Locator Identifier Separation Protocol (LISP) Mobility Troubleshooting Guide

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LISP Mobility Troubleshooting Guide

This document outlines and describes some basic troubleshooting steps for implementation of the Locator/ID Separation Protocol (LISP) with EID mobility. This guide assumes basic knowledge of IOS, NX-OS, and LISP.

LISP Terminology

ASM—across subnet mode; allows for EID mobility between LISP sites without a Layer 2 extension in place

EID—end-point identifier; IP address of host who's traffic will be encapsulated and sent using LISP

ESM—extended subnet mode; allows for EID mobility between LISP sites but requires a Layer 2 extension between LISP sites

Map-Notify—message used by an xTR that has detected an EID to update the other xTRs in the same LISP site about that discovery; also used by the map-server to confirm that a map-register has been received and processed

Map-Register—used by an xTR to register an EID with the map-server

RLOC—routing locator; IP address of xTR that outer encapsulation layer should be addressed to reach EID

SMR—solicit-map-request; control plane message used to tell remote xTRs to update the mappings they have cached

xTR—ingress/egress tunnel router; router responsible for encapsulating/decapsulating EID packets

Map-Server—receives map-register messages from xTRs and maintains database of EID to RLOC mappings

Basic Verification and Sanity Checks

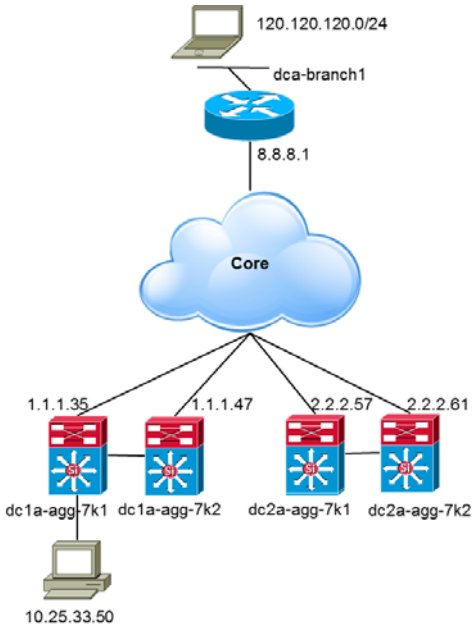
This section explains how LISP EID mobility functions when working correctly and walks through a migration of an EID between two LISP sites. These steps will help verify that a LISP installation is working as expected.

Note All procedures in this document use appropriate corresponding IOS and NX-OS commands accompanied by configuration examples.

ESM

This section walks through a migration of an EID in Extended Subnet Mode and verifies that all LISP components are working correctly. In this example, there are two data center sites that will be hosting the EID and a branch site with traffic to the EID that will be LISP encapsulated. The two data centers are connected together with a Layer 2 extension (Figure 1-1).

Figure 1-1 Branch Site Migration to a LISP Encapsulated EID



Step 1 With the EID in the first LISP site, start a ping from the EID to a remote branch site. Verify that the dynamic EID is present in the **show lisp dynamic-eid summary** output on the xTRs in that site.

```
dc1a-agg-7k1# show lisp dynamic-eid summary
LISP Dynamic EID Summary for VRF "default"
* = Dyn-EID learned by site-based Map-Notify
Dyn-EID Name    Dynamic-EID      Interface      Uptime    Last      Pending
                                                          Packet    Ping Count
EXTVLAN2533-1   10.25.33.50      Vlan2533       5d21h     5d21h     0
```

Step 2 The originating LISP site should have a LISP host route for the EID.

```
dc1a-agg-7k1# show ip route 10.25.33.50
IP Route Table for VRF "default"
'*' denotes best ucast next-hop
'**' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]

10.25.33.50/32, ubest/mbest: 1/0, attached
    *via 10.25.33.50, Vlan2533, [251/0], 00:00:30, lisp, dyn-eid
```

Step 3 The destination LISP site where the EID will be migrated should have a host null route installed for the EID.

```
dc2a-agg-7k1# show ip route 10.25.33.50
IP Route Table for VRF "default"
'*' denotes best ucast next-hop
```

```
'**' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]

10.25.33.50/32, ubest/mbest: 1/0, attached
    *via Null0, [252/0], 00:00:15, lisp, dyn-eid
```

Step 4 The dynamic EID should also be registered on the map-server with the correct RLOC addresses. Verify with **show lisp site detail**.

```
dc1a-agg-7k1-otv# show lisp site DATACENTER detail
LISP Site Registration Information for VRF "default"
* = truncated IPv6 address, -x = more-specifics count

Site name:   "DATACENTER"
Description: LISP site DATACENTER; key dci
Allowed configured locators: any
  Configured EID-prefix: 10.25.0.0/16, instance-id: 0
    More-specifics registered: 4
    Currently registered:      yes
    First registered:          2w1d
    Last registered:           00:00:42
    Who last registered:       1.1.1.47
    Routing table tag:         0
    Proxy Replying:            no
    Wants Map-Notifications:   yes
    Registered TTL:            1440 minutes
    Registered locators:
      1.1.1.35 (up), priority: 1, weight: 10
      1.1.1.47 (up), priority: 1, weight: 10
    Registration errors:
      Authentication failures: 0
      Allowed locators mismatch: 0
  More-specific EID-prefix: 10.25.33.50/32, instance-id: 0
    Currently registered:      yes
    First registered:          1w5d
    Last registered:           00:00:45
    Who last registered:       20.1.1.2
    Routing table tag:         0
    Proxy Replying:            no
    Wants Map-Notifications:   yes
    Registered TTL:            1440 minutes
    Registered locators:
      1.1.1.35 (up), priority: 1, weight: 10
      1.1.1.47 (up), priority: 1, weight: 10
    Registration errors:
      Authentication failures: 0
      Allowed locators mismatch: 0
```

