



Configuring Mobility Groups

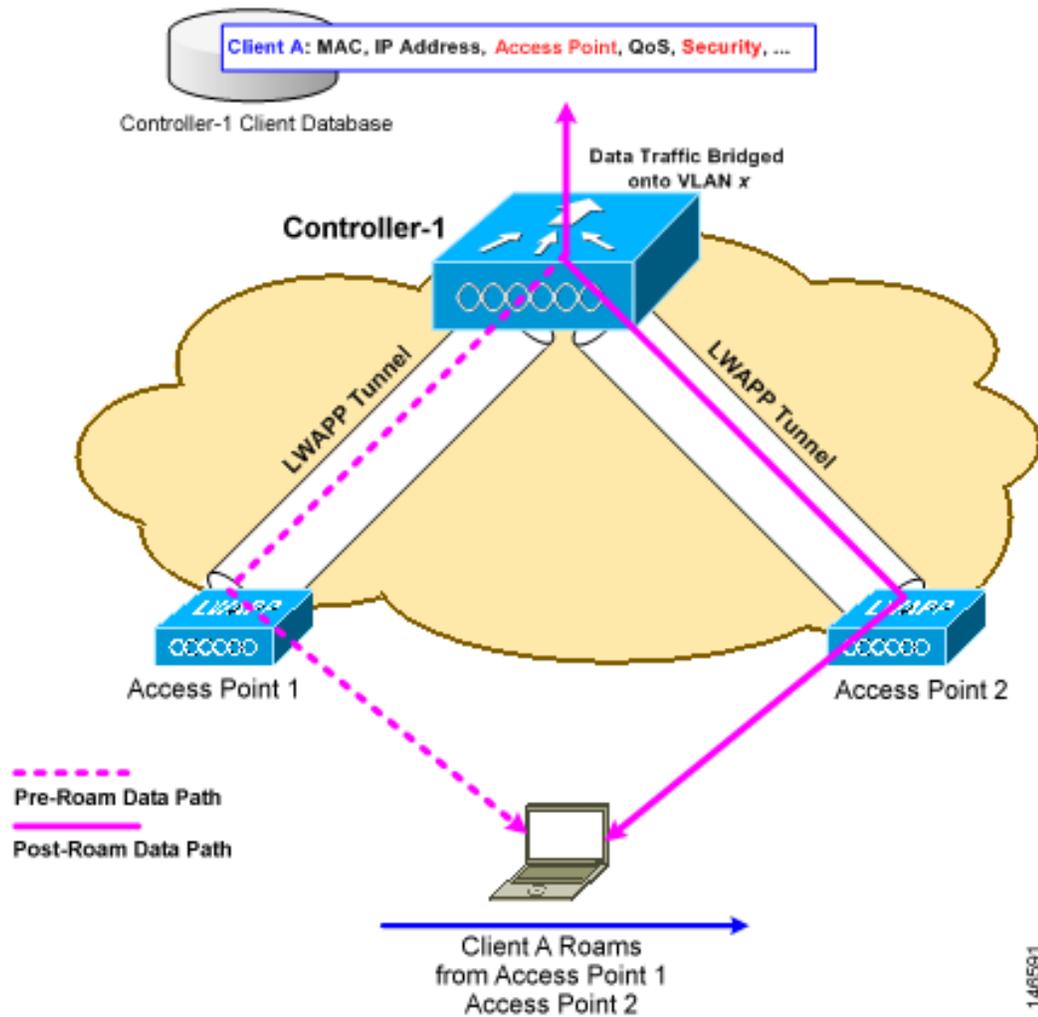
This chapter describes mobility groups and explains how to configure them on the controllers.

Overview of Mobility

Mobility, or roaming, is a wireless LAN client's ability to maintain its association seamlessly from one access point to another securely and with as little latency as possible. This section explains how mobility works when controllers are included in a wireless network.

When a wireless client associates and authenticates to an access point, the access point's controller places an entry for that client in its client database. This entry includes the client's MAC and IP addresses, security context and associations, quality of service (QoS) contexts, the WLAN, and the associated access point. The controller uses this information to forward frames and manage traffic to and from the wireless client. [Figure 14-1](#) shows a wireless client that roams from one access point to another when both access points are joined to the same controller.

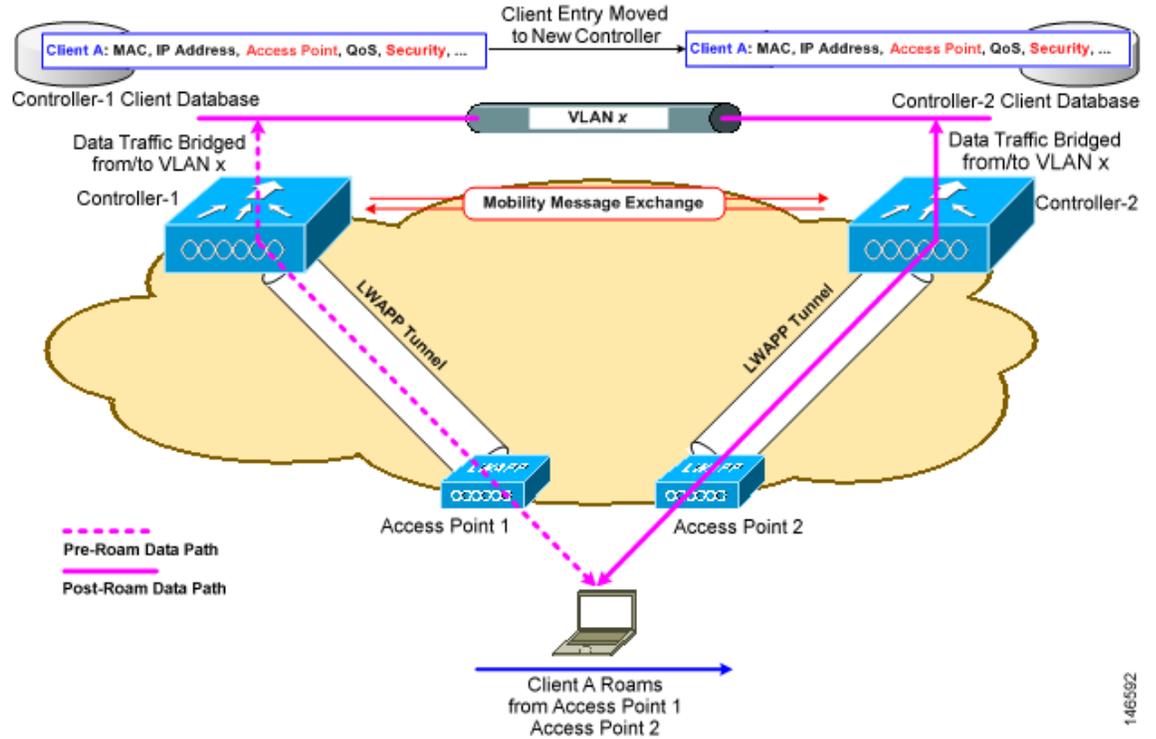
Figure 14-1 Intra-Controller Roaming



When the wireless client moves its association from one access point to another, the controller simply updates the client database with the newly associated access point. If necessary, new security context and associations are established as well.

The process becomes more complicated, however, when a client roams from an access point joined to one controller to an access point joined to a different controller. It also varies based on whether the controllers are operating on the same subnet. Figure 14-2 shows inter-controller roaming, which occurs when the controllers' wireless LAN interfaces are on the same IP subnet.

