



Configuring LISP (Locator ID Separation Protocol)

This guide describes how to configure basic Locator ID Separation Protocol (LISP) functionality on all LISP-related devices, including the egress tunnel router (ETR), ingress tunnel router (ITR), proxy ETR (PETR), proxy ITR (PITR), map resolver (MR), and map server (MS).

LISP is a network architecture and protocol that implements the use of two namespaces instead of a single IP address. These namespaces, known as endpoint identifiers (EIDs), are assigned to end-hosts and routing locators (RLOCs), which are assigned to devices (primarily routers) that make up the global routing system. Splitting EID and RLOC functions delivers improvements in routing system scalability, multi-homing efficiency, and ingress traffic engineering.

- [Prerequisites for Configuring LISP, on page 1](#)
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Prerequisites for Configuring LISP

- If a LISP xTR is also a First Hop Router (FH) or a Rendezvous Point (RP), then the xTR needs to have at least one connected interface that is covered by a local LISP database mapping. Before an ITR forwards traffic over LISP, it does a source check to ensure that the source address of the traffic stream is a local EID (database mapping). Since PIM register and register-stop messages are sourced directly from the router itself, to be forwarded over LISP, the messages must come from an interface covered by a database mapping. A loopback or other connected interface is fine for this purpose. No additional configuration is required to ensure the proper address is selected.

This prerequisite is not required on a Proxy xTR, which does not do a source check.

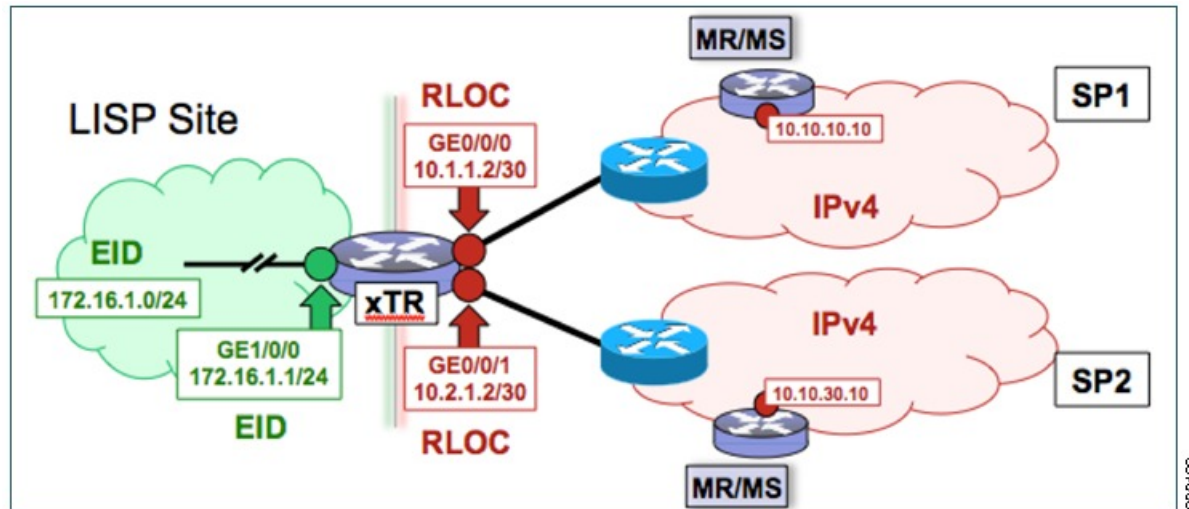
How to Configure LISP

Configure a Dual-Homed LISP Site with Two IPv4 RLOCs and an IPv4 EID

Perform this task to configure a dual-homed LISP site with two IPv4 RLOCs and an IPv4 EID. In this task, a LISP site uses a single edge router configured as both an ITR and an ETR (known as an xTR) with two connections to upstream providers. Both of the RLOCs and the EID prefix are IPv4. The LISP site registers

to two map resolver/map server (MR/MS) devices in the network core. The topology used in this LISP configuration is shown in the figure below.

Figure 1: Dual-Homed LISP Site with Two IPv4 RLOCs and an IPv4 EID



The components illustrated in the topology shown in the figure are described below:

• **LISP site:**

- The CPE functions as a LISP ITR and ETR (xTR).
- The LISP xTR is authoritative for the IPv4 EID prefix of 172.16.1.0/24.
- The LISP xTR has two RLOC connections to the core. The RLOC connection to SP1 is 10.1.1.2/30; the RLOC connection to SP2 is 10.2.1.2/30.
- For this simple dual-homed configuration, the LISP site policy specifies equal load sharing between service provider (SP) links for ingress traffic engineering.

• **Mapping system:**

- Two map resolver/map server (MR/MS) systems are assumed to be available for the LISP xTR to configure. The MR/MSs have IPv4 RLOCs 10.10.10.10 and 10.10.30.10.
- Mapping Services are assumed to be provided as part of this LISP solution via a private mapping system or as a public LISP mapping system. From the perspective of the configuration of this LISP site xTR, there is no difference.



Note Map server and map resolver configurations are not shown here. See the "Configure a Private LISP Mapping System Using a Standalone Map Resolver/Map Server" section for information about map server and map resolver configuration.

This task shows how to enable and configure LISP ITR and ETR (xTR) functionality when using a LISP map server and map resolver for mapping services.

SUMMARY STEPS

1. **configure terminal**
2. **router lisp**
3. Do one of the following:
 - **database-mapping** *EID-prefix/prefix-length locator* **priority** *priority* **weight** *weight*
 - **database-mapping** *EID-prefix/prefix-length* **ipv4-interface** *locator* **priority** *priority* **weight** *weight*
4. Repeat one of the choices in Step 3 to configure a second RLOC.
5. **ipv4 itr**
6. **ipv4 etr**
7. **ipv4 itr map-resolver** *map-resolver-address*
8. **ipv4 etr map-server** *map-server-address* **key** *key-type* *authentication-key*
9. **exit**
10. **ip route** *ipv4-prefix* *next-hop*
11. **exit**

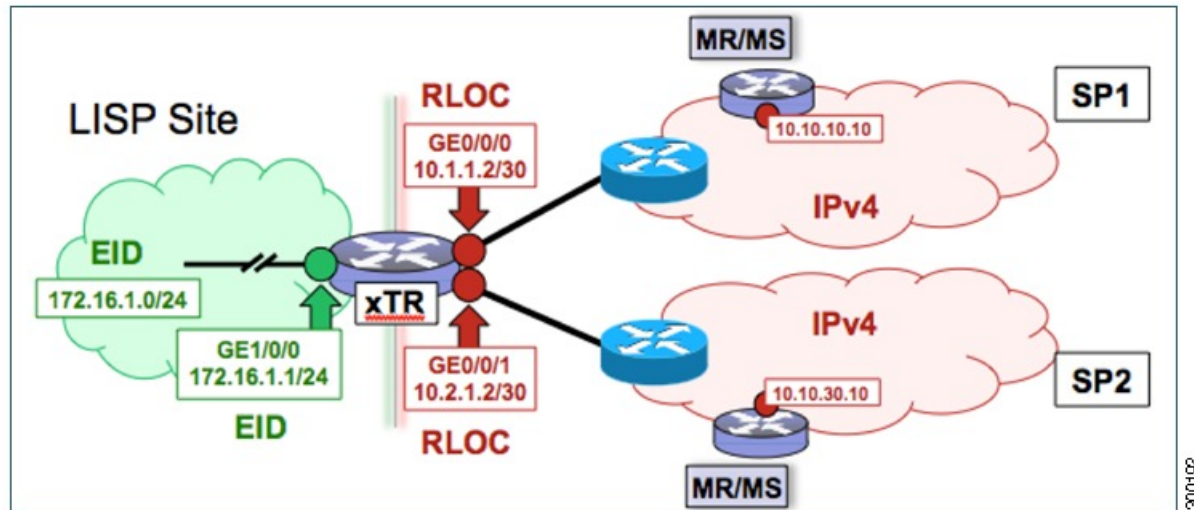
DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: <pre>Router# configure terminal</pre>	Enters global configuration mode.
Step 2	router lisp Example: <pre>Router(config)# router lisp</pre>	Enters LISP configuration mode (Cisco IOS XE software only).
Step 3	Do one of the following: • database-mapping <i>EID-prefix/prefix-length locator</i> priority <i>priority</i> weight <i>weight</i> • database-mapping <i>EID-prefix/prefix-length</i> ipv4-interface <i>locator</i> priority <i>priority</i> weight <i>weight</i> Example: <pre>Router(config-router-lisp)# database-mapping 172.16.1.0/24 10.1.1.2 priority 1 weight 50</pre> Example: <pre>Router(config-router-lisp)# database-mapping 172.16.1.0/24 ipv4-interface GigabitEthernet0/0/0 priority 1 weight 50</pre>	Configures an EID-to-RLOC mapping relationship and its associated traffic policy for this LISP site. • In this step example, a single EID prefix, 172.16.1.0/24, is being associated with the single IPv4 RLOC 10.1.1.2 but the <i>weight</i> argument of 50 signifies that a second database-mapping command is to be configured in the next step. • In the second example, the configuration shows the use of the dynamic interface form of the database-mapping command. This form is useful when the RLOC address is obtained dynamically, such as via DHCP.

	Command or Action	Purpose
Step 4	Repeat one of the choices in Step 3 to configure a second RLOC.	—
Step 5	ipv4 itr Example: <pre>Router(config-router-lisp)# ipv4 itr</pre>	Enables LISP ITR functionality for the IPv4 address family.
Step 6	ipv4 etr Example: <pre>Router(config-router-lisp)# ipv4 etr</pre>	Enables LISP ETR functionality for the IPv4 address family.
Step 7	ipv4 itr map-resolver map-resolver-address Example: <pre>Router(config-router-lisp)# ipv4 itr map-resolver 10.10.10.10</pre>	Configures the locator address of the LISP map resolver to which this router will send Map-Request messages for IPv4 EID-to-RLOC mapping resolutions. The locator address of the map resolver may be an IPv4 or IPv6 address. In this example, because each xTR has only IPv4 RLOC connectivity, the map resolver is reachable via its IPv4 locator address. (See the <i>LISP Command Reference</i> for more details.) Note Up to two map resolvers may be configured if multiple map resolvers are available. (See the <i>LISP Command Reference</i> for more details.)
Step 8	ipv4 etr map-server map-server-address key key-type authentication-key Example: <pre>Router(config-router-lisp)# ipv4 etr map-server 10.10.10.10 key 0 some-key</pre>	Configures the locator address of the LISP map server and the authentication key that this router, acting as an IPv4 LISP ETR, will use to register with the LISP mapping system. The map server must be configured with EID prefixes matching those configured on this ETR and with an identical authentication key. Note The locator address of the map server may be an IPv4 or IPv6 address. In this example, because each xTR has only IPv4 RLOC connectivity, the map server is reachable via its IPv4 locator address. (See the <i>LISP Command Reference</i> for more details.) Note Up to two map servers may be configured if multiple map servers are available. (See the <i>LISP Command Reference</i> for more details.)

	Command or Action	Purpose
Step 9	exit Example: <pre>Router(config-router-lisp)# exit</pre>	Exits LISP configuration mode and returns to global configuration mode.
Step 10	ip route <i>ipv4-prefix</i> <i>next-hop</i> Example: <pre>Router(config)# ip route 0.0.0.0 0.0.0.0 10.1.1.1</pre>	Configures a default route to the upstream next hop for all IPv4 destinations. • All IPv4 EID-sourced packets destined to both LISP and non-LISP sites are forwarded in one of two ways: • LISP-encapsulated to a LISP site when traffic is LISP-to-LISP • natively forwarded when traffic is LISP-to-non-LISP. • Packets are deemed to be a candidate for LISP encapsulation when they are sourced from a LISP EID and the destination matches one of the following entries: • a current map-cache entry • a default route with a legitimate next-hop • no route at all In this configuration example, because the xTR has IPv4 RLOC connectivity, a default route to the upstream SP is used for all IPv4 packets to support LISP processing.
Step 11	exit Example: <pre>Router(config)# exit</pre>	Exits global configuration mode.

Example:**Figure 2: Dual-Homed LISP Site with Two IPv4 RLOCs and an IPv4 EID**

This example shows the complete configuration for the LISP topology illustrated in the figure above and in this task.

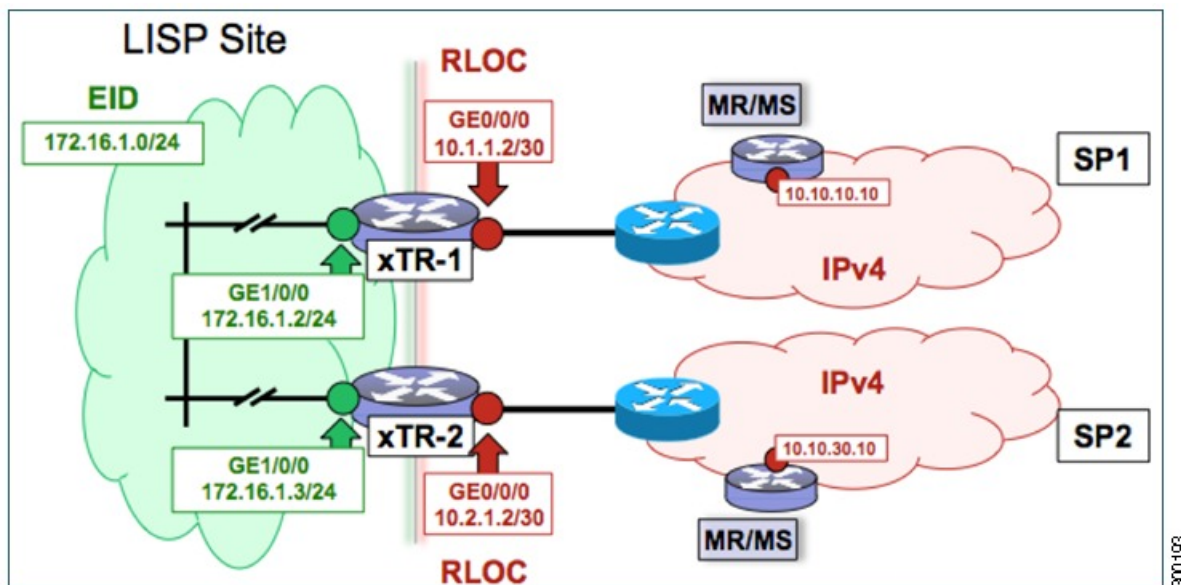
```
hostname xTR
!
no ip domain lookup
ip cef
!
interface Loopback0
 ip address 172.17.1.1 255.255.255.255
!
interface LISP0
!
interface GigabitEthernet0/0/0
 description Link to SP1 (RLOC)
 ip address 10.1.1.2 255.255.255.252
!
interface GigabitEthernet0/0/1
 description Link to SP2 (RLOC)
 ip address 10.2.1.2 255.255.255.252
!
interface GigabitEthernet1/0/0
 description Link to Site (EID)
 ip address 172.16.1.1 255.255.255.0
!
router lisp
 database-mapping 172.16.1.0/24 10.1.1.2 priority 1 weight 50
 database-mapping 172.16.1.0/24 10.2.1.2 priority 1 weight 50
 ipv4 itr
 ipv4 etr
 ipv4 itr map-resolver 10.10.10.10
 ipv4 itr map-resolver 10.10.30.10
 ipv4 etr map-server 10.10.10.10 key 0 some-key
 ipv4 etr map-server 10.10.30.10 key 0 some-key
 exit
!
```

```
ip route 0.0.0.0 0.0.0.0 10.1.1.1
ip route 0.0.0.0 0.0.0.0 10.2.1.1
```

Configure a Multihomed LISP Site with Two xTRs and Two IPv4 RLOCs and an IPv4 EID

Perform this task to configure a multihomed LISP site with two xTRs, two IPv4 RLOCs, and an IPv4 EID. In this task, a LISP site uses two edge routers. Each edge router is configured as an xTR (each performs as both an ITR and an ETR) and each also includes a single IPv4 connection to an upstream provider. (Two different providers are used in this example but the same upstream provider could be used for both connections.) Both of the RLOCs and the EID prefix are IPv4. The LISP site registers to two map resolver/map server (MR/MS) devices in the network core. The topology used in this typical multihomed LISP configuration is shown in the figure below.

Figure 3: Typical Multihomed LISP Site with Two xTRs and Two IPv4 RLOCs and an IPv4 EID



The components illustrated in the topology shown in the figure are described below:

- **LISP site:**

- Two CPE routers make up the LISP site: xTR-1 and xTR-2.
- Both CPE routers function as LISP xTRs (that is, an ITR and an ETR).
- The LISP site is authoritative for the IPv4 EID prefix of 172.16.1.0/24.
- Each LISP xTR has a single IPv4 RLOC connection to the core: the RLOC connection for xTR-1 to SP1 is 10.1.1.2/30; the RLOC connection for xTR-2 to SP2 is 10.2.1.2/30.
- For this multihomed case, the LISP site policy specifies equal load-sharing between service provider (SP) links for ingress traffic engineering.

- **Mapping system:**

- Two map resolver/map server (MR/MS) systems are assumed to be available for the LISP xTR to configure. The MR/MSs have IPv4 RLOCs 10.10.10.10 and 10.10.30.10.

- Mapping services are assumed to be provided as part of this LISP solution via a private mapping system or as a public LISP mapping system. From the perspective of the configuration of these LISP site xTRs, there is no difference.



Note Map server and map resolver configurations are not shown here. See the "Configure a Private LISP Mapping System Using a Standalone Map Resolver/Map Server" section for information about map server and map resolver configuration.

Perform the steps in this task (once through for each xTR in the LISP site) to enable and configure LISP ITR and ETR (xTR) functionality when using a LISP map server and map resolver for mapping services. The example configurations at the end of this task show the full configuration for configuring two xTRs (xTR1 and xTR2).

SUMMARY STEPS

1. **configure terminal**
2. **router lisp**
3. **database-mapping** *EID-prefix/prefix-length locator priority priority weight weight*
4. Repeat Step 3 to configure a second RLOC for the same xTR.
5. **ipv4 itr**
6. **ipv4 etr**
7. **ipv4 itr map-resolver** *map-resolver-address*
8. Repeat Step 7 to configure a second locator address for the map resolver.
9. **ipv4 etr map-server** *map-server-address key key-type authentication-key*
10. Repeat Step 9 to configure a second locator address for the map server.
11. **exit**
12. **ip route** *ipv4-prefix next-hop*
13. **exit**

DETAILED STEPS

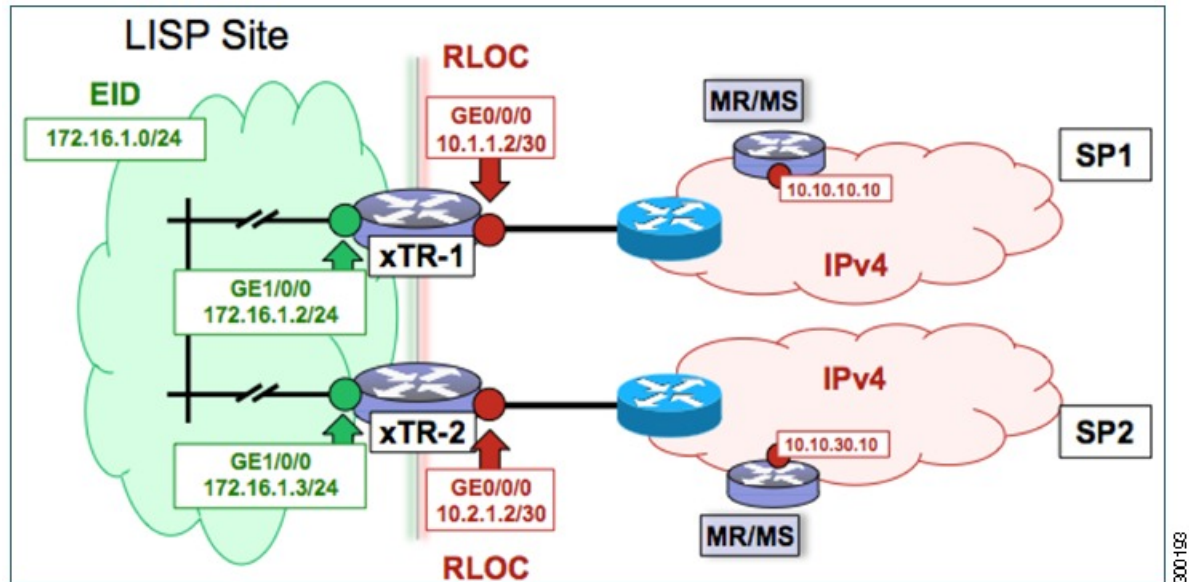
Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: <pre>Router# configure terminal</pre>	Enters global configuration mode.
Step 2	router lisp Example: <pre>Router(config)# router lisp</pre>	Enters LISP configuration mode (IOS XE software only).

