

排除IOS XE路由器上的PMIP隧道建立故障

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簡介

本文檔介紹如何對Cisco IOS® XE的PMIPv6技術進行故障排除。

必要條件

需求

思科建議您瞭解以下主題：

- [IP行動化：PMIPv6配置指南，Cisco IOS XE 17.x](#)
- [Cisco ISR和CGR的Verizon 4G LTE部署指南：專用網路部署](#)

採用元件

本檔案中的資訊是根據Cisco IOS XE軟體。

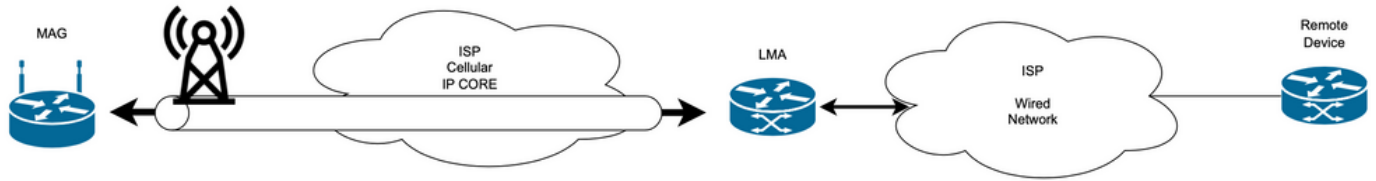
本文中的資訊是根據特定實驗室環境內的裝置所建立。文中使用到的所有裝置皆從已清除 (預設) 的組態來啟動。如果您的網路運作中，請確保您瞭解任何指令可能造成的影響。

背景資訊

當您對移動IP技術進行故障排除時，主要考慮事項是在蜂窩介面和無線網路控制器(RNC)之間有一個良好的訊號。您的Internet服務提供商(ISP)提供您用來在移動接入網關(MAG)和本地移動錨點(LMA)之間建立隧道的IP地址。

MAG不會建立指向LMA的PMIPv6隧道。

本節提供了在MAG上建立Tunnel0這一常見問題的解決方案。以下網路圖為例。



在此圖中，MAG無法建立通向LMA的Tunnel0。

```
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
```

診斷問題

1. 檢視移動接入網關(MAG)上的配置並驗證ISP提供的資訊是否正確：

- APN = 定義與本地IP核心資料包網路的資料連線，用於蜂窩連線
- NAI = 從MAG到ISP的網路ID
- LMA的IP地址=本地ISP提供的IP地址

此資訊可在手機介面上找到。

<#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) = xxxxxxxxxxxxxxxxx

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>

路由器配置示例。

配置鍵欄位

```
<#root>
```

```
ipv6 mobile pmipv6-domain LMA-DOMAIN  
replay-protection timestamp window 255  
encap gre-ipv4  
lma LMA_SVC
```

```
ipv4-address
```

```
nai IMSI@APN
```

```
lma LMA_SVC
```

```
ipv6 mobile pmipv6-mag
```

```
domain LMA-DOMAIN
```

```
role 3GPP
```

```
apn
```

```
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
```

```
encap gre-ipv4
```

```
logical-mn IMSI@
```

```
mobile network Ethernet0/1 < Interface to be advertised over the Tunnel0 >
```

```
home interface Loopback0 < Logical Mobile Node Interface >
```

組態範例

```
<#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. 驗證MAG的狀態。INIT狀態指示MAG嘗試連線到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, l1id: 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, l1id: 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. 驗證路由器上的MAG狀態。感興趣的報文是PBU和PBA，它們是請求和回覆MAG與LMA的繫結。

```
<#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. 驗證蜂窩介面是否有向ISP發出的良好訊號。

附註:手機網路故障排除超出本文檔的範圍。

5.啟用平台上的調試，以驗證MAG和LMA之間的報文交換。

<#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 s
*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 (31041
*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@
*Apr 14 20:53:30.773: [PMIPv6_MAG_EVENT]: Event received First path created for Nai: 310410901877700@13
*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@13511.mcs
*Apr 14 20:53:33.397: [PMIPV6_MAG_EVENT]: Event received Last path Down for Nai: 310410901877700@13511.mcs
*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

*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@13511.mcs
*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: Cellular0/1/0

