LISP Support for Disjoint RLOC Domains

The Locator/ID Separation Protocol (LISP) implements a "level of indirection" that enables a new IP routing architecture. LISP separates IP addresses into two namespaces: Endpoint Identifiers (EIDs), which are assigned to end-hosts, and Routing Locators (RLOCs), which are assigned to devices that make up the global routing system.

The LISP Support for Disjoint RLOC Domains feature enables LISP-to-LISP communication between LISP sites that are connected to different RLOC spaces but have no connectivity to each other. One example of disjointed RLOC space is that of between the IPv4 Internet and IPv6 Internet. When one LISP site has IPv4-only RLOC connectivity and the second site has IPv6-only RLOC connectivity, these sites can still communicate via LISP using the LISP Support for Disjoint RLOC Domains feature.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

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.

Prerequisites for LISP Support for Disjoint RLOC Domains

Map servers and re-encapsulating tunnel routers (RTRs) must have connectivity to all locator spaces that are being joined.

Restrictions for LISP Support for Disjoint RLOC Domains

Map servers and re-encapsulating tunnel routers (RTRs) cannot join more than eight locator scopes.

Information About LISP Support for Disjoint RLOC Domains

LISP Support for Disjoint RLOC Domains Overview

The fundamental principal of any network is that routing and reachability must exist between all devices that make up the total network system. There are many network systems, public and private, for which internetwork connectivity is not directly available. A few examples include:

- IPv4 Internet and IPv6 Internet.
- An IPv4 Multiprotocol Label Switching (MPLS) VPN from service provider A and an IPv4 MPLS VPN from service provider B.
- An IPv4 MPLS VPN from service provider A and IPv4 Internet.

When some sites within a network connect to one routing domain and other sites connect to another routing domain, a gateway function must be provided to facilitate connectivity between these disjointed routing domains. In traditional routing architectures, providing connectivity between disjointed routing domains can be quite complex.

The inherent property of Locator/ID Separation Protocol (LISP), which separates IP addresses into two namespaces, endpoint identifiers (EIDs) and routing locators (RLOCs), also gives it the ability to connect disjointed RLOC domains. The LISP Support for Disjoint RLOC Domains feature provides simplified configuration mechanisms that enable this capability. The key components are new control plane configuration options on the LISP map server, and a functionality called re-encapsulating tunnel router (RTR), which provides data plane connectivity between disjointed locator spaces.

LISP Map Server

The key concept in the LISP Support for Disjoint RLOC Domains feature is the recognition that the LISP Mapping System has full knowledge of all LISP sites. When a LISP site registers with a map server, the registration message not only provides information about the EID space that the site is authoritative for, but it also provides information about its own RLOCs.

The LISP Support for Disjoint RLOC Domains feature provides new configuration options to define within the map server the routing locator scopes that LISP sites can connect to. Once defined, the map server automatically determines whether individual sites have common or disjoint locator connectivity between themselves. The map server then uses this knowledge when handling Map-Request messages to determine how to inform LISP sites to communicate with each other. Map-Request messages contain both source and

destination EID information. When a map server receives a Map-Request message, it compares the RLOCs associated with the source EID and destination EID contained with the Map-Request message against the configured locator scopes.

- If the ingress tunnel router (ITR) (source EID) and egress tunnel router (ETR) (destination EID) share at least one RLOC in a common locator scope, the map server forwards the Map-Request message to the ETR as normal. In this case, the ETR is capable of generating a Map-Reply message that is sent back to the ITR since it has reachability across (at least one) common locator space.
- If the ITR (source EID) and ETR (destination EID) do not share at least one RLOC in a common locator scope, the map server sends a proxy Map-Reply message to the ITR that includes a list of RTRs that are capable of connecting the disjointed locator space between the ITR and ETR.
- If the RLOCs associated with the ITR (source EID) and ETR (destination EID) do not match any configured locator scopes, the map server forwards the Map-Request message to the ETR as normal. In this case, the RLOCs are assumed to be reachable via routing, even though they are not defined in any locator scope configuration.

LISP data plane packets flow directly between sites when the sites share locator space. An RTR is used to connect LISP data plane packets when locator spaces between the sites are disjointed.

