Configuring Locator ID Separation Protocol

This chapter describes how to configure the basic Cisco NX-OS Locator/ID Separation Protocol (LISP) functionality on all LISP-related devices, including the Ingress Tunnel Router (ITR), Egress Tunnel Router, Proxy ITR (PITR), Proxy ETR (PETR), Map Resolver (MR), Map Server (MS), and LISP-ALT device.

This chapter contains the following sections:

Licensing Requirements

For a complete explanation of Cisco NX-OS licensing recommendations and how to obtain and apply licenses, see the *Cisco NX-OS Licensing Guide*.

Information About Locator/ID Separation Protocol

The Locator/ID Separation Protocol (LISP) network architecture and protocol implements a new semantic for IP addressing by creating two new namespaces: Endpoint Identifiers (EIDs), which 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 improves routing system scalability, multihoming efficiency, and ingress traffic engineering. LISP end site support is configured on devices such as Cisco routers.

Information About LISP

In the current Internet routing and addressing architecture, the IP address is used as a single namespace that simultaneously expresses two functions about a device: its identity and how it is attached to the network. One very visible and detrimental result of this single namespace is demonstrated by the rapid growth of the Internet's default-free zone (DFZ) as a consequence of multi-homing, traffic engineering (TE), nonaggregatable address allocations, and business events such as mergers and acquisitions.

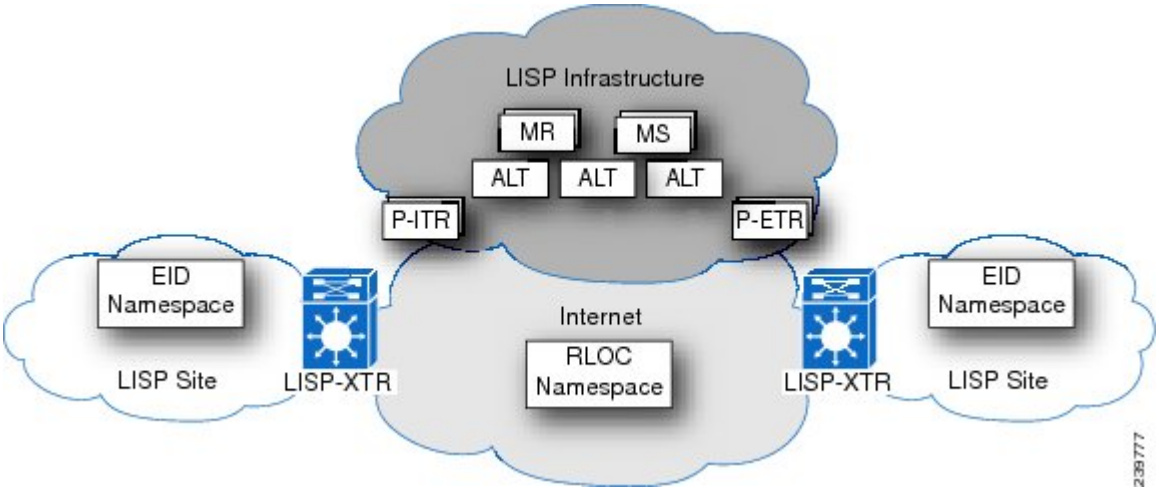
LISP changes current IP address semantics by creating two new namespaces: Endpoint Identifiers (EIDs) that are assigned to end-hosts and Routing Locators (RLOCs) that are assigned to devices (primarily routers) that make up the global routing system. These two namespaces provide the following advantages:

- Improved routing system scalability by using topologically aggregated RLOCs
- Provider independence for devices numbered out of the EID space
- Multihoming of endsites with improved traffic engineering
- IPv6 transition functionality

LISP is deployed primarily in network edge devices. It requires no changes to host stacks, Domain Name Service (DNS), or local network infrastructure, and little to no major changes to existing network infrastructures.

Figure 1: Cisco NX-OS LISP Deployment Environment

This figure shows a LISP deployment environment. Three essential environments exist in a LISP environment: LISP sites (EID namespace), non-LISP sites (RLOC namespace), and LISP Mapping Service (infrastructure).



