Out of Band Management Through USB Modem

Effective Cisco IOS XE Release 3.15.0S, the Cisco ASR 920 Series Router provides out-of-band connectivity to manage remotely-deployed cell site routers using the 3G or 4G cellular network through the USB modem (also called the dongle). This OOB connectivity gives the service providers the ability to securely manage their remote cell site routers at anytime from anywhere. This feature also eliminates the need for the onsite or remote IT staff to handle outages.

Out of Band Management feature is not supported in Cisco IOS XE Everest 16.5.1.

• Prerequisites for the OOB Management Through USB Modem, on page 1
• Restrictions for the OOB Management Through USB Modem, on page 1
• Information About the OOB Management Through USB Modem, on page 2
• Configuring the Management Interface on the MAG, on page 3
• Configuring the LMA, on page 6
• Verifying the Configuration, on page 8

Prerequisites for the OOB Management Through USB Modem

• The Local Mobility Anchor (LMA) must be a Cisco ASR 1000 Series Router.
• The Mobile Access Gateway (MAG) must be the Cisco ASR 920 Series Router (ASR-920-12CZ-A/D, ASR-920-4SZ-A/D, or ASR 920-10SZ-PD).
• The dongle can be inserted only in the USB Memory port of the Cisco ASR 920 Series Router.

Restrictions for the OOB Management Through USB Modem

For Cisco IOS-XE Release 3.15.0S:

• Multi-VRF is not supported on the Cisco ASR 1000 Series Router.
• Only UDP PMIPv6 tunnels are supported between the LMA and MAG.
• Only the following dongle are supported:
  • Reliance (ZTE: model- AC2739)
  • Airtel 4G (Huawei: model-E3272)
  • TATA DoCoMo (ZTE: model-MF190)
• OOB Management using USB Modem works only when the advancemetroipaccess license is enabled.
• Starting from Cisco IOS-XE 3.15.0S release, you cannot configure or remove a virtual interface, virtualPPP-4001, manually.

Information About the OOB Management Through USB Modem

![Sample Topology for OOB Management](image)

By default, the management interface remains in administratively down state until the dongle is inserted and the feature is enabled.

In the above topology, the LMA assigns an IP address to the LMN. The USB modem receives its IP address from the Service Provider. A UDP tunnel is established between the LMA and MAG through the proxy mobile IPv6 (PMIPv6) protocol.

• Proxy Mobile IPv6 technology—Provides network-based IP mobility management to a mobile node without requiring the participation of the mobile node in any mobility-related signaling. The network is responsible for managing IP mobility on behalf of the host.
• MAG—Manages mobility-related signaling for a mobile node attached to its access link. It is the first layer 3 attachment node for the mobile clients.

The major functions of MAG are:

• Assigning an IP address to the loopback address given by the LMA (when LMA assigns an IP address dynamically)
• Assigning an IP address to the loopback address and sending an update to LMA (in case of static IP address)
• Tunneling the traffic to the corresponding LMA.
• LMA—is the topological anchor point for the MAG
The LMA is responsible for assigning addresses to MAG and managing it.

In Cisco IOS-XE 3.15.0S, LMA is hosted on the Cisco ASR1000 Series Router.

## Configuring the Management Interface on the MAG

### SUMMARY STEPS

1. **platform usb modem username password**
2. **interface loopback loopback-id**
3. **ip route prefix mask {ip-address} virtualPPP-4001**
4. **exit**
5. ipv6 unicast-routing
6. ipv6 mobile pmipv6-domain domain-name
7. encap udptunnel
8. lma lma-id
9. ipv4-address ip-address
10. exit
11. nai user@realm
12. lma lma-id
13. ipv6 mobile pmipv6-mag mag-id domain-name
14. address {ipv4 ipv4-address | ipv6 ipv6-address | dynamic}
15. roaming interface type number priority priority-value egress-att access-tech-type label egress-label
16. interface loopback loopback-id
17. interface GigabitEthernet slot/subslot
18. lma lma-id domain-name
19. ipv4-address ipv4-address
20. auth-option spi {spi-hex-value | decimal spi-decimal-value} key {ascii ascii-string | hex hex-string}
21. logical-mn network-access-identifier
22. address {ipv4 ipv4-address | ipv6 ipv6-address | dynamic}
23. home interface type