	Command or Action	Purpose
Step 3	database-mapping <i>EID-prefix/prefix-length locator priority priority weight weight</i> Example: <pre>Router(config-router-lisp)# database-mapping 172.16.1.0/24 10.1.1.2 priority 1 weight 50</pre>	Configures an EID-to-RLOC mapping relationship and its associated traffic policy for this LISP site. In this step example, a single EID prefix, 172.16.1.0/24, is being associated with a LISP site that contains two separate xTRs. Each xTR has a single IPv4 RLOC connection to the core. In this example, xTR-1 has an IPv4 RLOC connection to SP1 at 10.1.1.2 but the <i>weight</i> argument of 50 signifies that a second database-mapping command is to be configured in the next step. Note Two database-mapping commands are required on each xTR to indicate to the mapping system that this LISP site is reachable via these two IPv4 RLOCs. In this example, one RLOC is local (connected) to one xTR and the other is local (connected) to the other xTR.
Step 4	Repeat Step 3 to configure a second RLOC for the same xTR. Example: <pre>Router(config-router-lisp)# database-mapping 172.16.1.0/24 10.2.1.2 priority 1 weight 50</pre>	Configures an EID-to-RLOC mapping relationship and its associated traffic policy for an xTR on this LISP site. In this step example, the second RLOC connection for xTR-1 has an IPv4 RLOC connection to SP2 (10.2.1.2). Note When a LISP site contains multiple xTRs, all xTRs must be configured with identical database-mapping commands to provide the mapping system with consistent information about EID-to-RLOC mappings.
Step 5	ipv4 itr Example: <pre>Router(config-router-lisp)# ipv4 itr</pre>	Enables LISP ITR functionality for the IPv4 address family.
Step 6	ipv4 etr Example: <pre>Router(config-router-lisp)# ipv4 etr</pre>	Enables LISP ETR functionality for the IPv4 address family.
Step 7	ipv4 itr map-resolver <i>map-resolver-address</i> Example: <pre>Router(config-router-lisp)# ipv4 itr map-resolver 10.10.10.10</pre>	Configures a locator address for the LISP map resolver to which this router will send Map-Request messages for IPv4 EID-to-RLOC mapping resolutions. The locator address of the map resolver may be an IPv4 or IPv6 address. In this example, because each xTR has only IPv4 RLOC connectivity, the map

	Command or Action	Purpose
		resolver is reachable via its IPv4 locator address. (See the <i>LISP Command Reference</i> for more details.) Note Up to two map resolvers may be configured if multiple map resolvers are available. (See the <i>LISP Command Reference</i> for more details.)
Step 8	Repeat Step 7 to configure a second locator address for the map resolver. Example: <pre>Router(config-router-lisp)# ipv4 itr map-resolver 10.10.30.10</pre>	Configures a second locator address for the LISP map resolver to which this router will send Map-Request messages for IPv4 EID-to-RLOC mapping resolutions.
Step 9	ipv4 etr map-server map-server-address key key-type authentication-key Example: <pre>Router(config-router-lisp)# ipv4 etr map-server 10.10.10.10 key 0 some-key</pre>	Configures a locator address for the LISP map server and an authentication key that this router, acting as an IPv4 LISP ETR, will use to register with the LISP mapping system. • In this example, each xTR must register to both map servers. • The map server must be configured with EID prefixes matching those configured on this ETR and with an identical authentication key. Note The locator address of the map server may be an IPv4 or IPv6 address. In this example, because each xTR has only IPv4 RLOC connectivity, the map server is reachable via its IPv4 locator address. (See the <i>LISP Command Reference</i> for more details.) Note Up to two map servers may be configured if multiple map servers are available. (See the <i>LISP Command Reference</i> for more details.)
Step 10	Repeat Step 9 to configure a second locator address for the map server. Example: <pre>Router(config-router-lisp)# ipv4 etr map-server 10.10.30.10 key 0 some-key</pre>	Configures a second locator address for the LISP map server and the authentication key that this router will use to register with the LISP mapping system.
Step 11	exit Example: <pre>Router(config-router-lisp)# exit</pre>	Exits LISP configuration mode and returns to global configuration mode.

	Command or Action	Purpose
Step 12	ip route <i>ipv4-prefix next-hop</i> Example: <pre>Router(config)# ip route 0.0.0.0 0.0.0.0 10.1.1.1</pre>	Configures a default route to the upstream next hop for all IPv4 destinations. • All IPv4 EID-sourced packets destined to both LISP and non-LISP sites are forwarded in one of two ways: • LISP-encapsulated to a LISP site when traffic is LISP-to-LISP • natively forwarded when traffic is LISP-to-non-LISP • Packets are deemed to be a candidate for LISP encapsulation when they are sourced from a LISP EID and the destination matches one of the following entries: • a current map-cache entry • a default route with a legitimate next-hop • no route at all In this configuration example, because the xTR has IPv4 RLOC connectivity, a default route to the upstream SP is used for all IPv4 packets to support LISP processing.
Step 13	exit Example: <pre>Router(config)# exit</pre>	Exits global configuration mode.

Example:**Figure 4: Typical Multihomed LISP Site with Two xTRs and Two IPv4 RLOCs and an IPv4 EID**

The examples below show the complete configuration for the LISP topology illustrated in the figure above and in this task:

Example configuration for xTR-1:

```
!
hostname xTR-1
!
no ip domain lookup
ip cef
!
interface Loopback0
 ip address 172.17.1.1 255.255.255.255
!
interface LISP0
!
interface GigabitEthernet0/0/0
 description Link to SP1 (RLOC)
 ip address 10.1.1.2 255.255.255.252
!
interface GigabitEthernet1/0/0
 description Link to Site (EID)
 ip address 172.16.1.2 255.255.255.0
!
router lisp
 database-mapping 172.16.1.0/24 10.1.1.2 priority 1 weight 50
 database-mapping 172.16.1.0/24 10.2.1.2 priority 1 weight 50
 ipv4 itr
 ipv4 etr
 ipv4 itr map-resolver 10.10.10.10
 ipv4 itr map-resolver 10.10.30.10
 ipv4 etr map-server 10.10.10.10 key 0 some-key
 ipv4 etr map-server 10.10.30.10 key 0 some-key
```

```

exit
!
ip route 0.0.0.0 0.0.0.0 10.1.1.1

```

Example configuration for xTR-2:

```

!
hostname xTR-2
!
no ip domain lookup
ip cef
!
interface Loopback0
 ip address 172.17.1.2 255.255.255.255
!
interface LISP0
!
interface GigabitEthernet0/0/0
 description Link to SP2 (RLOC)
 ip address 10.2.1.2 255.255.255.252
!
interface GigabitEthernet1/0/0
 description Link to Site (EID)
 ip address 172.16.1.3 255.255.255.0
!
router lisp
 database-mapping 172.16.1.0/24 10.1.1.2 priority 1 weight 50
 database-mapping 172.16.1.0/24 10.2.1.2 priority 1 weight 50
 ipv4 itr
 ipv4 etr
 ipv4 itr map-resolver 10.10.10.10
 ipv4 itr map-resolver 10.10.30.10
 ipv4 etr map-server 10.10.10.10 key 0 some-key
 ipv4 etr map-server 10.10.30.10 key 0 some-key
 exit
!
ip route 0.0.0.0 0.0.0.0 10.2.1.1

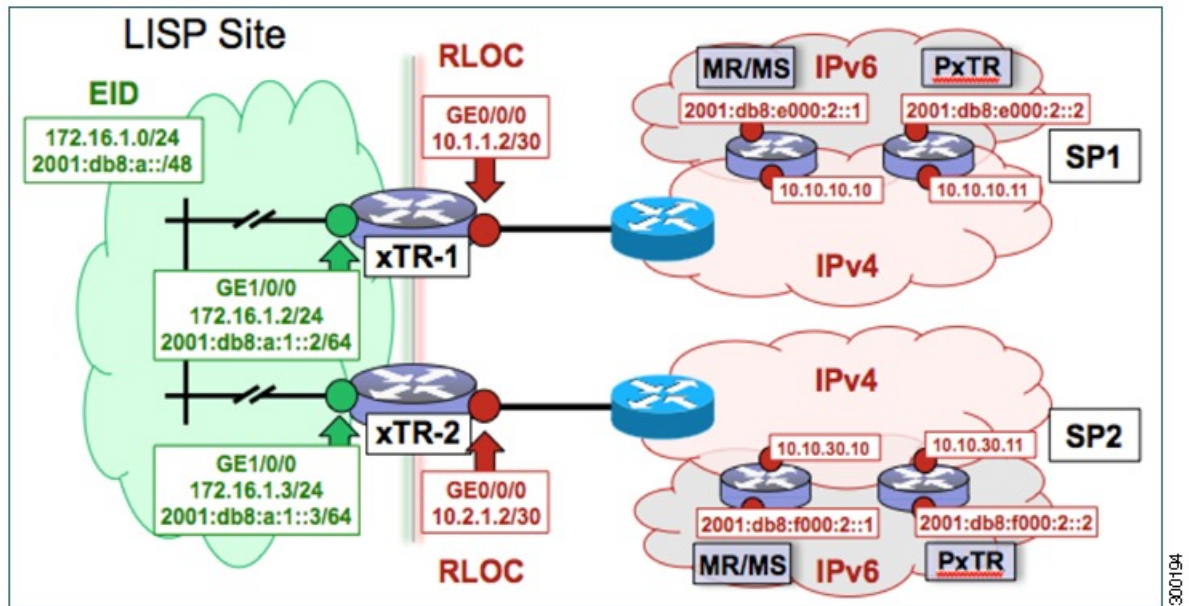
```

Configure a Multihomed LISP Site with Two xTRs and Two IPv4 RLOCs and Both an IPv4 and an IPv6 EID

Perform this task to configure a multihomed LISP site with two xTRs, two IPv4 RLOCs, and both an IPv4 and an IPv6 EID. In this task, a LISP site uses two edge routers. Each edge router is configured as an xTR (each performs as both an ITR and an ETR) and each also includes a single IPv4 connection to an upstream provider. (Two different providers are used in this example but the same upstream provider could be used for both connections.) Both of the RLOCs and one of the EIDs are IPv4. However, in this example, the LISP site includes an IPv6 EID, as well.

This LISP site requires the use of Proxy Ingress/Egress Tunnel Router (PxTR) LISP infrastructure for access to non-LISP IPv6 addresses. That is, the LISP site uses only its IPv4 RLOCs to reach IPv6 LISP and non-LISP addresses. Additionally, this LISP site registers to two map resolver/map server (MR/MS) devices in the network core. The topology used in this multihomed LISP configuration is shown in the figure below.

Figure 5: Multihomed LISP Site with Two xTRs, Two IPv4 RLOCs, and Both an IPv4 and an IPv6 EID



The components illustrated in the topology shown in the figure are described below:

- **LISP site:**

- Two CPE routers make up the LISP site: xTR-1 and xTR-2.
- Both CPE routers function as LISP xTRs (that is, an ITR and an ETR).
- The LISP site is authoritative for both the IPv4 EID prefix of 172.16.1.0/24 and the IPv6 EID prefix 2001:db8:a::/48.
- Each LISP xTR has a single RLOC connection to the core: the RLOC connection for xTR-1 to SP1 is 10.1.1.2/30; the RLOC connection for xTR-2 to SP2 is 10.2.1.2/30.
- For this multihomed case, the LISP site policy specifies equal load-sharing between service provider (SP) links for ingress traffic engineering.

- **Mapping system:**

- Two map resolver/map server (MR/MS) systems are assumed to be available for the LISP xTR to configure. The MR/MSs have IPv4 RLOCs 10.10.10.10 and 10.10.30.10.
- Mapping services are assumed to be provided as part of this LISP solution via a private mapping system or as a public LISP mapping system. From the perspective of the configuration of these LISP site xTRs, there is no difference.



Note

Map server and map resolver configurations are not shown here. See the "Configure a Private LISP Mapping System Using a Standalone Map Resolver/Map Server" section for information about map server and map resolver configuration.

- PxTR services are also assumed to be provided as part of this LISP solution via a private or public mapping system. From the perspective of the configuration of these LISP site xTRs, there is no difference.
- The PxTRs have IPv4 RLOCs of 10.10.10.11 and 10.10.30.11 and will be used (as PETRs) for LISP IPv6 EIDs to reach non-LISP IPv6 sites. Return traffic is attracted by the PITR function (with the assumption that the PITR advertises coarse aggregates for IPv6 LISP EIDs into the IPv6 core.)

Perform the steps in this task (once through for each xTR in the LISP site) to enable and configure LISP ITR and ETR (xTR) functionality when using a LISP map server and map resolver for mapping services. The example configurations at the end of this task show the full configuration for two xTRs (xTR1 and xTR2).

SUMMARY STEPS

1. **configure terminal**
2. **router lisp**
3. **database-mapping** *EID-prefix/prefix-length locator priority priority weight weight*
4. Repeat Step 3 to configure a second RLOC (10.2.1.2) for the same xTR and IPv4 EID prefix.
5. Repeat Step 3 and Step 4 to configure the same RLOC connections, again, for the same xTR but, when repeating these two steps, associate the IPv6 EID prefix, 2001:db8:a::/48, instead of the IPv4 EID prefix.
6. **ipv4 itr**
7. **ipv4 etr**
8. **ipv4 itr map-resolver** *map-resolver-address*
9. Repeat Step 8 to configure a second locator address of the map resolver.
10. **ipv4 etr map-server** *map-server-address key key-type authentication-key*
11. Repeat Step 10 to configure a second locator address for the map server.
12. **ipv6 itr**
13. **ipv6 etr**
14. **ipv6 itr map-resolver** *map-resolver-address*
15. Repeat Step 14 to configure a second locator address for the map resolver.
16. **ipv6 etr map-server** *map-server-address key key-type authentication-key*
17. Repeat Step 16 to configure a second locator address for the map server.
18. **ipv6 use-petr** *petr-address*
19. Repeat Step 18 to configure a second locator address for the PETR.
20. **exit**
21. **ip route** *ipv4-prefix next-hop*
22. **exit**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	configure terminal	Enters global configuration mode.
	Example: Router# <code>configure terminal</code>	

Configure a Multihomed LISP Site with Two xTRs and Two IPv4 RLOCs and Both an IPv4 and an IPv6 EID

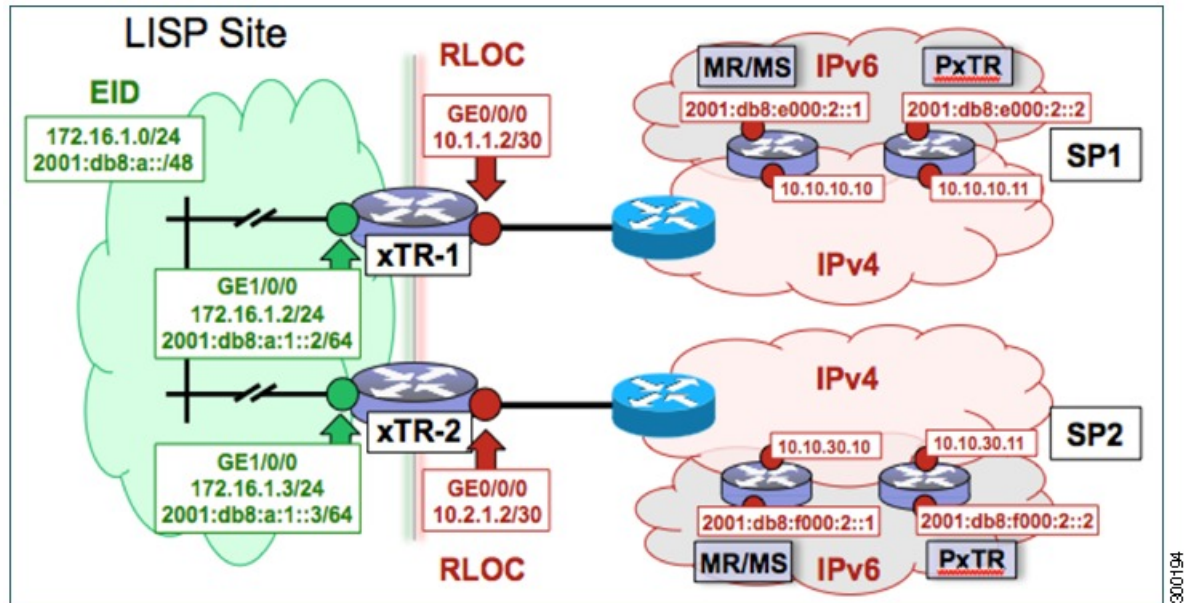
	Command or Action	Purpose
Step 2	router lisp Example: Router(config)# router lisp	Enters LISP configuration mode (IOS XE software only).
Step 3	database-mapping <i>EID-prefix/prefix-length locator</i> priority <i>priority</i> weight <i>weight</i> Example: Router(config-router-lisp)# database-mapping 172.16.1.0/24 10.1.1.2 priority 1 weight 50	Configures an EID-to-RLOC mapping relationship and its associated traffic policy for this LISP site. In steps 3, 4, and 5 of this example, an IPv4 EID prefix, 172.16.1.0/24, and an IPv6 prefix, 2001:db8:a::/48, are being associated with a LISP site that contains two separate xTRs that each have a single IPv4 RLOC connection to the core. In this first step example, xTR-1 is configured with an IPv4 RLOC connection to SP1 at 10.1.1.2 but the <i>weight</i> argument of 50 signifies that a second database-mapping command is to be configured in the next step. Note Four database-mapping commands are required for each xTR to indicate to the mapping system that both the associated IPv4 and IPv6 EID prefixes are reachable at this LISP site via these two IPv4 RLOCs. In this example, one RLOC is local (connected) to one xTR and the other is local (connected) to the other xTR.
Step 4	Repeat Step 3 to configure a second RLOC (10.2.1.2) for the same xTR and IPv4 EID prefix. Example: Router(config-router-lisp)# database-mapping 172.16.1.0/24 10.2.1.2 priority 1 weight 50	Configures an EID-to-RLOC mapping relationship and its associated traffic policy for an xTR on this LISP site. In this step example, the second RLOC connection for xTR-1 has an IPv4 RLOC connection to SP2 (10.2.1.2). Note When a LISP site contains multiple xTRs, all xTRs must be configured with identical database-mapping commands to provide the mapping system with consistent information about EID-to-RLOC mappings.
Step 5	Repeat Step 3 and Step 4 to configure the same RLOC connections, again, for the same xTR but, when repeating these two steps, associate the IPv6 EID prefix, 2001:db8:a::/48, instead of the IPv4 EID prefix.	—
Step 6	ipv4 itr Example: Router(config-router-lisp)# ipv4 itr	Enables LISP ITR functionality for the IPv4 address family.

	Command or Action	Purpose
Step 7	ipv4 etr Example: Router(config-router-lisp)# ipv4 etr	Enables LISP ETR functionality for the IPv4 address family.
Step 8	ipv4 itr map-resolver map-resolver-address Example: Router(config-router-lisp)# ipv4 itr map-resolver 10.10.10.10	Configures a locator address for the LISP map resolver to which this router will send Map-Request messages for IPv4 EID-to-RLOC mapping resolutions. The locator address of the map resolver may be an IPv4 or IPv6 address. In this example, because each xTR has only IPv4 RLOC connectivity, the map resolver is reachable via its IPv4 locator address. (See the <i>LISP Command Reference</i> for more details.) Note Up to two map resolvers may be configured if multiple map resolvers are available. (See the <i>LISP Command Reference</i> for more details.)
Step 9	Repeat Step 8 to configure a second locator address of the map resolver. Example: Router(config-router-lisp)# ipv4 itr map-resolver 10.10.30.10	Configures a second locator address for the LISP map resolver to which this router will send Map-Request messages for IPv4 EID-to-RLOC mapping resolutions.
Step 10	ipv4 etr map-server map-server-address key key-type authentication-key Example: Router(config-router-lisp)# ipv4 etr map-server 10.10.10.10 key 0 some-key	Configures a locator address for the LISP map server and an authentication key that this router, acting as an IPv4 LISP ETR, will use to register with the LISP mapping system. - In this example, each xTR must register to both map servers. - The map server must be configured with EID prefixes matching those configured on this ETR and with an identical authentication key. Note The locator address of the map server may be an IPv4 or IPv6 address. In this example, because each xTR has only IPv4 RLOC connectivity, the map server is reachable via its IPv4 locator address. (See the <i>LISP Command Reference</i> for more details.) Note Up to two map servers may be configured if multiple map servers are available. (See the <i>LISP Command Reference</i> for more details.)