The LISP EID namespace represents customer end sites as they are defined today. The only difference is that the IP addresses used within these LISP sites are not advertised within the non-LISP, Internet (RLOC namespace). End customer LISP functionality is deployed exclusively on CE routers that function within LISP as Ingress Tunnel Router (ITR) and Egress Tunnel Router (ETR) devices.

Note The ITR and ETR are abbreviated as xTR in the figure.

To fully implement LISP with support for Mapping Services and Internet interworking, you might need to deploy additional LISP infrastructure components such as Map Server (MS), Map Resolver (MR), Proxy Ingress Tunnel Router (PITR), Proxy Egress Tunnel Router (PETR), and Alternative Topology (ALT).

LISP Devices Overview

The following devices are found in a full LISP deployment:

LISP Site Devices

The LISP site devices are as follows:

Ingress Tunnel Router (ITR)—This device is deployed as a LISP site edge device. It receives packets from site-facing interfaces (internal hosts) and either LISP encapsulates packets to remote LISP sites or the ITR natively forwards packets to non-LISP sites.

Egress Tunnel Router (ETR)—This device is deployed as a LISP site edge device. It receives packets from core-facing interfaces (the Internet) and either decapsulates LISP packets or delivers them to local EIDs at the site.

Note Customer Edge (CE) devices can implement both ITR and ETR functions. This type of CE device is referred to as an xTR. The LISP specification does not require a device to perform both ITR and ETR functions, however.

For both devices, the EID namespace is used inside the sites for end-site addresses for hosts and routers. The EIDs go in DNS records. The EID namespace is not globally routed in the underlying Internet. The RLOC namespace is used in the (Internet) core. RLOCs are used as infrastructure addresses for LISP routers and ISP routers and are globally routed in the underlying infrastructure. Hosts do not know about RLOCs, and RLOCs do not know about hosts.

LISP Infrastructure

The LISP infrastructure devices are as follows:

Map Server (MS)—This device is deployed as a LISP Infrastructure component. It must be configured to permit a LISP site to register to it by specifying for each LISP site the EID prefixes for which registering ETRs are authoritative. An authentication key must match the key that is configured on the ETR. An MS receives Map-Register control packets from ETRs. When the MS is configured with a service interface to the LISP ALT, it injects aggregates for the EID prefixes for registered ETRs into the ALT. The MS also receives Map-Request control packets from the ALT, which it then encapsulates to the registered ETR that is authoritative for the EID prefix being queried.

Map Resolver (MR)—This device is deployed as a LISP Infrastructure device. It receives Map-Requests encapsulated to it from ITRs. When configured with a service interface to the LISP ALT, the MR forwards Map Requests to the ALT. The MR also sends Negative Map-Replies to ITRs in response to queries for non-LISP addresses.

Alternative Topology (ALT)—This is a logical topology and is deployed as part of the LISP Infrastructure to provide scalable EID prefix aggregation. Because the ALT is deployed as a dual-stack (IPv4 and IPv6)

Border Gateway Protocol (BGP) over Generic Routing Encapsulation (GRE) tunnels, you can use ALT-only devices with basic router hardware or other off-the-shelf devices that can support BGP and GRE.

LISP Internetworking Devices

The LISP internetworking devices are as follows:

Proxy ITR (PITR)—This device is a LISP infrastructure device that provides connectivity between non-LISP sites and LISP sites. A PITR advertises coarse-aggregate prefixes for the LISP EID namespace into the Internet, which attracts non-LISP traffic destined to LISP sites. The PITR then encapsulates and forwards this traffic to LISP sites. This process not only facilitates LISP/non-LISP internetworking but also allows LISP sites to see LISP ingress traffic engineering benefits from non-LISP traffic.

Proxy ETR (PETR)—This device is a LISP infrastructure device that allows IPv6 LISP sites without native IPv6 RLOC connectivity to reach LISP sites that only have IPv6 RLOC connectivity. In addition, the PETR can also be used to allow LISP sites with Unicast Reverse Path Forwarding (URPF) restrictions to reach non-LISP sites.