### DETAILED STEPS

<table>
<thead>
<tr>
<th></th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>platform usb modem username password</strong></td>
<td>Enables the dongle on the MAG. The <em>username</em> and <em>password</em> are the mobile numbers of the dongle (without the zero prefix).</td>
</tr>
<tr>
<td>2</td>
<td><strong>interface loopback loopback-id</strong></td>
<td>Creates an interface loopback.</td>
</tr>
<tr>
<td>3</td>
<td><strong>ip route prefix mask {ip-address} virtualPPP-4001</strong></td>
<td>Creates a route to reach the LMA through the dongle interface (virtual pp interface).</td>
</tr>
<tr>
<td>4</td>
<td><strong>exit</strong></td>
<td>Exits the interface.</td>
</tr>
<tr>
<td>Step</td>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>------</td>
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</tr>
<tr>
<td>5</td>
<td>ipv6 unicast-routing</td>
<td>Enables IPv6 routing.</td>
</tr>
<tr>
<td>6</td>
<td>ipv6 mobile pmipv6-domain domain-name</td>
<td>Configures common parameters valid across the domain—a logical grouping of the MAG and LMA. Creates a PMIPv6 domain and configures it by using the configuration from the LMA.</td>
</tr>
<tr>
<td>7</td>
<td>encap udptunnel</td>
<td>Configures the UDP tunnel encapsulation between the Mobile Access Gateway (MAG) and the Local Mobility Anchor (LMA).</td>
</tr>
<tr>
<td>8</td>
<td>lma lma-id</td>
<td>Configures an LMA within the PMIPv6 domain and enters PMIPv6 domain LMA configuration mode.</td>
</tr>
<tr>
<td>9</td>
<td>ipv4-address ip-address</td>
<td>Configures an IPv4 address for the LMA within the PMIPv6 domain.</td>
</tr>
<tr>
<td>10</td>
<td>exit</td>
<td>Exits the interface</td>
</tr>
<tr>
<td>11</td>
<td>nai user@realm</td>
<td>Configures a network access identifier (NAI) for the mobile node (MN) within the PMIPv6 domain and enters PMIPv6 domain mobile node configuration mode.</td>
</tr>
<tr>
<td>12</td>
<td>lma lma-id</td>
<td>Configures an LMA for the MN.</td>
</tr>
<tr>
<td>13</td>
<td>ipv6 mobile pmipv6-mag mag-id domain domain-name</td>
<td>Enables the MAG service on the dongle, configures the PMIPv6 domain for the MAG, and enters MAG configuration mode.</td>
</tr>
<tr>
<td>14</td>
<td>address {ipv4 ipv4-address</td>
<td>ipv6 ipv6-address</td>
</tr>
<tr>
<td>15</td>
<td>roaming interface type number priority priority-value egress-att access-tech-type label egress-label</td>
<td>Specifies an interface as a roaming interface for a Mobile Access Gateway (MAG) and set its parameters</td>
</tr>
<tr>
<td>16</td>
<td>interface loopback loopback-id</td>
<td>Creates an interface loopback.</td>
</tr>
<tr>
<td>17</td>
<td>interface GigabitEthernet slot/subslot</td>
<td>The local routing ACL’s are not populated, which affects the locally generated/destined data packets. This command ensures the issue does not arise.</td>
</tr>
<tr>
<td>18</td>
<td>lma lma-id domain-name</td>
<td>Configures the LMA for the MAG and enters MAG-LMA configuration mode.</td>
</tr>
<tr>
<td>19</td>
<td>ipv4-address ipv4-address</td>
<td>Configures the IPv4 address for the LMA within MAG, for the MAG with LMA, or for the LMA or MAG within the Proxy Mobile IPv6 (PMIPv6) domain.</td>
</tr>
<tr>
<td>20</td>
<td>auth-option spi {spi-hex-value</td>
<td>decimal spi-decimal-value} key {ascii ascii-string</td>
</tr>
</tbody>
</table>
Purpose Command or Action Purpose

**Note** This authentication should match that at the LMA side, otherwise the UDP tunnel will not be established.

**Step 21** logical-mn network-access-identifier Enables the mobile router functionality in MAG.

**Step 22** address {ipv4 ipv4-address | ipv6 ipv6-address | dynamic} Configures an IPv4, an IPv6, or dynamic address for a MAG or LMA.