*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 (1000)
*Apr 14 20:53:34.423: [PMIPV6_MAG_EVENT]: Event received First path created for Nai: 310410901877700@13511.mcs
```

要考慮的重要日誌：

A)MAG啟動與LMA的連線。

*2014年4月14日20:53:33.397:[PMIPV6_MAG_EVENT]:事件已收到為Nai附加的新MNintf:310410901877700@13511.mcs在路徑狀態機中，path:Cellular0/1/0，狀態：PATH_NULL，新狀態：PATH_INIT

B)傳送到LMA以建立隧道0的PBU消息

*2014年4月14日20:53:33.398:[PMIPV6_MAG_EVENT]:傳送給Nai的PBU消息：310410901877700@13511.mcs

C)MAG未收到來自LMA的確認(PBA)。MAG嘗試傳送另一個PBU以建立隧道。

*2014年4月20:53:34.423:[PMIPV6_MAG_EVENT]:收到事件的PBU Retx計時器已過期，用於Nai:310410901877700@13511.mcs在路徑狀態機中，path:Cellular0/1/0，狀態：PATH_INIT，新狀態：PATH_INIT

6.繼續使用嵌入式資料包捕獲(EPC)，驗證LMA沒有傳送PBA資料包。[嵌入式資料包捕獲配置指南](#)

。

<#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
```

資料包捕獲顯示IP地址203.0.113.2 (由ISP分配的地址) 將PBU資料包傳送到LMA IP地址203.0.113.10。

如需更多詳細資訊，可以使用monitor capture cap export bootflash:<name>.pcap 指令將擷取匯出至bootflash，並以.pcap檔案上傳到tftp伺服器。

在匯出的捕獲中，MAG向LMA請求確認，但LMA不傳送PBA資料包。

No.	Time	Delta	Source	Destination	seq
1	2023-04-14 17:45:29.814945	0.000000	203.0.113.2	203.0.113.10	Binding Update
2	2023-04-14 17:45:30.838945	1.024000	203.0.113.2	203.0.113.10	Binding Update
3	2023-04-14 17:45:32.889953	2.051008	203.0.113.2	203.0.113.10	Binding Update
4	2023-04-14 17:45:36.924939	4.034986	203.0.113.2	203.0.113.10	Binding Update
5	2023-04-14 17:45:44.993936	8.068997	203.0.113.2	203.0.113.10	Binding Update
6	2023-04-14 17:46:01.060986	16.067050	203.0.113.2	203.0.113.10	Binding Update
7	2023-04-14 17:46:35.571961	34.510975	203.0.113.2	203.0.113.10	Binding Update
8	2023-04-14 17:46:36.594955	1.022994	203.0.113.2	203.0.113.10	Binding Update
9	2023-04-14 17:46:38.642956	2.048001	203.0.113.2	203.0.113.10	Binding Update
10	2023-04-14 17:46:42.675959	4.033003	203.0.113.2	203.0.113.10	Binding Update
11	2023-04-14 17:46:50.745948	8.069989	203.0.113.2	203.0.113.10	Binding Update

```

> Frame 1: 194 bytes on wire (1552 bits), 194 bytes captured (1552 bits)
> Ethernet II, Src: 00:00:00_00:00:00 (00:00:00:00:00:00), Dst: 00:00:00_00:00:00 (00:00:00:00:00:00)
> Internet Protocol Version 4, Src: 203.0.113.2, Dst: 203.0.113.10
> User Datagram Protocol, Src Port: 5436, Dst Port: 5436
v Mobile IPv6
  Payload protocol: No Next Header for IPv6 (59)
  Header length: 18 (152 bytes)
  Mobility Header Type: Binding Update (5)
  Reserved: 0x00
  Checksum: 0x0001
  v Binding Update
    Sequence number: 90
    1... .. = Acknowledge (A) flag: Binding Acknowledgement requested
    .1. . . . = Home Registration (H) flag: Home Registration
    ..0. . . . = Link-Local Compatibility (L) flag: No Link-Local Address Compatibility
    ...0 . . . . = Key Management Compatibility (K) flag: No Key Management Mobility Compatibility
    .... 0... . . . . = MAP Registration Compatibility (M) flag: No MAP Registration Compatibility
    ..... 0.. . . . = Mobile Router (R) flag: No Mobile Router Compatibility
    ..... 0.. . . . = Proxy Registration (P) flag: Proxy Registration
    ..... 0.. . . . = Forcing UDP encapsulation (F) flag: No Forcing UDP encapsulation
    ..... 0.. . . . = TLV-header format (T) flag: No TLV-header format
    ..... 0.. . . . = Bulk-Binding-Update flag (B): Disable bulk binding update support
    Lifetime: 900 (3600 seconds)
  > Mobility Options