LISP Guidelines and Limitations

LISP has the following configuration guidelines and limitations:

- LISP requires the Cisco Nexus 7000 Series 32-Port, 10 Gigabit Ethernet (M1) module (N7K-M132XP-12 or N7K-M132XP-12L), with Electronic Programmable Logic Device (EPLD) version 186.008 or later.
- Use an Overlay Transport Virtualization (OTV) or another LAN extension mechanism to filter the HSRP hello messages across the data centers to create an active-active HSRP setup and provide egress path optimization for the data center hosts.
- Make sure that the HSRP group and the HSRP Virtual IP address in all data centers in the extended LAN are the same. Keeping the HSRP group number consistent across locations guarantees that the same MAC address is always used for the virtual first-hop gateway.
- LISP VM mobility across subnets requires that the same MAC address is configured across all HSRP groups that allow dynamic EIDs to roam. You must enable the Proxy Address Resolution Protocol (ARP) for the interfaces that have VM mobility enabled across subnets.
- LISP is not supported for F2 Series modules.
- From Release 8.2(1), LISP is supported on F3 and M3 line cards.

Default Settings for LISP

This table lists the default settings for LISP parameters.

Table 1: LISP Default Settings

Parameters	Default
feature lisp command	Disabled

Configuring Locator/ID Separation Protocol

Enabling the LISP Feature

You can enable the LISP feature on the Cisco NX-OS device.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**feature lisp** **Example:** `switch(config)# feature lisp`	Enables the LISP feature set if it is not already configured.

Configuring LISP ITR/ETR (xTR) Functionality

Configuring LISP ITR/ETR (xTR)

You can enable and configure a LISP xTR with a LISP Map-Server and Map-Resolver for mapping services for both IPv4 and IPv6 address families.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	{**ip** | **ipv6**} **lisp itr**
	Example:
	`switch(config)# ip lisp itr`
	Example:
	`switch(config)# ipv6 lisp itr`
		Enables LISP ITR functionality.

Step 3	{**ip** | **ipv6**} **lisp etr** **Example:** `switch(config)# ip lisp etr`	Enables LISP ETR functionality.

	Command or Action	Purpose
	Example: `switch(config)# ipv6 lisp etr`	

Step 4	(Optional) {**ip** | **ipv6**} **lisp itr-etr**
	Example:
	`switch(config)# ip lisp itr-etr`
	Example:
	`switch(config)# ipv6 lisp itr-etr`
		Enables both the LISP ITR and the LISP ETR functionality. When both ITR and ETR functionality is being enabled on the same device, the configuration can be simplified by using this command instead of the {**ip** | **ipv6**} **lisp itr** and {**ip** | **ipv6**} **lisp etr** commands separately.

Step 5	{**ip** | **ipv6**} **lisp itr map-resolver** *map-resolver-address*
	Example:
	`switch(config)# ip lisp itr map-resolver 10.10.10.1`
	Example:
	`switch(config)# ipv6 lisp itr map-resolver 10.10.10.1`
		Configures the locator address of the Map-Resolver to which this router sends Map-Request messages for IPv4 or IPv6 EIDs.
		Note The locator address of the Map-Resolver can be an IPv4 or IPv6 address. See the *Cisco Nexus 7000 Series NX-OS LISP Command Reference* for more details.

Step 6	{**ip** | **ipv6**} **database-mapping** *EID-prefix/prefixlength locator* **priority** *priority* **weight** *weight*
	Example:
	`switch(config)# ip lisp database-mapping 10.10.10.0/24 172.16.1.1 priority 1 weight 100`
	Example:
	`switch(config)# ipv6 lisp database-mapping 2001:db8:bb::/48 172.16.1.1 priority 1 weight 100`
		Configures an EID-to-RLOC mapping relationship and associated traffic policy for all IPv4 or IPv6 EID prefix(es) for this LISP site.
		Note If the site has multiple locators associated with the same EID-prefix block, enter multiple **ip lisp database-mapping** commands to configure all of the locators for a given EID-prefix block.
		If the site is assigned multiple EID-prefix blocks, enter the **ip lisp database-mapping** command for each EID-prefix block assigned to the site and for each locator by which the EID-prefix block is reachable.
		If the site has multiple ETRs, you must configure all ETRs with the **ip lisp database-mapping** and **ipv6 lisp database-mapping** commands ensuring the options used are consistent.