**Step 23** home interface type Enables the MAG service on the specified interface.

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**Configuration Example: MAG Configuration with Dynamic IP Address on Logical MN Interface**

```bash
Router(config)# platform usb modem 1234567890
Router(config)# interface loopback 1
Router(config-if)# exit
Router(config)# ipv6 unicast-routing
Router(config)# ip route 0.0.0.0 0.0.0.0 Virtual-PPP4001
Router(config)# ipv6 mobile pmipv6-domain D1
Router(config)# ipv6 mobile pmipv6-domain D1 encap udptunnel
Router(config)# ipv6 mobile pmipv6-domain D1 lma LMA1
Router(config)# ipv6 mobile pmipv6-domain D1 ipv4-address 173.39.88.101
Router(config)# ipv6 mobile pmipv6-domain D1 nai MN5@cisco.com
Router(config)# ipv6 mobile pmipv6-domain D1 lma LMA1
Router(config)# ipv6 mobile pmipv6-domain D1 egress-att 3g label etyr
Router(config)# ipv6 mobile pmipv6-domain D1 interface Virtual-PPP4001 priority 1
Router(config)# ipv6 mobile pmipv6-domain D1 interface GigabitEthernet0/0/1
Router(config)# ipv6 mobile pmipv6-domain D1 lma LMA1 D1
Router(config)# ipv6 mobile pmipv6-domain D1 ipv4-address 173.39.88.101
Router(config)# ipv6 mobile pmipv6-domain D1 auth-option spi 67 key ascii key1
Router(config)# ipv6 mobile pmipv6-domain D1 logical-mn MN5@cisco.com
Router(config)# ipv6 mobile pmipv6-domain D1 address dynamic
```

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**Configuration Example: MAG Configuration with Static IP Address on Logical MN Interface**

```bash
Router(config)# platform usb modem 1234567890
Router(config)# interface loopback 1
Router(config-if)# ip address 10.10.10.1 255.255.255.0
Router(config-if)# exit
Router(config)# ipv6 unicast-routing
Router(config)# ip route 0.0.0.0 0.0.0.0 Virtual-PPP4001
Router(config)# ipv6 mobile pmipv6-domain D1
Router(config)# ipv6 mobile pmipv6-domain D1 encap udptunnel
```
Router(config-ipv6-pmipv6-domain)# lma LMA1
Router(config-ipv6-pmipv6-domain-lma)# ipv4-address 173.39.88.101
Router(config-ipv6-pmipv6-domain-lma)# exit
Router(config-ipv6-pmipv6-domain)# nai MN5@cisco.com
Router(config-ipv6-pmipv6-domain-mn)# lma LMA1
Router(config-ipv6-pmipv6-domain-mn)# exit
Router(config-ipv6-pmipv6-domain)# ipv6 mobile pmipv6-mag M1 domain D1
Router(config-ipv6-pmipv6-domain)# ipv4-address 173.39.88.101
Router(config-ipv6-pmipv6-mag)# address dynamic
Router(config-ipv6-pmipv6-mag-addr-dyn)# roaming interface Virtual-PPP4001 priority 1 egress-att 3g label etyr
Router(config-ipv6-pmipv6-mag-addr-dyn)# interface loopback1
Router(config-ipv6-pmipv6-mag-addr-dyn)# interface GigabitEthernet0/0/1
Router(config-ipv6-pmipv6-mag-lma)# ipv4-address 173.39.88.101
Router(config-ipv6-pmipv6-mag-lma)# auth-option spi 67 key ascii key1
Router(config-ipv6-pmipv6-mag-lma)# logical-mn MN5@cisco.com
Router(config-ipv6-pmipv6-mag-logicalmn)# home interface loopback1

Configuring the LMA

SUMMARY STEPS

1. ip local pool pool-name low-ip-address high-ip-address
2. ipv6 mobile pmipv6-domain domain-name
3. auth-option spi {spi-hex-value | decimal spi-decimal-value} key {ascii ascii-string | hex hex-string}
4. encap udptunnel
5. nai user@realm
6. network network-name
7. ipv6 mobile pmipv6-lma lma-id domain domain-name [force]
8. address ipv4 ipv4-address | ipv6 ipv6-address | dynamic
9. dynamic mag learning
10. network network-name
11. pool ipv4 name pfxlen length
12. ip route prefix mask interface-name
13. exit

DETAILED STEPS

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<td><strong>Step 1</strong></td>
<td>ip local pool pool-name low-ip-address high-ip-address</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>ipv6 mobile pmipv6-domain domain-name</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>auth-option spi {spi-hex-value</td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td>This authentication should match that at the MAG side, otherwise the UDP tunnel will not be established.</td>
</tr>
<tr>
<td>Step</td>
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</tr>
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<td>nai user@realm</td>
</tr>
<tr>
<td>6</td>
<td>network network-name</td>
</tr>
<tr>
<td>7</td>
<td>ipv6 mobile pmipv6-lma lma-id domain domain-name [force]</td>
</tr>
<tr>
<td>8</td>
<td>address ipv4 ipv4-address</td>
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<tr>
<td>9</td>
<td>dynamic mag learning</td>
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<td>10</td>
<td>network network-name</td>
</tr>
<tr>
<td>11</td>
<td>pool ipv4 name pfxlen length</td>
</tr>
<tr>
<td>12</td>
<td>ip route prefix mask interface-name</td>
</tr>
<tr>
<td>13</td>
<td>exit</td>
</tr>
</tbody>
</table>

