Implementing IS-IS for IPv6

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This module describes how to configure Integrated Intermediate System-to-Intermediate System (IS-IS) for IPv6. IS-IS is an Interior Gateway Protocol (IGP) that advertises link-state information throughout the network to create a picture of the network topology. IS-IS is an Open Systems Interconnection (OSI) hierarchical routing protocol that designates an intermediate system as a Level 1 or Level 2 device. Level 2 devices route between Level 1 areas to create an intradomain routing backbone. Integrated IS-IS uses a single routing algorithm to support several network address families, such as IPv6, IPv4, and OSI.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see 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 at the end of this document.

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.

Restrictions for Implementing IS-IS for IPv6

In Cisco IOS Release 12.0(22)S or later releases, and Cisco IOS Release 12.2(8)T or later releases, IS-IS support for IPv6 implements single-topology IPv6 IS-IS functionality based on IETF IS-IS WG draft-ietf-isis-ipv6.txt. A single shortest path first (SPF) per level is used to compute OSI, IPv4 (if configured), and IPv6 routes. The use of a single SPF means that both IPv4 IS-IS and IPv6 IS-IS routing protocols must share a common network topology. To use IS-IS for IPv4 and IPv6 routing, any interface configured for

IPv4 IS-IS must also be configured for IPv6 IS-IS, and vice versa. All routers within an IS-IS area (Level 1 routing) or domain (Level 2 routing) must also support the same set of address families: IPv4 only, IPv6 only, or both IPv4 and IPv6.

Beginning with release Cisco IOS Release 12.2(15)T, IS-IS support for IPv6 is enhanced to also support multitopology IPv6 support as defined in IETF IS-IS WG draft-ietf-isis-wg-multi-topology.txt. Multitopology IPv6 IS-IS support uses multiple SPFs to compute routes and removes the restriction that all interfaces must support all configured address families and that all routers in an IS-IS area or domain must support the same set of address families.

The following IS-IS router configuration commands are specific to IPv4 and are not supported by, or have any effect on, IPv6 IS-IS:

- **mpls**
- **traffic-share**

Information About Implementing IS-IS for IPv6

IS-IS Enhancements for IPv6

IS-IS in IPv6 functions the same and offers many of the same benefits as IS-IS in IPv4. IPv6 enhancements to IS-IS allow IS-IS to advertise IPv6 prefixes in addition to IPv4 and OSI routes. Extensions to the IS-IS command-line interface (CLI) allow configuration of IPv6-specific parameters. IPv6 IS-IS extends the address families supported by IS-IS to include IPv6, in addition to OSI and IPv4.

IS-IS in IPv6 supports either single-topology mode or multiple topology mode.

IS-IS Single-Topology Support for IPv6

Single-topology support for IPv6 allows IS-IS for IPv6 to be configured on interfaces along with other network protocols (for example, IPv4 and Connectionless Network Service [CLNS]). All interfaces must be configured with the identical set of network address families. In addition, all routers in the IS-IS area (for Level 1 routing) or the domain (for Level 2 routing) must support the identical set of network layer address families on all interfaces.

When single-topology support for IPv6 is being used, either old- or new-style TLVs may be used. However, the TLVs used to advertise reachability to IPv6 prefixes use extended metrics. Cisco routers do not allow an interface metric to be set to a value greater than 63 if the configuration is not set to support only new-style TLVs for IPv4. In single-topology IPv6 mode, the configured metric is always the same for both IPv4 and IPv6.

IS-IS Multitopology Support for IPv6

IS-IS multitopology support for IPv6 allows IS-IS to maintain a set of independent topologies within a single area or domain. This mode removes the restriction that all interfaces on which IS-IS is configured

must support the identical set of network address families. It also removes the restriction that all routers in the IS-IS area (for Level 1 routing) or domain (for Level 2 routing) must support the identical set of network layer address families. Because multiple SPFs are performed, one for each configured topology, it is sufficient that connectivity exists among a subset of the routers in the area or domain for a given network address family to be routable.

You can use the **isis ipv6 metric** command to configure different metrics on an interface for IPv6 and IPv4.

When multitopology support for IPv6 is used, use the **metric-style wide**command to configure IS-IS to use new-style TLVs because TLVs used to advertise IPv6 information in link-state packets (LSPs) are defined to use only extended metrics.

Transition from Single-Topology to Multitopology Support for IPv6

All routers in the area or domain must use the same type of IPv6 support, either single-topology or multitopology. A router operating in multitopology mode will not recognize the ability of the single-topology mode router to support IPv6 traffic, which will lead to holes in the IPv6 topology. To transition from single-topology support to the more flexible multitopology support, a multitopology transition mode is provided.

