

# Troubleshoot Mobile IP Tunnel Establishment

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## Introduction

This document describes how to troubleshoot Mobile Technologies on Cisco IOS® XE platforms.

## Prerequisites

### Requirements

Cisco recommends that you have knowledge of these topics:

- Mobile IP
- Cisco IOS XE Software
- [IP Mobility: Mobile IP Configuration Guide, Cisco IOS Release 15M&T](#)
- [Cisco High-Speed WAN Interface Cards](#)

### Components Used

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

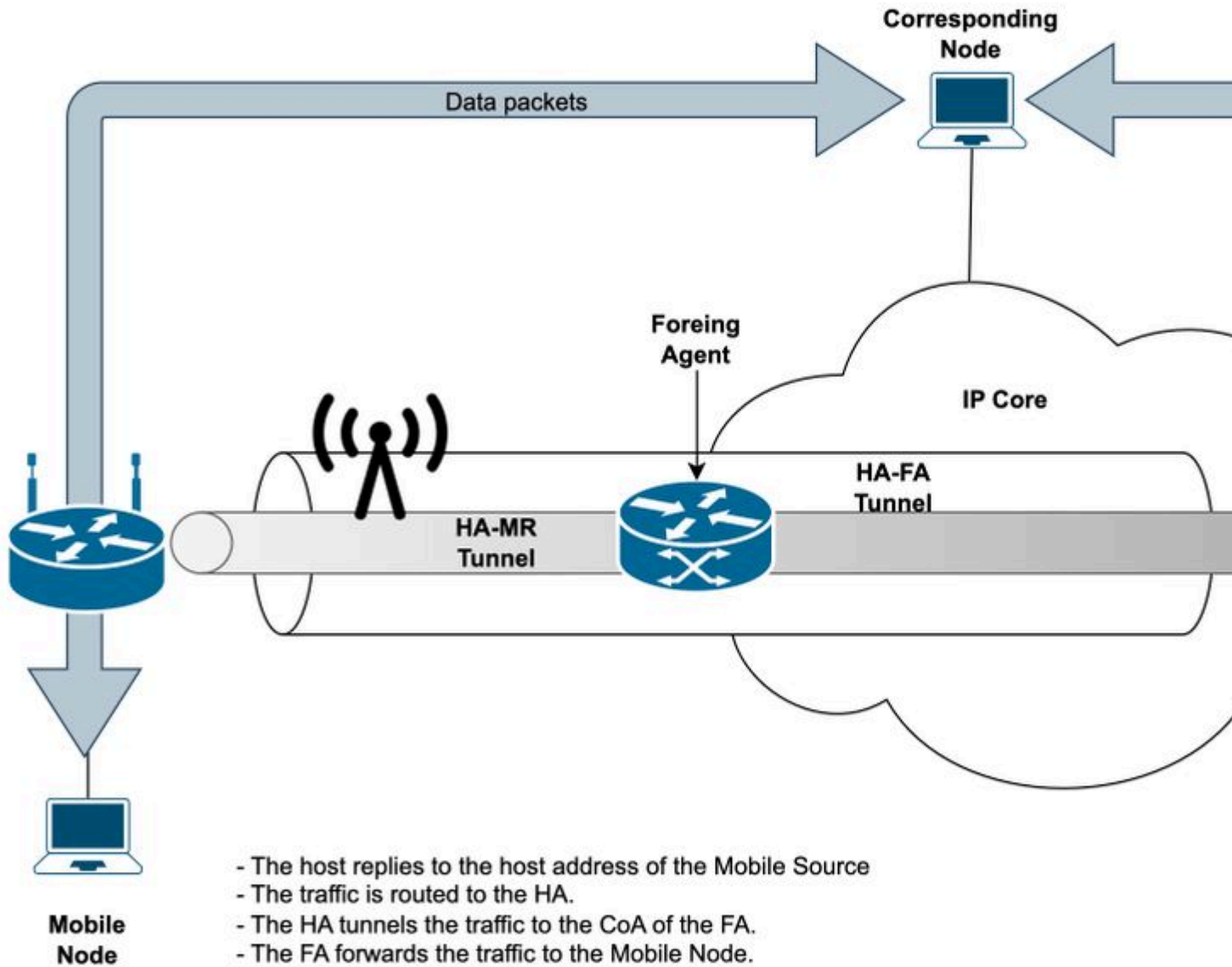
The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

## 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 Mobile Node and the Foreign Agent/Home Agent (FA/HA).

## Mobile Node not Established on the DMNR Tunnel0

This section provides a solution to the common problem of Tunnel0 down on the Mobile Network (MN). This network diagram is used as an example:



