



IP Mobility: PMIPv6 Configuration Guide, IOS XE Fuji 16.9.x

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CHAPTER 1

Read Me First

Important Information about Cisco IOS XE 16

Effective Cisco IOS XE Release 3.7.0E (for Catalyst Switching) and Cisco IOS XE Release 3.17S (for Access and Edge Routing) the two releases evolve (merge) into a single version of converged release—the Cisco IOS XE 16—providing one release covering the extensive range of access and edge products in the Switching and Routing portfolio.

Feature Information

Use [Cisco Feature Navigator](#) to find information about feature support, platform support, and Cisco software image support. An account on Cisco.com is not required.

Related References

- [Cisco IOS Command References, All Releases](#)

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see [What's New in Cisco Product Documentation](#).

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CHAPTER 2

Proxy Mobile IPv6 Support for MAG Functionality

The Proxy Mobile IPv6 Support for MAG Functionality feature provides network-based IP Mobility management to a mobile node (MN) without requiring the participation of the mobile node in any IP Mobility-related signaling. The Mobile Access Gateway (MAG) tracks the movements of the MN to and from an access link and sends signals to the local mobility anchor of the MN.

- [Finding Feature Information, on page 3](#)
- [Prerequisites for Proxy Mobile IPv6 Support for MAG Functionality, on page 3](#)
- [Information About Proxy Mobile IPv6 Support for MAG Functionality, on page 4](#)
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- [Configuration Examples for Proxy Mobile IPv6 Support for MAG Functionality, on page 19](#)
- [Where to Go Next, on page 20](#)
- [Additional References, on page 20](#)
- [Feature Information for Proxy Mobile IPv6 Support for MAG Functionality, on page 21](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Proxy Mobile IPv6 Support for MAG Functionality

The DHCP server must be configured.

Information About Proxy Mobile IPv6 Support for MAG Functionality

Proxy Mobile IPv6 Overview

Proxy Mobile IPv6 (PMIPv6) provides network-based IP Mobility management to a mobile node (MN), without requiring the participation of the MN in any IP mobility-related signaling. The mobility entities in the network track the movements of the MN, initiate the mobility signaling, and set up the required routing state.

The major functional entities of PMIPv6 are Mobile Access Gateways (MAGs), Local Mobility Anchors (LMAs), and MNs.

Mobile Access Gateways

Mobile Access Gateway (MAG) performs mobility-related signaling on behalf of the mobile nodes (MN) attached to its access links. MAG is the access router for the MN; that is, MAG is the first-hop router in the localized mobility management infrastructure.

MAG performs the following functions:

- Obtains an IP address from Local Mobility Anchor (LMA) and assigns it to MN.
- Retains the IP address of an MN when the MN roams across MAGs.
- Tunnels traffic from MN to LMA.

Local Mobility Anchor

Local Mobility Anchor (LMA) is the home agent for a mobile node (MN) in a Proxy Mobile IPv6 (PMIPv6) domain. It is the topological anchor point for MN home network prefixes and manages the binding state of an MN. An LMA has the functional capabilities of a home agent as defined in the Mobile IPv6 base specification (RFC 3775) along with the capabilities required for supporting the PMIPv6 protocol.



Note Use the **dynamic mag learning** command to enable LMA to accept Proxy Mobile IPv6 (PMIPv6) signaling messages from any Mobile Access Gateway (MAG) that is not configured locally.

Mobile Node

Mobile node (MN) is an IP host and the mobility of the MN is managed by a network. MN can be an IPv4-only node, an IPv6-only node, or a dual-stack node, which is a node with IPv4 and IPv6 protocol stacks. MN is not required to participate in any IP mobility-related signaling for achieving mobility for an IP address or a prefix that is obtained in the Proxy Mobile IPv6 (PMIPv6) domain.

AAA Server Attributes for Proxy Mobile IPv6

If an authentication, authorization, and accounting (AAA) server is available, a Mobile Access Gateway (MAG) obtains the profile information of the Proxy Mobile IPv6 (PMIPv6) domain and the mobile node (MN) from the server during the configuration and call-flow time, respectively.

The following are the AAA attributes required for configuring the PMIPv6 domain and the MN are:

- PMIPv6 domain-specific AAA attributes:
 - cisco-mpc-protocol-interface
 - lma-identifier
 - mag-identifier
 - mag-v4-address
 - mag-v6-address
 - pmip6-domain-identifier
 - pmip6-timestamp-window
 - pmip6-replay-protection
 - pmip6-spi-key
 - pmip6-spi-value
- MN-specific AAA attributes:
 - home-lma
 - home-lma-ipv6-address
 - mn-nai
 - home-lma-ipv4-address
 - mn-apn
 - Mobile-Node-Identifier
 - mn-network
 - mn-service
 - multihomed

How to Configure Proxy Mobile IPv6 Support for MAG Functionality

Configuring a Proxy Mobile IPv6 Domain by Using the Configuration from the AAA Server

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 mobile pmip6-domain *domain-name* load-aaa**
4. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ipv6 mobile pmipv6-domain domain-name load-aaa Example: Device(config)# ipv6 mobile pmipv6-domain D1 load-aaa	Creates a PMIPv6 domain and configures it by using the configuration from the AAA server.
Step 4	end Example: Device(config)# end	Exits global configuration mode and returns to privileged EXEC mode.

Configuring the Minimum Configuration for a MAG to Function

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 mobile pmipv6-domain domain-name**
4. **lma lma-id**
5. **ipv6-address ipv6-address**
6. **exit**
7. Repeat Steps 5 to 8 to configure the second LMA.
8. **nai [user]@realm**
9. **lma lma-id**
10. **service {dual | ipv4 | ipv6}**
11. **exit**
12. Repeat Steps 10 to 11 to configure the second MN.
13. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable	Enables privileged EXEC mode.

	Command or Action	Purpose
	Example: Device> enable	<ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ipv6 mobile pmipv6-domain domain-name Example: Device(config)# ipv6 mobile pmipv6-domain dn1	Creates the Proxy Mobile IPv6 (PMIPv6) domain and enters PMIPv6 domain configuration mode.
Step 4	lma lma-id Example: Device(config-ipv6-pmipv6-domain)# lma lma1	Configures an Local Mobility Anchor (LMA) within the PMIPv6 domain and enters PMIPv6 domain LMA configuration mode.
Step 5	ipv6-address ipv6-address Example: Device(config-ipv6-pmipv6-domain-lma)# ipv6-address 2001:DB8::1	Configures an IPv6 address for the LMA within the PMIPv6 domain.
Step 6	exit Example: Device(config-ipv6-pmipv6-domain-lma)# exit	Exits PMIPv6 domain LMA configuration mode and returns to PMIPv6 domain configuration mode.
Step 7	Repeat Steps 5 to 8 to configure the second LMA.	—
Step 8	nai [user]@realm Example: Device(config-ipv6-pmipv6-domain)# nai user1@example.com	Configures a network access identifier for the mobile node (MN) within the PMIPv6 domain and enters PMIPv6 domain mobile node configuration mode.
Step 9	lma lma-id Example: Device(config-ipv6-pmipv6-domain-mn)# lma lma1	Configures an LMA for the MN.
Step 10	service {dual ipv4 ipv6} Example: Device(config-ipv6-pmipv6-domain-mn)# service ipv4	Configures the service provided to the MN within the PMIPv6 domain. The type of services provided to the MN are as follows: <ul style="list-style-type: none"> • dual—Specifies both IPv4 and IPv6 services for an MN.

	Command or Action	Purpose
		<ul style="list-style-type: none"> • IPv4—Specifies IPv4 service for an MN. • IPv6—Specifies IPv6 service for an MN.
Step 11	exit Example: <pre>Device(config-ipv6-pmipv6-domain-mn)# exit</pre>	Exits PMIPv6 domain mobile node configuration mode and returns to PMIPv6 domain configuration mode.
Step 12	Repeat Steps 10 to 11 to configure the second MN.	—
Step 13	end Example: <pre>Device(config-ipv6-pmipv6-domain)# end</pre>	Exits PMIPv6 domain configuration mode and returns to privileged EXEC mode.

Configuring a Detailed Configuration for a MAG When an AAA Server Is Not Available

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 mobile pmipv6-domain** *domain-name*
4. **service password-encryption**
5. **replay-protection timestamp** [*window seconds*]
6. **auth-option spi** {*spi-hex-value* | **decimal** *spi-decimal-value*} **key** {**ascii** *ascii-string* | **hex** *hex-string*}
7. **encap** {**gre-ipv4** | **ipv6-in-ipv6**}
8. **local-routing-mag**
9. **lma** *lma-id*
10. **ipv6-address** *ipv6-address*
11. **exit**
12. Repeat Steps 10 to 12 to configure each LMA.
13. **mag** *mag-id*
14. **ipv6-address** *ipv6-address*
15. **exit**
16. **mn-profile-load-aaa**
17. **nai** [*user*]**@realm**
18. **lma** *lma-id*
19. **int att** *interface-access-type* **l2-addr** *mac-address*
20. **gre-encap-key** [**down** | **up**] *key-value*
21. **service** {**dual** | **ipv4** | **ipv6**}
22. **apn** *apn-name*
23. **exit**

24. Repeat Steps 20 to 24 to configure each MN.
25. end

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ipv6 mobile pmipv6-domain <i>domain-name</i> Example: Device(config)# ipv6 mobile pmipv6-domain dn1	Creates a Proxy Mobile IPv6 (PMIPv6) domain and enters PMIPv6 domain configuration mode.
Step 4	service password-encryption Example: Device(config)# service password-encryption	Converts unencrypted passwords to encrypted passwords automatically.
Step 5	replay-protection timestamp [window seconds] Example: Device(config-ipv6-pmipv6-domain)# replay-protection timestamp window 200	Configures the replay protection mechanism within the PMIPv6 domain.
Step 6	auth-option spi {spi-hex-value decimal spi-decimal-value} key {ascii ascii-string hex hex-string} Example: Device(config-ipv6-pmipv6-domain)# auth-option spi 67 key ascii key1	Configures authentication for the PMIPv6 domain.
Step 7	encap {gre-ipv4 ipv6-in-ipv6} Example: Device(config-ipv6-pmipv6-domain)# encap gre-ipv4	Configures the tunnel encapsulation mode type between the Mobile Access Gateway (MAG) and the Local Mobility Anchor (LMA).
Step 8	local-routing-mag Example: Device(config-ipv6-pmipv6-domain)# local-routing-mag	Enables local routing for the MAG.

	Command or Action	Purpose
Step 9	lma <i>lma-id</i> Example: Device(config-ipv6-pmipv6-domain)# lma lma1	Configures LMA within the PMIPv6 domain and enters PMIPv6 domain LMA configuration mode.
Step 10	ipv6-address <i>ipv6-address</i> Example: Device(config-ipv6-pmipv6-domain-lma)# ipv6-address 2001:0DB8:2:3::1	Configures an IPv6 address for the LMA within the PMIPv6 domain.
Step 11	exit Example: Device(config-ipv6-pmipv6-domain-lma)# exit	Exits PMIPv6 domain LMA configuration mode and returns to PMIPv6 domain configuration mode.
Step 12	Repeat Steps 10 to 12 to configure each LMA.	—
Step 13	mag <i>mag-id</i> Example: Device(config-ipv6-pmipv6-domain)# mag mag1	Configures a MAG within the PMIPv6 domain and enters PMIPv6 domain MAG configuration mode.
Step 14	ipv6-address <i>ipv6-address</i> Example: Device(config-ipv6-pmipv6-domain-mag)# ipv6-address 2001:0DB8:2:4::1	Configures an IPv6 address for the MAG within the PMIPv6 domain.
Step 15	exit Example: Device(config-ipv6-pmipv6-domain-mag)# exit	Exits PMIP domain MAG configuration mode and returns to PMIPv6 domain configuration mode.
Step 16	mn-profile-load-aaa Example: Device(config-ipv6-pmipv6-domain)# mn-profile-load-aaa	(Optional) Loads the profile configuration from AAA to the mobile node (MN) within the PMIPv6 domain. Note Steps 20 to 24 need not be entered if the MN is configured using the configuration from AAA. You can use the specific command to override the configuration for a specific mobile node (MN) parameter.
Step 17	nai [<i>user</i>]@ <i>realm</i> Example: Device(config-ipv6-pmipv6-domain)# nai user1@example.com	Configures the network address identifier (NAI) for the MN within the PMIPv6 domain and enters PMIPv6 domain MN configuration mode.

	Command or Action	Purpose
Step 18	<p>lma <i>lma-id</i></p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-domain-mn)# lma lma1</pre>	Configures the LMA for the MN.
Step 19	<p>int att <i>interface-access-type</i> l2-addr <i>mac-address</i></p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-domain-mn)# int att GigabitEthernet l2-addr 02c7.f800.0422</pre>	Configures the access technology type, interface, and MAC address of the MN interface within the PMIPv6 domain.
Step 20	<p>gre-encap-key [down up] <i>key-value</i></p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-domain-mn)# gre-encap-key down 45</pre>	Configures a generic routing encapsulation (GRE) key for the MN within the PMIPv6 domain.
Step 21	<p>service {dual ipv4 ipv6}</p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-domain-mn)# service ipv4</pre>	<p>Configures the service provided to the MN within the PMIPv6 domain.</p> <p>The type of services provided to the MN are as follows:</p> <ul style="list-style-type: none"> • dual—Specifies both IPv4 and IPv6 services for an MN. • IPv4—Specifies an IPv4 service for an MN. • IPv6—Specifies an IPv6 service for an MN.
Step 22	<p>apn <i>apn-name</i></p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-domain-mn)# apn apn1</pre>	Specifies an access point name (APN) to the MN subscriber within the PMIPv6 domain.
Step 23	<p>exit</p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-domain-mn)# exit</pre>	Exits PMIP domain MN configuration mode and returns to PMIPv6 domain configuration mode.
Step 24	Repeat Steps 20 to 24 to configure each MN.	—
Step 25	<p>end</p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-domain)# end</pre>	Exits PMIPv6 domain configuration mode and returns to privileged EXEC mode.

Configuring a Minimum Configuration for a MAG

SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `ipv6 mobile pmipv6-mag mag-id domain domain-name`
4. `address ipv6 ipv6-address`
5. `sessionmgr`
6. `generate grekey`
7. `interface type number`
8. `role {3gpp | lte | wimax | wlan}`
9. `apn apn-name`
10. `end`

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ipv6 mobile pmipv6-mag mag-id domain domain-name Example: Device(config)# ipv6 mobile pmipv6-mag mag1 domain dn1	Enables the MAG service on a device, configures the PMIPv6 domain for the MAG, and enters MAG configuration mode.
Step 4	address ipv6 ipv6-address Example: Device(config-ipv6-pmipv6-mag)# address ipv6 2001:0DB8:2:4::1	Configures an IPv6 address for the MAG.
Step 5	sessionmgr Example: Device(config-ipv6-pmipv6-mag)# sessionmgr	Enables the MAG to process the the notification it receives through the mobile client service abstraction (MCSA) from the Intelligent Services Gateway (ISG).
Step 6	generate grekey Example:	Enables dynamic generation of upstream generic routing encapsulation keys for mobile nodes in an LMA.

	Command or Action	Purpose
	Device(config-ipv6-pmipv6-mag)# generate grekey	
Step 7	interface <i>type number</i> Example: Device(config-ipv6-pmipv6-mag)# interface gigabitethernet 0/0/0	Enables an interface for the MAG.
Step 8	role {3gpp lte wimax wlan} Example: Device(config-ipv6-pmipv6-mag)# role lte	Configures a role for the MAG. The keywords are as follows: <ul style="list-style-type: none"> • 3gpp—Specifies the role as the 3rd Generation Partnership Project (3GPP). • lte—Specifies the role as Long Term Evaluation (LTE). • wimax—Specifies the role as wimax. • wlan—Specifies the role as wireless LAN (WLAN).
Step 9	apn <i>apn-name</i> Example: Device(config-ipv6-pmipv6-mag)# apn apn2	Specifies an access point name (APN) to the subscriber of the MAG. Note Specifying an APN is mandatory if the role of the MAG is 3GPP.
Step 10	end Example: Device(config-ipv6-pmipv6-mag)# end	Exits MAG configuration mode and returns to privileged EXEC mode.