The multitopology transition mode allows a network operating in single-topology IS-IS IPv6 support mode to continue to work while upgrading routers to include multitopology IS-IS IPv6 support. While in transition mode, both types of TLVs (single-topology and multitopology) are sent in LSPs for all configured IPv6 addresses, but the router continues to operate in single-topology mode (that is, the topological restrictions of the single-topology mode are still in effect). After all routers in the area or domain have been upgraded to support multitopology IPv6 and are operating in transition mode, transition mode can be removed from the configuration. Once all routers in the area or domain are operating in multitopology IPv6 mode, the topological restrictions of single-topology mode are no longer in effect.

IPv6 IS-IS Local RIB

A router that is running IS-IS IPv6 maintains a local RIB in which it stores all routes to destinations it has learned from its neighbors. At the end of each SPF, IS-IS attempts to install the best (that is, the least-cost) routes to a destination present in the local RIB in the global IPv6 routing table.

For further information on the IPv6 IS-IS local RIB, see the Verifying IPv6 IS-IS Configuration and Operation section.

How to Implement IS-IS for IPv6

When configuring supported routing protocols in IPv6, you must create the routing process, enable the routing process on interfaces, and customize the routing protocol for your particular network.

Configuring Single-Topology IS-IS for IPv6

Perform this task to create an IPv6 IS-IS process and enable IPv6 IS-IS support on an interface.

Configuring IS-IS comprises two activities. The first activity creates an IS-IS routing process and is performed using protocol-independent IS-IS commands. The second activity in configuring IPv6 IS-IS configures the operation of the IS-IS protocol on an interface.

Before configuring the router to run IPv6 IS-IS, globally enable IPv6 using the **ipv6 unicast-routing** global configuration command.

Note   If you are using IS-IS single-topology support for IPv6, IPv4, or both IPv6 and IPv4, you may configure both IPv6 and IPv4 on an IS-IS interface for Level 1, Level 2, or both Level 1 and Level 2. However, if both IPv6 and IPv4 are configured on the same interface, they must be running the same IS-IS level. That is, IPv4 cannot be configured to run on IS-IS Level 1 only on a specified Ethernet interface while IPv6 is configured to run IS-IS Level 2 only on the same Ethernet interface.

>

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router isis** *area-tag*
4. **net** *network-entity-title*
5. **exit**
6. **interface** *type number*
7. **ipv6 address** {*ipv6-address* **/** *prefix-length* | *prefix-name sub-bits* **/** *prefix-length*
8. **ipv6 router isis** *area-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**router isis** *area-tag* **Example:** `Router(config)# router isis area2`	Enables IS-IS for the specified IS-IS routing process, and enters router configuration mode.

Step 4	**net** *network-entity-title*
	
	Example:
	
	`Router(config-router)# net`
	`49.0001.0000.0000.000c.00`
		Configures an IS-IS network entity title (NET) for the routing process.
		
		• The *network-entity-title* argument defines the area addresses for the IS-IS area and the system ID of the router.
		
		Note For more details about the format of the *network-entity-title* argument, refer to the " Configuring ISO CLNS " chapter in the *Cisco IOS ISO CLNS Configuration Guide* .

Step 5	**exit** **Example:** `Router(config-router)# exit`	Exits router configuration mode and enters global configuration mode.
Step 6	**interface** *type number* **Example:** `Router(config)# interface Ethernet 0/0/1`	Specifies the interface type and number, and enters interface configuration mode.
Step 7	**ipv6 address** {*ipv6-address* / *prefix-length* | *prefix-name sub-bits* / *prefix-length* **Example:** `Router(config-if)# ipv6 address 2001:DB8::3/64`	Specifies the IPv6 network assigned to the interface and enables IPv6 processing on the interface. **Note** Refer to Implementing IPv6 Addressing and Basic Connectivity for more information on configuring IPv6 addresses.
Step 8	**ipv6 router isis** *area-name* **Example:** `Router(config-if)# ipv6 router isis area2`	Enables the specified IPv6 IS-IS routing process on an interface.

Configuring Multitopology IS-IS for IPv6

When multitopology IS-IS for IPv6 is configured, the **transition** keyword allows a user who is working with the single-topology SPF mode of IS-IS IPv6 to continue to work while upgrading to multitopology IS-

IS. After every router is configured with the **transition** keyword, users can remove the **transition** keyword on each router. When transition mode is not enabled, IPv6 connectivity between routers operating in single-topology mode and routers operating in multitopology mode is not possible.

