IS-IS Feature Guide for EX4600 Switches

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Juniper Networks, Inc.
1133 Innovation Way
Sunnyvale, California 94089
USA
408-745-2000
www.juniper.net

IS-IS Feature Guide for EX4600 Switches

The information in this document is current as of the date on the title page.

YEAR 2000 NOTICE

Juniper Networks hardware and software products are Year 2000 compliant. Junos OS has no known time-related limitations through the year 2038. However, the NTP application is known to have some difficulty in the year 2036.

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If the information in the latest release notes differs from the information in the documentation, follow the product Release Notes.

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Supported Platforms

For the features described in this document, the following platforms are supported:

- EX Series

Using the Examples in This Manual

If you want to use the examples in this manual, you can use the **load merge** or the **load merge relative** command. These commands cause the software to merge the incoming configuration into the current candidate configuration. The example does not become active until you commit the candidate configuration.

If the example configuration contains the top level of the hierarchy (or multiple hierarchies), the example is a *full example*. In this case, use the **load merge** command.

If the example configuration does not start at the top level of the hierarchy, the example is a *snippet*. In this case, use the **load merge relative** command. These procedures are described in the following sections.

Merging a Full Example

To merge a full example, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration example into a text file, save the file with a name, and copy the file to a directory on your routing platform.

   For example, copy the following configuration to a file and name the file **ex-script.conf**. Copy the **ex-script.conf** file to the **/var/tmp** directory on your routing platform.

   ```
   system {
     scripts {
       commit {
         file ex-script.xsl;
       }
     }
   }
   interfaces {
     fxp0 {
       disable;
       unit 0 {
         family inet {
           address 10.0.0.1/24;
         }
       }
     }
   }
   ```

2. Merge the contents of the file into your routing platform configuration by issuing the **load merge** configuration mode command:

   ```
   [edit]
   user@host# load merge /var/tmp/ex-script.conf
   load complete
   ```

Merging a Snippet

To merge a snippet, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration snippet into a text file, save the file with a name, and copy the file to a directory on your routing platform.

   For example, copy the following snippet to a file and name the file **ex-script-snippet.conf**. Copy the **ex-script-snippet.conf** file to the **/var/tmp** directory on your routing platform.

   ```
   commit {
     file ex-script-snippet.xsl; }
   ```

2. Move to the hierarchy level that is relevant for this snippet by issuing the following configuration mode command:

```
[edit]
user@host# edit system scripts
[edit system scripts]
```

3. Merge the contents of the file into your routing platform configuration by issuing the **load merge relative** configuration mode command:

```
[edit system scripts]
user@host# load merge relative /var/tmp/ex-script-snippet.conf
load complete
```

For more information about the **load** command, see the *CLI User Guide*.

Documentation Conventions

Table 1 on page xiii defines notice icons used in this guide.

Table 1: Notice Icons

Icon	Meaning	Description
	Informational note	Indicates important features or instructions.
	Caution	Indicates a situation that might result in loss of data or hardware damage.
	Warning	Alerts you to the risk of personal injury or death.
	Laser warning	Alerts you to the risk of personal injury from a laser.
	Tip	Indicates helpful information.
	Best practice	Alerts you to a recommended use or implementation.

Table 2 on page xiii defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the **configure** command: user@host> **configure**

Table 2: Text and Syntax Conventions *(continued)*

Convention	Description	Examples
`Fixed-width text like this`	Represents output that appears on the terminal screen.	`user@host>` **show chassis alarms** `No alarms currently active`
Italic text like this	• Introduces or emphasizes important new terms. • Identifies guide names. • Identifies RFC and Internet draft titles.	• A policy *term* is a named structure that defines match conditions and actions. • *Junos OS CLI User Guide* • RFC 1997, *BGP Communities Attribute*
Italic text like this	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# **set system domain-name** *domain-name*
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	• To configure a stub area, include the **stub** statement at the **[edit protocols ospf area area-id]** hierarchy level. • The console port is labeled **CONSOLE**.
< > (angle brackets)	Encloses optional keywords or variables.	**stub <default-metric** ***metric*****>;**
| (pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	**broadcast | multicast** **(*string1* | *string2* | *string3*)**
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	**rsvp { # Required for dynamic MPLS only**
[ ] (square brackets)	Encloses a variable for which you can substitute one or more values.	**community name members [** ***community-ids*** **]**

Indention and braces ({ })	Identifies a level in the configuration hierarchy.	[edit]
		routing-options {
		  static {
		  route default {
		  nexthop *address*;
		  retain;
		  }
		  }
		}

; (semicolon)	Identifies a leaf statement at a configuration hierarchy level.	
GUI Conventions		
Bold text like this	Represents graphical user interface (GUI) items you click or select.	• In the Logical Interfaces box, select **All Interfaces**. • To cancel the configuration, click **Cancel**.

Table 2: Text and Syntax Conventions *(continued)*

Convention	Description	Examples
> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select **Protocols>Ospf**.

