



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.

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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.

VRF Awareness on PMIPv6 MAG

Each Logical Mobile Node (LMN) represents a customer and it is associated with a unique Local Mobility Anchor (LMA). As the LMNs belong to different virtual routing and forwarding (VRF) instances, the Mobility Access Gateway (MAG) requires being aware of the customer VRF. The MAG has no notion of the transport VRF. The VRF Awareness on PMIPv6 MAG feature enables the MAG to host multiple customers and provide Proxy Mobile IPv6 (PMIPv6) services to them.

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 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 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 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 Proxy Mobile IPv6 (PMIPv6) domain and enters PMIPv6 domain configuration mode.
Step 4	lma <i>lma-id</i> 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.

	Command or Action	Purpose
Step 5	ipv6-address <i>ipv6-address</i> 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 [<i>user</i>]@ <i>realm</i> 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 <i>lma-id</i> Example: Device (config-ipv6-pmipv6-domain-mn) # lma lma1	Configures an LMA for the MN.
Step 10	service { <i>dual</i> <i>ipv4</i> <i>ipv6</i> } 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. • IPv4—Specifies IPv4 service for an MN. • IPv6—Specifies IPv6 service for an MN.
Step 11	exit Example: Device (config-ipv6-pmipv6-domain-mn) # exit	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: Device (config-ipv6-pmipv6-domain) # end	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	Enables privileged EXEC mode.

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

	Command or Action	Purpose
Step 17	nai <i>[user]@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.
Step 18	lma <i>lma-id</i> Example: Device (config-ipv6-pmipv6-domain-mn) # lma lma1	Configures the LMA for the MN.
Step 19	int att <i>interface-access-type l2-addr mac-address</i> Example: Device (config-ipv6-pmipv6-domain-mn) # int att GigabitEthernet l2-addr 02c7.f800.0422	Configures the access technology type, interface, and MAC address of the MN interface within the PMIPv6 domain.
Step 20	gre-encap-key [down up] <i>key-value</i> Example: Device (config-ipv6-pmipv6-domain-mn) # gre-encap-key down 45	Configures a generic routing encapsulation (GRE) key for the MN within the PMIPv6 domain.
Step 21	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. • IPv4—Specifies an IPv4 service for an MN. • IPv6—Specifies an IPv6 service for an MN.
Step 22	apn <i>apn-name</i> Example: Device (config-ipv6-pmipv6-domain-mn) # apn apn1	Specifies an access point name (APN) to the MN subscriber within the PMIPv6 domain.
Step 23	exit Example: Device (config-ipv6-pmipv6-domain-mn) # exit	Exits PMIP domain MN configuration mode and returns to PMIPv6 domain configuration mode.
Step 24	Repeat Steps 20 to 24 to configure each MN.	—

	Command or Action	Purpose
Step 25	end Example: Device (config-ipv6-pmipv6-domain)# end	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.

	Command or Action	Purpose
Step 3	<p>ipv6 mobile pmipv6-mag <i>mag-id</i> domain <i>domain-name</i></p> <p>Example:</p> <pre>Device(config)# ipv6 mobile pmipv6-mag mag1 domain dn1</pre>	Enables the MAG service on a device, configures the PMIPv6 domain for the MAG, and enters MAG configuration mode.
Step 4	<p>address ipv6 <i>ipv6-address</i></p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-mag)# address ipv6 2001:0DB8:2:4::1</pre>	Configures an IPv6 address for the MAG.
Step 5	<p>sessionmgr</p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-mag)# sessionmgr</pre>	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	<p>generate grekey</p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-mag)# generate grekey</pre>	Enables dynamic generation of upstream generic routing encapsulation keys for mobile nodes in an LMA.
Step 7	<p>interface <i>type number</i></p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-mag)# interface gigabitethernet 0/0/0</pre>	Enables an interface for the MAG.
Step 8	<p>role {3gpp lte wimax wlan}</p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-mag)# role lte</pre>	<p>Configures a role for the MAG.</p> <p>The keywords are as follows:</p> <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	<p>apn <i>apn-name</i></p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-mag)# apn apn2</pre>	<p>Specifies an access point name (APN) to the subscriber of the MAG.</p> <p>Note Specifying an APN is mandatory if the role of the MAG is 3GPP.</p>

	Command or Action	Purpose
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	Enables privileged EXEC mode.