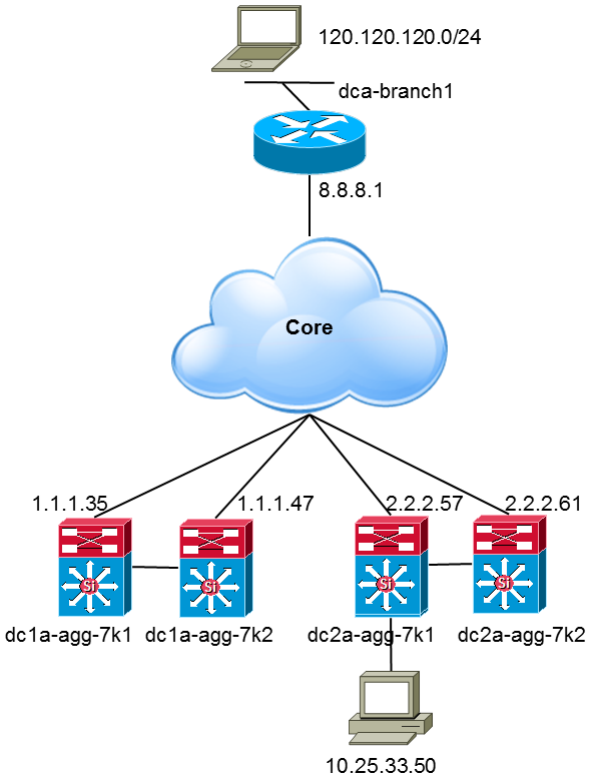
Step 5 Check the map-cache on the relevant xTRs and verify that the RLOC addresses are correct.

```
dc1a-agg-7k1# show ip lisp map-cache
LISP IP Mapping Cache for VRF "default" (iid 0), 1 entries
* = Locator data counters are cumulative across all EID-prefixes

120.120.120.0/24, uptime: 6d16h, expires: 07:26:34, via map-reply, auth
  Locator  Uptime    State       Priority/  Data     Control
                                 Weight     in/out   in/out
  8.8.8.1  6d16h     up          1/100      20937/   0/0


dca-branch1#show ip lisp map-cache
LISP IPv4 Mapping Cache for EID-table default (IID 0), 3 entries

0.0.0.0/0, uptime: 5d20h, expires: never, via static send map-request
```

```
  Negative cache entry, action: send-map-request
10.25.33.50/32, uptime: 5d20h, expires: 23:59:29, via map-reply, complete
  Locator   Uptime    State      Pri/Wgt
  1.1.1.35  5d20h     up           1/10
  1.1.1.47  5d20h     up           1/10
16.0.0.0/4, uptime: 00:29:08, expires: 00:00:37, via map-reply, forward-native
  Negative cache entry, action: forward-native
```

Step 6 Perform a migration of the EID to the other LISP site (Figure 1-2).. Keep the ping going between the EID and the remote branch site.

Figure 1-2 Branch Site Migration to another LISP Encapsulated EID



Step 7 The EID should now be detected on the xTR in the second site.

```
dc2a-agg-7k1# show lisp dynamic-eid summary
LISP Dynamic EID Summary for VRF "default"
* = Dyn-EID learned by site-based Map-Notify
Dyn-EID Name    Dynamic-EID      Interface      Uptime    Last      Pending
                                                          Packet    Ping Count
EXTVLAN2533-1   10.25.33.50      Vlan2533       00:00:11  00:00:11  0
```

Step 8 The first LISP site should now have a null route for the EID. This null route will stay in the routing table until the EID returns back to the site. This facilitates detection of the EID.

```
dc1a-agg-7k1# show ip route 10.25.33.50
IP Route Table for VRF "default"
'*' denotes best ucast next-hop
'**' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]

10.25.33.50/32, ubest/mbest: 1/0, attached
    *via Null0, [252/0], 00:00:21, lisp, dyn-eid
```

Step 9 The second LISP site where the EID is now located should have a LISP host route for the EID.

```
dc2a-agg-7k1# show ip route 10.25.33.50
IP Route Table for VRF "default"
'*' denotes best ucast next-hop
'**' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]

10.25.33.50/32, ubest/mbest: 1/0, attached
    *via 10.25.33.50, Vlan2533, [250/0], 00:01:46, am
     via 10.25.33.50, Vlan2533, [251/0], 00:01:28, lisp, dyn-eid
```

Step 10 Verify that the map-server has been updated with the correct RLOC address for the EID.

```
dc1a-agg-7k1-otv# show lisp site DATACENTER detail
LISP Site Registration Information for VRF "default"
* = truncated IPv6 address, -x = more-specifics count

Site name:   "DATACENTER"
Description: LISP site DATACENTER; key dci
Allowed configured locators: any
  Configured EID-prefix: 10.25.0.0/16, instance-id: 0
    More-specifics registered: 4
    Currently registered:      yes
    First registered:          2w1d
    Last registered:           00:00:32
    Who last registered:       1.1.1.47
    Routing table tag:         0
    Proxy Replying:            no
    Wants Map-Notifications:   yes
    Registered TTL:            1440 minutes
    Registered locators:
      1.1.1.35 (up), priority: 1, weight: 10
      1.1.1.47 (up), priority: 1, weight: 10
    Registration errors:
      Authentication failures: 0
      Allowed locators mismatch: 0
  More-specific EID-prefix: 10.25.33.50/32, instance-id: 0
    Currently registered:      yes
    First registered:          1w5d
    Last registered:           00:00:24
    Who last registered:       10.35.35.2
    Routing table tag:         0
    Proxy Replying:            no
    Wants Map-Notifications:   yes
    Registered TTL:            1440 minutes
    Registered locators:
      2.2.2.57 (up), priority: 1, weight: 10
      2.2.2.61 (up), priority: 1, weight: 10
    Registration errors:
      Authentication failures: 0
      Allowed locators mismatch: 0
```

Step 11 Finally, the map-cache in the branch site should have been updated to the correct RLOC address.

```
dca-branch1#show ip lisp map-cache
LISP IPv4 Mapping Cache for EID-table default (IID 0), 3 entries

0.0.0.0/0, uptime: 5d21h, expires: never, via static send map-request
  Negative cache entry, action: send-map-request
10.25.33.50/32, uptime: 5d20h, expires: 23:59:38, via map-reply, complete
  Locator   Uptime    State      Pri/Wgt
  2.2.2.57  00:02:12  up           1/10
  2.2.2.61  00:02:12  up           1/10
```

```
16.0.0.0/4, uptime: 00:02:56, expires: 00:11:56, via map-reply, forward-native
  Negative cache entry, action: forward-native
```