Documentation Feedback

We encourage you to provide feedback, comments, and suggestions so that we can improve the documentation. You can provide feedback by using either of the following methods:

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- E-mail—Send your comments to **techpubs-comments@juniper.net**. Include the document or topic name, URL or page number, and software version (if applicable).

Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or Partner Support Service support contract, or are covered under warranty, and need post-sales technical support, you can access our tools and resources online or open a case with JTAC.

- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at http://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf.
- Product warranties—For product warranty information, visit http://www.juniper.net/support/warranty/.
- JTAC hours of operation—The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

Self-Help Online Tools and Resources

For quick and easy problem resolution, Juniper Networks has designed an online self-service portal called the Customer Support Center (CSC) that provides you with the following features:

- Find CSC offerings: http://www.juniper.net/customers/support/
- Search for known bugs: http://www2.juniper.net/kb/
- Find product documentation: http://www.juniper.net/techpubs/
- Find solutions and answer questions using our Knowledge Base: http://kb.juniper.net/

- Download the latest versions of software and review release notes: http://www.juniper.net/customers/csc/software/
- Search technical bulletins for relevant hardware and software notifications: http://kb.juniper.net/InfoCenter/
- Join and participate in the Juniper Networks Community Forum: http://www.juniper.net/company/communities/
- Open a case online in the CSC Case Management tool: http://www.juniper.net/cm/

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool: https://tools.juniper.net/SerialNumberEntitlementSearch/

Opening a Case with JTAC

You can open a case with JTAC on the Web or by telephone.

- Use the Case Management tool in the CSC at http://www.juniper.net/cm/.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

For international or direct-dial options in countries without toll-free numbers, see http://www.juniper.net/support/requesting-support.html.

PART 1

Overview

CHAPTER 1

IS-IS Overview

IS-IS Overview

The IS-IS protocol is an interior gateway protocol (IGP) that uses link-state information to make routing decisions.

IS-IS is a link-state IGP that uses the shortest-path-first (SPF) algorithm to determine routes. IS-IS evaluates the topology changes and determines whether to perform a full SPF recalculation or a partial route calculation (PRC). This protocol originally was developed for routing International Organization for Standardization (ISO) Connectionless Network Protocol (CLNP) packets.

Like OSPF routing, IS-IS uses hello packets that allow network convergence to occur quickly when network changes are detected. IS-IS uses the SPF algorithm to determine routes. Using SPF, IS-IS evaluates network topology changes and determines if a full or partial route calculation is required.

NOTE: Because IS-IS uses ISO addresses, the configuration of IP version 6 (IPv6) and IP version 4 (IPv4) implementations of IS-IS is identical.

NOTE: See *Platforms/FPCs That Cannot Forward TCC Encapsulated ISO Traffic* to find a list of those devices and FPC configurations that cannot pass ISO traffic when encapsulated in TCC format.

This section discusses the following topics:

IS-IS Terminology

An IS-IS network is a single autonomous system (AS), also called a *routing domain*, that consists of *end systems* and *intermediate systems*. End systems are network entities that send and receive packets. Intermediate systems send and receive packets and relay (forward) packets. (Intermediate system is the Open System Interconnection [OSI] term for a router.) ISO packets are called network PDUs.

In IS-IS, a single AS can be divided into smaller groups called *areas*. Routing between areas is organized hierarchically, allowing a domain to be administratively divided into smaller areas. This organization is accomplished by configuring *Level 1* and *Level 2* intermediate systems. Level 1 systems route within an area; when the destination is outside an area, they route toward a Level 2 system. Level 2 intermediate systems route between areas and toward other ASs. No IS-IS area functions strictly as a backbone.

Level 1 routers share intra-area routing information, and Level 2 routers share interarea information about IP addresses available within each area. Uniquely, IS-IS routers can act as both Level 1 and Level 2 routers, sharing intra-area routes with other Level 1 routers and interarea routes with other Level 2 routers.

The propagation of link-state updates is determined by the level boundaries. All routers within a level maintain a complete link-state database of all other routers in the same level. Each router then uses the Dijkstra algorithm to determine the shortest path from the local router to other routers in the link-state database.

ISO Network Addresses

IS-IS uses ISO network addresses. Each address identifies a point of connection to the network, such as a router interface, and is called a *network service access point* (*NSAP*).

IS-IS supports multiple NSAP addresses on the loopback lo0 interface.

An end system can have multiple NSAP addresses, in which case the addresses differ only by the last byte (called the *n-selector*). Each NSAP represents a service that is available at that node. In addition to having multiple services, a single node can belong to multiple areas.

Each network entity also has a special network address called a *network entity title* (*NET*). Structurally, an NET is identical to an NSAP address but has an n-selector of 00. Most end systems and intermediate systems have one NET. Intermediate systems that participate in multiple areas can have multiple NETs.