```

7.此問題與ISP無關。聯絡您當地的ISP並詢問是否啟用了PMIP服務。

MAG未建立指向LMA的PMIPv6隧道 (PBU和PBA資料包交換)。

診斷問題

- 1.檢查移動接入網關(MAG)上的配置。
- 2.檢查MAG和LMA之間的關聯。

```
<#root>
```

```
MAG
```

```
#sh ipv6 mobile pmipv6 mag binding
```

```
MAG#
```

3.驗證PBU和PBA報文。

```
<#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表示MAG請求連線到LMA。當LMA拒絕PBU時，MAG從清除指示消息開始。

4.啟用debug ipv6 mobile mag events以驗證MAG上顯示的錯誤代碼。

<#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 s
*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 (31041
*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@13
*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

要考慮的重要日誌：

A)MAG啟動與LMA的連線。

*2017年4月18日13:22.885:[PMIPv6_MAG_EVENT]:事件已收到為Nai附加的新MNintf:310410901877700@13511.mcs在路徑狀態機中，path:Cellular0/1/0，狀態：PATH_NULL，新狀態：PATH_INIT

B)PBU從MAG傳送至LMA。

*2017年4月18日13:22.885:[PMIPv6_MAG_EVENT]:傳送給Nai的PBU消息：310410901877700@13511.mcs

C)從LMA收到的PBA。

*2017年4月18日13:22.886:[PMIPv6_MAG_EVENT]:收到的消息：PBA

D)由於代碼130,LMA拒絕了PBU消息

*2017年4月18日13:22.886:[PMIPv6_MAG_EVENT]:PBU被LMA拒絕，NAI:310410901877700@13511.mcs，狀態：130

E)由於代碼130,MAG拒絕了PBA消息。

*2017年4月18日

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)由於PBU和PBA資料包被拒絕，MAG回到NULL狀態。

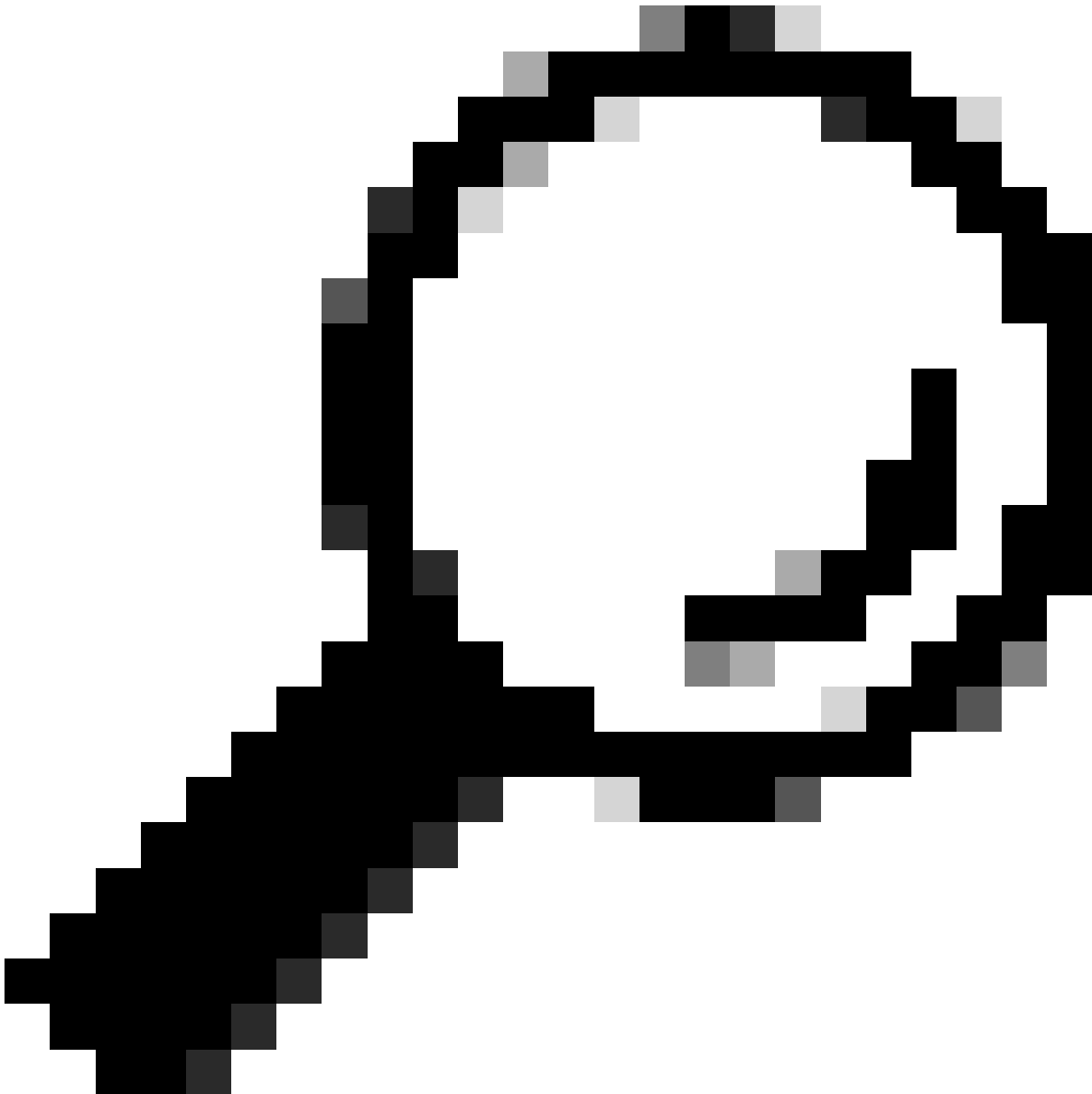
*2017年4月18日13:22.886:[PMIPv6_MAG_EVENT]:收到的Nai的PBA拒絕事件
: 310410901877700@13511.mcs在路徑狀態機中，path:Cellular0/1/0，狀態：PATH_INIT，新狀態：PATH_NULL

G)Clean消息指示需要重新建立通向LMA的隧道。

*2017年4月18日13:22.886:[PMIPv6_MAG_EVENT]:傳送清理查詢原因最後一個路徑關閉，源_事件PBA拒絕

*2017年4月18日13:22.886:[PMIPv6_LMN_EVENT]:事件已收到來自MAG的清理請求，狀態為：LMN_READY，新狀態：LMN_READY

*2017年4月18日13:22.886:[PMIPv6_MAG_EVENT]:Nai:310410901877700@13511.mcs，正在傳送地址(0.0.0.0)的IPv4地址清理指示



提示:LMA會傳送調試狀態以接受或拒絕隧道建立。當MAG收到PBA時，可以看到這些代碼
PBA:nai(310410901877700@13511.mcs),nai len:26, lli(310410901877700@135), ll
len:21, att:4, lifetime:0, status:130

請參閱值代碼。

值代碼	說明
0	已接受繫結更新
1	已接受，但需要字首發現
128	原因未指定
129	管理性禁止
130	資源不足
131	不支援家庭註冊
132	非主子網
133	不是此移動節點的家鄉代理
134	重複地址檢測失敗
135	序列號超出視窗
136	過期主目錄索引
137	過期的遺漏時間索引
138	到期的失效日期
139	不允許更改註冊型別

5.繼續捕獲路由器上的控制平面，並驗證確認資料包中的移動IPv6報頭。

比較捕獲

報頭有錯誤

