Mobility Groups

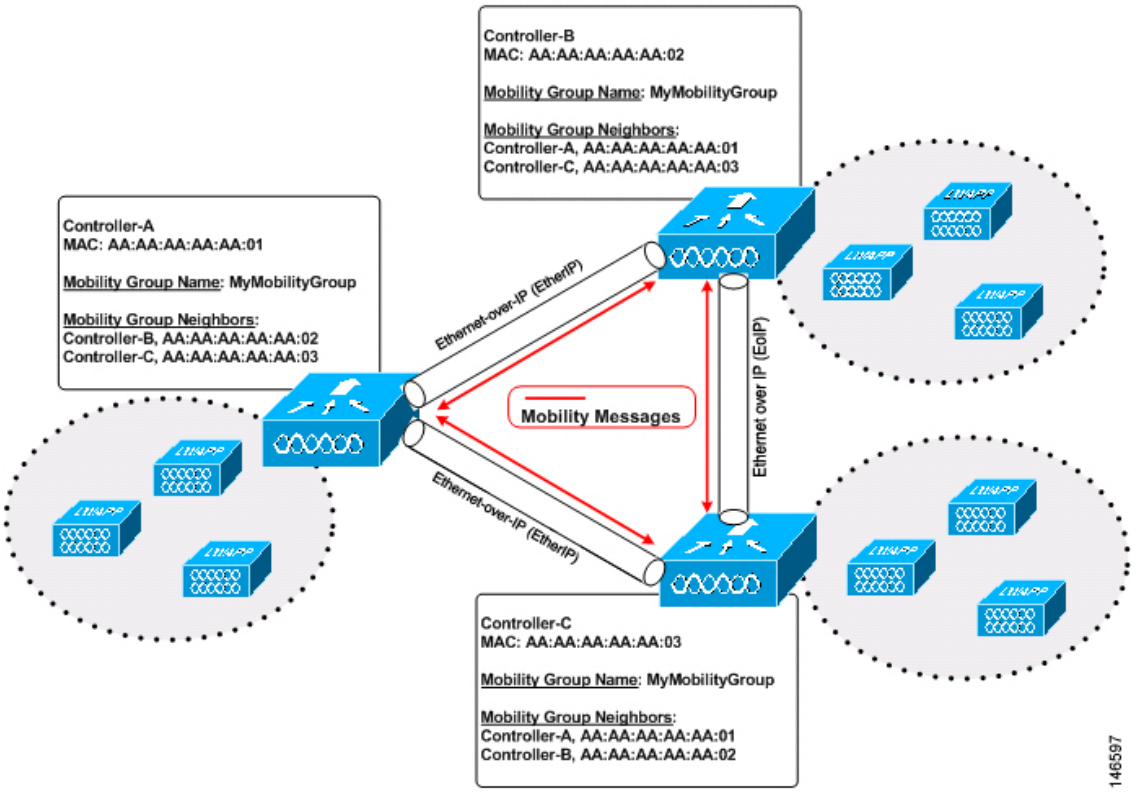
Information About Mobility Groups

A mobility group is a set of controllers, identified by the same mobility group name, that defines the realm of seamless roaming for wireless clients. By creating a mobility group, you can enable multiple controllers in a network to dynamically share information and forward data traffic when inter-controller or inter-subnet roaming occurs. Controllers in the same mobility group can share the context and state of client devices as well as their list of access points so that they do not consider each other's access points as rogue devices. With this information, the network can support inter-controller wireless LAN roaming and controller redundancy.

Note If migrating APs from one controller to another controller to decommission the old controller, clients that were associated with the first controller before the move might be anchored to the old controller after the move. As a workaround, you must disable the WLANs on the old controller before decommissioning it.

Note Controllers do not have to be of the same model to be a member of a mobility group. Mobility groups can be comprised of any combination of controller platforms as long as the controllers are running compatible AireOS versions. For more information, see the "IRCM Compatibility Matrix for AireOS Releases" section in the Cisco Wireless Solutions Software Compatibility Matrix document.