Configuring a Detailed Configuration for a MAG

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **vrf definition** *vrf-name*
4. **exit**
5. **ipv6 mobile pmipv6-mag** *mag-id domain domain-name*
6. **role** {3gpp | wlan}
7. **apn** *apn-name*
8. **local-routing-mag**
9. **discover-mn-detach poll interval** *seconds* **timeout** *seconds* **retries** *retry-count*
10. **address ipv4** *ipv4-address*
11. **address ipv6** *ipv6-address*

12. **sessionmgr**
13. **interface** *type number*
14. **binding maximum** *number*
15. **binding lifetime** *seconds*
16. **binding refresh-time** *seconds*
17. **binding init-retx-time** *milliseconds*
18. **binding max-retx-time** *milliseconds*
19. **replay-protection timestamp** [**window** *seconds*]
20. **bri delay min** *milliseconds*
21. **bri delay max** *milliseconds*
22. **bri retry** *number*
23. **lma** *lma-id domain-name*
24. **auth-option spi** *{spi-hex-value | decimal spi-decimal-value}* **key** *{ascii | hex} hex-string*
25. **ipv4-address** *ipv4-address*
26. **vrfid** *vrf-name*
27. **encap** *{gre-ipv4 | ipv6-in-ipv6}*
28. **end**
29. **show ipv6 mobile pmipv6 mag** *mag-id* **globals**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	vrf definition <i>vrf-name</i> Example: Device(config)# vrf definition vrf1	Configures a virtual routing and forwarding (VRF) routing table instance and enters VRF configuration mode.
Step 4	exit Example: Device(config-vrf) exit	Exits VRF configuration mode and returns to global configuration mode.
Step 5	ipv6 mobile pmipv6-mag <i>mag-id</i> domain <i>domain-name</i> Example: Device(config)# ipv6 mobile pmipv6-mag mag1 domain dn1	Enables the MAG service on a device, configures the PMIPv6 domain for the MAG, and enters MAG configuration mode.

	Command or Action	Purpose
Step 6	role {3gpp wlan} Example: <pre>Device(config-ipv6-pmipv6-mag)# role 3gpp</pre>	Configures a role for the MAG. The keywords are as follows: <ul style="list-style-type: none"> • 3gpp—Specifies the role as 3GPP. • lte—Specifies the role as LTE. • wimax—Specifies the role as wimax. • wlan—Specifies the role as wireless LAN (WLAN).
Step 7	apn <i>apn-name</i> Example: <pre>Device(config-ipv6-pmipv6-mag)# apn apn2</pre>	Specifies an access point name (APN) to the subscriber of the MAG.
Step 8	local-routing-mag Example: <pre>Device(config-ipv6-pmipv6-mag)# local-routing-mag</pre>	Enables local routing for the MAG.
Step 9	discover-mn-detach poll interval <i>seconds</i> timeout <i>seconds</i> retries <i>retry-count</i> Example: <pre>Device(config-ipv6-pmipv6-mag)# discover-mn-detach poll interval 11 timeout 3 retries 4</pre>	Enables periodic verification of the MN attachment with the MAG-enabled interface.
Step 10	address ipv4 <i>ipv4-address</i> Example: <pre>Device(config-ipv6-pmipv6-mag)# address ipv4 10.1.3.1</pre>	Configures an IPv4 address for the MAG.
Step 11	address ipv6 <i>ipv6-address</i> Example: <pre>Device(config-ipv6-pmipv6-mag)# address ipv6 2001:0DB8:2:4::1</pre>	Configures an IPv6 address for the MAG.
Step 12	sessionmgr Example: <pre>Device(config-ipv6-pmipv6-mag)# sessionmgr</pre>	Configures an IPv6 address for the MAG.
Step 13	interface <i>type number</i> Example:	Enables an interface for the MAG.

	Command or Action	Purpose
	Device(config-ipv6-pmipv6-mag) # interface gigabitethernet 0/0/0	
Step 14	binding maximum <i>number</i> Example: Device(config-ipv6-pmipv6-mag) # binding maximum 200	Specifies the maximum number of Proxy Binding Update (PBU) entries allowed for the MAG.
Step 15	binding lifetime <i>seconds</i> Example: Device(config-ipv6-pmipv6-mag) # binding lifetime 5000	Specifies the maximum lifetime permitted for the PBU entry.
Step 16	binding refresh-time <i>seconds</i> Example: Device(config-ipv6-pmipv6-mag) # binding refresh-time 2000	Specifies the PBU entry refresh time.
Step 17	binding init-retx-time <i>milliseconds</i> Example: Device(config-ipv6-pmipv6-mag) # binding init-retx-time 110	Specifies the initial timeout interval between the PBU and Proxy Binding Acknowledgment (PBA) until a PBA is received.
Step 18	binding max-retx-time <i>milliseconds</i> Example: Device(config-ipv6-pmipv6-mag) # binding max-retx-time 4000	Specifies the maximum timeout interval between the PBU and the PBA until a PBA is received.
Step 19	replay-protection timestamp [<i>window seconds</i>] Example: Device(config-ipv6-pmipv6-mag) # replay-protection timestamp window 200	Configures the replay protection mechanism within the PMIPv6 domain.
Step 20	bri delay min <i>milliseconds</i> Example: Device(config-ipv6-pmipv6-mag) # bri delay min 500	Specifies the minimum time for which an LMA should wait before transmitting the Binding Revocation Indication (BRI) message.
Step 21	bri delay max <i>milliseconds</i> Example: Device(config-ipv6-pmipv6-mag) # bri delay max 4500	Specifies the maximum time for which an LMA should wait for the Binding Revocation Acknowledgment (BRA) message before retransmitting the BRI message.

	Command or Action	Purpose
Step 22	bri retry <i>number</i> Example: <pre>Device(config-ipv6-pmipv6-mag)# bri retry 6</pre>	Specifies the maximum number of times an LMA should retransmit a BRI message, until a BRA is received.
Step 23	lma <i>lma-id domain-name</i> Example: <pre>Device(config-ipv6-pmipv6-mag)# lma lma3 dn1</pre>	Configures the LMA for the MAG and enters MAG-LMA configuration mode.
Step 24	auth-option spi { <i>spi-hex-value</i> decimal <i>spi-decimal-value</i> } key { ascii hex } <i>hex-string</i> Example: <pre>Device(config-ipv6-pmipv6mag-lma)# auth-option spi decimal 258 key hex BDF</pre>	Configures authentication for the LMA within the MAG.
Step 25	ipv4-address <i>ipv4-address</i> Example: <pre>Device(config-ipv6-pmipv6mag-lma)# ipv4-address 172.16.0.1</pre>	Configures an IPv4 address for the LMA within the MAG. Note You can repeat this command to configure multiple IP addresses.
Step 26	vrfid <i>vrf-name</i> Example: <pre>Device(config-ipv6-pmipv6mag-lma)# vrfid vrf1</pre>	Specifies a VRF for an LMA peer.
Step 27	encap { gre-ipv4 ipv6-in-ipv6 } Example: <pre>Device(config-ipv6-pmipv6mag-lma)# encap gre-ipv4</pre>	Configures a tunnel encapsulation mode type between the MAG and the LMA.
Step 28	end Example: <pre>Device(config-ipv6-pmipv6mag-lma)# end</pre>	Exits MAG-LMA configuration mode and returns to privileged EXEC mode.
Step 29	show ipv6 mobile pmipv6 mag <i>mag-id</i> globals Example: <pre>Device# show ipv6 mobile pmipv6 mag mag1 globals</pre>	(Optional) Displays MAG global configuration details.

Example

The following example shows the MAG global configuration:

```

Router# show ipv6 mobile pmipv6 mag mag1 globals
-----
Domain      : D1
Mag Identifier : M1
  MN's detach discover      : disabled
  Local routing             : disabled
  Mag is enabled on interface : GigabitEthernet0/0/0
  Mag is enabled on interface : GigabitEthernet0/1/0
  Max Bindings              : 3
  AuthOption                : disabled
  RegistrationLifeTime      : 3600 (sec)
  BRI InitDelayTime         : 1000 (msec)
  BRI MaxDelayTime          : 40000 (msec)
  BRI MaxRetries            : 6
  BRI EncapType             : IPV6_IN_IPV6
  Fixed Link address is     : enabled
  Fixed Link address        : aaaa.aaaa.aaaa
  Fixed Link Local address is : enabled
  Fixed Link local address  : 0xFE800000 0x0 0x0 0x2
  RefreshTime               : 300 (sec)
  Refresh RetxInit time     : 20000 (msec)
  Refresh RetxMax time      : 50000 (msec)
  Timestamp option          : enabled
  Validity Window           : 7

Peer : LMA1
  Max Bindings              : 3
  AuthOption                : disabled
  RegistrationLifeTime      : 3600 (sec)
  BRI InitDelayTime         : 1000 (msec)
  BRI MaxDelayTime          : 40000 (msec)
  BRI MaxRetries            : 6
  BRI EncapType             : IPV6_IN_IPV6
  Fixed Link address is     : enabled
  Fixed Link address        : aaaa.aaaa.aaaa
  Fixed Link Local address is : enabled
  Fixed Link local address  : 0xFE800000 0x0 0x0 0x2
  RefreshTime               : 300 (sec)
  Refresh RetxInit time     : 20000 (msec)
  Refresh RetxMax time      : 50000 (msec)
  Timestamp option          : enabled
  Validity Window           : 7

Peer : LMA2
  Max Bindings              : 3
  AuthOption                : disabled

```

Troubleshooting Tips

You can use the following commands to troubleshoot the MAG configuration:

- **debug ipv6 mobile mag event**
- **debug ipv6 mobile mag info**
- **show ipv6 mobile pmipv6 mag bindings**
- **show ipv6 mobile pmipv6 mag globals**

Configuration Examples for Proxy Mobile IPv6 Support for MAG Functionality

Example: Configuring a Proxy Mobile IPv6 Domain by Using the Configuration from the AAA Server

The following example shows how to configure the PMIPv6 domain by using the AAA server configuration:

```
Device# configure terminal
Device(config)# ipv6 mobile pmipv6-domain D1 load-aaa
```

The following example shows how to configure the PMIPv6 domain by using the configuration from the AAA server and how to override the configuration for specific PMIPv6 domain parameters:

```
Device# configure terminal
Device(config)# ipv6 mobile pmipv6-domain D11 load-aaa
Device(config)# ipv6 mobile pmipv6-domain D11
Device(config-ipv6-pmipv6-domain)# gre-ipv4
Device(config-ipv6-pmipv6-domain)# auth-option spi 67 key ascii key1
```

Example: Configuring a Proxy Mobile IPv6 Domain When the Configuration from an AAA Server Is Not Available

The following example shows how to configure the PMIPv6 domain when an AAA server configuration is not available:

```
Device# configure terminal
Device(config)# ipv6 mobile pmipv6-domain D2
Device(config-ipv6-pmipv6-domain)# replay-protection timestamp window 200
Device(config-ipv6-pmipv6-domain)# auth-option spi 100 key ascii hi
Device(config-ipv6-pmipv6-domain)# encap ipv6-in-ipv6
!
Device(config-ipv6-pmipv6-domain)# lma lma1
Device(config-ipv6-pmipv6-domain-lma)# ipv4-address 10.1.1.1
Device(config-ipv6-pmipv6-domain-lma)# ipv6-address 2001:0DB8:2:3::1
Device(config-ipv6-pmipv6-domain-lma)# exit
!
Device(config-ipv6-pmipv6-domain)# mag mag1
Device(config-ipv6-pmipv6-domain-mag)# ipv4-address 10.1.3.1
Device(config-ipv6-pmipv6-domain-mag)# ipv6-address 2001:0DB8:2:5::1
Device(config-ipv6-pmipv6-domain-mag)# exit
!
Device(config-ipv6-pmipv6-domain)# nai example1@example.com
Device(config-ipv6-pmipv6-domain-mn)# lma lma1
Device(config-ipv6-pmipv6-domain-mn)# int att gigabitethernet 12-addr 02c7.f800.0422
Device(config-ipv6-pmipv6-domain-mn)# gre-encap-key up 1234
Device(config-ipv6-pmipv6-domain-mn)# gre-encap-key down 5678
Device(config-ipv6-pmipv6-domain-mn)# service ipv4
Device(config-ipv6-pmipv6-domain-mn)# end
```

Example: Configuring a Mobile Access Gateway

The following example shows the minimum configuration required to enable MAG:

```
Device# configure terminal
Device(config)# ipv6 mobile pmipv6-domain D2
Device(config-ipv6-pmipv6-domain)# lma lma1
Device(config-ipv6-pmipv6-domain-lma)# ipv4-address 10.1.1.1
Device(config-ipv6-pmipv6-domain-lma)# ipv6-address 2001:0DB8:2:3::1
Device(config-ipv6-pmipv6-domain-lma)# exit
Device(config-ipv6-pmipv6-domain)# lma lma2
Device(config-ipv6-pmipv6-domain-lma)# ipv4-address 10.2.1.1
Device(config-ipv6-pmipv6-domain-lma)# ipv6-address 2001:0DB8:2:4::1
Device(config-ipv6-pmipv6-domain-lma)# exit
Device(config-ipv6-pmipv6-domain)# nai example1@example.com
Device(config-ipv6-pmipv6-domain-mn)# lma lma1
Device(config-ipv6-pmipv6-domain-mn)# exit
Device(config-ipv6-pmipv6-domain)# nai example2@example.com
Device(config-ipv6-pmipv6-domain-mn)# lma lma2
Device(config-ipv6-pmipv6-domain-mn)# exit
Device(config)# ipv6 mobile pmipv6-mag mag1 domain D2
Device(config-ipv6-pmipv6-mag)# address ipv6 2001:DB8:0:0:E000::F
Device(config-ipv6-pmipv6-mag)# address ipv4 10.2.1.1
Device(ipv6-mag-config)# interface gigabitethernet 0/0/0
Device(ipv6-mag-config)# role 3gpp
Device(ipv6-mag-config)# apn a
Device(ipv6-mag-config)# exit
```

Where to Go Next

The MAG entity works with the LMA provided by the ASR 5000 devices. To configure the LMA in the Cisco ASR 5000, see the “PDN Gateway Configuration” module in the [Cisco ASR 5000 Series Packet Data Network Gateway Administration Guide](#).

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
IP mobility commands	Cisco IOS IP Mobility Command Reference

Standards and RFCs

Standard/RFC	Title
RFC 3775	<i>Mobility Support in IPv6</i>
RFC 5213	<i>Proxy Mobile IPv6</i>

Standard/RFC	Title
RFC 5844	<i>IPv4 Support for Proxy Mobile IPv6</i>
RFC 5845	<i>Generic Routing Encapsulation (GRE) Key Option for Proxy Mobile IPv6</i>
RFC 5846	<i>Binding Revocation for IPv6 Mobility</i>

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Proxy Mobile IPv6 Support for MAG Functionality

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1: Feature Information for Proxy Mobile IPv6 MAG Functionality Support

Feature Name	Releases	Feature Information
Proxy Mobile IPv6 MAG Functionality Support	Cisco IOS XE Release 3.4S	<p>The Proxy Mobile IPv6 Support for MAG Functionality feature provides network-based IP Mobility management to a mobile node without requiring the participation of the mobile node in any IP mobility-related signaling. The Mobile Access Gateway tracks the movements of the mobile node to and from the access link, and sends signals to the local mobility anchor of the mobile node.</p> <p>In Cisco IOS XE Release 3.4S, this feature was introduced on the Cisco ASR Series Aggregation Services 1000 routers.</p> <p>The following commands were introduced: address, apn, auth-option, binding, bri, clear ipv6 mobile pmipv6 mag, debug ipv6 mobile mag, debug ipv6 mobile packets, discover-mn-detach, encap, fixed-link-layer-address, fixed-link-local-address, gre-encap-key, int att, interface, ipv4-address, ipv6 mobile pmipv6-domain, ipv6 mobile pmipv6-mag, ipv6-address, lma, local-routing-mag, mag, mn-profile-load-aaa, multi-homed, nai, replay-protection, role, service, show ipv6 mobile pmipv6 mag binding, show ipv6 mobile pmipv6 mag globals, show ipv6 mobile pmipv6 mag stats.</p>
IPv6 Client Support on Proxy Mobile IPv6 Mobile Access Gateway	Cisco IOS XE Release 3.5S	<p>Prior to the introduction of the IPv6 Client Support on Proxy Mobile IPv6 Mobile Access Gateway feature, only IPv4 service could be provided to an MN within the PMIP domain. The IPv6 client support on Proxy Mobile IPv6 MAG feature is an enhancement to provide IPv4, IPv6, and dual service to the MN within the PMIP domain.</p> <p>The following command was modified: service.</p>



CHAPTER 3

Proxy Mobile IPv6 Local Mobility Anchor

Local Mobility Anchor (LMA) acts as the home agent for a mobile node (MN) in a Proxy Mobile IPv6 domain, which is the network where the mobility management of an MN is handled using the Proxy Mobile IPv6 (PMIPv6) protocol. LMA is the topological anchor point for the MN's home network prefix(es) and is the entity that manages the MN's binding state. This module explains how to configure LMA.