```

User Datagram Protocol, Src Port: 5436, Dst Port: 5436
Mobile IPv6
  Payload protocol: No Next Header for IPv6 (59)
  Header length: 16 (136 bytes)
  Mobility Header Type: Binding Acknowledgement (6)
  Reserved: 0x00
  Checksum: 0x0000
  Binding Acknowledgement
    Status: Insufficient resources (130)
    Code 130 insufficient information
    0... .... = Key Management Compatibility (K) flag: No Key Management Mobility Compatibility
    .0.. .... = Mobile Router (R) flag: No Mobile Router Compatibility
    ..1. .... = Proxy Registration (P) flag: Proxy Registration
    ...0 .... = TLV-header format (T) flag: No TLV-header format
    .... 0... = Bulk-Binding-Update flag (B): Disabled bulk binding update support
    Sequence number: 149
    Lifetime: 0 (0 seconds)
  Mobility Options
    > MIPv6 Option - PadN
    > MIPv6 Option - Mobile Node Identifier: 310410901877700@13511.mcs
    MIPv6 Option - Pad1
    > MIPv6 Option - Handoff Indicator: Handoff state unknown
    > MIPv6 Option - Access Technology Type Option: IEEE 802.11a/b/g
    > MIPv6 Option - PadN
    > MIPv6 Option - Timestamp: May 8, 2023 17:33:10.175094604 UTC
    > MIPv6 Option - PadN
    > MIPv6 Option - Mobile Node Link-layer Identifier
    MIPv6 Option - Pad1
    > MIPv6 Option - IPv4 Home Address Reply: Virtual : 0.0.0.0
    LMA did not reply with a success address
    to establish the tunnel
    > MIPv6 Option - GRE Key
    > MIPv6 Option - PadN
    > MIPv6 Option - Vendor Specific: 3GPP Protocol Configuration Options
    MIPv6 Option - Pad1
    MIPv6 Option - Pad1
    MIPv6 Option - Pad1
    MIPv6 Option - Pad1
    MIPv6 Option - Pad1
    MIPv6 Option - Pad1
  
```

標頭無錯誤