The following ISO addresses illustrate the IS-IS address format:

```
49.0001.00a0.c96b.c490.00
49.0001.2081.9716.9018.00
```

NETs take several forms, depending on your network requirements. NET addresses are hexadecimal and range from 8 octets to 20 octets in length. Generally, the format consists

of an authority and format Identifier (AFI), a domain ID, an area ID, a system identifier, and a selector. The simplest format omits the domain ID and is 10 octets long. For example, the NET address 49.0001.1921.6800.1001.00 consists of the following parts:

- 49—AFI
- 0001—Area ID
- 1921.6800.1001—System identifier
- 00—Selector

The system identifier must be unique within the network. For an IP-only network, we recommend using the IP address of an interface on the router. Configuring a loopback NET address with the IP address is helpful when troubleshooting is required on the network.

The first portion of the address is the area number, which is a variable number from 1 through 13 bytes. The first byte of the area number (49) is the authority and format indicator (AFI). The next bytes are the assigned domain (area) identifier, which can be from 0 through 12 bytes. In the examples above, the area identifier is 0001.

The next six bytes form the system identifier. The system identifier can be any six bytes that are unique throughout the entire domain. The system identifier commonly is the media access control (MAC) address (as in the first example, 00a0.c96b.c490) or the IP address expressed in binary-coded decimal (BCD) (as in the second example, 2081.9716.9018, which corresponds to IP address 208.197.169.18). The last byte (00) is the n-selector.

NOTE: **The system identifier cannot be 0000.0000.0000. All 0s is an illegal setting, and the adjacency is not formed with this setting.**

To provide help with IS-IS debugging, the Junos® operating system (Junos OS) supports dynamic mapping of ISO system identifiers to the hostname. Each system can be configured with a hostname, which allows the system identifier-to-hostname mapping to be carried in a dynamic hostname type, length, and value (TLV) tuple in IS-IS link-state PDUs. This enables intermediate systems in the routing domain to learn about the ISO system identifier of a particular intermediate system.

IS-IS Packets

Each IS-IS PDU shares a common header. IS-IS uses the following PDUs to exchange protocol information:

- IS-IS hello (IIH) PDUs—Broadcast to discover the identity of neighboring IS-IS systems and to determine whether the neighbors are Level 1 or Level 2 intermediate systems.

  IS-IS hello PDUs establish adjacencies with other routers and have three different formats: one for point-to-point hello packets, one for Level 1 broadcast links, and one for Level 2 broadcast links. Level 1 routers must share the same area address to form an adjacency, while Level 2 routers do not have this limitation. The request for adjacency is encoded in the Circuit type field of the PDU.

  Hello PDUs have a preset length assigned to them. The IS-IS router does not resize any PDU to match the maximum transmission unit (MTU) on a router interface. Each interface supports the maximum IS-IS PDU of 1492 bytes, and hello PDUs are padded to meet the maximum value. When the hello is sent to a neighboring router, the connecting interface supports the maximum PDU size.

- Link-state PDUs—Contain information about the state of adjacencies to neighboring IS-IS systems. Link-state PDUs are flooded periodically throughout an area.

  Also included is metric and IS-IS neighbor information. Each link-state PDU must be refreshed periodically on the network and is acknowledged by information within a sequence number PDU.

  On point-to-point links, each link-state PDU is acknowledged by a partial sequence number PDU (PSNP), but on broadcast links, a complete sequence number PDU (CSNP) is sent out over the network. Any router that finds newer link-state PDU information in the CSNP then purges the out-of-date entry and updates the link-state database.

  Link-state PDUs support variable-length subnet mask addressing.

- Complete sequence number PDUs (CSNPs)—Contain a complete list of all link-state PDUs in the IS-IS database. CSNPs are sent periodically on all links, and the receiving systems use the information in the CSNP to update and synchronize their link-state PDU databases. The designated router multicasts CSNPs on broadcast links in place of sending explicit acknowledgments for each link-state PDU.

  Contained within the CSNP is a link-state PDU identifier, a lifetime, a sequence number, and a checksum for each entry in the database. Periodically, a CSNP is sent on both broadcast and point-to-point links to maintain a correct database. Also, the advertisement of CSNPs occurs when an adjacency is formed with another router. Like IS-IS hello PDUs, CSNPs come in two types: Level 1 and Level 2.

  When a device receives a CSNP, it checks the database entries against its own local link-state database. If it detects missing information, the device requests specific link-state PDU details using a partial sequence number PDU (PSNP).

- Partial sequence number PDUs (PSNPs)—Sent multicast by a receiver when it detects that it is missing a link-state PDU (when its link-state PDU database is out of date). The receiver sends a PSNP to the system that transmitted the CSNP, effectively

requesting that the missing link-state PDU be transmitted. That routing device, in turn, forwards the missing link-state PDU to the requesting routing device.

