Troubleshoot PMIP Tunnel Establishment on IOS XE Routers

Contents

[Introduction](#)
[Prerequisites](#)
[Requirements](#)
[Components Used](#)
[Background Information](#)
[MAG does not Establish PMIPv6 Tunnel towards the LMA.](#)
[MAG not established PMIPv6 Tunnel towards the LMA (PBU and PBA packets exchange).](#)
[PMIPv6 Bounces towards the LMA](#)
[Additional Information](#)

Introduction

This document describes how to troubleshoot PMIPv6 Technologies for Cisco IOS® XE.

Prerequisites

Requirements

Cisco recommends that you have knowledge of these topics:

- IP Mobility: PMIPv6 Configuration Guide, Cisco IOS XE 17.x
- Verizon 4G LTE Deployment Guides for Cisco ISR and CGR: Private Network Deployment

Components Used

The information in this document is based on Cisco IOS XE software.

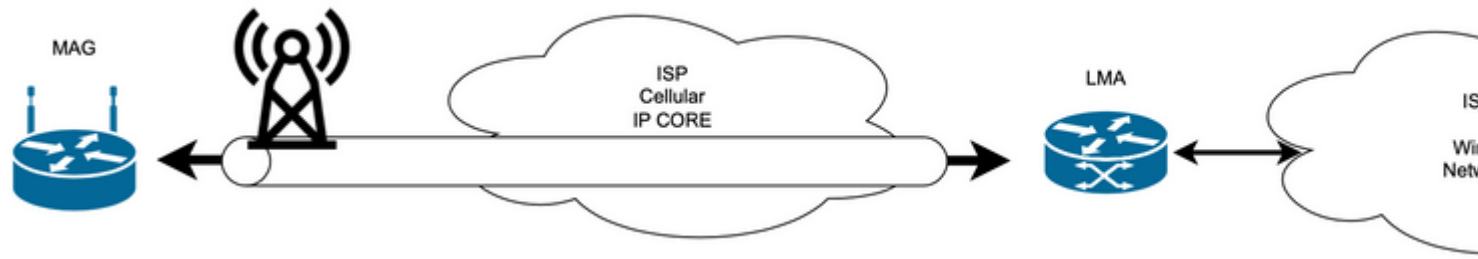
The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

Background Information

When you troubleshoot Mobile IP Technologies, the primary concern is to have a good signal between the Cellular interface and the Radio Network Controller (RNC). Your Internet Service Provider (ISP) provides the IP address that you use to establish the Tunnel between the Mobility Access Gateway (MAG) and Local Mobility Anchor (LMA).

MAG does not Establish PMIPv6 Tunnel towards the LMA.

This section provides a solution to the common problem of Tunnel0 creation on MAG. This network diagram is used as an example.



In this figure, the MAG is unable to establish the Tunnel0 towards the LMA.

```
 MAG#show ip interface brief | exclude unassigned
Interface              IP-Address      OK? Method Status                Protocol
Cellular0/1/0          203.0.113.1     YES NVRAM  up                    up
Ethernet0/1            198.51.100.254  YES NVRAM  up                    up
```

Diagnose the Problem

1. Review the configuration on the Mobile Access Gateway (MAG) and validate that the information provided by the ISP is correct:

- APN = Defines the data connectivity with the local IP Core Packet network for the cellular connectivity
- NAI = Network ID from the MAG to the ISP
- IP address of the LMA = IP address provided by the local ISP

This information is found at the cellular interface.

<#root>

```
Router#sh cellular 0/1/0 all
Hardware Information
====================
Modem Firmware Version = <version>
Modem Firmware built = 2015/03/04 21:30:23
Hardware Version = 1.0
Device Model ID: xxxx
Package Identifier ID: Cisco ID
```

International Mobile Subscriber Identity (IMSI) = 310410901877700

International Mobile Equipment Identity (IMEI) = xxxxxxxxxxxxxx

```
Integrated Circuit Card ID (ICCID) = < ICCID Number >
Mobile Subscriber Integrated Services
Digital Network-Number (MSISDN) =  < MSISDN ID >
Modem Status = Online
Current Modem Temperature = 33 deg C
```

```
PRI SKU ID = <SKU ID>, PRI version = 005.026, Carrier = ISP
OEM PRI version = <version>
```

Router configuration example.

Configuration Key Fields
<#root> ipv6 mobile pmipv6-domain LMA-DOMAIN replay-protection timestamp window 255 encap gre-ipv4 lma LMA_SVC **ipv4-address <LMA IP Address>** **nai IMSI@APN** lma LMA_SVC **ipv6 mobile pmipv6-mag <MAG Domain> domain LMA-DOMAIN** role 3GPP **apn <APN NAME>** address dynamic roaming interface Cellular0/1/0 priority 1 egress-ATT LTE label MAG replay-protection timestamp window no generate grekey ignore grekey **interface Loopback0 < Logical Mobile Node Interface >** lma LMA_SVC LMA-DOMAIN **ipv4-address <LMA IP Address>** encap gre-ipv4 **logical-mn IMSI@<APN>** **mobile network Ethernet0/1 < Interface to be advertised over the Tunnel0>** **home interface Loopback0 < Logical Mobile Node Interface >**
Configuration Example
<#root> ipv6 mobile pmipv6-domain LMA-DOMAIN

```
replay-protection timestamp window 255
encap gre-ipv4
lma LMA_SVC
ipv4-address 203.0.113.10


nai 310410901877700@13511.mcs


lma LMA_SVC
ipv6 mobile pmipv6-mag MAG819 domain LMA-DOMAIN
role 3GPP
apn 13511.mcs


address dynamic
roaming interface Cellular0/1/0 priority 1 egress-ATT LTE label MAG replay-protection timestamp window
no generate grekey
ignore grekey
interface Loopback0
lma LMA_SVC LMA-DOMAIN
ipv4-address 203.0.113.10


encap gre-ipv4
logical-mn 310410901877700@13511.mcs


mobile network Ethernet0/1


home interface Loopback0
```

2. Validate the status of the MAG. The INIT state indicates that the MAG tries to connect to the LMA.

<#root>

a) non-working example

MAG#

show ipv6 mobile pmipv6 mag binding

```
Total number of bindings: 1
----------------------------------------
[Binding][MN]: Domain: LMA-DOMAIN, Nai: 310410901877700@13511.mcs
    [Binding][MN]:
```