Step 7	{**ip** | **ipv6**} **lisp etr map-server** *map-server-address* **key** *key-type authentication-key* **Example:**	Configures the locator address of the LISP Map-Server to which this router, acting as an IPv4 or IPv6 LISP ETR, registers.

	Command or Action	Purpose

	`switch(config)# ip lisp etr map-server 172.16.1.2 key 0 123456789`
	Example:
	`switch(config)# ipv6 lisp etr map-server 172.16.1.2 key 0 123456789`
		Note The Map-Server must be configured with EID prefixes that match the EID-prefixes configured on this ETR, and a key matching the one configured on this ETR.
		The locator address of the Map-Server may be an IPv4 or IPv6 address. See the *Cisco Nexus 7000 Series NX-OS LISP Command Reference* for more details.

Step 8	**exit** **Example:** `switch(config)# exit switch#`	Exits global configuration mode.

Step 9	(Optional) **show** {**ip** | **ipv6**} **lisp**
	Example:
	`switch# show ip lisp`
	Example:
	`switch# show ipv6 lisp`
		Displays all configured IPv4 or IPv6 LISP configuration parameters.

What to do next

Complete the optional LISP xTR parameters as needed.

Configuring Optional LISP ITR/ETR (xTR) Functionality

You can configure optional capability for the LISP xTR.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal switch(config)#`	Enters global configuration mode.

Step 2	(Optional) {**ip** | **ipv6**} **lisp etr accept-map-request-mapping** [**verify**]
	Example:
	`switch(config)# ip lisp etr accept-map-request verify`
	Example:
	`switch(config)# ipv6 lisp etr accept-map-request verify`
		Configures the LISP ETR to cache IPv4 or IPv6 mapping data contained in a Map-Request message received from the Map-Server on behalf of a LISP ITR.
		The **verify** keyword allows the mapping data to be cached but not used for forwarding packets until the ETR can send its own Map-Request to one of the locators from the mapping data

	Command or Action	Purpose
		record and receive a Map-Reply with the same data in response. By default, the router does not cache mapping data contained in a Map-Request message.

Step 3	(Optional) {**ip** | **ipv6**} **lisp ip lisp etr map-cache-ttl** *time-to-live*
	Example:
	`switch(config)# ip lisp etr map-cache-ttl 720`
	Example:
	`switch(config)# ipv6 lisp etr map-cache-ttl 720`
		Configures the time-to-live (TTL) value, in minutes, inserted into LISP Map-Reply messages sent by this ETR.

Step 4	(Optional) {**ip** | **ipv6**} **lisp map-cache-limit** *cache-limit* [**reserve-list** *list*]
	Example:
	`switch(config)# ip lisp map-cache-limit 2000`
	Example:
	`switch(config)# ipv6 lisp map-cache-limit 2000`
		Configures the maximum number of LISP map-cache entries allowed to be stored. By default, the LISP map-cache limit is 1000 entries.

Step 5	(Optional) {**ip** | **ipv6**} **lisp map-request-source** *source-address*
	Example:
	`switch(config)# ip lisp map-request-source 172.16.1.1`
	Example:
	`switch(config)# ipv6 lisp map-request-source 2001:db8:0a::1`
		Configures the address to be used as the source address for LISP Map-Request messages. By default, one of the locator addresses configured with the **ip lisp database-mapping** or **ipv6 lisp database-mapping** command is used as the default source address for LISP Map-Request messages.

Step 6	(Optional) {**ip** | **ipv6**} **lisp path-mtu-discovery** {**min** *lower-bound* | **max** *upper-bound*}
	Example:
	`switch(config)# ip lisp path-mtu-discovery min 1200`
	Example:
	`switch(config)# ipv6 lisp path-mtu-discovery min 1200`
		Configures the minimum and maximum MTU settings for the LISP router for path-mtu-discovery. By default, path-mtu-discovery is enabled by the LISP router.
		Caution Disabling the use of path-mtu-discovery is not recommended.

Step 7	(Optional) [**no**] **lisp loc-reach-algorithm** {**tcp-count** | **echo-nonce** | **rloc-probing**}	Enables or disables the use of a LISP locator reachability algorithm. Locator reachability algorithms are address-family independent. By

	Command or Action	Purpose
	Example: `switch(config)# lisp loc-reach-algorithm rloc-probing`	default, all locator reachability algorithms are disabled.

