

# 无线PMIPv6 ( WLC上的MAG ) 流 , 带WLC调试和捕获

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## 简介

本文档介绍无线LAN控制器(WLC)上启用PMIPv6的WLAN所涉及的关键术语和客户端连接流程。

作者 : Cisco TAC工程师Chetan Pissay。

## 背景信息

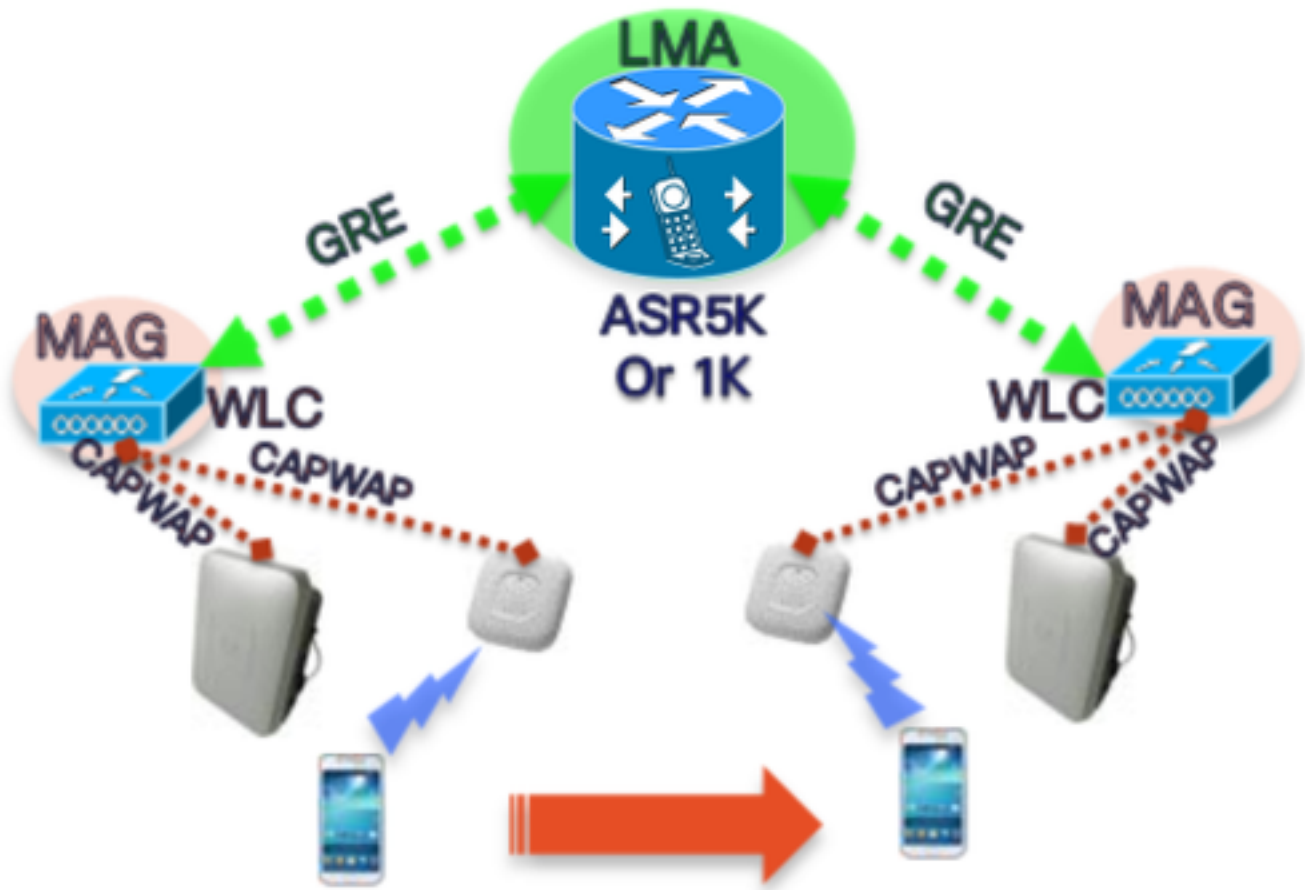
代理移动IPv6、PMIPv6或PMIP是无线客户端的基于网络的移动解决方案。这意味着客户端可能在LTE和WiFi之间漫游以及控制器间WLAN漫游，甚至无缝执行供应商间WLAN漫游。