Figure 1: Example of a Single Mobility Group



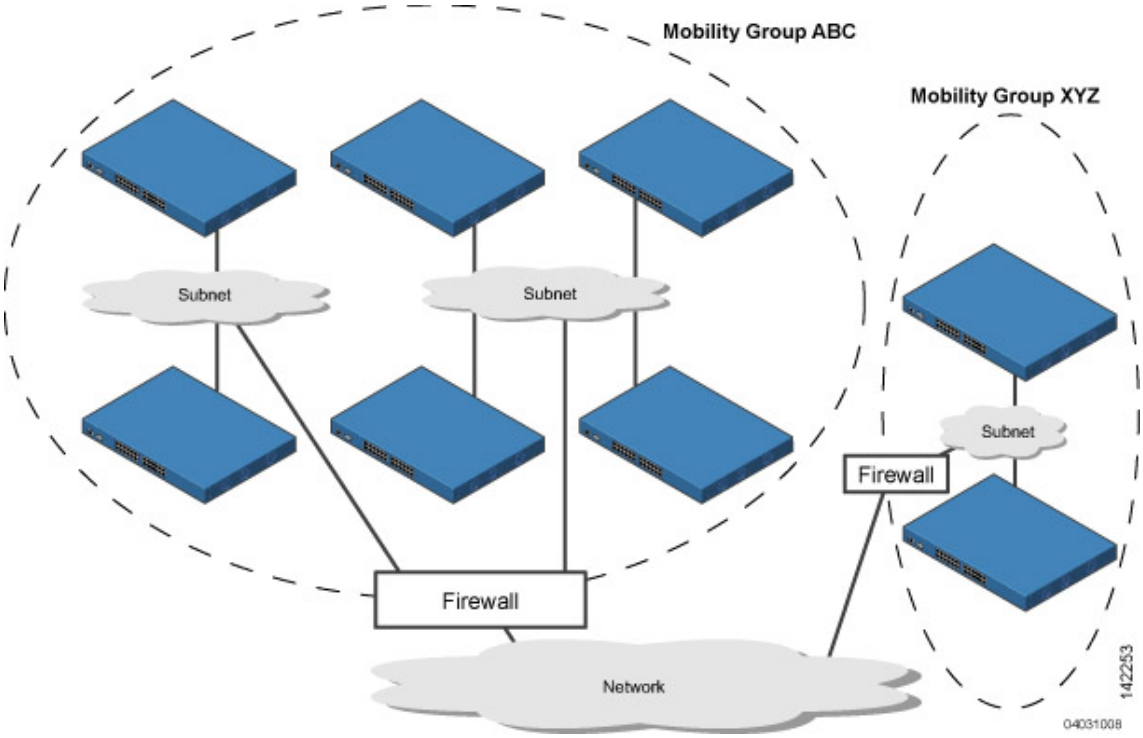
As shown above, each controller is configured with a list of the other members of the mobility group. In this example, client data traffic is tunneled between controllers in Ethernet-over-IP as mobility encryption is not configured. Whenever a new client joins a controller, the controller sends out a unicast message (or multicast message if mobility multicast is configured) to all of the controllers in the mobility group. The controller to which the client was previously connected passes on the status of the client. You can configure the controller to use multicast to send the Mobile Announce messages. This functionality enables the controller to send only one copy of the message to the network, which destines it to the multicast group that contains all the mobility members. To derive the maximum benefit from multicast messaging, we recommend that you enable multicast messaging for all group members.

For example, if a controller supports 6000 access points, a mobility group that consists of 24 such controllers supports up to 144,000 access points (24 * 6000 = 144,000 access points).

Mobility messages among mobility group members can be transmitted in IPv4 or IPv6, as unicast or multicast. We recommend multicast messaging for large mobility groups.

Figure 2: Two Mobility Groups

This figure shows the results of creating distinct mobility group names for two groups of controllers.



The controllers in the ABC mobility group share access point and client information with each other. The controllers in the ABC mobility group do not share the access point or client information with the XYZ controllers, which are in a different mobility group, unless each mobility group member is configured with mobility list entries for the other mobility group members. Likewise, the controllers in the XYZ mobility group do not share access point or client information with the controllers in the ABC mobility group. This feature ensures mobility group isolation across the network.

Every controller maintains information about its peer controllers in a mobility list. Controllers can communicate across mobility groups and clients may roam between access points in different mobility groups if the controllers are included in each other's mobility lists.