Mobile node is unable to establish the Tunnel0 towards the Foreign Agent.

```
MN#show ip int br | exclude unassigned
Interface          IP-Address      OK? Method Status  Protocol
GigabitEthernet1/0 192.0.2.254    YES NVRAM  up      up
Cellular0/0/0      203.0.113.1    YES NVRAM  up      up
Loopback1234       x.x.x.x        YES NVRAM  up      up
```

Diagnose the Problem

1. Review the configuration on the MN to confirm that the parameters provided by the ISP are correct.

### Configuration Example

```
<#root>
ip mobile secure
home-agent <IP HA>
  spi 101 key
hex <32 Hex digits>
  algorithm md5 mode prefix-suffix
ip mobile router
address < Non-routable IP address, local Loopback>

home-agent <home Agent>

mobile-network < LAN network to be propagated over the tunnel>

reverse-tunnel
tunnel mode gre
```

2. Use the command **show ip mobile router** to confirm the parameters sent to the ISP.

```
<#root>
MN#
show ip mobile router

Mobile Router
  Enabled 05/29/23 21:57:14
  Last redundancy state transition NEVER

Configuration:

Home Address x.x.x.x Mask 255.255.255.0

Home Agent 203.0.113.10 Priority 100 (best)
```

Registration lifetime 65534 sec  
Retransmit Init 1000, Max 5000 msec, Limit 3  
Extend Expire 120, Retry 3, Interval 10  
Reverse tunnel required  
Request GRE tunnel  
Multi-path enabled, Requested metric: bandwidth

Mobile Networks: GigabitEthernet1/0 (192.0.2.0/255.255.255.0)

Monitor:

Status -Pending-

No active agent  
No Tunnel

3. Activate **debug ip mobile router detail** and examine the MobRtrX messages in the syslog.

<#root>

MN#debug ip mobile router detail  
Mobile router details debugging is on

MN#

\*May 29 22:35:19.319:

**MobRtrX: Register timer to 203.0.113.2 (CoA 203.0.113.2) expired**

\*May 29 22:35:19.319: MobRtrX: Extsize 18 netcnt 1

\*May 29 22:35:19.319:

**MobRtrX: 1) Mobile network 192.0.2.0/24**

\*May 29 22:35:19.319: MobRtrX: Roaming Interface Attributes: ID 6 BW 1000000

\*May 29 22:35:19.319:

**MobRtrX: Status Pending -> Pending**

<snip>

\*May 29 22:35:28.319:

**MobRtrX: Register timer to 203.0.113.2 (CoA 203.0.113.2) expired**

\*May 29 22:35:28.319:

**MobRtrX: Status Isolated -> Isolated**

...

Logs to consider:

- The Cellular interface sends a registration to the FA/HA with the Care of Address (CoA) that is part of the IP address on the ISP side.  
**MobRtrX: Register timer to 203.0.113.2 (CoA 203.0.113.2) expired**
- Sends the advertisement of the networks that are allowed to cross over the tunnel.  
**MobRtrX: 1) Mobile network 192.0.2.0/24**
- The MN waits for the reply of the HA to create the tunnel.  
**MobRtrX: Status Pending -> Pending**
- Exceeded the timer. This is declared isolated. Next action is to perform a new request.  
**MobRtrX: Register timer to 203.0.113.2 (CoA 203.0.113.2) expired**  
**MobRtrX: Status Isolated -> Isolated**

4. Validate if the registration is performed on the router. In this scenario, the counter restarts to counter 00:00.

```
<#root>
```

```
MN#
```

```
show ip mobile router registration
```

```
Mobile Router Registrations:
```

```
Foreign agent 203.0.113.2:
  Registration count 4, Interval 5 sec, On Cellular0/0/0
  Care-of addr 203.0.113.2, HA addr 203.0.113.10, Home addr x.x.x.x
  Lifetime requested 01:00:00 (3600)
  Flags sbdmG-T-, Identification E81FACF1.53E5A9D0
```

```
Register next time 00:00:02
```

```
Extensions:
  Mobile Network 192.0.2.0/24
  MN-HA Authentication SPI 101
```

```
MN#show ip mobile router registration
```

```
Mobile Router Registrations:
```

```
Foreign agent 203.0.113.2:
  Registration count 4, Interval 5 sec, On Cellular0/0/0
  Care-of addr 203.0.113.2, HA addr 203.0.113.10, Home addr x.x.x.x
  Lifetime requested 01:00:00 (3600)
  Flags sbdmG-T-, Identification E81FACF1.53E5A9D0
```

```
Register next time 00:00:01
```

```
Extensions:
  Mobile Network 192.0.2.0/24
  MN-HA Authentication SPI 101
```

