

AP States:

o Lightweight AP goes through variety of states defined as part of Control & Provisioning.

AP Boots:

Once AP receives power, it boots on small IOS image so it can work through remaining states and communicate over its network connection. The AP must also receive an IP address from either DHCP server or a static configuration so that it can communicate over the network.

WLC Discovery:

The AP goes through a series of steps to find one or more controllers that it might join.

CAPWAP Tunnel:

AP attempts to build a CAPWAP tunnel with one or more controllers. The tunnel will provide a secure Datagram Transport Layer Security (DTLS) channel for subsequent AP-WLC control messages. AP & WLC authenticate each other through an exchange of digital certificates.

WLC Join:

The AP selects a WLC from a list of candidates and then sends a CAPWAP Join Request message to it. The WLC replies with a CAPWAP Join Response message.

Download Image:

The WLC informs the AP of its software release. If the AP's own software is a different release, the AP downloads a matching image from the controller, reboots to apply the new image, and then returns to step 1.

Download Config:

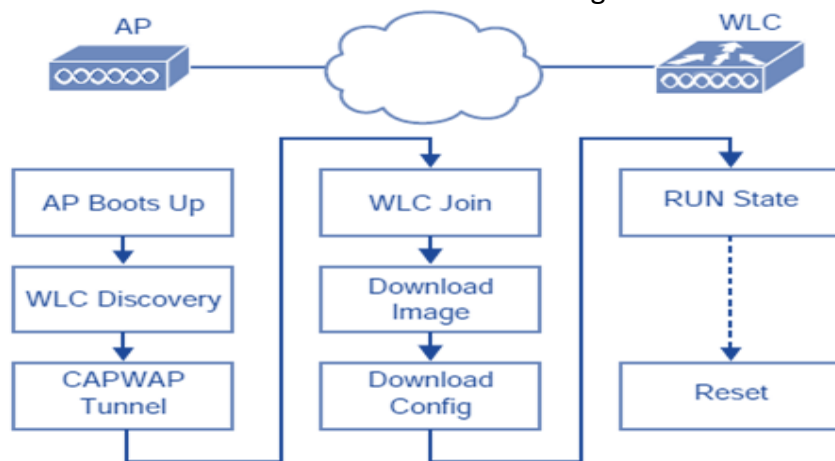
The AP pulls configuration parameters down from the WLC and can update existing values with those sent from the controller. Settings include RF, service set identifier (SSID), security, and quality of service (QoS) parameters.

Run State:

Once the AP is fully initialized, the WLC places it in the "run" state. The AP and WLC then begin providing a BSS and begin accepting wireless clients.

Reset:

If an AP is reset by the WLC, it tears down existing client associations and any CAPWAP tunnels to WLCs. The AP then reboots and starts through the entire state machine again.



Discovering WLC:

To discover a WLC, an AP sends a unicast CAPWAP Discovery Request to a controller's IP over UDP port 5246 or a broadcast to the local subnet. If the controller exists, it returns a CAPWAP Discovery Response to the AP. An AP must discover any WLCs that it can join without any pre-configuration. Several methods of discovery are used, and the sequence of discovery.

1. The AP broadcasts a CAPWAP Discovery Request on its local wired subnet. Any WLCs on the subnet answer with a CAPWAP Discovery Response.
2. An AP can be "primed" with up to 3 controllers: a primary, a secondary, and a tertiary. These are stored in NVRAM so that the AP can remember them after a reboot. Otherwise, if an AP has previously joined a WLC, it may have stored up to 8 out of a list of 32 WLC addresses that it received from the last controller it joined. The AP attempts to contact as many controllers as possible to build a list of candidates.
3. DHCP server that supplies an IP can also send DHCP option 43 to suggest WLC addresses.
4. The AP attempts to resolve the name CISCO-CAPWAP-CONTROLLER.localdomain with a DNS request (where localdomain is the domain name learned from DHCP). If the name resolves to an IP address, the controller attempts to contact a WLC at that address.
5. If none of steps has been successful, AP resets itself & restarts the discovery process again.



If the AP and controllers lie on different subnets, you can configure the local router to relay any broadcast requests on UDP port 5246 to specific controller addresses.