A mobility group can have up to 24 members and a mobility list can have up to 72 members. For example, the following combinations are allowed:

- 3 mobility groups with 24 members in each group
- 12 mobility groups with 6 members in each group
- 24 mobility groups with 3 members in each group
- 72 mobility groups with 1 member in each group

The controller supports seamless roaming across multiple mobility groups. During seamless roaming, the client maintains its IP address across all mobility groups; however, Cisco Centralized Key Management (CCKM) and proactive key caching (PKC) are supported only for inter-mobility-group roaming. When a client crosses a mobility group boundary during a roam, the client is fully authenticated, but the IP address is maintained, and mobility tunneling is initiated for Layer 3 roaming.

Note When a controller is added to a mobility group, some of the APs (which are running in local mode) do not get the complete controllers list updated, those APs are connected to controllers that are in the same mobility group. You can view the controller list in the APs using the command **show capwap client config** *ap-name* command. For example, if the mobility group is for 19 controllers and then you add two more controllers to the mobility group, the AP shows 19 controllers instead of 21 in its list. To address this issue, you must reboot the AP or move the AP to another controller that is part of the same mobility group to get the controller list updated. This issue is observed in AP1242 connected to different Cisco 5508 WLCs running code 7.6.120.0.

Prerequisites for Configuring Mobility Groups

Before you add controllers to a mobility group, you must verify that the following requirements have been met for all controllers that are to be included in the group:

- IP connectivity must exist between the management interfaces of all controllers.

Note You can verify IP connectivity by pinging the controllers using the mping and eping commands.

Note Mobility control packets can use any interface address as the source, based on routing table. It is recommended that all controllers in the mobility group should have the management interface in the same subnet. A topology where one controller's management interface and other controller's dynamic interface are on same subnet not recommended for seamless mobility.

- If configuring mobility peers that run different software versions, see the "IRCM Compatibility Matrix for AireOS Releases" section in the Cisco Wireless Solutions Software Compatibility Matrix document.

Note If you inadvertently configure a controller with a failover controller that runs a different software release, the access point might take a long time to join the failover controller because the access point starts the discovery process in CAPWAP and then changes to LWAPP discovery.

- All controllers must be configured with the same virtual interface IP address.
- You must have gathered the MAC address and IP address of every controller that is to be included in the mobility group. This information is necessary because you will be configuring all controllers with the MAC address and IP address of all the other mobility group members.

Note You can find the MAC and IP addresses of the other controllers to be included in the mobility group on the **Controller** > **Mobility Groups** page of each controller's GUI.

- If you have a firewall b/w your mobility group members, open UDP port 16666 and IP protocol 97. If you are using encrypted mobility, open UDP port 5246 and 5247.

  If you are using New Mobility, UDP port 16666, 16667, and 16668 are used.

For information about protocols and port numbers that must be used for management and operational purposes, see the Cisco Unified Wireless Network Protocol and Port Matrix document.

Note To view information on mobility support across controllers with different software versions, see http://www.cisco.com/c/en/us/td/docs/wireless/compatibility/matrix/compatibility-matrix.html.

Note You cannot perform port address translation (PAT) on the firewall. You must configure one-to-one network address translation (NAT).

Configuring Mobility Groups (GUI)

Procedure

Step 1 Choose **Controller** > **Mobility Management** > **Mobility Groups** to open the **Static Mobility Group Members** page.

This page shows the mobility group name in the Default Mobility Group text box and lists the MAC address and IPv4/IPv6 address of each controller that is currently a member of the mobility group. The first entry is the local controller, which cannot be deleted.

Note If you want to delete any of the remote controllers from the mobility group, hover your cursor over the blue drop-down arrow for the desired controller and choose **Remove**.

Step 2 Perform one of the following to add controllers to a mobility group:

- If you are adding only one controller or want to individually add multiple controllers, click **New**.

  OR

- If you are adding multiple controllers and want to add them in bulk, click **EditAll**.

Note The EditAll option enables you to enter the MAC and IPv4/IPv6 addresses of all the current mobility group members and then copy and paste all the entries from one controller to the other controllers in the mobility group.