State: INIT

```
    [Binding][MN]: Interface: Loopback0
    [Binding][MN]:
```

```
 Hoa: 0.0.0.0, Att: 4, llid: 310410901877700@135

    [Binding][MN]: HNP: 0
    [Binding][MN]: APN: 13511.mcs
    [Binding][MN][LMA]: Id: LMA_SVC
    [Binding][MN][LMA]: Lifetime: 0
    [Binding][MN]: Yes
    [Binding][MN][Mobile Network]: Ethernet0/1
    [Binding][MN][PATH]: interface: Cellular0/1/0, Label: MAG
        State: PATH_INIT
        Refresh time: 0(sec), Refresh time Remaining: 0(sec)
---------------------------------------
```

b) working example

```
MAG#show ipv6 mobile pmipv6 mag binding


Total number of bindings: 1
---------------------------------------
[Binding][MN]: Domain: LMA-DOMAIN, Nai: 310410901877700@13511.mcs
    [Binding][MN]:

 State: ACTIVE

    [Binding][MN]: Interface: Loopback0
    [Binding][MN]:

 Hoa: x.x.x.x, Att: 4, llid: 310410901877700@135

    [Binding][MN]: HNP: 0
    [Binding][MN]: APN: 13511.mcs
    [Binding][MN][LMA]: Id: LMA_SVC
    [Binding][MN][LMA]: Lifetime: 3600
    [Binding][MN]: Yes
    [Binding][MN][Mobile Network]: Ethernet0/1
    [Binding][MN][PATH]: interface: Cellular0/1/0, Label: MAG
        State: PATH_ACTIVE
        Tunnel: Tunnel0
        Refresh time: 300(sec), Refresh time Remaining: 299(sec)
        [Binding][MN][PATH][GREKEY]: Upstream: 0, Downstream: 0
---------------------------------------
```

3. Validate the MAG status on the router. The messages of interest are PBUs and PBAs, which are the request and reply for the binding from the MAG to the LMA.

<#root>

```
MAG#show ipv6 mobile pmipv6 mag stats
---------------------------------------
[MAG819]: Total Bindings    : 1

[MAG819]: PBU Sent        : 6
[MAG819]: PBA Rcvd        : 0

[MAG819]: PBRI Sent        : 0
```

```
[MAG819]: PBRI Rcvd        : 0
[MAG819]: PBRA Sent        : 0
[MAG819]: PBRA Rcvd        : 0
[MAG819]: No Of handoff    : 0

Detailed Statistics Information
```

< snip >

4. Validate if the Cellular interface has a good signal towards the ISP.

Note: Cellular troubleshooting is out of scope for this document.

---

5. Enable debugs on the platform to validate the messages exchange between the MAG and LMA.

<#root>

MAG#debug ipv6 mobile mag events

```
*Apr 14 20:53:30.772: PMIPv6 RIB_RWATCH: Debugging is ON
*Apr 14 20:53:30.773: [PMIPV6_LMN_EVENT]: Attach Timer expired
*Apr 14 20:53:30.773: [PMIPV6_LMN_EVENT]: Event received Attach timer expiry in state: LMN_READY, new st
*Apr 14 20:53:30.773: [PMIPV6_LMN_EVENT]: Logical MN (310410901877700@13511.mcs) sending Attach trigger
*Apr 14 20:53:30.773: [PMIPV6_LMN_EVENT]: Starting Logical MN attach timer, period (5000)
*Apr 14 20:53:30.773: [PMIPV6_MAG_EVENT]: Trigger request received (Session create trigger) from (310410
*Apr 14 20:53:30.773: [PMIPV6_MAG_EVENT]: Trigger attach request received
*Apr 14 20:53:30.773: [PMIPV6_MAG_EVENT]: Event received Old MN intf attached for Nai: 310410901877700@1
*Apr 14 20:53:30.773: [PMIPV6_MAG_EVENT]: Event received First path created for Nai: 310410901877700@135
*Apr 14 20:53:33.397: [PMIPV6_MAG_EVENT]: Retx Timer expired for Nai: 310410901877700@13511.mcs
*Apr 14 20:53:33.397: [PMIPV6_MAG_EVENT]: Event received ReTx timer exhausted for Nai: 310410901877700@1
*Apr 14 20:53:33.397: [PMIPV6_MAG_EVENT]: Event received Last path Down for Nai: 310410901877700@13511.m
*Apr 14 20:53:33.397: [PMIPV6_MAG_EVENT]:
```

Event received New MN intf attached for Nai: 310410901877700@13511.mcs in path state machine, path: Cell

```
*Apr 14 20:53:33.398: [PMIPV6_MAG_EVENT]: Starting Retx timer, period (1000)
*Apr 14 20:53:33.398: [PMIPV6_MM_EVENT]: Allocated packet of size 152 with tlv length 140
*Apr 14 20:53:33.398: [PMIPV6_MAG_EVENT]:
```

PBU message sent for Nai: 310410901877700@13511.mcs

```
*Apr 14 20:53:33.398: [PMIPV6_MAG_EVENT]: Event received First path created for Nai: 310410901877700@135
*Apr 14 20:53:34.423: [PMIPV6_MAG_EVENT]: Retx Timer expired for Nai: 310410901877700@13511.mcs
*Apr 14 20:53:34.423: [PMIPV6_MAG_EVENT]:
```

Event received PBU Retx timer expired for Nai: 310410901877700@13511.mcs in path state machine, path: Ce

```
*Apr 14 20:53:34.423: [PMIPV6_MM_EVENT]: Allocated packet of size 152 with tlv length 140
*Apr 14 20:53:34.423: [PMIPV6_MAG_EVENT]: PBU message sent for Nai: 310410901877700@13511.mcs
*Apr 14 20:53:34.423: [PMIPV6_MAG_EVENT]: Starting Retx timer for Nai: 310410901877700@13511.mcs,period
*Apr 14 20:53:34.423: [PMIPV6_MAG_EVENT]: Event received First path created for Nai: 310410901877700@135
```

Important logs to be considered:

A) The MAG starts the connection with the LMA.