Step 12 Now migrate the EID back to the original site. Verify that the xTRs in the original site properly detect the EID and that map-server is updated with the new RLOC address.

```
dc1a-agg-7k1# show lisp dynamic-eid summary
LISP Dynamic EID Summary for VRF "default"
* = Dyn-EID learned by site-based Map-Notify
Dyn-EID Name   Dynamic-EID      Interface     Uptime    Last      Pending
                                                       Packet    Ping Count
EXTVLAN2533-1  10.25.33.50      Vlan2533      00:00:28  00:00:28  0


dc1a-agg-7k1-otv# show lisp site DATACENTER detail
LISP Site Registration Information for VRF "default"
* = truncated IPv6 address, -x = more-specifics count

Site name:   "DATACENTER"
Description: LISP site DATACENTER; key dci
Allowed configured locators: any
  Configured EID-prefix: 10.25.0.0/16, instance-id: 0
    More-specifics registered: 4
    Currently registered:      yes
    First registered:          2w1d
    Last registered:           00:00:39
    Who last registered:       1.1.1.47
    Routing table tag:         0
    Proxy Replying:            no
    Wants Map-Notifications:   yes
    Registered TTL:            1440 minutes
    Registered locators:
      1.1.1.35 (up), priority: 1, weight: 10
      1.1.1.47 (up), priority: 1, weight: 10
    Registration errors:
      Authentication failures: 0
      Allowed locators mismatch: 0
  More-specific EID-prefix: 10.25.33.50/32, instance-id: 0
    Currently registered:      yes
    First registered:          1w5d
    Last registered:           00:00:44
    Who last registered:       20.1.1.2
    Routing table tag:         0
    Proxy Replying:            no
    Wants Map-Notifications:   yes
    Registered TTL:            1440 minutes
    Registered locators:
      1.1.1.35 (up), priority: 1, weight: 10
      1.1.1.47 (up), priority: 1, weight: 10
    Registration errors:
      Authentication failures: 0
      Allowed locators mismatch: 0
```

Step 13 The routing table entries for the EID should now be back as they were originally.

```
dc1a-agg-7k1# show ip route 10.25.33.50
IP Route Table for VRF "default"
'*' denotes best ucast next-hop
'**' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]

10.25.33.50/32, ubest/mbest: 1/0, attached
    *via 10.25.33.50, Vlan2533, [251/0], 00:00:20, lisp, dyn-eid
```

```
dc2a-agg-7k1# show ip route 10.25.33.50
IP Route Table for VRF "default"
'*' denotes best ucast next-hop
'**' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]

10.25.33.50/32, ubest/mbest: 1/0, attached
    *via Null0, [252/0], 00:00:15, lisp, dyn-eid
```

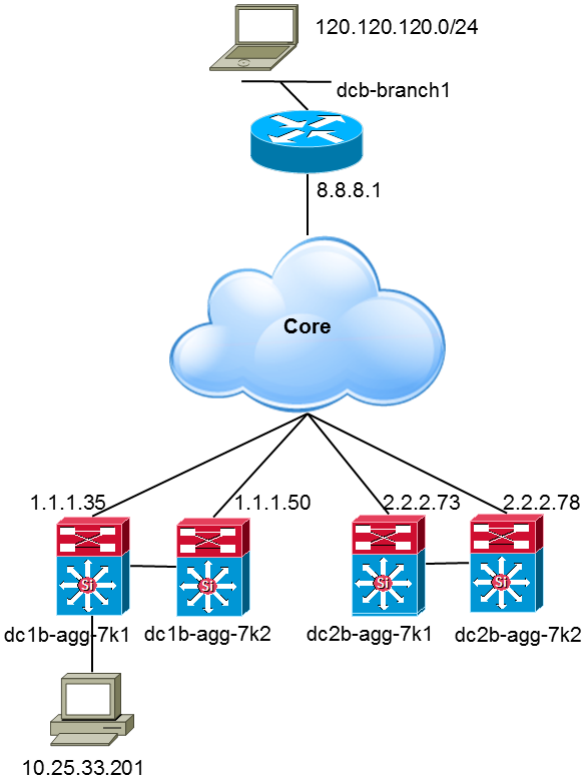
Step 14 Finally, verify that the map-cache on the branch also got updated.

```
dca-branch1#show ip lisp map-cache
LISP IPv4 Mapping Cache for EID-table default (IID 0), 3 entries

0.0.0.0/0, uptime: 5d21h, expires: never, via static send map-request
  Negative cache entry, action: send-map-request
10.25.33.50/32, uptime: 5d21h, expires: 23:59:28, via map-reply, complete
  Locator   Uptime    State      Pri/Wgt
  1.1.1.35  00:03:22  up           1/10
  1.1.1.47  00:03:22  up           1/10
16.0.0.0/4, uptime: 00:08:32, expires: 00:06:20, via map-reply, forward-native
  Negative cache entry, action: forward-native
```

ASM

This section walks through a migration of an EID in Across Subnet Mode and verifies that all of the LISP components are working correctly (Figure 1-3). In this example, there are two datacenter sites that will be hosting the EID and a branch site whose traffic to the EID will be LISP encapsulated. The first data center will be the home site (i.e. location where EID's subnet is located) and the second data center will be the remote site. The two data centers only have Layer 3 connectivity and do not have a Layer 2 extension.

Figure 1-3 Branch Site Migration to a LISP Encapsulated EID



Step 1 With the EID in the home LISP site, start a ping from the EID to a remote branch site. Verify that the dynamic EID is not present in the **show lisp dynamic-eid summary** output.

```
dc1b-agg-7k1# show lisp dynamic-eid summary
LISP Dynamic EID Summary for VRF "default"
* = Dyn-EID learned by site-based Map-Notify
Dyn-EID Name   Dynamic-EID      Interface     Uptime    Last      Pending
                                                       Packet    Ping Count
```

Step 2 The routing table for the home site should only have a directly connected route for the EID.

```
dc1b-agg-7k1# show ip route 10.25.33.201
IP Route Table for VRF "default"
'*' denotes best ucast next-hop
'**' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]

10.25.33.0/24, ubest/mbest: 1/0, attached
    *via 10.25.33.253, Vlan3633, [0/0], 00:02:12, direct
```

Step 3 The routing table for the remote site should have general null route installed.

```
dc2b-agg-7k1# show ip route 10.25.33.201
IP Route Table for VRF "default"
'*' denotes best ucast next-hop
'**' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]

10.25.33.0/24, ubest/mbest: 1/0
    *via Null0, [251/0], 2w0d, lisp, dyn-eid
```

Step 4 Also, the dynamic EID will not be registered on the map-server. Verify with the **show lisp site detail** output. Note that this output has a more general 10.25.0.0/16 prefix registered but not one specifically for the EID.