	Command or Action	Purpose
Step 11	Repeat Step 10 to configure a second locator address for the map server. Example: <pre>Router(config-router-lisp)# ipv4 etr map-server 10.10.30.10 key 0 some-key</pre>	Configures a second locator address for the LISP map server and the authentication key that this router will use to register with the LISP mapping system.
Step 12	ipv6 itr Example: <pre>Router(config-router-lisp)# ipv6 itr</pre>	Enables LISP ITR functionality for the IPv6 address family.
Step 13	ipv6 etr Example: <pre>Router(config-router-lisp)# ipv6 etr</pre>	Enables LISP ETR functionality for the IPv6 address family.
Step 14	ipv6 itr map-resolver map-resolver-address Example: <pre>Router(config-router-lisp)# ipv6 itr map-resolver 10.10.10.10</pre>	Configures a locator address for the LISP map resolver to which this router will send Map-Request messages for IPv6 EID-to-RLOC mapping resolutions. The locator address of the map resolver may be an IPv4 or IPv6 address. In this example, because each xTR has only IPv4 RLOC connectivity, the map resolver is reachable via its IPv4 locator address. (See the <i>LISP Command Reference</i> for more details.) Note Up to two map resolvers may be configured if multiple map resolvers are available. (See the <i>LISP Command Reference</i> for more details.)
Step 15	Repeat Step 14 to configure a second locator address for the map resolver. Example: <pre>Router(config-router-lisp)# ipv6 itr map-resolver 10.10.30.10</pre>	Configures a second locator address for the LISP map resolver to which this router will send Map-Request messages for IPv4 EID-to-RLOC mapping resolutions.
Step 16	ipv6 etr map-server map-server-address key key-type authentication-key Example: <pre>Router(config-router-lisp)# ipv6 etr map-server 10.10.10.10 key 0 some-key</pre>	Configures a locator address for the LISP map server and an authentication key that this router, acting as an IPv6 LISP ETR, will use to register to the LISP mapping system. - In this example, each xTR must register to both map servers. - The map server must be configured with EID prefixes matching those configured on this ETR and with an identical authentication key. Note The locator address of the map server may be an IPv4 or IPv6 address. In this example, because each xTR has only

	Command or Action	Purpose
		IPv4 RLOC connectivity, the map server is reachable via its IPv4 locator address. (See the <i>LISP Command Reference</i> for more details.) Note Up to two map servers may be configured if multiple map servers are available. (See the <i>LISP Command Reference</i> for more details.)
Step 17	Repeat Step 16 to configure a second locator address for the map server. Example: <pre>Router(config-router-lisp)# ipv6 itr map-server 10.10.30.10 key 0 some-key</pre>	Configures a second locator address for the LISP map server and an authentication key that this router, acting as an IPv6 LISP ETR, will use to register with the LISP mapping system.
Step 18	ipv6 use-petr petr-address Example: <pre>Router(config-router-lisp)# ipv6 use-petr 10.10.10.11</pre>	Configures a locator address for the Proxy Egress Tunnel Router (PETR) to which each xTR will forward LISP-encapsulated IPv6 EIDs (using the xTR's IPv4 RLOC) to reach non-LISP IPv6 addresses. Note The PETR is assumed to be dual-stacked and capable of natively reaching the non-LISP IPv6 address. In addition, the PITR is assumed to be dual-stacked and to be advertising coarse aggregates for IPv6 LISP EIDs into the IPv6 core to handle return traffic (non-LISP IPv6 to LISP IPv6 over an IPv4 infrastructure). Note The locator address of the PETR may be an IPv4 or IPv6 address. In this example, because each xTR has only IPv4 RLOC connectivity, the PETR is reachable via its IPv4 locator address. (See the <i>LISP Command Reference</i> for more details.) Note Up to eight PETRs may be configured if multiple PETRs are available. (See the <i>LISP Command Reference</i> for more details.)
Step 19	Repeat Step 18 to configure a second locator address for the PETR. Example: <pre>Router(config-router-lisp)# ipv6 use-petr 10.10.30.11</pre>	Configures a second locator address for the PETR to which each xTR will forward LISP-encapsulated IPv6 EIDs (using the xTR's IPv4 RLOC) to reach non-LISP IPv6 addresses.
Step 20	exit Example: <pre>Router(config-router-lisp)# exit</pre>	Exits LISP configuration mode and returns to global configuration mode.

	Command or Action	Purpose
Step 21	ip route <i>ipv4-prefix next-hop</i> Example: <pre>Router(config)# ip route 0.0.0.0 0.0.0.0 10.1.1.1</pre>	Configures a default route to the upstream next hop for all IPv4 destinations. • All IPv4 EID-sourced packets destined to both LISP and non-LISP sites are forwarded in one of two ways: • LISP-encapsulated to a LISP site when traffic is LISP-to-LISP • natively forwarded when traffic is LISP-to-non-LISP • Packets are deemed to be a candidate for LISP encapsulation when they are sourced from a LISP EID and the destination matches one of the following entries: • a current map-cache entry • a default route with a legitimate next-hop • no route at all In this configuration example, because the xTR has IPv4 RLOC connectivity, a default route to the upstream SP is used for all IPv4 packets to support LISP processing.
Step 22	exit Example: <pre>Router(config)# exit</pre>	Exits global configuration mode.

Example:**Figure 6: Multihomed LISP Site with Two xTRs, Two IPv4 RLOCs, and Both an IPv4 and an IPv6 EID**

The examples below show the complete configuration for the LISP topology illustrated in the figure above and in this task:

Example configuration for xTR-1:

```
!
hostname xTR-1
!
no ip domain lookup
ip cef
ipv6 unicast-routing
ipv6 cef
!
interface Loopback0
 ip address 172.17.1.1 255.255.255.255
!
interface LISP0
!
interface GigabitEthernet0/0/0
 description Link to SP1 (RLOC)
 ip address 10.1.1.2 255.255.255.252
!
interface GigabitEthernet1/0/0
 description Link to Site (EID)
 ip address 172.16.1.2 255.255.255.0
 ipv6 address 2001:db8:a:1::2/64
!
router lisp
 database-mapping 172.16.1.0/24 10.1.1.2 priority 1 weight 50
 database-mapping 172.16.1.0/24 10.2.1.2 priority 1 weight 50
 database-mapping 2001:db8:a::/48 10.1.1.2 priority 1 weight 50
 database-mapping 2001:db8:a::/48 10.2.1.2 priority 1 weight 50
 ipv4 itr
```

Configure a Multihomed LISP Site with Two xTRs and Two IPv4 RLOCs and Both an IPv4 and an IPv6 EID

```

ipv4 etr
ipv4 itr map-resolver 10.10.10.10
ipv4 itr map-resolver 10.10.30.10
ipv4 etr map-server 10.10.10.10 key 0 some-key
ipv4 etr map-server 10.10.30.10 key 0 some-key
ipv6 itr
ipv6 etr
ipv6 itr map-resolver 10.10.10.10
ipv6 itr map-resolver 10.10.30.10
ipv6 etr map-server 10.10.10.10 key 0 some-key
ipv6 etr map-server 10.10.30.10 key 0 some-key
ipv6 use-petr 10.10.10.11
ipv6 use-petr 10.10.30.11
exit
!
ip route 0.0.0.0 0.0.0.0 10.1.1.1
!
ipv6 route ::/0

```

Example configuration for xTR-2:

```

!
no ip domain lookup
ip cef
ipv6 unicast-routing
ipv6 cef
!
interface Loopback0
 ip address 172.17.1.2 255.255.255.255
!
interface LISP0
!
interface GigabitEthernet0/0/0
 description Link to SP2 (RLOC)
 ip address 10.2.1.2 255.255.255.252
!
interface GigabitEthernet1/0/0
 description Link to Site (EID)
 ip address 172.16.1.3 255.255.255.0
 ipv6 address 2001:db8:a::1::3/64
!
router lisp
 database-mapping 172.16.1.0/24 10.1.1.2 priority 1 weight 50
 database-mapping 172.16.1.0/24 10.2.1.2 priority 1 weight 50
 database-mapping 2001:db8:a::/48 10.1.1.2 priority 1 weight 50
 database-mapping 2001:db8:a::/48 10.2.1.2 priority 1 weight 50
 ipv4 itr
 ipv4 etr
 ipv4 itr map-resolver 10.10.10.10
 ipv4 itr map-resolver 10.10.30.10
 ipv4 etr map-server 10.10.10.10 key 0 some-xtr-key
 ipv4 etr map-server 10.10.30.10 key 0 some-xtr-key
 ipv6 itr
 ipv6 etr
 ipv6 itr map-resolver 10.10.10.10
 ipv6 itr map-resolver 10.10.30.10
 ipv6 etr map-server 10.10.10.10 key 0 some-xtr-key
 ipv6 etr map-server 10.10.30.10 key 0 some-xtr-key
 ipv6 use-petr 10.10.10.11
 ipv6 use-petr 10.10.30.11
 exit
!
ip route 0.0.0.0 0.0.0.0 10.2.1.1

```

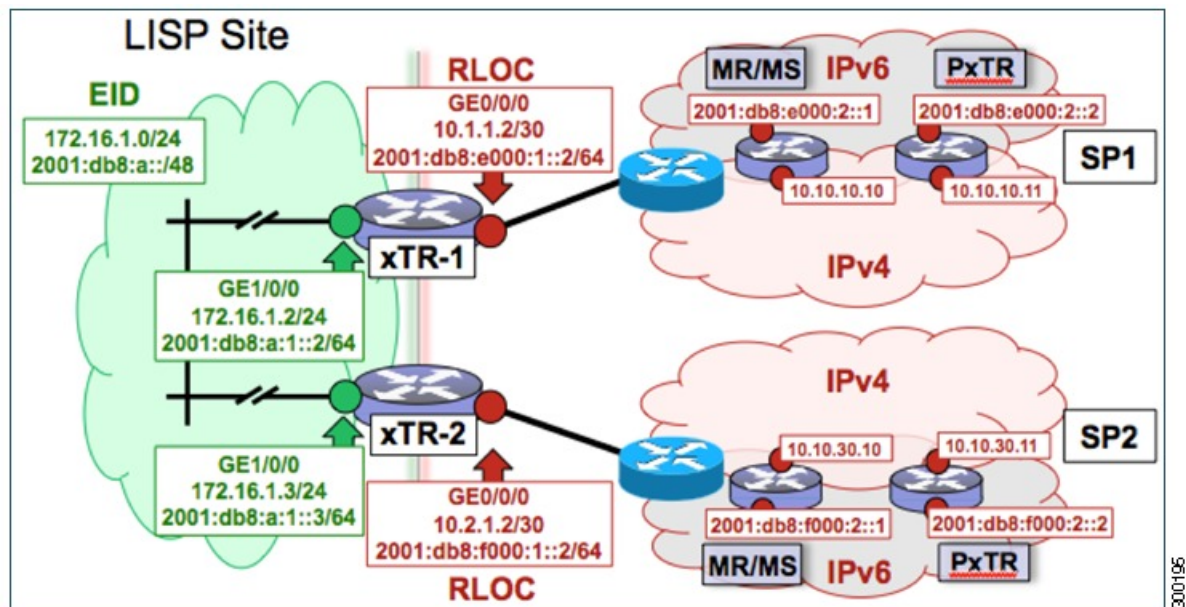
```
!
ipv6 route :::/0
```

Configure a Multihomed LISP Site with Two xTRs that Each have Both an IPv4 and an IPv6 RLOC and Both an IPv4 and an IPv6 EID

Perform this task to configure a multihomed LISP site with two xTRs, each with both an IPv4 and an IPv6 RLOC and both with an IPv4 and an IPv6 EID. In this task, a LISP site uses two edge routers. Each edge router is configured as an xTR (each performs as both an ITR and an ETR) and each also includes a single, dual stack (IPv4 and IPv6) connection to an upstream provider. (Two different providers are used in this example but the same upstream provider could be used for both connections.) Each xTR has an IPv4 RLOC and an IPv6 RLOC and both IPv4 and IPv6 EID prefixes are being used within the LISP site. However, because the site has both IPv4 and IPv6 RLOCs, it does not require a Proxy Ingress/Egress Tunnel Router (PxTR) LISP infrastructure for access to non-LISP IPv6 addresses. (The PxTR infrastructure can still be configured as a resiliency mechanism if desired.)

The LISP site registers to two map resolver/map server (MR/MS) devices in the network core using both IPv4 and IPv6 locators. The topology used in this multihomed LISP configuration is shown in the figure below.

Figure 7: Multihomed LISP Site with Two xTRs, Each with an IPv4 and an IPv6 RLOC and each with an IPv4 and an IPv6 EID



The components illustrated in the topology shown in the figure are described below:

- **LISP site:**

- Two CPE routers make up the LISP site: xTR-1 and xTR-2.
- Both CPE routers function as LISP xTRs (that is, an ITR and an ETR).
- The LISP site is authoritative for both the IPv4 EID prefix of 172.16.1.0/24 and the IPv6 EID prefix 2001:db8:a::/48.
- Each LISP xTR has a single IPv4 RLOC connection and a single IPv6 RLOC connection to the core: the RLOC connections for xTR-1 to SP1 include an IPv4 RLOC, 10.1.1.2/30, and an IPv6

RLOC, 2001:db8:e000:1::2/64. The xTR-2 connections to SP2 include IPv4 RLOC 10.2.1.2/30 and IPv6 RLOC 2001:db8:f000:1::2/64.

- For this multihomed case, the LISP site policy specifies equal load-sharing between service provider (SP) links for ingress traffic engineering.

- **Mapping system:**

- Two map resolver/map server systems are assumed to be available for the LISP xTR to configure. The MR/MSs have IPv4 RLOCs 10.10.10.10 and 10.10.30.10 and IPv6 RLOCs 2001:db8:e000:2::1 and 2001:db8:f000:2::1.
- Mapping services are assumed to be provided as part of this LISP solution via a private mapping system or as a public LISP mapping system. From the perspective of the configuration of these LISP site xTRs, there is no difference.



Note Map resolver and map server configurations are not shown here. See the "Configure a Private LISP Mapping System Using a Standalone Map Resolver/Map Server" section for information about map resolver and map server configuration.

- PxTR services are not required in this example since both xTRs have dual-stack connectivity to the core.

Perform the steps in this task (once through for each xTR in the LISP site) to enable and configure LISP ITR and ETR (xTR) functionality when using a LISP map resolver and map server for mapping services. The example configurations at the end of this task show the full configuration for two xTRs (xTR1 and xTR2).

SUMMARY STEPS

1. **configure terminal**
2. **router lisp**
3. **database-mapping** *EID-prefix/prefix-length locator* **priority** *priority* **weight** *weight*
4. Repeat Step 3 to configure a second IPv4 RLOC for the same xTR and IPv4 EID prefix.
5. Repeat Step 3 and Step 4 to configure the same RLOC connections, again, for the same xTR but, when repeating these two steps, associate the IPv6 EID prefix, 2001:db8:a::/48, instead of the IPv4 EID prefix.
6. Repeat Step 3, Step 4, and Step 5 to configure the second set of IPv4 and IPv6 RLOC connections on the same xTR for both the IPv4 and IPv6 EID prefixes.
7. **ipv4 itr**
8. **ipv4 etr**
9. **ipv4 itr map-resolver** *map-resolver-address*
10. Repeat Step 9 to configure a second locator address of the LISP map resolver.
11. Repeat Step 9 and Step 10 to configure the IPv6 locator addresses of the LISP two map resolvers.
12. **ipv4 etr map-server** *map-server-address* **key** *key-type* *authentication-key*
13. Repeat Step 12 to configure a second locator address of the map server.
14. Repeat Step 12 and Step 13 to configure the IPv6 locator addresses of the two map servers.
15. **ipv6 itr**
16. **ipv6 etr**
17. **ipv6 itr map-resolver** *map-resolver-address*

18. Repeat Step 17 to configure a second IPv6 locator address of the LISP map resolver.
19. Repeat Step 17 and Step 18 to configure the IPv6 (instead of IPv4) locator addresses for the two map resolvers to which this router will send Map-Request messages for IPv6 EID-to-RLOC mapping resolutions.
20. **ipv6 etr map-server map-server-address key key-type authentication-key**
21. Repeat Step 20 to configure a second locator address of the LISP map server.
22. Repeat Steps 20 and 21 to configure the IPv6 locator addresses of the two map servers for which this router, acting as an IPv6 LISP ETR, will use to register to the LISP mapping system.
23. **exit**
24. **ip route ipv4-prefix next-hop**
25. **exit**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: <pre>Router# configure terminal</pre>	Enters global configuration mode.
Step 2	router lisp Example: <pre>Router(config)# router lisp</pre>	Enters LISP configuration mode (IOS XE software only).
Step 3	database-mapping EID-prefix/prefix-length locator priority priority weight weight Example: <pre>Router(config-router-lisp)# database-mapping 172.16.1.0/24 10.1.1.2 priority 1 weight 50</pre>	Configures an EID-to-RLOC mapping relationship and its associated traffic policy for this LISP site. In this example, a single IPv4 EID prefix, 172.16.1.0/24, and a single IPv6 prefix, 2001:db8:a::/48, are being associated with a LISP site that contains two separate xTRs that each have a single IPv4 RLOC connection and a single IPv6 connection to the core. In this first database-mapping step example, xTR-1 is configured with an IPv4 RLOC connection to SP1 (10.1.1.2) and an IPv6 RLOC connection to SP1 (2001:db8:e000:1::2/64.) while xTR-2 has an IPv4 RLOC connection of 10.2.1.2 to SP2 and an IPv6 RLOC connection of 2001:db8:f000:1::2/64 to SP2. The <i>weight</i> argument of 50 signifies that a second database-mapping command is to be configured in the next step. Note Eight database-mapping commands are required for each xTR to indicate to the mapping system that both the IPv4 and IPv6 EID prefixes are reachable at this LISP site via

	Command or Action	Purpose
		both the two IPv4 RLOCs and the two IPv6 RLOCs. In this example, one IPv4 RLOC and one IPv6 RLOC are local (connected) to one xTR and the others are local (connected) to the other xTR.
Step 4	Repeat Step 3 to configure a second IPv4 RLOC for the same xTR and IPv4 EID prefix. Example: <pre>Router(config-router-lisp)# database-mapping 172.16.1.0/24 10.2.1.2 priority 1 weight 50</pre>	Configures an EID-to-RLOC mapping relationship and its associated traffic policy for an xTR on this LISP site. In this step example, the second RLOC connection for xTR-1 has an IPv4 RLOC connection to SP2 (10.2.1.2). Note When a LISP site contains multiple xTRs, all xTRs must be configured with identical database-mapping commands to provide the mapping system with consistent information about EID-to-RLOC mappings.
Step 5	Repeat Step 3 and Step 4 to configure the same RLOC connections, again, for the same xTR but, when repeating these two steps, associate the IPv6 EID prefix, 2001:db8:a::/48, instead of the IPv4 EID prefix. Example: <pre>Router(config-router-lisp)# database-mapping 2001:db8:a::/48 10.1.1.2 priority 1 weight 50</pre> Example: <pre>Router(config-router-lisp)# database-mapping 2001:db8:a::/48 10.2.1.2 priority 1 weight 50</pre>	—
Step 6	Repeat Step 3, Step 4, and Step 5 to configure the second set of IPv4 and IPv6 RLOC connections on the same xTR for both the IPv4 and IPv6 EID prefixes.	—
Step 7	ipv4 itr Example: <pre>Router(config-router-lisp)# ipv4 itr</pre>	Enables LISP ITR functionality for the IPv4 address family.
Step 8	ipv4 etr Example: <pre>Router(config-router-lisp)# ipv4 etr</pre>	Enables LISP ETR functionality for the IPv4 address family.