- [Finding Feature Information, on page 23](#)
- [Prerequisites for Proxy Mobile IPv6 LMA, on page 23](#)
- [Information About Proxy Mobile IPv6 Support for LMA Functionality, on page 24](#)
- [How to Configure Proxy Mobile IPv6 LMA, on page 26](#)
- [Configuration Examples for Proxy Mobile IPv6 Support for LMA Functionality, on page 43](#)
- [Where to Go Next, on page 45](#)
- [Additional References, on page 45](#)
- [Feature Information for Proxy Mobile IPv6 Local Mobility Anchor , on page 46](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Proxy Mobile IPv6 LMA

You must configure the IPv4 and IPv6 address pool for LMA to assign IPv4 or IPv6 addresses.

Information About Proxy Mobile IPv6 Support for LMA Functionality

Proxy Mobile IPv6 Overview

Proxy Mobile IPv6 (PMIPv6) provides network-based IP Mobility management to a mobile node (MN), without requiring the participation of the MN in any IP mobility-related signaling. The mobility entities in the network track the movements of the MN, initiate the mobility signaling, and set up the required routing state.

The major functional entities of PMIPv6 are Mobile Access Gateways (MAGs), Local Mobility Anchors (LMAs), and MNs.

Mobile Access Gateways

Mobile Access Gateway (MAG) performs mobility-related signaling on behalf of the mobile nodes (MN) attached to its access links. MAG is the access router for the MN; that is, MAG is the first-hop router in the localized mobility management infrastructure.

MAG performs the following functions:

- Obtains an IP address from Local Mobility Anchor (LMA) and assigns it to MN.
- Retains the IP address of an MN when the MN roams across MAGs.
- Tunnels traffic from MN to LMA.

Local Mobility Anchor

Local Mobility Anchor (LMA) is the home agent for a mobile node (MN) in a Proxy Mobile IPv6 (PMIPv6) domain. It is the topological anchor point for MN home network prefixes and manages the binding state of an MN. An LMA has the functional capabilities of a home agent as defined in the Mobile IPv6 base specification (RFC 3775) along with the capabilities required for supporting the PMIPv6 protocol.



Note Use the **dynamic mag learning** command to enable LMA to accept Proxy Mobile IPv6 (PMIPv6) signaling messages from any Mobile Access Gateway (MAG) that is not configured locally.

Mobile Node

Mobile node (MN) is an IP host and the mobility of the MN is managed by a network. MN can be an IPv4-only node, an IPv6-only node, or a dual-stack node, which is a node with IPv4 and IPv6 protocol stacks. MN is not required to participate in any IP mobility-related signaling for achieving mobility for an IP address or a prefix that is obtained in the Proxy Mobile IPv6 (PMIPv6) domain.

VRF-Aware LMA

The VRF Aware LMA feature is an enhancement that enables VRF awareness support on Local Mobility Anchor (LMA). This feature includes the following capabilities:

- Awareness of multiple customers belonging to different VRFs.
- Peer with multiple mobile operators for transport towards the Customer Premises Equipment (CPE) or Mobile Access Gateway (MAG) devices in separate peering or transport VRFs.

AAA Server Attributes for Proxy Mobile IPv6

If an authentication, authorization, and accounting (AAA) server is available, a Mobile Access Gateway (MAG) obtains the profile information of the Proxy Mobile IPv6 (PMIPv6) domain and the mobile node (MN) from the server during the configuration and call-flow time, respectively.

The following are the AAA attributes required for configuring the PMIPv6 domain and the MN are:

- PMIPv6 domain-specific AAA attributes:
 - cisco-mpc-protocol-interface
 - lma-identifier
 - mag-identifier
 - mag-v4-address
 - mag-v6-address
 - pmip6-domain-identifier
 - pmip6-timestamp-window
 - pmip6-replay-protection
 - pmip6-spi-key
 - pmip6-spi-value
- MN-specific AAA attributes:
 - home-lma
 - home-lma-ipv6-address
 - mn-nai
 - home-lma-ipv4-address
 - mn-apn
 - Mobile-Node-Identifier
 - mn-network
 - mn-service
 - multihomed

How to Configure Proxy Mobile IPv6 LMA

Configuring a Proxy Mobile IPv6 Domain by Using the Configuration from the AAA Server

SUMMARY STEPS

1. enable
2. configure terminal
3. ipv6 mobile pmipv6-domain *domain-name* load-aaa
4. end

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ipv6 mobile pmipv6-domain <i>domain-name</i> load-aaa Example: Device(config)# ipv6 mobile pmipv6-domain D1 load-aaa	Creates a PMIPv6 domain and configures it by using the configuration from the AAA server.
Step 4	end Example: Device(config)# end	Exits global configuration mode and returns to privileged EXEC mode.

Configuring a Minimum Configuration for a Domain When an AAA Server Is Not Available

SUMMARY STEPS

1. enable
2. configure terminal

3. **ipv6 mobile pmipv6-domain** *domain-name*
4. **mag** *mag-id*
5. **ipv4-address** *ipv4-address*
6. **ipv6-address** *ipv6-address*
7. **exit**
8. Repeat Steps 4 to 7 to configure the second MAG.
9. **nai** [*user*]@*realm*
10. **network** *network-name*
11. **service** {*dual* | *ipv4* | *ipv6*}
12. **exit**
13. Repeat Steps 8 to 12 to configure the second MN.
14. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ipv6 mobile pmipv6-domain <i>domain-name</i> Example: Device(config)# ipv6 mobile pmipv6-domain dn1	Creates the PMIP domain and enters PMIP domain configuration mode.
Step 4	mag <i>mag-id</i> Example: Device(config-ipv6-pmipv6-domain)# mag mag1	Configures a MAG within the PMIP domain and enters PMIP domain MAG configuration mode.
Step 5	ipv4-address <i>ipv4-address</i> Example: Device(config-ipv6-pmipv6-domain-mag)# ipv4-address 192.0.2.254	Configures an IPv4 address for the MAG within the PMIP domain.
Step 6	ipv6-address <i>ipv6-address</i> Example: Device(config-ipv6-pmipv6-domain-mag)# ipv6-address 2001:DB8::1	Configures an IPv6 address for the MAG within the PMIP domain.

	Command or Action	Purpose
Step 7	exit Example: Device(config-ipv6-pmipv6-domain-mag)# exit	Exits PMIP domain MAG configuration mode and returns to PMIP domain configuration mode.
Step 8	Repeat Steps 4 to 7 to configure the second MAG.	—
Step 9	nai <i>[user]@realm</i> Example: Device(config-ipv6-pmipv6-domain)# nai example1@example.com	Configures a network access identifier (NAI) for the MN within the PMIP domain and enters PMIP domain MN configuration mode.
Step 10	network <i>network-name</i> Example: Device(config-ipv6-pmipv6-domain-mn)# network network1	Associates a network name with the LMA under which an IPv4 or IPv6 pool can be enabled.
Step 11	service { dual ipv4 ipv6 } Example: Device(config-ipv6-pmipv6-domain-mn)# service ipv4	Configures the service provided to the MN within the PMIP domain.
Step 12	exit Example: Device(config-ipv6-pmipv6-domain-mn)# exit	Exits PMIP domain MN configuration mode and returns to PMIP domain configuration mode.
Step 13	Repeat Steps 8 to 12 to configure the second MN.	—
Step 14	end Example: Device(config-ipv6-pmipv6-domain)# end	Exits PMIP domain configuration mode and returns to privileged EXEC mode.

Configuring a Detailed Configuration for a Domain When the AAA Server Is Not Available

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 mobile pmipv6-domain** *domain-name*
4. **fixed-link-local-address** *ipv6-address*
5. **fixed-link-layer-address** *hardware-address*

6. **replay-protection timestamp** [*window seconds*]
7. **auth-option spi** {*spi-hex-value* | **decimal** *spi-decimal-value*} **key** {**ascii** *ascii-string* | **hex** *hex-string*}
8. **encap** {**gre-ipv4** | **ipv6-in-ipv6**}
9. **local-routing-mag**
10. **mag** *mag-id*
11. **ipv4-address** *ipv4-address*
12. **ipv6-address** *ipv6-address*
13. **exit**
14. Repeat Steps 10 to 13 to configure each MAG.
15. **mag** *mag-id*
16. **ipv4-address** *ipv4-address*
17. **ipv6-address** *ipv6-address*
18. **exit**
19. **mn-profile-load-aaa**
20. **nai** [*user*]@*realm*
21. **lma** *lma-id*
22. **service** {**dual** | **ipv4** | **ipv6**}
23. **network** *network-name*
24. Repeat Steps 22 and 23 to configure each MN.
25. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: <pre>Device> enable</pre>	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: <pre>Device# configure terminal</pre>	Enters global configuration mode.
Step 3	ipv6 mobile pmipv6-domain <i>domain-name</i> Example: <pre>Device(config)# ipv6 mobile pmipv6-domain dn1</pre>	Creates a PMIP domain and enters PMIPv6 domain configuration mode.
Step 4	fixed-link-local-address <i>ipv6-address</i> Example: <pre>Router(config-ipv6-pmipv6-domain)# fixed-link-local-address FE80::CE00:BFF:FEFC:0</pre>	Configures a fixed link-local address for the MAG-enabled interface toward the MN.
Step 5	fixed-link-layer-address <i>hardware-address</i> Example:	Configures a fixed link layer address (Layer 2 address) for the MAG-enabled interface toward the MN.

	Command or Action	Purpose
	Router (config-ipv6-pmipv6-domain) # fixed-link-layer-address aaaa.bbbb.cccc	
Step 6	replay-protection timestamp [window seconds] Example: Device (config-ipv6-pmipv6-domain) # replay-protection timestamp window 200	Configures the replay protection mechanism within the PMIP domain.
Step 7	auth-option spi {spi-hex-value decimal spi-decimal-value} key {ascii ascii-string hex hex-string} Example: Device (config-ipv6-pmipv6-domain) # auth-option spi 67 key ascii key1	Configures authentication for the PMIP domain.
Step 8	encap {gre-ipv4 ipv6-in-ipv6} Example: Device (config-ipv6-pmipv6-domain) # encap gre-ipv4	Configures the tunnel encapsulation mode type between the MAG and the LMA.
Step 9	local-routing-mag Example: Device (config-ipv6-pmipv6-domain) # local-routing-mag	Enables local routing for the MAG.
Step 10	mag mag-id Example: Device (config-ipv6-pmipv6-domain) # mag mag1	Configures MAG within the PMIP domain and enters PMIP domain MAG configuration mode.
Step 11	ipv4-address ipv4-address Example: Device (config-ipv6-pmipv6-domain-mag) # ipv4-address 192.0.2.254	Configures an IPv4 address for the MAG.
Step 12	ipv6-address ipv6-address Example: Device (config-ipv6-pmipv6-domain-mag) # ipv6-address 2001:0DB8:2:3::1	Configures an IPv6 address for the MAG.
Step 13	exit Example: Device (config-ipv6-pmipv6-domain-mag) # exit	Exits PMIP domain MAG configuration mode and returns to PMIP domain configuration mode.

	Command or Action	Purpose
Step 14	Repeat Steps 10 to 13 to configure each MAG.	—
Step 15	mag <i>mag-id</i> Example: Device(config-ipv6-pmipv6-domain)# mag mag1	Configures a MAG within the PMIP domain and enters PMIP domain MAG configuration mode.
Step 16	ipv4-address <i>ipv4-address</i> Example: Device(config-ipv6-pmipv6-domain-mag)# ipv4-address 192.0.2.254	Configures an IPv4 address for the MAG.
Step 17	ipv6-address <i>ipv6-address</i> Example: Device(config-ipv6-pmipv6-domain-mag)# ipv6-address 2001:0DB8:2:4::2	Configures an IPv6 address for the MAG.
Step 18	exit Example: Device(config-ipv6-pmipv6-domain-mag)# exit	Exits PMIP domain MAG configuration mode and returns to PMIP domain configuration mode.
Step 19	mn-profile-load-aaa Example: Device(config-ipv6-pmipv6-domain)# mn-profile-load-aaa	(Optional) Loads the profile configuration from the AAA server to the MN within the PMIP domain. Note Steps 20 to 24 need not be executed if the MN is configured using the configuration from the AAA server. You can use the specific command to override the configuration for the specific MN parameter.
Step 20	nai [<i>user</i>]@ <i>realm</i> Example: Device(config-ipv6-pmipv6-domain)# nai example1@example.com	Configures the NAI for the MN within the PMIP domain and enters PMIP domain MN configuration mode.
Step 21	lma <i>lma-id</i> Example: Device(config-ipv6-pmipv6-domain-mn)# lma lma1	Configures the LMA for the MN.
Step 22	service { dual ipv4 ipv6 } Example: Device(config-ipv6-pmipv6-domain-mn)# service ipv4	Configures the service provided to the MN within the PMIP domain.

	Command or Action	Purpose
Step 23	network <i>network-name</i> Example: Device (config-ipv6-pmipv6-domain-mn) # network network1	Associates a network name with the LMA under which an IPv4 or IPv6 pool can be enabled.
Step 24	Repeat Steps 22 and 23 to configure each MN.	—
Step 25	end Example: Device (config-ipv6-pmipv6-domain-mn) # end	Exits PMIP domain MN configuration mode and returns to privileged EXEC mode.

Configuring a Minimum Configuration for an LMA

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip local pool** *pool-name low-ip-address high-ip-address*
4. **ipv6 local pool** *pool-name prefix/prefix-length assigned-length*
5. **ipv6 unicast-routing**
6. **ipv6 mobile pmipv6-lma** *lma-id domain domain-name*
7. **address ipv6** *ipv6-address*
8. **network** *network1*
9. **pool ipv4** *pool-name pfxlen number*
10. **pool ipv6** *pool-name pfxlen number*
11. **exit**
12. **default profile** *profile-name*
13. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.

	Command or Action	Purpose
Step 3	<p>ip local pool <i>pool-name low-ip-address high-ip-address</i></p> <p>Example:</p> <pre>Device(config)# ip local pool v4pool 172.16.23.1 172.16.23.10</pre>	Creates a local pool of IPv4 addresses.
Step 4	<p>ipv6 local pool <i>pool-name prefix/prefix-length assigned-length</i></p> <p>Example:</p> <pre>Device(config)# ipv6 local pool v6pool 2001:0DB8::/29 64</pre>	Creates a local pool of IPv6 addresses.
Step 5	<p>ipv6 unicast-routing</p> <p>Example:</p> <pre>Device(config)# ipv6 unicast-routing</pre>	Enables IPv6 routing.
Step 6	<p>ipv6 mobile pmipv6-lma <i>lma-id domain domain-name</i></p> <p>Example:</p> <pre>Device(config)# ipv6 mobile pmipv6-lma lma1 domain dn1</pre>	Enables the LMA service on the router, configures the PMIP domain for the LMA, and enters LMA configuration mode.
Step 7	<p>address ipv6 <i>ipv6-address</i></p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-lma)# address ipv6 2001:DB8::1</pre>	Configures an IPv6 address for the LMA.
Step 8	<p>network <i>network1</i></p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-lma)# network network1</pre>	Associates a network, on which an IPv4 or IPv6 pool is configured, with the LMA, and enters LMA-network configuration mode.
Step 9	<p>pool ipv4 <i>pool-name pfxlen number</i></p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6lma-network)# pool ipv4 v4pool pfxlen 24</pre>	Specifies the name of the IPv4 address pool from which a home address is allocated to an MN subscriber.
Step 10	<p>pool ipv6 <i>pool-name pfxlen number</i></p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6lma-network)# pool ipv6 v6pool pfxlen 24</pre>	Specifies the name of the IPv6 address pool from which a home address is allocated to the MN subscriber.