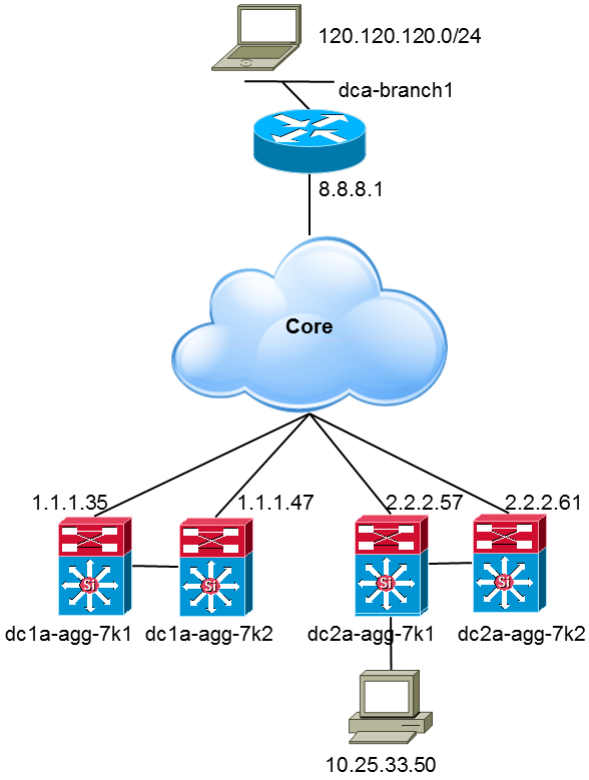
```
dc1b-agg-7k1# show lisp site DATACENTER detail
LISP Site Registration Information for VRF "default"
* = truncated IPv6 address, -x = more-specifics count

Site name:   "DATACENTER"
Description: LISP site DATACENTER; key dci
Allowed configured locators: any
  Configured EID-prefix: 10.25.0.0/16, instance-id: 0
    More-specifics registered: 0
    Currently registered:      yes
    First registered:          never
    Last registered:           00:00:01
    Who last registered:       1.1.1.35
    Routing table tag:         0
    Proxy Replying:            no
    Wants Map-Notifications:   yes
    Registered TTL:            1440 minutes
    Registered locators:
      1.1.1.35 (up), priority: 1, weight: 10
      1.1.1.50 (up), priority: 1, weight: 10
    Registration errors:
      Authentication failures: 0
      Allowed locators mismatch: 0
```

Step 5 Check the map-cache on the relevant xTRs and verify that the RLOC addresses are correct. In this case, traffic sent to the EID from the branch will leverage the 10.25.0.0/16 prefix.

```
dc1b-agg-7k1# show ip lisp map-cache
LISP IP Mapping Cache for VRF "default" (iid 0), 1 entries
* = Locator data counters are cumulative across all EID-prefixes

120.120.120.0/24, uptime: 1w1d, expires: 23:20:13, via map-reply, auth
  Locator  Uptime    State       Priority/  Data     Control
                                 Weight     in/out   in/out
  8.8.8.1  1w1d      up          1/100      25248/   0/0

dcb-branch1#show ip lisp map-cache
LISP IPv4 Mapping Cache, 3 entries

0.0.0.0/0, uptime: 1w1d, expires: never, via static
  Negative cache entry, action: send-map-request
10.25.0.0/16, uptime: 1w1d, expires: 23:59:31, via map-reply, complete
  Locator   Uptime    State      Pri/Wgt
  1.1.1.35  1w1d      up           1/10
  1.1.1.50  1w1d      up           1/10
16.0.0.0/4, uptime: 00:12:45, expires: 00:02:07, via map-reply, forward-native
  Negative cache entry, action: forward-native
```

Step 6 Perform a migration of the EID to the remote LISP site (Figure 1-4). Keep the ping going between the EID and the remote branch site.

Figure 1-4 Branch Site Migration to another LISP Encapsulated EID



Step 7 The EID should now be detected on the xTR in the remote site.

```
dc2b-agg-7k1# show lisp dynamic-eid summary
LISP Dynamic EID Summary for VRF "default"
* = Dyn-EID learned by site-based Map-Notify
Dyn-EID Name   Dynamic-EID      Interface     Uptime    Last      Pending
                                                       Packet    Ping Count
NETWORK_10.25. 10.25.33.201     Vlan3633      00:00:46  00:00:46  0
```

Step 8 The routing table on the home site should now have a null route installed for the EID.

```
dc1b-agg-7k1# show ip route 10.25.33.201
IP Route Table for VRF "default"
'*' denotes best ucast next-hop
'**' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]

10.25.33.201/32, ubest/mbest: 1/0, attached
    *via Null0, [252/0], 00:00:31, lisp, dyn-eid
```

Step 9 The routing table on the remote site should have a LISP route installed for the EID.

```
dc2b-agg-7k1# show ip route 10.25.33.201
IP Route Table for VRF "default"
'*' denotes best ucast next-hop
'**' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]

10.25.33.201/32, ubest/mbest: 1/0, attached
    *via 10.25.33.201, Vlan3633, [251/0], 00:01:01, lisp, dyn-eid
```

Step 10 The EID should now be registered on the map-server with the correct RLOC.

```
dc1b-agg-7k1# show lisp site DATACENTER detail
LISP Site Registration Information for VRF "default"
* = truncated IPv6 address, -x = more-specifics count

Site name:   "DATACENTER"
Description: LISP site DATACENTER; key dci
Allowed configured locators: any
  Configured EID-prefix: 10.25.0.0/16, instance-id: 0
    More-specifics registered: 1
    Currently registered:      yes
    First registered:          never
    Last registered:           00:00:18
    Who last registered:       1.1.1.35
    Routing table tag:         0
    Proxy Replying:            no
    Wants Map-Notifications:   yes
    Registered TTL:            1440 minutes
    Registered locators:
      1.1.1.35 (up), priority: 1, weight: 10
      1.1.1.50 (up), priority: 1, weight: 10
    Registration errors:
      Authentication failures: 0
      Allowed locators mismatch: 0
  More-specific EID-prefix: 10.25.33.201/32, instance-id: 0
    Currently registered:      yes
    First registered:          00:01:14
    Last registered:           00:00:15
    Who last registered:       10.35.35.2
    Routing table tag:         0
    Proxy Replying:            no
    Wants Map-Notifications:   yes
    Registered TTL:            1440 minutes
    Registered locators:
      2.2.2.73 (up), priority: 1, weight: 10
      2.2.2.78 (up), priority: 1, weight: 10
    Registration errors:
      Authentication failures: 0
      Allowed locators mismatch: 0
```