Figure 14-2 Inter-Controller Roaming



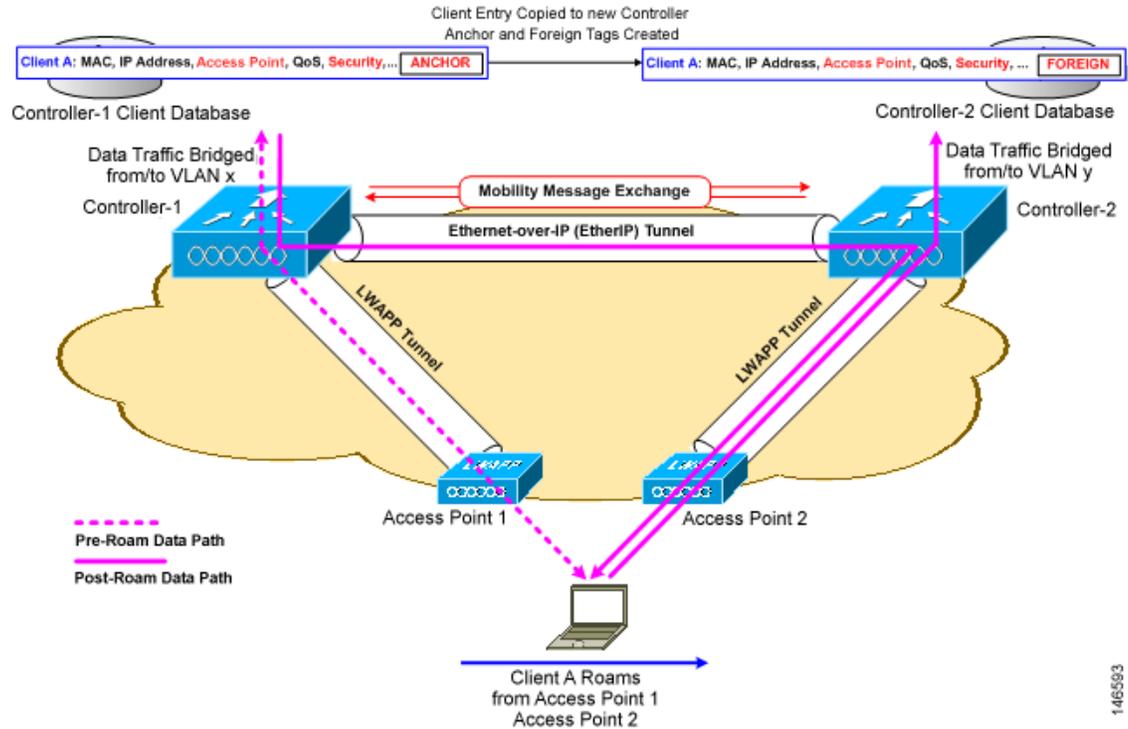
When the client associates to an access point joined to a new controller, the new controller exchanges mobility messages with the original controller, and the client database entry is moved to the new controller. New security context and associations are established if necessary, and the client database entry is updated for the new access point. This process remains transparent to the user.

**Note**

All clients configured with 802.1X/Wi-Fi Protected Access (WPA) security complete a full authentication in order to comply with the IEEE standard.

Figure 14-3 shows inter-subnet roaming, which occurs when the controllers' wireless LAN interfaces are on different IP subnets.

Figure 14-3 Inter-Subnet Roaming



Inter-subnet roaming is similar to inter-controller roaming in that the controllers exchange mobility messages on the client roam. However, instead of moving the client database entry to the new controller, the original controller marks the client with an “Anchor” entry in its own client database. The database entry is copied to the new controller client database and marked with a “Foreign” entry in the new controller. The roam remains transparent to the wireless client, and the client maintains its original IP address.

In inter-subnet roaming, WLANs on both anchor and foreign controllers need to have the same network access privileges and no source-based routing or source-based firewalls in place. Otherwise, the clients may have network connectivity issues after the handoff.

**Note**

If a client roams in web authentication state, the client is considered as a new client on another controller instead of considering it as a mobile client.

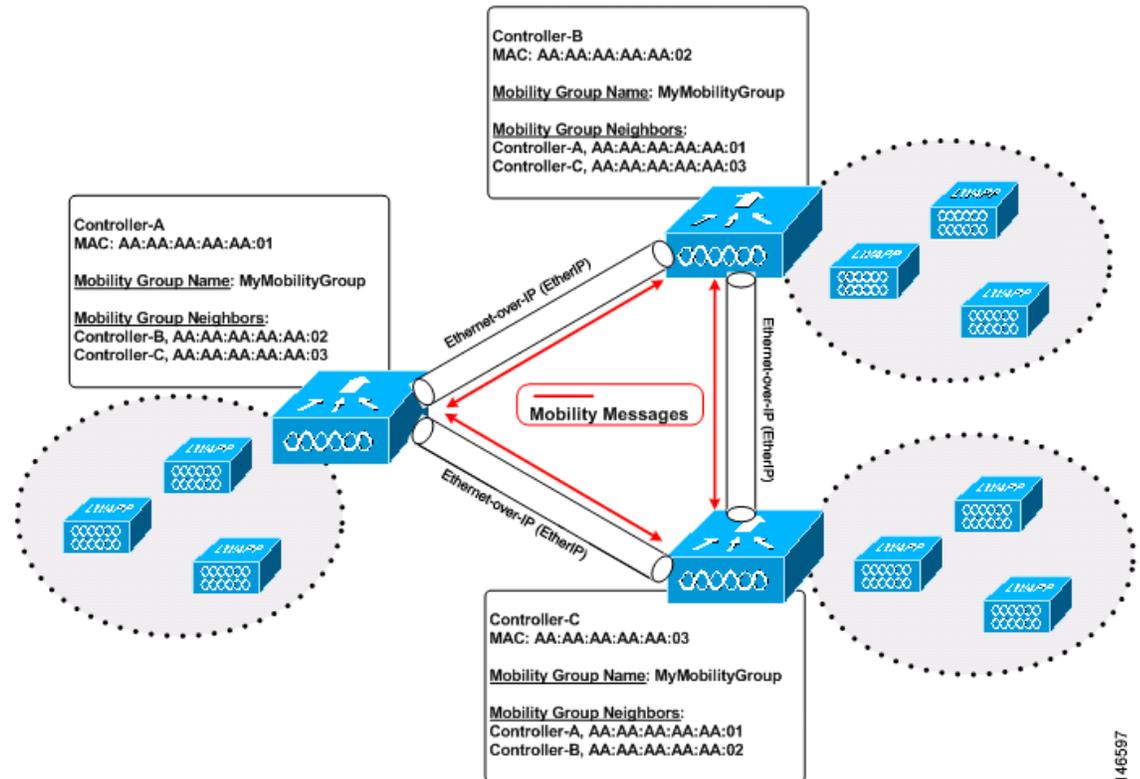
Overview of Mobility Groups

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. Figure 14-4 shows an example of a mobility group.

**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.

Figure 14-4 Single Mobility Group



As shown above, each controller is configured with a list of the other members of the mobility group. 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.

**Note**

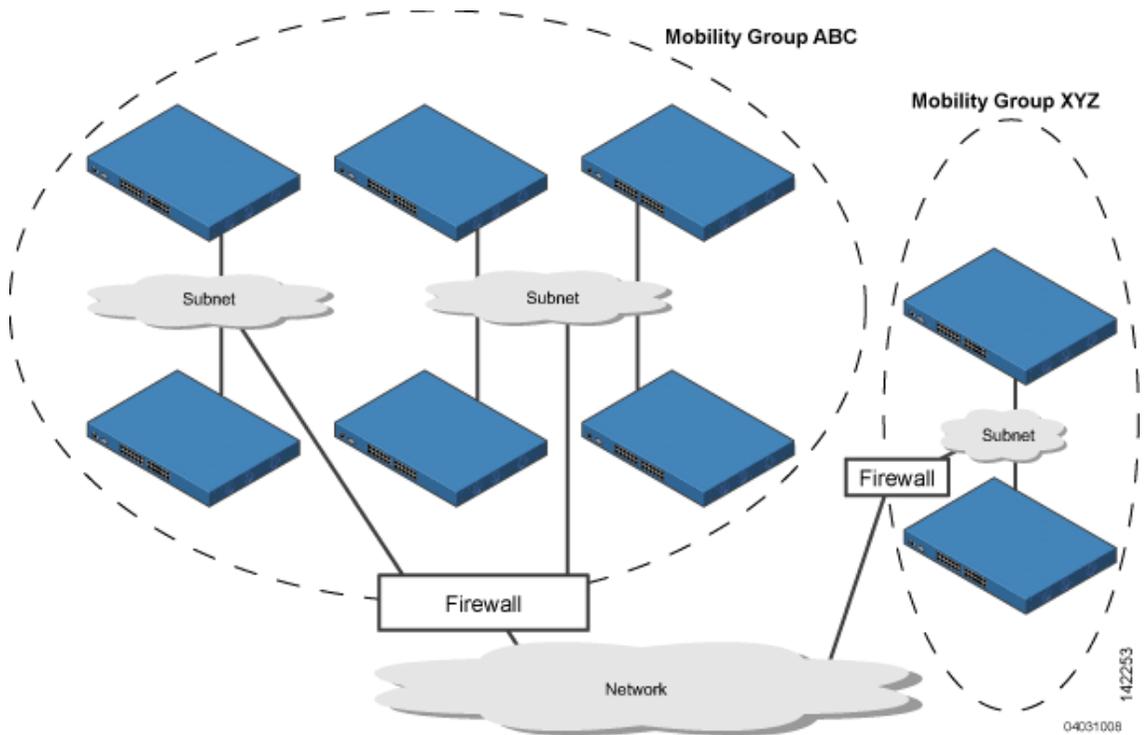
Controller software release 5.1 or later releases support up to 24 controllers in a single mobility group. The number of access points supported in a mobility group is bound by the number of controllers and controller types in the group.