	Command or Action	Purpose
Step 11	exit Example: Device(config-ipv6-pmipv6lma-network)# exit	Exits the LMA-network configuration mode and enters LMA configuration mode.
Step 12	default profile <i>profile-name</i> Example: Device(config-ipv6-pmipv6-lma)# default profile profile1	Enables the default profile for the MN.
Step 13	end Example: Device(config-ipv6-pmipv6-lma)# end	Exits LMA configuration mode and enters privileged EXEC mode.

Configuring a Detailed Configuration for an LMA

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip local pool** *pool-name low-ip-address high-ip-address*
4. **ipv6 local pool** *pool-name prefix/prefix-length assigned-length*
5. **ipv6 mobile pmipv6-lma** *lma-id domain domain-name*
6. **enable aaa accounting**
7. **network** *network-name*
8. **pool ipv4** *pool-name pfxlen number*
9. **pool ipv6** *pool-name pfxlen number*
10. **exit**
11. **default profile** *profile1*
12. **address ipv4** *ipv4-address*
13. **address ipv6** *ipv6-address*
14. **bce maximum** *number*
15. **bce lifetime** *seconds*
16. **bce refresh-time** *seconds*
17. **bce delete-wait-time** *seconds*
18. **replay-protection timestamp** [**window** *seconds*]
19. **bri delay min** *milliseconds*
20. **bri delay max** *milliseconds*
21. **bri retries** *number*
22. **mag** *mag-id domain-name*
23. **auth-option spi** {*spi-hex-value* | **decimal** *spi-decimal-value*} **key** {**ascii** | **hex**} *hex-string*
24. **ipv4-address** *ipv4-address*

25. `ipv6-address ipv6-address`
26. `encap {gre-ipv4 | ipv6-in-ipv6}`
27. `end`
28. `show ipv6 mobile pmipv6 lma lma1 globals`

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: <pre>Device> enable</pre>	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: <pre>Device# configure terminal</pre>	Enters global configuration mode.
Step 3	ip local pool <i>pool-name</i> <i>low-ip-address</i> <i>high-ip-address</i> Example: <pre>Device(config)# ip local pool v4pool 172.16.23.1 172.16.23.10</pre>	Creates a local pool of IPv4 addresses.
Step 4	ipv6 local pool <i>pool-name</i> <i>prefix/prefix-length</i> <i>assigned-length</i> Example: <pre>Device(config)# ipv6 local pool v6pool 2001:0DB8::/29 64</pre>	Creates a local pool of IPv6 addresses.
Step 5	ipv6 mobile pmipv6-lma <i>lma-id</i> <i>domain</i> <i>domain-name</i> Example: <pre>Device(config)# ipv6 mobile pmipv6-lma lma1 domain dn1</pre>	Enables the LMA service on a device, configures the PMIP domain for the LMA, and enters LMA configuration mode.
Step 6	enable aaa accounting Example: <pre>Device(config-ipv6-pmipv6-lma)# enable aaa accounting</pre>	Enables AAA accounting for MN sessions.
Step 7	network <i>network-name</i> Example: <pre>Device(config-ipv6-pmipv6-lma)# network network1</pre>	Configures a network name with the LMA under which an IPv4 or IPv6 pool is to be enabled and enters LMA-network configuration mode.

	Command or Action	Purpose
Step 8	pool ipv4 <i>pool-name</i> pxlen <i>number</i> Example: <pre>Device(config-ipv6-pmipv6lma-network)# pool ipv4 v4pool pxlen 24</pre>	Specifies the name of the IPv4 address pool from which a home address is allocated to an MN subscriber.
Step 9	pool ipv6 <i>pool-name</i> pxlen <i>number</i> Example: <pre>Device(config-ipv6-pmipv6lma-network)# pool ipv6 v6pool pxlen 24</pre>	Specifies the name of the IPv6 address pool from which a home address is allocated to an MN subscriber.
Step 10	exit Example: <pre>Device(config-ipv6-pmipv6lma-network)# exit</pre>	Exits LMA-network configuration mode and enters LMA configuration mode.
Step 11	default profile <i>profile1</i> Example: <pre>Device(config-ipv6-pmipv6-lma)# default profile profile1</pre>	Enables the default profile for the MN.
Step 12	address ipv4 <i>ipv4-address</i> Example: <pre>Device(config-ipv6-pmipv6-lma)# address ipv4 192.0.2.1</pre>	Configures an IPv4 address for the LMA.
Step 13	address ipv6 <i>ipv6-address</i> Example: <pre>Device(config-ipv6-pmipv6-lma)# address ipv6 2001:DB8::1</pre>	Configures an IPv6 address for the LMA.
Step 14	bce maximum <i>number</i> Example: <pre>Device(config-ipv6-pmipv6-lma)# bce maximum 200</pre>	Specifies the maximum number of Binding Cache Entries (BCE) that is allowed for the LMA on the MN.
Step 15	bce lifetime <i>seconds</i> Example: <pre>Device(config-ipv6-pmipv6-lma)# bce lifetime 5000</pre>	Specifies the maximum lifetime of a BCE on a MN.
Step 16	bce refresh-time <i>seconds</i> Example:	Specifies the time to refresh the BCE of an MN.

	Command or Action	Purpose
	Device(config-ipv6-pmipv6-lma)# bce refresh-time 2000	
Step 17	bce delete-wait-time <i>seconds</i> Example: Device(config-ipv6-pmipv6-lma)# bce delete-wait-time 2000	Specify the minimum amount of time in seconds the LMA must wait before it deletes a BCE on receiving the notification from the MAG.
Step 18	replay-protection timestamp [<i>window seconds</i>] Example: Device(config-ipv6-pmipv6-lma)# replay-protection timestamp window 200	Configures the replay protection mechanism within the PMIP domain.
Step 19	bri delay min <i>milliseconds</i> Example: Device(config-ipv6-pmipv6-lma)# bri delay min 500	Specifies the minimum time for which an LMA should wait before transmitting the Binding Revocation Indication (BRI) message.
Step 20	bri delay max <i>milliseconds</i> Example: Device(config-ipv6-pmipv6-lma)# bri delay max 4500	Specifies the maximum time for which an LMA should wait for the Binding Revocation Acknowledgment (BRA) message before retransmitting the BRI message.
Step 21	bri retries <i>number</i> Example: Device(config-ipv6-pmipv6-lma)# bri retries 6	Specifies the maximum number of times an LMA should retransmit a BRI message until a BRA is received.
Step 22	mag mag-id <i>domain-name</i> Example: Device(config-ipv6-pmipv6-lma)# mag mag3 dn1	Configures the MAG for the LMA and enters LMA-MAG configuration mode.
Step 23	auth-option spi { <i>spi-hex-value</i> decimal <i>spi-decimal-value</i> } key { ascii hex } <i>hex-string</i> Example: Device(config-ipv6-pmipv6-lma-mag)# auth-option spi decimal 258 key hex FFFFF	Configures authentication for the LMA within the MAG.
Step 24	ipv4-address <i>ipv4-address</i> Example: Device(config-ipv6-pmipv6mag-lma)# ipv4-address 192.0.2.254	Configures an IPv4 address for the LMA within the MAG. Note Repeat the ipv4-address <i>ipv4-address</i> to configure as many IPv4 addresses as required.

Example

	Command or Action	Purpose
Step 25	ipv6-address <i>ipv6-address</i> Example: Device(config-ipv6-pmipv6mag-lma)# ipv6-address 2001:0DB8:2:5::1	Configures an IPv6 address for the LMA within the MAG. Note Repeat the ipv6-address <i>ipv6-address</i> to configure as many IPv6 addresses as required.
Step 26	encap {gre-ipv4 ipv6-in-ipv6} Example: Device(config-ipv6-pmipv6mag-lma)# encap gre-ipv4	Configures a tunnel encapsulation mode type between the MAG and the LMA.
Step 27	end Example: Device(config-ipv6-pmipv6mag-lma)# end	Exits LMA-MAG configuration mode and returns to privileged EXEC mode.
Step 28	show ipv6 mobile pmipv6 lma lma1 globals Example: Device# show ipv6 mobile pmipv6 lma lma1 globals	(Optional) Displays LMA global configuration details.

Example

The following is sample output from the **show ipv6 mobile lma globals** command:

```
Device# show ipv6 mobile pmipv6 lma lma1 globals
-----
Domain : D1

LMA Identifier : lma1
  AAA Accounting : Disabled
  Default MN Profile : profile1
  Network : network1
  IPv4 Pool Name : v4
  Prefix Length : 24
  IPv6 Pool Name : v6pool
  Prefix Length : 48
  Max. HNPs : 1
  Max Bindings : 128000
  AuthOption : disabled
  RegistrationLifeTime : 3600 (sec)
  DeleteTime : 10000 (msec)
  CreateTime : 1500 (msec)
  BRI InitDelayTime : 1000 (msec)
  BRI MaxDelayTime : 2000 (msec)
  BRI MaxRetries : 1
  BRI EncapType : IPV6_IN_IPV6
  Fixed Link address is : enabled
  Fixed Link address : aaaa.aaaa.aaaa
  Fixed Link Local address is : enabled
  Fixed Link local address : 0xFE800000 0x0 0x0 0x2
  RefreshTime : 300 (sec)
  Refresh RetxInit time : 1000 (msec)
```

```

Refresh RetxMax time      : 32000 (msec)
Timestamp option         : enabled
Validity Window          : 10

Peer : mag1
Max. HNPs                : 1
Max Bindings              : 128000
AuthOption                : disabled
RegistrationLifeTime      : 3600 (sec)
DeleteTime                : 10000 (msec)
CreateTime                : 1500 (msec)
BRI InitDelayTime         : 1000 (msec)
BRI MaxDelayTime          : 2000 (msec)
BRI MaxRetries            : 1
BRI EncapType             : IPV6_IN_IPV6
Fixed Link address is     : enabled
Fixed Link address        : aaaa.aaaa.aaaa
Fixed Link Local address is : enabled
Fixed Link local address  : 0xFE800000 0x0 0x0 0x2
RefreshTime                : 300 (sec)
Refresh RetxInit time     : 1000 (msec)
Refresh RetxMax time      : 32000 (msec)
Timestamp option         : enabled
Validity Window          : 10

Peer : mag0
Max. HNPs                : 1
Max Bindings              : 128000
AuthOption                : disabled
RegistrationLifeTime      : 3600 (sec)
DeleteTime                : 10000 (msec)
CreateTime                : 1500 (msec)
BRI InitDelayTime         : 1000 (msec)
BRI MaxDelayTime          : 2000 (msec)
BRI MaxRetries            : 1
BRI EncapType             : GRE in IPV4
Fixed Link address is     : enabled
Fixed Link address        : aaaa.aaaa.aaaa
Fixed Link Local address is : enabled
Fixed Link local address  : 0xFE800000 0x0 0x0 0x2
RefreshTime                : 300 (sec)
Refresh RetxInit time     : 1000 (msec)
Refresh RetxMax time      : 32000 (msec)
Timestamp option         : enabled
Validity Window          : 10

```

Troubleshooting Tips

You can use the following commands to troubleshoot the LMA configuration:

- **debug ipv6 mobile lma event**
- **debug ipv6 mobile lma info**
- **show ipv6 pmipv6 lma bindings info**
- **show ipv6 pmipv6 lma globals**
- **show ipv6 pmipv6 lma tunnel**

Configuring VRF-Aware LMA

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 mobile pmipv6-lma** *lma-identifier* **domain** *domain-name*
4. **hnp maximum** *number*
5. **heartbeat interval** *interval-values* **retries** *retries-values*
6. **bce maximum** *number*
7. **bce lifetime** *seconds*
8. **bce delete-wait-time** *milliseconds*
9. **replay-protection timestamp window** *seconds*
10. **bri delay min** *milliseconds*
11. **bri retries** *count*
12. **dynamic mag learning**
13. **dscp control-plane** *dscp-value*
14. **mobility-service mobile-local-loop**
15. **customer** *customer-name* **vrf** *vrf-name*
16. **auth-option spi** *hex-value* **key ascii** *hex-value*
17. **heartbeat interval** *interval-value* **retries** *retries-value*
18. **network unauthorized**
19. **transport** [**vrf** *vrf-name*]
20. **address ipv6** *ipv6-address*
21. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ipv6 mobile pmipv6-lma <i>lma-identifier</i> domain <i>domain-name</i> Example: Device(config)# ipv6 mobile pmipv6-lma lma1 domain dn1	Enables the Local Mobility Anchor (LMA) service on the device, configures the PMIPv6 domain for the LMA, and enters LMA configuration mode.

	Command or Action	Purpose
Step 4	hnp maximum <i>number</i> Example: Device (config-pmipv6-lma)# hnp maximum 2	Configures the maximum number of home network prefixes (HNP) that a mobile node can possess.
Step 5	heartbeat interval <i>interval-values</i> retries <i>retries-values</i> Example: Device (config-pmipv6-lma)# heartbeat interval 300 retries 3	Configures heartbeat detection between MAG and LMA.
Step 6	bce maximum <i>number</i> Example: Device (config-pmipv6-lma)# bce maximum 2500	Configures the maximum number of binding cache entries (BCEs) or bindings that the LMA can support.
Step 7	bce lifetime <i>seconds</i> Example: Device (config-pmipv6-lma)# bce lifetime 2500	Specifies the maximum lifetime of a BCE on a mobile node.
Step 8	bce delete-wait-time <i>milliseconds</i> Example: Device (config-pmipv6-lma)# bce delete-wait-time 2000	Configures the minimum amount of time in seconds the LMA must wait before it deletes a BCE on receiving the notification from the MAG.
Step 9	replay-protection timestamp window <i>seconds</i> Example: Device (config-pmipv6-lma)# replay-protection timestamp window 200	Configures the replay protection mechanism within the PMIP domain.
Step 10	bri delay min <i>milliseconds</i> Example: Device (config-pmipv6-lma)# bri delay min 500	Configures the minimum time for which an LMA should wait before transmitting the Binding Revocation Indication (BRI) message.
Step 11	bri retries <i>count</i> Example: Device (config-pmipv6-lma)# bri retries 6	Configures the maximum number of times an LMA should retransmit a BRI message until a Binding Revocation Acknowledgment (BRA) is received.
Step 12	dynamic mag learning Example: Device (config-pmipv6-lma)# dynamic mag learning	Enables the LMA to accept PMIPv6 signaling messages from any MAG that is not locally configured.