*Apr 14 20:53:33.397: [PMIPV6_MAG_EVENT]: Event received New MN intf attached for Nai: 310410901877700@13511.mcs in path state machine, path: Cellular0/1/0, state: PATH_NULL, new state: PATH_INIT

B) A PBU message sent to the LMA in order to establish the Tunnel 0

*Apr 14 20:53:33.398: [PMIPV6_MAG_EVENT]: PBU message sent for Nai: 310410901877700@13511.mcs

C) The MAG does not receive the acknowledgement (PBA) from the LMA. The MAG attempts to send another PBU to establish the Tunnel.

*Apr 14 20:53:34.423: [PMIPV6_MAG_EVENT]: Event received PBU Retx timer expired for Nai: 310410901877700@13511.mcs in path state machine, path: Cellular0/1/0, state: PATH_INIT, new state: PATH_INIT

6. Proceed with an Embedded Packet Capture (EPC) to validate that the LMA does not send the PBA packets. Embedded Packet Capture Configuration Guide.

<#root>

MAG#

monitor capture cap control-plane both access-list tac buffer size 10

MAG#

monitor capture cap start

< wait at least 3 minutes >

MAG#

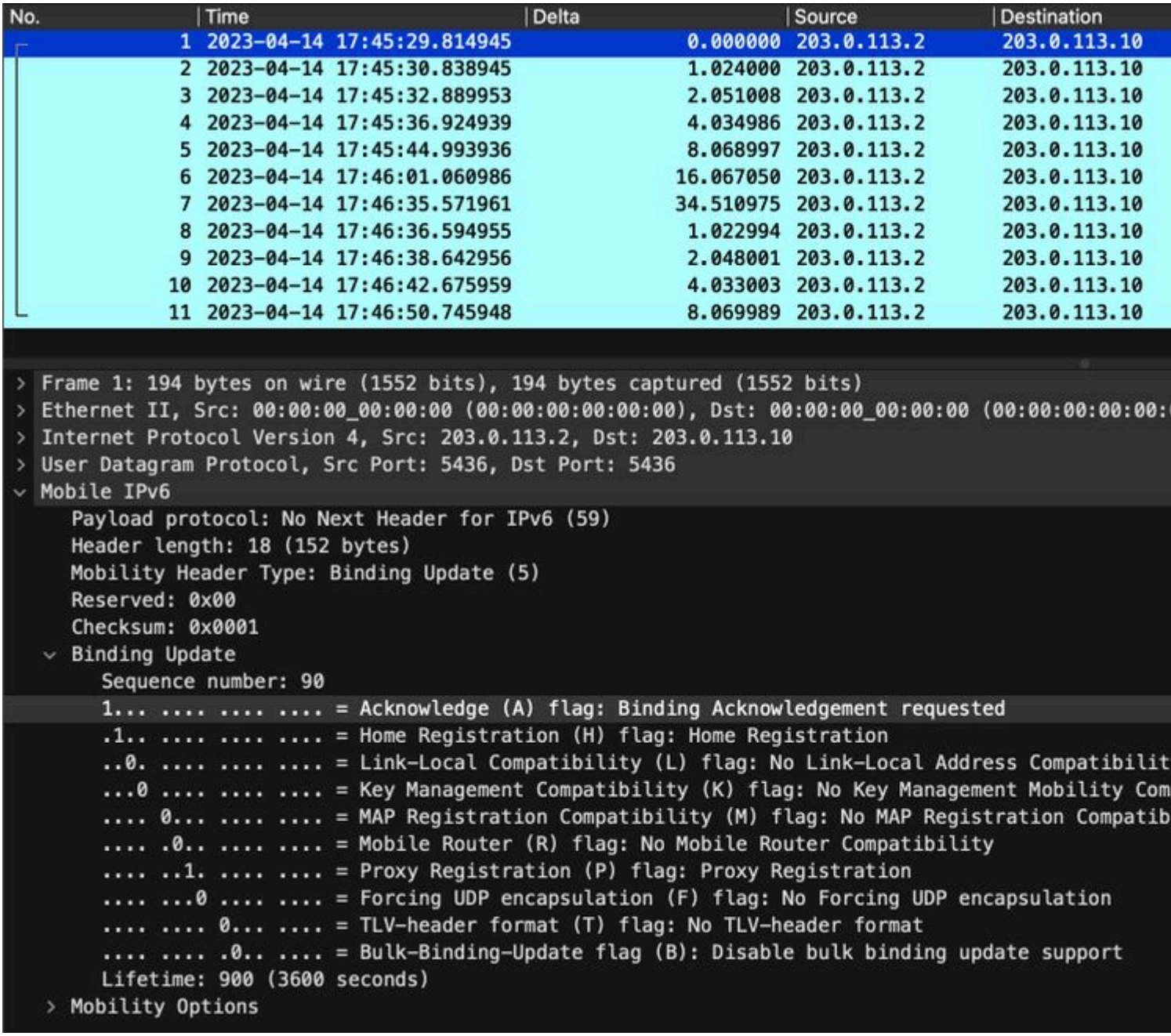
show monitor capture cap buffer brief

```
 ------------------------------------------------------------------------------
 #   size   timestamp     source             destination      dscp    protocol
 ------------------------------------------------------------------------------
   0  194    0.000000   203.0.113.2      ->  203.0.113.10     0  BE   UDP
   1  194    1.024000   203.0.113.2      ->  203.0.113.10     0  BE   UDP
   2  194    3.075008   203.0.113.2      ->  203.0.113.10     0  BE   UDP
   3  194    7.109994   203.0.113.2      ->  203.0.113.10     0  BE   UDP
   4  194   15.178991   203.0.113.2      ->  203.0.113.10     0  BE   UDP
   5  194   31.246041   203.0.113.2      ->  203.0.113.10     0  BE   UDP
   6  194   65.757016   203.0.113.2      ->  203.0.113.10     0  BE   UDP
   7  194   66.780010   203.0.113.2      ->  203.0.113.10     0  BE   UDP
   8  194   68.828011   203.0.113.2      ->  203.0.113.10     0  BE   UDP
   9  194   72.861014   203.0.113.2      ->  203.0.113.10     0  BE   UDP
  10  194   80.931003   203.0.113.2      ->  203.0.113.10     0  BE   UDP
```

The packet capture shows that the IP address 203.0.113.2 (address assigned by the ISP) is sending the PBU packets to the 203.0.113.10 the LMA IP address.