	Command or Action	Purpose
	<p>Example: Device> enable</p>	<ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	<p>configure terminal</p> <p>Example: Device# configure terminal</p>	Enters global configuration mode.
Step 3	<p>vrf definition <i>vrf-name</i></p> <p>Example: Device(config)# vrf definition vrf1</p>	Configures a virtual routing and forwarding (VRF) routing table instance and enters VRF configuration mode.
Step 4	<p>exit</p> <p>Example: Device(config-vrf) exit</p>	Exits VRF configuration mode and returns to global configuration mode.
Step 5	<p>ipv6 mobile pmipv6-mag <i>mag-id</i> domain <i>domain-name</i></p> <p>Example: Device(config)# ipv6 mobile pmipv6-mag mag1 domain dn1</p>	Enables the MAG service on a device, configures the PMIPv6 domain for the MAG, and enters MAG configuration mode.
Step 6	<p>role {3gpp wlan}</p> <p>Example: Device(config-ipv6-pmipv6-mag)# role 3gpp</p>	<p>Configures a role for the MAG.</p> <p>The keywords are as follows:</p> <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	<p>apn <i>apn-name</i></p> <p>Example: Device(config-ipv6-pmipv6-mag)# apn apn2</p>	Specifies an access point name (APN) to the subscriber of the MAG.
Step 8	<p>local-routing-mag</p> <p>Example: Device(config-ipv6-pmipv6-mag)# local-routing-mag</p>	Enables local routing for the MAG.

	Command or Action	Purpose
Step 9	<p>discover-mn-detach poll interval <i>seconds</i> timeout <i>seconds</i> retries <i>retry-count</i></p> <p>Example:</p> <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	<p>address ipv4 <i>ipv4-address</i></p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-mag)# address ipv4 10.1.3.1</pre>	Configures an IPv4 address for the MAG.
Step 11	<p>address ipv6 <i>ipv6-address</i></p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-mag)# address ipv6 2001:0DB8:2:4::1</pre>	Configures an IPv6 address for the MAG.
Step 12	<p>sessionmgr</p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-mag)# sessionmgr</pre>	Configures an IPv6 address for the MAG.
Step 13	<p>interface <i>type number</i></p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-mag)# interface gigabitethernet 0/0/0</pre>	Enables an interface for the MAG.
Step 14	<p>binding maximum <i>number</i></p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-mag)# binding maximum 200</pre>	Specifies the maximum number of Proxy Binding Update (PBU) entries allowed for the MAG.
Step 15	<p>binding lifetime <i>seconds</i></p> <p>Example:</p> <pre>Device(config-ipv6-pmipv6-mag)# binding lifetime 5000</pre>	Specifies the maximum lifetime permitted for the PBU entry.

	Command or Action	Purpose
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.
Step 22	bri retry <i>number</i> Example: Device(config-ipv6-pmipv6-mag)# bri retry 6	Specifies the maximum number of times an LMA should retransmit a BRI message, until a BRA is received.
Step 23	lma lma-id <i>domain-name</i> Example: Device(config-ipv6-pmipv6-mag)# lma lma3 dn1	Configures the LMA for the MAG and enters MAG-LMA configuration mode.

	Command or Action	Purpose
Step 24	auth-option <i>spi</i> { <i>spi-hex-value</i> decimal <i>spi-decimal-value</i> } key { ascii hex } <i>hex-string</i> Example: Device(config-ipv6-pmipv6mag-lma)# auth-option spi decimal 258 key hex BDF	Configures authentication for the LMA within the MAG.
Step 25	ipv4-address <i>ipv4-address</i> Example: Device(config-ipv6-pmipv6mag-lma)# ipv4-address 172.16.0.1	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: Device(config-ipv6-pmipv6mag-lma)# vrfid vrf1	Specifies a VRF for an LMA peer.
Step 27	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 28	end Example: Device(config-ipv6-pmipv6mag-lma)# end	Exits MAG-LMA configuration mode and returns to privileged EXEC mode.
Step 29	show ipv6 mobile pmipv6 mag <i>mag-id</i> globals Example: Device# show ipv6 mobile pmipv6 mag mag1 globals	(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**