Step 8	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits global configuration mode.

Step 9	(Optional) **show** {**ip** | **ipv6**} **lisp**
	Example:
	`switch# show ip lisp`
	Example:
	`switch# show ipv6 lisp`
		Displays all configured IPv4 or IPv6 LISP configuration parameters.

Related Topics

Configuring LISP ITR/ETR (xTR) , on page 5

Configuring LISP-ALT Functionality

You can enable and configure LISP-ALT (ALT) functionality for both IPv4 and IPv6 address families.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	{**ip** | **ipv6**} **lisp alt-vrf** *vrf-name*
	Example:
	`switch(config)# ip lisp alt-vrf lisp`
	Example:
	`switch(config)# ipv6 lisp alt-vrf lisp`
		Configures LISP to use the LISP-ALT VRF vrf-name.

Step 3	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits global configuration mode.

Step 4	(Optional) **show** {**ip** | **ipv6**} **lisp** **Example:** `switch# show ip lisp`	Displays all configured IPv4 or IPv6 LISP configuration parameters.

	Command or Action	Purpose
	Example: `switch# show ipv6 lisp`	

Configuring Required LISP Map-Resolver Functionality

You can enable and configure LISP Map-Resolver (MR) functionality for both IPv4 and IPv6 address families.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	{**ip** | **ipv6**} **lisp map-resolver**
	Example:
	`switch(config)# ip lisp map-resolver`
	Example:
	`switch(config)# ipv6 lisp map-resolver`
		Enables LISP Map-Resolver functionality on the device.

Step 3	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits global configuration mode.

Step 4	(Optional) **show** {**ip** | **ipv6**} **lisp**
	Example:
	`switch# show ip lisp`
	Example:
	`switch# show ipv6 lisp`
		Displays all configured IPv4 or IPv6 LISP configuration parameters.

Related Topics

Configuring LISP-ALT Functionality, on page 9

Configuring LISP Map-Server Functionality

Configuring Required LISP Map-Server Functionality

You can enable and configure LISP Map-Server (MS) functionality for both IPv4 and IPv6 address families.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	{**ip** | **ipv6**} **lisp map-server**
	Example:
	`switch(config)# ip lisp map-server`
	Example:
	`switch(config)# ipv6 lisp map-server`
		Enables LISP Map-Server functionality on the device.

Step 3	**lisp site** *site-name*
	Example:
	`switch(config)# lisp site Customer1`
	`switch(config-lisp-site)#`
		Creates the site name and enters LISP site configuration mode.

Step 4	**description** *description* **Example:** `switch(config-lisp-site)# description LISP Site Customer1`	Enters a description for the LISP site being configured.
Step 5	**authentication-key** *key-type password* **Example:** `switch(config-lisp-site)# authentication-key 0 123456789`	Enters the authentication key type and password for the LISP site being configured. **Note** The password must match the one configured on the ETR in order for the ETR to successfully register.

Step 6	**eid-prefix** *EID-prefix* [**route-tag** *tag*]
	Example:
	`switch(config-lisp-site)# eid-prefix 192.168.1.0/24`
	`route-tag 12345`
	Example:
	`switch(config-lisp-site)# eid-prefix 2001:db8:aa::/48`
	`route-tag 12345`
		Enters the EID-prefix for which the LISP site being configured is authoritative and optionally adds a route-tag.

Step 7	**end**
	Example:
	`switch(config-lisp-site)# end`
	`switch#`
		Exits LISP site configuration mode.

Step 8	(Optional) **show** {**ip** | **ipv6**} **lisp** **Example:**	Displays all configured IPv4 or IPv6 LISP configuration parameters.

	Command or Action	Purpose

	`switch# show ip lisp`
	
	Example:
	`switch# show ipv6 lisp`	

What to do next

Complete the optional LISP Map-Server configuration items as needed.

Related Topics

Configuring LISP-ALT Functionality, on page 9

Configuring Optional LISP Map-Server Functionality

You can configure optional LISP Map-Server functionality.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**lisp site** *site-name*
	Example:
	`switch(config)# lisp site Customer1`
	`switch(config-lisp-site)#`
		Enters LISP site configuration mode for the indicated site. If the site does not exist, it will be created.