For more details the capture can be exported to the bootflash with the command **monitor capture cap export bootflash:<name>.pcap** and uploaded to a tftp server as a .pcap file.

In the exported capture, the MAG requests the acknowledgment to the LMA, but the LMA does not send the PBA packets.



7. This issue is isolated to the ISP. Contact your local ISP and ask if the service for PMIP is enabled.

MAG not established PMIPv6 Tunnel towards the LMA (PBU and PBA packets exchange).

Diagnose the Problem

1. Review the configuration on the Mobile Access Gateway (MAG).

2. Check the association between the MAG and LMA.

<#root>

MAG

#sh ipv6 mobile pmipv6 mag binding

MAG#

3. Validate the PBU and PBA messages.

<#root>

MAG#

show ipv6 mobile pmipv6 mag stats

```
----------------------------------------
[MAG819]: Total Bindings    : 0

[MAG819]: PBU Sent        : 48
[MAG819]: PBA Rcvd        : 36

[MAG819]: PBRI Sent        : 0
[MAG819]: PBRI Rcvd        : 0
[MAG819]: PBRA Sent        : 0
[MAG819]: PBRA Rcvd        : 0
[MAG819]: No Of handoff    : 0
-----------------------------------------------

<snip>

Trigger Sent Stats
Response to DHCP DISCOVER     : 0    Response to DHCP REQUEST      : 0
Response to ARP REQUEST       : 0
Response to GARP              : 0    Response to Rtr Solicitation  : 0
ATTACH QUERY Sent             : 0

CLEANUP INDICATION Sent       : 37

Resp to MCSA CREATE REQ       : 62

Resp to MCSA UPD REQ          : 0
Resp to MCSA DEL REQ          : 0
```

A) Resp to MCSA CREATE REQ indicates that MAG requests to connect to the LMA. When the LMA rejects the PBU, the MAG starts with the CLEANUP INDICATION message.

4. Enable **debug ipv6 mobile mag events** to validate the error code that appears on the MAG.

<#root>

```
*Apr 17 18:13:22.885: [PMIPV6_LMN_EVENT]: Attach Timer expired
*Apr 17 18:13:22.885: [PMIPV6_LMN_EVENT]: Event received Attach timer expiry in state: LMN_READY, new st
*Apr 17 18:13:22.885: [PMIPV6_LMN_EVENT]: Logical MN (310410901877700@13511.mcs) sending Attach trigger
*Apr 17 18:13:22.885: [PMIPV6_LMN_EVENT]: Starting Logical MN attach timer, period (5000)
*Apr 17 18:13:22.885: [PMIPV6_MAG_EVENT]: Trigger request received (Session create trigger) from (310410
*Apr 17 18:13:22.885: [PMIPV6_MAG_EVENT]: Trigger attach request received
*Apr 17 18:13:22.885: [PMIPV6_MAG_EVENT]:

Event received New MN intf attached for Nai: 310410901877700@13511.mcs in path state machine, path: Cell

*Apr 17 18:13:22.885: [PMIPV6_MAG_EVENT]: Starting Retx timer, period (1000)
*Apr 17 18:13:22.885: [PMIPV6_MM_EVENT]:  Allocated packet of size 160 with tlv length 148
*Apr 17 18:13:22.885: [PMIPV6_MAG_EVENT]:

PBU message sent for Nai: 310410901877700@13511.mcs

*Apr 17 18:13:22.885: [PMIPV6_MAG_EVENT]: Event received First path created for Nai: 310410901877700@135
*Apr 17 18:13:22.886: [PMIPV6_MAG_EVENT]:

message received: PBA


*Apr 17 18:13:22.886: [PMIPV6_MAG_EVENT]:

PBU rejected by LMA, NAI:310410901877700@13511.mcs, status: 130


*Apr 17 18:13:22.886: [PMIPV6_MAG_EVENT]:

PBA: nai(310410901877700@13511.mcs),nai len: 26, lli (310410901877700@135), ll len: 21, att:4, lifetime:

*Apr 17 18:13:22.886: [PMIPV6_MAG_EVENT]:

Event received PBA reject for Nai: 310410901877700@13511.mcs in path state machine, path: Cellular0/1/0,

<snip>
*Apr 17 18:13:22.886: [PMIPV6_MAG_EVENT]: S

ending cleanup ind reason Last path Down, orig_event PBA reject

*Apr 17 18:13:22.886: [PMIPV6_LMN_EVENT]:

Event received Cleanup request from MAG in state: LMN_READY, new state: LMN_READY

*Apr 17 18:13:22.886: [PMIPV6_MAG_EVENT]:

 Nai: 310410901877700@13511.mcs, Sending IPv4 address cleanup indication for address (0.0.0.0)

*Apr 17 18:13:22.886: [PMIPV6_MAG_EVENT]: Nai: 310410901877700@13511.mcs, Binding Removed
```

Important logs to be considered:

A) MAG initiates the connection towards the LMA.
*Apr 17 18:13:22.885: [PMIPV6_MAG_EVENT]: Event received New MN intf attached for Nai: 310410901877700@13511.mcs in path state machine, path: Cellular0/1/0, state: PATH_NULL, new state: PATH_INIT

B) PBU sent from the MAG towards the LMA.

*Apr 17 18:13:22.885: [PMIPV6_MAG_EVENT]: PBU message sent for Nai: 310410901877700@13511.mcs

C) PBA received from the LMA.

*Apr 17 18:13:22.886: [PMIPV6_MAG_EVENT]: Message received: PBA

D) PBU message rejected by the LMA due to code 130

*Apr 17 18:13:22.886: [PMIPV6_MAG_EVENT]: PBU rejected by LMA, NAI:310410901877700@13511.mcs, status: 130

E) PBA message rejected by the MAG due to code 130.

*Apr 17 18:13:22.886: [PMIPV6_MAG_EVENT]: PBA: nai(310410901877700@13511.mcs),nai len: 26, lli (310410901877700@135), ll len: 21, att:4, lifetime:0, status:130

F) The MAG falls back to the NULL state since the PBU and PBA packets are rejected.