	Command or Action	Purpose
Step 13	dscp control-plane <i>dscp-value</i> Example: Device (config-pmipv6-lma)# dscp control-plane 50	Configures the value of Differentiated Services Code Point (DSCP) in the outgoing PMIPv6 control plane messages.
Step 14	mobility-service mobile-local-loop Example: Device (config-pmipv6-lma)# mobility-service mobile-local-loop	Configures Mobile Loop Local (MLL) service on the LMA and enters the PMIPv6 LMA MLL configuration mode.
Step 15	customer <i>customer-name</i> vrf <i>vrf-name</i> Example: Device (config-pmipv6-lma-ml1)# customer cust1 vrf vrf1	Configures the name and the VRF of a customer and enters the PMIPv6 LMA MLL Customer configuration mode. Note You should have already configured the VRF by the name <i>vrf1</i> in the device.
Step 16	auth-option spi <i>hex-value</i> key ascii <i>hex-value</i> Example: Device (config-pmipv6-lma-ml1-cust)# auth-option spi 87E key ascii key1	Configures customer-specific authentication for the LMA within the MLL.
Step 17	heartbeat interval <i>interval-value</i> retries <i>retries-value</i> Example: Device (config-pmipv6-lma-ml1-cust)# heartbeat interval 300 retries 10	Configures the heartbeat detection.
Step 18	network unauthorized Example: Device (config-pmipv6-lma-ml1-cust)# network unauthorized	Configures customer-specific unauthorized network.
Step 19	transport [vrf <i>vrf-name</i>] Example: Device (config-pmipv6-lma-ml1-cust)# transport vrf transport_vrf	Configures customer-specific transport options in an LMA within a MLL and enters PMIPv6 LMA MLL Customer Transport configuration mode. Note If the transport is in global VRF, then the vrf and <i>vrf-name</i> keyword-argument pair can be omitted in this command.
Step 20	address ipv6 <i>ipv6-address</i> Example: Device (config-pmipv6-lma-ml1-cust-tpt)# address ipv6 2001:DB8::1	Configures customer-specific LMA IP address. There can only be two instances of addresses, one for IPv4 and one for IPv6.
Step 21	end Example:	Exits the PMIPv6 LMA MLL Customer Transport configuration mode and returns to privileged EXEC mode.

	Command or Action	Purpose
	Device (config-pmipv6-lma-ml1-cust-tpt)# end	

Configuration Examples for Proxy Mobile IPv6 Support for LMA Functionality

Example: Configuring a Proxy Mobile IPv6 Domain by Using the Configuration from the AAA Server

The following example shows how to configure the PMIPv6 domain by using the AAA server configuration:

```
Device# configure terminal
Device(config)# ipv6 mobile pmipv6-domain D1 load-aaa
```

The following example shows how to configure the PMIPv6 domain by using the configuration from the AAA server and how to override the configuration for specific PMIPv6 domain parameters:

```
Device# configure terminal
Device(config)# ipv6 mobile pmipv6-domain D11 load-aaa
Device(config)# ipv6 mobile pmipv6-domain D11
Device(config-ipv6-pmipv6-domain)# gre-ipv4
Device(config-ipv6-pmipv6-domain)# auth-option spi 67 key ascii key1
```

Example: Configuring a Minimum Configuration for a Domain When the Configuration from the AAA Server Is Not Available

The following example shows how to configure a minimum configuration for a domain when the AAA server configuration is not available:

```
Device# configure terminal
Device(config)# ipv6 mobile pmipv6-domain D2
Device(config-ipv6-pmipv6-domain)# replay-protection timestamp window 200
Device(config-ipv6-pmipv6-domain)# auth-option spi 100 key ascii hi
Device(config-ipv6-pmipv6-domain)# encaps ipv6-in-ipv6
!
Device(config-ipv6-pmipv6-domain)# lma lma1
Device(config-ipv6-pmipv6-domain-lma)# ipv4-address 10.1.1.1
Device(config-ipv6-pmipv6-domain-lma)# ipv6-address 2001:0DB8:2:3::1
Device(config-ipv6-pmipv6-domain-lma)# exit
!
Device(config-ipv6-pmipv6-domain)# mag mag1
Device(config-ipv6-pmipv6-domain-mag)# ipv4-address 10.1.3.1
Device(config-ipv6-pmipv6-domain-mag)# ipv6-address 2001:0DB8:2:5::1
Device(config-ipv6-pmipv6-domain-mag)# exit
!
Device(config-ipv6-pmipv6-domain)# nai example@example.com
Device(config-ipv6-pmipv6-domain-mn)# lma lma1
Device(config-ipv6-pmipv6-domain-mn)# int att GigabitETHERNET 12-addr 02c7.f800.0422
Device(config-ipv6-pmipv6-domain-mn)# gre-encap-key up 1234
```

```

Device (config-ipv6-pmipv6-domain-mn) # gre-encap-key down 5678
Device (config-ipv6-pmipv6-domain-mn) # service ipv4
Device (config-ipv6-pmipv6-domain-mn) # network-name example1
Device (config-ipv6-pmipv6-domain-mn) # end

```

Example: Configuring an LMA

The following example shows the minimum configuration required to enable LMA:

```

Device# configure terminal
Device (config) # ipv6 mobile pmipv6-domain D2
!
Device (config-ipv6-pmipv6-domain) # lma lma1
Device (config-ipv6-pmipv6-domain-lma) # ipv4-address 10.1.1.1
Device (config-ipv6-pmipv6-domain-lma) # ipv6-address 2001:0DB8:2:3::1
Device (config-ipv6-pmipv6-domain-lma) # exit
!
Device (config-ipv6-pmipv6-domain) # lma lma2
Device (config-ipv6-pmipv6-domain-lma) # ipv4-address 10.2.1.1
Device (config-ipv6-pmipv6-domain-lma) # ipv6-address 2001:0DB8:2:4::1
Device (config-ipv6-pmipv6-domain-lma) # exit
!
Device (config-ipv6-pmipv6-domain) # nai example1@example.com
Device (config-ipv6-pmipv6-domain-mn) # network-name example1
Device (config-ipv6-pmipv6-domain-mn) # exit
!
Device (config-ipv6-pmipv6-domain) # nai example2@example.com
Device (config-ipv6-pmipv6-domain-mn) # network-name example1
Device (config-ipv6-pmipv6-domain-mn) # exit
!
Device (config) # ipv6 mobile pmipv6-lma lma1 domain D2
Device (config-ipv6-pmipv6-lma) # address ipv6 2001:DB8:0:0:E000::F
Device (config-ipv6-pmipv6-lma) # address ipv4 10.2.1.1
Device (config-ipv6-pmipv6-domain-mn) # network-name example1
Device (config-ipv6-pmipv6-lma-network) # pool ipv4 v4pool pfxlen number
Device (config-ipv6-pmipv6-lma-network) # pool ipv6 v6pool pfxlen number
Device (config-ipv6-pmipv6-lma-network) # exit
Device (config-ipv6-pmipv6-lma) # default profile example2@example.com

Device (ipv6-mag-config) # exit

```

Example: Configuring VRF-Aware LMA

```

Device# configure
Device (config) # ipv6 mobile pmipv6-lma lma1 domain example.com
Device (config-pmipv6-lma) # hnp maximum 2
Device (config-pmipv6-lma) # heartbeat interval 300 retries 3
Device (config-pmipv6-lma) # bce maximum 2500
Device (config-pmipv6-lma) # bce lifetime 2500
Device (config-pmipv6-lma) # bce delete-wait-time 2000
Device (config-pmipv6-lma) # replay-protection timestamp window 200
Device (config-pmipv6-lma) # bri delay min 500
Device (config-pmipv6-lma) # bri retries 6
Device (config-pmipv6-lma) # dynamic mag learning
Device (config-pmipv6-lma) # dscp control-plane 50
Device (config-pmipv6-lma) # mobility-service mobile-local-loop
Device (config-pmipv6-lma-ml1) # customer cust1 vrf vrf1
Device (config-pmipv6-lma-ml1-cust) # auth-option spi 87E key ascii key1

```

```

Device (config-pmipv6-lma-ml1-cust)# heartbeat interval 300 retries 10
Device (config-pmipv6-lma-ml1-cust)# network unauthorized
Device (config-pmipv6-lma-ml1-cust)# transport vrf transport_vrf
Device (config-pmipv6-lma-ml1-cust-tpt)# address ipv6 2001:DB8::1
Device (config-pmipv6-lma-ml1-cust-tpt)# end

```

Where to Go Next

The MAG entity works with the LMA provided by the ASR 5000 devices. To configure the LMA in the Cisco ASR 5000, see the “PDN Gateway Configuration” module in the [Cisco ASR 5000 Series Packet Data Network Gateway Administration Guide](#).

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
IP mobility commands	Cisco IOS IP Mobility Command Reference

Standards and RFCs

Standard/RFC	Title
RFC 3775	<i>Mobility Support in IPv6</i>
RFC 5213	<i>Proxy Mobile IPv6</i>
RFC 5844	<i>IPv4 Support for Proxy Mobile IPv6</i>
RFC 5845	<i>Generic Routing Encapsulation (GRE) Key Option for Proxy Mobile IPv6</i>
RFC 5846	<i>Binding Revocation for IPv6 Mobility</i>

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Proxy Mobile IPv6 Local Mobility Anchor

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 2: Feature Information for Proxy Mobile IPv6 Local Mobility Anchor

Feature Name	Releases	Feature Information
Proxy Mobile IPv6 Local Mobility Anchor	15.5(2)T	Local Mobility Anchor (LMA) acts as the home agent for a mobile node (MN) in a Proxy Mobile IPv6 domain, which is the network where the mobility management of an MN is handled using the Proxy Mobile IPv6 (PMIPv6) protocol. LMA is the topological anchor point for the MN's home network prefix(es) and is the entity that manages the MN's binding state. This module explains how to configure LMA.



CHAPTER 4

PMIP Mobility - 3G Mobility Anchor

The 3G Mobility Anchor(3GMA) feature acts as an anchor point for 3G User Equipment (UE). 3GMA functions as the DHCP server for Gateway general packet radio service (GPRS) Support Node (GGSN)/Packet Data Serving Node (PDSN), and as a Local Mobility Anchor (LMA) towards Wi-Fi Mobile Access Gateway (MAG).

This module describes the 3G Mobility Anchor feature.

- [Finding Feature Information, on page 47](#)
- [Prerequisites for 3G Mobility Anchor, on page 47](#)
- [Information about PMIP Mobility - 3G Mobility Anchor, on page 48](#)
- [How to Configure PMIP Mobility - 3G Mobility Anchor, on page 49](#)
- [Configuration Examples for PMIP Mobility - 3G Mobility Anchor, on page 51](#)
- [Additional References for PMIP Mobility - 3G Mobility Anchor, on page 52](#)
- [Feature Information for PMIP Mobility - 3G Mobility Anchor, on page 52](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for 3G Mobility Anchor

You must configure the IPv4 and IPv6 address pools for the Local Mobility Anchor (LMA) to assign IPv4 or IPv6 addresses.

Information about PMIP Mobility - 3G Mobility Anchor

3G Mobility Anchor Overview

Third-generation Mobility Anchor (3GMA) is the default gateway for Packet Data Serving Node (PDSN)/General Packet Radio Service (GPRS) Support Node (GGSN). A 3GMA node is placed on Gi interface of the PDSN/GGSN to serve as an anchor point for 3G User Equipments (UEs). Gi interface is the reference point between a GPRS network and an external packet data network. 3GMA node works as a DHCP server towards GGSN/PDSN, and as an LMA towards a WiFi MAG. 3GMA node assigns an IP address and responds to DHCP messages from GGSN/PDSN. UEs are configured with a specific Access Point Names (APNs); when a UE connects to this APN, PDSN/ GGSN is configured to operate in Proxy DHCP mode, instead of using local address pool. In 3GMA mode, the IP address assigned to the mobile is obtained from an external DHCP server (3GMA node). Local Mobility Anchor (LMA) functionality described in RFC 5213 can also be configured in 3GMA mode.

Local Mobility Anchor

Local Mobility Anchor (LMA) is the home agent for a mobile node (MN) in a Proxy Mobile IPv6 (PMIPv6) domain. It is the topological anchor point for MN home network prefixes and manages the binding state of an MN. An LMA has the functional capabilities of a home agent as defined in the Mobile IPv6 base specification (RFC 3775) along with the capabilities required for supporting the PMIPv6 protocol.



Note Use the **dynamic mag learning** command to enable LMA to accept Proxy Mobile IPv6 (PMIPv6) signaling messages from any Mobile Access Gateway (MAG) that is not configured locally.

Mobile Node

Mobile node (MN) is an IP host and the mobility of the MN is managed by a network. MN can be an IPv4-only node, an IPv6-only node, or a dual-stack node, which is a node with IPv4 and IPv6 protocol stacks. MN is not required to participate in any IP mobility-related signaling for achieving mobility for an IP address or a prefix that is obtained in the Proxy Mobile IPv6 (PMIPv6) domain.

Radio Access Technology Type

A radio access type (RAT) refers to the method of allocating radio resources in a wireless network for communication in the uplink (user to network) and downlink (network to user). RAT indicates the type of radio technology used to access a Core Network (CN), which is the central part of a telecommunication network that provides various services to customers who are connected by the access network. RAT is implemented by the radio access network (RAN) that resides between a device such as a mobile phone, a computer, or any remotely controlled machine, and provides connection with its CN. Mobile phones and other wireless connected devices are known as user equipment (UE). Examples of RAT types include Worldwide Interoperability for Microwave Access (WiMAX), Wireless Local Area Network (WLAN), and 3GPP

How to Configure PMIP Mobility - 3G Mobility Anchor

Configuring LMA in 3GMA Mode

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip local pool** *pool-name low-ip-address high-ip-address*
4. **ipv6 local pool** *pool-name prefix/prefix-length assigned-length*
5. **ipv6 unicast-routing**
6. **ipv6 mobile pmipv6-lma** *lma-id domain domain-name*
7. **address ipv6** *ipv6-address*
8. **network** *network1*
9. **pool ipv4** *pool-name pfxlen number*
10. **pool ipv6** *pool-name pfxlen number*
11. **exit**
12. **default profile** *profile-name*
13. **role** *3gma*
14. **interface** *interface-type*
15. **rat** *rat-type priority priority-number*
16. **end**
17. **show ipv6 mobile pmipv6 lma binding**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ip local pool <i>pool-name low-ip-address high-ip-address</i> Example: Device(config)# ip local pool v4pool 209.165.201.1 209.165.201.10	Creates a local pool of IPv4 addresses.

	Command or Action	Purpose
Step 4	ipv6 local pool <i>pool-name prefix/prefix-length assigned-length</i> Example: <pre>Device(config)# ipv6 local pool v6pool 2001:0DB8::/32 64</pre>	Creates a local pool of IPv6 addresses.
Step 5	ipv6 unicast-routing Example: <pre>Device(config)# ipv6 unicast-routing</pre>	Enables IPv6 routing.
Step 6	ipv6 mobile pmipv6-lma <i>lma-id domain domain-name</i> Example: <pre>Device(config)# ipv6 mobile pmipv6-lma lma1 domain dn1</pre>	Enables the Local Mobility Anchor (LMA) service on the device, configures the Proxy Mobile IPv6 (PMIPv6) domain for the LMA, and enters LMA configuration mode.
Step 7	address ipv6 <i>ipv6-address</i> Example: <pre>Device(config-ipv6-pmipv6-lma)# address ipv6 2001:DB8::1</pre>	Configures an IPv6 address for the LMA.
Step 8	network <i>network1</i> Example: <pre>Device(config-ipv6-pmipv6-lma)# network network1</pre>	Associates a network, on which an IPv4 or IPv6 pool is configured, with the LMA, and enters LMA-network configuration mode.
Step 9	pool ipv4 <i>pool-name pfxlen number</i> Example: <pre>Device(config-ipv6-pmipv6lma-network)# pool ipv4 v4pool pfxlen 24</pre>	Specifies the name of the IPv4 address pool from which a home address is allocated to an mobile node (MN) subscriber.
Step 10	pool ipv6 <i>pool-name pfxlen number</i> Example: <pre>Device(config-ipv6-pmipv6lma-network)# pool ipv6 v6pool pfxlen 24</pre>	Specifies the name of the IPv6 address pool from which a home address is allocated to the MN subscriber.
Step 11	exit Example: <pre>Device(config-ipv6-pmipv6lma-network)# exit</pre>	Exits the LMA-network configuration mode and enters LMA configuration mode.
Step 12	default profile <i>profile-name</i> Example:	Enables the default profile for the MN.

	Command or Action	Purpose
	Device(config-ipv6-pmipv6-lma)# default profile profile1	
Step 13	role 3gma Example: Device(config-ipv6-pmipv6-lma)# role 3gma	Enables 3GMA and enters 3GMA mode. Note Specifying at least one interface is mandatory. The role 3gma command does not work if no interface is specified.
Step 14	interface interface-type Example: Device(config-ipv6-pmipv6lma-role)# interface Ethernet 1	Configures 3GMA interface on LMA.
Step 15	rat rat-type priority priority-number Example: Device (config-ipv6-pmipv6lma-role)# rat wlan priority 2	Sets the priority for Radio Access Type (RAT).
Step 16	end Example: Device (config-ipv6-pmipv6lma-role)# end	Exits 3GMA role configuration mode and enters privileged EXEC mode.
Step 17	show ipv6 mobile pmipv6 lma binding Example: Device# show ipv6 mobile pmipv6 lma binding	Displays the list of the LMA bindings established over the Proxy Mobile IPv6 (PMIPv6) signaling plane.