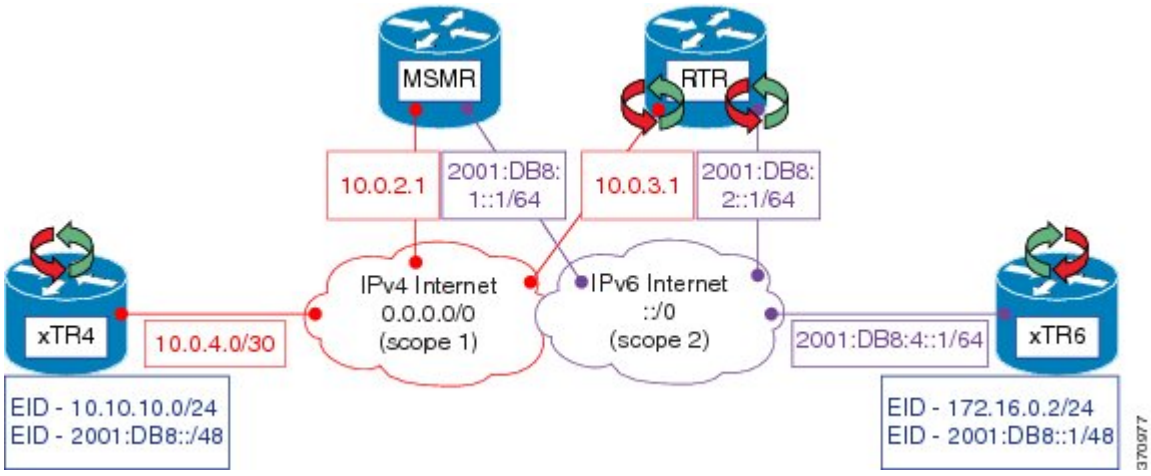
LISP RTR

A re-encapsulating tunnel router (RTR) provides data plane communications support for LISP-to-LISP traffic between LISP sites that do not share common locator space. Functionally, an RTR takes in LISP encapsulated packets from an ITR in one locator scope, decapsulates them, does a map-cache lookup, and then re-encapsulates them to an ETR in another locator scope. The following are important considerations for an RTR:

- The RTR itself must have RLOCs in all locator scopes that are being joined.
- An RTR sends Map-Request messages to populate its own map cache. As a Map-Request message contains an ITR RLOC field that is populated with one or more entries corresponding to the locators of the device sending the Map-Request message, the RTR in this case, the locator set configuration is also required on the RTR to define its locators. This enables the map server to correctly receive Map-Requests from the RTR to assess locator scope connectivity.

- An RTR performs functions similar to a proxy ingress tunnel router (PITR) and proxy egress tunnel router (PETR), therefore these features must be enabled on the RTR.

Figure 1: LISP - Disjoint RLOC Domains Topology



Referring to Figure 1, the tasks below illustrate the configuration steps required to provide Locator/ID Separation Protocol (LISP) Disjoint Routing Locator (RLOC) support for cross address-family (IPv4/IPv6) connectivity.

- Ingress/Egress tunnel router (xTR) represents the LISP Site router. In Figure 1, xTR4 only has RLOC connectivity to the IPv4 Internet, and xTR6 only has RLOC connectivity to the IPv6 Internet.
- Map server map resolver (MSMR) represents the MSMR supporting the LISP control plane.
- Re-encapsulating tunnel router (RTR) represents the LISP data plane device that joins locator scopes.

How to configure LISP Support for Disjoint RLOC Domains

Configuring xTR

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip address** *ip-address mask*
5. **ipv6 address** *ipv6-address/ipv6-prefix*
6. **interface** *type number*
7. **ip address** *ip-address mask*
8. **router lisp**
9. **locator-set** *locator-set-name*
10. *ipv4-address* **priority** *priority-locator* **weight** *locator-weight*
11. *ipv6-address* **priority** *priority-locator* **weight** *locator-weight*
12. **exit**
13. **eid-table default instance-id** *id*
14. **database-mapping** *dynamic-eid-prefix/prefix-length* **locator-set** *name*
15. **database-mapping** *dynamic-eid-prefix/prefix-length* **locator-set** *name*
16. **exit**
17. **ipv4 itr map-resolver** *map-resolver-address*
18. **ipv4 itr**
19. **ipv4 etr map-server** *map-server-address* **key** *authentication-key*
20. **ipv4 etr**
21. **ipv6 itr map-resolver** *map-resolver-address*
22. **ipv6 itr**
23. **ipv6 etr map-server** *map-server-address* **key** *authentication-key*
24. **ipv6 etr**
25. **exit**
26. **ip route** *prefix mask ip-address*
27. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Device(config)# interface loopback0`	Specifies the interface type and number and enters interface configuration mode.
Step 4	**ip address** *ip-address mask* **Example:** `Device(config-if)# ip address 10.10.10.4 255.255.255.0`	Configures an IPv4 address for the interface.
Step 5	**ipv6 address** *ipv6-address/ipv6-prefix* **Example:** `Device(config-if)# ipv6 address 2001:DB8:0:ABCD::1/64`	Configures an IPv6 address for the interface.
Step 6	**interface** *type number* **Example:** `Device(config)# interface ethernet0/0`	Specifies the interface type and number and enters interface configuration mode.
Step 7	**ip address** *ip-address mask* **Example:** `Device(config-if)# ip address 10.0.4.1 255.255.255.252`	Configures an IPv4 address for the interface.
Step 8	**router lisp** **Example:** `Device(config-if)# router lisp`	Enters LISP configuration mode.
Step 9	**locator-set** *locator-set-name* **Example:** `Device(config-router-lisp)# locator-set R4`	Specifies a locator set and enters LISP locator set configuration mode.
Step 10	*ipv4-address* **priority** *priority-locator* **weight** *locator-weight*	Configures the LISP locator set. The LISP locator set is the set of addresses the first-hop router uses when communicating with the gateway xTR. You can configure each IPv4 locator