客户端保留相同的IP地址、网关地址、DHCP服务器和单个锚点。连接到为PMIPv6配置的WLAN的无线客户端与常规WLAN的主要区别在于如何处理DHCP和客户端流量。

## 术语

- 本地移动锚点(LMA)将是分配和维护客户端IP地址并处理客户端流量路由的锚点。LMA通常是ASR5K或ASR1K路由器。
- 移动接入网关(MAG)扮演中介者的角色，它将代表无线客户端执行移动管理，并处理实际的DHCP事务。这将与LMA形成双向隧道以接收和转发客户端流量。此隧道是静态GRE隧道，UDP端口5436同时用作源端口和目的端口。  
在这种情况下，MAG将是无线控制器。但是，我们也可以将MAG作为Flexconnect AP。
- 客户端称为移动节点(MN)，其IP地址称为家庭地址(HOA)。
- 网络访问标识符(NAI)是客户端的唯一标识符，可用于路由发往它的流量，而不是使用IP地址。此格式为mac-address@realm。
- NAI领域通常以域名 ( 如cisco.com ) 的形式。这将用于确定客户端应属于哪个“网络”。在无线术语中，这将替代将所需VLAN映射到客户端的动态接口。  
这在WLAN上配置，并且还确定MAG将与哪个LMA形成双向隧道。

有关IP移动术语的详细信息，请参阅[https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/mob\\_ip/configuration/15-mt/mob-ip-15-mt-book/imo-nai-haa.html](https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/mob_ip/configuration/15-mt/mob-ip-15-mt-book/imo-nai-haa.html)



## 流

- PMIP客户端将完成802.11关联和WLAN上配置的任何第2层身份验证。

\*apfMsConnTask\_2:Jun 18 14:50:40.023:[PA] 00:23:c2:db:29:2d 0.0.0.0开始(0)状态更改为AUTHCHECK(2)最后状态开始(0)

\*apfMsConnTask\_2:Jun 18 14:50:40.023:[PA] 00:23:c2:db:29:2d 0.0.0.0 AUTHCHECK(2)将状态更改为L2AUTHCOMPLETE(4)最后状态AUTHCHECK(2)

- L2身份验证完成后，MAG会在将客户端推进到下一阶段之前，将此客户端通知LMA并请求LMA的IP地址。从技术角度讲，MAG会向LMA发送代理绑定更新(PBU)。LMA将回复代理绑定确认(PBA)。
- 然后，WLC将充当客户端的DHCP服务器，并根据从LMA收到的信息与其执行DHCP事务。不需要启用DHCP代理，但启用它意味着客户端会将WLC的虚拟接口IP视为DHCP服务器地址。在本例中，DHCP代理已启用。

## 使用WLC调试和数据包捕获的PMIPv6事件细分

### 使用的组件

MAG: WLC 3504 running 8.8.120.0

LMA: ASR1K running 3.13.10S

AP: AIR-CAP3802-D-K9

WLC IP: 10.106.35.111

Virtual Interface IP: 192.0.2.1

Router IP: 10.106.37.40

Client IP (Received via DHCP): 192.168.5.44

## 使用的调试命令

( 思科控制器 ) >debug client <mac-addr>

( 思科控制器 ) >debug proxy-mobility all enable

在WLC上行链路端口捕获的数据包。

首先，当客户端完成L2身份验证后，MAG上会显示L2连接触发器

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\*PMIPv6\_Thread\_2: Jun 18 14:50:40.023: [PA]

[PMIPv6\_MAG\_EVENT]: Trigger request received (L2 Attach trigger) from (0023.c2db.292d)

\*PMIPv6\_Thread\_2: Jun 18 14:50:40.023: [PA]