Examples:

1. A 4404-100 controller supports up to 100 access points. Therefore, a mobility group that consists of 24 4404-100 controllers supports up to 2400 access points ($24 * 100 = 2400$ access points).
2. A 4402-25 controller supports up to 25 access points, and a 4402-50 controller supports up to 50 access points. Therefore, a mobility group that consists of 12 4402-25 controllers and 12 4402-50 controllers supports up to 900 access points ($12 * 25 + 12 * 50 = 300 + 600 = 900$ access points).

Mobility groups enable you to limit roaming between different floors, buildings, or campuses in the same enterprise by assigning different mobility group names to different controllers within the same wireless network. Figure 14-5 shows the results of creating distinct mobility group names for two groups of controllers.

Figure 14-5 Two Mobility Groups



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. 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. In the following example, controller 1 can communicate with either controller 2 or 3, but controller 2 and controller 3 can communicate only with controller 1 and not with each other. Similarly, clients can roam between controller 1 and controller 2 or between controller 1 and controller 3 but not between controller 2 and controller 3.

Example:

Controller 1	Controller 2	Controller 3
Mobility group: A	Mobility group: A	Mobility group: C
Mobility list:	Mobility list:	Mobility list:
Controller 1 (group A)	Controller 1 (group A)	Controller 1 (group A)
Controller 2 (group A)	Controller 2 (group A)	Controller 3 (group C)
Controller 3 (group C)		

**Note**

Controller software release 5.1 or later releases support up to 72 controllers in a controller's mobility list. The support for 24 controllers in a mobility group has been the same across all releases.

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 public key cryptography (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**

Controller software release 5.0 release supports up to 48 controllers in a mobility list.

Determining When to Include Controllers in a Mobility Group

If it is possible for a wireless client in your network to roam from an access point joined to one controller to an access point joined to another controller, but both controllers should be in the same mobility group.

Messaging Among Mobility Groups

The controller provides inter-subnet mobility for clients by sending mobility messages to other member controllers. In controller software release 5.0 or later releases, two improvements have been made to mobility messaging, each of which is especially useful when sending messages to the full list of mobility members:

- Sending Mobile Announce messages within the same group first and then to other groups in the list

The controller sends a Mobile Announce message to members in the mobility list each time that a new client associates to it. In controller software releases prior to 5.0, the controller sends this message to all members in the list irrespective of the group to which they belong. However, in controller software release 5.0 or later releases, the controller sends the message only to those members that are in the same group as the controller (the local group) and then includes all of the other members while sending retries.

- Sending Mobile Announce messages using multicast instead of unicast

In controller software releases prior to 5.0, the controller sends all mobility messages using unicast mode, which requires sending a copy of the messages to every mobility member. This behavior is not efficient because many messages (such as Mobile Announce, PMK Update, AP List Update, and IDS Shun) are meant for all members in the group. In controller software release 5.0 or later releases, the controller may be configured to use multicast to send the Mobile Announce messages. This behavior allows 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 it be enabled on all group members.

Using Mobility Groups with NAT Devices

In controller software releases prior to 4.2, mobility between controllers in the same mobility group does not work if one of the controllers is behind a network address translation (NAT) device. This behavior creates a problem for the guest anchor feature where one controller is expected to be outside the firewall.

Mobility message payloads carry IP address information about the source controller. This IP address is validated with the source IP address of the IP header. This behavior is a problem when a NAT device is introduced in the network because it changes the source IP address in the IP header. In the guest WLAN feature, any mobility packet, that is being routed through a NAT device is dropped because of the IP address mismatch.

In controller software release 4.2 or later releases, the mobility group lookup is changed to use the MAC address of the source controller. Because the source IP address is changed due to the mapping in the NAT device, the mobility group database is searched before a reply is sent to get the IP address of the requesting controller. This process is done using the MAC address of the requesting controller.

When configuring the mobility group in a network where 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. Also, make sure that the following ports are open on the firewall if you are using a firewall such as PIX:

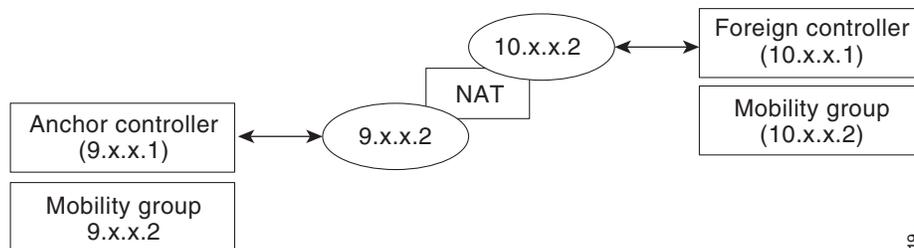
- UDP 16666 for tunnel control traffic
- IP protocol 97 for user data traffic
- UDP 161 and 162 for SNMP

**Note**

Client mobility among controllers works only if auto-anchor mobility (also called guest tunneling) or symmetric mobility tunneling is enabled. Asymmetric tunneling is not supported when mobility controllers are behind the NAT device. See the “[Configuring Auto-Anchor Mobility](#)” and “[Using Symmetric Mobility Tunneling](#)” sections for details on these mobility options.

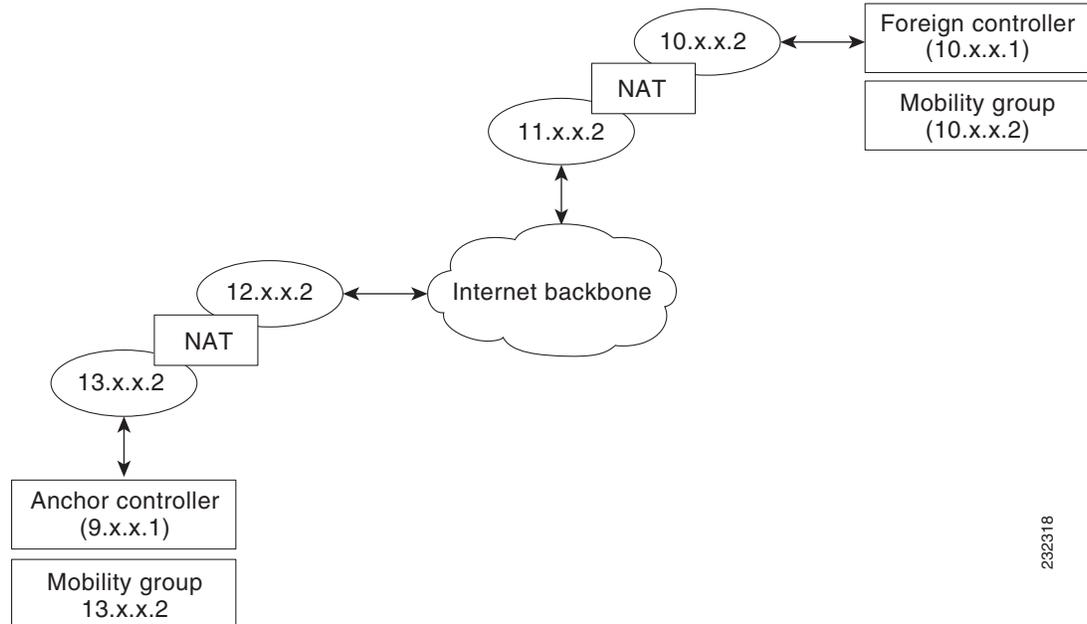
Figure 14-6 shows an example mobility group configuration with a NAT device. In this example, all packets pass through the NAT device (that is, packets from the source to the destination and vice versa). Figure 14-7 shows an example mobility group configuration with two NAT devices. In this example, one NAT device is used between the source and the gateway, and the second NAT device is used between the destination and the gateway.