Configuration Examples for PMIP Mobility - 3G Mobility Anchor

Example: Configuring LMA in 3GMA Mode

The following example shows how to configure LMA in 3GMA mode:

```
Device> enable
Device# configure terminal
Device(config)# ip local pool v4pool 209.165.201.1 209.165.201.10
Device(config)# ipv6 local pool v6pool 2001:0DB8::/32 64
Device(config)# ipv6 unicast-routing
Device(config)# ipv6 mobile pmipv6-lma lma1 domain dn1
Device(config-ipv6-pmipv6-lma)# address ipv6 2001:DB8::1
Device(config-ipv6-pmipv6-lma)# network network1
Device(config-ipv6-pmipv6lma-network)# pool ipv4 v4pool pfxlen 24
Device(config-ipv6-pmipv6lma-network)# pool ipv6 v6pool pfxlen 24
Device(config-ipv6-pmipv6lma-network)# exit
```

```

Device(config-ipv6-pmipv6-lma)# default profile profile1
Device(config-ipv6-pmipv6-lma)# role 3gma
Device(config-ipv6-pmipv6lma-role)# interface Ethernet 1
Device (config-ipv6-pmipv6lma-role)# rat wlan priority 2
Device (config-ipv6-pmipv6lma-role)# end
Device# show ipv6 mobile pmipv6 lma binding

```

Additional References for PMIP Mobility - 3G Mobility Anchor

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
IP mobility commands	Cisco IOS IP Mobility Command Reference

Standards and RFCs

Standard/RFC	Title
RFC 3775	<i>Mobility Support in IPv6</i>
RFC 5213	<i>Proxy Mobile IPv6</i>
RFC 5844	<i>IPv4 Support for Proxy Mobile IPv6</i>
RFC 5845	<i>Generic Routing Encapsulation (GRE) Key Option for Proxy Mobile IPv6</i>
RFC 5846	<i>Binding Revocation for IPv6 Mobility</i>

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for PMIP Mobility - 3G Mobility Anchor

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 3: Feature Information for PMIP Mobility - 3G Mobility Anchor

Feature Name	Releases	Feature Information
PMIP Mobility - 3G Mobility Anchor	Cisco IOS XE Release 3.9S	<p>The 3G Mobility Anchor(3GMA) feature acts as an anchor point for 3G User Equipment (UE). 3GMA functions as the DHCP server for Gateway general packet radio service (GPRS) Support Node (GGSN)/Packet Data Serving Node (PDSN), and as a Local Mobility Anchor (LMA) towards Wi-Fi Mobile Access Gateway (MAG).</p> <p>The following commands were introduced or modified: rat, role 3gma, interface (proxy mobile IPv6), and show ipv6 mobile pmipv6 lma binding</p>



CHAPTER 5

PMIP: Multipath Support on MAG and LMA

The PMIP: Multipath Support on MAG and LMA feature enables Mobile Access Gateway (MAG) to register multiple transport end-points with Local Mobility Anchor (LMA), allowing MAG and LMA to establish multiple tunnels and apply path selection on a flow basis.

- [Finding Feature Information, on page 55](#)
- [Prerequisites for PMIP: Multipath Support for MAG and LMA, on page 55](#)
- [Information About PMIP: Multipath Support for MAG and LMA, on page 56](#)
- [How to Configure PMIP: Multipath Support for MAG and LMA, on page 58](#)
- [Configuration Examples for PMIPv6 Multipath Support for MAG and LMA, on page 78](#)
- [Additional References, on page 81](#)
- [Feature Information for PMIP: Multipath Support on MAG and LMA, on page 82](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for PMIP: Multipath Support for MAG and LMA

- Configure UDP in tunnel encapsulation mode on Mobile Access Gateway (MAG) and Local Mobility Anchor (LMA).
- Configure multipath and run the IP SLA responder.

Information About PMIP: Multipath Support for MAG and LMA

Local Mobility Anchor

Local Mobility Anchor (LMA) is the home agent for a mobile node (MN) in a Proxy Mobile IPv6 (PMIPv6) domain. It is the topological anchor point for MN home network prefixes and manages the binding state of an MN. An LMA has the functional capabilities of a home agent as defined in the Mobile IPv6 base specification (RFC 3775) along with the capabilities required for supporting the PMIPv6 protocol.



Note Use the **dynamic mag learning** command to enable LMA to accept Proxy Mobile IPv6 (PMIPv6) signaling messages from any Mobile Access Gateway (MAG) that is not configured locally.

Mobile Access Gateways

Mobile Access Gateway (MAG) performs mobility-related signaling on behalf of the mobile nodes (MN) attached to its access links. MAG is the access router for the MN; that is, MAG is the first-hop router in the localized mobility management infrastructure.

MAG performs the following functions:

- Obtains an IP address from Local Mobility Anchor (LMA) and assigns it to MN.
- Retains the IP address of an MN when the MN roams across MAGs.
- Tunnels traffic from MN to LMA.

Mobile Node

Mobile node (MN) is an IP host and the mobility of the MN is managed by a network. MN can be an IPv4-only node, an IPv6-only node, or a dual-stack node, which is a node with IPv4 and IPv6 protocol stacks. MN is not required to participate in any IP mobility-related signaling for achieving mobility for an IP address or a prefix that is obtained in the Proxy Mobile IPv6 (PMIPv6) domain.

Multipath Support

At any given time, many network paths exist between Local Mobility Anchor (LMA) and Mobile Access Gateway (MAG). The PMIP: Multipath Support on MAG and LMA feature enables MAG to select any one of the paths on a priority basis or select all the existing network paths simultaneously to create tunnels to reach LMA. All paths have the same priority when multiple paths are selected.

Mobile Map

Mobile map configuration facilitates application-based routing. More than one mobile map can be configured under the Proxy Mobile IPv6 (PMIPv6) domain, however, at a given point of time, only one mobile map is

active at Mobile Access Gateway (MAG) and Local Mobility Anchor (LMA). The mobile map and its entries are configured or modified when no bindings are available.

Logical Mobile Node

Logical Mobile Node (LMN) is a logical entity that represents a mobile node (MN) that is hosted on one of the interfaces of Mobile Access Gateway (MAG) device. LMN has Network Access Indicator (NAI) similar to MN. One or more networks can be associated with each LMN through the interfaces designated as mobile network interfaces. LMN on mobile network receives an IP address from a DHCP server that runs on MAG, unlike a mobile node whose address is assigned by Local Mobility Anchor (LMA).

Multipath Management

The PMIPv6 Multipath Management feature enables PMIPv6 to choose from multiple available links which have different access technologies. Available path is constantly monitored using PMIPv6 heartbeat which is a special type of PMIPv6 packet. Link preferences can be assigned to various types of traffic using mobile maps.

Hybrid-Access Service

Hybrid-access service is a multipath management solution, which provides mobility service under MAG. PMIPv6 hybrid-access service is an independent function that manages application profiles, captures and stores link performance statistics, and programs the PMIPv6 data plane based on the application requirements (HTTP, SSH, Telnet, and video).



Note PMIPv6 hybrid-access service has no interference with the core PMIPv6 functionality.

MAG to MAG Traffic Blocking on the PMIPv6 LMA

To prevent communication between PMIPv6 clients such as, mobile nodes (MNs), or entire mobile networks, that are connected to the same Local Mobility Anchor (LMA), the inter-MAG tunnel traffic is blocked by applying access control list (ACL) on the PMIPv6 tunnels. To enable the blockage of inter-MAG tunnel traffic, the prefixes of all the PMIPv6 addresses mentioned in the address pool configured on LMA, must be entered in the ACL.

IP SLA Optimization

IP SLA optimization helps solve MAG scaling limitations. In the case of PMIPv6 multipath scenario, if hybrid access is enabled then MAG and LMA start SLA probes to measure link performance. Programmatically created IP SLA probes uses dynamic route map entries to route these SLA packets. The current IP SLA implementation supports only 1024 dynamic route map entries on ASR1000 Series Aggregation Services Routers and this limits MAG scaling.

As a solution, IP SLA APIs have been enhanced to accept egress interface for UDP jitter probes. With this enhancement, PMIPv6 does not create dynamic route map entries to redirect IP SLA traffic over PMIPv6 tunnel instead it uses new enhanced APIs to configure egress interface for the dynamically created SLA probes.

Loopback as a Roaming Interface

Loopback as roaming interface solves customer IP address space limitation issues. In case of PMIPv6 multipath VRF scenario, MAG supports different service providers. This leads to duplicate IP address on roaming interface (each service provider can use the same IP). The current implementation does not support this scenarios because LMA expects unique roaming interface IP. This limits the usage of IP address space for different customers.

Loopback IP as a tunnel source solves this problem. The roaming interface is the loopback interface which is associated with a physical egress interface. Loopback interface should be unique across MAGs, however, physical interface IPs can be duplicated.

How to Configure PMIP: Multipath Support for MAG and LMA

Configuring PMIP: Multipath Support for MAG and LMA

Configuring UDP Encapsulation for a PMIPv6 Domain

SUMMARY STEPS

1. enable
2. configure terminal
3. ipv6 mobile pmipv6-domain *domain-name*
4. encap udptunnel
5. end

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ipv6 mobile pmipv6-domain <i>domain-name</i> Example: Device(config)# ipv6 mobile pmipv6-domain dn1	Creates a PMIPv6 domain and enters PMIPv6 domain configuration mode.

	Command or Action	Purpose
Step 4	encap udptunnel Example: Device(config-ipv6-pmipv6-domain)# encap udptunnel	Configures the tunnel encapsulation mode type between Mobile Access Gateway (MAG) and Local Mobility Anchor (LMA).
Step 5	end Example: Device(onfig-ipv6-pmipv6-domain)# end	Exits PMIPv6 domain configuration mode and returns to privileged EXEC mode.

Configuring Roaming Interface



Note Perform this task when configuring multipath for MAG.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 mobile pmipv6-mag mag-id domain domain-name**
4. **address dynamic**
5. **roaming interface type number**
6. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ipv6 mobile pmipv6-mag mag-id domain domain-name Example: Device(config)# ipv6 mobile pmipv6-mag mag1 domain dn1	Enables MAG service on a device, configures the PMIPv6 domain for MAG, and enters MAG configuration mode.
Step 4	address dynamic Example: Device(config-ipv6-pmipv6-mag)# address dynamic	Configures dynamic address for MAG and enters MAG dynamic address configuration mode.

	Command or Action	Purpose
Step 5	roaming interface <i>type number</i> Example: Device(config-ipv6-pmipv6-mag-addr-dyn) # roaming interface Ethernet 0/0	Specifies an interface as a roaming interface on MAG.
Step 6	exit Example: Device(config-ipv6-pmipv6-mag-addr-dyn) # exit	Exits MAG dynamic address configuration mode and returns to privileged EXEC mode.

Configuring Multipath under LMA and MAG Configurations

SUMMARY STEPS

1. enable
2. configure terminal
3. ipv6 mobile pmipv6-lma *lma-id domain domain-name*
4. multipath
5. exit
6. ipv6 mobile pmipv6-mag mag1 domain dn1
7. multipath
8. exit

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ipv6 mobile pmipv6-lma <i>lma-id domain domain-name</i> Example: Device(config) # ipv6 mobile pmipv6-lma lma1 domain dn1	Enables LMA service on the device, configures the PMIPv6 domain for Local Mobility Anchor (LMA), and enters LMA configuration mode.
Step 4	multipath Example: Device(config-ipv6-pmipv6-lma) # multipath	Enables multipath support on LMA.
Step 5	exit Example:	Exits LMA configuration mode and enters global configuration mode.

	Command or Action	Purpose
	Device(config-ipv6-pmipv6-lma)# exit	
Step 6	ipv6 mobile pmipv6-mag mag1 domain dn1 Example: Device(config)# ipv6 mobile pmipv6-mag mag1 domain dn1	Enables MAG service on a device, configures the PMIPv6 domain for MAG, and enters MAG configuration mode.
Step 7	multipath Example: Device(config-ipv6-pmipv6-mag)# multipath	Enables multipath support on MAG.
Step 8	exit Example: Device(config-ipv6-pmipv6-mag)# exit	Exits MAG configuration mode and returns to global configuration mode.

Configuring Mobile Map Support on LMA

Configuring Access Lists in LMA

SUMMARY STEPS

1. enable
2. configure terminal
3. ip access-list extended *access-list-name*
4. permit *protocol any any*
5. exit
6. ip access-list extended *access-list-name*
7. permit *protocol any any*
8. exit
9. ip access-list extended *access-list-name*
10. permit *protocol any any*
11. exit
12. ip access-list extended *access-list-name*
13. permit ip any *destination-address destination-wildcard*
14. end

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.

	Command or Action	Purpose
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ip access-list extended <i>access-list-name</i> Example: Device(config)# ip access-list extended tcp	Configures an extended named ACL specific to TCP.
Step 4	permit <i>protocol</i> any any Example: Device(config-ext-nacl)# permit tcp any any	Sets conditions in named IP lists that permit packets.
Step 5	exit Example: Device(config-ext-nacl)# exit	Exits extended-ACL configuration mode and returns to global configuration mode.
Step 6	ip access-list extended <i>access-list-name</i> Example: Device(config)# ip access-list extended icmp	Configures an extended named ACL specific to Internet Control Message Protocol (ICMP).
Step 7	permit <i>protocol</i> any any Example: Device(config-ext-nacl)# permit icmp any any	Sets conditions in named IP lists that permit packets.
Step 8	exit Example: Device(config-ext-nacl)# exit	Exits extended-ACL configuration mode and returns to global configuration mode.
Step 9	ip access-list extended <i>access-list-name</i> Example: Device(config)# ip access-list extended udp	Configures an extended named ACL specific to UDP.
Step 10	permit <i>protocol</i> any any Example: Device(config-ext-nacl)# permit udp any any	Sets conditions in named IP lists that permit packets.
Step 11	exit Example:	Exits extended-ACL configuration mode and returns to global configuration mode.

	Command or Action	Purpose
	<code>Device(config-ext-nacl)# exit</code>	
Step 12	ip access-list extended <i>access-list-name</i> Example: <code>Device(config)# ip access-list extended LB010ACL</code>	Configures an extended named ACL.
Step 13	permit ip any <i>destination-address destination-wildcard</i> Example: <code>Device(config-ext-nacl)# permit ip any 10.255.224.0 0.0.0.255</code>	Sets conditions in named IP lists that permit packets.
Step 14	end Example: <code>Device(config-ext-nacl)# end</code>	Exits extended-ACL configuration mode and returns to privileged EXEC mode.

Configuring Mobile Maps under the PMIPv6 domain

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 mobile pmipv6-domain** *domain-name* **terminal**
4. **mobile-map** *map-name sequence-number*
5. **match access-list** *acl-list-name*
6. **set link-type** *link-name1* [*link-name2*] [*link-name2*] **null**
7. **exit**
8. **mobile-map** *map-name sequence-number*
9. **match access-list** *acl-list-name*
10. **set link-type** *link-name1* **null**
11. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: <code>Device> enable</code>	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	configure terminal Example: <code>Device# configure terminal</code>	Enters global configuration mode.