---

**Tip:** Next time, the Register increases are registered with the HA.

---

5. Validate the traffic status with the command **show ip mobile router traffic**.

<#root>

MN#show ip mobile router traffic

Mobile Router Counters:

Agent Discovery:

**Solicitations sent 11, advertisements received 494**

Agent reboots detected 0

Registration:

Register 988, Deregister 0 requests sent

Register 987, Deregister 0 replies received

**Requests accepted 0**

,

**denied 0 by HA 0 / FA 0**

Denied due to mismatched ID 0

Authentication failed for HA 0 / FA 0

Invalid extensions 0, ignored 0

Invalid home address 0, ID 987

Unknown HA 0 / FA 0

Gratuitous ARPs sent 0

Movement:

Came up on HA 0, on FA 0

Moved HA to FA 0, FA to FA 0, FA to HA 0

Better interface detected 0

New HA Registrations 0

Tunnel Traffic:

Packets received 0, sent 0

Mobile Router Counters:

Bytes received 0, sent 0

Services:

Redundancy state active 0, passive

Important logs:

- Mobile node sends a packet to validate if this is connected to the FA or if the device has moved from its location; this message is an ICMP with TTL 1, after the FA receives the packet, it replies with the point of attachment to the internet (advertisement).

**Solicitations sent 11, advertisements received 494**

- FA/HA accepts the mobile node to be registered.

**Requests accepted 0, denied 0 by HA 0 / FA 0 < Fail output >**

## Requests accepted 2, denied 1 by HA 0 / FA 1 < works output >

6. Proceed with an Embedded Packet Capture (EPC) in control-plane to validate the Register packet to the FA, the response packet's code from the FA to the mobile node. This shows the reason for failure.

No.	Time	Source	Destination	seq
2	2023-05-30 12:13:30.291397	203.0.113.2	X.X.X.X	Reg Reply: HoA=X.X.X.X
3	2023-05-30 12:13:30.291508	X.X.X.X	203.0.113.2	Reg Request: HoA=X.X.X.X
6	2023-05-30 12:13:31.393385	203.0.113.2	X.X.X.X	Reg Reply: HoA=1.2.3.4
7	2023-05-30 12:13:33.220242	203.0.113.2	X.X.X.X	Reg Reply: HoA=X.X.X.X

> Frame 6: 62 bytes on wire (496 bits), 62 bytes captured (496 bits) on interface -, id 0  
> Ethernet II, Src: ca:03:42:9d:00:38 (ca:03:42:9d:00:38), Dst: ca:04:42:ac:00:38 (ca:04:42:ac:00:38)  
> Internet Protocol Version 4, Src: 203.0.113.2, Dst: 1.2.3.4  
> User Datagram Protocol, Src Port: 434, Dst Port: 434  
v Mobile IP  
  Message Type: Registration Reply (3)  
  Reply Code: Reg Deny (FA)- Registration Timeout (78)  
  Lifetime: 36000  
  Home Address:  
  Home Agent: 203.0.113.10  
  Identification: May 30, 2023 13:13:23.783650739 UTC

In the capture, the MN sends a request to solicit the tunnel, the FA replies with a error code 78. This code means there is a problem to establish the tunnel between the MN and the HA since the packet is not being delivered properly; due to this condition the FA sends a time out.

**Tip:** Refer to the value codes at the end of this document

## Mobile Tunnel is not Established (Intermittent Connectivity)

In this scenario, the problem is with the ISP provider that does not create the connection with the Mobile node to the FA as a first step in order to create the Tunnel between the HA and Mobile Node.

Mobile node is unable to establish the Tunnel0 and maintain a stable Tunnel.