Figure 14-6 Mobility Group Configuration with One NAT Device



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Figure 14-7 Mobility Group Configuration with Two NAT Devices



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Configuring Mobility Groups

This section describes how to configure controller mobility groups through either the GUI or the CLI.



Note

You can also configure mobility groups using the Cisco Wireless Control System (WCS). See the *Cisco Wireless Control System Configuration Guide* for instructions.

Prerequisites

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.



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.

- All controllers must be configured with the same mobility group name.



Note The mobility group name is generally set at deployment time through the Startup Wizard. However, you can change it if necessary through the Default Mobility Domain Name text box on the Controller > General page. The mobility group name is case sensitive.



Note For the Cisco WiSM, both controllers should be configured with the same mobility group name for seamless routing among 300 access points.



Note If one controller in the mobility group is configured for preferred call configuration, other controllers in the mobility group must also be configured with the same preferred call configuration.

- When controllers in the mobility list use different software versions, Layer 2 or Layer 3 clients have limited roaming support. Layer 2 or Layer 3 client roaming is supported only between controllers that use the same version or with controllers that run versions 4.2.X, 6.0.X, and 7.0.X. See [Table 14-2](#) for more information on mobility support across controllers.



Note If you inadvertently configure a controller that runs software release 5.2 or later releases with a failover controller that runs a different software release (such as 4.2, 5.0, or 5.1), 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.



Note If necessary, you can change the virtual interface IP address by editing the virtual interface name on the Controller > Interfaces page. See [Chapter 3, “Configuring Ports and Interfaces,”](#) for more information on the controller’s virtual interface.



Note If all the controllers within a mobility group are not using the same virtual interface, inter-controller roaming may appear to work, but the handoff does not complete, and the client loses connectivity for a period of time.

- 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.

- When you configure mobility groups using a third-party firewall, for example, Cisco PIX, or Cisco ASA, you must open port 16666, and IP protocol 97.
- For inter-controller CAPWAP data and control traffic for releases 5.0, 6.0, and 7.0, you must open the ports 5247 and 5246.

- For inter-controller LWAPP data and control traffic for prior releases to 5.0, do not open ports 12222 and 12223.

Table 14-1 lists the protocols and port numbers that must be used for management and operational purposes:

Table 14-1 Protocol/Service and Port Number

Protocol/Service	Port Number
SSH/Telnet	TCP Port 22 or 29
TFTP	UDP Port 69
NTP	UDP Port 123
SNMP	UDP Port 161 for gets and sets and UDP port 162 for traps.
HTTPS/HTTP	TCP port 443 for HTTPS and port 80 for HTTP
Syslog	TCP port 514
Radius Auth/Account	UDP port 1812 and 1813



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

Table 14-2 describes support for mobility across controllers with different software versions.

Table 14-2 Mobility Support Across controller versions

CUWN Service	4.2.X.X	5.0.X.X	5.1.X.X	6.0.X.X	7.0.X.X
Layer 2 and Layer 3 Roaming	X	–	–	X	X
Guest access/termination	X	X	X	X	X
Rogue detection	X	–	–	X	X
Fast roaming (CCKM) in a mobility group	X	–	–	X	X
Location services	X	–	–	X	X
Radio Resource Management (RRM)	X	–	–	X	X
Management Frame Protection (MFP)	X	–	–	X	X
AP failover	X	–	–	X	X

Using the GUI to Configure Mobility Groups

To configure mobility groups using the controller GUI, follow these steps:



Note

See the “[Using the CLI to Configure Mobility Groups](#)” section on page 14-15 if you would prefer to configure mobility groups using the CLI.

- Step 1** Choose **Controller > Mobility Management > Mobility Groups** to open the Static Mobility Group Members page (see [Figure 14-8](#)).

Figure 14-8 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 IP 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** and go to [Step 3](#).
 - 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 IP 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** Choose **Controller > Mobility Management > Mobility Groups** to open the Mobility Group Member > New page (see [Figure 14-9](#)).

Figure 14-9 Mobility Group Member > New Page

The screenshot shows the Cisco configuration interface for adding a new mobility group member. The page title is "Mobility Group Member > New". The left sidebar contains a navigation menu with categories like General, Inventory, Interfaces, Network Routes, Internal DHCP Server, and Mobility Management. The main content area has three input fields: "Member IP Address" with the value "209.165.200.225", "Member MAC Address" with the value "00:0b:85:33:08:80", and "Group Name" with the value "VoWLAN". There are "Back" and "Apply" buttons at the top right. The Cisco logo is in the top left, and navigation tabs (MONITOR, WLANs, CONTROLLER, WIRELESS, SECURITY, MANAGEMENT, COMMANDS, HELP) are at the top. A vertical ID "210936" is on the right edge.

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

- a. In the Member IP Address text box, enter the management interface IP 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 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.

- 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.

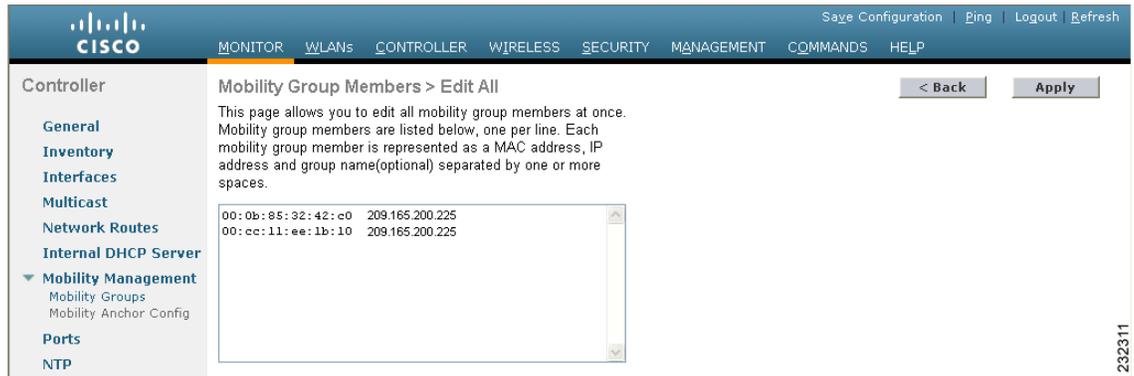
- d. Click **Apply** to commit your changes. The new controller is added to the list of mobility group members on the Static Mobility Group Members page.
- e. Click **Save Configuration** to save your changes.
- f. Repeat [Step a](#) through [Step e](#) to add all of the controllers in the mobility group.
- g. 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.

The Mobility Group Members > Edit All page (see [Figure 14-10](#)) lists the MAC address, IP 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.

Figure 14-10 Mobility Group Members > Edit All Page



- Step 5** Add more controllers to the mobility group as follows:
- Click inside the edit box to start a new line.
 - Enter the MAC address, the management interface IP 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.

- Repeat [Step a](#) and [Step b](#) for each additional controller that you want to add to the mobility group.
- Highlight and copy the complete list of entries in the edit box.
- 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.
- Click **Save Configuration** to save your changes.
- 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 **Multicast Messaging** to open the Mobility Multicast Messaging page (see [Figure 14-11](#)).

Figure 14-11 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, select 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 IP address for the local mobility group in the Local Group Multicast IP Address text box. This address is used for multicast mobility messaging.



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

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

Step 10 If desired, you can also configure the multicast group IP address for nonlocal groups within the mobility list. To do so, click the name of a nonlocal mobility group to open the Mobility Multicast Messaging > Edit page (see Figure 14-12), and enter the multicast group IP address for the nonlocal mobility group in the Multicast IP Address text box.



Note If you do not configure the multicast IP address for nonlocal groups, the controller uses unicast mode to send mobility messages to those members.

Figure 14-12 Mobility Multicast Messaging > Edit Page



Step 11 Click **Apply** to commit your changes.

Step 12 Click **Save Configuration** to save your changes.

