21/2018 12:47:01.561553     NH_MAC_ADDR_RESULT         next_hop mac:0050.56a0.80f4
06/21/2018 12:47:01.555291    NH_MAC_ADDR_SUBSCRIBE     src IP: 9.9.71.51,dst IP: 9.9.71.98
06/21/2018 12:47:01.555060     MGMT_IF_CHANGE

06/21/2018 12:47:00.618530    CPP_PLUMB               egress src mac:001e.7a9a.e9ff,vlan:9
06/21/2018 12:47:00.607985     MAGIC_MAC_RESOLVED         0000.0002.0001
06/21/2018 12:47:00.607290     MAGIC_MAC_REQ

06/21/2018 12:47:00.606344     NH_MAC_ADDR_RESULT         next_hop mac:0050.56a0.80f4
06/21/2018 12:47:00.601806    NH_MAC_ADDR_SUBSCRIBE     src IP: 9.9.71.51,dst IP: 9.9.71.98
06/21/2018 12:47:00.600603     MGMT_IF_CHANGE
```

```
06/21/2018 12:46:55.847387    NH_MAC_ADDR_SUBSCRIBE     src IP: 9.9.71.51,dst IP: 9.9.71.98
06/21/2018 12:46:55.847094     MGMT_IF_CHANGE

06/21/2018 12:46:54.937173    NH_MAC_ADDR_SUBSCRIBE     src IP: 9.9.71.51,dst IP: 9.9.71.98
06/21/2018 12:46:54.936310     MGMT_IF_CHANGE

06/21/2018 12:46:53.186883    NH_MAC_ADDR_SUBSCRIBE     src IP: 9.9.71.51,dst IP: 9.9.71.98
06/21/2018 12:46:53.134721     MGMT_IF_CHANGE

06/21/2018 12:46:52.965403     MGMT_IF_CHANGE
```

To verify if lawful interception is enabled on a particular AP, use the following **show** command:

```
show ap name <ap_name> config general | include Lawful-Interception
Lawful-Interception Admin status               : Enabled
Lawful-Interception Oper status                : Enabled
```

Information About FlexConnect High Scale Mode

This feature helps to scale up the FlexConnect site capacity to accommodate 300 APs and 3000 802.1x clients per site. The FlexConnect site capability is scaled up by using the Pairwise Master Key (PMK) option to skip Extensible Authentication Protocol (EAP) exchange while performing client roaming.

When a client associates with an AP under an 802.1x authentication architecture, an EAP exchange takes place, followed by a four-way handshake to verify the encryption keys. Using PMK caching, an AP can cache the PMK identifier of the EAP exchange, and for the subsequent client join. In PMK caching, the EAP exchange process is eliminated, and the authentication time process is decreased.

The PMK propagation feature is disabled by default. Until Cisco IOS XE Cupertino 17.7.1, the wireless controller used to push the PMK cache to every FlexConnect AP in the site. From Cisco IOS XE Cupertino 17.8.1 onwards, when PMK propagation is enabled, the controller pushes the PMK cache only to selective FlexConnect APs. These FlexConnect APs then forward the PMK identifier to the other FlexConnect APs within the same site.

Enabling PMK Propagation (CLI)

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**wireless profile flex** *test-flex-profile* **Example:** `Device(config)# wireless profile flex test-flex-profile`	Creates a FlexConnect profile.
Step 3	**pmk propagate** **Example:**	Propagates PMK information to the other APs in the site.

	Command or Action	Purpose
	`Device(config-wireless-flex-profile)# pmk propogate`	**Note** The PMK propagation feature is disabled by default.

Examples