Step 11 Finally, the map-cache in the branch site should have been updated to the correct RLOC address.

```
dcb-branch1#show ip lisp map-cache
LISP IPv4 Mapping Cache, 4 entries

0.0.0.0/0, uptime: 1w1d, expires: never, via static
  Negative cache entry, action: send-map-request
10.25.0.0/16, uptime: 1w1d, expires: 23:59:34, via map-reply, complete
  Locator   Uptime    State      Pri/Wgt
  1.1.1.35  1w1d      up           1/10
  1.1.1.50  1w1d      up           1/10
10.25.33.201/32, uptime: 00:02:02, expires: 23:59:52, via map-reply, complete
  Locator   Uptime    State      Pri/Wgt
  2.2.2.73  00:02:02  up           1/10
  2.2.2.78  00:02:02  up           1/10
16.0.0.0/4, uptime: 00:22:53, expires: 00:06:52, via map-reply, forward-native
  Negative cache entry, action: forward-native
```

Step 12 Now migrate the EID back to the home site. Initially, the EID will be detected by the xTR in the home site and will be registered on the map-server, but these will time out within approximately five minutes.

```
dc1b-agg-7k1# show lisp dynamic-eid summary
LISP Dynamic EID Summary for VRF "default"
* = Dyn-EID learned by site-based Map-Notify
Dyn-EID Name   Dynamic-EID      Interface     Uptime    Last      Pending
```

```
                                                          Packet    Ping Count
NETWORK_10.25. 10.25.33.201     Vlan3633      00:00:41  00:00:39  0

dc1b-agg-7k1# show lisp site DATACENTER detail
LISP Site Registration Information for VRF "default"
* = truncated IPv6 address, -x = more-specifics count

Site name:   "DATACENTER"
Description: LISP site DATACENTER; key dci
Allowed configured locators: any
  Configured EID-prefix: 10.25.0.0/16, instance-id: 0
    More-specifics registered: 1
    Currently registered:      yes
    First registered:          never
    Last registered:           00:00:35
    Who last registered:       1.1.1.35
    Routing table tag:         0
    Proxy Replying:            no
    Wants Map-Notifications:   yes
    Registered TTL:            1440 minutes
    Registered locators:
      1.1.1.35 (up), priority: 1, weight: 10
      1.1.1.50 (up), priority: 1, weight: 10
    Registration errors:
      Authentication failures: 0
      Allowed locators mismatch: 0
  More-specific EID-prefix: 10.25.33.201/32, instance-id: 0
    Currently registered:      yes
    First registered:          00:00:26
    Last registered:           00:00:26
    Who last registered:       19.98.1.2
    Routing table tag:         0
    Proxy Replying:            no
    Wants Map-Notifications:   yes
    Registered TTL:            1440 minutes
    Registered locators:
      1.1.1.35 (up), priority: 1, weight: 10
      1.1.1.50 (up), priority: 1, weight: 10
    Registration errors:
      Authentication failures: 0
      Allowed locators mismatch: 0
```

Step 13 The null route at the home site should be replaced by a LISP route for the EID. However, these entries will also time out within approximately five minutes and will be replaced by a directly connected route.

```
dc1b-agg-7k1# show ip route 10.25.33.201
IP Route Table for VRF "default"
'*' denotes best ucast next-hop
'**' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]

10.25.33.201/32, ubest/mbest: 1/0, attached
    *via 10.25.33.201, Vlan3633, [250/0], 00:00:15, am
     via 10.25.33.201, Vlan3633, [251/0], 00:00:15, lisp, dyn-eid
```

Step 14 The specific LISP route should have been removed on the remote site leaving the general LISP null route.

```
dc2b-agg-7k1# show ip route 10.25.33.201
IP Route Table for VRF "default"
'*' denotes best ucast next-hop
'**' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]
```

```
10.25.33.0/24, ubest/mbest: 1/0
    *via Null0, [251/0], 2w0d, lisp, dyn-eid

Finally, verify that the map-cache on the branch also got updated. Note that the
specific EID entry will time out after 24 hours.
dcb-branch1#show ip lisp map-cache
LISP IPv4 Mapping Cache, 4 entries

0.0.0.0/0, uptime: 00:10:48, expires: never, via static
  Negative cache entry, action: send-map-request
10.25.0.0/16, uptime: 00:10:48, expires: 23:59:47, via map-reply, complete
  Locator   Uptime    State      Pri/Wgt
  1.1.1.35  00:10:48  up           1/10
  1.1.1.50  00:10:48  up           1/10
10.25.33.201/32, uptime: 00:02:49, expires: 23:59:43, via map-reply, complete
  Locator   Uptime    State      Pri/Wgt
  1.1.1.35  00:00:09  up           1/10
  1.1.1.50  00:00:09  up           1/10
16.0.0.0/4, uptime: 00:08:30, expires: 00:06:22, via map-reply, forward-native
  Negative cache entry, action: forward-native
```

LISP Debugs

The following LISP debugs are helpful in troubleshooting issues.

NX-OS

- **debug ip lisp mapping control**
- **debug lisp mapping register**
- **debug lisp smr**
- **debug lisp ha**
- **debug lisp loc-reach-algorithm receive-probe**
- **debug lisp loc-reach-algorithm send-probe**
- **debug ip mroute** *map_notify_addr*/**32 detail**
- **debug ip lisp mapping data**

IOS

- **debug lisp control-plane all**

Show Commands

NX-OS/IOS

- **show ip lisp**—view LISP status and configuration
- **show ip lisp map-cache**—view LISP mapping cache
- **show lisp site detail**—view configured LISP sites on map-server and see registered locators for those sites
- **show ip route lisp**—displays routes that LISP process has entered into routing table

- **show ip route** *eid_addr*—verify correct routes have been installed into routing table for EID
- **show ip mroute**—verify that the xTR has mroutes for all of the map-notify-groups

NX-OS

- **show run lisp**—view LISP related configuration
- **show lisp dynamic-eid summary**—look at dynamic EIDs that have been detected on the xTR
- **show forwarding route vrf all**—verify that forwarding tables are programed correctly for LISP routes
- **show lisp internal event-history** *options*—displays log of internal LISP events

Common Issues

This section outlines common issues that may be faced with LISP and possible resolutions to those issues.