You can continue to use the existing IPv6 topology while upgrading to multitopology IS-IS. The optional **isis ipv6 metric** command allows you to differentiate between link costs for IPv6 and IPv4 traffic when operating in multitopology mode.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router isis** *area-tag*
4. **metric-style wide** [**transition**] [**level-1** | **level-2** | **level-1-2**
5. **address-family ipv6** [**unicast** | **multicast**]
6. **multi-topology** [**transition**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**router isis** *area-tag* **Example:** `Router(config)# router isis area2`	Enables IS-IS for the specified IS-IS routing process, and enters router configuration mode.
Step 4	**metric-style wide** [**transition**] [**level-1**	**level-2**	**level-1-2** **Example:** `Router(config-router)# metric-style wide level-1`	Configures a router running IS-IS to generate and accept only new-style TLVs.

Command or Action	Purpose
Step 5 **address-family ipv6** [**unicast** | **multicast**] **Example:** `Router(config-router)# address-family ipv6`	Specifies the IPv6 address family, and enters address family configuration mode. • The **unicast** keyword specifies the unicast IPv6 unicast address family. By default, the router is placed in configuration mode for the unicast IPv6 address family if the **unicast** keyword is not specified with the **address-family ipv6** command.
Step 6 **multi-topology** [**transition**] **Example:** `Router(config-router-af)# multi-topology`	Enables multitopology IS-IS for IPv6. • The optional **transition** keyword allows an IS-IS IPv6 user to continue to use single-topology mode while upgrading to multitopology mode.

Customizing IPv6 IS-IS

Perform this task to configure a new administrative distance for IPv6 IS-IS, configure the maximum number of equal-cost paths that IPv6 IS-IS will support, configure summary prefixes for IPv6 IS-IS, and configure an IS-IS instance to advertise the default IPv6 route (::/0). It also explains how to configure the hold-down period between partial route calculations (PRCs) and how often Cisco IOS software performs the SPF calculation when using multitopology IS-IS.

You can customize IS-IS multitopology for IPv6 for your network, but you likely will not need to do so. The defaults for this feature are set to meet the requirements of most customers and features. If you change the defaults, refer to the IPv4 configuration guide and the IPv6 command reference to find the appropriate syntax.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router isis** *area-tag*
4. **address-family ipv6** [**unicast** | **multicast**]
5. **default-information originate** [**route-map** *map-name*]
6. **distance** *value*
7. **maximum-paths** *number-paths*
8. **summary-prefix** *ipv6-prefix prefix-length* **level-1** | **level-1-2**| **level-2**]
9. **prc-interval** *seconds* [*initial-wait*] [*secondary-wait*
10. **spf-interval** [**level-1** | **level-2**] *seconds initial-wait*] [*secondary-wait*
11. **exit**
12. **interface** *type number*
13. **isis ipv6 metric** *metric-value* [**level-1** | **level-2** | **level-1-2**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**router isis** *area-tag* **Example:** `Router(config)# router isis area2`	Enables IS-IS for the specified IS-IS routing process, and enters router configuration mode.
Step 4	**address-family ipv6** [**unicast** | **multicast**] **Example:** `Router(config-router)# address-family ipv6`	Specifies the IPv6 address family, and enters address family configuration mode. • The **unicast** keyword specifies the unicast IPv6 unicast address family. By default, the router is placed in configuration mode for the unicast IPv6 address family if the **unicast** keyword is not specified with the **address-family ipv6** command.
Step 5	**default-information originate** [**route-map** *map-name*] **Example:** `Router(config-router-af)# default-information originate`	(Optional) Injects a default IPv6 route into an IS-IS routing domain. • The **route-map** keyword and *map-name* argument specify the conditions under which the IPv6 default route is advertised. • If the **route map** keyword is omitted, then the IPv6 default route will be unconditionally advertised at Level 2.
Step 6	**distance** *value* **Example:** `Router(config-router-af)# distance 90`	(Optional) Defines an administrative distance for IPv6 IS-IS routes in the IPv6 routing table. • The *value* argument is an integer from 10 to 254. (The values 0 to 9 are reserved for internal use).