Using the CLI to Configure Mobility Groups

To configure mobility groups using the controller CLI, follow these steps:

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

```
show mobility summary
```

Information similar to the following appears:

```
Symmetric Mobility Tunneling (current) ..... Enabled
Symmetric Mobility Tunneling (after reboot) .... Enabled
Mobility Protocol Port..... 16666
Mobility Security Mode..... Disabled
Default Mobility Domain..... snmp_gui
Multicast Mode ..... Disabled
```

```

Mobility Domain ID for 802.11r..... 0x66bd
Mobility Keepalive Interval..... 10
Mobility Keepalive Count..... 3
Mobility Group Members Configured..... 3
Mobility Control Message DSCP Value..... 0

```

Controllers configured in the Mobility Group

MAC Address	IP Address	Group Name	Multicast	IP	Status
00:0b:85:32:42:c0	1.100.163.24	snmp_gui	0.0.0.0		Up
00:cc:11:ee:1b:10	10.100.100.1	VoWLAN	0.0.0.0		Control and Data Path Down
11:22:11:33:11:44	1.2.3.4	test	0.0.0.0		Control and Data Path Down

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 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 IP address for the local mobility group. This address is used for multicast mobility messaging.

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 5 (Optional) You can also configure the multicast group IP address for nonlocal 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 IP address for nonlocal groups, the controller uses unicast mode to send mobility messages to those members.

Step 6 Verify the mobility configuration by entering this command:

```
show mobility summary
```

Step 7 Save your changes by entering this command:

```
save config
```

- Step 8** 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 9** Enable or disable debugging of multicast usage for mobility messages by entering this command:
- ```
debug mobility multicast {enable | disable}
```
- 

## Viewing Mobility Group Statistics

You can view three types of mobility group statistics from the controller GUI:

- Global statistics—Affect all mobility transactions
- Mobility initiator statistics—Generated by the controller initiating a mobility event
- Mobility responder statistics—Generated by the controller responding to a mobility event

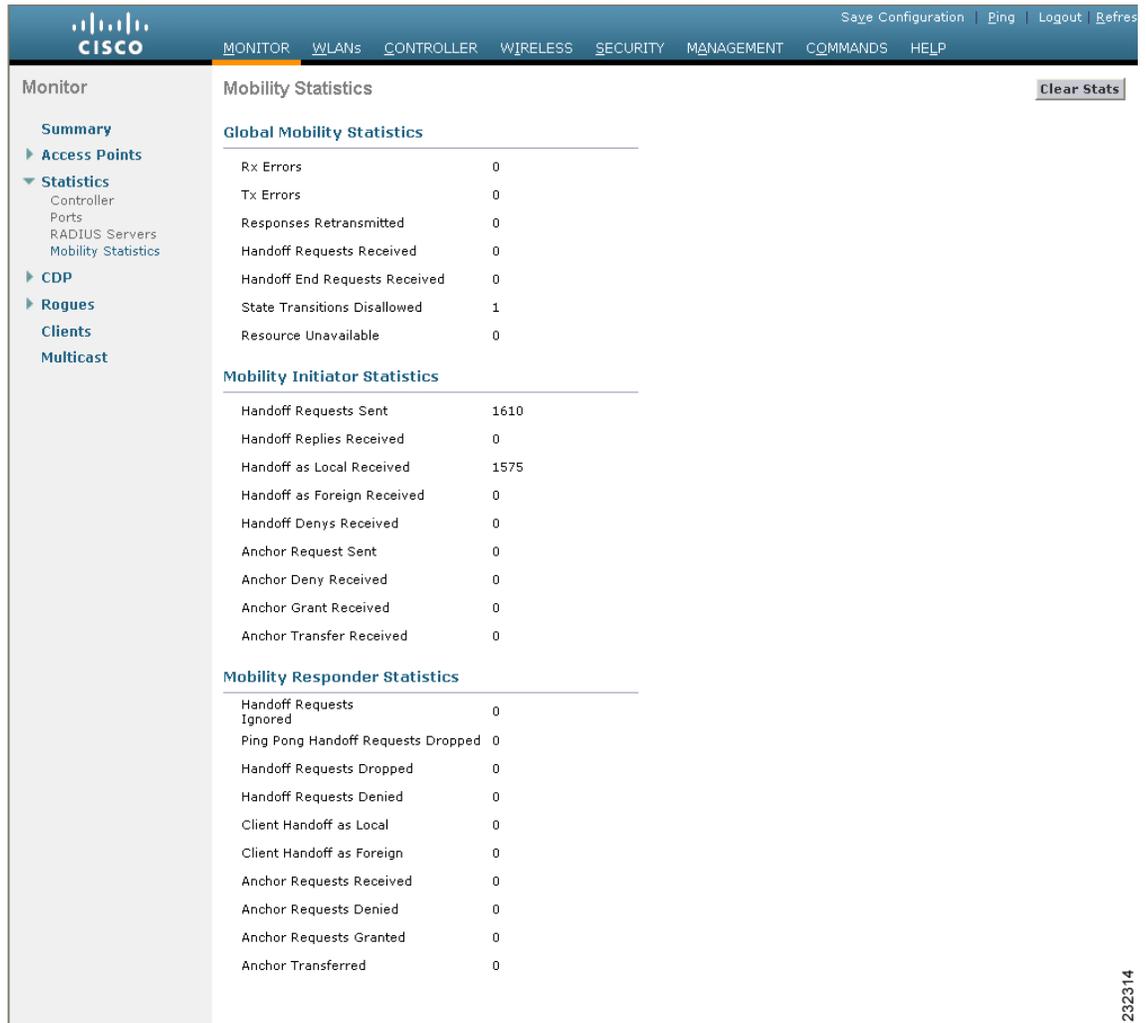
You can view mobility group statistics using the controller GUI or CLI.

## Using the GUI to View Mobility Group Statistics

To view mobility group statistics using the controller GUI, follow these steps:

- Step 1** Choose **Monitor > Statistics > Mobility Statistics** to open the Mobility Statistics page (see [Figure 14-13](#)).

Figure 14-13 Mobility Statistics Page



**Step 2** See [Table 14-3](#) for a description of each statistic.

Table 14-3 Mobility Statistics

| Parameter                        | Description                                                                                                                                                                                                                                                                                        |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Group Mobility Statistics</b> |                                                                                                                                                                                                                                                                                                    |
| 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. |

**Table 14-3** *Mobility Statistics (continued)*

| <b>Parameter</b>                     | <b>Description</b>                                                                                                                                                                                                     |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 aborted.                                                                                             |
| Resource Unavailable                 | Necessary resource, such as a buffer, was unavailable, resulting in the handoff being aborted.                                                                                                                         |
| <b>Mobility Initiator Statistics</b> |                                                                                                                                                                                                                        |
| 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.                                                                                              |

**Table 14-3** *Mobility Statistics (continued)*

| Parameter                            | Description                                                                                                                                    |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Mobility Responder Statistics</b> |                                                                                                                                                |
| 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 3** If you want to clear the current mobility statistics, click **Clear Stats**.

---

## Using the CLI to View Mobility Group Statistics

To view mobility group statistics using the controller CLI, follow these steps:

- 
- Step 1** See mobility group statistics by entering this command:  
**show mobility statistics**
  - Step 2** Refer to [Table 14-3](#) for a description of each statistic.
  - Step 3** If you want to clear the current mobility statistics, enter this command:  
**clear stats mobility**
- 

## Configuring Auto-Anchor Mobility

You can use auto-anchor mobility (also called guest tunneling) to improve load balancing and security for roaming clients on your wireless LANs. Under normal roaming conditions, client devices join a wireless LAN and are anchored to the first controller that they contact. If a client roams to a different

subnet, the controller to which the client roamed sets up a foreign session for the client with the anchor controller. However, when you use the auto-anchor mobility feature, you can specify a controller or set of controllers as the anchor points for clients on a wireless LAN.

In auto-anchor mobility mode, a subset of a mobility group is specified as the anchor controllers for a WLAN. You can use this feature to restrict a WLAN to a single subnet, regardless of a client's entry point into the network. Clients can then access a guest WLAN throughout an enterprise but still be restricted to a specific subnet. Auto-anchor mobility can also provide geographic load balancing because the WLANs can represent a particular section of a building (such as a lobby, a restaurant, and so on), effectively creating a set of home controllers for a WLAN. Instead of being anchored to the first controller that they happen to contact, mobile clients can be anchored to controllers that control access points in a particular vicinity.