Branch SMR Update

It's possible that at some point an SMR message might not be received or acted upon correctly by an xTR router, and the RLOC data in the affected router's map-cache will become stale, resulting in black-holing of traffic due to the incorrect mapping. If you suspect this to be the case, the following procedure may help identify and clear problematic mapping data.

Step 1 Displays the map-cache data. If you know that all of your severs are located in "Site 1", but one of the servers still shows as being in "Site 2", you have a stale map-cache entry that should be cleared.

show ip lisp map-cache

Step 2 Clear the stale map-cache entry to allow a new SMR process to take place and update the mapping-data.

clear ip lisp map-cache *ip_address/netmask*

ip address *ip_addr/mask*

```
lisp-router# clear ip lisp map-cache 10.25.33.50/32
```

Step 3 Displays the map-cache data. After clearing the old map-cache data, a new SMR process should have been initiated and the RLOC should be updated to show it is now in "Location A".

show ip lisp map-cache

Example

In this example, the EIDs are located in the first LISP site and should be mapped to RLOCs 1.1.1.35 and 1.1.1.47. However, the lisp map-cache on the branch router still has the RLOC for the second site for EID 10.25.33.50/32.

```
dca-branch1#show ip lisp map-cache
LISP IPv4 Mapping Cache for EID-table default (IID 0), 5 entries

0.0.0.0/0, uptime: 6d00h, expires: never, via static send map-request
  Negative cache entry, action: send-map-request
10.25.33.50/32, uptime: 6d00h, expires: 23:59:44, via map-reply, complete
  Locator   Uptime    State      Pri/Wgt
```

```
  2.2.2.57  03:25:04  up           1/10
  2.2.2.61  03:25:04  up           1/10
10.25.35.50/32, uptime: 00:00:42, expires: 23:59:10, via map-reply, complete
  Locator   Uptime    State      Pri/Wgt
  1.1.1.35  00:00:42  up           1/10
  1.1.1.47  00:00:42  up           1/10
10.25.55.50/32, uptime: 00:00:18, expires: 23:59:35, via map-reply, complete
  Locator   Uptime    State      Pri/Wgt
  1.1.1.35  00:00:18  up           1/10
  1.1.1.47  00:00:18  up           1/10
10.25.57.50/32, uptime: 00:00:03, expires: 23:59:49, via map-reply, complete
  Locator   Uptime    State      Pri/Wgt
  1.1.1.35  00:00:03  up           1/10
  1.1.1.47  00:00:03  up           1/10

dca-branch1#clear ip lisp map-cache 10.25.33.50/32

dca-branch1#show ip lisp map-cache
LISP IPv4 Mapping Cache for EID-table default (IID 0), 6 entries

0.0.0.0/0, uptime: 6d00h, expires: never, via static send map-request
  Negative cache entry, action: send-map-request
10.25.33.50/32, uptime: 00:00:13, expires: 23:59:39, via map-reply, complete
  Locator   Uptime    State      Pri/Wgt
  1.1.1.35  00:00:13  up           1/10
  1.1.1.47  00:00:13  up           1/10
10.25.35.50/32, uptime: 00:07:35, expires: 23:57:11, via map-reply, complete
  Locator   Uptime    State      Pri/Wgt
  1.1.1.35  00:07:35  up           1/10
  1.1.1.47  00:07:35  up           1/10
10.25.55.50/32, uptime: 00:07:11, expires: 23:58:42, via map-reply, complete
  Locator   Uptime    State      Pri/Wgt
  1.1.1.35  00:07:11  up           1/10
  1.1.1.47  00:07:11  up           1/10
10.25.57.50/32, uptime: 00:06:56, expires: 23:59:35, via map-reply, complete
  Locator   Uptime    State      Pri/Wgt
  1.1.1.35  00:06:56  up           1/10
  1.1.1.47  00:06:56  up           1/10
16.0.0.0/4, uptime: 00:06:46, expires: 00:08:06, via map-reply, forward-native
  Negative cache entry, action: forward-native
```

Dynamic EID Not Detected by xTR

Dynamic EID discovery relies on Unicast Reverse Path Forwarding (URPF) to detect whether a specific EID is located in a given LISP site. This is accomplished by the LISP process installing a null route to the EID in the routing table. When a packet originates from the EID, the xTR performs a URPF check to verify that there is a corresponding return route to the EID on the interface where the packet was received. In the case of a null route, an exception is raised. This exception causes the initial packet to be punted to the supervisor so that the LISP process on the xTR can handle the EID learning process, populate the map-cache, update the map-server, and install a LISP route into the routing table of the switch.

Verify URPF is Enabled

The following procedure verifies that URPF is enabled.

Step 1 Connect to module where EID traffic enters to be LISP encapsulated.

attach module *module_num*

```
switch# attach module 3
```

Step 2 View internal hardware forwarding information.

show hardware internal forwarding *interface interface*

```
module-3# show hardware internal forwarding interface vlan 3633
```

Step 3 Verify that reverse path forwarding is enabled.

Verify that **v4_rpf_mode** is set to one.