```
Device# configure terminal
Device(config)# wireless profile flex test-flex-profile
Device(config-wireless-flex-profile)# pmk propagate
```

Flex Resilient with Flex and Bridge Mode Access Points

Information About Flex Resilient with Flex and Bridge Mode Access Points

The Flex Resilient with Flex and Bridge Mode Access Points describe how to set up a controller with Flex+Bridge mode Access Points (APs) and Flex Resilient feature. The Flex Resilient feature works only in Flex+Bridge mode APs. The feature resides in Mesh link formed between RAP - MAP, once the link is UP and RAP loses connection to the CAPWAP controller, both RAP and MAP continue to bridge the traffic. A child Mesh AP (MAP) maintains its link to a parent AP and continues to bridge till the parent link is lost. A child MAP cannot establish a new parent or child link till it reconnects to the CAPWAP controller.

Note Existing wireless clients in locally switching WLAN can stay connected with their AP in this mode. No new or disconnected wireless client can associate to the Mesh AP in this mode. Client traffic in Flex+Bridge MAP is dropped at RAP switchport for the locally switched WLANs.

Configuring a Flex Profile (GUI)

Procedure

Step 1 Choose **Configuration** > **Tags & Profiles** > **Flex**.

Step 2 Click a **Flex Profile Name**. The **Edit Flex Profile** dialog box appears.

Step 3 Under the **General** tab, choose the **Flex Resilient** check box to enable the Flex Resilient feature.

Step 4 Under the **VLAN** tab, choose the required VLANs.

Step 5 (Optionally) Under the **Local Authentication** tab, choose the desired server group from the **Local Accounting RADIUS Server Group** drop-down list. Also, choose the **RADIUS** check box.

Step 6 Click **Update & Apply to Device**.

Configuring a Flex Profile (CLI)

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode
Step 2	**wireless profile flex** *flex-profile* **Example:** `Device(config)# wireless profile flex new-flex-profile`	Configures a Flex profile and enters Flex profile configuration mode.
Step 3	**arp-caching** **Example:** `Device(config-wireless-flex-profile)# arp-caching`	Enables ARP caching.
Step 4	**description** *description* **Example:** `Device(config-wireless-flex-profile)# description "new flex profile"`	Enables default parameters for the Flex profile.
Step 5	**native-vlan-id** **Example:** `Device(config-wireless-flex-profile)# native-vlan-id 2660`	Configures native vlan-id information.
Step 6	**resilient** **Example:** `Device(config-wireless-flex-profile)# resilient`	Enables the resilient feature.
Step 7	**vlan-name** *vlan_name* **Example:** `Device(config-wireless-flex-profile)# vlan-name VLAN2659`	Configures VLAN name.
Step 8	**vlan-id** *vlan_id* **Example:** `Device(config-wireless-flex-profile)# vlan-id 2659`	Configures VLAN ID. The valid VLAN ID ranges from 1 to 4096.
Step 9	**end** **Example:** `Device(config-wireless-flex-profile)# end`	Exits configuration mode and returns to privileged EXEC mode.

Configuring a Site Tag (CLI)

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode
Step 2	**wireless tag site** *site-name* **Example:** `Device(config)# wireless tag site new-flex-site`	Configures a site tag and enters site tag configuration mode.
Step 3	**flex-profile** *flex-profile-name* **Example:** `Device(config-site-tag)# flex-profile new-flex-profile`	Configures a flex profile.
Step 4	**no local-site** **Example:** `Device(config-site-tag)# no local-site`	**Local site** is not configured on the site tag.
Step 5	**site-tag** *site-tag-name* **Example:** `Device(config-site-tag)# site-tag new-flex-site`	Maps a site tag to an AP.
Step 6	**end** **Example:** `Device(config-site-tag)# end`	Exits configuration mode and returns to privileged EXEC mode.

Configuring a Mesh Profile (CLI)

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode
Step 2	**wireless profile mesh** *profile-name* **Example:** `Device(config)# wireless profile mesh Mesh_Profile`	Configures a Mesh profile and enters the Mesh profile configuration mode.

	Command or Action	Purpose