Step 3	(Optional) **allowed-locators** *rloc1* `[`*rloc2* `[...]]` **Example:** `switch(config-lisp-site)# allowed-locators 172.16.8.1 2001:db8:aa::1`	Enters the locators that are to be allowed to be included in the Map-Register message for the LISP site being configured. **Note** When the **allowed-locators** command is configured, all locators listed on the Map-Server within the LISP site configuration must also appear in the Map-Register message sent by the ETR for the Map-Register message to be accepted.

Step 4	**end**
	Example:
	`switch(config-lisp-site)# end`
	`switch#`
		Exits LISP site configuration mode.

	Command or Action	Purpose

Step 5	(Optional) **show** {**ip** | **ipv6**} **lisp**
	Example:
	`switch# show ip lisp`
	Example:
	`switch# show ipv6 lisp`
		Displays all configured IPv4 or IPv6 LISP configuration parameters.

Related Topics

Configuring LISP-ALT Functionality, on page 9
Configuring Required LISP Map-Server Functionality, on page 10

Configuring Required LISP Proxy-ITR Functionality

You can enable and configure LISP Proxy-ITR functionality for both IPv4 and IPv6 address families.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	{**ip** | **ipv6**} **proxy-itr** *locator* [*other-address-family-locator*]
	Example:
	`switch(config)# ip lisp proxy-itr 172.16.8.1`
	Example:
	`switch(config)# ipv6 lisp proxy-itr 2001:db8:aa::1`
		Configures LISP Proxy-ITR functionality on the device. The *locator* address is used as a source address for encapsulating data packets or Map-Request messages. Optionally, you can provide an address for the other address family (for example, IPv6 for the **ip proxy-itr** command).

Step 3	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits global configuration mode.

Step 4	(Optional) **show** {**ip** | **ipv6**} **lisp**
	Example:
	`switch# show ip lisp`
	Example:
	`switch# show ipv6 lisp`
		Displays all configured IPv4 or IPv6 LISP configuration parameters.

Related Topics

Configuring LISP-ALT Functionality, on page 9

Configuring Required LISP Proxy-ETR Functionality

You can enable and configure LISP Proxy-ETR functionality for both IPv4 and IPv6 address families.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	{**ip** | **ipv6**} **proxy-etr**
	Example:
	`switch(config)# ip lisp proxy-etr`
	Example:
	`switch(config)# ipv6 lisp proxy-etr`
		Configures LISP Proxy-ETR functionality.

Step 3	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits global configuration mode.

Step 4	(Optional) **show** {**ip** | **ipv6**} **lisp**
	Example:
	`switch# show ip lisp`
	Example:
	`switch# show ipv6 lisp`
		Displays all configured IPv4 or IPv6 LISP configuration parameters.

Related Topics

Configuring LISP-ALT Functionality, on page 9

Additional References

This section includes additional information related to implementing LISP.

Related Documents

Related Topic	Document Title
Cisco NX-OS licensing	*Cisco NX-OS Licensing Guide*

Standards

Standard	Title
No new or modified standards are supported by this release.	

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco NX-OS software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
draft-ietf-lisp-07	Locator/ID Separation Protocol (LISP) http://tools.ietf.org/html/draft-ietf-lisp-07
draft-ietf-lisp-alt-04	LISP Alternative Topology (LISP+ALT) http://tools.ietf.org/html/draft-ietf-lisp-alt-04
draft-ietf-lisp-interworking-01	Interworking LISP with IPv4 and IPv6 http://tools.ietf.org/html/draft-ietf-lisp-interworking-01
draft-ietf-lisp-lig-00	LISP Internet Groper (LIG) http://tools.ietf.org/html/draft-ietf-lisp-lig-00
draft-ietf-lisp-ms-05	LISP Map Server http://tools.ietf.org/html/draft-ietf-lisp-ms-05

Feature History for LISP

Table 2: Feature History for LISP

Feature Name	Releases	Feature Information
LISP-ALT functionality	5.2(3)	This functionality is no longer required to configure other LISP features.

Feature Name	Releases	Feature Information
Locator/ID Separation Protocol (LISP)	5.2(1)	This feature is introduced.