Configuring VRF Awareness on PMIPv6 MAG

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **vrf definition** *vrf-name*
4. **address-family ipv4**
5. **exit-address-family**
6. **exit**
7. **interface** *type number*
8. **vrf forwarding** *vrf-name*
9. **ip address** *ip-address mask*
10. **interface** *type number*
11. **vrf forwarding** *vrf-name*
12. **ip address** *ip-address mask*
13. **exit**
14. **ipv6 mobile pmipv6-domain** *domain-name*
15. **nai** *[user]@[user]*
16. **mobility-service mobile-local-loop**
17. **exit**
18. **lma** *lma-id*
19. **ipv4-address** *ipv4-address*
20. **ipv6-address** *ipv6-address*
21. **exit**
22. **ipv6 mobile pmipv6-mag** *mag-id domain domain-name*
23. **mobility-service mobile-local-loop**
24. **egress interface** *interface-name*
25. **ignore homeaddress** *interface*
26. **exit**
27. **lma** *lma-id*
28. **ipv4-address** *ipv4-address*
29. **ipv6-address** *ipv6-address*
30. **encap** {*gre-ipv4* | *gre-ipv6*}
31. **encap** *gre-ipv4*
32. **vrfid** *vrf-name*
33. **exit**
34. **logical-mn** *network-access-identifier*
35. **home interface** *interface*
36. **mobile network** *interface*
37. **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	vrf definition <i>vrf-name</i> Example: Device (config)# vrf definition customer1	Configures a VRF routing table and enters VRF configuration mode.
Step 4	address-family ipv4 Example: Device (config-vrf)# address-family ipv4	Enters VRF address family configuration mode to specify an address family for a VRF. • The ipv4 keyword specifies an IPv4 address family for a VRF
Step 5	exit-address-family Example: Device (config-vrf-af)# exit-address-family	Exits from VRF address family configuration mode and enters the global configuration mode • Exits from VRF address family configuration mode and enters the global configuration mode.
Step 6	exit Example: Device (config-vrf)# exit	Exits the VRF address family configuration mode and returns to the global configuration mode.
Step 7	interface <i>type number</i> Example: Device (config)# interface ethernet 0/1	Enables the interface on the MAG.
Step 8	vrf forwarding <i>vrf-name</i> Example: Device (config-if)# vrf forwarding customer1	Associates a VRF with an interface or subinterface. • The <i>vrf-name</i> argument is the name of the VRF
Step 9	ip address <i>ip-address mask</i>	Sets a primary or secondary IP address for an interface

	Command or Action	Purpose
	<p>Example:</p> <pre>Device (config-if)# ip address 10.24.24.24 255.255.255.255</pre>	
Step 10	<p>interface <i>type number</i></p> <p>Example:</p> <pre>Device (config-if)# interface loopback 0</pre>	Configures an interface type and enters interface configuration mode.
Step 11	<p>vrf forwarding <i>vrf-name</i></p> <p>Example:</p> <pre>Device (config-if)# vrf forwarding customer1</pre>	<p>Associates a VRF with an interface or subinterface.</p> <ul style="list-style-type: none"> The <i>vrf-name</i> argument is the name of the VRF
Step 12	<p>ip address <i>ip-address mask</i></p> <p>Example:</p> <pre>Device (config-if)# ip address 10.14.24.24 255.255.255.255</pre>	Sets a primary or secondary IP address for an interface
Step 13	<p>exit</p> <p>Example:</p> <pre>Device (config-if)# exit</pre>	Exits interface configuration mode and enters global configuration mode.
Step 14	<p>ipv6 mobile pmipv6-domain <i>domain-name</i></p> <p>Example:</p> <pre>Device (config)# ipv6 mobile pmipv6-domain dn1</pre>	Configures the PMIPv6 domain.
Step 15	<p>nai <i>[user]@[user]</i></p> <p>Example:</p> <pre>Device (config-ipv6-pmipv6-domain)# nai example1@example.com</pre>	Configures the NAI for the MN within the PMIP domain and enters PMIP domain MN configuration mode.
Step 16	<p>mobility-service mobile-local-loop</p> <p>Example:</p> <pre>Device (config-ipv6-pmipv6-domain-mn)# mobility-service mobile-local-loop</pre>	Enables the mobile local loop service on the mobile node.