	Command or Action	Purpose
Step 7	**maximum-paths** *number-paths* **Example:** Router(config-router-af)# maximum-paths 3	(Optional) Defines the maximum number of equal-cost routes that IPv6 IS-IS can support. • This command also supports IPv6 Border Gateway Protocol (BGP) and Routing Information Protocol (RIP). • The *number-paths* argument is an integer from 1 to 64. The default for BGP is one path; the default for IS-IS and RIP is 16 paths.
Step 8	**summary-prefix** *ipv6-prefix prefix-length* **level-1** | **level-1-2**| **level-2**] **Example:** Router(config-router-af)# summary-prefix 2001:DB8::/24	(Optional) Allows a Level 1-2 router to summarize Level 1 prefixes at Level 2, instead of advertising the Level 1 prefixes directly when the router advertises the summary. • The *ipv6-prefix* argument in the **summary-prefix** command must be in the form documented in RFC 2373 where the address is specified in hexadecimal using 16-bit values between colons. • The *prefix-length* argument is a decimal value that indicates how many of the high-order contiguous bits of the address comprise the prefix (the network portion of the address). A slash mark must precede the decimal value.
Step 9	**prc-interval** *seconds* [*initial-wait*] [*secondary-wait* **Example:** Router(config-router-af)# prc-interval 20	(Optional) Configures the hold-down period between PRCs for multitopology IS-IS for IPv6.
Step 10	**spf-interval** [**level-1** | **level-2**] *seconds initial-wait*] [*secondary-wait* **Example:** Router(config-router-af)# spf-interval 30	(Optional) Configures how often Cisco IOS software performs the SPF calculation for multitopology IS-IS for IPv6.
Step 11	**exit** **Example:** Router(config-router-af)# exit	Exits address family configuration mode, and returns the router to router configuration mode. • Repeat this step to exit router configuration mode and return the router to global configuration mode.
Step 12	**interface** *type number* **Example:** Router(config-router)# interface Ethernet 0/0/1	Specifies the interface type and number, and enters interface configuration mode.

Command or Action	Purpose
Step 13 **isis ipv6 metric** *metric-value* [**level-1** | **level-2** | **level-1-2**] **Example:** `Router(config-if)# isis ipv6 metric 20`	(Optional) Configures the value of an multitopology IS-IS for IPv6 metric.

Redistributing Routes into an IPv6 IS-IS Routing Process

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router isis** *area-tag*
4. **address-family ipv6** [**unicast** \| **multicast**]
5. **redistribute** *source-protocol process-id*] [**include-connected**] [*target-protocol-options*] [*source-protocol-options*

DETAILED STEPS

Command or Action	Purpose
Step 1 **enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2 **configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3 **router isis** *area-tag* **Example:** `Router(config)# router isis area2`	Enables IS-IS for the specified IS-IS routing process, and enters router configuration mode.

Command or Action	Purpose

Step 4   **address-family ipv6** [**unicast** | **multicast**]
 	
Example:
`Router(config-router)# address-family`
`ipv6`
	Specifies the IPv6 address family, and enters address family configuration mode.
	
	• The **unicast** keyword specifies the unicast IPv6 unicast address family. By default, the router is placed in configuration mode for the unicast IPv6 address family if the **unicast** keyword is not specified with the **address-family ipv6** command.

Step 5   **redistribute** *source-protocol process-id*] [**include-connected**] [*target-protocol-options*] [*source-protocol-options*
 	
Example:
`Router(config-router-af)# redistribute`
`bgp 64500 metric 100 route-map isismap`
	Redistributes routes from the specified protocol into the IS-IS process.
	
	• The *source-protocol* argument can be one of the following keywords: **bgp**, **connected**, **isis**, **rip**, or **static**.
	• Only the arguments and keywords relevant to this task are specified here.

Redistributing IPv6 IS-IS Routes Between IS-IS Levels

Perform this task to redistribute IPv6 routes learned at one IS-IS level into a different level.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router isis** *area-tag*
4. **address-family ipv6** [**unicast** \| **multicast**]
5. **redistribute isis** [*process-id*] {**level-1** \| **level-2**} **into** {**level-1** \| **level-2**} **distribute-list** *list-name*

DETAILED STEPS

Command or Action	Purpose
Step 1 **enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2 **configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

Command or Action	Purpose
Step 3 **router isis** *area-tag* **Example:** `Router(config)# router isis area2`	Enables IS-IS for the specified IS-IS routing process, and enters router configuration mode.
Step 4 **address-family ipv6** [**unicast** | **multicast**] **Example:** `Router(config-router)# address-family ipv6`	Specifies the IPv6 address family, and enters address family configuration mode. • The **unicast** keyword specifies the unicast IPv6 unicast address family. By default, the router is placed in configuration mode for the unicast IPv6 address family if the **unicast** keyword is not specified with the **address-family ipv6** command.
Step 5 **redistribute isis** [*process-id*] {**level-1** | **level-2**} **into** {**level-1** | **level-2**} **distribute-list** *list-name* **Example:** `Router(config-router-af)# redistribute isis level-1 into level-2`	Redistributes IPv6 routes from one IS-IS level into another IS-IS level. • By default, the routes learned by Level 1 instances are redistributed by the Level 2 instance. **Note** The *protocol* argument must be **isis** in this configuration of the **redistribute** command. Only the arguments and keywords relevant to this task are specified here.