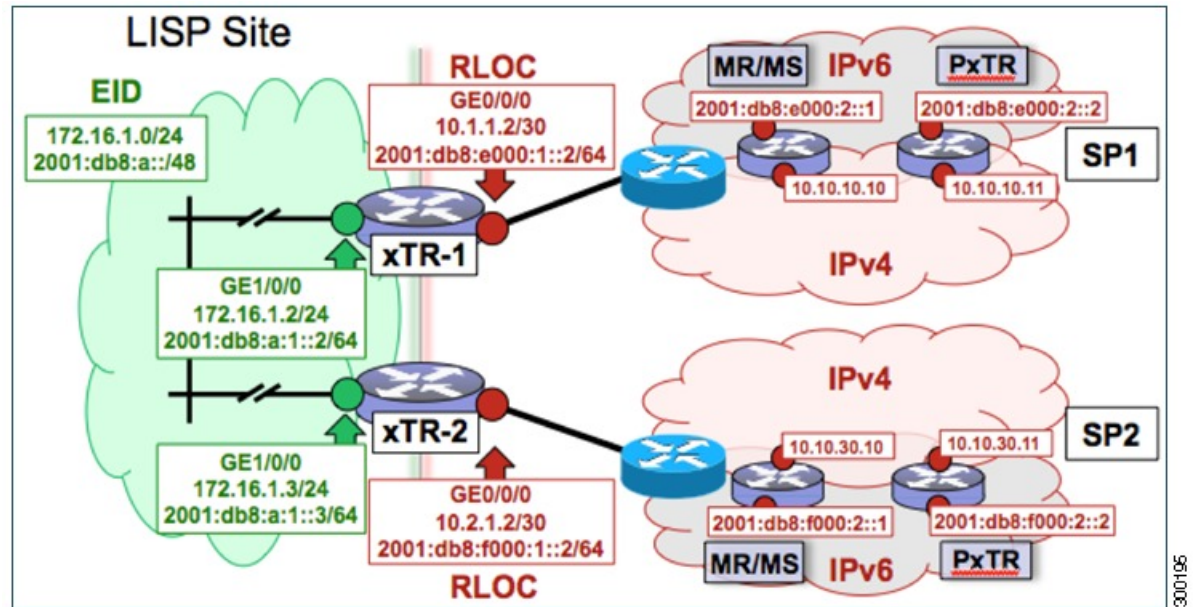
	Command or Action	Purpose
Step 9	ipv4 itr map-resolver map-resolver-address Example: <pre>Router(config-router-lisp)# ipv4 itr map-resolver 10.10.10.10</pre>	Configures a locator address for the LISP map resolver to which this router will send Map-Request messages for IPv4 EID-to-RLOC mapping resolutions. The locator address of the map resolver may be an IPv4 or IPv6 address. In this example, because each xTR has both IPv4 and IPv6 RLOC connectivity, the map resolver is reachable via both IPv4 and IPv6 locator addresses. (See the <i>LISP Command Reference</i> for more details.) Note Up to two map resolvers may be configured if multiple map resolvers are available. (See the <i>LISP Command Reference</i> for more details.)
Step 10	Repeat Step 9 to configure a second locator address of the LISP map resolver. Example: <pre>Router(config-router-lisp)# ipv4 itr map-resolver 10.10.30.10</pre>	Configures a second locator address for the LISP map resolver to which this router will send Map-Request messages for IPv4 EID-to-RLOC mapping resolutions.
Step 11	Repeat Step 9 and Step 10 to configure the IPv6 locator addresses of the LISP two map resolvers.	—
Step 12	ipv4 etr map-server map-server-address key key-type authentication-key Example: <pre>Router(config-router-lisp)# ipv4 etr map-server 10.10.10.10 key 0 some-key</pre>	Configures a locator address for the LISP map server and an authentication key that this router, acting as an IPv4 LISP ETR, will use to register with the LISP mapping system. - In this example, a second xTR can be registered to the same two map servers using the same authentication key. - The map server must be configured with EID prefixes matching those configured on this ETR and with an identical authentication key. Note The locator address of the map server may be an IPv4 or IPv6 address. In this example, because each xTR has both IPv4 and IPv6 RLOC connectivity, the map server is reachable via both IPv4 and IPv6 locator addresses. (See the <i>LISP Command Reference</i> for more details.) Note Up to two map servers may be configured if multiple map servers are available. (See the <i>LISP Command Reference</i> for more details.)

Configure a Multihomed LISP Site with Two xTRs that Each have Both an IPv4 and an IPv6 RLOC and Both an IPv4 and an IPv6 EID

	Command or Action	Purpose
Step 13	Repeat Step 12 to configure a second locator address of the map server. Example: <pre>Router(config-router-lisp)# ipv4 etr map-server 10.10.30.10 key 0 some-key</pre>	Configures a second IPv4 locator address of the LISP map server and the authentication key that this router, acting as an IPv4 LISP ETR, will use to register with the LISP mapping system.
Step 14	Repeat Step 12 and Step 13 to configure the IPv6 locator addresses of the two map servers. Example: <pre>ipv4 etr map-server 2001:db8:e000:2::1 key 0 some-xtr-key</pre> Example: <pre>ipv4 etr map-server 2001:db8:f000:2::1 key 0 some-xtr-key</pre>	—
Step 15	ipv6 itr Example: <pre>Router(config-router-lisp)# ipv6 itr</pre>	Enables LISP ITR functionality for the IPv6 address family.
Step 16	ipv6 etr Example: <pre>Router(config-router-lisp)# ipv6 etr</pre>	Enables LISP ETR functionality for the IPv6 address family.
Step 17	ipv6 itr map-resolver map-resolver-address Example: <pre>Router(config-router-lisp)# ipv6 itr map-resolver 10.10.10.10</pre>	Configures a locator address for the LISP map resolver to which this router will send Map-Request messages for IPv6 EID-to-RLOC mapping resolutions. The locator address of the map resolver may be an IPv4 or IPv6 address. In this example, because each xTR has both IPv4 and IPv6 RLOC connectivity, the map resolver is reachable via both IPv4 and IPv6 locator addresses. (See the <i>LISP Command Reference</i> for more details.) Note Up to two map resolvers may be configured if multiple map resolvers are available. (See the <i>LISP Command Reference</i> for more details.)
Step 18	Repeat Step 17 to configure a second IPv6 locator address of the LISP map resolver. Example: <pre>Router(config-router-lisp)# ipv6 itr map-resolver 10.10.30.10</pre>	Configures a second locator address of the map resolver to which this router will send Map-Request messages for IPv6 EID-to-RLOC mapping resolutions.

	Command or Action	Purpose
Step 19	Repeat Step 17 and Step 18 to configure the IPv6 (instead of IPv4) locator addresses for the two map resolvers to which this router will send Map-Request messages for IPv6 EID-to-RLOC mapping resolutions. Example: <pre>ipv6 itr map-resolver 2001:db8:e000:2::1</pre> Example: <pre>ipv6 itr map-resolver 2001:db8:f000:2::1</pre>	—
Step 20	ipv6 etr map-server map-server-address key key-type authentication-key Example: <pre>Router(config-router-lisp)# ipv6 etr map-server 10.10.10.10 key 0 some-key</pre>	Configures a locator address for the LISP map server and an authentication key that this router, acting as an IPv6 LISP ETR, will use to register to the LISP mapping system. • In this example, a second xTR can be registered to the same two map servers using the same authentication key. • The map server must be configured with EID prefixes matching those configured on this ETR and with an identical authentication key. Note The locator address of the map server may be an IPv4 or IPv6 address. In this example, because each xTR has both IPv4 and IPv6 RLOC connectivity, the map server is reachable via both IPv4 and IPv6 locator addresses. (See the <i>LISP Command Reference</i> for more details.) Note Up to two map servers may be configured if multiple map servers are available. (See the <i>LISP Command Reference</i> for more details.)
Step 21	Repeat Step 20 to configure a second locator address of the LISP map server. Example: <pre>Router(config-router-lisp)# ipv6 etr map-server 10.10.30.10 key 0 some-key</pre>	Configures a second locator address for the LISP map server and an authentication key that this router, acting as an IPv6 LISP ETR, will use to register with the LISP mapping system.
Step 22	Repeat Steps 20 and 21 to configure the IPv6 locator addresses of the two map servers for which this router, acting as an IPv6 LISP ETR, will use to register to the LISP mapping system. Example: <pre>ipv6 etr map-server 2001:db8:e000:2::1 key 0 some-xtr-key</pre> Example:	—

	Command or Action	Purpose
	<code>ipv6 etr map-server 2001:db8:f000:2::1 key 0 some-xtr-key</code>	
Step 23	exit Example: <code>Router(config-router-lisp)# exit</code>	Exits LISP configuration mode and returns to global configuration mode.
Step 24	ip route <i>ipv4-prefix</i> <i>next-hop</i> Example: <code>Router(config)# ip route 0.0.0.0 0.0.0.0 10.1.1.1</code>	Configures a default route to the upstream next hop for all IPv4 destinations. • All IPv4 EID-sourced packets destined to both LISP and non-LISP sites are forwarded in one of two ways: • LISP-encapsulated to a LISP site when traffic is LISP-to-LISP • natively forwarded when traffic is LISP-to-non-LISP • Packets are deemed to be a candidate for LISP encapsulation when they are sourced from a LISP EID and the destination matches one of the following entries: • a current map-cache entry • a default route with a legitimate next-hop • no route at all In this configuration example, because the xTR has IPv4 RLOC connectivity, a default route to the upstream SP is used for all IPv4 packets to support LISP processing.
Step 25	exit Example: <code>Router(config)# exit</code>	Exits global configuration mode.

Example:**Figure 8: Multihomed LISP Site with Two xTRs, Each with an IPv4 and an IPv6 RLOC and each with an IPv4 and an IPv6 EID**

The examples below show the complete configuration for the LISP topology illustrated in the figure above and in this task:

Example configuration for xTR-1:

```
!
hostname xTR-1
!
no ip domain lookup
ip cef
ipv6 unicast-routing
ipv6 cef
!
interface Loopback0
 ip address 172.17.1.1 255.255.255.255
!
interface LISP0
!
interface GigabitEthernet0/0/0
 description Link to SP1 (RLOC)
 ip address 10.1.1.2 255.255.255.252
 ipv6 address 2001:db8:e000:1::2/64
!
interface GigabitEthernet1/0/0
 description Link to Site (EID)
 ip address 172.16.1.2 255.255.255.0
 ipv6 address 2001:db8:a:1::2/64
!
router lisp
 database-mapping 172.16.1.0/24 10.1.1.2 priority 1 weight 50
 database-mapping 172.16.1.0/24 10.2.1.2 priority 1 weight 50
 database-mapping 2001:db8:a::/48 10.1.1.2 priority 1 weight 50
```

```

database-mapping 2001:db8:a::/48 10.2.1.2 priority 1 weight 50
database-mapping 172.16.1.0/24 2001:db8:e000:1::2 priority 1 weight 50
database-mapping 172.16.1.0/24 2001:db8:f000:1::2 priority 1 weight 50
database-mapping 2001:db8:a::/48 2001:db8:e000:1::2 priority 1 weight 50
database-mapping 2001:db8:a::/48 2001:db8:f000:1::2 priority 1 weight 50
ipv4 itr
ipv4 etr
ipv4 itr map-resolver 10.10.10.10
ipv4 itr map-resolver 10.10.30.10
ipv4 itr map-resolver 2001:db8:e000:2::1
ipv4 itr map-resolver 2001:db8:f000:2::1
ipv4 etr map-server 10.10.10.10 key 0 some-xtr-key
ipv4 etr map-server 10.10.30.10 key 0 some-xtr-key
ipv4 etr map-server 2001:db8:e000:2::1 key 0 some-xtr-key
ipv4 etr map-server 2001:db8:f000:2::1 key 0 some-xtr-key
ipv6 itr
ipv6 etr
ipv6 itr map-resolver 10.10.10.10
ipv6 itr map-resolver 10.10.30.10
ipv6 itr map-resolver 2001:db8:e000:2::1
ipv6 itr map-resolver 2001:db8:f000:2::1
ipv6 etr map-server 10.10.10.10 key 0 some-xtr-key
ipv6 etr map-server 10.10.30.10 key 0 some-xtr-key
ipv6 etr map-server 2001:db8:e000:2::1 key 0 some-xtr-key
ipv6 etr map-server 2001:db8:f000:2::1 key 0 some-xtr-key
exit
!
ip route 0.0.0.0 0.0.0.0 10.1.1.1
!
ipv6 route ::/0 2001:db8:e000:1::1
!

```

Example configuration for xTR-2:

```

!
hostname xTR-2
!
no ip domain lookup
ip cef
ipv6 unicast-routing
ipv6 cef
!
interface Loopback0
 ip address 172.17.1.2 255.255.255.255
!
interface LISP0
!
interface GigabitEthernet0/0/0
 description Link to SP2 (RLOC)
 ip address 10.2.1.2 255.255.255.252
 ipv6 address 2001:db8:f000:1::2/64
!
interface GigabitEthernet1/0/0
 description Link to Site (EID)
 ip address 172.16.1.3 255.255.255.0
 ipv6 address 2001:db8:a:1::3/64
!
router lisp
 database-mapping 172.16.1.0/24 10.1.1.2 priority 1 weight 50
 database-mapping 172.16.1.0/24 10.2.1.2 priority 1 weight 50
 database-mapping 2001:db8:a::/48 10.1.1.2 priority 1 weight 50
 database-mapping 2001:db8:a::/48 10.2.1.2 priority 1 weight 50
 database-mapping 172.16.1.0/24 2001:db8:e000:1::2 priority 1 weight 50
 database-mapping 172.16.1.0/24 2001:db8:f000:1::2 priority 1 weight 50

```

```

database-mapping 2001:db8:a::/48 2001:db8:e000:1::2 priority 1 weight 50
database-mapping 2001:db8:a::/48 2001:db8:f000:1::2 priority 1 weight 50
ipv4 itr
ipv4 etr
ipv4 itr map-resolver 10.10.10.10
ipv4 itr map-resolver 10.10.30.10
ipv4 itr map-resolver 2001:db8:e000:2::1
ipv4 itr map-resolver 2001:db8:f000:2::1
ipv4 etr map-server 10.10.10.10 key 0 some-xtr-key
ipv4 etr map-server 10.10.30.10 key 0 some-xtr-key
ipv4 etr map-server 2001:db8:e000:2::1 key 0 some-xtr-key
ipv4 etr map-server 2001:db8:f000:2::1 key 0 some-xtr-key
ipv6 itr
ipv6 etr
ipv6 itr map-resolver 10.10.10.10
ipv6 itr map-resolver 10.10.30.10
ipv6 itr map-resolver 2001:db8:e000:2::1
ipv6 itr map-resolver 2001:db8:f000:2::1
ipv6 etr map-server 10.10.10.10 key 0 some-xtr-key
ipv6 etr map-server 10.10.30.10 key 0 some-xtr-key
ipv6 etr map-server 2001:db8:e000:2::1 key 0 some-xtr-key
ipv6 etr map-server 2001:db8:f000:2::1 key 0 some-xtr-key
exit
!
ip route 0.0.0.0 0.0.0.0 10.2.1.1
!
ipv6 route ::/0 2001:db8:f000:1::1
!

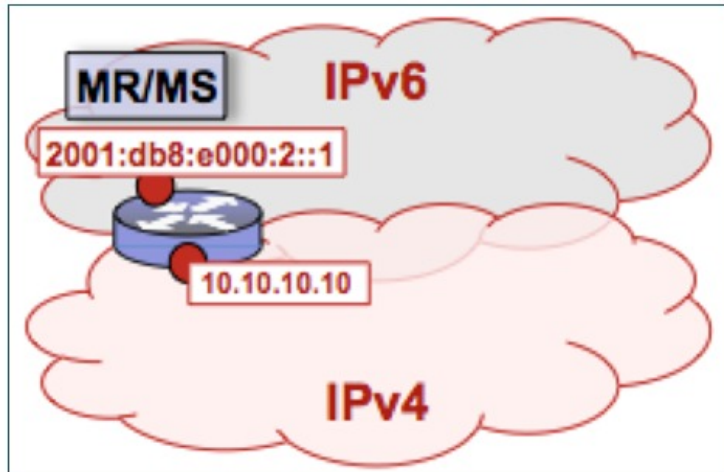
```

Configure a Private LISP Mapping System Using a Standalone Map Resolver/Map Server

Perform this task to configure and enable standalone LISP map resolver/map server (MR/MS) functionality for both IPv4 and IPv6 address families. In this task, a Cisco device is configured as a standalone MR/MS for a private LISP mapping system. Because the MR/MS is configured as a standalone device, it has no need for LISP alternative logical topology (ALT) connectivity. All relevant LISP sites must be configured to register with this map server so that this map server has full knowledge of all registered EID prefixes within the (assumed) private LISP system. However, because this device is functioning as a map resolver/map server, the data structure associated with an ALT virtual routing and forwarding (VRF) table must still be configured to hold LISP EIDs for registered sites.

The map resolver/map server is configured with both IPv4 and IPv6 RLOC addresses. The topology used in this most basic LISP MR/MS configuration is shown in the figure below.

Figure 9: Standalone LISP Map Resolver/Map Server with both IPv4 and IPv6 RLOCs



The components illustrated in the topology shown in the figure are described below, although the map resolver is configured separately:

Mapping System

- The LISP device is configured to function as a standalone map resolver/map server (MR/MS).
- The xTRs in the LISP site are assumed to be registered to this map server. That is, the xTR registers the IPv4 EID prefix of 172.16.1.0/24 and, when IPv6 EIDs are used, the xTR also registers the IPv6 EID of prefix 2001:db8:a::/48.
- The MR/MS has an IPv4 locator of 10.10.10.10/24 and an IPv6 locator of 2001:db8:e000:2::1/64.

SUMMARY STEPS

1. **configure terminal**
2. **vrf definition** *vrf-name*
3. **address-family ipv4** [unicast]
4. **exit-address-family**
5. **address-family ipv6**
6. **exit-address-family**
7. **exit**
8. **router lisp**
9. **ipv4 alt-vrf** *vrf-name*
10. **ipv4 map-server**
11. **ipv4 map-resolver**
12. **ipv6 alt-vrf** *vrf-name*
13. **ipv6 map-server**
14. **ipv6 map-resolver**
15. **site** *site-name*
16. **eid-prefix** *EID-prefix*
17. **authentication-key** [*key-type*] *authentication-key*
18. **exit**

19. Repeat Steps 15 through 18 to configure additional LISP sites.
20. **exit**
21. **ip route** *ipv4-prefix next-hop*
22. **ipv6 route** *ipv6-prefix next-hop*
23. **exit**

DETAILED STEPS

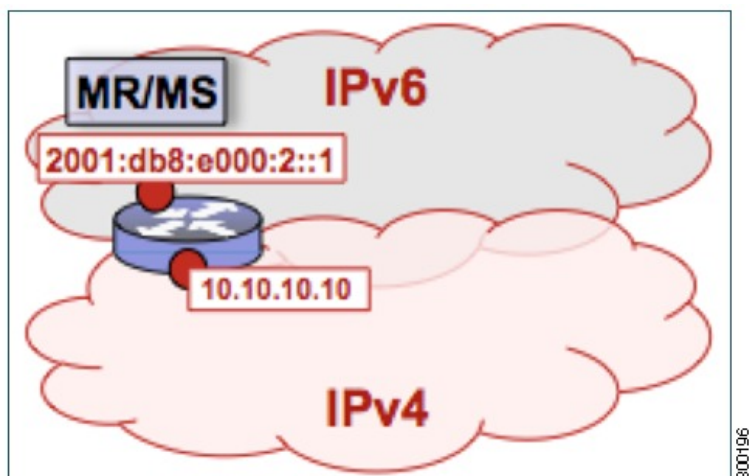
Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: <pre>Router# configure terminal</pre>	Enters global configuration mode.
Step 2	vrf definition <i>vrf-name</i> Example: <pre>Router(config)# vrf definition lisp</pre>	Creates a virtual routing and forwarding (VRF) table and enters VRF configuration mode. • Use the <i>vrf-name</i> argument to specify a name to be assigned to the VRF table. In this example, a VRF table named <i>lisp</i> is created to hold EID prefixes.
Step 3	address-family <i>ipv4 [unicast]</i> Example: <pre>Router(config-vrf)# address-family ipv4</pre>	Enters VRF IPv4 address family configuration mode to specify an IPv4 address family for a VRF table. • In this example, the VRF table named <i>lisp</i> handles IPv4 EID prefixes.
Step 4	exit-address-family Example: <pre>Router(config-vrf-af)# exit-address-family</pre>	Exits VRF IPv4 address family configuration mode and returns to VRF configuration mode.
Step 5	address-family <i>ipv6</i> Example: <pre>Router(config-vrf)# address-family ipv6</pre>	Enters VRF IPv6 address family configuration mode to specify an IPv6 address family for a VRF table. • In this example, the VRF table named <i>lisp</i> handles IPv6 EID prefixes.
Step 6	exit-address-family Example: <pre>Router(config-vrf-af)# exit-address-family</pre>	Exits VRF IPv6 address family configuration mode and returns to VRF configuration mode.
Step 7	exit Example: <pre>Router(config-vrf)# exit</pre>	Exits VRF configuration mode and enters global configuration mode.