	Command or Action	Purpose
	Example: `Device(config-router-lisp-locator-set)# 10.0.4.1 priority 1 weight 1`	address by creating a locator entry with assigned priority and weight.
Step 11	*ipv6-address* **priority** *priority-locator* **weight** *locator-weight* **Example:** `Device(config-router-lisp-locator-set)# 2001:DB8:4::2 priority 1 weight 1`	Configures the LISP locator set. The LISP locator set is the set of addresses the first-hop router uses when communicating with the gateway xTR. You can configure each IPv6 locator address by creating a locator entry with assigned priority and weight.
Step 12	**exit** **Example:** `Device(config-router-lisp-locator-set)# exit`	Exits LISP locator set configuration mode and returns to LISP configuration mode.
Step 13	**eid-table default instance-id** *id* **Example:** `Device(config-router-lisp)# eid-table default instance-id 0`	Configures an association between the default (global) routing table and a LISP instance ID, and enters EID table configuration mode.
Step 14	**database-mapping** *dynamic-eid-prefix/prefix-length* **locator-set** *name* **Example:** `Device(config-router-lisp-eid-table)# database-mapping 10.10.10.0/24 locator-set R4`	Configures an IPv4/IPv6 mapping relationship and an associated traffic policy (as defined in the locator set) for this LISP site.
Step 15	**database-mapping** *dynamic-eid-prefix/prefix-length* **locator-set** *name* **Example:** `Device(config-router-lisp-eid-table)# database-mapping 2001:DB8::/48 locator-set R4`	Configures an IPv4/IPv6 mapping relationship and an associated traffic policy (as defined in the locator set) for this LISP site.
Step 16	**exit** **Example:** `Device(config-router-lisp-eid-table)# exit`	Exits EID table configuration mode and returns to LISP configuration mode.
Step 17	**ipv4 itr map-resolver** *map-resolver-address* **Example:** `Device(config-router-lisp)# ipv4 itr map-resolver 10.0.2.1`	Configures a locator address for the LISP map resolver to which this device will send Map-Request messages for IPv4 endpoint identifier-to-routing locator (EID-to-RLOC) mapping resolutions. • The locator address of the map resolver may be an IPv4 or IPv6 address. **Note** You can configure up to eight map resolvers if multiple map resolvers are available.

	Command or Action	Purpose
Step 18	**ipv4 itr** **Example:** `Device(config-router-lisp)# ipv4 itr`	Enables LISP ingress tunnel router (ITR) functionality for an IPv4 address family.
Step 19	**ipv4 etr map-server** *map-server-address* **key** *authentication-key* **Example:** `Device(config-router-lisp)# ipv4 etr map-server 10.0.2.1 key R4KEY`	Configures the IPv4 locator address of the LISP map server to be used by the egress tunnel router (ETR) when registering itself for IPv4 endpoint identifiers (EIDs).
Step 20	**ipv4 etr** **Example:** `Device(config-router-lisp)# ipv4 etr`	Enables LISP ETR functionality for an IPv4 address family.
Step 21	**ipv6 itr map-resolver** *map-resolver-address* **Example:** `Device(config-router-lisp)# ipv6 itr map-resolver 10.0.2.1`	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. **Note** You can configure up to eight map resolvers if multiple map resolvers are available.
Step 22	**ipv6 itr** **Example:** `Device(config-router-lisp)# ipv6 itr`	Enables LISP ITR functionality for an IPv6 address family.
Step 23	**ipv6 etr map-server** *map-server-address* **key** *authentication-key* **Example:** `Device(config-router-lisp)# ipv6 etr map-server 10.0.2.1 key R4KEY`	Configures the IPv6 locator address for the LISP map server to be used by the ETR when registering for IPv6 EIDs.
Step 24	**ipv6 etr** **Example:** `Device(config-router-lisp)# ipv6 etr`	Enables LISP ETR functionality for an IPv6 address family.
Step 25	**exit** **Example:** `Device(config-router-lisp)# exit`	Exits LISP configuration mode and returns to global configuration mode.
Step 26	**ip route** *prefix mask ip-address* **Example:** `Device(config)# ip route 0.0.0.0 0.0.0.0 10.0.4.2`	Establishes static routes to the next hop destination.

	Command or Action	Purpose
Step 27	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Configuring MSMR

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip address** *ip-address mask*
5. **ipv6 address** *ipv6-address/ipv6-prefix*
6. **router lisp**
7. **locator-set** *locator-set-name*
8. *ipv4-address* **priority** *priority-locator* **weight** *locator-weight*
9. **exit**
10. Repeat Step 7 to Step 9 to specify and configure another locator set.
11. **locator-scope** *name*
12. **rtr-locator-set** *locator-set-name*
13. **rloc-prefix** *ipv4-rloc-prefix*
14. **exit**
15. Repeat Step 11 to Step 14 to specify and configure another locator scope.
16. **site** *site-name*
17. **authentication-key** *password*
18. **eid-prefix** *ipv4-eid-prefix*
19. **eid-prefix** *ipv6-eid-prefix*
20. **exit**
21. Repeat Step 16 to Step 20 to configure another LISP site on the map server.
22. **ipv4 map-server**
23. **ipv6 map-server**
24. **ipv4 map-resolver**
25. **ipv6 map-resolver**
26. **exit**
27. **ip route** *prefix mask ip-address*
28. **ipv6 route** *ipv6-prefix/prefix-length ipv6-address*
29. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Device(config)# interface ethernet0/0`	Specifies the interface type and number and enters interface configuration mode.
Step 4	**ip address** *ip-address mask* **Example:** `Device(config-if)# ip address 10.0.2.1 255.255.255.252`	Configures an IPv4 address for the interface.
Step 5	**ipv6 address** *ipv6-address/ipv6-prefix* **Example:** `Device(config-if)# ipv6 address 2001:DB8:1::1/64`	Configures an IPv6 address for the interface.
Step 6	**router lisp** **Example:** `Device(config-if)# router lisp`	Enters LISP configuration mode.
Step 7	**locator-set** *locator-set-name* **Example:** `Device(config-router-lisp)# locator-set rtr-set1`	Specifies a locator set and enters LISP locator set configuration mode.
Step 8	*ipv4-address* **priority** *priority-locator* **weight** *locator-weight* **Example:** `Device(config-router-lisp-locator-set)# 10.0.3.1 priority 1 weight 1`	Configures the LISP locator set. The LISP locator set is the set of addresses the first-hop router uses when communicating with the gateway xTR. You can configure each locator address by creating a locator entry with assigned priority and weight.
Step 9	**exit** **Example:** `Device(config-router-lisp-locator-set)# exit`	Exits LISP locator set configuration mode and returns to LISP configuration mode.
Step 10	Repeat Step 7 to Step 9 to specify and configure another locator set.	—