*Apr 17 18:13:22.886: [PMIPV6_MAG_EVENT]: Event received PBA reject for Nai: 310410901877700@13511.mcs in path state machine, path: Cellular0/1/0, state: PATH_INIT, new state: PATH_NULL

G) Clean messages indicate the tunnel needs to be restablished towards the LMA.
*Apr 17 18:13:22.886: [PMIPV6_MAG_EVENT]: Sending cleanup ind reason Last path Down, orig_event PBA reject
*Apr 17 18:13:22.886: [PMIPV6_LMN_EVENT]: Event received Cleanup request from MAG in state: LMN_READY, new state: LMN_READY
*Apr 17 18:13:22.886: [PMIPV6_MAG_EVENT]: Nai: 310410901877700@13511.mcs, Sending IPv4 address cleanup indication for address (0.0.0.0)

Tip: The status on the debug are sent by the LMA to accept or reject the tunnel establishment. These codes can be seen when the PBA is received by the MAG
PBA: nai(310410901877700@13511.mcs),nai len: 26, lli (310410901877700@135), ll len: 21, att:4, lifetime:0, status:130

Please refer to the value codes.

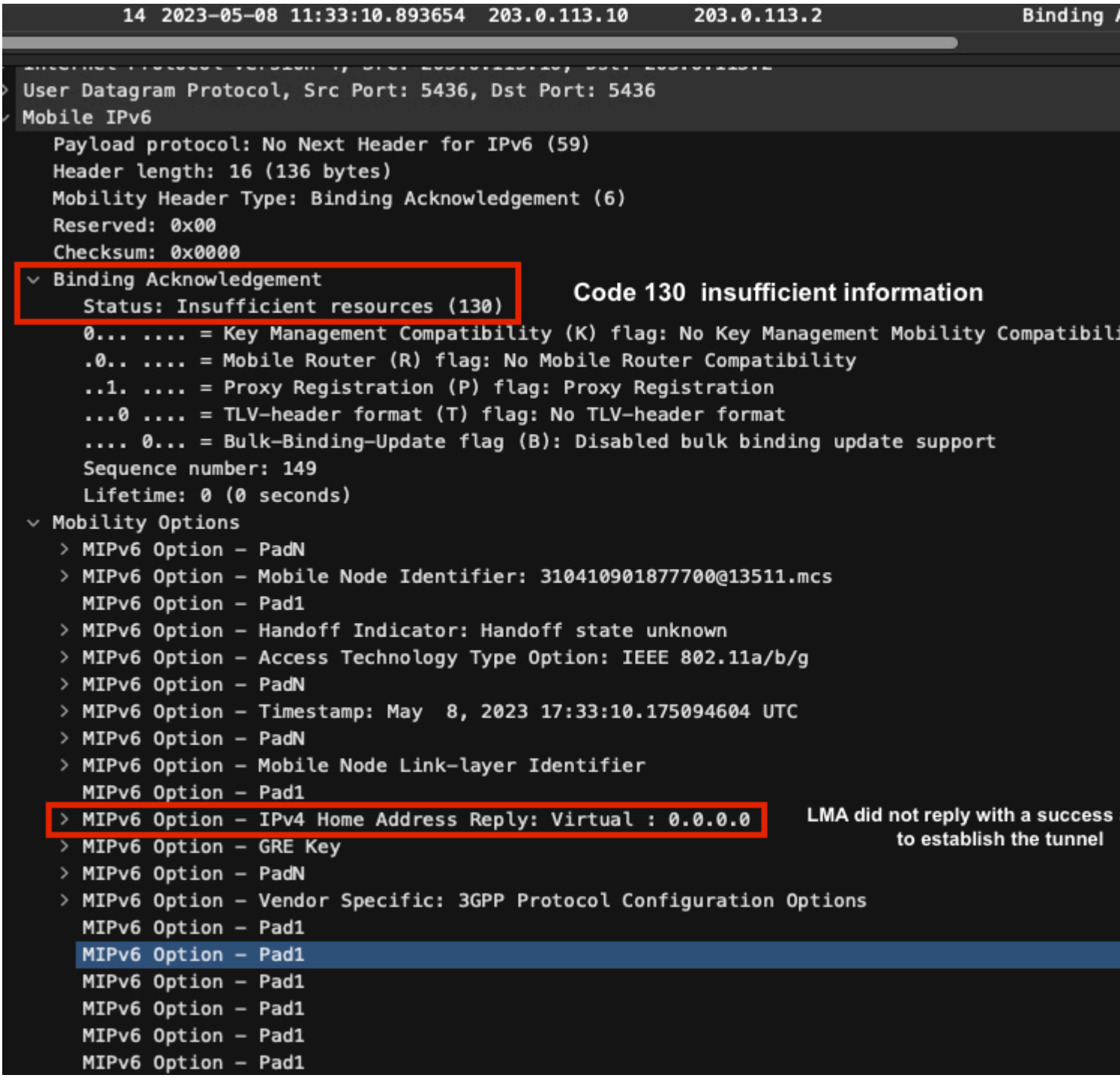
Value code	Description
0	Binding Update accepted
1	Accepted but prefix discovery necessary
128	Reason unspecified
129	Administratively prohibited
130	Insufficent resources
131	Home registration not supported
132	Not home subnet
133	Not home agent for this mobile node
134	Duplicate Address Detection failed

135	Sequence number out of window
136	Expired home nonce index
137	Expired care-of nonce index
138	Expired nonces
139	Registration type change disallowed