Step 3 Click **New** to open the **Mobility Group Member** > **New** page.

Step 4 Add a controller to the mobility group as follows:

a. In the Member IP Address text box, enter the management interface IPv4/IPv6 address of the controller to be added.

Note If you are configuring the mobility group in a network where network address translation (NAT) is enabled, enter the IPv4/IPv6 address that is sent to the controller from the NAT device rather than the controller's management interface IPv4/IPv6 address. Otherwise, mobility will fail among controllers in the mobility group.

b. In the **Member MAC Address** text box, enter the MAC address of the controller to be added.

c. In the **Group Name** text box, enter the name of the mobility group.

Note The mobility group name is case sensitive.

d. In the **Hash** text box, enter the hash key of the peer mobility controller, which should be a virtual controller in the same domain.

You must configure the hash only if the peer mobility controller is a virtual controller in the same domain.

Note Hash is not supported for IPv6 members.

e. Click **Apply** to commit your changes. The new controller is added to the list of mobility group members on the **Static Mobility Group Members** page.

f. Click **Save Configuration**.

g. Repeat Step a through Step e to add all of the controllers in the mobility group.

h. Repeat this procedure on every controller to be included in the mobility group. All controllers in the mobility group must be configured with the MAC address and IPv4/IPv6 address of all other mobility group members.

The **Mobility Group Members** > **EditAll** page lists the MAC address, IPv4/IPv6 address, and mobility group name (optional) of all the controllers currently in the mobility group. The controllers are listed one per line with the local controller at the top of the list.

Note If desired, you can edit or delete any of the controllers in the list.

Step 5 Add more controllers to the mobility group as follows:

a. Click inside the edit box to start a new line.

b. Enter the MAC address, the management interface IPv4/IPv6 address, and the name of the mobility group for the controller to be added.

Note You should enter these values on one line and separate each value with one or two spaces.

Note The mobility group name is case sensitive.

c. Repeat Step a and Step b for each additional controller that you want to add to the mobility group.

d. Highlight and copy the complete list of entries in the edit box.

e. Click **Apply** to commit your changes. The new controllers are added to the list of mobility group members on the **Static Mobility Group Members** page.

f. Click **Save Configuration**to save your changes.

g. Paste the list into the text box on the Mobility Group Members > Edit All page of all the other controllers in the mobility group and click **Apply** and **Save Configuration**.

Step 6 Choose **Mobility Management** > **Multicast Messaging** to open the **Mobility Multicast Messaging** page.

The names of all the currently configured mobility groups appear in the middle of the page.

Step 7 On the **Mobility Multicast Messaging** page, check the **Enable Multicast Messaging** check box to enable the controller to use multicast mode to send Mobile Announce messages to the mobility members. If you leave it unselected, the controller uses unicast mode to send the Mobile Announce messages. The default value is unselected.

Step 8 If you enabled multicast messaging in the previous step, enter the multicast group IPv4 address for the local mobility group in the **Local Group Multicast IPv4 Address** text box. This address is used for multicast mobility messaging.

Note In order to use multicast messaging, you must configure the IPv4 address for the local mobility group.

Note IPv6 is not supported for mobility multicast.

Step 9 Click **Apply** to commit your changes.

Step 10 If desired, you can also configure the multicast group IPv4 address for non-local groups within the mobility list. To do so, click the name of a non-local mobility group to open the Mobility Multicast Messaging > Edit page, and enter the multicast group IPv4 address for the non-local mobility group in the Multicast IP Address text box.

Note If you do not configure the multicast IPv4 address for non-local groups, the controller uses unicast mode to send mobility messages to those members.

Step 11 Click **Apply**.

Step 12 Click **Save Configuration**.

Configuring Mobility Groups (CLI)

Procedure

Step 1 Check the current mobility settings by entering this command:

Step 2 Create a mobility group by entering this command:

config mobility group domain *domain_name*

Note Enter up to 31 case-sensitive ASCII characters for the group name. Spaces are not allowed in mobility group names.

Step 3 Add a group member by entering this command:

config mobility group member add *mac_address ip_address*

Note If you are configuring the mobility group in a network where network address translation (NAT) is enabled, enter the IP address that is sent to the controller from the NAT device rather than the controller's management interface IP address. Otherwise, mobility will fail among controllers in the mobility group.