	Command or Action	Purpose
Step 11	**locator-scope** *name* **Example:** `Device(config-router-lisp)# locator-scope s1`	Specifies the locator scope and enters locator scope configuration mode.
Step 12	**rtr-locator-set** *locator-set-name* **Example:** `Device(config-router-lisp-locator-scope)# rtr-locator-set rtr-set1`	Specifies the locator set of re-encapsulating tunnel router (RTR) to use in proxy reply for disjoint/cross address family routing locator (RLOC).
Step 13	**rloc-prefix** *ipv4-rloc-prefix* **Example:** `Device(config-router-lisp-locator-scope)# rloc-prefix 0.0.0.0/0`	Specifies the RLOC prefix to check against ingress tunnel router (ITR) RLOC and egress tunnel router (ETR) RLOC.
Step 14	**exit** **Example:** `Device(config-router-lisp-locator-set)# exit`	Exits LISP locator set configuration mode and returns to LISP configuration mode.
Step 15	Repeat Step 11 to Step 14 to specify and configure another locator scope.	—
Step 16	**site** *site-name* **Example:** `Device(config-router-lisp)# site R4`	Configures a LISP site on a map server and enters LISP site configuration mode.
Step 17	**authentication-key** *password* **Example:** `Device(config-router-lisp-site)# authentication-key R4KEY`	Specifies the authentication key that the LISP site uses.
Step 18	**eid-prefix** *ipv4-eid-prefix* **Example:** `Device(config-router-lisp-site)# eid-prefix 10.10.10.0/24`	Specifies a site IPv4 EID prefix.
Step 19	**eid-prefix** *ipv6-eid-prefix* **Example:** `Device(config-router-lisp-site)# eid-prefix 2001:DB8::/48`	Specifies a site IPv6 EID address prefix.
Step 20	**exit** **Example:** `Device(config-router-lisp-site)# exit`	Exits LISP site configuration mode and returns to LISP configuration mode.
Step 21	Repeat Step 16 to Step 20 to configure another LISP site on the map server.	—

	Command or Action	Purpose
Step 22	**ipv4 map-server** **Example:** `Device(config-router-lisp)# ipv4 map-server`	Enables IPv4 map server functionality.
Step 23	**ipv6 map-server** **Example:** `Device(config-router-lisp)# ipv6 map-server`	Enables IPv6 map server functionality.
Step 24	**ipv4 map-resolver** **Example:** `Device(config-router-lisp)# ipv4 map-resolver`	Enables IPv4 map resolver functionality.
Step 25	**ipv6 map-resolver** **Example:** `Device(config-router-lisp)# ipv6 map-resolver`	Enables IPv6 map resolver functionality.
Step 26	**exit** **Example:** `Device(config-router-lisp)# exit`	Exits LISP configuration mode and returns to global configuration mode.
Step 27	**ip route** *prefix mask ip-address* **Example:** `Device(config)# ip route 0.0.0.0 0.0.0.0 10.0.2.2`	Establishes static routes to the next hop destination.
Step 28	**ipv6 route** *ipv6-prefix/prefix-length ipv6-address* **Example:** `Device(config)# ipv6 route ::/0 2001:DB8:1::ABCD`	Establishes static routes to the next hop destination.
Step 29	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Configuring RTR