A PSNP is used by an IS-IS router to request link-state PDU information from a neighboring router. A PSNP can also explicitly acknowledge the receipt of a link-state PDU on a point-to-point link. On a broadcast link, a CSNP is used as implicit knowledge. Like hello PDUs and CSNPs, the PSNP also has two types: Level 1 and Level 2.

When a device compares a CSNP to its local database and determines that a link-state PDU is missing, the router issues a PSNP for the missing link-state PDU, which is returned in a link-state PDU from the router sending the CSNP. The received link-state PDU is then stored in the local database, and an acknowledgment is sent back to the originating router.

Persistent Route Reachability

IPv4 and IPv6 route reachability information in IS-IS link-state PDUs is preserved when you commit a configuration. IP prefixes are preserved with their original packet fragment upon link-state PDU regeneration.

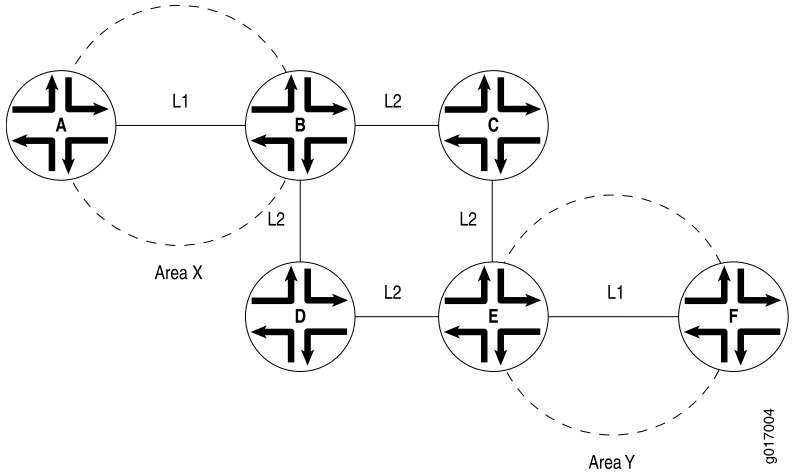
IS-IS Support for Multipoint Network Clouds

IS-IS does not support multipoint configurations. Therefore, when configuring Frame Relay or Asynchronous Transfer Mode (ATM) networks, you must configure them as collections of point-to-point links, not as multipoint clouds.

Installing a Default Route to the Nearest Routing Device That Operates at Both IS-IS Levels

When a routing device that operates as both a Level 1 and Level 2 router (Router B) determines that it can reach at least one area other than its own (for example, in Area Y), it sets the ATTACHED bit in its Level 1 link-state PDU. Thereafter, the Level 1 router (Router A) introduces a default route pointing to the nearest attached routing device that operates as both a Level 1 and Level 2 router (Router B). See Figure 1 on page 7.

Figure 1: Install Default Route to Nearest Routing Device That Operates at Both Level 1 and Level 2



Related Documentation

- *IS-IS Feature Guide for Routing Devices*

Understanding BFD Authentication for IS-IS

Bidirectional Forwarding Detection (BFD) enables rapid detection of communication failures between adjacent systems. By default, authentication for BFD sessions is disabled. However, when running BFD over Network Layer protocols, the risk of service attacks can be significant. We strongly recommend using authentication if you are running BFD over multiple hops or through insecure tunnels. Beginning with Junos OS Release 9.6, Junos OS supports authentication for BFD sessions running over IS-IS. BFD authentication is only supported in the domestic image and is not available in the export image.

You authenticate BFD sessions by specifying an authentication algorithm and keychain, and then associating that configuration information with a security authentication keychain using the keychain name.

The following sections describe the supported authentication algorithms, security keychains, and level of authentication that can be configured:

- BFD Authentication Algorithms on page 8
- Security Authentication Keychains on page 9
- Strict Versus Loose Authentication on page 9

BFD Authentication Algorithms

Junos OS supports the following algorithms for BFD authentication:

- **simple-password**—Plain-text password. One to 16 bytes of plain text are used to authenticate the BFD session. One or more passwords might be configured. This method is the least secure and should be used only when BFD sessions are not subject to packet interception.
- **keyed-md5**—Keyed Message Digest 5 hash algorithm for sessions with transmit and receive intervals greater than 100 ms. To authenticate the BFD session, keyed MD5 uses one or more secret keys (generated by the algorithm) and a sequence number that is updated periodically. With this method, packets are accepted at the receiving end of the session if one of the keys matches and the sequence number is greater than or equal to the last sequence number received. Although more secure than a simple password, this method is vulnerable to replay attacks. Increasing the rate at which the sequence number is updated can reduce this risk.
- **meticulous-keyed-md5**—Meticulous keyed Message Digest 5 hash algorithm. This method works in the same manner as keyed MD5, but the sequence number is updated with every packet. Although more secure than keyed MD5 and simple passwords, this method might take additional time to authenticate the session.
- **keyed-sha-1**—Keyed Secure Hash Algorithm I for sessions with transmit and receive intervals greater than 100 ms. To authenticate the BFD session, keyed SHA uses one or more secret keys (generated by the algorithm) and a sequence number that is updated periodically. The key is not carried within the packets. With this method,

packets are accepted at the receiving end of the session if one of the keys matches and the sequence number is greater than the last sequence number received.