	Command or Action	Purpose
Step 17	exit Example: Device (config-ipv6-pmipv6-domain-mn)# exit	Exits the PMIP domain MN configuration mode and returns to PMIP domain mode.
Step 18	lma lma-id Example: Device (config-ipv6-pmipv6-domain)# lma lma1	Configures the LMA for the MN.
Step 19	ipv4-address ipv4-address Example: Device (config-ipv6-pmipv6mag-lma)# ipv4-address 192.168.1.0	Configures an IPv4 address for the LMA within the MAG.
Step 20	ipv6-address ipv6-address Example: Device (config-ipv6-pmipv6mag-lma)# ipv6-address 2001:DB8:0:0:E000::F	Configures an IPv6 address for the LMA.
Step 21	exit Example: Device (config-ipv6-pmipv6-domain)# exit	Configures the LMA for the MN.
Step 22	ipv6 mobile pmipv6-mag mag-iddomain 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 23	mobility-service mobile-local-loop Example: Device (config-ipv6-pmipv6-mag)# mobility-service mobile-local-loop	Enables mobile local loop service on the mobile node and enters MAG MLL services configuration mode.
Step 24	egress interface interface-name Example: Device (config-ipv6-pmipv6-mag-svc)# egress interface ethernet	Monitors the specified interface and initiates PMIPv6 signaling when the interface goes down.

	Command or Action	Purpose
Step 25	ignore homeaddress <i>interface</i> Example: <pre>Device (config-ipv6-pmipv6-mag-svc)# ignore homeaddress ethernet</pre>	Makes the MAG ignore the received home address from the LMA and skip the creation of reverse tunnel for logical MN.
Step 26	exit Example: <pre>Device (config-ipv6-pmipv6-mag-svc)# exit</pre>	Exits the MAG MLL services configuration mode and enters MAG configuration mode.
Step 27	lma <i>lma-id</i> Example: <pre>Device (config-ipv6-pmipv6-mag)# lma lma1</pre>	Configures the LMA for the MN.
Step 28	ipv4-address <i>ipv4-address</i> Example: <pre>Device (config-ipv6-pmipv6mag-lma)# ipv4-address 192.168.0.0</pre>	Configures an IPv4 address for the LMA within the MAG.
Step 29	ipv6-address <i>ipv6-address</i> Example: <pre>Device (config-ipv6-pmipv6mag-lma)# ipv6-address 2001:0DB8:2:5::1</pre>	Configures an IPv6 address for the LMA.
Step 30	encap { gre-ipv4 gre-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 31	encap gre-ipv4 Example: <pre>Device (config-ipv6-pmipv6mag-lma)# encap gre-ipv4</pre>	Configures a tunnel encapsulation mode type between the MAG and the LMA.
Step 32	vrfid <i>vrf-name</i> Example: <pre>Device (config-ipv6-pmipv6mag-lma)# vrfid customer1</pre>	Configures a tunnel encapsulation mode type between the MAG and the LMA.

	Command or Action	Purpose
Step 33	exit Example: Device (config-ipv6-pmipv6mag-lma)# exit	Exits the LMA-MAG configuration mode and enters the MAG configuration mode.
Step 34	logical-mn <i>network-access-identifier</i> Example: Router (config-ipv6-pmipv6-mag)# logical-mn mnl@example.com	Enables mobile router functionality in MAG and enters MAG logical MN configuration.
Step 35	home interface <i>interface</i> Example: Device (config-ipv6-pmipv6-mag)# home interface loopback 0	Enables a specific interface as the home interface for a logical mobile node (LMN).
Step 36	mobile network <i>interface</i> Example: Device (config-ipv6-pmipv6-mag)# mobile network interface	Specifies the mobile router interface that is connected to the dynamic mobile network.
Step 37	end Example: Device (config-ipv6-pmipv6-mag)# end	Exits the MAG configuration mode and enters privileged EXEC mode.