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip address** *ip-address mask*
5. **ipv6 address** *ipv6-address/ipv6-prefix*
6. **router lisp**
7. **locator-set** *locator-set-name*
8. *ipv4-address* **priority** *priority-locator* **weight** *locator-weight*
9. *ipv6-address* **priority** *priority-locator* **weight** *locator-weight*
10. **exit**
11. **map-request itr-rlocs** *locator-set-name*
12. **eid-table default instance-id** *id*
13. **map-cache** *ipv4-EID-prefix* **map-request**
14. **map-cache** *ipv6-EID-prefix* **map-request**
15. **exit**
16. **ipv4 map-request-source** *source-address*
17. **ipv4 map-cache-limit** *cache-limit*
18. **ipv4 proxy-etr**
19. **ipv4 proxy-itr** *ipv4-local-locator ipv6-local-locator*
20. **ipv4 itr map-resolver** *map-resolver-address*
21. **ipv6 map-request-source** *source-address*
22. **ipv6 map-cache-limit** *cache-limit*
23. **ipv6 proxy-etr** *cache-limit*
24. **ipv6 proxy-itr** *ipv6-local-locator ipv4-local-locator*
25. **ipv6 itr map-resolver** *map-resolver-address*
26. **exit**
27. **ip route** *prefix mask ip-address*
28. **ipv6 route** *ipv6-prefix/prefix-length ipv6-address*
29. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Device(config)# interface ethernet0/0`	Specifies the interface type and number and enters interface configuration mode.
Step 4	**ip address** *ip-address mask* **Example:** `Device(config-if)# ip address 10.0.3.1 255.255.255.252`	Configures an IPv4 address for the interface.
Step 5	**ipv6 address** *ipv6-address/ipv6-prefix* **Example:** `Device(config-if)# ipv6 address 2001:DB8:2::1/64`	Configures an IPv6 address for the interface.
Step 6	**router lisp** **Example:** `Device(config-if)# router lisp`	Enters LISP configuration mode.
Step 7	**locator-set** *locator-set-name* **Example:** `Device(config-router-lisp)# locator-set setALL`	Specifies a locator set and enters LISP locator set configuration mode.
Step 8	*ipv4-address* **priority** *priority-locator* **weight** *locator-weight* **Example:** `Device(config-router-lisp-locator-set)# 10.0.3.1 priority 1 weight 1`	Configures an IPv4 or IPv6 address and policy for the re-encapsulation tunnel router (RTR).
Step 9	*ipv6-address* **priority** *priority-locator* **weight** *locator-weight* **Example:** `Device(config-router-lisp-locator-set)# 2001:DB8:2::1 priority 1 weight 1`	Configures an IPv4 or IPv6 address and policy for the RTR.

	Command or Action	Purpose
Step 10	**exit** **Example:** `Device(config-router-lisp-locator-set)# exit`	Exits LISP locator set configuration mode and returns to LISP configuration mode.
Step 11	**map-request itr-rlocs** *locator-set-name* **Example:** `Device(config-router-lisp)# map-request itr-rlocs setALL`	Configures the locator set to be used as routing locators (RLOCs) in the ingress tunnel router (ITR) RLOC field of Map-Request messages sent from the RTR.
Step 12	**eid-table default instance-id** *id* **Example:** `Device(config-router-lisp)# eid-table default instance-id 0`	Configures an association between the default (global) routing table and a LISP instance ID, and enters EID table configuration mode.
Step 13	**map-cache** *ipv4-EID-prefix* **map-request** **Example:** `Device(config-router-lisp-eid-table)# map-cache 0.0.0.0/0 map-request`	Configures static endpoint identifier-to-routing locator (EID-to-RLOC) mappings for an ITR and enables sending of Map-Request message for a LISP destination EID.
Step 14	**map-cache** *ipv6-EID-prefix* **map-request** **Example:** `Device(config-router-lisp-eid-table)# map-cache ::/0 map-request`	Configures static EID-to-RLOC mappings for an ITR and enables sending of Map-Request message for a LISP destination EID.
Step 15	**exit** **Example:** `Device(config-router-lisp-eid-table)# exit`	Exits LISP EID table configuration mode and returns to LISP configuration mode.
Step 16	**ipv4 map-request-source** *source-address* **Example:** `Device(config-router-lisp)# ipv4 map-request-source 10.0.3.1`	Specifies the IPv4 source address to be used in LISP IPv4 Map-Request messages. The ITR RLOCs configured under Steps 7 through 10, and Step 11 take precedence. However, this step (16) is still required.
Step 17	**ipv4 map-cache-limit** *cache-limit* **Example:** `Device(config-router-lisp)# ipv4 map-cache-limit 100000`	(Optional) Specifies maximum number of IPv4 LISP map cache entries allowed to be stored on the router. The valid range is from 0 to 100000.
Step 18	**ipv4 proxy-etr** **Example:** `Device(config-router-lisp)# ipv4 proxy-etr`	Configures a device to act as an IPv4 LISP proxy egress tunnel router (PETR).
Step 19	**ipv4 proxy-itr** *ipv4-local-locator ipv6-local-locator* **Example:** `Device(config-router-lisp)# ipv4 proxy-itr 10.0.3.1 2001:DB8:2::1`	Configures this device to act as an IPv4 proxy ingress tunnel router (PITR), and configures the IPv4 and IPv6 locator addresses used as a source address for encapsulation of data packets.

	Command or Action	Purpose

Step 20	**ipv4 itr map-resolver** *map-resolver-address*
	
	Example:
	`Device(config-router-lisp)# ipv4 itr map-resolver 10.0.2.1`
	`Device(config-router-lisp)# ipv4 itr map-resolver 2001:DB8:1::1`
		Configures a locator address for the LISP map resolver to which this device 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.
		
		Note You can configure up to 8 map resolvers if multiple map resolvers are available.

Step 21	**ipv6 map-request-source** *source-address* **Example:** `Device(config-router-lisp)# ipv6 map-request-source 2001:DB8:2::1`	The ITR RLOCs configured under Steps 7 through 10, and Step 11 take precedence. However, this step (16) is still required.
Step 22	**ipv6 map-cache-limit** *cache-limit* **Example:** `Device(config-router-lisp)# ipv6 map-cache-limit 100000`	(Optional) Specifies the maximum number of IPv6 LISP map cache entries allowed to be stored on the device. The valid range is from 0 to 100000.
Step 23	**ipv6 proxy-etr** *cache-limit* **Example:** `Device(config-router-lisp)# ipv6 proxy-etr`	Configures a device to act as an IPv6 LISP PETR.
Step 24	**ipv6 proxy-itr** *ipv6-local-locator ipv4-local-locator* **Example:** `Device(config-router-lisp)# ipv6 proxy-itr 2001:DB8:2::1 10.0.3.1`	Configures this device to act as an IPv6 PITR, and configures the IPv4 and IPv6 locator addresses used as a source address for encapsulation of data packets.