<#root>

MN#

show log | sec Tunnel

```
*May 30 17:11:08.503: %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel0, changed state to up
*May 30 17:17:01.855: %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel0, changed state to up
*May 30 17:23:27.483: %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel0, changed state to up
*May 30 17:29:16.687: %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel0, changed state to up
*May 30 17:30:45.699: %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel0, changed state to up
*May 30 17:34:07.719: %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel0, changed state to up
*May 30 17:35:16.451: %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel0, changed state to up
```

## 1. Check the cellular signal towards the Anthenna (RNC)

---

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

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## 2. Validate the mobile router status.

```
<#root>
```

```
MN#
```

```
show ip mobile router
```

```
Mobile Router
```

```
Enabled 05/30/23 17:11:00
```

```
Last redundancy state transition NEVER
```

```
Configuration:
```

```
Home Address x.x.x.x Mask 255.255.255.0
```

```
Home Agent 203.0.113.10 Priority 100 (best) (current)
```

```
Registration lifetime 65534 sec
```

```
Retransmit Init 1000, Max 5000 msec, Limit 3
```

```
Extend Expire 120, Retry 3, Interval 10
```

```
Reverse tunnel required
```

```
Request GRE tunnel
```

```
Multi-path enabled, Requested metric: bandwidth
```

```
Mobile Networks: GigabitEthernet1/0 (192.0.2.0/255.255.255.0)
```

```
Monitor:
```

```
Status -Pending-
```

```
No active agent
```

```
No Tunnel
```

## 4. Enable **debug ip mobile router** and validate the logs.

```
<#root>
```

```
MN#
```

```
debug ip mobile router
```

```
Mobile router debugging is on
```

```
*May 30 18:29:53.103:
```

```
MobRtr: Delete FA 203.0.113.2 CoA 203.0.113.2 int Cellular0/0/0
```

```
*May 30 18:29:53.103: MobRtr: Delete reg to FA 203.0.113.2 (CoA 203.0.113.2) int Cellular0/0/0
```

```
*May 30 18:29:53.103:
```

```
MobRtr: Delete default route (Tunnel0)
```

```
*May 30 18:29:53.107:
```



MobRtr: Delete host route to HA 203.0.113.10 via 203.0.113.2 (Cellular0/0/0)

\*May 30 18:29:53.107: MobRtr: Delete GW 203.0.113.2

\*May 30 18:29:53.111:

MobRtr: Status Registered -> Isolated

\*May 30 18:29:53.111:

MobRtr: Delete tunnel Tunnel0 s x.x.x.x d 203.0.113.10

\*May 30 18:30:04.159: MobRtr: New agent 203.0.113.2 CoA 203.0.113.2 int Cellular0/0/0 MAC ca03.429d.0038

\*May 30 18:30:04.163: MobRtr: Register reason: left home

\*May 30 18:30:04.167:

HA entry 203.0.113.10 updated with RegID E820BF2C

\*May 30 18:30:04.171:

MobRtr: Register to FA 203.0.113.2 CoA 203.0.113.2 home x.x.x.x HA 203.0.113.10 life 36000  
int Cellular0/0/0 flag sbdmGT cnt 0 id E820BF2C.2AEC80C8

\*May 30 18:30:04.171:

MobRtr: Status Isolated -> Pending

\*May 30 18:30:04.319:

MobRtr:

MN rcv accept (0) reply on Cellular0/0/0 from 203.0.113.2 lifetime 36000  
id E820BF2C.2AEC80C8

\*May 30 18:30:04.323: MobRtr: No Active FA

\*May 30 18:30:04.323:

MobRtr: Status Pending -> Registered

\*May 30 18:30:04.387: MobRtr: Add host route to HA 203.0.113.10 via 203.0.113.2 (Cellular0/0/0) 0

\*May 30 18:30:04.391: MobRtr: Add default route via 203.0.113.2 (Tunnel0) 0

MN#

\*May 30 18:30:04.399: %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel0, changed state to up

## Important Logs:

- Due to the unstable connection, the Care of Address (CoA) is disconnected and as a consequence, the default route through the Tunnel0 is deleted from the MN along with the connection between the MN and the HA. This results in Isolated status on the debug.

**MobRtr: Delete FA 203.0.113.2 CoA 203.0.113.2 int Cellular0/0/0**

**MobRtr: Delete default route (Tunnel0)**

**MobRtr: Delete host route to HA 203.0.113.10 via 203.0.113.2 (Cellular0/0/0)**

**MobRtr: Status Registered -> Isolated**

**MobRtr: Delete tunnel Tunnel0 s x.x.x.x d 203.0.113.10**

- Mobile Node sends the ID to the FA in order to establish the new Tunnel.

**HA entry 203.0.113.10 updated with RegID E820BF2C**

**MobRtr: Register to FA 203.0.113.2 CoA 203.0.113.2 home x.x.x.x HA 203.0.113.10 life 36000 int Cellular0/0/0 flag sbdmGT cnt 0 id E820BF2C.2AEC80C8**

## MobRtr: Status Isolated -> Pending

- Mobile Node receives code 0 from the HA and registers this connection, creating the host route towards the MN and HA. Once the Tunnel is created, the default route is sent to the HA.