	Command or Action	Purpose
Step 8	router lisp Example: <pre>Router(config)# router lisp</pre>	Enters LISP configuration mode (Cisco IOS XE software only).
Step 9	ipv4 alt-vrf vrf-name Example: <pre>Router(config-router-lisp)# ipv4 alt-vrf lisp</pre>	Associates a VRF table with the LISP ALT for IPv4 EIDs. • In this example, the VRF table named lisp (created in Step 2) is associated with the LISP ALT.
Step 10	ipv4 map-server Example: <pre>Router(config-router-lisp)# ipv4 map-server</pre>	Enables LISP map server functionality for EIDs in the IPv4 address family.
Step 11	ipv4 map-resolver Example: <pre>Router(config-router-lisp)# ipv4 map-resolver</pre>	Enables LISP map resolver functionality for EIDs in the IPv4 address family.
Step 12	ipv6 alt-vrf vrf-name Example: <pre>Router(config-router-lisp)# ipv6 alt-vrf lisp</pre>	Associates a VRF table with the LISP ALT for IPv6 EIDs. • In this example, the VRF table named lisp (created in Step 2) is associated with the LISP ALT.
Step 13	ipv6 map-server Example: <pre>Router(config-router-lisp)# ipv6 map-server</pre>	Enables LISP map server functionality for EIDs in the IPv6 address family.
Step 14	ipv6 map-resolver Example: <pre>Router(config-router-lisp)# ipv6 map-resolver</pre>	Enables LISP map resolver functionality for EIDs in the IPv6 address family.
Step 15	site site-name Example: <pre>Router(config-router-lisp)# site Site-1</pre>	Specifies a LISP site named Site-1 and enters LISP site configuration mode. Note A LISP site name is locally significant to the map server on which it is configured. It has no relevance anywhere else. This name is used solely as an administrative means of associating one or more EID prefixes with an authentication key and other site-related mechanisms.
Step 16	eid-prefix EID-prefix Example:	Configures an IPv4 or IPv6 EID prefix associated with this LISP site.

	Command or Action	Purpose
	<pre>Router(config-router-lisp-site)# eid-prefix 172.16.1.0/24</pre>	- Repeat this step as necessary to configure additional EID prefixes under this LISP sites. - In this step example, only an IPv4 EID prefix is configured but to complete the configuration, an IPv6 EID prefix must also be configured. Note The LISP ETR must be configured with matching EID prefixes and an identical authentication key. Note Additional eid-prefix command configuration options are available. (See the <i>LISP Command Reference</i> for more details.)
Step 17	authentication-key [<i>key-type</i>] <i>authentication-key</i> Example: <pre>Router(config-router-lisp-site)# authentication-key 0 some-key</pre>	Configures the authentication key associated with this site. Note The LISP ETR must be configured with matching EID prefixes and an identical authentication key. Note The authentication-key can be configured with Type 6 encryption. (See the <i>LISP Command Reference</i> for more details.)
Step 18	exit Example: <pre>Router(config-router-lisp-site)# exit</pre>	Exits LISP site configuration mode and returns to LISP configuration mode.
Step 19	Repeat Steps 15 through 18 to configure additional LISP sites.	—
Step 20	exit Example: <pre>Router(config-router-lisp)# exit</pre>	Exits LISP configuration mode and returns to global configuration mode.
Step 21	ip route <i>ipv4-prefix next-hop</i> Example: <pre>Router(config)# ip route 0.0.0.0 0.0.0.0 10.1.1.1</pre>	Configures an IPv4 static route. In this example, a default route to the upstream next hop for all IPv4 destinations is created.
Step 22	ipv6 route <i>ipv6-prefix next-hop</i> Example: <pre>Router(config)# ipv6 route ::/0 2001:db8:e000:1::1</pre>	Configures an IPv6 static route. In this example, a default route to the upstream next hop for all IPv6 destinations is created.

	Command or Action	Purpose
Step 23	exit Example: Router(config)# exit	Exits global configuration mode and returns to privileged EXEC mode.

Example:*Figure 10: Standalone LISP Map Resolver/Map Server with both IPv4 and IPv6 RLOCs*

The example below shows the complete configuration for the LISP topology illustrated in the figure above and in this task. However, this example is for a full configuration of a standalone LISP MR/MS and includes some basic IPv4 and IPv6 configuration not covered in this task:

```

!
hostname MR-MS
!
vrf definition lisp
!
  address-family ipv4
  exit-address-family
!
  address-family ipv6
  exit-address-family
!
no ip domain lookup
ip cef
ipv6 unicast-routing
ipv6 cef
!
interface Loopback0
 ip address 172.17.2.1 255.255.255.255
!
interface LISP0
!
interface GigabitEthernet0/0/0
 description Link to SP1 (RLOC)
 ip address 10.10.10.10 255.255.255.0

```

```

    ipv6 address 2001:db8:e000:2::1/64
    !
router lisp
  site Site-1
    authentication-key some-key
    eid-prefix 172.16.1.0/24
    eid-prefix 2001:db8:a::/48
    exit
  !
  site Site-2
    authentication-key another-key
    eid-prefix 172.16.2.0/24
    eid-prefix 2001:db8:b::/48
    exit
  !
!---more LISP site configs---
!
ipv4 map-server
ipv4 map-resolver
ipv4 alt-vrf lisp
ipv6 map-server
ipv6 map-resolver
ipv6 alt-vrf lisp
exit
!
ip route 0.0.0.0 0.0.0.0 10.10.10.1
!
ipv6 route ::/0 2001:db8:e000:2::fof

```

Configure a Public Mapping System Using Separate ALT-Connected Map Resolver and Map Server Devices

The following tasks show how to configure a map resolver (MR) and a map server (MS) on separate devices, each using LISP alternative logical topology (ALT) connectivity. The MR and MS share their EID prefix information via the LISP ALT connectivity, which is typical of a public LISP deployment model where higher performance and scalability (for tasks such as the handling of Map-Request messages) is required. The LISP ALT is implemented as an overlay virtualized network using GRE tunnels and BGP, which allows for separation of EID prefixes from the underlying core network.

Configuring an ALT-Connected LISP Map Resolver

Before you begin

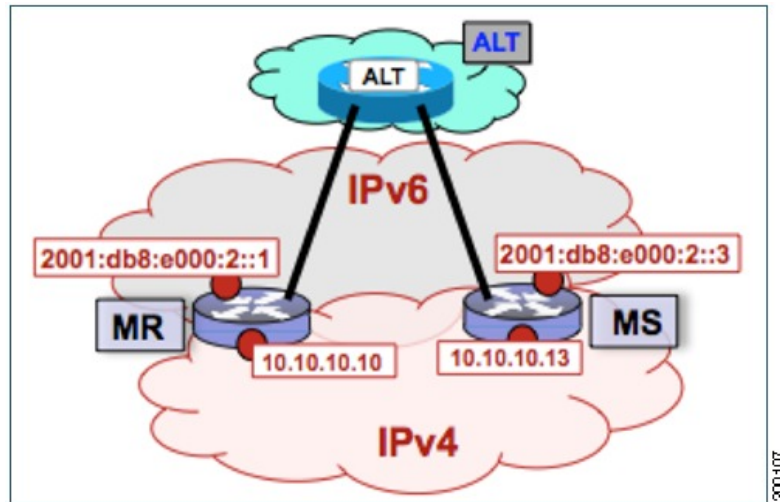
Perform this task to configure LISP alternative logical topology (ALT) map resolver functionality for both IPv4 and IPv6 address family mapping services on Cisco IOS XE Everest 16.6.1 and later releases.



Note You must also configure an ALT-connected LISP map server (see the Configuring an ALT-Connected LISP Map Server task).

In the figure below, the map resolver (MR) and map server (MS) are configured on separate devices and share their EID prefix information via connectivity.

Figure 11: ALT-Connected LISP Map Resolver and Map Server, each having both an IPv4 and an IPv6 RLOC



The map resolver illustrated in the topology shown in the figure is described below; the map server and LISP ALT are configured in separate tasks:

Mapping System

- Two LISP devices are configured, one as an MS and the other as an MR.
- The MS has an IPv4 locator of 10.10.10.13/24 and an IPv6 locator of 2001:db8:e000:2::3/64.
- The MR has an IPv4 locator of 10.10.10.10/24 and an IPv6 locator of 2001:db8:e000:2::1/64.
- Assume that the xTRs in the LISP site register to this map server. That is, the xTR registers the IPv4 EID-prefix of 172.16.1.0/24 and, when IPv6 EIDs are used, the xTR registers the IPv6 EID-prefix of 2001:db8:a::/48.



Note The configuration of the xTR must be changed to use the MS RLOC for its map server configuration and the MR RLOC for its map resolver configuration. For example:

- `ipv4 itr map-resolver 10.10.10.10`
- `ipv4 etr map-server 10.10.10.13 key 0 some-key`

Other Infrastructure

- The MR has IPv4 and IPv6 tunnel endpoints in the VRF table (named lisp) of 192.168.1.1/30 and 2001:db8:ffff::1/64, respectively, and the MS has IPv4 and IPv6 tunnel endpoints of 192.168.1.2/30 and 2001:db8:ffff::2/64, respectively, in the same VRF table. This tunnel is used for the ALT.

SUMMARY STEPS

1. **configure terminal**
2. **vrf definition** *vrf-name*
3. **rd** *route-distinguisher*
4. **address-family** *ipv4* [*unicast*]

5. **exit-address-family**
6. **address-family ipv6**
7. **exit-address-family**
8. **exit**
9. **interface** *type number*
10. **vrf forwarding** *vrf-name*
11. **ip address** *ip-address mask*
12. **ipv6 address** *ipv6-address/mask*
13. **tunnel source** *interface-type interface-number*
14. **tunnel destination** *ipv4-address*
15. **exit**
16. **router lisp**
17. **ipv4 map-resolver**
18. **ipv4 alt-vrf** *vrf-name*
19. **ipv6 map-resolver**
20. **ipv6 alt-vrf** *vrf-name*
21. **exit**
22. **router bgp** *autonomous-system-number*
23. **address-family ipv4** [**unicast** | **multicast** | **vrf** *vrf-name*]
24. **neighbor** *ip-address* **remote-as** *autonomous-system-number*
25. **neighbor** *ip-address* **activate**
26. **exit**
27. **address-family ipv6** **vrf** *vrf-name*
28. **neighbor** *ip-address* **remote-as** *autonomous-system-number*
29. **neighbor** *ip-address* **activate**
30. **exit**
31. **exit**
32. **ip route** *ipv4-prefix next-hop*
33. **ipv6 route** *ipv6-prefix next-hop*
34. **exit**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: Router# <code>configure terminal</code>	Enters global configuration mode.
Step 2	vrf definition <i>vrf-name</i> Example: Router(config)# <code>vrf definition lisp</code>	Creates a virtual routing and forwarding (VRF) table and enters VRF configuration mode. Use the <i>vrf-name</i> argument to specify a name to be assigned to the VRF. In this example, a VRF named <code>lisp</code> is created to hold EID prefixes.

	Command or Action	Purpose
Step 3	rd route-distinguisher Example: Router(config-vrf)# rd 1:1	Creates routing and forwarding tables for a VRF.
Step 4	address-family ipv4 [unicast] Example: Router(config-vrf)# address-family ipv4	Enters VRF IPv4 address family configuration mode to specify an IPv4 address family for a VRF table. In this example, the VRF table named lisp handles IPv4 EID prefixes.
Step 5	exit-address-family Example: Router(config-vrf-af)# exit-address-family	Exits VRF IPv4 address family configuration mode and returns to VRF configuration mode.
Step 6	address-family ipv6 Example: Router(config-vrf)# address-family ipv6	Enters VRF IPv6 address family configuration mode to specify an IPv6 address family for a VRF table. In this example, the VRF table named lisp handles IPv6 EID prefixes.
Step 7	exit-address-family Example: Router(config-vrf-af)# exit-address-family	Exits VRF IPv6 address family configuration mode and returns to VRF configuration mode.
Step 8	exit Example: Router(config-vrf)# exit	Exits VRF configuration mode and enters global configuration mode.
Step 9	interface type number Example: Router(config)# interface tunnel 192	Specifies the interface type of tunnel and the interface number and enters interface configuration mode.
Step 10	vrf forwarding vrf-name Example: Router(config-if)# vrf forwarding lisp	Associates a VRF instance configured in Step 2 with the tunnel interface configured in Step 9. When the interface is bound to a VRF, previously configured IP addresses are removed, and the interface is disabled.
Step 11	ip address ip-address mask Example: Router(config-if)# ip address 192.168.1.1 255.255.255.252	Configures an IPv4 address for the tunnel interface.
Step 12	ipv6 address ipv6-address/mask Example:	Configures an IPv6 address for the tunnel interface.

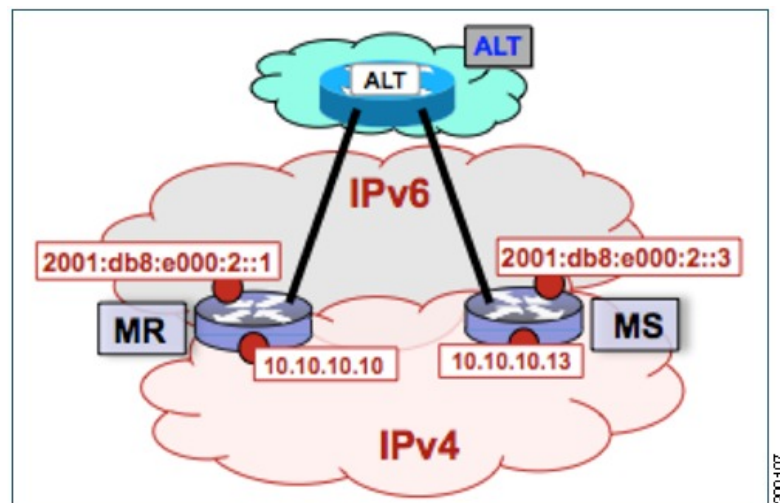
	Command or Action	Purpose
	Router(config-if)# ipv6 address 2001:db8:ffff::1/64	
Step 13	tunnel source <i>interface-type interface-number</i> Example: Router(config-if)# tunnel source GigabitEthernet 0/0/0	Configures the tunnel source.
Step 14	tunnel destination <i>ipv4-address</i> Example: Router(config-if)# tunnel destination 10.10.10.13	Configures the tunnel destination IPv4 address for the tunnel interface.
Step 15	exit Example: Router(config-if)# exit	Exits interface configuration mode and enters global configuration mode.
Step 16	router lisp Example: Router(config)# router lisp	Enters LISP configuration mode (IOS XE software only).
Step 17	ipv4 map-resolver Example: Router(config-router-lisp)# ipv4 map-resolver	Enables LISP map resolver functionality for EIDs in the IPv4 address family.
Step 18	ipv4 alt-vrf <i>vrf-name</i> Example: Router(config-router-lisp)# ipv4 alt-vrf lisp	Associates a VRF table with the LISP ALT for IPv4 EIDs. • In this example, the VRF table named lisp (created in Step 2) is associated with the LISP ALT.
Step 19	ipv6 map-resolver Example: Router(config-router-lisp)# ipv6 map-resolver	Enables LISP map resolver functionality for EIDs in the IPv6 address family.
Step 20	ipv6 alt-vrf <i>vrf-name</i> Example: Router(config-router-lisp)# ipv6 alt-vrf lisp	Associates a VRF table with the LISP ALT for IPv6 EIDs. • In this example, the VRF table named lisp (created in Step 2) is associated with the LISP ALT.
Step 21	exit Example: Router(config-router-lisp)# exit	Exits LISP configuration mode and returns to global configuration mode.
Step 22	router bgp <i>autonomous-system-number</i> Example: Router(config)# router bgp 65010	Enters router configuration mode for the specified routing process.

	Command or Action	Purpose
Step 23	address-family ipv4 [unicast multicast vrf vrf-name] Example: <pre>Router(config-router)# address-family ipv4 vrf lisp</pre>	Specifies the IPv4 address family and enters IPv4 address family configuration mode. - The vrf keyword and <i>vrf-name</i> argument specify the name of the VRF instance to associate with subsequent commands. - In this example, the VRF table named lisp (created in Step 2) is associated with the BGP IPv4 VRF that carries EID-prefixes in the LISP ALT.
Step 24	neighbor ip-address remote-as autonomous-system-number Example: <pre>Router(config-router-af)# neighbor 192.168.1.2 remote-as 65011</pre>	Adds the IP address of the neighbor in the specified autonomous system to the IPv4 multiprotocol BGP neighbor table of the local router.
Step 25	neighbor ip-address activate Example: <pre>Router(config-router-af)# neighbor 192.168.1.2 activate</pre>	Enables the neighbor to exchange prefixes for the IPv4 unicast address family.
Step 26	exit Example: <pre>Router(config-router-af)# exit</pre>	Exits IPv4 address family configuration mode and returns to router configuration mode.
Step 27	address-family ipv6 vrf vrf-name Example: <pre>Router(config-router)# address-family ipv6 vrf lisp</pre>	Specifies the IPv6 address family and enters IPv6 address family configuration mode. - The vrf keyword and <i>vrf-name</i> argument specify the name of the VRF instance to associate with subsequent commands. - In this example, the VRF table named lisp (created in Step 2) is associated with the BGP IPv6 VRF that carries EID-prefixes in the LISP ALT.
Step 28	neighbor ip-address remote-as autonomous-system-number Example: <pre>Router(config-router-af)# neighbor 2001:db8:ffff::2 remote-as 65011</pre>	Adds the IPv6 address of the neighbor in the specified autonomous system to the IPv6 multiprotocol BGP neighbor table of the local router.
Step 29	neighbor ip-address activate Example: <pre>Router(config-router-af)# neighbor 2001:db8:ffff::2 activate</pre>	Enables the neighbor to exchange prefixes for the IPv6 unicast address family.

	Command or Action	Purpose
Step 30	exit Example: <code>Router(config-router-af)# exit</code>	Exits address family configuration mode and returns to router configuration mode.
Step 31	exit Example: <code>Router(config-router)# exit</code>	Exits router configuration mode and returns to global configuration mode.
Step 32	ip route ipv4-prefix next-hop Example: <code>Router(config)# ip route 0.0.0.0 0.0.0.0 10.10.10.1</code>	Configures an IPv4 static route. • In this example, a default route to the upstream next hop for all IPv4 destinations is created.
Step 33	ipv6 route ipv6-prefix next-hop Example: <code>Router(config)# ipv6 route ::/0 2001:db8:e000:2::f0f</code>	Configures an IPv6 static route. • In this example, a default route to the upstream next hop for all IPv6 destinations is created.
Step 34	exit Example: <code>Router(config)# exit</code>	Exits global configuration mode and returns to privileged EXEC mode.

Examples

Figure 12: ALT-Connected LISP Map Resolver and Map Server, each having both an IPv4 and an IPv6 RLOC



The example below shows the full configuration for a LISP map resolver including some basic IP and IPv6 configuration not included in the task table for this task:

!

```

vrf definition lisp
  rd 1:1
  !
  address-family ipv4
  exit-address-family
  !
  address-family ipv6
  exit-address-family
  !
no ip domain lookup
ip cef
ipv6 unicast-routing
ipv6 cef
!
interface Loopback0
  no ip address
  !
interface Tunnel192
  vrf forwarding lisp
  ip address 192.168.1.1 255.255.255.252
  ipv6 address 2001:db8:ffff::1/64
  tunnel source GigabitEthernet 0/0/0
  tunnel destination 10.10.10.13
  !
interface GigabitEthernet 0/0/0
  description Link to SP1 (RLOC)
  ip address 10.10.10.10 255.255.255.0
  ipv6 address 2001:db8:e000:2::1/64
  !
router lisp
  ipv4 map-resolver
  ipv4 alt-vrf lisp
  ipv6 map-resolver
  ipv6 alt-vrf lisp
  exit
  !
router bgp 65010
  bgp asnotation dot
  bgp log-neighbor-changes
  !
  address-family ipv4 vrf lisp
    neighbor 192.168.1.2 remote-as 65011
    neighbor 192.168.1.2 activate
  exit-address-family
  !
  address-family ipv6 vrf lisp
    neighbor 2001:db8:ffff::2 remote-as 65011
    neighbor 2001:db8:ffff::2 activate
  exit-address-family
  !
ip route 0.0.0.0 0.0.0.0 10.10.10.1
  !
ipv6 route ::/0 2001:db8:e000:2::f0f
  !

```

Configuring an ALT-Connected LISP Map Server

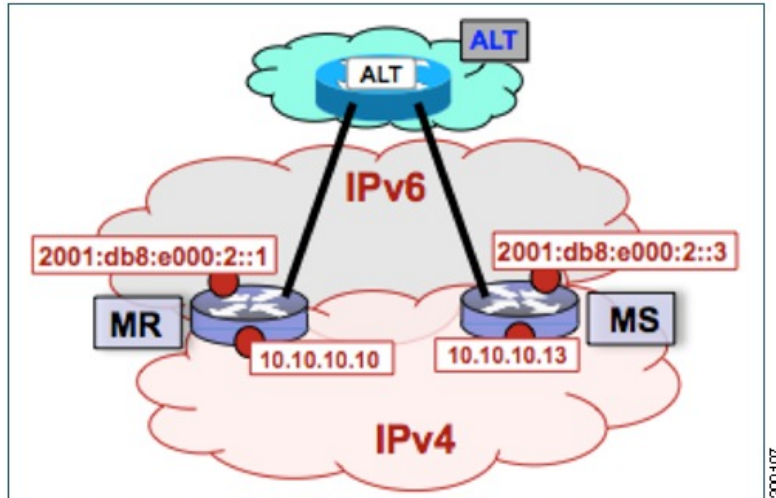
Perform this task to configure LISP alternative logical topology (ALT) map server functionality for both IPv4 and IPv6 address family mapping services.