- **meticulous-keyed-sha-1**—Meticulous keyed Secure Hash Algorithm I. This method works in the same manner as keyed SHA, but the sequence number is updated with every packet. Although more secure than keyed SHA and simple passwords, this method might take additional time to authenticate the session.

NOTE: **Nonstop active routing (NSR) is not supported with meticulous-keyed-md5 and meticulous-keyed-sha-1 authentication algorithms. BFD sessions using these algorithms might go down after a switchover.**

Security Authentication Keychains

The security authentication keychain defines the authentication attributes used for authentication key updates. When the security authentication keychain is configured and associated with a protocol through the keychain name, authentication key updates can occur without interrupting routing and signaling protocols.

The authentication keychain contains one or more keychains. Each keychain contains one or more keys. Each key holds the secret data and the time at which the key becomes valid. The algorithm and keychain must be configured on both ends of the BFD session, and they must match. Any mismatch in configuration prevents the BFD session from being created.

BFD allows multiple clients per session, and each client can have its own keychain and algorithm defined. To avoid confusion, we recommend specifying only one security authentication keychain.

Strict Versus Loose Authentication

By default, strict authentication is enabled and authentication is checked at both ends of each BFD session. Optionally, to smooth migration from nonauthenticated sessions to authenticated sessions, you can configure *loose checking*. When loose checking is configured, packets are accepted without authentication being checked at each end of the session. This feature is intended for transitional periods only.

Related Documentation

- Example: Configuring BFD Authentication for IS-IS on page 48

Understanding Hitless Authentication Key Rollover for IS-IS

IS-IS protocol exchanges can be authenticated to guarantee that only trusted routing devices participate in routing. By default, authentication is disabled. The authentication algorithm creates an encoded checksum that is included in the transmitted packet. The receiving routing device uses an authentication key (password) to verify the packet's checksum.

If you configure authentication for all peers, each peer in that group inherits the group's authentication.

You can update authentication keys without resetting any IS-IS neighbor sessions. This is referred to as *hitless authentication key rollover*.

Hitless authentication key rollover uses authentication keychains, which consist of the authentication keys that are being updated. The keychain includes multiple keys. Each key in the keychain has a unique start time. At the next key's start time, a rollover occurs from the current key to the next key, and the next key becomes the current key.

You can choose the algorithm through which authentication is established. You can configure MD5 or SHA-1 authentication. You associate a keychain and the authentication algorithm with an IS-IS neighboring session. Each key contains an identifier and a secret password.

The sending peer chooses the active key based on the system time and the start times of the keys in the keychain. The receiving peer determines the key with which it authenticates based on the incoming key identifier.

You can configure either RFC 5304-based encoding or RFC 5310-based encoding for the IS-IS protocol transmission encoding format.

Related Documentation

- Example: Configuring Hitless Authentication Key Rollover for IS-IS on page 29

PART 2

Configuring

CHAPTER 2

Configuration Tasks

Configuring IS-IS Authentication

All IS-IS protocol exchanges can be authenticated to guarantee that only trusted routing devices participate in the autonomous system (AS) routing. By default, IS-IS authentication is disabled on the routing device.

To configure IS-IS authentication, you must define an authentication password and specify the authentication type.

You can configure one of the following authentication methods:

- Simple authentication—Uses a text password that is included in the transmitted packet. The receiving routing device uses an authentication key (password) to verify the packet. Simple authentication is included for compatibility with existing IS-IS implementations. However, we recommend that you do *not* use this authentication method because it is insecure (the text can be "sniffed").

  CAUTION: **A simple password that exceeds 254 characters is truncated.**

- HMAC-MD5 authentication—Uses an iterated cryptographic hash function. The receiving routing device uses an authentication key (password) to verify the packet.

You can also configure more fine-grained interface-level authentication for hello packets.

To enable authentication and specify an authentication method, include the **authentication-type** statement, specifying the **simple** or **md5** authentication type:

```
authentication-type authentication;
```

For a list of hierarchy levels at which you can include this statement, see the statement summary section for this statement.

To configure a password, include the **authentication-key** statement. The authentication password for all routing devices in a domain must be the same.

authentication-key *key*;

For a list of hierarchy levels at which you can include this statement, see the statement summary section for this statement.

To configure hitless authentication key rollover, include the authentication-key-chain (Protocols IS-IS) statement.

The password can contain up to 255 characters. If you include spaces, enclose all characters in quotation marks (“ ”).

If you are using the Junos OS IS-IS software with another implementation of IS-IS, the other implementation must be configured to use the same password for the domain, the area, and all interfaces that are shared with a Junos OS implementation.