**MobRtr: MN rcv accept (0) reply on Cellular0/0/0 from 203.0.113.2 lifetime 36000 id E820BF2C.2AEC80C8**

**MobRtr: Status Pending -> Registered**

**MobRtr: Add host route to HA 203.0.113.10 via 203.0.113.2 (Cellular0/0/0) 0**

**MobRtr: Add default route via 203.0.113.2 (Tunnel0) 0**

5- Proceed with an Embedded Packet Capture (EPC) in control-plane and validate the packets from the MN to the FA and vice versa.

No.	Time	Source	Destination	seq	Details
2023-07-09 19:45:15.802224	X.X.X.X	203.0.113.1	Reg Request: HoA=	HA=203.	
2023-07-09 19:45:15.803968	203.0.113.1	X.X.X.X	Reg Reply: HoA=	HA=203.	
2023-07-09 19:47:28.802092	X.X.X.X	203.0.113.1	Reg Request: HoA=	HA=203.	
2023-07-09 19:47:28.812184	203.0.113.1	X.X.X.X	Reg Reply: HoA=	HA=203.	
2023-07-09 19:47:57.814295	X.X.X.X	203.0.113.1	Reg Request: HoA=	HA=203.	
2023-07-09 19:47:57.824722	203.0.113.1	X.X.X.X	Reg Reply: HoA=	HA=203.	
2023-07-09 19:47:58.810516	X.X.X.X	203.0.113.1	Reg Request: HoA=	HA=203.	
2023-07-09 19:47:58.820862	203.0.113.1	X.X.X.X	Reg Reply: HoA=	HA=203.	
2023-07-09 19:50:37.807838	X.X.X.X	203.0.113.1	Reg Request: HoA=	HA=203.	
2023-07-09 19:50:37.818144	203.0.113.1	X.X.X.X	Reg Reply: HoA=	HA=203.	
2023-07-09 19:50:41.801935	X.X.X.X	203.0.113.1	Reg Request: HoA=	HA=203.	
2023-07-09 19:50:41.812436	203.0.113.1	X.X.X.X	Reg Reply: HoA=	HA=203.	
2023-07-09 19:51:00.806197	X.X.X.X	203.0.113.1	Reg Request: HoA=	HA=203.	
2023-07-09 19:51:00.816672	203.0.113.1	X.X.X.X	Reg Reply: HoA=	HA=203.	
2023-07-09 19:51:18.804445	X.X.X.X	203.0.113.1	Reg Request: HoA=	HA=203.	
2023-07-09 19:51:18.814709	203.0.113.1	X.X.X.X	Reg Reply: HoA=1	HA=203.	

> Frame 73: 62 bytes on wire (496 bits), 62 bytes captured (496 bits) on interface -, id 0  
> Ethernet II, Src: ca:02:16:09:00:38 (ca:02:16:09:00:38), Dst: ca:03:15:c8:00:38 (ca:03:15:c8:00:38)  
> Internet Protocol Version 4, Src: 203.0.113.1, Dst:  
> User Datagram Protocol, Src Port: 434, Dst Port: 434  
v Mobile IP  
  Message Type: Registration Reply (3)  
  Reply Code: Reg Deny (FA)- Home Network Unreachable (80)  
  Lifetime: 3600  
  Home Address:   
  Home Agent: 203.0.113.10  
  Identification: Jul 10, 2023 01:45:15.535851720 UTC

In the capture, the MN sends a request. The HA does not receive the response, as a consequence, the FA replies with code 80 with the network unreachable.

**Tip:** Refer to the value codes at the end of this document.

In this scenario, the problem is with the ISP path being unstable. The communication between the HA and the FA is not stable, and is not creating the tunnel between them to deliver the packets.

## Value Codes

Value Codes	Description
0	Registration Accepted
<b>Registration Denied   Foreign Agent</b>	
64	Reason Unspecified
65	Administratively Prohibited
66	Insufficient Resources
67	Mobile Node Failed Authentication
68	Home Agent Failed Authentication
69	Requested Lifetime too long
70	Poorly Formed Request
71	Poorly Formed Reply
72	Requested Encapsulation Unavailable
73	Reserved and Unavailable
77	Invalid care-of Address
78	Registration Timeout
80	Home Network Unreachable ( ICMP error received )
81	Home Agent Host Unreachable ( ICMP error received )
82	Home Agent Port Unreachable ( ICMP error received )
88	Home Agent Unreachable ( other ICMP error received )