When a client first associates to a controller of a mobility group that has been preconfigured as a mobility anchor for a WLAN, the client associates to the controller locally, and a local session is created for the client. Clients can be anchored only to preconfigured anchor controllers of the WLAN. For a given WLAN, you should configure the same set of anchor controllers on all controllers in the mobility group.

When a client first associates to a controller of a mobility group that has not been configured as a mobility anchor for a WLAN, the client associates to the controller locally, a local session is created for the client, and the client is announced to the other controllers in the mobility list. If the announcement is not answered, the controller contacts one of the anchor controllers configured for the WLAN and creates a foreign session for the client on the local switch. Packets from the client are encapsulated through a mobility tunnel using EtherIP and sent to the anchor controller, where they are decapsulated and delivered to the wired network. Packets to the client are received by the anchor controller and forwarded to the foreign controller through a mobility tunnel using EtherIP. The foreign controller decapsulates the packets and forwards them to the client.

In controller software releases prior to 4.1, there is no automatic way of determining if a particular controller in a mobility group is unreachable. As a result, the foreign controller may continually send all new client requests to a failed anchor controller, and the clients remain connected to this failed controller until a session timeout occurs. In controller software release 4.1 or later releases, mobility list members can send ping requests to one another to check the data and control paths among them to find failed members and reroute clients. You can configure the number and interval of ping requests that are sent to each anchor controller. This functionality provides guest N+1 redundancy for guest tunneling and mobility failover for regular mobility.

If multiple controllers are added as mobility anchors for a particular WLAN on a foreign controller, the foreign controller internally sorts the controller by their IP address. The controller with the lowest IP address is the first anchor. For example, a typical ordered list would be 172.16.7.25, 172.16.7.28, 192.168.5.15. If the first client associates to the foreign controller's anchored WLAN, the client database entry is sent to the first anchor controller in the list, the second client is sent to the second controller in the list, and so on, until the end of the anchor list is reached. The process is repeated starting with the first anchor controller. If any of the anchor controller is detected to be down, all the clients anchored to the controller are deauthenticated, and the clients then go through the authentication/anchoring process again in a round-robin manner with the remaining controller in the anchor list. This functionality is also extended to regular mobility clients through mobility failover. This feature enables mobility group members to detect failed members and reroute clients.

**Note**

A Cisco 2100 Series Controller cannot be designated as an anchor for a WLAN. However, a WLAN created on a Cisco 2100 Series Controller can have a Cisco 4400 Series Controller as its anchor.

**Note**

The IPsec and L2TP Layer 3 security policies are unavailable for WLANs that are configured with a mobility anchor.

## Guidelines for Using Auto-Anchor Mobility

Follow these guidelines when you configure auto-anchor mobility:

- You must add controllers to the mobility group member list before you can designate them as mobility anchors for a WLAN.
- You can configure multiple controllers as mobility anchors for a WLAN.
- You must disable the WLAN before configuring mobility anchors for it.
- Auto-anchor mobility supports web authorization but does not support other Layer 3 security types.
- You must configure the WLANs on both the foreign controller and the anchor controller with mobility anchors. On the anchor controller, configure the anchor controller itself as a mobility anchor. On the foreign controller, configure the anchor as a mobility anchor.
- Auto-anchor mobility is not supported for use with DHCP option 82.
- When using the guest N+1 redundancy and mobility failover features with a firewall, make sure that the following ports are open:
  - UDP 16666 for tunnel control traffic
  - IP Protocol 97 for user data traffic
  - UDP 161 and 162 for SNMP

## Using the GUI to Configure Auto-Anchor Mobility

To create a new mobility anchor for a WLAN using the controller GUI, follow these steps:

**Note**

See the [“Using the CLI to Configure Auto-Anchor Mobility”](#) section on page 14-24 if you would prefer to configure auto-anchor mobility using the CLI.

- Step 1** Configure the controller to detect failed anchor controllers within a mobility group as follows:
- a. Choose **Controller > Mobility Management > Mobility Anchor Config** to open the Mobility Anchor Config page.
  - b. In the Keep Alive Count text box, enter the number of times a ping request is sent to an anchor controller before the anchor is considered to be unreachable. The valid range is 3 to 20, and the default value is 3.
  - c. In the Keep Alive Interval text box, enter the amount of time (in seconds) between each ping request that is sent to an anchor controller. The valid range is 1 to 30 seconds, and the default value is 10 seconds.
  - d. In the DSCP Value text box, enter the DSCP value. The default is 0.
  - e. Click **Apply** to commit your changes.
- Step 2** Choose **WLANs** to open the WLANs page (see [Figure 14-14](#)).

Figure 14-14 WLANs Page

| Profile Name                  | Type      | WLAN SSID     | Admin Status | Security Policies         |
|-------------------------------|-----------|---------------|--------------|---------------------------|
| <a href="#">wireless-test</a> | WLAN      | wireless-test | Enabled      | WEP                       |
| <a href="#">testipv6</a>      | WLAN      | testipv6      | Disabled     |                           |
| <a href="#">test</a>          | WLAN      | test          | Enabled      |                           |
| <a href="#">devesh</a>        | WLAN      | devesh        | Enabled      | 802.1X, Cond-Web-Redirect |
| <a href="#">guestLan</a>      | Guest LAN | guestLan      | Disabled     | Web-Auth                  |
| <a href="#">wiredguestA</a>   | Guest LAN | wiredguestA   | Disabled     | Web-Auth                  |
| <a href="#">GuestLAN1</a>     | Guest LAN | LAN1          | Disabled     | Web-Auth                  |

- Step 3** Click the blue drop-down arrow for the desired WLAN or wired guest LAN and choose **Mobility Anchors**. The Mobility Anchors page appears (see Figure 14-15).

Figure 14-15 Mobility Anchors Page

This page lists the controllers that have already been configured as mobility anchors and shows the current state of their data and control paths. Controllers within a mobility group communicate among themselves over a well-known UDP port and exchange data traffic through an Ethernet-over-IP (EoIP) tunnel. They send mpings, which test mobility control packet reachability over the management interface over mobility UDP port 16666 and they send epings, which test the mobility data traffic over the management interface over EoIP port 97. The Control Path text box shows whether mpings have passed (up) or failed (down), and the Data Path text box shows whether epings have passed (up) or failed (down). If the Data or Control Path text box shows “down,” the mobility anchor cannot be reached and is considered failed.

- Step 4** Select the IP address of the controller to be designated a mobility anchor in the Switch IP Address (Anchor) drop-down list.
- Step 5** Disable the WLAN or wired guest LAN for which you are configuring mobility anchors by selecting the WLAN ID check box and choose **Disable Selected** from the drop-down list and click **Go**.
- Step 6** Click **Mobility Anchor Create**. The selected controller becomes an anchor for this WLAN or wired guest LAN.



**Note** To delete a mobility anchor for a WLAN or wired guest LAN, hover your cursor over the blue drop-down arrow for the anchor and choose **Remove**.

- Step 7** Click **Save Configuration** to save your changes.

- Step 8** Repeat [Step 4](#) and [Step 7](#) to set any other controllers as mobility anchors for this WLAN or wired guest LAN.
- Step 9** Configure the same set of mobility anchors on every controller in the mobility group.
- 

## Using the CLI to Configure Auto-Anchor Mobility

Use these commands to configure auto-anchor mobility using the controller CLI:



### Note

See the [“Using the GUI to Configure Auto-Anchor Mobility” section on page 14-22](#) for the valid ranges and default values of the parameters used in the CLI commands.

---

- The controller is programmed to always detect failed mobility list members. To change the parameters for the ping exchange between mobility members, enter these commands:
  - **config mobility group keepalive count** *count*—Specifies the number of times a ping request is sent to a mobility list member before the member is considered to be unreachable. The valid range is 3 to 20, and the default value is 3.
  - **config mobility group keepalive interval** *seconds*—Specifies the amount of time (in seconds) between each ping request sent to a mobility list member. The valid range is 1 to 30 seconds, and the default value is 10 seconds.
- Disable the WLAN or wired guest LAN for which you are configuring mobility anchors by entering this command:
 

```
config {wlan | guest-lan} disable {wlan_id | guest_lan_id}
```
- Create a new mobility anchor for the WLAN or wired guest LAN by entering one of these commands:
  - **config mobility group anchor add** {wlan | guest-lan} {wlan\_id | guest\_lan\_id} *anchor\_controller\_ip\_address*
  - **config {wlan | guest-lan} mobility anchor add** {wlan\_id | guest\_lan\_id} *anchor\_controller\_ip\_address*



### Note

The *wlan\_id* or *guest\_lan\_id* must exist and be disabled, and the *anchor\_controller\_ip\_address* must be a member of the default mobility group.