Note You must also configure an ALT-connected LISP map resolver (see the Configuring an ALT-Connected LISP Map Resolver task).

In the figure below, the map resolver (MR) and map server (MS) are configured on separate devices and share their EID prefix information via connectivity.

Figure 13: ALT-Connected LISP Map Resolver and Map Server, each having both an IPv4 and an IPv6 RLOC



The map server illustrated in the topology shown in the figure is described below; the map resolver and LISP ALT are configured in separate tasks:

Mapping System

- Two LISP devices are configured, one as an MS and the other as an MR.
- The MS has an IPv4 locator of 10.10.10.13/24 and an IPv6 locator of 2001:db8:e000:2::3/64.
- The MR has an IPv4 locator of 10.10.10.10/24 and an IPv6 locator of 2001:db8:e000:2::1/64.
- Assume that the xTRs in the LISP site register to this map server. That is, the xTR registers the IPv4 EID-prefix of 172.16.1.0/24 and, when IPv6 EIDs are used, the xTR registers the IPv6 EID-prefix of 2001:db8:a::/48.



Note The configuration of the xTR must be changed to use the MS RLOC for its map server configuration and the MR RLOC for its map resolver configuration. For example:

- `ipv4 itr map-resolver 10.10.10.10`
- `ipv4 etr map-server 10.10.10.13 key 0 some-key`

Other Infrastructure

- The MR has IPv4 and IPv6 tunnel endpoints in the VRF table (named lisp) of 192.168.1.1/30 and 2001:db8:ffff::1/64, respectively, and the MS has IPv4 and IPv6 tunnel endpoints of 192.168.1.2/30 and 2001:db8:ffff::2/64, respectively, in the same VRF table. This tunnel is used for the ALT.

SUMMARY STEPS

1. **configure terminal**
2. **vrf definition** *vrf-name*
3. **rd** *route-distinguisher*
4. **address-family ipv4** [*unicast*]
5. **exit-address-family**
6. **address-family ipv6**
7. **exit-address-family**
8. **exit**
9. **interface** *type number*
10. **vrf forwarding** *vrf-name*
11. **ip address** *ip-address mask*
12. **ipv6 address** *ipv6-address/mask*
13. **tunnel source** *interface-type interface-number*
14. **tunnel destination** *ipv4-address*
15. **exit**
16. **router lisp**
17. **ipv4 map-server**
18. **ipv4 alt-vrf** *vrf-name*
19. **ipv6 map-server**
20. **ipv6 alt-vrf** *vrf-name*
21. **site** *site-name*
22. **eid-prefix** *EID-prefix*
23. **authentication-key** *key-type authentication-key*
24. **exit**
25. Repeat Steps 21 through 24 to configure additional LISP sites.
26. **exit**
27. **router bgp** *autonomous-system-number*
28. **address-family ipv4** [*unicast* | *multicast* | *vrf vrf-name*]
29. **redistribute lisp**
30. **neighbor** *ip-address* **remote-as** *autonomous-system-number*
31. **neighbor** *ip-address* **activate**
32. **exit**
33. **address-family ipv6** *vrf vrf-name*
34. **redistribute lisp**
35. **neighbor** *ip-address* **remote-as** *autonomous-system-number*
36. **neighbor** *ip-address* **activate**
37. **exit**
38. **exit**
39. **ip route** *ipv4-prefix next-hop*

40. `ipv6 route ipv6-prefix next-hop`
41. `exit`

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: <pre>Router# configure terminal</pre>	Enters global configuration mode.
Step 2	vrf definition vrf-name Example: <pre>Router(config)# vrf definition lisp</pre>	Creates a virtual routing and forwarding (VRF) table and enters VRF configuration mode. • Use the <i>vrf-name</i> argument to specify a name to be assigned to the VRF. In this example, a VRF named <i>lisp</i> is created to hold EID prefixes.
Step 3	rd route-distinguisher Example: <pre>Router(config-vrf)# rd 1:1</pre>	Creates routing and forwarding tables for a VRF.
Step 4	address-family ipv4 [unicast] Example: <pre>Router(config-vrf)# address-family ipv4</pre>	Enters VRF IPv4 address family configuration mode to specify an IPv4 address family for a VRF table. • In this example, the VRF table named <i>lisp</i> handles IPv4 EID prefixes.
Step 5	exit-address-family Example: <pre>Router(config-vrf-af)# exit-address-family</pre>	Exits VRF IPv4 address family configuration mode and returns to VRF configuration mode.
Step 6	address-family ipv6 Example: <pre>Router(config-vrf)# address-family ipv6</pre>	Enters VRF IPv6 address family configuration mode to specify an IPv6 address family for a VRF table. • In this example, the VRF table named <i>lisp</i> handles IPv6 EID prefixes.
Step 7	exit-address-family Example: <pre>Router(config-vrf-af)# exit-address-family</pre>	Exits VRF IPv6 address family configuration mode and returns to VRF configuration mode.
Step 8	exit Example:	Exits VRF configuration mode and enters global configuration mode.

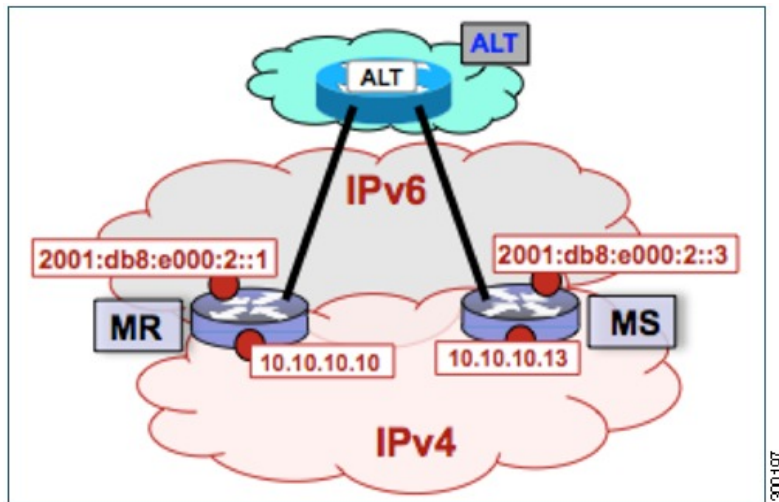
	Command or Action	Purpose
	<code>Router(config-vrf)# exit</code>	
Step 9	interface <i>type number</i> Example: <code>Router(config)# interface tunnel 191</code>	Specifies the interface type of tunnel and the interface number and enters interface configuration mode.
Step 10	vrf forwarding <i>vrf-name</i> Example: <code>Router(config-if)# vrf forwarding lisp</code>	Associates a VRF instance configured in Step 2 with the tunnel interface configured in Step 9. • When the interface is bound to a VRF, previously configured IP addresses are removed, and the interface is disabled.
Step 11	ip address <i>ip-address mask</i> Example: <code>Router(config-if)# ip address 192.168.1.6 255.255.255.252</code>	Configures an IPv4 address for the tunnel interface.
Step 12	ipv6 address <i>ipv6-address/mask</i> Example: <code>Router(config-if)# ipv6 address 2001:DB8:ffff::6/64</code>	Configures an IPv6 address for the tunnel interface.
Step 13	tunnel source <i>interface-type interface-number</i> Example: <code>Router(config-if)# tunnel source GigabitEthernet 0/0/0</code>	Configures the tunnel source.
Step 14	tunnel destination <i>ipv4-address</i> Example: <code>Router(config-if)# tunnel destination 10.10.10.13</code>	Configures the tunnel destination IPv4 address for the tunnel interface.
Step 15	exit Example: <code>Router(config-if)# exit</code>	Exits interface configuration mode and enters global configuration mode.
Step 16	router lisp Example: <code>Router(config)# router lisp</code>	Enters LISP configuration mode (Cisco IOS XE software only).

	Command or Action	Purpose
Step 17	ipv4 map-server Example: <pre>Router(config-router-lisp)# ipv4 map-server</pre>	Enables LISP map server functionality for EIDs in the IPv4 address family.
Step 18	ipv4 alt-vrf vrf-name Example: <pre>Router(config-router-lisp)# ipv4 alt-vrf lisp</pre>	Associates a VRF table with the LISP ALT for IPv4 EIDs. In this example, the VRF table named lisp (created in Step 2) is associated with the LISP ALT.
Step 19	ipv6 map-server Example: <pre>Router(config-router-lisp)# ipv6 map-server</pre>	Enables LISP map server functionality for EIDs in the IPv6 address family.
Step 20	ipv6 alt-vrf vrf-name Example: <pre>Router(config-router-lisp)# ipv6 alt-vrf lisp</pre>	Associates a VRF table with the LISP ALT for IPv6 EIDs. In this example, the VRF table named lisp (created in Step 2) is associated with the LISP ALT.
Step 21	site site-name Example: <pre>Router(config-router-lisp)# site Site-1</pre>	Specifies a LISP site and enters LISP site configuration mode. Note A LISP site name is locally significant to the map server on which it is configured. It has no relevance anywhere else. This name is used solely as an administrative means of associating one or more EID prefixes with an authentication key and other site-related mechanisms.
Step 22	eid-prefix EID-prefix Example: <pre>Router(config-router-lisp-site)# eid-prefix 172.16.1.0/24</pre>	Configures an IPv4 or IPv6 EID prefix associated with this LISP site. - Repeat this step as necessary to configure additional EID prefixes under this LISP sites. - In this step example, only an IPv4 EID prefix is configured but to complete the configuration, an IPv6 EID prefix must also be configured. Note The LISP ETR must be configured with matching EID prefixes and an identical authentication key. Note Additional eid-prefix command configuration options are available. (See the <i>LISP Command Reference</i> for more details.)

	Command or Action	Purpose
Step 23	authentication-key <i>key-type authentication-key</i> Example: <pre>Router(config-router-lisp-site)# authentication-key 0 some-key</pre>	Configures the authentication key associated with this site. Note The LISP ETR must be configured with matching EID prefixes and an identical authentication key. Note The authentication-key can be configured with Type 6 encryption. (See the <i>LISP Command Reference</i> for more details.)
Step 24	exit Example: <pre>Router(config-router-lisp-site)# exit</pre>	Exits LISP site configuration mode and returns to LISP configuration mode.
Step 25	Repeat Steps 21 through 24 to configure additional LISP sites.	—
Step 26	exit Example: <pre>Router(config-router-lisp)# exit</pre>	Exits LISP configuration mode and returns to global configuration mode.
Step 27	router bgp <i>autonomous-system-number</i> Example: <pre>Router(config)# router bgp 65011</pre>	Enters router configuration mode for the specified routing process.
Step 28	address-family ipv4 [unicast multicast vrf <i>vrf-name</i>] Example: <pre>Router(config-router)# address-family ipv4 vrf lisp</pre>	Specifies the IPv4 address family and enters IPv4 address family configuration mode. - The vrf keyword and <i>vrf-name</i> argument specify the name of the VRF instance to associate with subsequent commands. - In this example, the VRF table named <code>lisp</code> (created in Step 2) is associated with the BGP IPv4 VRF that carries EID prefixes in the LISP ALT.
Step 29	redistribute lisp Example: <pre>Router(config-router-af)# redistribute lisp</pre>	Redistributes EID prefixes known to LISP into BGP.
Step 30	neighbor <i>ip-address</i> remote-as <i>autonomous-system-number</i> Example:	Adds the IP address of the neighbor in the specified autonomous system to the IPv4 multiprotocol BGP neighbor table of the local router.

	Command or Action	Purpose
	<pre>Router(config-router-af)# neighbor 192.168.1.1 remote-as 65010</pre>	
Step 31	neighbor ip-address activate Example: <pre>Router(config-router-af)# neighbor 192.168.1.1 activate</pre>	Enables the neighbor to exchange prefixes for the IPv4 unicast address family.
Step 32	exit Example: <pre>Router(config-router-af)# exit</pre>	Exits address family configuration mode and returns to router configuration mode.
Step 33	address-family ipv6 vrf vrf-name Example: <pre>Router(config-router)# address-family ipv6 vrf lisp</pre>	Specifies the IPv6 address family and enters IPv6 address family configuration mode. • The vrf keyword and <i>vrf-name</i> argument specify the name of the VRF instance to associate with subsequent commands. • In this example, the VRF table named lisp (created in Step 2) is associated with the BGP IPv6 VRF that carries EID prefixes in the LISP ALT.
Step 34	redistribute lisp Example: <pre>Router(config-router-af)# redistribute lisp</pre>	Redistributes EID prefixes known to LISP into BGP.
Step 35	neighbor ip-address remote-as autonomous-system-number Example: <pre>Router(config-router-af)# neighbor 2001:db8:ffff::1 remote-as 65010</pre>	Adds the IPv6 address of the neighbor in the specified autonomous system to the IPv6 multiprotocol BGP neighbor table of the local router.
Step 36	neighbor ip-address activate Example: <pre>Router(config-router-af)# neighbor 2001:db8:ffff::1 activate</pre>	Enables the neighbor to exchange prefixes for the IPv6 unicast address family.
Step 37	exit Example: <pre>Router(config-router-af)# exit</pre>	Exits address family configuration mode and returns to router configuration mode.

	Command or Action	Purpose
Step 38	exit Example: <pre>Router(config-router)# exit</pre>	Exits router configuration mode and returns to global configuration mode.
Step 39	ip route ipv4-prefix next-hop Example: <pre>Router(config)# ip route 0.0.0.0 0.0.0.0 10.10.10.1</pre>	Configures an IPv4 static route. In this example, a default route to the upstream next hop for all IPv4 destinations is created.
Step 40	ipv6 route ipv6-prefix next-hop Example: <pre>Router(config)# ipv6 route ::/0 2001:db8:e000:2::f0f</pre>	Configures an IPv6 static route. In this example, a default route to the upstream next hop for all IPv6 destinations is created.
Step 41	exit Example: <pre>Router(config)# exit</pre>	Exits global configuration mode and returns to privileged EXEC mode.

Example:**Figure 14: ALT-Connected LISP Map Resolver and Map Server, each having both an IPv4 and an IPv6 RLOC**

The example below shows the full configuration for a LISP map server including some basic IP and IPv6 configuration not included in the task table for this task:

```
!
hostname MS
```

```

!
vrf definition lisp
  rd 1:1
  !
  address-family ipv4
  exit-address-family
  !
  address-family ipv6
  exit-address-family
  !
no ip domain lookup
ip cef
ipv6 unicast-routing
ipv6 cef
!
interface Loopback0
  no ip address
!
interface Tunnel192
  vrf forwarding lisp
  ip address 192.168.1.2 255.255.255.252
  ipv6 address 2001:db8:ffff::2/64
  tunnel source GigabitEthernet 0/0/0
  tunnel destination 10.10.10.10
!
interface GigabitEthernet 0/0/0
  description Link to SP1 (RLOC)
  ip address 10.10.10.13 255.255.255.0
  ipv6 address 2001:db8:e000:2::3/64
!
router lisp
  site Site-1
    authentication-key 0 some-xtr-key
    eid-prefix 172.16.1.0/24
    eid-prefix 2001:db8:a::/48
    exit
  !
  site Site-2
    authentication-key 0 another-xtr-key
    eid-prefix 172.16.2.0/24
    eid-prefix 2001:db8:b::/48
    exit
  !
  !---configure more LISP sites as required---
  !
  ipv4 map-server
  ipv4 alt-vrf lisp
  ipv6 map-server
  ipv6 alt-vrf lisp
  exit
!
router bgp 65011
  bgp asnotation dot
  bgp log-neighbor-changes
  !
  address-family ipv4 vrf lisp
    redistribute lisp
    neighbor 192.168.1.1 remote-as 65010
    neighbor 192.168.1.1 activate
  exit-address-family
  !
  address-family ipv6 vrf lisp
    redistribute lisp
    neighbor 2001:db8:ffff::1 remote-as 65010

```

```

neighbor 2001:db8:ffff::1 activate
exit-address-family
!
ip route 0.0.0.0 0.0.0.0 10.10.10.1
!
ipv6 route ::/0 2001:db8:e000:2::f0f

```

Configure a PETR and a PITR

The following tasks show how to design and deploy a Proxy Egress Tunnel Router (PETR) and a Proxy Ingress Tunnel Router (PITR). The example scenario shows deployment of a PETR and PITR as separate devices but it is also possible to deploy a single device that acts simultaneously as a PETR and a PITR, which is called a PxTR.

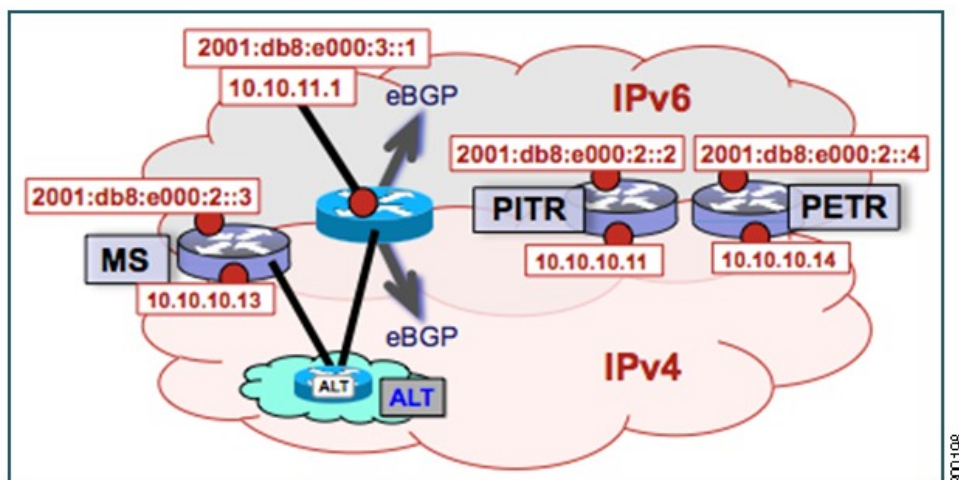
Deploying a Proxy Egress Tunnel Router with both an IPv4 and an IPv6 RLOC

Perform this task to deploy a Proxy Egress Tunnel Router (PETR) for both IPv4 and IPv6 address families. You can also perform this task to configure PETR functionality on a single device that acts simultaneously as a PETR and as a Proxy Ingress Tunnel Router (PITR), referred to as a PxTR.

A PETR simply takes in LISP encapsulated packets and decapsulates them and forwards them. For example, a PETR can be used to provide IPv6 LISP EIDs access to non-LISP EIDs when the LISP site only has IPv4 RLOC connectivity. A PETR, therefore, is used for LISP-to-non-LISP access in situations where cross-address family connectivity is an issue. (A PETR can still be used for matching EID and RLOC address families if desired.) Note that a PITR is required to provide return-traffic flow. A PETR is simple to deploy because it need only provide dual-stack connectivity to the core.

The topology used in this PETR example is shown in the figure. The PETR and PITR in this example are deployed as separate devices and each have both an IPv4 and an IPv6 locator.

Figure 15: Proxy Egress Tunnel Router with both an IPv4 and an IPv6 RLOC



The components illustrated in the topology shown in the figure are described below:

PETR

- When deployed as a standalone LISP device, the PETR has dual-stack connectivity to the core network.
- The PETR IPv4 locator is 10.10.10.14/24 and the IPv6 locator is 2001:db8:e000:2::4/64.