Disabling IPv6 Protocol-Support Consistency Checks

Perform this task to disable protocol-support consistency checks in IPv6 single-topology mode.

For single-topology IS-IS IPv6, routers must be configured to run the same set of address families. IS-IS performs consistency checks on hello packets and will reject hello packets that do not have the same set of configured address families. For example, a router running IS-IS for both IPv4 and IPv6 will not form an adjacency with a router running IS-IS for IPv4 or IPv6 only. In order to allow adjacency to be formed in mismatched address-families network, the **adjacency-check** command in IPv6 address family configuration mode must be disabled.

Note   Entering the **no adjacency-check** command can adversely affect your network configuration. Enter the **no adjacency-check** command only when you are running IPv4 IS-IS on all your routers and you want to add IPv6 IS-IS to your network but you need to maintain all your adjacencies during the transition. When the IPv6 IS-IS configuration is complete, remove the **no adjacency-check** command from the configuration.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router isis** *area-tag*
4. **address-family ipv6** [**unicast** \| **multicast**]
5. **no adjacency-check**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**router isis** *area-tag* **Example:** Router(config)# router isis area2	Enables IS-IS for the specified IS-IS routing process, and enters router configuration mode.
Step 4	**address-family ipv6** [**unicast** | **multicast**] **Example:** Router(config-router)# address-family ipv6	Specifies the IPv6 address family, and enters address family configuration mode. • The **unicast** keyword specifies the unicast IPv6 unicast address family. By default, the router is placed in configuration mode for the unicast IPv6 address family if the **unicast** keyword is not specified with the **address-family ipv6** command.
Step 5	**no adjacency-check** **Example:** Router(config-router-af)# no adjacency-check	Disables the IPv6 protocol-support consistency checks performed on hello packets, allowing IPv6 to be introduced into an IPv4-only network without disrupting existing adjacencies. • The **adjacency-check**command is enabled by default.

Disabling IPv4 Subnet Consistency Checks

Perform this task to disable IPv4 subnet consistency checking when forming adjacencies. Cisco IOS software historically makes checks on hello packets to ensure that the IPv4 address is present and has a consistent subnet with the neighbor from which the hello packets are received. To disable this check, use the **no adjacency-check** command in the router configuration mode. However, if multitopology IS-IS is configured, this check is automatically suppressed, because multitopology IS-IS requires routers to form an adjacency regardless of whether or not all routers on a LAN support a common protocol.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router isis** *area-tag*
4. **no adjacency-check**

DETAILED STEPS

Command or Action	Purpose
Step 1 **enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2 **configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3 **router isis** *area-tag* **Example:** `Router(config)# router isis area2`	Enables IS-IS for the specified IS-IS routing process, and enters router configuration mode.
Step 4 **no adjacency-check** **Example:** `Router(config-router-af)# no adjacency-check`	Disables the IPv6 protocol-support consistency checks performed on hello packets, allowing IPv6 to be introduced into an IPv4-only network without disrupting existing adjacencies. • The **adjacency-check**command is enabled by default.

Verifying IPv6 IS-IS Configuration and Operation

SUMMARY STEPS

1. **enable**
2. **show ipv6 protocols** [**summary**]
3. **show isis** [*process-tag*] [**ipv6** | *****] **topology**
4. **show clns** [*process-tag*] **neighbors** *interface-type interface-number*] [**area**] [**detail**
5. **show clns** *area-tag* **is-neighbors** [*type number*] [**detail**]
6. **show isis** [*process-tag*] **database** [**level-1**] [**level-2**] [**l1**] [**l2**] [**detail**] [**lspid**
7. **show isis ipv6 rib** [*ipv6-prefix*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show ipv6 protocols** [**summary**] **Example:** Router# show ipv6 protocols	Displays the parameters and current state of the active IPv6 routing processes.
Step 3	**show isis** [*process-tag*] [**ipv6** │ *****] **topology** **Example:** Router# show isis topology	Displays a list of all connected routers running IS-IS in all areas.
Step 4	**show clns** [*process-tag*] **neighbors** *interface-type interface-number*] [**area**] [**detail** **Example:** Router# show clns neighbors detail	Displays end system (ES), intermediate system (IS), and multitopology IS-IS (M-ISIS) neighbors.
Step 5	**show clns** *area-tag* **is-neighbors** [*type number*] [**detail**] **Example:** Router# show clns is-neighbors detail	Displays IS-IS adjacency information for IS-IS neighbors. • Use the **detail** keyword to display the IPv6 link-local addresses of the neighbors.
Step 6	**show isis** [*process-tag*] **database** [**level-1**] [**level-2**] [**l1**] [**l2**] [**detail**] [**lspid** **Example:** Router# show isis database detail	Displays the IS-IS link-state database. • In this example, the contents of each LSP are displayed using the **detail** keyword.
Step 7	**show isis ipv6 rib** [*ipv6-prefix*] **Example:** Router# show isis ipv6 rib	Displays the IPv6 local RIB.