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)# 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 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 VRF Awareness on PMIPv6 MAG

The following example shows how to configure VRF Awareness on PMIPv6 MAG:

```
Device# configure terminal
Device(config)# ipv6 mobile pmipv6-domain D2
Device(config)# vrf definition customer1
Device(config-vrf)# address-family ipv4
Device(config-vrf-af)# exit-address-family
Device(config-vrf)# exit
Device(config)# interface ethernet 0/1
Device (config-if)# vrf forwarding customer1
Device (config-if)# ip address 10.24.24.24 255.255.255.255
Device (config-if)# interface loopback 0
Device (config-if)# vrf forwarding customer1
Device (config-if)# ip address 10.14.24.24 255.255.255.255
Device (config-if)# exit
Device (config)# ipv6 mobile pmipv6-domain dn1
Device (config-ipv6-pmipv6-domain)# nai example1@example.com
Device (config-ipv6-pmipv6-domain-mn)# mobility-service mobile-local-loop
Device (config-ipv6-pmipv6-domain-mn)# exit
```

Example: Configuring a Mobile Access Gateway

```

Device (config-ipv6-pmipv6-domain) # lma lma1
Device (config-ipv6-pmipv6mag-lma) # ipv4-address 192.168.1.0
Device (config-ipv6-pmipv6mag-lma) # ipv6-address 2001:DB8:0:0:E000::F
Device (config-ipv6-pmipv6-domain) # exit
Device (config) # ipv6 mobile pmipv6-mag mag1 domain dn1
Device (config-ipv6-pmipv6-mag) # mobility-service mobile-local-loop
Device (config-ipv6-pmipv6-mag-svc) # egress interface ethernet
Device (config-ipv6-pmipv6-mag-svc) # ignore homeaddress ethernet
Device (config-ipv6-pmipv6-mag-svc) # exit
Device (config-ipv6-pmipv6-mag) # lma lma1
Device (config-ipv6-pmipv6mag-lma) # ipv4-address 192.168.0.0
Device (config-ipv6-pmipv6mag-lma) # ipv6-address 2001:0DB8:2:5::1
Device (config-ipv6-pmipv6mag-lma) # encap gre-ipv4
Device (config-ipv6-pmipv6mag-lma) # encap gre-ipv4
Device (config-ipv6-pmipv6mag-lma) # vrfid customer1
Device (config-ipv6-pmipv6mag-lma) # exit
Device (config-ipv6-pmipv6-mag) # logical-mn mn1@example.com
Device (config-ipv6-pmipv6-mag) # mobile network interface
Device (config-ipv6-pmipv6-mag) # end
Device (config-ipv6-pmipv6-mag) # home interface loopback 0
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

```

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

```

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 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 Support for MAG Functionality

Feature Name	Releases	Feature Information
Proxy Mobile IPv6 MAG Functionality Support	15.2(4)M	<p>The Proxy Mobile IPv6 Support for MAG Functionality feature provides network-based IP Mobility management to a MN without requiring the participation of the MN in any IP mobility-related signaling. The Mobile Access Gateway tracks the movements of the MN to and from the access link, and sends signals to the local mobility anchor of the MN.</p> <p>The following commands were introduced or modified: address (proxy mobile IPv6), apn (proxy mobile IPv6), 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, mn-profile-load-aaa, multi-homed, nai (proxy mobile IPv6), replay-protection, role, service, show ipv6 mobile pmipv6 mag binding, show ipv6 mobile pmipv6 mag globals, and show ipv6 mobile pmipv6 mag stats.</p>
VRF Awareness in PMIPv6 MAG		<p>The VRF Awareness on PMIPv6 MAG feature enables the MAG to host multiple customers and provide PMIPv6 services to them.</p> <p>The following commands were introduced or modified:</p> <p>mobility-service mobile-local-loop, ignore homeaddress, and egress interface.</p>