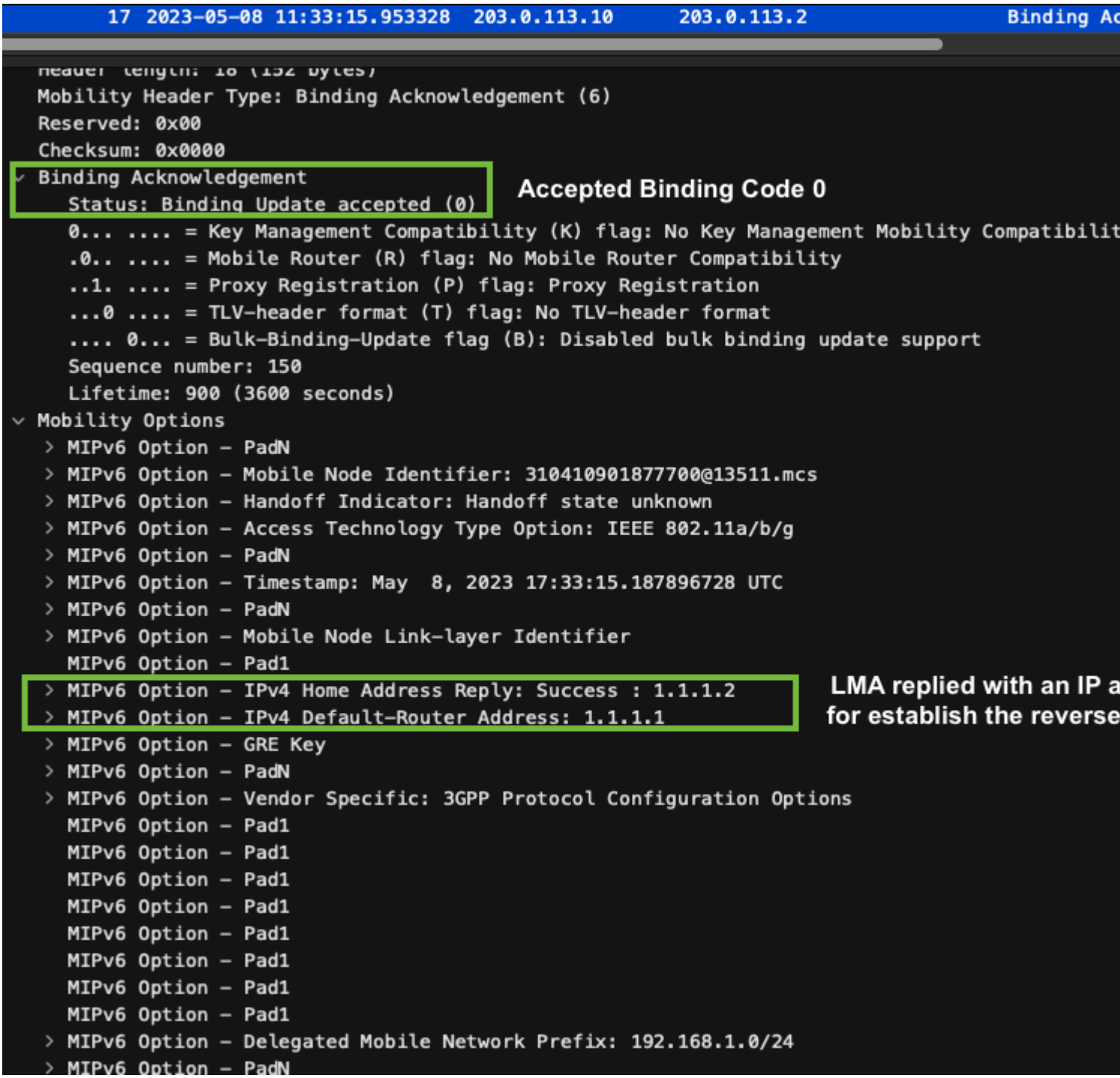
5. Proceed with a Control Plane capture on the router and validate the Mobile IPv6 header from the Acknowledgment packet.

Comparative Captures

Header with Error



Header with no Error



6. Validate with your local ISP. In this case, the LMA reply does not contain the home address in order to establish the reverse tunnel.

PMIPv6 Bounces towards the LMA

```
*May  8 23:09:33.631: %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel0, changed state to up
*May  8 23:09:33.632: %PMIPV6-5-TUNNELUP: Bringing up the Proxy Mobile IPv6 tunnel Tunnel0
*May  8 23:15:39.067: %PMIPV6-5-TUNNELDELETE: Deleting the Proxy Mobile IPv6 tunnel Tunnel0
*May  8 23:17:16.655: %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel0, changed state to up
*May  8 23:17:16.656: %PMIPV6-5-TUNNELUP: Bringing up the Proxy Mobile IPv6 tunnel Tunnel0
```

Diagnose the Problem

1. Validate if the antenna has a good signal.

Note: Cellular troubleshooting is out of scope for this document.

---

2. Activate **debug ipv6 mobile** to validate if the device sends the PBU packets to the LMA.

<#root>

```
*May  9 20:28:26.784: [PMIPV6_LMN_EVENT]:

Attach Timer expired

*May  9 20:28:26.784: [PMIPV6_LMN_EVENT]:

 Event received Attach timer expiry in state: LMN_READY, new state: LMN_READY

*May  9 20:28:26.784: [PMIPV6_LMN_EVENT]: Logical MN (310410901877700@13511.mcs) sending Attach trigger
*May  9 20:28:26.784: [PMIPV6_LMN_EVENT]: Starting Logical MN attach timer, period (5000)
*May  9 20:28:26.784: [PMIPV6_MAG_EVENT]: Trigger request received (Session create trigger) from (310410
*May  9 20:28:26.784: [PMIPV6_MAG_EVENT]: Trigger attach request received
*May  9 20:28:26.784: [PMIPV6_MAG_EVENT]:

 Event received Old MN intf attached for Nai: 310410901877700@13511.mcs in path state machine, path: Cel

*May  9 20:28:26.784: [PMIPV6_MAG_EVENT]:

Event received First path created for Nai: 310410901877700@13511.mcs in state: INIT, new state: INIT


 <snip>


At this point the MAG waits for a reply from the LMA to establish the tunnel. Since the timer expires, t

*May  9 20:28:39.523: [PMIPV6_MAG_EVENT]:

Event received Last path Down for Nai: 310410901877700@13511.mcs in state: INIT, new state: NULL

*May  9 20:28:39.523: [PMIPV6_MAG_EVENT]: Trigger Reply sent in Bul Null state entry for Nai: 3104109018
*May  9 20:28:39.523: [PMIPV6_LMN_EVENT]: Event received Trigger Attach Failure in state: LMN_READY, new
< snip >
*May  9 20:28:39.523: [PMIPV6_MAG_EVENT]:

sending cleanup ind reason Last path Down, orig_event ReTx timer exhausted

*May  9 20:28:39.523: [PMIPV6_LMN_EVENT]:

Event received Cleanup request from MAG in state: LMN_READY, new state: LMN_READY

*May  9 20:28:39.523: [PMIPV6_MAG_EVENT]:

Nai: 310410901877700@13511.mcs, Sending IPv4 address cleanup indication for address (0.0.0.0)

*May  9 20:28:39.523: [PMIPV6_MAG_EVENT]:

Nai: 310410901877700@13511.mcs, Binding Removed

< Snip >
```

```
*May  9 20:28:41.955: [PMIPV6_MAG_EVENT]: Event received New MN intf attached for Nai: 310410901877700@1
*May  9 20:28:41.955: [PMIPV6_MAG_EVENT]: Starting Retx timer, period (1000)
*May  9 20:28:41.955: [PMIPV6_MM_EVENT]: Allocated packet of size 160 with tlv length 148
*May  9 20:28:41.955: [PMIPV6_MAG_EVENT]:
```