	Command or Action	Purpose
Step 3	ipv6 mobile pmipv6-domain <i>domain-name</i> terminal Example: Device(config)# ipv6 mobile pmipv6-domain dn1	Creates a PMIP domain and enters PMIPv6 domain configuration mode.
Step 4	mobile-map <i>map-name sequence-number</i> Example: Device(config-ipv6-pmipv6-domain)# mobile-map mobilemap1 10	Configures a mobile map for the PMIPv6 domain and enters mobile-map configuration mode.
Step 5	match access-list <i>acl-list-name</i> Example: Device(config-ipv6-pmipv6-domain-mobile-map)# match access-list LB010ACL	Specifies an access list (ACL) name.
Step 6	set link-type <i>link-name1</i> [<i>link-name2</i>] [<i>link-name2</i>] null Example: Device(config-ipv6-pmipv6-domain-mobile-map)# set link-type lte_intf 3g_intf wifi_intf null	Specifies the link type for a match clause.
Step 7	exit Example: Device(config-ipv6-pmipv6-domain-mobile-map)# exit	Exits mobile-map configuration mode and enters global configuration mode.
Step 8	mobile-map <i>map-name sequence-number</i> Example: Device(config-ipv6-pmipv6-domain)# mobile-map mobilemap1 20	Configures a mobile map for a PMIPv6 domain and enters mobile-map configuration mode.
Step 9	match access-list <i>acl-list-name</i> Example: Device(config-ipv6-pmipv6-domain-mobile-map)# match access-list icmp	Specifies an access-list (ACL) name.
Step 10	set link-type <i>link-name1</i> null Example: Device(config-ipv6-pmipv6-domain-mobile-map)# set link-type 3g_intf_lte_intf null	Specifies the link type for a match clause.

	Command or Action	Purpose
Step 11	end Example: Device (config-ipv6-pmipv6-domain-mobile-map) # end	Exits mobile-map configuration mode and returns to privileged EXEC mode.

Configuring a Mobile Map under LMA Configuration and Applying it on an Interface

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 mobile pmipv6-lma** *lma-id domain domain-name*
4. **mobile-map** *map-name*
5. **interface** *type number*
6. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ipv6 mobile pmipv6-lma <i>lma-id domain domain-name</i> Example: Device(config)# ipv6 mobile pmipv6-lma lma1 domain dn1	Enables LMA service on the device, configures the PMIP domain for LMA, and enters LMA configuration mode.
Step 4	mobile-map <i>map-name</i> Example: Device (config-ipv6-pmipv6-lma) # mobile-map mobilemap1	Configures a mobile map for the PMIPv6 domain and enters mobile-map configuration mode. Note If you modify one or more access-list entries, for the modified access list to be applied, you must unconfigure the mobile map from LMA configuration and reconfigure it.
Step 5	interface <i>type number</i> Example:	Enables an interface for the mobile map.

	Command or Action	Purpose
	Device(config-ipv6-pmipv6-lma)# interface gigabitethernet 0/0/0	
Step 6	end Example: Device(config-ipv6-pmipv6-lma)# end	Exits mobile-map configuration mode and returns to privileged EXEC mode.

Configuring the MTU to be Applied on the PMIPv6 Tunnel

SUMMARY STEPS

1. enable
2. configure terminal
3. ipv6 mobile pmipv6-lma lma-id domain domain-name
4. tunnel mtu mtu-size
5. end

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ipv6 mobile pmipv6-lma lma-id domain domain-name Example: Device(config)# ipv6 mobile pmipv6-lma lma1 domain dn1	Enables LMA service on the device, configures the PMIP domain for LMA, and enters LMA configuration mode.
Step 4	tunnel mtu mtu-size Example: Device(config-ipv6-pmipv6-lma)# tunnel mtu 1360	Configures a maximum transmission unit (MTU) on a PMIPv6 tunnel.
Step 5	end Example: Device(config-ipv6-pmipv6-lma)# end	Exits LMA configuration mode and returns to privileged EXEC mode.

Applying an ACL on the PMIPv6 Tunnel

SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `ip access-list extended access-list-name`
4. `deny protocol host addr any`
5. `permit protocol any any`
6. `exit`
7. `ipv6 mobile pmipv6-mag mag-id domain domain-name`
8. `tunnel acl acl-list-name`
9. `end`

DETAILED STEPS

	Command or Action	Purpose
Step 1	<code>enable</code> Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none">• Enter your password if prompted.
Step 2	<code>configure terminal</code> Example: Device# configure terminal	Enters global configuration mode.
Step 3	<code>ip access-list extended <i>access-list-name</i></code> Example: Device(config)# ip access-list extended acl1	Defines an IP access list by name and enters the extended ACL configuration mode.
Step 4	<code>deny protocol host <i>addr any</i></code> Example: Device(config-ext-nacl)# deny ip host 10.2.2.2 any	Sets conditions in a named IP access list that will deny packets.
Step 5	<code>permit protocol any any</code> Example: Device(config-ext-nacl)# permit ip any any	Sets conditions to allow a packet to pass a named IP access list.
Step 6	<code>exit</code> Example: Device(config-ext-nacl)# exit	Exits the extended ACL configuration mode and returns to the global configuration mode.
Step 7	<code>ipv6 mobile pmipv6-mag <i>mag-id domain domain-name</i></code> Example: Device(config)# ipv6 mobile pmipv6-lma mag1 domain dn1	Enables MAG service on the device, configures the PMIP domain for LMA, and enters MAG configuration mode.

	Command or Action	Purpose
Step 8	tunnel acl <i>acl-list-name</i> Example: Device(config-ipv6-pmipv6-lma)# tunnel acl acl1	Specifies an ACL to be applied on the PMIPv6 tunnel in an LMA.
Step 9	end Example: Device(config-ipv6-pmipv6-lma)# end	Exits LMA configuration mode and returns to privileged EXEC mode.

Configuring Multiple Mobile Network IPv4 or IPv6 Address Pools for a Network Under LMA Configuration

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 mobile pmipv6-lma** *lma-id* **domain** *domain-name*
4. **network** *name*
5. Do one of the following:
 - **mobile-network pool** *address* **pool-prefix** *pool-prefix* **network-prefix** *network-prefix*
 - **mobile-network v6pool** *address* **pool-prefix** *pool-prefix* **network-prefix** *network-prefix*
6. Do one of the following:
 - **mobile-network pool** *address* **pool-prefix** *pool-prefix* **network-prefix** *network-prefix*
 - **mobile-network v6pool** *address* **pool-prefix** *pool-prefix* **network-prefix** *network-prefix*
7. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ipv6 mobile pmipv6-lma <i>lma-id</i> domain <i>domain-name</i> Example: Device(config)# ipv6 mobile pmipv6-lma lma1 domain dn1	Enables LMA service on the device, configures the PMIP domain for LMA, and enters LMA configuration mode.

	Command or Action	Purpose
Step 4	network <i>name</i> Example: Device(config-ipv6-pmipv6-lma)# <i>network name</i>	Specifies mobile address pools, from which a mobile network prefix is allocated to a logical mobile node (LMN) and enters LMA-network configuration mode.
Step 5	Do one of the following: <ul style="list-style-type: none"> • mobile-network pool <i>address pool-prefix pool-prefix network-prefix network-prefix</i> • mobile-network v6pool <i>address pool-prefix pool-prefix network-prefix network-prefix</i> Example: Device(config)# <i>mobile-network pool 10.20.2.1 pool-prefix 24 network-prefix 30</i> Example: Device(config)# <i>mobile-network pool 2001:DB8::1 pool-prefix 48 pool-prefix 48 network-prefix 30</i>	Associates a network, to which an IPv4 or IPv6 pool can be configured, with LMA.
Step 6	Do one of the following: <ul style="list-style-type: none"> • mobile-network pool <i>address pool-prefix pool-prefix network-prefix network-prefix</i> • mobile-network v6pool <i>address pool-prefix pool-prefix network-prefix network-prefix</i> Example: Device(config)# <i>mobile-network pool 10.20.2.2 pool-prefix 24 network-prefix 30</i> Example: Device(config)# <i>mobile-network pool 2001:DB8::2 pool-prefix 64 pool-prefix 48 network-prefix 30</i>	Associates a network, to which an IPv4 or IPv6 pool can be configured, with LMA.
Step 7	end Example: Device(config-ipv6-pmipv6lma-network)# <i>end</i>	Exits LMA-network configuration mode and returns to privileged EXEC mode.

Configuring Heartbeat under LMA Configuration

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 mobile pmipv6-lma** *lma-id domain domain-name*
4. **heartbeat** [*interval interval retries retries* [*label label*] **natreboot**]
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ipv6 mobile pmipv6-lma lma-id domain domain-name Example: Device(config)# ipv6 mobile pmipv6-lma lma1 domain dn1	Enables LMA service on the device, configures the PMIP domain for LMA, and enters LMA configuration mode.
Step 4	heartbeat [interval interval retries retries [label label] natreboot] Example: Device(config-ipv6-pmipv6-lma)# heartbeat interval 300 retries 2 label label1 natreboot	Configures heartbeat detection between MAG and LMA.
Step 5	end Example: Device(config-ipv6-pmipv6-lma)# end	Exits LMA configuration mode and returns to privileged EXEC mode.

Configuring Multipath Management

Configuring Multipath Management on LMA

SUMMARY STEPS

1. enable
2. configure terminal
3. ipv6 mobile pmipv6-domain domain-name
4. mobile-map map-name sequence-number
5. match access-list access list name
6. set link-type link-type
7. ipv6 mobile pmipv6-lma lma-id domain domain-name
8. address ipv4 ipv4-address
9. heartbeat [interval interval retries retries]
10. bce maximum number

11. **default profile** *profile-name*
12. **dynamic mag learning**
13. **multipath**
14. **mobile-map** *map-name sequence-number*
15. **tunnel mtu** *mtu-size*
16. **interface** *interface-type*
17. **network** *network-name*
18. Do one of the following:
 - **pool ipv4** *pool-name pfxlen number*
 - **mobile-network v4pool** *address pool-prefix pool-prefix network-prefix network-prefix*
19. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ipv6 mobile pmipv6-domain <i>domain-name</i> Example: Device(config)# ipv6 mobile pmipv6-domain D1	Creates the PMIP domain and enters PMIP domain configuration mode.
Step 4	mobile-map <i>map-name sequence-number</i> Example: Device (config-ipv6-pmipv6-domain)# mobile-map MAP1 12	Configures a mobile map for the PMIPv6 domain and enters mobile-map configuration mode. <ul style="list-style-type: none"> • The range is from 1 to 255.
Step 5	match access-list <i>access list name</i> Example: Device (config-ipv6-pmipv6-domain-mobile-map)# match access-list voice	Specifies the access list that identifies an application.
Step 6	set link-type <i>link-type</i> Example: Device (config-ipv6-pmipv6-domain-mobile-map)# set link-type lte_intf 3g_intf	Sets link preferences for the application.
Step 7	ipv6 mobile pmipv6-lma <i>lma-id domain domain-name</i> Example: Device (config-ipv6-pmipv6-domain-mobile-map)# ipv6 mobile pmipv6-lma LMA1 domain D1	Enables LMA service on the device, configures the PMIP domain for LMA, and enters LMA configuration mode.

	Command or Action	Purpose
Step 8	address ipv4 <i>ipv4-address</i> Example: Device (config-ipv6-pmipv6-lma)# address ipv4 9.9.9.1	Configures an IPv4 address for LMA.
Step 9	heartbeat [<i>interval interval retries retries</i>] Example: Device (config-ipv6-pmipv6-lma)# heartbeat interval 15 retries 1	Configures heartbeat.
Step 10	bce maximum <i>number</i> Example: Device (config-ipv6-pmipv6-lma)# bce maximum 128000	Configures the maximum number of binding cache entries (BCEs) or bindings that LMA can support. Note Bindings represent a mobile node session.
Step 11	default profile <i>profile-name</i> Example: Device (config-ipv6-pmipv6-lma)# default profile regularmn	Configures the default profile for mobile nodes.
Step 12	dynamic mag learning Example: Device (config-ipv6-pmipv6-lma)# dynamic mag learning	Enables LMA to accept PMIPv6 signaling messages from any MAG that is not configured locally.
Step 13	multipath Example: Device (config-ipv6-pmipv6-lma)# multipath	Enables multipath support on LMA.
Step 14	mobile-map <i>map-name sequence-number</i> Example: Device (config-ipv6-pmipv6-lma)# mobile-map MAP1	Configures a mobile map for the PMIPv6 domain and enters mobile-map configuration mode.
Step 15	tunnel mtu <i>mtu-size</i> Example: Device (config-ipv6-pmipv6-lma)# tunnel mtu 1360	Configures a maximum transmission unit (MTU) on a PMIPv6 tunnel.
Step 16	interface <i>interface-type</i> Example: Device (config-ipv6-pmipv6-lma)# interface Ethernet 0/2	Configures an egress interface for LMA.
Step 17	network <i>network-name</i> Example: Device (config-ipv6-pmipv6-lma)# network net1	Specifies mobile address pools, from which a mobile network prefix is allocated to a Logical Mobile Node (LMN) and enters LMA-network configuration mode.

	Command or Action	Purpose
Step 18	<p>Do one of the following:</p> <ul style="list-style-type: none"> • pool ipv4 <i>pool-name</i> pxlen <i>number</i> • mobile-network v4pool <i>address</i> pool-prefix <i>pool-prefix</i> network-prefix <i>network-prefix</i> <p>Example:</p> <pre>Device (config-ipv6-pmipv6lma-network)# pool ipv4 v4pool pfxlen 24</pre> <p>Example:</p> <pre>Device (config-ipv6-pmipv6lma-network)# mobile-network pool 10.0.0.1 pool-prefix 24 network-prefix 30</pre>	Specifies an IPv4 address pool from which a home address is allocated to the MN subscriber and configures IPv4 pool for mobile networks or mobile nodes.
Step 19	<p>end</p> <p>Example:</p> <pre>Device (config-ipv6-pmipv6lma-network)# end</pre>	Exits LMA configuration mode and returns to privileged EXEC mode.

Configuring Multipath Management on MAG

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 mobile pmipv6-domain** *domain-name*
4. **mobile-map** *map-name* *sequence-number*
5. **match access-list** *access-list name*
6. **traffic-profile** *profile-name*
7. **ipv6 mobile pmipv6-mag** *mag-id* **domain** *domain-name*
8. **address dynamic**
9. **roaming interface** *type* *number* **priority** *interface* *priority* **egress-att** *interface-attribute* *user assigned labels*
10. **exit**
11. **heartbeat** [**interval** *interval* **retries** *retries*]
12. **bce maximum** *number*
13. **multipath**
14. **mobile-map** *map-name* *sequence-number*
15. **tunnel mtu** *mtu-size*
16. **interface** *interface-type*
17. **lma** *lma-id* *domain-name*
18. **mobility-service hybrid-access**
19. **profile-definition** *profile-name*
20. **jitter** *value*
21. **rtt** *value*
22. **packet-loss** *value*
23. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none">• Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ipv6 mobile pmipv6-domain <i>domain-name</i> Example: Device(config)# ipv6 mobile pmipv6-domain D1	Creates the PMIP domain and enters PMIP domain configuration mode.
Step 4	mobile-map <i>map-name sequence-number</i> Example: Device (config-ipv6-pmipv6-domain)# mobile-map MAP1 12	Configures a mobile map for the PMIPv6 domain and enters mobile-map configuration mode. <ul style="list-style-type: none">• The range is from 1 to 255.
Step 5	match access-list <i>access-list name</i> Example: Device (config-ipv6-pmipv6-domain-mobile-map)# match access-list voice	Specifies an ACL that identifies an application such as HTTP, SSH, Telnet, and video.
Step 6	traffic-profile <i>profile-name</i> Example: Device (config-ipv6-pmipv6-domain-mobile-map)# traffic-profile haccess-voice	Specifies a hybrid access profile where the performance requirements have been defined.
Step 7	ipv6 mobile pmipv6-mag <i>mag-id domain domain-name</i> Example: Device (config-ipv6-pmipv6-domain-mobile-map)# ipv6 mobile pmipv6-mag MAG1 domain D1	Enables MAG service on the device, configures the PMIP domain for MAG, and enters MAG configuration mode.
Step 8	address dynamic Example: Device (config-ipv6-pmipv6-mag)# address dynamic	Configures dynamic address for MAG and enters MAG dynamic address configuration mode.
Step 9	roaming interface <i>type number priority interface priority egress-att interface-attribute user assigned labels</i> Example: Device (config-ipv6-pmipv6-mag-addr-dyn)# roaming interface Ethernet1/0 priority 1 egress-att LTE label lte_intf Example:	Specifies a roaming interface and priority on MAG.