SUMMARY STEPS

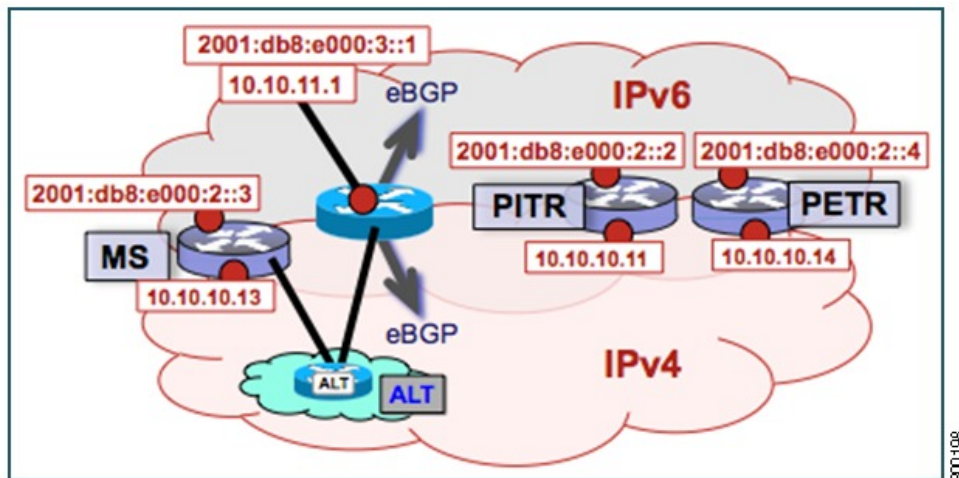
1. **enable**
2. **configure terminal**
3. **router lisp**
4. **ipv4 proxy-etr**
5. **ipv6 proxy-etr**
6. **exit**
7. **ip route *ipv4-prefix next-hop***
8. **ipv6 route *ipv6-prefix next-hop***
9. **exit**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	enable Example: <pre>Router> enable</pre>	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	configure terminal Example: <pre>Router# configure terminal</pre>	Enters global configuration mode.
Step 3	router lisp Example: <pre>Router(config)# router lisp</pre>	Enters LISP configuration mode (IOS XE software only).
Step 4	ipv4 proxy-etr Example: <pre>Router(config-router-lisp)# ipv4 proxy-etr</pre>	Enables PETR functionality for IPv4 EIDs.
Step 5	ipv6 proxy-etr Example: <pre>Router(config-router-lisp)# ipv6 proxy-etr</pre>	Enables PETR functionality for IPv6 EIDs.
Step 6	exit Example: <pre>Router(config-router-lisp)# exit</pre>	Exits LISP configuration mode and enters global configuration mode.
Step 7	ip route <i>ipv4-prefix next-hop</i>	Configures an IPv4 static route.

	Command or Action	Purpose
	Example: Router(config)# ip route 0.0.0.0 0.0.0.0 10.10.10.1	In this example, a default route to the upstream next hop for all IPv4 destinations is created.
Step 8	ipv6 route ipv6-prefix next-hop Example: Router(config)# ipv6 route ::/0 2001:db8:e000:2::f0f	Configures an IPv6 static route. In this example, a default route to the upstream next hop for all IPv6 destinations is created.
Step 9	exit Example: Router(config)# exit	Exits global configuration mode and returns to privileged EXEC mode.

Example:**Figure 16: Proxy Egress Tunnel Router with both an IPv4 and an IPv6 RLOC**

The example below shows the full configuration for a PETR including some basic IP and IPv6 configuration not included in the task table for this task:

```
!
hostname PETR
!
no ip domain lookup
ip cef
ipv6 unicast-routing
ipv6 cef
!
interface Loopback0
no ip address
!
interface GigabitEthernet 0/0/0
description Link to Core (RLOC)
```

```

ip address 10.10.10.14 255.255.255.0
ipv6 address 2001:db8:e000:2::4/64
!
router lisp
  ipv4 proxy-etr
  ipv6 proxy-etr
exit
!
ip route 0.0.0.0 0.0.0.0 10.10.10.1
!
ipv6 route ::/0 2001:db8:e000:2::f0f

```

Deploying a Proxy Ingress Tunnel Router with both an IPv4 and an IPv6 RLOC

Perform this task to deploy a Proxy Ingress Tunnel Router (PITR) for both IPv4 and IPv6 address families. You can also perform this task to configure PITR functionality on a single device that acts simultaneously as a PITR and as a Proxy Egress Tunnel Router (PETR), referred to as a PxTR.

A PITR attracts non-LISP packets by advertising a coarse-aggregate prefix for LISP EIDs into the core (such as the Internet or a Multiprotocol Label Switching (MPLS) core) and then performs LISP encapsulation services (like an ITR) to provide access to LISP EIDs. Thus, a PITR provides non-LISP-to-LISP interworking. A PITR is also used to provide address family “hop-over” for non-LISP-to-LISP traffic. For example, a dual-stacked PxTR can be used to provide a return-traffic path from non-LISP IPv6 sites to IPv6 LISP sites that contain only IPv4 RLOCs.

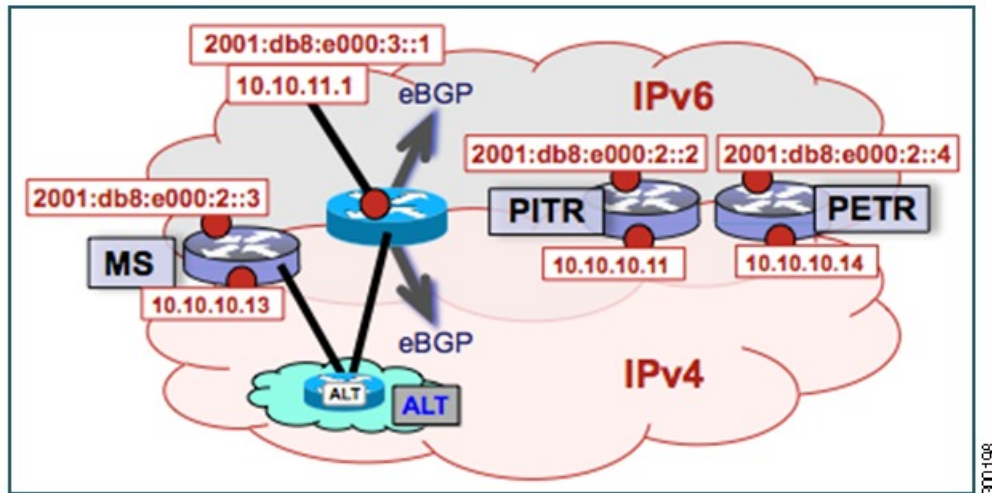
To resolve EID-to-RLOC mappings for creating non-LISP-to-LISP flows, configure PITR to query the LISP mapping system. In this task, the PITR is configured to send Map-Rrequest messages via the LISP alternate logical topology (ALT) to resolve EID-to-RLOC mappings.



Note To attract non-LISP traffic destined to LISP sites, the PITR must advertise coarse-aggregate EID prefixes into the underlying network infrastructure. In an Internet-as-the-core example, attracting non-LISP traffic destined to LISP sites is typically managed via external BGP (eBGP) and by advertising the coarse-aggregate that includes all appropriate EID prefixes into the Internet. The example configuration in the figure utilizes this approach. Because this is a standard BGP configuration, summary and detailed command guidance is not provided in the task table for this task, although the complete configuration example that follows the task table does include an accurate example of this eBGP peering. Any other approach that advertises coarse-aggregates that include all appropriate EID prefixes into the core are also acceptable.

The topology used in this example is shown in the figure. The PITR is deployed as a separate device, with both an IPv4 and an IPv6 locator. A map resolver and core-peering router are also shown in the figure for reference because they are required components for completing the PITR configuration shown in the figure.

Figure 17: Proxy Ingress Tunnel Router with both an IPv4 and an IPv6 RLOC



The components illustrated in the topology shown in the figure are described below:

PITR

- When deployed as a standalone LISP device, the PITR has dual-stack connectivity to the core network.
- The PITR IPv4 locator is 10.10.10.11/24 and the IPv6 locator is 2001:db8:e000:2::2/64.
- The use of LISP EID prefixes throughout this task (172.16.1.0/24 and 2001:db8:a::/48 configuration) is assumed and are part of LISP EID blocks that can be summarized in coarse-aggregates and advertised by the PITR into the core network. The advertisement of the IPv4 coarse-aggregate of 172.16.0.0/16 and the IPv6 coarse-aggregate of 2001:db8::/33 by the PITR into the IPv4 and IPv6 core networks is also assumed.
- The PITR eBGP peers with the core router with locators 10.10.11.1 and 2001:db8:e000:3::1 in order to advertise the coarse-aggregate IPv4 EID prefix of 172.16.0.0/16 and the IPv6 EID prefix of 2001:db8::/33 into the IPv4 and IPv6 cores, respectively.
- The PITR is configured to use the LISP ALT (GRE+BGP) via the map server with locators 10.10.10.13 and 2001:db8:e000:2::3. The relevant configuration is shown for the PITR.

Other Infrastructure

- The MS has IPv4 and IPv6 tunnel endpoints in the VRF table (named lisp) of 192.168.5/30 and 2001:db8:ffff::5/64, respectively. The configuration of the map server is not in the task table.
- The core router has an IPv4 address of 10.10.11.1 and an IPv6 address of 2001:db8:e000:3::1. These addresses will be used for eBGP peering. The core router configuration is assumed to be familiar as a typical ISP peering router and is therefore not included in the task table.

SUMMARY STEPS

1. **configure terminal**
2. **vrf definition** *vrf-name*
3. **rd** *route-distinguisher*
4. **address-family ipv4 [unicast]**

5. **exit-address-family**
6. **address-family ipv6**
7. **exit-address-family**
8. **exit**
9. **interface** *type number*
10. **vrf forwarding** *vrf-name*
11. **ip address** *ip-address mask*
12. **ipv6 address** *ipv6-address/mask*
13. **tunnel source** *interface-type interface-number*
14. **tunnel destination** *ipv4-address*
15. **exit**
16. **router lisp**
17. **ipv4 alt-vrf** *vrf-name*
18. **ipv4 proxy-itr** *ipv4-locator [ipv6-locator]*
19. **ipv4 map-cache-limit** *map-cache-limit*
20. **ipv6 alt-vrf** *vrf-name*
21. **ipv6 proxy-itr** *ipv6-locator [ipv4-locator]*
22. **ipv6 map-cache-limit** *map-cache-limit*
23. **exit**
24. **router bgp** *autonomous-system-number*
25. **address-family ipv4** [**unicast** | **multicast** | **vrf** *vrf-name*]
26. **neighbor** *ip-address remote-as autonomous-system-number*
27. **neighbor** *ip-address activate*
28. **exit**
29. **address-family ipv6** [**unicast** | **multicast** | **vrf** *vrf-name*]
30. **neighbor** *ip-address remote-as autonomous-system-number*
31. **neighbor** *ip-address activate*
32. **exit**
33. **exit**
34. **ip route** *ipv4-prefix next-hop*
35. **ip route** *ipv4-prefix next-hop*
36. **ipv6 route** *ipv6-prefix next-hop*
37. **ipv6 route** *ipv6-prefix next-hop*
38. **exit**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	configure terminal	Enters global configuration mode.
	Example: Router# <code>configure terminal</code>	

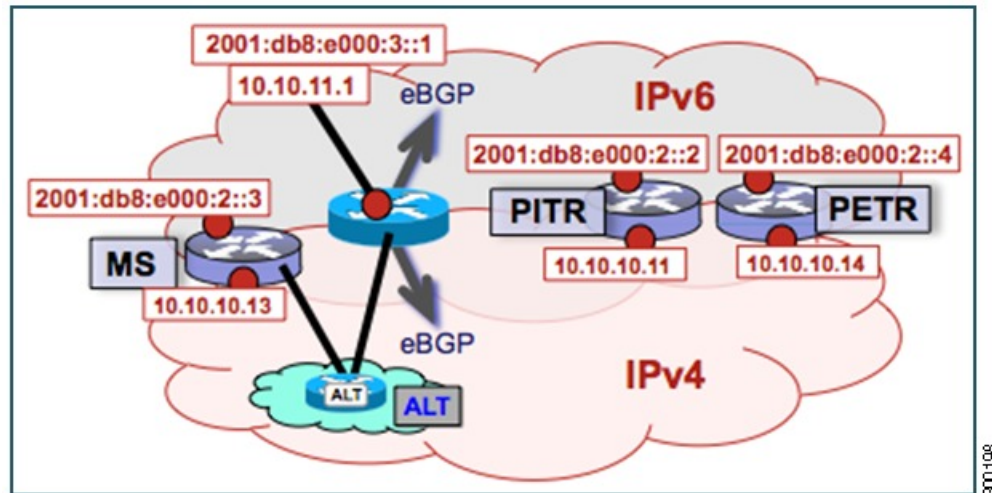
	Command or Action	Purpose
Step 2	vrf definition <i>vrf-name</i> Example: <pre>Router(config)# vrf definition lisp</pre>	Configures a virtual routing and forwarding (VRF) table and enters VRF configuration mode. Use the <i>vrf-name</i> argument to specify a name to be assigned to the VRF. In this example, a VRF named lisp is created to hold EID prefixes.
Step 3	rd <i>route-distinguisher</i> Example: <pre>Router(config-vrf)# rd 1:1</pre>	Creates routing and forwarding tables for a VRF.
Step 4	address-family ipv4 [unicast] Example: <pre>Router(config-vrf)# address-family ipv4</pre>	Enters VRF IPv4 address family configuration mode to specify an IPv4 address family for a VRF table. In this example, the VRF named lisp handles IPv4 EID prefixes.
Step 5	exit-address-family Example: <pre>Router(config-vrf-af)# exit-address-family</pre>	Exits VRF address family configuration mode and returns to VRF configuration mode.
Step 6	address-family ipv6 Example: <pre>Router(config-vrf)# address-family ipv6</pre>	Enters VRF IPv6 address family configuration mode to specify an IPv6 address family for a VRF table. In this example, the VRF table named lisp handles IPv6 EID prefixes.
Step 7	exit-address-family Example: <pre>Router(config-vrf-af)# exit-address-family</pre>	Exits VRF address family configuration mode and returns to VRF configuration mode.
Step 8	exit Example: <pre>Router(config-vrf)# exit</pre>	Exits VRF configuration mode and enters global configuration mode.
Step 9	interface <i>type number</i> Example: <pre>Router(config)# interface tunnel 191</pre>	Specifies the interface type of tunnel and the interface number and enters interface configuration mode.
Step 10	vrf forwarding <i>vrf-name</i> Example:	Associates a VRF instance configured in Step 2 with the tunnel interface configured in Step 9.

	Command or Action	Purpose
	<code>Router(config-if)# vrf forwarding lisp</code>	When the interface is bound to a VRF, previously configured IP addresses are removed, and the interface is disabled.
Step 11	ip address <i>ip-address mask</i> Example: <code>Router(config-if)# ip address 192.168.1.6 255.255.255.252</code>	Configures an IPv4 address for the tunnel interface.
Step 12	ipv6 address <i>ipv6-address/mask</i> Example: <code>Router(config-if)# ipv6 address 2001:DB8:ffff::6/64</code>	Configures an IPv6 address for the tunnel interface.
Step 13	tunnel source <i>interface-type interface-number</i> Example: <code>Router(config-if)# tunnel source GigabitEthernet 0/0/0</code>	Configures the tunnel source.
Step 14	tunnel destination <i>ipv4-address</i> Example: <code>Router(config-if)# tunnel destination 10.10.10.13</code>	Configures the tunnel destination IPv4 address for the tunnel interface.
Step 15	exit Example: <code>Router(config-if)# exit</code>	Exits interface configuration mode and enters global configuration mode.
Step 16	router lisp Example: <code>Router(config)# router lisp</code>	Enters LISP configuration mode (IOS XE software only).
Step 17	ipv4 alt-vrf <i>vrf-name</i> Example: <code>Router(config-router-lisp)# ipv4 alt-vrf lisp</code>	Associates a VRF table with the LISP ALT for IPv4 EIDs. In this example, the VRF table named lisp (created in Step 2) is associated with the LISP ALT.
Step 18	ipv4 proxy-itr <i>ipv4-locator [ipv6-locator]</i> Example: <code>Router(config-router-lisp)# ipv4 proxy-itr 10.10.10.11 2001:db8:e000:2::2</code>	Enables Proxy Ingress Tunnel Router (PITR) functionality for IPv4 EIDs, and specifies the IPv4 and (optionally) the IPv6 RLOCs (local to the PITR) to use when LISP-encapsulating packets to LISP sites.

	Command or Action	Purpose
Step 19	ipv4 map-cache-limit <i>map-cache-limit</i> Example: <pre>Router(config-router-lisp)# ipv4 map-cache-limit 100000</pre>	Specifies the maximum number of IPv4 map-cache entries to be maintained by the PITR. - When the map-cache reaches this limit, existing entries are removed according to the rules described in the command reference guide. (See the <i>LISP Command Reference</i> for more details.) - The default map-cache-limit is 10000. In this example, since the device is being configured as a PITR, a larger map-cache limit is configured.
Step 20	ipv6 alt-vrf <i>vrf-name</i> Example: <pre>Router(config-router-lisp)# ipv6 alt-vrf lisp</pre>	Associates a VRF table with the LISP ALT for IPv6 EIDs. In this example, the VRF table named lisp (created in Step 2) is associated with the LISP ALT.
Step 21	ipv6 proxy-itr <i>ipv6-locator</i> [<i>ipv4-locator</i>] Example: <pre>Router(config-router-lisp)# ipv6 proxy-itr 2001:db8:e000:2::2 10.10.10.11</pre>	Enables Proxy Ingress Tunnel Router (PITR) functionality for IPv6 EIDs, and specifies the IPv6 and (optionally) the IPv4 RLOCs (local to the PITR) to use when LISP-encapsulating packets to LISP sites.
Step 22	ipv6 map-cache-limit <i>map-cache-limit</i> Example: <pre>Router(config-router-lisp)# ipv6 map-cache-limit 100000</pre>	Specifies the maximum number of IPv6 map-cache entries to be maintained by the PITR. When the map-cache reaches this limit, existing entries are removed according to the rules described in the command reference guide. (See the <i>LISP Command Reference</i> for more details.) The default map-cache-limit is 10000. In this example, since the device is being configured as a PITR, a larger map-cache limit is configured.
Step 23	exit Example: <pre>Router(config-router-lisp)# exit</pre>	Exits LISP configuration mode and returns to global configuration mode.
Step 24	router bgp <i>autonomous-system-number</i> Example: <pre>Router(config)# router bgp 65015</pre>	Enters router configuration mode for the specified routing process.
Step 25	address-family ipv4 [unicast multicast vrf <i>vrf-name</i>] Example: <pre>Router(config-router)# address-family ipv4 vrf lisp</pre>	Specifies the IPv4 address family and enters IPv4 address family configuration mode. The vrf keyword and <i>vrf-name</i> argument specify the name of the VRF instance to associate with subsequent commands.

	Command or Action	Purpose
		In this example, the VRF table named lisp (created in Step 2) is associated with the BGP IPv4 VRF that carries EID prefixes in the LISP ALT.
Step 26	neighbor ip-address remote-as autonomous-system-number Example: <pre>Router(config-router-af)# neighbor 192.168.1.5 remote-as 65011</pre>	Adds the IP address of the neighbor in the specified autonomous system to the IPv4 multiprotocol BGP neighbor table of the local router.
Step 27	neighbor ip-address activate Example: <pre>Router(config-router-af)# neighbor 192.168.1.5 activate</pre>	Enables the neighbor to exchange prefixes for the IPv4 unicast address family.
Step 28	exit Example: <pre>Router(config-router-af)# exit</pre>	Exits address family configuration mode.
Step 29	address-family ipv6 [unicast multicast vrf vrf-name] Example: <pre>Router(config-router-af)# address-family ipv6 vrf lisp</pre>	Specifies the IPv6 address family and enters IPv6 address family configuration mode. - The vrf keyword and <i>vrf-name</i> argument specify the name of the VRF instance to associate with subsequent commands. - In this example, the VRF table named lisp (created in Step 2) is associated with the BGP IPv6 VRF that carries EID prefixes in the LISP ALT.
Step 30	neighbor ip-address remote-as autonomous-system-number Example: <pre>Router(config-router-af)# neighbor 2001:db8:ffff::5 remote-as 65011</pre>	Adds the IPv6 address of the neighbor in the specified autonomous system to the IPv6 multiprotocol BGP neighbor table of the local router.
Step 31	neighbor ip-address activate Example: <pre>Router(config-router-af)# neighbor 2001:db8:ffff::5 activate</pre>	Enables the neighbor to exchange prefixes for the IPv6 unicast address family.
Step 32	exit Example:	Exits address family configuration mode.

	Command or Action	Purpose
	<code>Router(config-router-af)# exit</code>	
Step 33	exit Example: <code>Router(config-router)# exit</code>	Exits router configuration mode.
Step 34	ip route ipv4-prefix next-hop Example: <code>Router(config)# ip route 0.0.0.0 0.0.0.0 10.10.10.1</code>	Configures an IPv4 static route. In this example, a default route to the upstream next hop for all IPv4 destinations is created.
Step 35	ip route ipv4-prefix next-hop Example: <code>Router(config)# ip route 172.16.0.0 255.255.0.0 Null0 tag 123</code>	Configures an IPv4 static route. In this example, a static route is configured to Null0 for the coarse-aggregate IPv4 EID prefix 172.16.0.0/16. This static route is required to ensure proper operation of LISP in querying the mapping system for LISP EIDs. The tag 123 is added to this null route as a reference point for the route map used to permit the advertisement of this coarse aggregate to the upstream ISP BGP peer.
Step 36	ipv6 route ipv6-prefix next-hop Example: <code>Router(config)# ipv6 route ::/0 2001:db8:e000:2::f0f</code>	Configures an IPv6 static route. In this example, a default route to the upstream next hop for all IPv6 destinations is created.
Step 37	ipv6 route ipv6-prefix next-hop Example: <code>Router(config)# ipv6 route 2001:db8::/33 Null0 tag 123</code>	Configures an IPv6 static route. In this example, a static route is configured to Null0 for the coarse-aggregate IPv6 EID prefix 2001:db8::/33. This is required to ensure proper operation of LISP in querying the mapping system for LISP EIDs. The tag 123 is added to this null route as a handy reference point for the route-map used to permit the advertisement of this coarse-aggregate to the upstream ISP BGP peer.
Step 38	exit Example: <code>Router(config)# exit</code>	Exits global configuration mode.