Step 25	**ipv6 itr map-resolver** *map-resolver-address*
	
	Example:
	`Device(config-router-lisp)#  ipv6 itr map-resolver 10.0.2.1`
	`Device(config-router-lisp)#  ipv6 itr map-resolver 2001:DB8:1::1`
		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.
		
		Note You can configure up to eight map resolvers if multiple map resolvers are available.

Step 26	**exit** **Example:** `Device(config-router-lisp)# exit`	Exits LISP configuration mode and returns to global configuration mode.
Step 27	**ip route** *prefix mask ip-address* **Example:** `Device(config)# ip route 0.0.0.0 0.0.0.0 10.0.3.2`	Establishes static routes to the next hop destination.

	Command or Action	Purpose
Step 28	**ipv6 route** *ipv6-prefix/prefix-length ipv6-address* **Example:** `Device(config)# ipv6 route ::/0 2001:DB8:ABCD::1`	Establishes static routes to the next hop destination.
Step 29	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Verifying LISP Support for Disjoint RLOC Domains

SUMMARY STEPS

1. **enable**
2. **show ip lisp database**
3. **show ipv6 lisp database**
4. **show lisp site detail**
5. **show ip lisp map-cache**
6. **show ipv6 lisp map-cache**

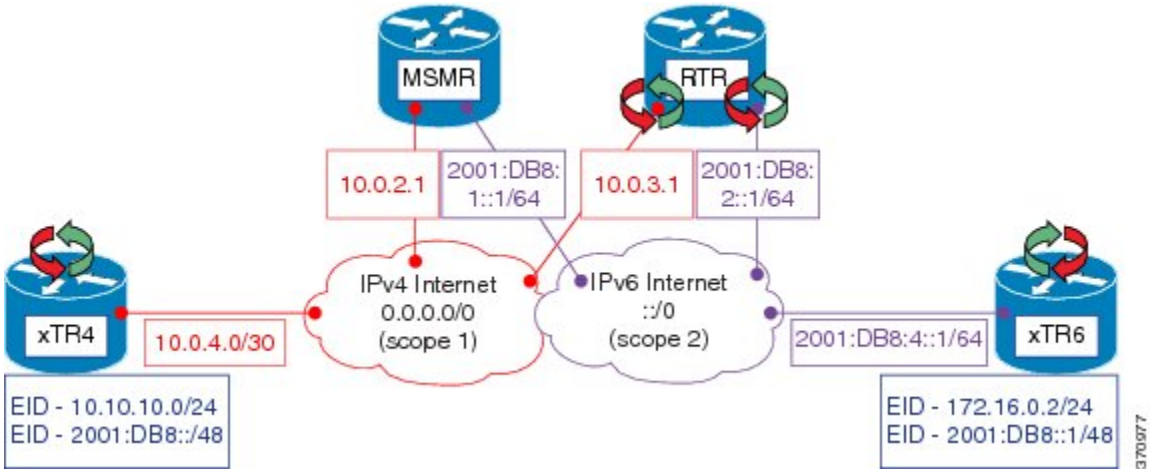
DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show ip lisp database** **Example:** `Device# show ip lisp database`	Displays Locator/ID Separation Protocol (LISP) egress tunnel router (ETR) configured local IPv4 endpoint identifier (EID) prefixes and associated locator sets.
Step 3	**show ipv6 lisp database** **Example:** `Device# show ipv6 lisp database`	Displays LISP ETR configured local IPv6 EID prefixes and associated locator sets.
Step 4	**show lisp site detail** **Example:** `Device# show lisp site detail`	Displays details of LISP sites configured on a LISP map server.

	Command or Action	Purpose
Step 5	**show ip lisp map-cache** **Example:** `Device# show ip lisp map-cache`	Displays the current dynamic and static IPv4 endpoint identifier-to-routing locator (EID-to-RLOC) map cache entries.
Step 6	**show ipv6 lisp map-cache** **Example:** `Device# show ipv6 lisp map-cache`	Displays the current dynamic and static IPv6 EID-to-RLOC map cache entries.

Configuration Examples for LISP Support for Disjoint RLOC Domains

Figure 2: LISP - Disjoint RLOC Domains topology



The examples below show the complete configuration for the LISP topology illustrated in the figure above.