[PMIPv6\_MAG\_EVENT]: Event received New MN intf attached in state: NULL, new state: INIT

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客户端的PMIP绑定更新消息使用日志中可见的nai进行准备。

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\*PMIPv6\_Thread\_2: Jun 18 14:50:40.023: [PA]

[PMIPv6\_MAG\_INFO]: PBU message nai(0023.c2db.292d@ciscotacbangalore.com), nai len: 15, hoa(0), att(4) llid(0023.c2db.292d) , ll len: 16 seqNo:9465

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绑定更新请求数据包由MAG发送到LMA

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\*PMIPv6\_Thread\_2: Jun 18 14:50:40.023: [PA]

[PMIPv6\_MM] Sending UDP Packet, src: 0x0a6a236f, dst: 0x0a6a2528, sport: 5436, dport:5436

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0x0a6a236f = IP Address of MAG

0x0a6a2528 = IP Address of LMA

客户端IP和默认路由器地址的请求如下所示：

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\*PMIPv6\_Thread\_2: Jun 18 14:50:40.023: [PA]

[PMIPv6\_MM] V4HOAREQ option included len 6 val 0

\*PMIPv6\_Thread\_2: Jun 18 14:50:40.023: [PA]

[PMIPv6\_MM] V4DFT\_RTR option included len 6 val 0

\*PMIPv6\_Thread\_2: Jun 18 14:50:40.023: [PA]