	Command or Action	Purpose
	Device (config-ipv6-pmipv6-mag-addr-dyn)# roaming interface Ethernet1/1 priority 2 egress-att 3G label 3g_intf	
Step 10	exit Example: Device (config-ipv6-pmipv6-mag-addr-dyn)# exit	Enters MAG dynamic address configuration mode and returns to privileged EXEC mode.
Step 11	heartbeat [interval <i>interval</i> retries <i>retries</i>] Example: Device (config-ipv6-pmipv6-mag)# heartbeat interval 15 retries 1	Configures heartbeat.
Step 12	bce maximum <i>number</i> Example: Device (config-ipv6-pmipv6-mag)# bce maximum 128000	Configures the maximum number of binding cache entries (BCEs) or bindings that MAG can support.
Step 13	multipath Example: Device (config-ipv6-pmipv6-mag)# multipath	Enables multipath support on MAG.
Step 14	mobile-map <i>map-name sequence-number</i> Example: Device (config-ipv6-pmipv6-mag)# mobile-map MAP1	Configures a mobile map for the PMIPv6 domain and enters mobile-map configuration mode.
Step 15	tunnel mtu <i>mtu-size</i> Example: Device (config-ipv6-pmipv6-mag)# tunnel mtu 1360	Configures a maximum transmission unit (MTU) on a PMIPv6 tunnel.
Step 16	interface <i>interface-type</i> Example: Device (config-ipv6-pmipv6-mag)# interface Ethernet 0/2	Configures an egress interface for MAG.
Step 17	lma <i>lma-id domain-name</i> Example: Device(config-ipv6-pmipv6- mag)# lma LMA1 D1	Enables LMA service on the device, configures the PMIP domain for LMA, and enters LMA configuration mode.
Step 18	mobility-service hybrid-access Example: Device (config-ipv6-pmipv6-mag)# mobility-service hybrid-access	Configures hybrid-access service.
Step 19	profile-definition <i>profile-name</i> Example:	Defines a traffic profile.

	Command or Action	Purpose
	Device (config-ipv6-pmipv6-mag-haccess-svc) # profile-definition haccess-voice	
Step 20	jitter value Example: Device (config-ipv6-pmipv6-mag-haccess-profile-def-svc) # jitter 50	Configures the jitter value, in milliseconds.
Step 21	rtt value Example: Device (config-ipv6-pmipv6-mag-haccess-profile-def-svc) # rtt 100	Configures the Round Trip Time (RTT) value, in milliseconds.
Step 22	packet-loss value Example: Device (config-ipv6-pmipv6-mag-haccess-profile-def-svc) # packet-loss 2	Configures the packet loss value, in percentage.
Step 23	end Example: Device (config-ipv6-pmipv6-mag-haccess-profile-def-svc) # end	Exits MAG configuration mode and returns to privileged EXEC mode.

Configuring Loopback as a Roaming Interface

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 mobile pmipv6-mag mag-id domain domain-name**
4. **heartbeat [interval interval retries retries timeout timeout]**
5. **address dynamic**
6. **roaming interface type number egress-interface type number priority interface priority egress-att interface-attribute user assigned labels**
7. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ipv6 mobile pmipv6-mag mag-id domain domain-name Example: Device(config)# ipv6 mobile pmipv6-mag mag1 domain dn1	Enables MAG service on a device, configures the PMIPv6 domain for MAG, and enters MAG configuration mode.
Step 4	heartbeat [interval interval retries retries timeout timeout] Example: Device (config-ipv6-pmipv6-mag)# heartbeat interval 15 retries 1 timeout 6	Configures heartbeat.
Step 5	address dynamic Example: Device(config-ipv6-pmipv6-mag)# address dynamic	Configures dynamic address for MAG and enters MAG dynamic address configuration mode.
Step 6	roaming interface type number egress-interface type number priority interface priority egress-att interface-attribute user assigned labels Example: Device (config-ipv6-pmipv6-mag-addr-dyn)# roaming interface loopback0 egress-interface Dialer1 priority 90 egress-att ETHERNET label DSL Example: Device (config-ipv6-pmipv6-mag-addr-dyn)# roaming interface loopback1 egress-interface GigabitEthernet8 priority 91 egress-att ETHERNET label LTE	Specifies a roaming interface and priority on MAG.
Step 7	exit Example: Device(config-ipv6-pmipv6-mag-addr-dyn)# exit	Exits MAG dynamic address configuration mode and returns to privileged EXEC mode.

Configuration Examples for PMIPv6 Multipath Support for MAG and LMA

Example: Configuring Multipath on LMA

Example: Configuring UDP Encapsulation under PMIPv6 Domain

```
Device> enable
Device# configuration terminal
Device(config) ipv6 mobile pmipv6-domain D1
Device(config-ipv6-pmipv6-domain) # encap udptunnel
Device(config-ipv6-pmipv6-domain) # end
```

Example: Configuring Roaming Interface



Note This example is applicable when configuring multipath for MAG.

```
Device> enable
Device# configuration terminal
Device(config) ipv6 mobile pmipv6-ma mag1 domain D1
Device(config-ipv6-pmipv6-mag) address dynamic
Device(config-ipv6-pmipv6-mag-addr-dyn) # roaming interface Ethernet 0/0
Device(config-ipv6-pmipv6-mag-addr-dyn) # end
```

Example: Configuring PMIP: Multipath Support on LMA

```
Device> enable
Device# configuration terminal
Device(config) ipv6 mobile pmipv6-lma LMA1 domain D1
Device(config-ipv6-pmipv6-lma) # multipath
Device(config-ipv6-pmipv6-lma) # end
```

Example: Configuring Mobile Map on an LMA

Example: Configuring Access List on an LMA

```
Device> enable
Device# configuration terminal
Device(config) # ip access-list extended tcp
Device(config-ext-nacl) # permit tcp any any
Device(config-ext-nacl) # exit
Device(config) # ip access-list extended icmp
```

```

Device(config-ext-nacl)# permit icmp any any
Device(config-ext-nacl)# exit
Device(config)# ip access-list extended udp
Device(config-ext-nacl)# permit udp any any
Device(config-ext-nacl)# exit
Device(config)# ip access-list extended LB010ACL
Device(config-ext-nacl)# permit ip any 10.255.224.0 0.0.0.255
Device(config-ext-nacl)# end

```

Example: Applying an ACL on the PMIPv6 Tunnel

```

Device> enable
Device# configure terminal
Device(config)# ip access-list extended acl1
Device(config-ext-nacl)# deny ip host 10.2.2.2 any
Device(config)# permit ip any any
Device(config)# ipv6 mobile pmipv6-lma lma1 domain dn1
Device(config-ipv6-pmipv6-lma)# tunnel acl acl1
Device(config-ipv6-pmipv6-lma)# end

```

Example: Configuring mobile maps under the PMIPv6 domain

```

Device> enable
Device# configure terminal
Device(config)# ipv6 mobile pmipv6-domain dn1
Device(config-ipv6-pmipv6-domain)# mobile-map mobilemap1 10
Device(config-ipv6-pmipv6-domain-mobile-map)# match access-list LB010ACL
Device(config-ipv6-pmipv6-domain-mobile-map)# set link-type lte_intf_3g_intf null
Device(config-ipv6-pmipv6-domain-mobile-map)# exit
Device(config-ipv6-pmipv6-domain)# mobile-map mobilemap1 20
Device(config-ipv6-pmipv6-domain-mobile-map)# match access-list icmp
Device(config-ipv6-pmipv6-domain-mobile-map)# set link-type lte_intf_3g_intf wifi_intf null
Device(config-ipv6-pmipv6-domain-mobile-map)# end

```

Example: Configuring a Mobile Map Under LMA Configuration and Applying it on an Interface

```

Device> enable
Device# configure terminal
Device(config)# ipv6 mobile pmipv6-lma lma1 domain dn1
Device(config-ipv6-pmipv6-domain)# mobile-map mobilemap1 10
Device(config-ipv6-pmipv6-domain-mobile-map)# interface gigabitethernet 0/0/0
Device(config-ipv6-pmipv6-domain-mobile-map)# end

```

Example: Configuring the MTU to be Applied on the PMIPv6 Tunnel

```

Device> enable
Device# configure terminal
Device(config)# ipv6 mobile pmipv6-lma lma1 domain dn1
Device(config-ipv6-pmipv6-lma)# tunnel mtu 1360
Device(config-ipv6-pmipv6-lma)# end

```

Example: Configuring Multiple Mobile Network Pools for a Network Under LMA Configuration

```

Device> enable
Device# configure terminal
Device(config)# ipv6 mobile pmipv6-lma lma1 domain dn1
Device(config-ipv6-pmipv6-lma)# network name
Device(config-ipv6-pmipv6lma-network)# mobile-network pool 10.20.2.1 pool-prefix 24
network-prefix 30
Device(config-ipv6-pmipv6lma-network)# mobile-network pool 10.20.3.1 pool-prefix 24
network-prefix 30
Device(config-ipv6-pmipv6lma-network)# end

```

Example: Configuring Heartbeat under LMA Configuration

```

Device> enable
Device# configure terminal
Device(config)# ipv6 mobile pmipv6-lma lma1 domain dn1
Device(config-ipv6-pmipv6-lma)# heartbeat interval 300 retries 2 label label1 natreboot
Device(config-ipv6-pmipv6-lma)# end

```

Example: Configuring Multipath Management

Example: Configuring Multipath Management on LMA

```

Device> enable
Device# configure terminal
Device(config)# ipv6 mobile pmipv6-domain D1
Device(config-ipv6-pmipv6-domain)# mobile-map MAP1 12
Device(config-ipv6-pmipv6-domain-mobile-map)# match access-list voice
Device(config-ipv6-pmipv6-domain-mobile-map)# set link-type lte_intf 3g_intf
Device(config-ipv6-pmipv6-domain-mobile-map)# ipv6 mobile pmipv6-lma LMA1 domain D1
Device(config-ipv6-pmipv6-lma)# address ipv4 9.9.9.1
Device(config-ipv6-pmipv6-lma)# heartbeat interval 15 retries 1
Device(config-ipv6-pmipv6-lma)# bce maximum 128000
Device(config-ipv6-pmipv6-lma)# default profile RegularMn
Device(config-ipv6-pmipv6-lma)# dynamic mag learning
Device(config-ipv6-pmipv6-lma)# multipath
Device(config-ipv6-pmipv6-lma)# mobile-map MAP1
Device(config-ipv6-pmipv6-lma)# tunnel mtu 1360
Device(config-ipv6-pmipv6-lma)# interface Ethernet0/2
Device(config-ipv6-pmipv6-lma)# network net1
Device(config-ipv6-pmipv6lma-network)# pool ipv4 v4pool pfxlen 24
Device(config-ipv6-pmipv6lma-network)# mobile-network pool 20.20.2.1 pool-prefix 24
network-prefix 30
Device(config-ipv6-pmipv6lma-network)# mobile-network pool 20.20.1.1 pool-prefix 24
network-prefix 30
Device(config-ipv6-pmipv6lma-network)# mobile-network pool 30.30.2.1 pool-prefix 24
network-prefix 30
Device(config-ipv6-pmipv6lma-network)# network net2
Device(config-ipv6-pmipv6lma-network)# pool ipv4 rv4pool pfxlen 16
Device(config-ipv6-pmipv6lma-network)# network net3

```

```

Device(config-ipv6-pmipv6lma-network) # pool ipv4 netpool2 pfxlen 24
Device(config-ipv6-pmipv6lma-network) # mobile-network pool 31.31.1.1 pool-prefix 24
network-prefix 30
Device(config-ipv6-pmipv6lma-network) # mobile-network pool 20.20.4.1 pool-prefix 24
network-prefix 30
Device(config-ipv6-pmipv6lma-network) # mobile-network pool 20.20.3.1 pool-prefix 24
network-prefix 30
Device(config-ipv6-pmipv6lma-network) # mobile-network pool 30.30.5.1 pool-prefix 23
network-prefix 30
Device(config-ipv6-pmipv6lma-network) # end

```

Example: Configuring Multipath Management on MAG

```

Device> enable
Device# configure terminal
Device(config)# ipv6 mobile pmipv6-domain D1
Device(config-ipv6-pmipv6-domain)# mobile-map MAP1 12
Device(config-ipv6-pmipv6-domain-mobile-map)# match access-list voice
Device(config-ipv6-pmipv6-domain-mobile-map)# traffic-profile haccess-voice
Device(config-ipv6-pmipv6-domain-mobile-map)# ipv6 mobile pmipv6-mag MAG1 domain D1
Device(config-ipv6-pmipv6-mag)# address dynamic
Device(config-ipv6-pmipv6-mag-addr-dyn)# roaming interface Ethernet1/0 priority 1 egress-att
LTE label lte_intf
Device(config-ipv6-pmipv6-mag-addr-dyn)# roaming interface Ethernet1/1 priority 2 egress-att
3G label 3g_intf
Device(config-ipv6-pmipv6-mag-addr-dyn)# exit
Device(config-ipv6-pmipv6-mag)# heartbeat interval 15 retries 1
Device(config-ipv6-pmipv6- mag)# bce maximum 128000
Device(config-ipv6-pmipv6- mag)# multipath
Device(config-ipv6-pmipv6- mag)# mobile-map MAP1
Device(config-ipv6-pmipv6- mag)# tunnel mtu 1360
Device(config-ipv6-pmipv6- mag)# interface Ethernet0/2
Device(config-ipv6-pmipv6- mag)# lma LMA1 D1
Device(config-ipv6-pmipv6-mag)# mobility-service hybrid-access
Device(config-ipv6-pmipv6-mag-haccess-svc)# profile-definition haccess-voice
Device(config-ipv6-pmipv6-mag-haccess-profile-def-svc)# jitter 50
Device(config-ipv6-pmipv6-mag-haccess-profile-def-svc)# rtt 100
Device(config-ipv6-pmipv6-mag-haccess-profile-def-svc)# packet-loss 2
Device(config-ipv6-pmipv6-mag-haccess-profile-def-svc)# end

```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
IP mobility commands	Cisco IOS IP Mobility Command Reference

Standards and RFCs

Standard/RFC	Title
RFC 3775	<i>Mobility Support in IPv6</i>
RFC 5213	<i>Proxy Mobile IPv6</i>
RFC 5844	<i>IPv4 Support for Proxy Mobile IPv6</i>
RFC 5845	<i>Generic Routing Encapsulation (GRE) Key Option for Proxy Mobile IPv6</i>
RFC 5846	<i>Binding Revocation for IPv6 Mobility</i>

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for PMIP: Multipath Support on MAG and LMA

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 4: Feature Information for PMIP: Multipath Support on MAG and LMA

Feature Name	Releases	Feature Information
PMIP: Multipath Support on MAG and LMA		<p>The PMIP: Multipath Support on MAG and LMA feature enables Mobility Access Gateway (MAG) to register multiple transport end-points with Local Mobility Anchor (LMA), allowing MAG and LMA to establish multiple tunnels and apply path selection on a flow basis.</p> <p>The following commands were introduced or modified: encap (proxy mobile IPv6), heartbeat, interface (proxy mobile IPv6), match access-list (PMIPv6), mobile-map (PMIPv6 domain), mobile-map (LMA), mobile-network PMIPv6), multipath, set link-type, tunnel mtu,</p>
PMIPv6 Multipath Management		<p>The PMIPv6 Multipath Management feature enables PMIPv6 to choose from multiple available links which have different access technologies.</p> <p>The following commands were introduced or modified: address dynamic, bce maximum, default profile, dynamic mag learning, heartbeat, jitter, match access-list, mobile-map, mobility-service hybrid-access, packet loss, profile-definition, rtt, set link-type, traffic-profile.</p>
PMIPv6: IP SLA optimization and Loopback as a roaming interface	Cisco IOS XE Fuji 16.9.1	<p>IP SLA optimization helps solve MAG scaling limitations.</p> <p>Loopback as roaming interface solves customer IP address space limitation issues.</p> <p>The following commands were added or modified:</p> <p>roaming interface type number egress-interface type number priority interface priority egress-att interface-attribute user assigned labels.</p>