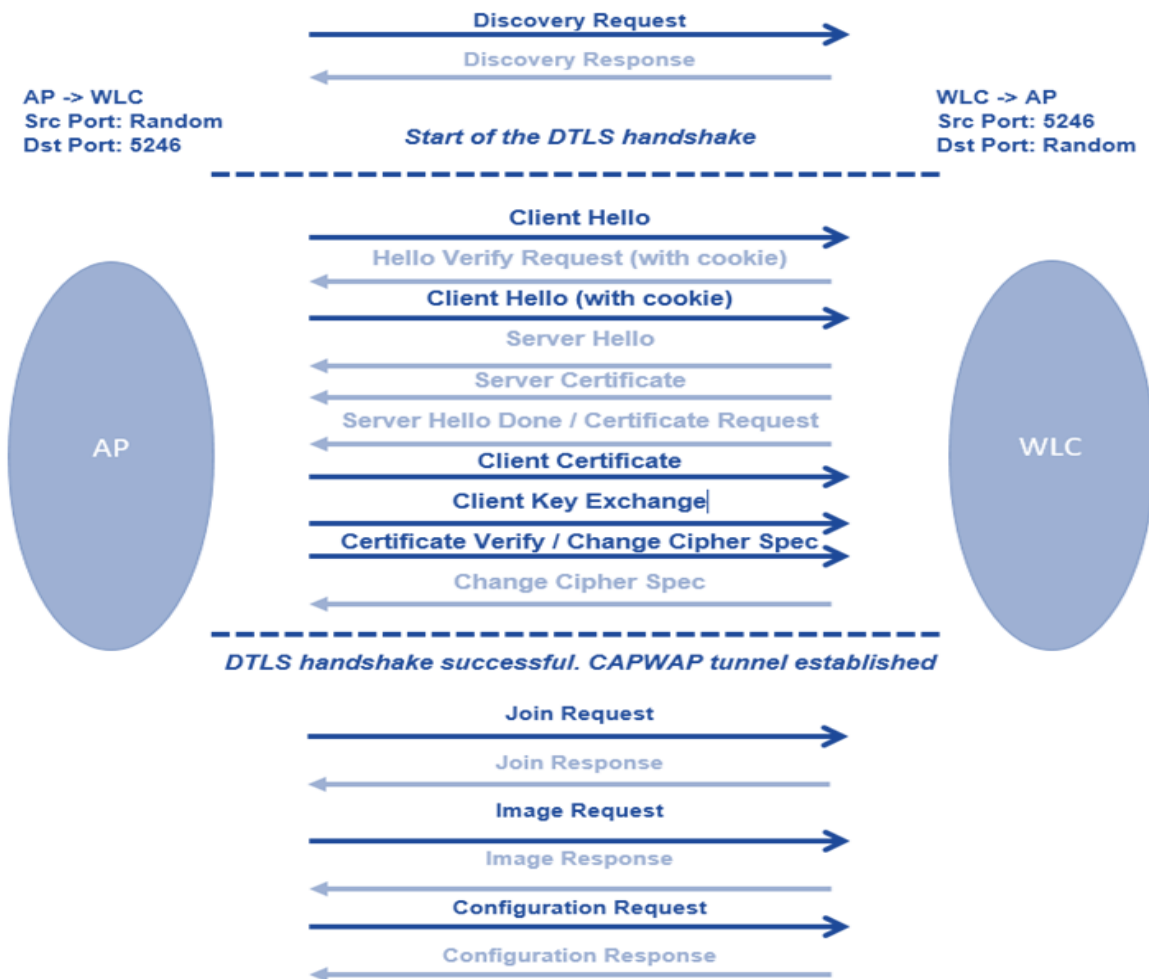
<code>Router(config)# ip forward-protocol udp 5246</code>
<code>Router(config)# interface vlan number</code>
<code>Router(config-int)# ip helper-address WLC1-MGMT-ADDR</code>
<code>Router(config-int)# ip helper-address WLC2-MGMT-ADDR</code>

AP Joining Process:

Joining a WLC involves sending it a CAPWAP Join Request and waiting for it to return a CAPWAP Join Response. From that point on, the AP and WLC build a DTLS tunnel to secure their CAPWAP control messages. The WLC selection process consists of the following three steps:

1. If the AP has previously joined a controller and has been configured or “primed” with a primary, secondary, and tertiary controller, it tries to join those controllers in succession.
2. If the AP does not know of any candidate controller, it tries to discover one. If a controller has been configured as a master controller, it responds to the AP’s request.
3. AP attempts to join the least-loaded WLC, to load balance APs across a set of controllers. During the discovery phase, each controller reports its load—the ratio of the number of currently joined APs to the total AP capacity.

Least-loaded WLC is the one with the lowest ratio. If the controller already has the maximum number of APs joined to it, it rejects any additional APs. To provide flexibility in supporting APs on an oversubscribed controller, can configure the APs with priority value. Once controller is full of APs, it rejects AP with lowest priority to make room for new one that has higher priority.



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2. If the AP does not know of any candidate controller, it tries to discover one. If a controller has been configured as a master controller, it responds to the AP’s request.
3. The AP attempts to join the least-loaded WLC, to load balance APs across a set of controllers. During the discovery phase, each controller reports its load—the ratio of the number of currently joined APs to the total AP capacity.

The least-loaded WLC is the one with the lowest ratio. If the controller already has the maximum number of APs joined to it, it rejects any additional APs. To provide flexibility in supporting APs on an oversubscribed controller, you can configure the APs with a priority value. Once a controller is full of APs, it rejects an AP with the lowest priority to make room for a new one that has a higher priority.