[PMIPv6\_MAG\_EVENT]: PBU message sent

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```
> Frame 1: 198 bytes on wire (1584 bits), 198 bytes captured (1584 bits) on interface 0
> Ethernet II, Src: Cisco_78:be:cd (50:0f:80:78:be:cd), Dst: Cisco_7a:97:71 (00:00:0c:7a:97:71)
> 802.1Q Virtual LAN, PRI: 0, DEI: 0, ID: 35
> Internet Protocol Version 4, Src: 10.106.35.111, Dst: 10.106.37.40
> 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: 0x0000
  > Binding Update
  v Mobility Options
    > MIPv6 Option - PadN
    > MIPv6 Option - Mobile Node Identifier: 0023.c2db.292d
    > MIPv6 Option - Service Selection: @ciscotacbangalore.com
    > MIPv6 Option - Handoff Indicator: Attachment over a new interface
    > MIPv6 Option - Access Technology Type Option: IEEE 802.11a/b/g
    MIPv6 Option - Pad1
    > MIPv6 Option - Timestamp: Jun 18, 2019 04:50:40.0000 UTC
    > MIPv6 Option - PadN
    > MIPv6 Option - Mobile Node Link-layer Identifier
    > MIPv6 Option - PadN
    > MIPv6 Option - IPv4 Home Address Request: 0.0.0.0
    > MIPv6 Option - IPv4 Default-Router Address: 0.0.0.0
```

响应作为绑定更新确认接收，并包含要分配给客户端和默认路由器地址的IP地址。

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\*PMIPv6\_Thread\_0: Jun 18 14:50:40.026: [PA]

[PMIPv6\_MM] NAI option received len 15

\*PMIPv6\_Thread\_0: Jun 18 14:50:40.026: [PA]

[PMIPv6\_MM] V4HOAREPLY option received len 6 val 3232236844

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3232236844 = IP address of MN returned by LMA from the IP Pool in Decimal.

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\*PMIPv6\_Thread\_0: Jun 18 14:50:40.026: [PA]

[PMIPv6\_MM] V4DFT\_RTR option received len 6 val 3232236801

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3232236801 = Default router address in Decimal

Mobility Header Type: Binding Acknowledgement (6)

Reserved: 0x00

Checksum: 0x0604

▼ Binding Acknowledgement

Status: Binding Update accepted (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: 9465

Lifetime: 7200 (28800 seconds)

▼ Mobility Options

> MIPv6 Option - PadN

> MIPv6 Option - Mobile Node Identifier: 0023.c2db.292d

> MIPv6 Option - Handoff Indicator: Attachment over a new interface

> MIPv6 Option - Access Technology Type Option: IEEE 802.11a/b/g

MIPv6 Option - Pad1

> MIPv6 Option - Timestamp: Jun 18, 2019 04:50:40.0000 UTC

> MIPv6 Option - PadN

> MIPv6 Option - Mobile Node Link-layer Identifier

> MIPv6 Option - PadN

▼ MIPv6 Option - IPv4 Home Address Reply: Success : 192.168.5.44

Length: 6

Status: Success (0)

0100 11.. = Prefix-len: 24

IPv4 Home Address: 192.168.5.44

> MIPv6 Option - IPv4 Default-Router Address: 192.168.5.1

MAG绑定状态更改为活动。

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\*PMIPv6\_Thread\_2: Jun 18 14:50:40.026: [PA]

[PMIPv6\_MAG\_EVENT]: Event received PBA accept in state: INIT, new state: ACTIVE

\*PMIPv6\_Thread\_2: Jun 18 14:50:40.026: [PA]

[PMIPv6\_MM] L2 Attach Status: Success

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这将遵循客户端状态更改为DHCP\_REQD并看到常规DHCP日志。DHCP数据包事务将仅在WLC和客户端之间，因为WLC已收到要包含在DHCP提供/确认数据包中的IP地址、子网掩码和路由器地址。

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\*apfMsConnTask\_2: Jun 18 14:50:40.023: [PA] 00:23:c2:db:29:2d 0.0.0.0 L2AUTHCOMPLETE (4) Change state to DHCP\_REQD (7) last state L2AUTHCOMPLETE (4)

\*DHCP Socket Task: Jun 18 14:50:40.235: [PA] 00:23:c2:db:29:2d DHCP transmitting DHCP DISCOVER (1)

\*DHCP Socket Task: Jun 18 14:50:40.236: [PA] 00:23:c2:db:29:2d DHCP transmitting DHCP OFFER (2)

\*DHCP Socket Task: Jun 18 14:50:41.072: [PA] 00:23:c2:db:29:2d DHCP transmitting DHCP REQUEST (3)

\*DHCP Socket Task: Jun 18 14:50:41.074: [PA] 00:23:c2:db:29:2d DHCP transmitting DHCP ACK (5)

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No.	Time	Source	Destination	Protocol	Length	Info
1	2019-06-18 04:50:40.048613	10.106.35.111	10.106.37.40	MIPv6	198	Binding Update
2	2019-06-18 04:50:40.051456	10.106.37.40	10.106.35.111	MIPv6	174	Binding Acknowledgement
3	2019-06-18 04:50:40.399814	0.0.0.0	255.255.255.255	DHCP	430	DHCP Discover - Transaction ID 0xd24d2a35
4	2019-06-18 04:50:40.399931	192.0.2.1	192.168.5.44	DHCP	418	DHCP Offer - Transaction ID 0xd24d2a35
5	2019-06-18 04:50:40.401783	0.0.0.0	255.255.255.255	DHCP	442	DHCP Request - Transaction ID 0xd24d2a35
6	2019-06-18 04:50:40.401905	192.0.2.1	192.168.5.44	DHCP	418	DHCP ACK - Transaction ID 0xd24d2a35

## 验证

使用本部分可确认配置能否正常运行。

客户端状态可通过WLC上的以下输出确认：

```
(Cisco Controller) >show pmipv6 mag binding
```

```
[Binding][MN]: Domain: D1, Nai: 0023.c2db.292d@ciscotacbangalore.com
```

```
[Binding][MN]: State: ACTIVE
```

```
[Binding][MN]: Interface: Management
```

```
[Binding][MN]: Hoa: 0xc0a8052c, att: 3, llid: 0023.c2db.292d
```

```
[Binding][MN][LMA]: Id: LMA1
```

```
[Binding][MN][LMA]: lifetime: 3600
```

```
[Binding][MN][GREKEY]: Upstream: 100, Downstream: 1
```

```
(Cisco Controller) >show client detail 00:23:c2:db:29:2d
```

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Client Type..... PMIPv6

PMIPv6 State..... Complete

PMIPv6 MAG location..... WLC

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