Note Enter the **config mobility group member delete** *mac_address* command if you want to delete a group member.

Step 4 To configure the hash key of a peer mobility controller, which is a virtual controller in the same domain, enter this command:

config mobility group member hash *peer-ip-address key*

Step 5 Enable or disable multicast mobility mode by entering this command:

config mobility multicast-mode {**enable** | **disable**} *local_group_multicast_address*

where *local_group_multicast_address* is the multicast group IPv4 address for the local mobility group. This address is used for multicast mobility messaging.

Note In order to use multicast messaging, you must configure the IPv4 address for the local mobility group.

Note IPv6 is not supported for mobility multicast.

If you enable multicast mobility mode, the controller uses multicast mode to send Mobile Announce messages to the local group. If you disable multicast mobility mode, the controller uses unicast mode to send the Mobile Announce messages to the local group. The default value is disabled.

Step 6 (Optional) You can also configure the multicast group IPv4 address for non-local groups within the mobility list. To do so, enter this command:

config mobility group multicast-address *group_name IP_address*

If you do not configure the multicast IPv4 address for non-local groups, the controller uses unicast mode to send mobility messages to those members.

Step 7 Verify the mobility configuration by entering this command:

show mobility summary

Step 8 To see the hash key of mobility group members in the same domain, enter this command:

show mobility group member hash

Step 9 Save your changes by entering this command:

save config

Step 10 Repeat this procedure on every controller to be included in the mobility group. All controllers in the mobility group must be configured with the MAC address and IP address of all other mobility group members.

Step 11 Enable or disable debugging of multicast usage for mobility messages by entering this command:

debug mobility multicast {**enable** | **disable**}

Viewing Mobility Group Statistics (GUI)

Procedure

Step 1 Choose **Monitor** > **Statistics** > **Mobility Statistics** to open the Mobility Statistics page.

This page contains the following fields

- Global Mobility Statistics
  - Rx Errors—Generic protocol packet receive errors, such as packet too short or format incorrect.
  - Tx Errors—Generic protocol packet transmit errors, such as packet transmission fail.
  - Responses Retransmitted—Mobility protocol that uses UDP and resends requests several times if it does not receive a response. Because of network or processing delays, the responder may receive one or more retry requests after it initially responds to a request. This text box shows a count of the response resends.
  - Handoff Requests Received—Total number of handoff requests received, ignored, or responded to.
  - Handoff End Requests Received—Total number of handoff end requests received. These requests are sent by the anchor or foreign controller to notify the other about the close of a client session.
  - State Transitions Disallowed—Policy enforcement module (PEM) that has denied a client state transition, usually resulting in the handoff being terminated.
  - Resource Unavailable—Necessary resource, such as a buffer, was unavailable, resulting in the handoff being terminated.
- Mobility Initiator Statistics
  - Handoff Requests Sent—Number of clients that have associated to the controller and have been announced to the mobility group.
  - Handoff Replies Received—Number of handoff replies that have been received in response to the requests sent.
  - Handoff as Local Received—Number of handoffs in which the entire client session has been transferred.
  - Handoff as Foreign Received—Number of handoffs in which the client session was anchored elsewhere.
  - Handoff Denys Received—Number of handoffs that were denied.
  - Anchor Request Sent—Number of anchor requests that were sent for a three-party (foreign-to-foreign) handoff. The handoff was received from another foreign controller, and the new controller is requesting the anchor to move the client.
  - Anchor Deny Received—Number of anchor requests that were denied by the current anchor.
  - Anchor Grant Received—Number of anchor requests that were approved by the current anchor.

- Anchor Transfer Received—Number of anchor requests that closed the session on the current anchor and transferred the anchor back to the requestor.