Example if URPF Enablement

```
dc1b-agg-7k1# attach module 3
Attaching to module 3 ...
To exit type 'exit', to abort type '$.'
module-3# show hardware internal forwarding interface vlan 3633
Software Tables:
  Interface = Vlan3633 VDC(1) VLAN(3633) LIF = 0x94
  State(up)

Hardware Tables:
Note: Below L2-LIF entry may not be valid for some ports
Instance: 0x1
L2-LIF entry with index = 0xe231
  pt_cam_en = 1 ipv4_igmp_snoop = 1 ipv4_pim_snoop = 0 ipv6_mld_snoop = 0
  ipv6_pim_snoop = 0 bd = 0x94 l2v4 = 0 ingr_lif = 0x94
  hdr_gm_en = 0 dsm = 0 ipv4_en = 1 ipv6_en = 1
  l2l3_lkup_cfg = 1 mpls_en = 1 sm_en = 0 red_ids_chk_fail_en = 1
  ldb_rbh_en = 0 age_tmr_sel = 1 bndl_port = 0 dl_np = 0
  dl_p = 0 dnl = 0 eompls_bd = 0 nf_en = 0
  dff = 0 dmn = 1 multi_miss_cap1 = 1 uni_miss_cap1 = 0

L3-INGRESS-LIF entry with index = 0x94
  v6_rpf_mode = 0 ecc = 23 v6_vpn = 1 v6_rpfv3_en = 0
  ipv6_en = 0 v6_sgt_prio = 0 v6_dgt_prio = 0 expl_null_rpf_en = 0
  per_pkt_ls_en = 0 no_stats = 0 v4_sgt_prio = 3 v4_dgt_prio = 1
  diag = 0 trust_lif = 0 tunnel_lif = 0 df_mask = 0x0
  f_index = 0 non_ipv6_vpn = 1 mpls_vpn_sel = 0 mpls_vpn_acl_en = 0
  v4_rpfv3_en = 0 ipv4_en = 1 eompls_en = 0 mpls_en = 0
  ipv4_mcast_en = 1 v4_rpf_mode = 1 qppb_recirc_en = 0 qppb_dest_en = 0
  bd_lif = 1 eompls_p2p = 0 ipv6_mcast_en = 0 mac_ip_chk_ipv4 = 0
  mac_ip_chk_ipv6 = 0 cpp_en = 1 group_en = 0 acl_en = 0
  qos_en = 0 acct_en = 0 l2_acl_en = 0 l2_cos_sel = 0
  recirc_id = 0 lif_label_b = 0 lif_label_a = 0 base_policer_id = 0
  mut_map_index = 0 ilm_trig = 0 base_acct_id = 0

L3-EGRESS-LIF entry with index = 0x94
  ecc = 406 v6_same_if_check = 1 entry_type = 0 egress_vlan = 3633
  dest_index = 0x0 flood = 0 mtu_index = 0 v4_same_if_check = 2
  frr_link_down = 0 frr_node_down = 0 use_mpls_key_a = 0 use_mpls_key_b = 0
  cpp_lif = 0 group_en = 0 acl_en = 0 qos_en = 1
  acct_en = 0 l2_acl_en = 0 l2_cos_sel = 0 recirc_id = 0
  lif_label_b = 0 lif_label_a = 0 base_policer_id = 0 mut_map_index = 0
  elm_trig = 0 base_acct_id = 0
```

Incorrect ARP Entries for EIDs

Another issue that can be encountered is an incorrect ARP entry for the EID host. For example, the HSRP MAC address may incorrectly be present in the ARP table for the EID host. Verify that the ARP table contains the correct MAC address for the EID.

Clear Invalid ARP Entry

The following procedure clears an invalid ARP entry.

Step 1 Display ARP table entry for EID address.

show ip arp *eid_addr*

```
switch# show ip arp 10.25.33.50
```

Step 2 Verify that MAC address is correct for EID. If MAC address is incorrect, then delete the entry from the ARP table as specified in step 3.

Step 3 Delete invalid ARP entry.

clear ip arp *eid_addr*

```
switch# clear ip arp 10.25.33.50
```

Example of Invalid ARP Entry

```
dc1a-agg-7k2# show ip arp 10.25.33.50
show ip arp 10.25.35.50

Flags: * - Adjacencies learnt on non-active FHRP router
       + - Adjacencies synced via CFSoE
       # - Adjacencies Throttled for Glean
       D - Static Adjacencies attached to down interface

IP ARP Table
Total number of entries: 1
Address         Age       MAC Address     Interface
10.25.33.50     00:00:32  0000.0c07.ac01  Vlan2533
```

Incorrect Host Routes for EIDs

The proper host routes will need to be installed into the routing table by the LISP process in order for EID mobility to function correctly. Please read the “Basic Verification and Sanity Checks” section above for information on what routes should be installed in the routing table for the EID.

When an EID host is migrated away from a site, the LISP process should install a null route. This null route facilitates the URPF EID detection scheme outlined above.

```
dc1a-agg-7k2# show ip route 10.25.33.50
    IP Route Table for VRF "default"
    '*' denotes best ucast next-hop
    '**' denotes best mcast next-hop
    '[x/y]' denotes [preference/metric]

    10.25.33.50/32, ubest/mbest: 1/0, attached
        *via Null0, [252/0], 00:00:44, lisp, dyn-eid
```

Here is an example of a failure where a null route was added but the adjacency manager route was not removed. As a result, the URPF check will not be performed when the EID returns to the site, and the EID will not be detected.

```
dc1b-agg-7k2# show ip route 10.25.33.201
IP Route Table for VRF "default"
'*' denotes best ucast next-hop
'**' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]

10.25.33.201/32, ubest/mbest: 1/0, attached
   *via 10.25.33.201, Vlan3633, [250/0], 00:09:21, am
    via Null0, [252/0], 00:09:22, lisp, dyn-eid
```

In the event that incorrect routes show up, a couple of corrective actions can be taken. First, try to clear the offending routes from the routing table. Second, try clearing the map-cache on the xTR.

Step 1 View the routing table entries that apply to the EID. Note any that are incorrect.

show ip route eid_addr

```
switch# show ip route 10.25.33.201
```

Step 2 Clear any host routes for the EID.

clear ip route eid_addr

```
switch# clear ip route 10.25.33.201
```

Step 3 Generate traffic on the EID and verify that EID is detected. If it is not, then proceed to step 4.

show lisp dynamic-eid summary

Step 4 Clear the map-cache on the xTR where the dynamic EID should be detected. Warning this command could adversely affect other LISP traffic.

clear ip lisp map-cache

Step 5 Generate traffic on the EID and verify that EID is detected.

show lisp dynamic-eid summary

Path MTU Discovery

Because LISP adds an encapsulation layer, the MTU of the encapsulated packets is slightly reduced. Jumbo frames are currently not supported with LISP. As a result if a host sends a packet of 1500 bytes with the Don't Fragment (DF) bit set, the packet will be dropped. Therefore, Path MTU Discovery (PMTUD) needs to be functioning correctly so that hosts can send packets of correct size. PMTUD relies on ICMP to operate. Therefore, blocking ICMP can break PMTUD.