---



### Note

Auto-anchor mobility is enabled for the WLAN or wired guest LAN when you configure the first mobility anchor.

---

- Delete a mobility anchor for the WLAN or wired guest LAN by entering one of these commands:
  - **config mobility group anchor delete** {wlan | guest-lan} {wlan\_id | guest\_lan\_id} *anchor\_controller\_ip\_address*
  - **config {wlan | guest-lan} mobility anchor delete** {wlan\_id | guest\_lan\_id} *anchor\_controller\_ip\_address*




---

**Note** The *wlan\_id* or *guest\_lan\_id* must exist and be disabled.

---




---

**Note** Deleting the last anchor disables the auto-anchor mobility feature and resumes normal mobility for new associations.

---

- Save your settings by entering this command:

**save config**

- See a list and status of controllers configured as mobility anchors for a specific WLAN or wired guest LAN by entering this command:

**show mobility anchor { wlan | guest-lan } { wlan\_id | guest\_lan\_id }**




---

**Note** The *wlan\_id* and *guest\_lan\_id* parameters are optional and constrain the list to the anchors in a particular WLAN or guest LAN. To see all of the mobility anchors on your system, enter the **show mobility anchor** command.

---

Information similar to the following appears:

```
Mobility Anchor Export List
WLAN ID IP Address Status
 1 10.50.234.2 UP
 1 10.50.234.6 UP
 2 10.50.234.2 UP
 2 10.50.234.3 CNTRL_DATA_PATH_DOWN

GLAN ID IP Address Status
 1 10.20.100.2 UP
 2 10.20.100.3 UP
```

The Status text box shows one of these values:

- UP—The controller is reachable and able to pass data.
  - CNTRL\_PATH\_DOWN—The mpings failed. The controller cannot be reached through the control path and is considered failed.
  - DATA\_PATH\_DOWN—The epings failed. The controller cannot be reached and is considered failed.
  - CNTRL\_DATA\_PATH\_DOWN—Both the mpings and epings failed. The controller cannot be reached and is considered failed.
- See the status of all mobility group members by entering this command:

**show mobility summary**

Information similar to the following appears:

```
Mobility Keepalive interval..... 10
Mobility Keepalive count..... 3
Mobility Group members configured..... 3

Controllers configured in the mobility group
MAC Address IP Address Group Name Status
00:0b:85:32:b1:80 10.10.1.1 local Up
00:0b:85:33:a1:70 10.1.1.2 local Data Path Down
```

```
00:0b:85:23:b2:30 10.20.1.2 local Up
```

- Troubleshoot mobility issues by entering these commands:
  - **debug mobility handoff {enable | disable}**—Debugs mobility handoff issues.
  - **debug mobility keep-alive {enable | disable} all**—Dumps the keepalive packets for all mobility anchors.
  - **debug mobility keep-alive {enable | disable} IP\_address**—Dumps the keepalive packets for a specific mobility anchor.

## WLAN Mobility Security Values

For any anchoring or mobility event, the WLAN security policy values on each controller must match. These values can be validated in the controller debugs. [Table 14-4](#) lists the WLAN mobility security values and their corresponding security policy.

**Table 14-4** WLAN Mobility Security Values

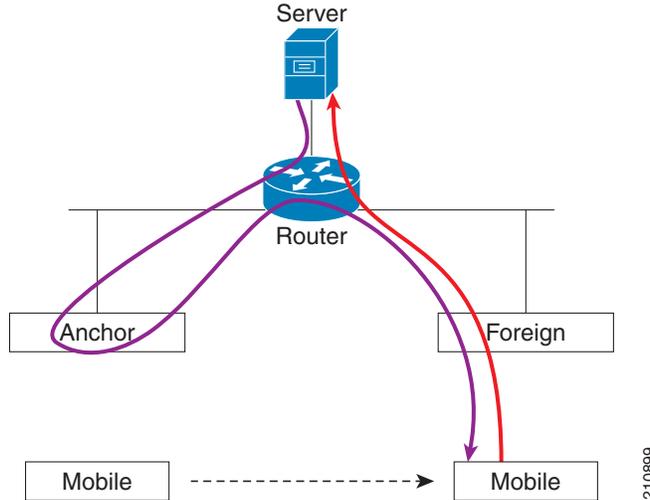
| Security Hexadecimal Value | Security Policy                |
|----------------------------|--------------------------------|
| 0x00000000                 | Security_None                  |
| 0x00000001                 | Security_WEP                   |
| 0x00000002                 | Security_802_1X                |
| 0x00000004                 | Security_IPSec*                |
| 0x00000008                 | Security_IPSec_Passthrough*    |
| 0x00000010                 | Security_Web                   |
| 0x00000020                 | Security_PPTP*                 |
| 0x00000040                 | Security_DHCP_Required         |
| 0x00000080                 | Security_WPA_NotUsed           |
| 0x00000100                 | Security_Cranite_Passthrough*  |
| 0x00000200                 | Security_Fortress_Passthrough* |
| 0x00000400                 | Security_L2TP_IPSec*           |
| 0x00000800                 | Security_802_11i_NotUsed*      |
| 0x00001000                 | Security_Web_Passthrough       |

\*Controllers running software release 6.0 or later releases do not support this security policy.

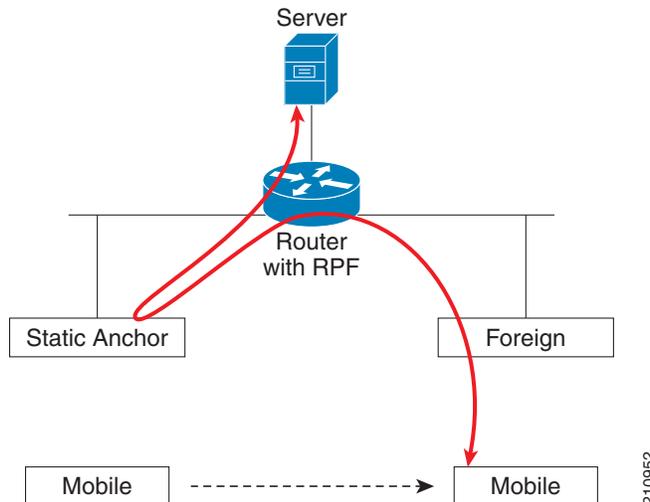
## Using Symmetric Mobility Tunneling

Controller software releases 4.1 through 5.1 support both asymmetric and symmetric mobility tunneling. Controller software release 5.2 or later releases support only symmetric mobility tunneling, which is now always enabled by default.

In asymmetric tunneling, client traffic to the wired network is routed directly through the foreign controller, as shown in [Figure 14-16](#).

**Figure 14-16 Asymmetric Tunneling or Uni-Directional Tunneling**

Asymmetric tunneling breaks when an upstream router has reverse path filtering (RPF) enabled. In this case, the client traffic is dropped at the router because the RPF check ensures that the path back to the source address matches the path from which the packet is coming. When symmetric mobility tunneling is enabled, all client traffic is sent to the anchor controller and can then successfully pass the RPF check, as shown in [Figure 14-17](#).

**Figure 14-17 Symmetric Mobility Tunneling or Bi-Directional Tunneling**

Symmetric mobility tunneling is also useful in the following situations:

- If a firewall installation in the client packet path drops packets because the source IP address does not match the subnet on which the packets are received.
- If the access-point group VLAN on the anchor controller is different than the WLAN interface VLAN on the foreign controller. In this case, client traffic could be sent on an incorrect VLAN during mobility events.

**Note**

Although a Cisco 2100 Series Controller cannot be designated as an anchor for a WLAN when you are using auto-anchor mobility, it can serve as an anchor in symmetric mobility tunneling to process and forward the upstream client data traffic tunneled from the foreign controller.

Both the controller GUI and CLI show that symmetric mobility tunneling is enabled on the controller:

- To use the controller GUI to verify that symmetric mobility tunneling is enabled, choose **Controller > Mobility Management > Mobility Anchor Config** to open the Mobility Anchor Config page (see Figure 14-18). The Symmetric Mobility Tunneling Mode text box shows Enabled.