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Examples

Sample Output from the show ipv6 protocols Command

In the following example, output information about the parameters and current state of that active IPv6 routing processes is displayed using the **show ipv6 protocols**command:

```
Router# show ipv6 protocols
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "static"
IPv6 Routing Protocol is "isis"
  Interfaces:
    Ethernet0/0/3
    Ethernet0/0/1
    Serial1/0/1
    Loopback1 (Passive)
    Loopback2 (Passive)
    Loopback3 (Passive)
    Loopback4 (Passive)
    Loopback5 (Passive)
  Redistribution:
    Redistributing protocol static at level 1
  Address Summarization:
    L2: 2001:DB8:33::/16  advertised with metric 0
    L2: 2001:DB8:44::/16  advertised with metric 20
    L2: 2001:DB8:66::/16  advertised with metric 10
    L2: 2001:DB8:77::/16  advertised with metric 10
```

Sample Output from the show isis topology Command

In the following example, output information about all connected routers running IS-IS in all areas is displayed using the **show isis topology**command:

```
Router# show isis topology
IS-IS paths to level-1 routers
System Id         Metric  Next-Hop         Interface       SNPA
0000.0000.000C
0000.0000.000D  20      0000.0000.00AA   Se1/0/1         *HDLC*
0000.0000.000F  10      0000.0000.000F   Et0/0/1         0050.e2e5.d01d
0000.0000.00AA  10      0000.0000.00AA   Se1/0/1         *HDLC*
IS-IS paths to level-2 routers
System Id         Metric  Next-Hop         Interface       SNPA
0000.0000.000A  10      0000.0000.000A   Et0/0/3         0010.f68d.f063
0000.0000.000B  20      0000.0000.000A   Et0/0/3         0010.f68d.f063
0000.0000.000C  --
0000.0000.000D  30      0000.0000.000A   Et0/0/3         0010.f68d.f063
0000.0000.000E  30      0000.0000.000A   Et0/0/3         0010.f68d.f063
```

Sample Output from the show clns is-neighbors Command

In the following example, output information to confirm that the local router has formed all the necessary IS-IS adjacencies with other IS-IS neighbors is displayed using the **show clns is-neighbors**command. To display the IPv6 link-local addresses of the neighbors, specify the **detail** keyword.

```
Router# show clns is-neighbors detail
System Id       Interface   State  Type Priority  Circuit Id         Format
0000.0000.00AA Se1/0/1     Up     L1   0         00                 Phase V
  Area Address(es): 49.0001
  IPv6 Address(es): FE80::YYYY:D37C:C854:5
  Uptime: 17:21:38
0000.0000.000F Et0/0/1     Up     L1   64        0000.0000.000C.02  Phase V
  Area Address(es): 49.0001
  IPv6 Address(es): FE80::XXXX:E2FF:FEE5:D01D
  Uptime: 17:21:41
```

```
0000.0000.000A Et0/0/3    Up    L2   64          0000.0000.000C.01  Phase V
  Area Address(es): 49.000b
  IPv6 Address(es): FE80::ZZZZ:F6FF:FE8D:F063
  Uptime: 17:22:06
```

Sample Output from the show clns neighbors Command

In the following example, detailed output information that displays both end system (ES) and intermediate system (IS) neighbors is displayed using the **show clns neighbors** command with the **detail** keyword.

```
Router# show clns neighbors detail
System Id         Interface    SNPA           State  Holdtime  Type Protocol
0000.0000.0007    Et3/3        aa00.0400.6408 UP     26        L1   IS-IS
Area Address(es): 20
IP Address(es): 172.16.0.42*
Uptime: 00:21:49
0000.0C00.0C35    Et3/2        0000.0c00.0c36 Up     91        L1   IS-IS
Area Address(es): 20
IP Address(es): 192.168.0.42*
Uptime: 00:21:52
0800.2B16.24EA    Et3/3        aa00.0400.2d05 Up     27        L1   M-ISIS
Area Address(es): 20
IP Address(es): 192.168.0.42*
IPv6 Address(es): FE80::2B0:8EFF:FE31:EC57
Uptime: 00:00:27
0800.2B14.060E    Et3/2        aa00.0400.9205 Up     8         L1   IS-IS
Area Address(es): 20
IP Address(es): 192.168.0.30*
Uptime: 00:21:52
```