```

header length: 16 (152 bytes)
Mobility Header Type: Binding Acknowledgement (6)
Reserved: 0x00
Checksum: 0x0000
✓ Binding Acknowledgement
  Status: Binding Update accepted (0)
  Accepted Binding Code 0
  0... .... = Key Management Compatibility (K) flag: No Key Management Mobility Compatibility
  .0.. .... = Mobile Router (R) flag: No Mobile Router Compatibility
  ..1. .... = Proxy Registration (P) flag: Proxy Registration
  ...0 .... = TLV-header format (T) flag: No TLV-header format
  .... 0... = Bulk-Binding-Update flag (B): Disabled bulk binding update support
  Sequence number: 150
  Lifetime: 900 (3600 seconds)
  ✓ Mobility Options
    > MIPv6 Option - PadN
    > MIPv6 Option - Mobile Node Identifier: 310410901877700@13511.mcs
    > MIPv6 Option - Handoff Indicator: Handoff state unknown
    > MIPv6 Option - Access Technology Type Option: IEEE 802.11a/b/g
    > MIPv6 Option - PadN
    > MIPv6 Option - Timestamp: May 8, 2023 17:33:15.187896728 UTC
    > MIPv6 Option - PadN
    > MIPv6 Option - Mobile Node Link-layer Identifier
    MIPv6 Option - Pad1
    > MIPv6 Option - IPv4 Home Address Reply: Success : 1.1.1.2
    > MIPv6 Option - IPv4 Default-Router Address: 1.1.1.1
    > MIPv6 Option - GRE Key
    > MIPv6 Option - PadN
    > MIPv6 Option - Vendor Specific: 3GPP Protocol Configuration Options
    MIPv6 Option - Pad1
    MIPv6 Option - Pad1
    MIPv6 Option - Pad1
    MIPv6 Option - Pad1
    MIPv6 Option - Pad1
    MIPv6 Option - Pad1
    MIPv6 Option - Pad1
    MIPv6 Option - Pad1
    MIPv6 Option - Pad1
    MIPv6 Option - Pad1
    > MIPv6 Option - Delegated Mobile Network Prefix: 192.168.1.0/24
    > MIPv6 Option - PadN
  
```

LMA replied with an IP address for establish the reverse Tunnel

6.向本地ISP驗證。在這種情況下，為了建立反向隧道，LMA回覆不包含家鄉地址。

PMIPv6向LMA迴轉

```

*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
  
```

診斷問題

1.驗證天線是否有良好訊號。

附註:手機網路故障排除超出本文檔的範圍。

2.啟用debug ipv6 mobile , 以驗證裝置是否將PBU資料包傳送到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 (31041

*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

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

*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: 310410901

*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@13

*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@13

*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: 310410901877700

*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@13

*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: 310410901877700

*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@13
*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 (0x31041090187
*May 9 20:28:45.230: [PMIPV6_MAG_EVENT]: Populating Reverse V4 Tunnel entry, l2 address (0x31041090187
*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.m
*May 9 20:28:45.230: [PMIPV6_MAG_EVENT]: Nai: 310410901877700@13511.mcs, Updating binding succeeded

```

要考慮的重要日誌：

A)MAG使與LMA的連線過期並等待響應。

*5月9日20:28:26.784:[PMIPV6_LMN_EVENT]:附加計時器已過期

*5月9日20:28:26.784:[PMIPV6_LMN_EVENT]:已收到事件附加計時器過期狀態
: LMN_READY，新狀態：LMN_READY

*5月9日20:28:26.784:[PMIPV6_MAG_EVENT]:事件收到為Nai附加的舊
MNintf:310410901877700@13511.mcs在路徑狀態機中，path:Cellular0/1/0，狀態
: PATH_INIT，新狀態：PATH_INIT