**Configuration Example**

```
ip local pool v4pool 10.10.10.0 10.10.10.254
! ipv6 mobile pmipv6-domain D1
    auth-option spi 64 key ascii 100
    encaps udptunnel
    nai MN5@cisco.com
    network net1
    ipv6 mobile pmipv6-lma LMA1 domain D1
    address ipv4 173.39.88.101
    dynamic mag learning
    network net1
    pool ipv4 v4pool pfxlen 24
! ip route 0.0.0.0 0.0.0.0 GigabitEthernet0/0/2
exit
```
Verifying the Configuration

MAG Call Setup

On the MAG:

```
AR920-MAG# show ipv6 mobile pmipv6 mag binding
Total number of bindings: 1
----------------------------------------
[Binding][MN]: Domain: D1, Nai: MN5@cisco.com
    [Binding][MN]: State: ACTIVE
    [Binding][MN]: Interface: Loopback1
    [Binding][MN]: Hoa: 10.10.10.1, Att: 4, llid: MN5@cisco.com
    [Binding][MN]: HNP: 0
    [Binding][MN][LMA]: Id: LMA1
    [Binding][MN][LMA]: Lifetime: 3600
    [Binding][MN]: Yes
    [Binding][MN][PATH]: interface: Virtual-PPP4001, Label: etyr
        State: PATH_ACTIVE
        Tunnel: Tunnel0
        Refresh time: 300(sec), Refresh time Remaining: 272(sec)
----------------------------------------
```

On the LMA:

```
AR1000-LMA# show ipv6 mobile pmipv6 lma binding
Total number of bindings: 1
----------------------------------------
[Binding][MN]: State: BCE_ACTIVE
[Binding][MN]: Domain: D1, NAI: MN5@cisco.com
[Binding][MN]: HOA: 10.10.10.1, Prefix: 24
[Binding][MN]: HNP: 0
[Binding][MN][PEER]: Default Router: 10.10.10.0
    [Binding][MN][PEER]: LLID: MN5@cisco.com
    [Binding][MN][PEER]: Id: dynamic_mag165
    [Binding][MN][PEER]: Lifetime: 3600(sec)
    [Binding][MN][PEER]: Lifetime Remaining: 3538(sec)
    [Binding][MN][PEER]: Tunnel: Tunnel0
    [Binding][MN][GREKEY]: Upstream: 1, Downstream: 0
----------------------------------------
```

If the LMA has bindings to multiple MAGs, use the following command to view a specific MAG: `show ipv6 mobile pmipv6 LMA binding nai MN5@cisco.com`.

---

**Note**

If the LMA has bindings to multiple MAGs, use the following command to view a specific MAG: `show ipv6 mobile pmipv6 LMA binding nai MN5@cisco.com`.

---

**MAG Data Path**

- To verify the dynamic tunnel created between the MAG and the LMA:

  ```
  show interface tunnel tunnel-number
  ```

- To verify dongle interface status (virtual ppp interface) and tunnel status:
show ip interface brief

```
ASR920-MAG# show ip int brief | i Virtual-PPP4001
Virtual-PPP4001   106.216.155.17 YES unset up          up
ASR920-MAG# show ip int brief | i Tunnel
Tunnel0           106.216.155.17 YES unset up          up
```

Note
Addresses assigned to the MN should be from the local pool configured in the LMA.

- To verify dynamic route map created in MAG:

  `show route-map dynamic`

**Debug Commands**

The following debugs can be used to debug the call flow information and events.

- `debug ipv6 mobile mag events`
- `debug ipv6 mobile mag info`
- `debug ipv6 mobile mag api`

To view the packet level information messages, use

- `debug ipv6 mobile packets`

To clear the PMIPv6 bindings and statistics:

- `clear ipv6 mobile pmipv6 mag binding all`
- `clear ipv6 mobile pmipv6 mag binding nai MN-nai`

**Related Documents**

For more information on mobility commands, see the *Cisco IOS IP Mobility Command Reference*. 