Sample Output from the show isis database Command

In the following example, detailed output information about LSPs received from other routers and the IPv6 prefixes they are advertising is displayed using the **show isis database**command with the **detail** keyword specified:

```
Router# show isis database detail
IS-IS Level-1 Link State Database
LSPID              LSP Seq Num  LSP Checksum  LSP Holdtime  ATT/P/OL
0000.0C00.0C35.00-00  0x0000000C  0x5696        325           0/0/0
  Area Address: 47.0004.004D.0001
  Area Address: 39.0001
  Metric: 10   IS 0000.0C00.62E6.03
  Metric: 0    ES 0000.0C00.0C35
 --More--
0000.0C00.40AF.00-00* 0x00000009  0x8452        608           1/0/0
  Area Address: 47.0004.004D.0001
  Topology: IPv4 (0x0) IPv6 (0x2)
  NLPID: 0xCC 0x8E
  IP Address: 172.16.21.49
  Metric: 10   IS 0800.2B16.24EA.01
  Metric: 10   IS 0000.0C00.62E6.03
  Metric: 0    ES 0000.0C00.40AF
  IPv6 Address: 2001:DB8::/32
  Metric: 10   IPv6 (MT-IPv6) 2001:DB8::/64
  Metric: 5    IS-Extended cisco.03
  Metric: 10   IS-Extended cisco1.03
  Metric: 10    IS (MT-IPv6) cisco.03
IS-IS Level-2 Link State Database:
LSPID              LSP Seq Num  LSP Checksum  LSP Holdtime      ATT/P/OL
0000.0000.000A.00-00  0x00000059  0x378A        949               0/0/0
  Area Address: 49.000b
  NLPID:        0x8E
  IPv6 Address: 2001:DB8:1:1:1:1:1:1
  Metric: 10         IPv6 2001:DB8:2:YYYY::/64
  Metric: 10         IPv6 2001:DB8:3:YYYY::/64
  Metric: 10         IPv6 2001:DB8:2:YYYY::/64
  Metric: 10         IS-Extended 0000.0000.000A.01
  Metric: 10         IS-Extended 0000.0000.000B.00
```

```
    Metric: 10        IS-Extended 0000.0000.000C.01
    Metric: 0         IPv6 11:1:YYYY:1:1:1:1:1/128
    Metric: 0         IPv6 11:2:YYYY:1:1:1:1:1/128
    Metric: 0         IPv6 11:3:YYYY:1:1:1:1:1/128
    Metric: 0         IPv6 11:4:YYYY:1:1:1:1:1/128
    Metric: 0         IPv6 11:5:YYYY:1:1:1:1:1/128
0000.0000.000A.01-00  0x00000050   0xB0AF         491              0/0/0
    Metric: 0         IS-Extended 0000.0000.000A.00
    Metric: 0         IS-Extended 0000.0000.000B.00
```

Sample Output from the show isis ipv6 rib Command

The following example shows output from the **show isis ipv6 rib** command. An asterisk (*) indicates prefixes that have been installed in the master IPv6 RIB as IS-IS routes. Following each prefix is a list of all paths in order of preference, with optimal paths listed first and suboptimal paths listed after optimal paths.

```
Router# show isis ipv6 rib

IS-IS IPv6 process "", local RIB
  2001:DB8:88:1::/64
     via FE80::210:7BFF:FEC2:ACC9/Ethernet2/0, type L2  metric 20 LSP [3/7]
     via FE80::210:7BFF:FEC2:ACCC/Ethernet2/1, type L2  metric 20 LSP [3/7]
* 2001:DB8:1357:1::/64
     via FE80::202:7DFF:FE1A:9471/Ethernet2/1, type L2  metric 10 LSP [4/9]
* 2001:DB8:45A::/64
     via FE80::210:7BFF:FEC2:ACC9/Ethernet2/0, type L1  metric 20 LSP [C/6]
     via FE80::210:7BFF:FEC2:ACCC/Ethernet2/1, type L1  metric 20 LSP [C/6]
     via FE80::210:7BFF:FEC2:ACC9/Ethernet2/0, type L2  metric 20 LSP [3/7]
     via FE80::210:7BFF:FEC2:ACCC/Ethernet2/1, type L2  metric 20 LSP [3/7]
```