Authentication of hello packets, partial sequence number PDU (PSNP), and complete sequence number PDU (CSNP) can be suppressed to enable interoperability with the routing software of different vendors. Different vendors handle authentication in various ways, and suppressing authentication for different PDU types might be the simplest way to allow compatibility within the same network.

To configure IS-IS to generate authenticated packets, but not to check the authentication on received packets, include the **no-authentication-check** statement:

no-authentication-check;

To suppress authentication of IS-IS hello packets, include the **no-hello-authentication** statement:

no-hello-authentication;

To suppress authentication of PSNPs, include the **no-psnp-authentication** statement:

no-psnp-authentication;

To suppress authentication of CSNPs, include the **no-csnp-authentication** statement:

no-csnp-authentication;

For a list of hierarchy levels at which you can include these statements, see the statement summary sections for these statements.

NOTE: The **authentication** and the **no-authentication** statements must be configured at the same hierarchy level. Configuring **authentication** at the **[edit protocols isis interface *interface-name*]** hierarchy level and configuring **no-authentication** at the **[edit protocols isis]** hierarchy level has no effect.

Related Documentation

- Configuring Authentication Without Network-Wide Deployment on page 15

Configuring Authentication Without Network-Wide Deployment

To allow the use of authentication without requiring network-wide deployment, include the **loose-authentication-check** statement:

```
loose-authentication-check;
```

For a list of hierarchy levels at which you can include this statement, see the statement summary section for this statement.

Related Documentation

- *Example: Configuring Hitless Authentication Key Rollover for IS-IS*

Example: Configuring IS-IS

This example shows how to configure IS-IS.

Requirements

No special configuration beyond device initialization is required before configuring this example.

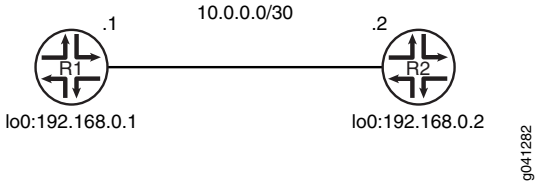
Overview

In this example, you configure the two IS-IS routing devices in a single area. The devices have NET addresses 49.0002.0192.0168.0001.00 and 49.0002.0192.0168.0002.00 on the lo0 interfaces. Additionally, you configure the ISO family on the IS-IS interfaces.

For Junos OS security devices only, you configure the **mode packet-based** statement at the **[edit security forwarding-options family iso]** hierarchy level.

Figure 2 on page 15 shows the topology used in this example.

Figure 2: Simple IS-IS Topology



"CLI Quick Configuration" on page 16 shows the configuration for both of the devices in Figure 2 on page 15. The section "Step-by-Step Procedure" on page 16 describes the steps on Device R1.

Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

Device R1

```
set security forwarding-options family iso mode packet-based
set interfaces ge-1/2/0 unit 0 description to-R2
set interfaces ge-1/2/0 unit 0 family inet address 10.0.0.1/30
set interfaces ge-1/2/0 unit 0 family iso
set interfaces lo0 unit 0 family inet address 192.168.0.1/32
set interfaces lo0 unit 0 family iso address 49.0002.0192.0168.0001.00
set protocols isis interface ge-1/2/0.0
set protocols isis interface lo0.0
```

Device R2

```
set security forwarding-options family iso mode packet-based
set interfaces ge-1/2/0 unit 0 description to-R1
set interfaces ge-1/2/0 unit 0 family inet address 10.0.0.2/30
set interfaces ge-1/2/0 unit 0 family iso
set interfaces lo0 unit 0 family inet address 192.168.0.2/32
set interfaces lo0 unit 0 family iso address 49.0002.0192.0168.0002.00
set protocols isis interface ge-1/2/0.0
set protocols isis interface lo0.0
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure IS-IS:

1. Enable IS-IS if your router is in secure context.

   ```
   [edit security forwarding-options family iso]
   user@R1# set mode packet-based
   ```

2. Create the interface that connects to Device R2, and configure the ISO family on the interface.

   ```
   [edit interfaces ge-1/2/0 unit 0]
   user@R1# set description to-R2
   user@R1# set family inet address 10.0.0.1/30
   user@R1# set family iso
   ```

3. Create the loopback interface, set the IP address, and set the NET address.

   ```
   [edit interfaces lo0 unit 0]
   user@R1# set family inet address 192.168.0.1/32
   user@R1# set family iso address 49.0002.0192.0168.0001.00
   ```

4. Enable IS-IS on the interfaces.

   ```
   [edit protocols isis]
   user@R1# set interface ge-1/2/0.0
   user@R1# set interface lo0.0
   ```

Results From configuration mode, confirm your configuration by entering the **show interfaces**, **show protocols**, and **show security** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@R1# show security
forwarding-options {
    family iso {
        mode packet-based;
    }
}
```

```
user@R1# show interfaces
ge-1/2/0 {
    unit 0 {
        description to-R2;
        family inet {
            address 10.0.0.1/30;
        }
        family iso;
    }
}
lo0 {
    unit 0 {
        family inet {
            address 192.168.0.1/32;
        }
        family iso {
            address 49.0002.0192.0168.0001.00;
        }
    }
}
```

```
user@R1# show protocols
isis {
    interface ge-1/2/0.0;
    interface lo0.0;
}
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

Confirm that the configuration is working properly.

Verifying IS-IS Interface Configuration

Purpose Verify the status of the IS-IS-enabled interfaces.

Action From operational mode, enter the **show isis interface brief** command.