*5月9日20:28:26.784:[PMIPV6_MAG_EVENT]:收到事件為Nai建立的第一個路徑
: 310410901877700@13511.mcs狀態：INIT，新狀態：INIT

B)傳送一條明確消息，刪除以前的繫結並建立新隧道。

*5月9日20:28:39.523:[PMIPV6_MAG_EVENT]:Nai收到事件最後路徑關閉
: 310410901877700@13511.mcs狀態：INIT，新狀態：空

*5月9日20:28:39.523:[PMIPV6_MAG_EVENT]:傳送清理查詢原因上次路徑關閉，源_事件
ReTx計時器已耗盡

*5月9日20:28:39.523:[PMIPV6_LMN_EVENT]:事件已收到來自MAG的清理請求，狀態為：LMN_READY，新狀態：LMN_READY

*5月9日20:28:39.523:[PMIPV6_MAG_EVENT]:Nai:310410901877700@13511.mcs，正在傳送地址(0.0.0.0)的IPv4地址清理指示

*5月9日20:28:39.523:[PMIPV6_MAG_EVENT]:Nai:310410901877700@13511.mcs，已移除繫結

C)向LMA傳送PBU消息以建立新的隧道0。MAG收到後，PBA將啟動隧道。

*5月9日20:28:41.955:[PMIPV6_MAG_EVENT]：為Nai傳送的PBU消息：310410901877700@13511.mcs

D)MAG和LMA接收並接受PBA。

*5月9日20:28:45.228:[PMIPV6_MAG_EVENT]:收到的消息：PBA

*5月9日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

*5月9日20:28:45.228:[PMIPV6_MAG_EVENT]:已收到針對Nai的PBA接受事件：310410901877700@13511.mcs在路徑狀態機中，path:Cellular0/1/0，狀態：PATH_INIT，新狀態：PATH_ACTIVE

E)隧道0已建立。

*5月9日20:28:45.229:[PMIPV6_LMN_EVENT]:收到Tunnel0的地址更改事件

*5月9日20:28:45.229:%LINEPROTO-5-UPDOWN:介面Tunnel0上的線路協定，狀態更改為up

*5月9日20:28:45.230:%PMIPV6-5-TUNNELUP:啟用代理移動IPv6隧道Tunnel0

3.繼續路由器上的控制平面捕獲，並驗證資料包是否在MAG和LMA之間共用。

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

在匯出的捕獲中，MAG請求確認LMA。LMA將使用此消息進行響應；但是，由於傳輸出現問題，這些消息不是由MAG持續接收的。

一旦傳輸穩定，隧道就會變得穩定。

4.與您的本地ISP確認這兩台裝置之間的傳輸是否穩定。

其他資訊

PMIP預計不會從ISP收到預設路由。為了獲得連線並建立隧道，必須具有指向LMA的IP的主機路由，並將蜂窩介面新增為下一跳。

範例：

ip route 203.0.113.10 255.255.255 cellular0/1/0

技術	說明
國際行動使用者識別碼(IMSI)	分配給SIM卡的15位數字代碼號
國際流動裝置識別(IMEI)	分配給流動裝置的15位代碼
積體電路卡識別碼(ICCID)	為硬體SIM卡指定專用的19到20位代碼
行動站國際使用者目錄號碼(MSISDN)	ISP分配的流動裝置號碼。其中包括國家/地區代碼和分配的編號。
網路存取識別碼(NAI)	使用者身份在網路訪問身份驗證期間由客戶端提交
存取點名稱(APN)	與行動網路資料連線的流動裝置的資訊 (漫遊過程)
行動節點(MN)	參與任何與IP移動性相關的PMIP所需的IP主機或路由器
行動存取閘道(MAG)	管理與ISP連線的接入裝置
本機行動錨點(LMA)	代理移動IPv6域(PMIP)中移動節點的家鄉代理
住宅地址(HoA)	LMA池分配的動態IP地址
代理繫結更新(PBU)	來自MAG的請求，以在LMA之間建立隧道。此請求包括移動節點識別符號選項。
代理繫結確認(PBA)	從LMA到MAG的消息，包括HoA網路字首並觸發建立雙向隧道

關於此翻譯

思科已使用電腦和人工技術翻譯本文件，讓全世界的使用者能夠以自己的語言理解支援內容。請注意，即使是最佳機器翻譯，也不如專業譯者翻譯的內容準確。Cisco Systems, Inc. 對這些翻譯的準確度概不負責，並建議一律查看原始英文文件（提供連結）。