Example: Configuring xTR

The following example shows how to configure xTR4:

```
Device> enable
Device# configure terminal
Device(config)# interface loopback0
Device(config-if)# ip address 10.10.10.4 255.255.255.0
Device(config-if)# ipv6 address 2001:DB8:0:ABCD::1/64
Device(config-if)# interface ethernet0/0
Device(config-if)# ip address 10.0.4.1 255.255.255.252
Device(config-if)# router lisp
```

```
Device(config-router-lisp)# locator-set R4
Device(config-router-lisp-locator-set)# 10.0.4.1 priority 1 weight 1
Device(config-router-lisp-locator-set)# exit
Device(config-router-lisp)# eid-table default instance-id 0
Device(config-router-lisp-eid-table)# database-mapping 10.10.10.0/24 locator-set R4
Device(config-router-lisp-eid-table)# database-mapping  2001:DB8::/48 locator-set R4
Device(config-router-lisp-eid-table)# exit
Device(config-router-lisp)# ipv4 itr map-resolver 10.0.2.1
Device(config-router-lisp)# ipv4 itr
Device(config-router-lisp)# ipv4 etr map-server 10.0.2.1 key R4KEY
Device(config-router-lisp)# ipv4 etr
Device(config-router-lisp)# ipv6 itr map-resolver 10.0.2.1
Device(config-router-lisp)# ipv6 itr
Device(config-router-lisp)# ipv6 etr map-server 10.0.2.1 key R4KEY
Device(config-router-lisp)# ipv6 etr
Device(config-router-lisp)# exit
Device(config)# ip route 0.0.0.0 0.0.0.0 10.0.4.2
```

The following example shows how to configure xTR6:

```
Device> enable
Device# configure terminal
Device(config)# interface loopback0
Device(config-if)# ip address 172.16.0.4 255.255.255.0
Device(config-if)# ipv6 address 2001:DB8::4/64
Device(config-if)# interface ethernet0/0
Device(config-if)# ipv6 address 2001:DB8:4::2/64
Device(config-if)# router lisp
Device(config-router-lisp)# locator-set R6
Device(config-router-lisp-locator-set)# 2001:DB8:4::2 priority 1 weight 1
Device(config-router-lisp-locator-set)# exit
Device(config-router-lisp)# eid-table default instance-id 0
Device(config-router-lisp-eid-table)# database-mapping 172.16.0.2/24 locator-set R4
Device(config-router-lisp-eid-table)# database-mapping 2001:DB8::1/48 locator-set R4
Device(config-router-lisp-eid-table)# exit
Device(config-router-lisp)# ipv4 itr map-resolver 2001:DB8:3::2
Device(config-router-lisp)# ipv4 itr
Device(config-router-lisp)# ipv4 etr map-server 2001:DB8:3::2 key R4KEY
Device(config-router-lisp)# ipv4 etr
Device(config-router-lisp)# ipv6 itr map-resolver 2001:DB8:3::2
Device(config-router-lisp)# ipv6 itr
Device(config-router-lisp)# ipv6 etr map-server 2001:DB8:3::2 key R4KEY
Device(config-router-lisp)# ipv6 etr
Device(config-router-lisp)# exit
Device(config)# ipv6 route ::/0 2001:DB8:4::1
```

Example: Configuring MSMR

```
Device> enable
Device# configure terminal
Device(config)# interface ethernet0/0
Device(config-if)# ip address 10.0.2.1 255.255.255.252
Device(config-if)# ipv6 address 2001:DB8:1::1/64
Device (config-if)# router lisp
Device(config-router-lisp)# locator-set rtr-set1
Device(config-router-lisp-locator-set)# 10.0.3.1 priority 1 weight 1
Device(config-router-lisp-locator-set)# exit
Device(config-router-lisp)# locator-set rtr-set2
Device(config-router-lisp-locator-set)# 2001:DB8:2::1/64 priority 1 weight 1
Device(config-router-lisp-locator-set)# exit
Device(config-router-lisp)# locator-scope s1
Device(config-router-lisp-locator-scope)# rtr-locator-set rtr-set1
Device(config-router-lisp-locator-scope)# rloc-prefix 0.0.0.0/0
Device(config-router-lisp-locator-scope)# exit
Device(config-router-lisp)# locator-scope s2
Device(config-router-lisp-locator-scope)# rtr-locator-set rtr-set2
```

```
Device(config-router-lisp-locator-scope)# rloc-prefix ::/0
Device(config-router-lisp-locator-scope)# exit
Device(config-router-lisp)# site R4
Device(config-router-lisp-site)# authentication-key R4KEY
Device(config-router-lisp-site)# eid-prefix 10.10.10.0/24
Device(config-router-lisp-site)# eid-prefix 2001:DB8::/48
Device(config-router-lisp-site)# exit
Device(config-router-lisp)# site R6
Device(config-router-lisp-site)# authentication-key R6KEY
Device(config-router-lisp-site)# eid-prefix 172.16.0.2/24
Device(config-router-lisp-site)# eid-prefix 2001:DB8::1/48
Device(config-router-lisp-site)# exit
Device(config-router-lisp)# ipv4 map-server
Device(config-router-lisp)# ipv4 map-resolver
Device(config-router-lisp)# exit
Device(config)# ip route 0.0.0.0 0.0.0.0 10.0.2.2
Device(config)# ipv6 route ::/0 2001:DB8:1::ABCD
```