Configuration Examples for IPv6 IS-IS

Example Configuring Single-Topology IS-IS for IPv6

The following example enables single-topology mode, creates an IS-IS process, defines the NET, configures an IPv6 address on an interface, and configures the interface to run IPv6 IS-IS:

```
ipv6 unicast-routing
!
router isis
 net 49.0001.0000.0000.000c.00
 exit
interface Ethernet0/0/1
 ipv6 address 2001:DB8::3/64
 ipv6 router isis area2
```

Example Customizing IPv6 IS-IS

The following example advertises the IPv6 default route (::/0)--with an origin of Ethernet interface 0/0/1--with all other routes in router updates sent on Ethernet interface 0/0/1. This example also sets an administrative distance for IPv6 IS-IS to 90, defines the maximum number of equal-cost paths that IPv6 IS-IS will support as 3, and configures a summary prefix of 2001:DB8::/24 for IPv6 IS-IS.

```
router isis
 address-family ipv6
 default-information originate
 distance 90
 maximum-paths 3
 summary-prefix 2001:DB8::/24
 exit
```

Example Redistributing Routes into an IPv6 IS-IS Routing Process

The following example redistributes IPv6 BGP routes into the IPv6 IS-IS Level 2 routing process:

```
router isis
 address-family ipv6
 redistribute bgp 64500 metric 100 route-map isismap
 exit
```

Example Redistributing IPv6 IS-IS Routes Between IS-IS Levels

The following example redistributes IPv6 IS-IS Level 1 routes into the IPv6 IS-IS Level 2 routing process:

```
router isis
 address-family ipv6
 redistribute isis level-1 into level-2
```

Example Disabling IPv6 Protocol-Support Consistency Checks

The following example disables the **adjacency-check** command to allow a network administrator to configure IPv6 IS-IS on the router without disrupting the existing adjacencies:

```
router isis
 address-family ipv6
 no adjacency-check
```

Example Configuring Multitopology IS-IS for IPv6

The following example configures multitopology IS-IS in IPv6 after you have configured IS-IS for IPv6:

```
router isis
 metric-style wide
 address-family ipv6
 multi-topology
```

Example Configuring the IS-IS IPv6 Metric for Multitopology IS-IS

The following example sets the value of an IS-IS IPv6 metric to 20:

```
interface Ethernet 0/0/1
 isis ipv6 metric 20
```

Additional References

Related Documents

Related Topic	Document Title
IPv6 supported feature list	"Start Here: Cisco IOS Software Release Specifics for IPv6 Features ," *Cisco IOS IPv6 Configuration Guide*
IPv6 commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS IPv6 Command Reference*
IS-IS configuration tasks	*Cisco IOS IP Routing Protocols Configuration Guide*
IS-IS commands: complete command syntax, command mode, defaults, usage guidelines, and examples	*Cisco IOS IP Routing Protocols Command Reference*

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

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

RFCs

RFCs	Title
RFC 1195	*Use of OSI IS-IS for Routing in TCP/IP and Dual Environments*
RFC 5120	*M-ISIS: Multi Topology (MT) Routing in Intermediate System to Intermediate Systems (IS-ISs)*
RFC 5308	*Routing IPv6 with IS-IS*

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 Implementing IS-IS for IPv6

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 Implementing IS-IS for IPv6*

Feature Name	Releases	Feature Information
IPv6 Routing--Route Redistribution	12.0(22)S 12.2(14)S 12.2(28)SB 12.2(25)SG 12.2(33)SRA 12.2(2)T 12.3 12.3(2)T 12.4 12.4(2)T 15.0(1)S	IS-IS for IPv6 supports redistributing routes into an IPv6 IS-IS routing process and redistributing IPv6 IS-IS routes between IS-IS levels.
IPv6 Routing--IS-IS Support for IPv6	12.0(22)S 12.2(14)S 12.2(28)SB 12.2(25)SG 12.2(33)SRA 12.2(8)T 12.3 12.3(2)T 12.4 12.4(2)T 15.0(1)S	IPv6 enhancements to IS-IS allow IS-IS to advertise IPv6 prefixes in addition to IPv4 and OSI routes.

Feature Name	Releases	Feature Information
IPv6 Routing--IS-IS Multitopology Support for IPv6	12.0(26)S 12.2(18)S 12.2(28)SB 12.2(25)SG 12.2(33)SRA12.2(15)T 12.3 12.3(2)T 12.4 12.4(2)T 15.0(1)S	IS-IS multitopology support for IPv6 allows IS-IS to maintain a set of independent topologies within a single area or domain.
IPv6 Routing--IS-IS Local RIB	12,2(22)S 12.2(33)SRA 12.2(33)SXH	A router that is running IS-IS IPv6 maintains a local RIB in which it stores all routes to destinations it has learned from its neighbors.