- Mobility Responder Statistics
  - Handoff Requests Ignored—Number of handoff requests or client announcements that were ignored because the controller had no knowledge of that client.
  - Ping Pong Handoff Requests Dropped—Number of handoff requests that were denied because the handoff period was too short (3 seconds).
  - Handoff Requests Dropped—Number of handoff requests that were dropped due to either an incomplete knowledge of the client or a problem with the packet.
  - Handoff Requests Denied—Number of handoff requests that were denied.
  - Client Handoff as Local—Number of handoff responses sent while the client is in the local role.
  - Client Handoff as Foreign—Number of handoff responses sent while the client is in the foreign role.
  - Anchor Requests Received—Number of anchor requests received.
  - Anchor Requests Denied—Number of anchor requests denied.
  - Anchor Requests Granted—Number of anchor requests granted.
  - Anchor Transferred—Number of anchors transferred because the client has moved from a foreign controller to a controller on the same subnet as the current anchor.

Step 2 If you want to clear the current mobility statistics, click **Clear Stats**.

Viewing Mobility Group Statistics (CLI)

Procedure

Step 1 See mobility group statistics by entering this command:

show mobility statistics

Step 2 Clear the current mobility statistics by entering this command:

clear stats mobility

Information about Encrypted Mobility Tunnel

A secure link in which data is encrypted using CAPWAP DTLS protocol can be established between two controllers. This secured link is called Encrypted Mobility Tunnel.

If encrypted mobility tunnel is in enabled state, the data traffic is encrypted and the controller uses UDP port 16667, instead of EoIP, to send the data traffic.

To ensure that controllers with expired MIC certificates are able to join the encrypted mobility tunnel enabled network, an existing CLI is used to disable the MIC certificate date validation.

Note This command disables the date validation check during Cisco AP join and encrypted mobility tunnel creation. When the **config ap cert-expiry-ignore** CLI is enabled, the lifetime check is disabled.

Restrictions for Encrypted Mobility Tunnel

- This feature is supported on Cisco 3504, 5520, 8510 and 8540 controllers only.

Note The Cisco 5508 and 8510 Wireless Controllers do not support tunnel encryption protocols. They support IRCM with unencrypted mobility tunnels only.

- Native IPv6 is not supported.
- Mobility Multicast for an encrypted tunnel is not supported.
- The Encrypted Mobility Tunnel feature should be enabled on all the mobility peers in the network to have the tunnel created. The default state is set to disabled.
- If the packets passing through the controller after L3 roaming are greater than the MTU size of the controller in secure mobility, along with secure mobility, data encryption functionality must be enabled for the fragmented packets to be forwarded through a secure mobility tunnel.
- Only MIC certificate is supported to create the tunnel.
- When using Cisco 3504 controller as an anchor, we recommend reducing the client load by 30% of the controller's maximum load capability.

Configuring Global Encrypted Mobility Tunnel (GUI)

Procedure

Step 1 Choose **Controller** > **Mobility Management** > **Mobility Configuration** to open the **Global Configuration** page.

Step 2 Check the **Mobility Encryption** check box to enable mobility encryption on the network.

Step 3 Save the configuration.
Cisco WLC reboots to reflect the change in mobility encryption state.

Configuring Global Encrypted Mobility Tunnel (CLI)

Procedure

Step 1 [Optional] Disable the MIC certificate validation check by entering this command:

config ap cert-expiry-ignore mic { **enable | disable** }

Note You must use this command only when there are mobility peers with expired MIC certificates in the network.

Step 2 Configure encrypted mobility tunnel by entering this command:

config mobility encryption {enable | disable}

Note The WLC reboots after the feature is enabled or disabled.

Step 3 View the status of the encrypted mobility tunnel by entering this command:

lines

show mobility summary

Note DTLS Mode status is not displayed in the output when encrypted mobility tunnel feature is disabled.

Information similar to the following is displayed:

```
(Cisco Controller) >show mobility summary

Mobility Protocol Port.......................... 16666
Default Mobility Domain......................... TestSpartan8500Dev1Group
Multicast Mode ................................. Disabled
DTLS Mode ...................................... Enabled
Mobility Domain ID for 802.11r.................. 0x209c
Mobility Keepalive Interval..................... 10
Mobility Keepalive Count........................ 3
Mobility Group Members Configured............... 1
Mobility Control Message DSCP Value............. 0

Controllers configured in the Mobility Group
 MAC Address        IP Address    Group Name               Multicast IP
    Status
 f4:cf:e2:0a:ea:00  8.1.4.2      Test8500Dev1Group        0.0.0.0
       Up
```