PBU message sent for Nai: 310410901877700@13511.mcs

```
*May  9 20:28:41.956: [PMIPV6_MAG_EVENT]: Event received First path created for Nai: 310410901877700@135
*May  9 20:28:42.979: [PMIPV6_MAG_EVENT]: Retx Timer expired for Nai: 310410901877700@13511.mcs
*May  9 20:28:42.979: [PMIPV6_MAG_EVENT]: Event received PBU Retx timer expired for Nai: 31041090187770
*May  9 20:28:42.979: [PMIPV6_MM_EVENT]: Allocated packet of size 160 with tlv length 148
*May  9 20:28:42.979: [PMIPV6_MAG_EVENT]:
```

PBU message sent for Nai: 310410901877700@13511.mcs

```
*May  9 20:28:42.979: [PMIPV6_MAG_EVENT]: Starting Retx timer for Nai: 310410901877700@13511.mcs,period
*May  9 20:28:42.979: [PMIPV6_MAG_EVENT]: Event received First path created for Nai: 310410901877700@135
*May  9 20:28:45.027: [PMIPV6_MAG_EVENT]: Retx Timer expired for Nai: 310410901877700@13511.mcs
*May  9 20:28:45.027: [PMIPV6_MAG_EVENT]: Event received PBU Retx timer expired for Nai: 31041090187770
*May  9 20:28:45.027: [PMIPV6_MM_EVENT]: Allocated packet of size 160 with tlv length 148
*May  9 20:28:45.027: [PMIPV6_MAG_EVENT]: PBU message sent for Nai: 310410901877700@13511.mcs
*May  9 20:28:45.027: [PMIPV6_MAG_EVENT]: Starting Retx timer for Nai: 310410901877700@13511.mcs,period
*May  9 20:28:45.027: [PMIPV6_MAG_EVENT]: Event received First path created for Nai: 310410901877700@135
*May  9 20:28:45.228: [PMIPV6_MAG_EVENT]:
```

message received: PBA

```
*May  9 20:28:45.228: [PMIPV6_MAG_EVENT]: P
```

BA: nai(310410901877700@13511.mcs),nai len: 26, lli (310410901877700@135), ll len: 21, att:4, lifetime:3

```
*May  9 20:28:45.228: [PMIPV6_MAG_EVENT]:
```

Event received PBA accept for Nai: 310410901877700@13511.mcs in path state machine, path: Cellular0/1/0,

```
*May  9 20:28:45.228: [PMIPV6_MAG_EVENT]: Starting Refresh timer, period (300000)
*May  9 20:28:45.229: PMIPV6_LMN_EVENT]: Received event (20)
*May  9 20:28:45.229: [PMIPV6_LMN_EVENT]:
```

Address change event received for Tunnel0

```
*May  9 20:28:45.229: %LINEPROTO-5-UPDOWN:
```

Line protocol on Interface Tunnel0, changed state to up

```
*May  9 20:28:45.230: %PMIPV6-5-TUNNELUP:
```

Bringing up the Proxy Mobile IPv6 tunnel Tunnel0

```
*May  9 20:28:45.230: [PMIPV6_MAG_EVENT]: Adding V4 Tunnel, Handle (Tunnel0), mode: (GRE_IN_IPV4)
*May  9 20:28:45.230: [PMIPV6_MAG_EVENT]: Populating Reverse V4 Tunnel entry, l2 address (0x3104109018
*May  9 20:28:45.230: [PMIPV6_MAG_EVENT]: Populating Reverse V4 Tunnel entry, l2 address (0x3104109018
*May  9 20:28:45.230: [PMIPV6_MAG_EVENT]: Stopping Retx timer for Nai: 310410901877700@13511.mcs
*May  9 20:28:45.230: [PMIPV6_MAG_EVENT]: Event received First path UP for Nai: 310410901877700@13511.mc
*May  9 20:28:45.230: [PMIPV6_MAG_EVENT]: Nai: 310410901877700@13511.mcs, Updating binding succeeded
```

Important logs to be considered:

A) MAG expires the connectivity with the LMA and waits for a response.

*May 9 20:28:26.784: [PMIPV6_LMN_EVENT]: Attach Timer expired
*May 9 20:28:26.784: [PMIPV6_LMN_EVENT]: Event received Attach timer expiry in state:

LMN_READY, new state: LMN_READY

*May 9 20:28:26.784: [PMIPV6_MAG_EVENT]: Event received Old MN intf attached for Nai: 310410901877700@13511.mcs in path state machine, path: Cellular0/1/0, state: PATH_INIT, new state: PATH_INIT
*May 9 20:28:26.784: [PMIPV6_MAG_EVENT]: Event received First path created for Nai: 310410901877700@13511.mcs in state: INIT, new state: INIT

B) A clear message is sent to delete the previous binding and establish a new Tunnel.

*May 9 20:28:39.523: [PMIPV6_MAG_EVENT]: Event received Last path Down for Nai: 310410901877700@13511.mcs in state: INIT, new state: NULL

*May 9 20:28:39.523: [PMIPV6_MAG_EVENT]: Sending cleanup ind reason Last path Down, orig_event ReTx timer exhausted
*May 9 20:28:39.523: [PMIPV6_LMN_EVENT]: Event received Cleanup request from MAG in state: LMN_READY, new state: LMN_READY
*May 9 20:28:39.523: [PMIPV6_MAG_EVENT]: Nai: 310410901877700@13511.mcs, Sending IPv4 address cleanup indication for address (0.0.0.0)
*May 9 20:28:39.523: [PMIPV6_MAG_EVENT]: Nai: 310410901877700@13511.mcs, Binding Removed

C) A PBU message is sent to the LMA in order to establish a new Tunnel 0. Once the MAG receives, the PBA brings up the Tunnel.