LISP Data Packet Decode Example

Figure 1-5 shows an example of a packet encapsulated inside of a LISP data packet. An IP header, a UDP header, and a LISP header will be added to the original packet. The outer IP packet will be directly addressed between the xTR routers in this case 10.46.1.1 and 1.1.1.47. For data packets, the UDP layer will use destination port 4341. This results in 36 bytes of added overhead due to the encapsulation.

Figure 1-5 Packet Encapsulated Inside of a LISP Data Packet

```
⊞ Frame 11: 142 bytes on wire (1136 bits), 142 bytes captured (1136 bits)
⊞ Ethernet II, Src: Cisco_49:9f:40 (00:26:0b:49:9f:40), Dst: Cisco_c2:ef:c1 (00:1b:54:c2:ef:c1)
⊞ 802.1Q Virtual LAN, PRI: 0, CFI: 0, ID: 0
⊟ Internet Protocol Version 4, Src: 10.46.1.1 (10.46.1.1), Dst: 1.1.1.47 (1.1.1.47)
    Version: 4
    Header length: 20 bytes
  ⊞ Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00: Not-ECT (Not ECN-Capable Transport))
    Total Length: 120
    Identification: 0xe84e (59470)
  ⊞ Flags: 0x02 (Don't Fragment)
    Fragment offset: 0
    Time to live: 62
    Protocol: UDP (17)
  ⊞ Header checksum: 0x46c8 [correct]
    Source: 10.46.1.1 (10.46.1.1)
    Destination: 1.1.1.47 (1.1.1.47)
⊟ User Datagram Protocol, Src Port: 11819 (11819), Dst Port: lisp-data (4341)
    Source port: 11819 (11819)
    Destination port: lisp-data (4341)
    Length: 100
  ⊞ Checksum: 0x0000 (none)
⊟ Locator/ID Separation Protocol (Data)
  ⊞ Flags: 0xc0
    Nonce: 2843155 (0x2b6213)
    0000 0000 0000 0000 0000 0000 0000 0001 = Locator-Status-Bits: 0x00000001
⊟ Internet Protocol Version 4, Src: 120.120.120.120 (120.120.120.120), Dst: 10.25.33.50 (10.25.33.50)
    Version: 4
    Header length: 20 bytes
  ⊞ Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00: Not-ECT (Not ECN-Capable Transport))
    Total Length: 84
    Identification: 0x0000 (0)
  ⊞ Flags: 0x02 (Don't Fragment)
    Fragment offset: 0
    Time to live: 63
    Protocol: ICMP (1)
  ⊞ Header checksum: 0x1f6e [correct]
    Source: 120.120.120.120 (120.120.120.120)
    Destination: 10.25.33.50 (10.25.33.50)
⊟ Internet Control Message Protocol
    Type: 8 (Echo (ping) request)
    Code: 0
    Checksum: 0x1241 [correct]
    Identifier (BE): 35159 (0x8957)
    Identifier (LE): 22409 (0x5789)
    Sequence number (BE): 37 (0x0025)
    Sequence number (LE): 9472 (0x2500)
    [Response In: 12]
  ⊞ Data (56 bytes)
```

PMTUD Verification

To verify that PMTUD is working correctly, perform a packet capture on the host end-points (Figure 1-6). Start a TCP session and generate traffic. Verify that no packets larger than the path MTU are being sent. If there are packets larger than the path MTU, verify that an ICMP packet (or several) is being received of type 3 (Destination unreachable) and code 4 (Fragmentation needed). The last ICMP packet of this type should have the proper path MTU size in its header. After the host end-point receives this packet, it should start reducing the size of the packets that it sends.

Figure 1-6 PMTUD Verification

```
⊞ Frame 28: 70 bytes on wire (560 bits), 70 bytes captured (560 bits)
⊞ Ethernet II, Src: Cisco_c2:ef:c1 (00:1b:54:c2:ef:c1), Dst: Vmware_95:50:27 (00:50:56:95:50:27)
⊞ Internet Protocol Version 4, Src: 10.25.33.253 (10.25.33.253), Dst: 10.25.33.50 (10.25.33.50)
⊟ Internet Control Message Protocol
    Type: 3 (Destination unreachable)
    Code: 4 (Fragmentation needed)
    Checksum: 0xf9cd [correct]
    MTU of next hop: 1400
  ⊞ Internet Protocol Version 4, Src: 10.25.33.50 (10.25.33.50), Dst: 120.120.120.120 (120.120.120.120)
  ⊞ Transmission Control Protocol, Src Port: 48432 (48432), Dst Port: 49851 (49851)
```

Only One Local xTR Detects EID

For LISP sites that have xTR redundancy, the xTRs rely on map-notifiy messages to update the other xTR when an EID is detected. If there is a problem with this mechanism, then only one of the xTRs will show the EID in the **show lisp dynamic-eid summary** output. The others will not. Because the xTRs use multicast to send these map-notify messages, issues with multicast can also cause failures. If Protocol Independent Multicast (PIM) is to be configured on the LISP mobility interface, you may then need to add the following loopback with IGMP join statements for the map-notify-groups.

Step 1 Look at the LISP configuration. Note any map-notify-group multicast addresses that are configured. These will be used in steps 4 and 5.

show run lisp

```
switch# show run lisp
```

Step 2 Create a loopback interface and apply an IP address.

interface loopback *num*

ip address *ip_addr/mask*

```
switch(config)# interface loopback 1007
switch(config-if)# ip address 3.3.3.35/32
```

Step 3 Enable PIM sparse-mode on interface.

ip pim sparse-mode

```
switch(config-if)# ip pim sparse-mode
```

Step 4 Add IGMP join-group for first map-notify-group.

ip igmp join-group *multicast_addr*

```
switch(config-if)# ip igmp join-group 239.1.10.10
```

Step 5 Repeat step 4 for remaining map-notify-groups.

```
switch(config-if)# ip igmp join-group 239.1.33.10
switch(config-if)# ip igmp join-group 239.1.41.10
switch(config-if)# ip igmp join-group 239.1.56.10
switch(config-if)# ip igmp join-group 239.1.63.10
```

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