Example:**Figure 18: Proxy Ingress Tunnel Router with both an IPv4 and an IPv6 RLOC**

The example below shows the full configuration for a PITR includes some basic IP, BGP, and route map configuration not included in the task table for this task:

```
!
hostname PITR
!
no ip domain lookup
ip cef
ipv6 unicast-routing
ipv6 cef
!
interface Loopback0
 no ip address
!
interface Tunnel191
 vrf forwarding lisp
 ip address 192.168.1.6 255.255.255.252
 ipv6 address 2001:db8:ffff::6/64
 tunnel source GigabitEthernet 0/0/0
 tunnel destination 10.10.10.13
!
interface GigabitEthernet 0/0/0
 description Link to Core (RLOC)
 ip address 10.10.10.11 255.255.255.0
 ipv6 address 2001:db8:e000:2::2/64
!
router lisp
 ipv4 alt-vrf lisp
 ipv4 map-cache-limit 100000
 ipv4 proxy-itr 10.10.10.11 2001:db8:e000:2::2
 ipv6 alt-vrf lisp
 ipv6 map-cache-limit 100000
 ipv6 proxy-itr 2001:db8:e000:2::2 10.10.10.11
 exit
!
router bgp 65015
 bgp asnotation dot
 bgp log-neighbor-changes
```

```

neighbor 10.10.11.1 remote-as 65111
neighbor 2001:db8:e000:3::1 remote-as 65111
!
address-family ipv4
  no synchronization
  redistribute static route-map populate-default
  neighbor 10.10.11.1 activate
  neighbor 10.10.11.1 send-community both
  neighbor 10.10.11.1 route-map dfz-out out
exit-address-family
!
address-family ipv6
  redistribute static route-map populate-default
  neighbor 2001:db8:e000:3::1 activate
  neighbor 2001:db8:e000:3::1 send-community both
  neighbor 2001:db8:e000:3::1 route-map dfz-out out
exit-address-family
!
address-family ipv4 vrf lisp
  no synchronization
  neighbor 192.168.1.5 remote-as 65011
  neighbor 192.168.1.5 activate
exit-address-family
!
address-family ipv6 vrf lisp
  no synchronization
  neighbor 2001:db8:ffff::5 remote-as 65011
  neighbor 2001:db8:ffff::5 activate
exit-address-family
!
ip bgp-community new-format
ip community-list standard dfz-upstream permit 65100:123
!
ip route 0.0.0.0 0.0.0.0 10.10.10.1
ip route 172.16.0.0 255.255.0.0 Null0 tag 123
!
ipv6 route 2001:db8::/33 Null0 tag 123
ipv6 route ::/0 2001:db8:e000:2::f0f
!
route-map populate-default permit 10
  match tag 123
  set origin igp
  set community 65100:123
!
route-map dfz-out permit 10
  match community dfz-upstream
!

```

Verify and Troubleshoot Locator ID Separation Protocol

Once LISP is configured, you can verify and troubleshoot LISP configuration and operations by following the optional steps in this task. Note that certain verification and troubleshooting steps are specific to certain LISP devices and only apply if configured in your LISP site. For the below commands, if **instance-id** is unspecified, the ID is specified as zero.

SUMMARY STEPS

1. enable
2. show running-config | section router lisp

3. **show** [ip | ipv6] lisp [instance-id *number*]
4. **show** [ip | ipv6] lisp map-cache [instance-id *number*]
5. **show** [ip | ipv6] lisp database [instance-id *number*]
6. **show** lisp site [name *site-name*]
7. **lig** {[instance-id *number*] [self {ipv4 | ipv6}]} | {hostname | destination-EID}}
8. **ping** {hostname | destination-EID}
9. **clear** [ip | ipv6] lisp map-cache [instance-id *number* | *]

DETAILED STEPS

Procedure

Step 1 enable

Enables privileged EXEC mode. Enter your password if prompted.

Example:

```
Router> enable
```

Step 2 show running-config | section router lisp

The **show running-config | section router lisp** command is useful for quickly verifying the LISP configuration on the device. This command applies to any Cisco IOS LISP device.

The following is sample output from the **show running-config | section router lisp** command when a multihomed LISP site is configured with IPv4 and IPv6 EID prefixes:

Example:

```
Router# show running-config | section router lisp
router lisp
service ipv4
  itr map-resolver 10.10.10.10
  itr map-resolver 10.10.30.10
  itr
  etr map-server 10.10.10.10 key some-key
  etr map-server 10.10.30.10 key some-key
  etr
  exit-service-ipv4
!
service ipv6
  itr map-resolver 10.10.10.10
  itr map-resolver 10.10.30.10
  itr
  etr map-server 10.10.10.10 key some-key
  etr map-server 10.10.30.10 key some-key
  etr
  use-petr 10.10.10.11
  use-petr 10.10.30.11
  exit-service-ipv6
!
instance-id 1
service ipv4
  eid-table default
  database-mapping 172.16.1.0/24 10.1.1.2 priority 1 weight 50
  database-mapping 172.16.1.0/24 10.2.1.2 priority 1 weight 50
  exit-service-ipv4
```

```

!
service ipv6
  eid-table default
  database-mapping 2001:DB8:A::/48 10.1.1.2 priority 1 weight 50
  database-mapping 2001:DB8:A::/48 10.2.1.2 priority 1 weight 50
exit-service-ipv6
!
exit-instance-id
!
exit-router-lisp

```

Step 3 **show [ip | ipv6] lisp [instance-id number]**

The **show ip lisp** and **show ipv6 lisp** commands are useful for quickly verifying the operational status of LISP as configured on the device, as applicable to the IPv4 and IPv6 address families, respectively. This command applies to any Cisco IOS LISP device.

Example:

The following example shows LISP operational status and IPv4 address family information:

```
Router# show ip lisp
```

```

Ingress Tunnel Router (ITR):      enabled
Egress Tunnel Router (ETR):      enabled
Proxy-ITR Router (PITR):         disabled
Proxy-ETR Router (PETR):         disabled
Map Server (MS):                 disabled
Map Resolver (MR):               disabled
Map-Request source:              172.16.1.1
ITR Map-Resolver(s):             10.10.10.10, 10.10.30.10
ETR Map-Server(s):               10.10.10.10 (00:00:56), 10.10.30.10 (00:00:12)
ETR accept mapping data:         disabled, verify disabled
ETR map-cache TTL:               1d00h
Locator Status Algorithms:
  RLOC-probe algorithm:          disabled
Static mappings configured:       0
Map-cache size/limit:            2/1000
Map-cache activity check period: 60 secs
Map-database size:               1

```

Example:

The following example shows LISP operational status and IPv6 address family information:

```
Router# show ip lisp
```

```

Ingress Tunnel Router (ITR):      enabled
Egress Tunnel Router (ETR):      enabled
Proxy-ITR Router (PITR):         disabled
Proxy-ETR Router (PETR):         disabled
Map Server (MS):                 disabled
Map Resolver (MR):               disabled
Map-Request source:              2001:DB8:A::1
ITR Map-Resolver(s):             10.10.10.10, 10.10.30.10
ETR Map-Server(s):               10.10.10.10 (00:00:23), 10.10.30.10 (00:00:40)
ETR accept mapping data:         disabled, verify disabled
ETR map-cache TTL:               1d00h
Locator Status Algorithms:
  RLOC-probe algorithm:          disabled
Static mappings configured:       0
Map-cache size/limit:            1/1000
Map-cache activity check period: 60 secs
Map-database size:               1

```

Step 4 **show [ip | ipv6] lisp map-cache [instance-id number]**

The **show ip lisp map-cache** and **show ipv6 lisp map-cache** commands are useful for quickly verifying the operational status of the map-cache on a device configured as an ITR or PITR, as applicable to the IPv4 and IPv6 address families, respectively. Based on a configuration when a multithomed LISP site is configured with IPv4 and IPv6 EID prefixes, this example output assumes that a map-cache entry has been received for another site with the IPv4 EID prefix of 172.16.2.0/24 and the IPv6 EID prefix of 2001:db8:b::/48.

Example:

The following example shows IPv4 mapping cache information:

```
Router# show ip lisp map-cache

LISP IPv4 Mapping Cache, 2 entries

0.0.0.0/0, uptime: 02:48:19, expires: never, via static send map-request
  Negative cache entry, action: send-map-request
172.16.2.0/24, uptime: 01:45:24, expires: 22:14:28, via map-reply, complete
  Locator   Uptime   State   Pri/Wgt
  10.0.0.6   01:45:24   up      1/1
```

Example:

The following example shows IPv6 mapping cache information:

```
Router# show ipv6 lisp map-cache

LISP IPv6 Mapping Cache, 2 entries

::/0, uptime: 02:49:39, expires: never, via static send map-request
  Negative cache entry, action: send-map-request
2001:DB8:B::/48, uptime: 00:00:07, expires: 23:59:46, via map-reply, complete
  Locator   Uptime   State   Pri/Wgt
  10.0.0.6   00:00:07   up      1/1
```

Step 5 **show [ip | ipv6] lisp database [instance-id number]**

The **show ip lisp database** and **show ipv6 lisp database** commands are useful for quickly verifying the the operational status of the database mapping on a device configured as an ETR, as applicable to the IPv4 and IPv6 address families, respectively. The following example output is based on a configuration when a multithomed LISP site is configured with IPv4 and IPv6 EID prefixes.

Example:

The following example shows IPv4 mapping database information:

```
Router# show ip lisp database

LISP ETR IPv4 Mapping Database, LSBs: 0x3, 1 entries

172.16.1.0/24
```

Example:

The following example shows IPv6 mapping database information:

```
Router# show ipv6 lisp database

LISP ETR IPv6 Mapping Database, LSBs: 0x1, 1 entries

2001:DB8:A::/48
```

Step 6 **show lisp site [name site-name]**

The **show lisp site** command is useful for quickly verifying the operational status of LISP sites, as configured on a map server. This command applies only to a device configured as a map server.

The following examples are based on configurations where a multihomed LISP site is configured with both IPv4 and IPv6 EID prefixes:

Example:

```
Router# show lisp site
```

LISP Site Registration Information

Site Name	Last Register	Up	Who Last Registered	EID Prefix
Site-1	00:00:15	yes	10.1.1.2	172.16.1.0/24
	00:00:11	yes	10.1.1.2	2001:DB8:A::/48
Site-2	00:00:27	yes	10.0.0.6	172.16.2.0/24
	00:00:37	yes	10.0.0.6	2001:DB8:B::/48

Example:

```
Router# show lisp site name Site-1
```

```
Site name: Site-1
Allowed configured locators: any
Allowed EID-prefixes:
  EID-prefix: 172.16.1.0/24
    First registered: 00:04:51
    Routing table tag: 0
    Origin: Configuration
    Merge active: No
    Proxy reply: No
    TTL: 1d00h
  Registration errors:
    Authentication failures: 0
    Allowed locators mismatch: 0
  ETR 10.1.1.2, last registered 00:00:01, no proxy-reply, map-notify
    TTL 1d00h, no merge
    Locator Local State Pri/Wgt
    10.1.1.2 yes up 1/50
  ETR 10.2.1.2, last registered 00:00:03, no proxy-reply, map-notify
    TTL 1d00h, merge
    Locator Local State Pri/Wgt
    10.1.1.2 yes up 1/50
    10.2.1.2 yes up 1/50
  EID-prefix: 2001:DB8:A::/48
    First registered: 00:04:51
    Routing table tag: 0
    Origin: Configuration
    Merge active: No
    Proxy reply: No
    TTL: 1d00h
  Registration errors:
    Authentication failures: 0
    Allowed locators mismatch: 0
  ETR 10.1.1.2, last registered 00:00:01, no proxy-reply, map-notify
    TTL 1d00h, no merge
    Locator Local State Pri/Wgt
    10.1.1.2 yes up 1/50
  ETR 10.2.1.2, last registered 00:00:03, no proxy-reply, map-notify
    TTL 1d00h, merge
    Locator Local State Pri/Wgt
    10.1.1.2 yes up 1/50
    10.2.1.2 yes up 1/50
```

Step 7 **lig** {[instance-id number] [self {ipv4 | ipv6}]} | {hostname | destination-EID}}

The LISP Internet Groper (lig) command is useful for testing the LISP control plane. The **lig** command can be used to query for the indicated destination hostname or EID, or the router's local EID prefix. This command provides a simple means of testing whether a destination EID exists in the LISP mapping database system, or whether your site is registered with the mapping database system. This command is applicable for both the IPv4 and IPv6 address families and applies to any Cisco IOS LISP device that maintains a map-cache (i.e. configured as an ITR or PITR).

The following examples are based on configurations where a multihomed LISP site is configured with both IPv4 and IPv6 EID prefixes:

Example:

```
Router# lig self ipv4
```

```
Mapping information for EID 172.16.1.0 from 10.1.1.2 with RTT 12 msecs
172.16.1.0/24, uptime: 00:00:00, expires: 23:59:52, via map-reply, self
  Locator  Uptime    State      Pri/Wgt
  10.1.1.2  00:00:00   up, self   1/50
  10.2.1.2  00:00:00   up         1/50
```

Example:

```
Router# lig self ipv6
```

```
Mapping information for EID 2001:DB8:A:: from 10.0.0.2 with RTT 12 msecs
2001:DB8:A::/48, uptime: 00:00:00, expires: 23:59:52, via map-reply, self
  Locator  Uptime    State      Pri/Wgt
  10.1.1.2  00:00:00   up, self   1/50
  10.2.1.2  00:00:00   up         1/50
```

Example:

```
Router# lig 172.16.2.1
```

```
Mapping information for EID 2001:DB8:A:: from 10.0.0.2 with RTT 12 msecs
2001:DB8:A::/48, uptime: 00:00:00, expires: 23:59:52, via map-reply, self
  Locator  Uptime    State      Pri/Wgt
  10.1.1.2  00:00:00   up, self   1/50
  10.2.1.2  00:00:00   up         1/50
```

Example:

```
Router# lig 2001:db8:b::1
```

```
Mapping information for EID 172.16.2.1 from 10.0.0.6 with RTT 4 msecs
2001:DB8:B::/48, uptime: 01:52:45, expires: 23:59:52, via map-reply, complete
  Locator  Uptime    State      Pri/Wgt
  10.0.0.6  01:52:45   up         1/1
```

Step 8 **ping** {hostname | destination-EID}

The **ping** command is useful for testing basic network connectivity and reachability and liveness of a destination EID or RLOC address. It is important to be aware that because LISP uses encapsulation, you should always specify a source address when using **ping**. Never allow the **ping** application to assign its own default source address because there are four possible ways to use **ping** and unless the source address is explicitly named, the wrong address may be used by the application and return erroneous results that complicate operational verification or troubleshooting.

The four possible uses of **ping** are:

- RLOC-to-RLOC—Sends out “echo” packets natively (no LISP encapsulation) and receives the “echo-reply” back natively. This use of **ping** can test the underlying network connectivity between locators of various devices, such as between an xTR and a map server or map resolver.

- EID-to-EID—Sends out “echo” packets with LISP encapsulation and receives the “echo-reply” back as LISP encapsulated. This use of **ping** can be used to test the LISP data plane (encapsulation) between LISP sites.
- EID-to-RLOC—Sends out “echo” packets natively (no LISP encapsulation) and receives the “echo-reply” back as LISP encapsulated through a PITR mechanism. This use of **ping** can be used to test the PITR infrastructure.
- RLOC-to-EID - Sends out “echo” packets with LISP encapsulation and receives the “echo-reply” back natively (no LISP encapsulation). This use of **ping** can be used to test PETR capabilities.

The **ping** command is applicable to the IPv4 and IPv6 address families, respectively, and can be used on any IOS XE LISP device but is limited by the LISP device and site configuration. (For example, the ability to do LISP encapsulation requires the device to be configured as either an ITR or PITR.)

The following examples are based on configurations where a multihomed LISP site is configured with both IPv4 and IPv6 EID prefixes:

Example:

```
Router# ping 172.16.2.1 source 172.16.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.2.1, timeout is 2 seconds:
Packet sent with a source address of 172.16.1.1
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/3/8 ms
```

Example:

```
Router# ping 2001:db8:b::1 source 2001:db8:a::1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:B::1, timeout is 2 seconds:
Packet sent with a source address of 2001:DB8:A::1
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/3/8 ms
```

Step 9 **clear [ip | ipv6] lisp map-cache [instance-id number | *]**

The **clear ip lisp map-cache** and **clear ipv6 lisp map-cache** commands remove all IPv4 or IPv6 dynamic LISP map-cache entries stored by the router. The ***** keyword clears all entries. This command applies to a LISP device that maintains a map-cache (like one configured as an ITR or PITR) and can be useful if trying to quickly verify the operational status of the LISP control plane. Based on a configuration when a multihomed LISP site is configured with both IPv4 and IPv6 EID prefixes, the following example output assumes that a map-cache entry has been received for another site with the IPv4 EID prefix of 172.16.2.0/24 or an IPv6 EID prefix of 2001:db8:b::/48.

Example:

The following example shows IPv4 mapping cache information, how to clear the mapping cache, and the **show** information after the cache is cleared.

```
Router# show ip lisp map-cache

LISP IPv4 Mapping Cache, 2 entries

0.0.0.0/0, uptime: 02:48:19, expires: never, via static send map-request
  Negative cache entry, action: send-map-request
172.16.2.0/24, uptime: 01:45:24, expires: 22:14:28, via map-reply, complete
  Locator   Uptime    State     Pri/Wgt
  10.0.0.6   01:45:24   up        1/1

Router# clear ip lisp map-cache

Router# show ip lisp map-cache
```

```
LISP IPv4 Mapping Cache, 1 entries
```

```
0.0.0.0/0, uptime: 00:00:02, expires: never, via static send map-request
Negative cache entry, action: send-map-request
```

Example:

The following example shows IPv6 mapping cache information, how to clear the mapping cache, and the **show** information after the cache is cleared.

```
Router# show ipv6 lisp map-cache
```

```
LISP IPv6 Mapping Cache, 2 entries
```

```
::/0, uptime: 02:49:39, expires: never, via static send map-request
Negative cache entry, action: send-map-request
2001:DB8:B::/48, uptime: 00:00:07, expires: 23:59:46, via map-reply, complete
Locator   Uptime   State   Pri/Wgt
10.0.0.6  00:00:07  up      1/1
```

```
Router# clear ip lisp map-cache
```

```
Router# show ip lisp map-cache
```

```
LISP IPv6 Mapping Cache, 1 entries
```

```
::/0, uptime: 00:00:02, expires: never, via static send map-request
Negative cache entry, action: send-map-request
```

Additional References for Configuring LISP

The following sections provide references related to the Locator ID Separation Protocol.

Related Documents

Document Title	Location
Cisco IOS LISP Lab Test Configuration Application Note	http://lisp4.cisco.com/lisp_tech.html
Cisco IOS IP Routing: LISP Command Reference	http://www.cisco.com/en/US/docs/ios-xml/ios/iproute_lisp/command/ip-lisp-cr-book.html

MIBs

MIB	MIBs Link
LISP MIB	To locate and download MIBs for selected platforms, Cisco IOS software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 6830	Locator/ID Separation Protocol (LISP) http://tools.ietf.org/html/draft-ietf-lisp-07
RFC 6832	Interworking LISP with IPv4 and IPv6 https://tools.ietf.org/html/rfc6832
RFC 6833	LISP Map Server https://tools.ietf.org/html/rfc6833
RFC 6835	LISP Internet Groper (LIG) https://tools.ietf.org/html/rfc6835

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for LISP

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1: Feature Information for Locator/ID Separation Protocol

Feature Name	Release	Feature Configuration Information
Configure LISP		Introduces LISP functionality to support ITR, ETR, PITR, PETR, MS, MR, and LISP ALT devices for IPv4 and IPv6 address families.

Feature Name	Release	Feature Configuration Information
LISP MIB		This feature introduces LISP MIB on Cisco software.