*May 9 20:28:41.955: [PMIPV6_MAG_EVENT]:PBU message sent for Nai: 310410901877700@13511.mcs

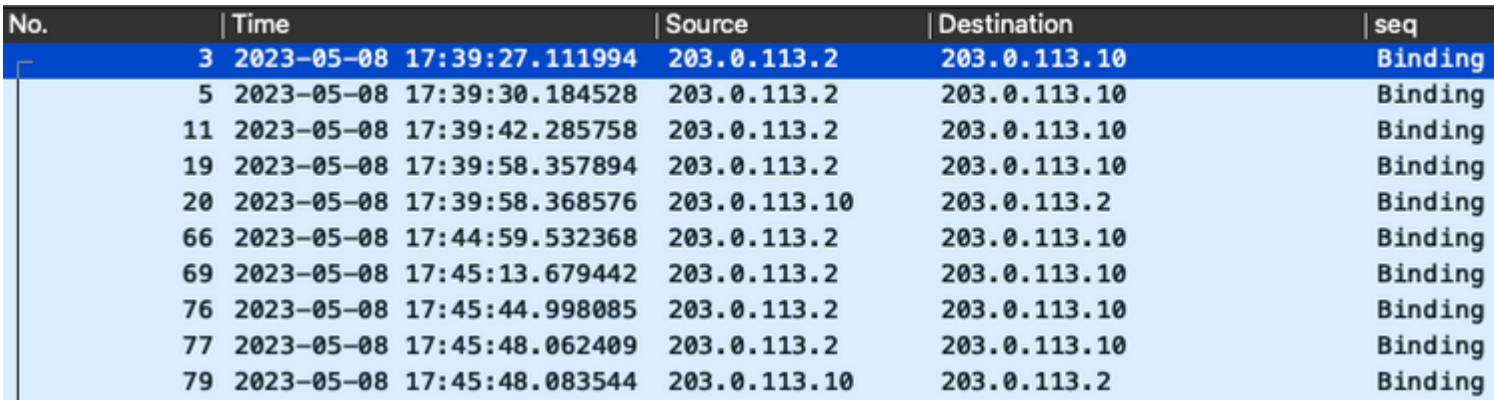
D) A PBA is received and accepted by the MAG and LMA.

*May 9 20:28:45.228: [PMIPV6_MAG_EVENT]: Message received: PBA
*May 9 20:28:45.228: [PMIPV6_MAG_EVENT]: PBA: nai(310410901877700@13511.mcs),nai len: 26, lli (310410901877700@135), ll len: 21, att:4, lifetime:3600, status:0
*May 9 20:28:45.228: [PMIPV6_MAG_EVENT]: Event received PBA accept for Nai: 310410901877700@13511.mcs in path state machine, path: Cellular0/1/0, state: PATH_INIT, new state: PATH_ACTIVE

E) Tunnel 0 is established.

*May 9 20:28:45.229: [PMIPV6_LMN_EVENT]: Address change event received for Tunnel0
*May 9 20:28:45.229: %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel0, changed state to up
*May 9 20:28:45.230: %PMIPV6-5-TUNNELUP: Bringing up the Proxy Mobile IPv6 tunnel Tunnel0

3. Proceed with the Control Plane capture on the router and validate if the packets are shared between MAG and LMA.



No.	Time	Source	Destination	seq
3	2023-05-08 17:39:27.111994	203.0.113.2	203.0.113.10	Binding
5	2023-05-08 17:39:30.184528	203.0.113.2	203.0.113.10	Binding
11	2023-05-08 17:39:42.285758	203.0.113.2	203.0.113.10	Binding
19	2023-05-08 17:39:58.357894	203.0.113.2	203.0.113.10	Binding
20	2023-05-08 17:39:58.368576	203.0.113.10	203.0.113.2	Binding
66	2023-05-08 17:44:59.532368	203.0.113.2	203.0.113.10	Binding
69	2023-05-08 17:45:13.679442	203.0.113.2	203.0.113.10	Binding
76	2023-05-08 17:45:44.998085	203.0.113.2	203.0.113.10	Binding
77	2023-05-08 17:45:48.062409	203.0.113.2	203.0.113.10	Binding
79	2023-05-08 17:45:48.083544	203.0.113.10	203.0.113.2	Binding

In the exported capture, the MAG requests the acknowledgment to the LMA. The LMA responds with this message; however, since the transport has a problem, these messages are not received consistently by the MAG.
Once the transport is stable, the tunnel becomes stable.

4. Validate with your local ISP if the transport is stable between these two devices.

Additional Information

PMIP is expected to not receive a default-route from the ISP. In order to get connectivity and establish the tunnel, it is necessary to have a host route that points to the IP of the LMA and add the cellular interface as the next-hop.

Example:
ip route 203.0.113.10 255.255.255.255 cellular0/1/0

Terminology	Description
International Mobile Subscriber Identity (IMSI)	15 digit code number assigned to the SIM card
International Mobile Equipment Identity (IMEI)	15 digit code that is assigned to Mobile equipment
Integrated Circuit Card Identifier (ICCID)	19 to 20 digit code that is assigned specifical to the hardware SIM card
Mobile Station International Subscriber Directory Number (MSISDN)	Mobile device number assigned by the ISP. This includes the country code and the number assigned.
Network Access Identifier (NAI)	User Identity submitted by the client during network access authentication
Access Point Name (APN)	Information of the Mobile device to connect with the mobile network data (Roam process)
Mobile Node (MN)	IP host or router required to participate in any IP mobility related PMIP
Mobile Access Gateway (MAG)	Access device that manages the connection with the ISP

Local Mobility Anchor (LMA)	Home Agent for the mobile node in a Proxy Mobile IPv6 domain (PMIP)
Home Address (HoA)	Dynamic IP address assigned by the LMAs pool
Proxy Binding Update (PBU)	Request from the MAG to establish the tunnel between LMA. This request includes the Mobile Node Identifier Option.
Proxy Binding Acknowledgment (PBA)	Message from LMA to MAG, which includes the HoA network prefixes and triggers the establishment of a bidirectional Tunnel