**Figure 14-18** Mobility Anchor Config Page



- To use the controller CLI to verify that symmetric mobility tunneling is enabled, enter this command:

```
show mobility summary
```

Information similar to the following appears:

```
Symmetric Mobility Tunneling (current) Enabled
Symmetric Mobility Tunneling (after reboot) Enabled
Mobility Protocol Port..... 16666
Mobility Security Mode..... Disabled
Default Mobility Domain..... User1
Mobility Keepalive interval..... 10
Mobility Keepalive count..... 3
Mobility Group members configured..... 7
```

```
Controllers configured in the Mobility Group
MAC Address IP Address Group Name Status
00:0b:85:32:b0:80 10.28.8.30 User1 Up
00:0b:85:47:f6:00 10.28.16.10 User1 Up
00:16:9d:ca:d8:e0 10.28.32.10 User1 Up
00:18:73:34:a9:60 10.28.24.10 <local> Up
00:18:73:36:55:00 10.28.8.10 User1 Up
00:1a:a1:c1:7c:e0 10.28.32.30 User1 Up
00:d0:2b:fc:90:20 10.28.32.61 User1 Control and Data Path Down
```

# Running Mobility Ping Tests

Controllers in a mobility list communicate with each other by controlling information over a well-known UDP port and exchanging data traffic through an Ethernet-over-IP (EoIP) tunnel. Because UDP and EoIP are not reliable transport mechanisms, there is no guarantee that a mobility control packet or data packet will be delivered to a mobility peer. Mobility packets may be lost in transit due to a firewall filtering the UDP port or EoIP packets or due to routing issues.

Controller software release 4.0 or later releases enable you to test the mobility communication environment by performing mobility ping tests. These tests may be used to validate connectivity between members of a mobility group (including guest controllers). Two ping tests are available:

- Mobility ping over UDP—This test runs over mobility UDP port 16666. It tests whether the mobility control packet can be reached over the management interface.
- Mobility ping over EoIP—This test runs over EoIP. It tests the mobility data traffic over the management interface.

Only one mobility ping test per controller can be run at a given time.

**Note**

---

These ping tests are not Internet Control Message Protocol (ICMP) based. The term “ping” is used to indicate an echo request and an echo reply message.

---

**Note**

---

Any ICMP packet greater than 1280 bytes will always be responded with a packet that is truncated to 1280 bytes. For example, a ping with a packet that is greater than 1280 bytes from a host to the management interface is always responded with a packet that is truncated to 1280 bytes.

---

Use these commands to run mobility ping tests using the controller CLI:

- To test the mobility UDP control packet communication between two controllers, enter this command:  
**mping** *mobility\_peer\_IP\_address*  
The *mobility\_peer\_IP\_address* parameter must be the IP address of a controller that belongs to the mobility list.
- To test the mobility EoIP data packet communication between two controllers, enter this command:

**eping** *mobility\_peer\_IP\_address*

The *mobility\_peer\_IP\_address* parameter must be the IP address of a controller that belongs to the mobility list.

- To troubleshoot your controller for mobility ping, enter these commands:

**config logging buffered debugging**

**show logging**

To troubleshoot your controller for mobility ping over UDP, enter this command to display the mobility control packet:

**debug mobility handoff enable**

**Note**

---

We recommend using an ethereal trace capture when troubleshooting.

---

# Configuring Dynamic Anchoring for Clients with Static IP Addresses

At times you may want to configure static IP addresses for wireless clients. When these wireless clients move about in a network, they could try associating with other controllers. If the clients try to associate with a controller that does not support the same subnet as the static IP, the clients fail to connect to the network. You can now enable dynamic tunneling of clients with static IP addresses.

Dynamic anchoring of static IP clients with static IP addresses can be associated with other controllers where the client's subnet is supported by tunneling the traffic to another controller in the same mobility group. This feature enables you to configure your WLAN so that the network is serviced even though the clients use static IP addresses.

## How Dynamic Anchoring of Static IP Clients Works

The following sequence of steps occur when a client with a static IP address tries to associate with a controller:

1. When a client associates with a controller, for example, WLC-1, it performs a mobility announcement. If a controller in the mobility group responds (for example WLC-2), the client traffic is tunneled to the controller WLC-2. As a result, the controller WLC 1 becomes the foreign controller and WLC-2 becomes the anchor controller.
2. If none of the controllers respond, the client is treated as a local client and authentication is performed. The IP address for the client is updated either through an orphan packet handling or an ARP request processing. If the client's IP subnet is not supported in the controller (WLC-1), WLC-1 sends another static IP mobile announce and if a controller (for example WLC-3) which supports the clients subnet responds to that announce, the client traffic is tunneled to that controller WLC-3. As a result, the controller WLC 1 becomes the export foreign controller and WLC-3 becomes the export anchor controller.
3. Once the acknowledgement is received, the client traffic is tunneled between the anchor and the controller (WLC-1).



### Note

If you configure WLAN with an interface group and any of the interfaces in the interface group supports the static IP client subnet, the client is assigned to that interface. This situation occurs in local or remote (static IP Anchor) controller.



### Note

A security level 2 authentication is performed only in the local (static IP foreign) controller, which is also known as the exported foreign controller.



### Note

Do not configure overridden interfaces when you perform AAA for static IP tunneling, this is because traffic can get blocked for the client if the overridden interface does not support the client's subnet. This can be possible in extreme cases where the overriding interface group supports the client's subnet.



### Note

The local controller must be configured with the correct AAA server where this client entry is present.

The following restrictions apply when configuring static IP tunneling with other features on the same WLAN:

- Auto anchoring mobility (guest tunneling) cannot be configured for the same WLAN.
- Hybrid-REAP local authentication cannot be configured for the same WLAN.
- The DHCP required option cannot be configured for the same WLAN.



**Note**

You cannot configure dynamic anchoring of static IP clients with hybrid REAP local switching.

## Using the GUI to Configure Dynamic Anchoring of Static IP Clients

To configure dynamic anchoring of static IP clients using the controller GUI, follow these steps:

- 
- Step 1** Choose **WLANs** to open the WLANs page.
- Step 2** Click the ID number of the WLAN on which you want to enable dynamic anchoring of IP clients. The WLANs > Edit page is displayed.
- Step 3** Choose the **Advanced** tab to open the WLANs > Edit (Advanced) page.
- Step 4** Enable dynamic anchoring of static IP clients by selecting the **Static IP Tunneling** check box.
- Step 5** Click **Apply** to commit your changes.
- 

## Using the CLI to Configure Dynamic Anchoring of Static IP Clients

To configure dynamic anchoring of Static IP clients using the controller CLI, use the following commands:

**config wlan static-ip tunneling {enable | disable} wlan\_id**— Enables or disables the dynamic anchoring of static IP clients on a given WLAN.

To monitor and troubleshoot your controller for clients with static IP, use the following commands:

- **show wlan wlan\_id**—Enables you to see the status of the static IP clients feature.

```
.....
Static IP client tunneling..... Enabled
.....
```

- **debug client client-mac**
- **debug dot11 mobile enable**
- **debug mobility handoff enable**

## Configuring Foreign Mappings

Auto-Anchor mobility, also known as Foreign Mapping, allows you to configure users that are on different foreign controllers to obtain IP addresses from a subnet or group of subnets.

## Using the GUI to Configure Foreign MAC Mapping

To configure a foreign mapping using the controller GUI, follow these steps:

- 
- Step 1** Choose the WLANs tab.  
The WLANs page appears listing the available WLANs.
- Step 2** Click the Blue drop down arrow for the desired WLAN and choose **Foreign-Maps**.  
The foreign mappings page appears. This page also lists the MAC addresses of the foreign controllers that are in the mobility group and interfaces/interface groups.
- Step 3** Choose the desired foreign controller MAC and the interface or interface group to which it must be mapped and click on **Add Mapping**.
- 

## Using the CLI to Configure Foreign Controller MAC Mapping

To configure foreign controller MAC mapping, use this command:

```
config wlan mobility foreign-map add wlan-id foreign_ctrl_mac interface/interface_grp name
```

To configure a foreign mappings, use this command:

```
config wlan mobility foreign-map add wlan_id interface
```