```
user@R1> show isis interface brief
IS-IS interface database:
Interface             L CirID Level 1 DR        Level 2 DR        L1/L2 Metric
lo0.0                 3   0x1 Passive           Passive                 0/0
ge-1/2/0.0            3   0x1 R2.02         R2.02               10/10
```

Meaning Verify that the output shows the intended configuration of the interfaces on which IS-IS is enabled.

Verifying IS-IS Interface Configuration in Detail

Purpose Verify the details of IS-IS-enabled interfaces.

Action From operational mode, enter the **show isis interface detail** command.

```
user@R1> show isis interface detail
IS-IS interface database:
lo0.0
  Index: 75, State: 0x6, Circuit id: 0x1, Circuit type: 0
  LSP interval: 100 ms, CSNP interval: disabled
  Adjacency advertisement: Advertise
  Level Adjacencies Priority Metric Hello (s) Hold (s) Designated Router
    1             0       64      0 Passive
    2             0       64      0 Passive
ge-1/2/0.0
  Index: 77, State: 0x6, Circuit id: 0x1, Circuit type: 3
  LSP interval: 100 ms, CSNP interval: 10 s
  Adjacency advertisement: Advertise
  Level Adjacencies Priority Metric Hello (s) Hold (s) Designated Router
    1             1       64     10     9.000       27 R2.02 (not us)
    2             1       64     10     9.000       27 R2.02 (not us)
```

Meaning Check the following output fields and verify that the output shows the intended configuration of IS-IS-enabled interfaces:

- Interface—Interface configured for IS-IS.
- State—Internal implementation information.
- Circuit id—Circuit identifier.
- Circuit type—Configured level of IS-IS:
  - 1—Level 1 only
  - 2—Level 2 only
  - 3—Level 1 and Level 2
- link-state PDU interval—Time between IS-IS information messages.
- L or Level—Type of adjacency:
  - 1—Level 1 only
  - 2—Level 2 only
  - 3—Level 1 and Level 2

- Adjacencies—Adjacencies established on the interface.
- Priority—Priority value established on the interface.
- Metric—Metric value for the interface.
- Hello(s)—Intervals between hello PDUs.
- Hold(s)—Hold time on the interface.

Verifying IS-IS Adjacencies

Purpose Display brief information about IS-IS neighbors.

Action From operational mode, enter the **show isis adjacency brief** command.

```
user@R1> show isis adjacency brief
Interface             System         L State       Hold (secs) SNPA
ge-1/2/0.0            R2             1  Up                    6  0:5:85:8f:c8:bd
ge-1/2/0.0            R2             2  Up                    6  0:5:85:8f:c8:bd
```

Meaning Verify the adjacent routers in the IS-IS database.

Verifying IS-IS Adjacencies in Detail

Purpose Display extensive information about IS-IS neighbors.

Action From operational mode, enter the **show isis adjacency extensive** command.

```
user@R1> show isis adjacency extensive
R2
  Interface: ge-1/2/0.0, Level: 1, State: Up, Expires in 6 secs
  Priority: 64, Up/Down transitions: 1, Last transition: 00:40:28 ago
  Circuit type: 3, Speaks: IP, IPv6, MAC address: 0:5:85:8f:c8:bd
  Topologies: Unicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  LAN id: R2.02, IP addresses: 10.0.0.2
  Transition log:
  When                  State        Event           Down reason
  Thu May 31 11:18:48   Up           Seenself