Example: Configuring RTR

```
Device> enable
Device# configure terminal
Device(config)# interface Ethernet0/0
Device(config-if)# ip address 10.0.3.1 255.255.255.252
Device(config-if)# ipv6 address 2001:DB8:2::1/64
Device (config-if)# router lisp
Device(config-router-lisp)# locator-set setALL
Device(config-router-lisp-locator-set)# 10.0.3.1 priority 1 weight 1
Device(config-router-lisp-locator-set)# 2001:DB8:2::1 priority 1 weight 1
Device(config-router-lisp-locator-set)# exit
Device(config-router-lisp)# map-request itr-rlocs setALL
Device(config-router-lisp)# eid-table default instance-id 0
Device(config-router-lisp-eid-table)# map-cache 0.0.0.0/0 map-request
Device(config-router-lisp-eid-table)# map-cache ::/0 map-request
Device(config-router-lisp-eid-table)# exit
Device(config-router-lisp)# ipv4 map-request-source 10.0.3.1
Device(config-router-lisp)# ipv4 map-cache-limit 100000
Device(config-router-lisp)# ipv4 proxy-etr
Device(config-router-lisp)# ipv4 proxy-itr 10.0.3.1 2001:DB8:2::1
Device(config-router-lisp)# ipv4 itr map-resolver 10.0.2.1
Device(config-router-lisp)# ipv4 itr map-resolver 2001:DB8:1::1
Device(config-router-lisp)# ipv6 map-request-source 2001:DB8:2::1
Device(config-router-lisp)# ipv6 map-cache-limit 100000
Device(config-router-lisp)# ipv6 proxy-etr
Device(config-router-lisp)# ipv6 proxy-itr 2001:DB8:2::1 10.0.3.1
Device(config-router-lisp)# ipv6 itr map-resolver 10.0.2.1
Device(config-router-lisp)# ipv6 itr map-resolver 2001:DB8:1::1
Device(config-router-lisp)# exit
Device(config)# ip route 0.0.0.0 0.0.0.0 10.0.3.2
Device(config)# ipv6 route ::/0 2001:DB8:ABCD::1
```

Example: Verifying LISP Support for Disjoint RLOC Domains

Sample Output for the show ip lisp database Command

To display Locator/ID Separation Protocol (LISP) egress tunnel router (ETR) configured local IPv4 endpoint identifier (EID) prefixes and associated locator sets, use the **show ip lisp database** command in privileged EXEC mode.

```
Device# show ip lisp database
.
```

```
.
.
10.10.10.0/24, locator-set R4
Locator Pri/Wgt Source State
10.0.4.1 1/1 cfg-addr site-self, reachable
```

Sample Output for the show ipv6 lisp database Command

To display LISP ETR configured local IPv6 EID prefixes and associated locator sets, use the **show ip lisp database** command in privileged EXEC mode.

```
Device# show ipv6 lisp database
.
.
.
2001:DB8::/48, locator-set R4
Locator Pri/Wgt Source State
10.0.4.1 1/1 cfg-addr site-self, reachable
 mm
```

Sample Output for the show lisp site detail Command

To display configured LISP sites on a LISP map server, use the **show lisp site detail** in privileged EXEC mode.

```
Device# show lisp site detail
.
.
.
Site name: R4
.
.
.
EID-prefix: 10.10.10.0/24
.
.
.
ETR 10.0.4.1, last registered 00:00:52, no proxy-reply, map-notify
TTL 1d00h, no merge, hash-function sha1, nonce 0x28517C31-0x7B233E66
state complete, no security-capability
xTR-ID 0xEC52ECC2-0x006CEAFE-0x814263B3-0x89675EB6
site-ID unspecified
Locator Local State Pri/Wgt Scope
10.0.4.1 yes up 1/1 s1
EID-prefix: 2001:DB8::/48
.
.
.
.
ETR 10.0.4.1, last registered 00:00:39, no proxy-reply, map-notify
TTL 1d00h, no merge, hash-function sha1, nonce 0xF91CB211-0x5B00E72C
state complete, no security-capability
xTR-ID 0xEC52ECC2-0x006CEAFE-0x814263B3-0x89675EB6
site-ID unspecified
Locator Local State Pri/Wgt Scope
10.0.4.1 yes up 1/1 s1
.
.
.
```

Sample Output for the show ip lisp map-cache Command

To display the current dynamic and static IPv4 endpoint identifier-to-routing locator (EID-to-RLOC) map cache entries, use the **show ip lisp map-cache** command in privileged EXEC mode.

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

```
LISP IPv4 Mapping Cache for EID-table default (IID 0), 2 entries
.
.
.
172.16.0.2/24, uptime: 00:01:14, expires: 00:13:44, via map-reply, complete
  Locator   Uptime    State      Pri/Wgt
  10.0.3.1  00:01:14  up           1/1
```

Sample Output for the show ipv6 lisp map-cache Command

To display the current dynamic and static IPv6 EID-to-RLOC map-cache entries, use the **show ipv6 lisp map-cache** command in privileged EXEC mode.

```
Device# show ipv6 lisp map-cache

LISP IPv6 Mapping Cache for EID-table default (IID 0), 2 entries
.
.
.
2001:DB8::1/48, uptime: 00:02:18, expires: 00:12:44, via map-reply, complete
  Locator   Uptime    State      Pri/Wgt
  10.0.3.1  00:02:18  up           1/1
```

Additional References for LISP Support for Disjoint RLOC Domains

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
Locator/ID Separation Protocol (LISP) commands	Cisco IOS IP Routing: LISP Command Reference

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 Support for Disjoint RLOC Domains

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.

Feature Name	Release	Feature Information
LISP Support for Disjoint RLOC Domains		The LISP Support for Disjoint RLOC domains feature enables LISP-to-LISP communications between LISP sites that are connected to different RLOC spaces but have no connectivity to each other.