Step 3	**no ethernet-vlan-transparent** **Example:** `Device(config-wireless-profile-mesh)# no ethernet-vlan-transparent`	Disables VLAN transparency to ensure that the bridge is VLAN aware.
Step 4	**end** **Example:** `Device(config-wireless-profile-mesh)# end`	Exits configuration mode and returns to privileged EXEC mode.

Associating Wireless Mesh to an AP Profile (CLI)

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode
Step 2	**ap profile** *ap-profile-name* **Example:** `Device(config)# ap profile new-ap-join-profile`	Configures the AP profile and enters AP profile configuration mode.
Step 3	**mesh-profile** *mesh-profile-name* **Example:** `Device(config-ap-profile)# mesh-profile Mesh_Profile`	Configures the Mesh profile in AP profile configuration mode.
Step 4	**ssh** **Example:** `Device(config-ap-profile)# ssh`	Configures the Secure Shell (SSH).
Step 5	**mgmtuser username** *username* **password** {**0** | **8**} *password* **Example:** `Device(config-ap-profile)# mgmtuser username Cisco password 0 Cisco secret 0 Cisco`	Specifies the AP management username and password for managing all of the access points configured to the controller. • **0**: Specifies an UNENCRYPTED password. • **8**: Specifies an AES encrypted password. **Note** While configuring an username, ensure that special characters are not used as it results in error with bad configuration.

	Command or Action	Purpose
Step 6	**end** **Example:** `Device(config-ap-profile)# end`	Exits configuration mode and returns to privileged EXEC mode.

Attaching Site Tag to an Access Point (CLI)

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode
Step 2	**ap** *mac-address* **Example:** `Device(config)# ap F866.F267.7DFB`	Configures Cisco APs and enters ap-tag configuration mode.
Step 3	**site-tag** *site-tag-name* **Example:** `Device(config-ap-tag)# site-tag new-flex-site`	Maps a site tag to the AP. **Note** Associating Site Tag causes the associated AP to reconnect.
Step 4	**end** **Example:** `Device(config-ap-tag)# end`	Exits configuration mode and returns to privileged EXEC mode.

Configuring Switch Interface for APs (CLI)

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode
Step 2	**interface** *interface-id* **Example:** `Device(config)# interface <int-id>`	Enters the interface to be added to the VLAN.
Step 3	**switchport trunk native vlan** *vlan-id* **Example:**	Assigns the allowed VLAN ID to the port when it is in trunking mode.

	Command or Action	Purpose
	`Device(config-if)# switchport trunk native vlan 2660`	
Step 4	**switchport trunk allowed vlan** *vlan-id* **Example:** `Device(config-if)# switchport trunk allowed vlan 2659,2660`	Assigns the allowed VLAN ID to the port when it is in trunking mode.
Step 5	**switchport mode trunk** **Example:** `Device(config-if)# switchport mode trunk`	Sets the trunking mode to trunk unconditionally. **Note** When the controller works as a host for spanning tree, ensure that you configure portfast trunk, using **spanning-tree portfast trunk** command, in the uplink switch to ensure faster convergence.
Step 6	**end** **Example:** `Device(config-if)# end`	Exits configuration mode and returns to privileged EXEC mode.

Verifying Flex Resilient with Flex and Bridge Mode Access Points Configuration

To view the AP mode and model details, use the following command:

```
Device# show ap name <ap-name> config general | inc AP Mode
AP Mode                                         : Flex+Bridge
AP Model                                        : AIR-CAP3702I-A-K9
```

To view the MAP mode details, use the following command:

```
Device# show ap name MAP config general | inc AP Mode
AP Mode                                         : Flex+Bridge
AP Model                                        : AIR-CAP3702I-A-K9
```

To view the RAP mode details, use the following command:

```
Device# show ap name RAP config general | inc AP Mode
AP Mode                                         : Flex+Bridge
AP Model                                        : AIR-AP2702I-A-K9
```

To view if the Flex Profile - Resilient feature is enabled or not, use the following command:

```
Device# show  wireless profile flex detailed FLEX_TAG | inc resilient
Flex resilient                : ENABLED
```