R2
  Interface: ge-1/2/0.0, Level: 2, State: Up, Expires in 8 secs
  Priority: 64, Up/Down transitions: 1, Last transition: 00:40:28 ago
  Circuit type: 3, Speaks: IP, IPv6, MAC address: 0:5:85:8f:c8:bd
  Topologies: Unicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  LAN id: R2.02, IP addresses: 10.0.0.2
  Transition log:
  When                  State        Event           Down reason
  Thu May 31 11:18:48   Up           Seenself
```

Meaning Check the following fields and verify the adjacency information about IS-IS neighbors:

- Interface—Interface through which the neighbor is reachable.
- L or Level—Configured level of IS-IS:

  - 1—Level 1 only
  - 2—Level 2 only
  - 3—Level 1 and Level 2

  An exclamation point before the level number indicates that the adjacency is missing an IP address.
- State—Status of the adjacency: **Up**, **Down**, **New**, **One-way**, **Initializing**, or **Rejected**.
- Event—Message that identifies the cause of a state.
- Down reason—Reason the adjacency is down.
- Restart capable—A neighbor is configured for graceful restart.
- Transition log—List of transitions including **When**, **State**, and **Reason**.

Related Documentation

- *Understanding IS-IS Configuration*
- *Example: Configuring IS-IS for GRES with Graceful Restart*
- Example: Configuring Designated Router Election Priority for IS-IS on page 78
- *Junos OS Feature Support Reference for SRX Series and J Series Devices*

CHAPTER 3

Configuration Examples

Example: Configuring Multi-Level IS-IS

This example shows how to configure a multi-level IS-IS topology.

Requirements

No special configuration beyond device initialization is required before configuring this example.

Overview

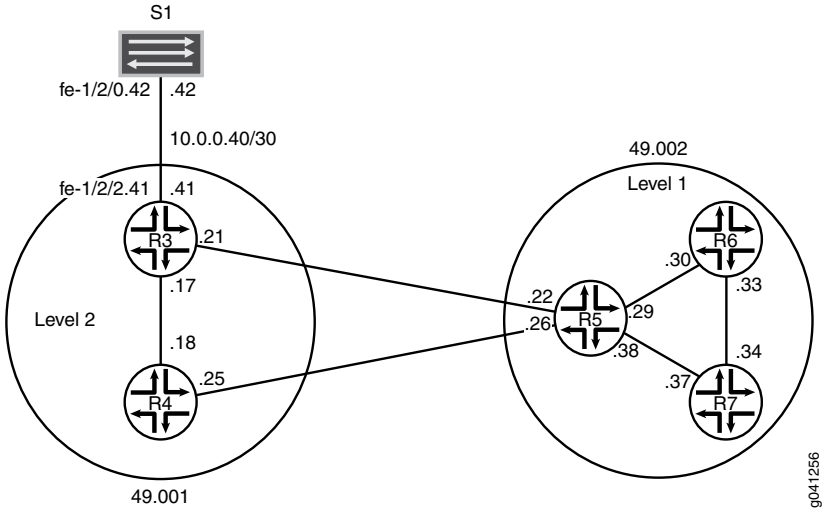
Like OSPF, the IS-IS protocol supports the partitioning of a routing domain into multiple areas with levels that control interarea flooding. The use of multiple levels improves protocol scalability, as Level 2 (backbone) link-state PDUs are normally not flooded into a Level 1 area.

An IS-IS Level 2 area is analogous to the OSPF backbone area (0), while a Level 1 area operates much like an OSPF totally stubby area, in that a default route is normally used to reach both inter-level and AS external routes.

Unlike OSPF, IS-IS area boundaries occur between routers, such that a given routing device is always wholly contained within a particular area. Level 1 adjacencies can be formed between routers that share a common area number, while a Level 2 adjacency can be formed between routers that might or might not share an area number.

Figure 3 on page 22 shows the topology used in this example.

Figure 3: IS-IS Multi-Level Topology



"CLI Quick Configuration" on page 22 shows the configuration for all of the devices in Figure 3 on page 22. The section "Step-by-Step Procedure" on page 24 describes the steps on Device R5.

This example has the following characteristics:

- Device R5 functions as a Level 1/Level 2 router to interconnect the Level 2 backbone area 49.001 and the Level 1 area 49.002 containing Device R6 and Device R7.
- The system ID is based on the devices' IPv4 lo0 addresses.
- Loss of any individual interface does not totally disrupt the IS-IS operation.
- The IPv4 lo0 addresses of all routers are reachable through IS-IS.
- The link between Device R3 and Device S1 appears in area 49.001 as an intra-area route. No IS-IS adjacencies can be established on this interface. This is accomplished by configuring the **passive** statement on Device R3's interface to Device S1.
- The loopback addresses of Level 2 devices do not appear in a Level 1 area.
- There is only one adjacency for each device pairing.

Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

Device R3
```
set interfaces fe-1/2/0 unit 0 description to-R4
set interfaces fe-1/2/0 unit 0 family inet address 10.0.0.17/30
set interfaces fe-1/2/0 unit 0 family iso
set interfaces fe-1/2/1 unit 0 description to-R5
set interfaces fe-1/2/1 unit 0 family inet address 10.0.0.21/30
set interfaces fe-1/2/1 unit 0 family iso
set interfaces fe-1/2/2 unit 0 family inet address 10.0.0.41/30
set interfaces fe-1/2/2 unit 0 description to-S1
set interfaces lo0 unit 0 family inet address 192.168.0.3/32
set interfaces lo0 unit 0 family iso address 49.001.0192.0168.0003.00
set protocols isis interface fe-1/2/0.0 level 1 disable
set protocols isis interface fe-1/2/1.0 level 1 disable
set protocols isis interface lo0.0 level 1 disable
set protocols isis interface fe-1/2/2.0 passive
```

Device R4
```
set interfaces fe-1/2/0 unit 0 description to-R3
set interfaces fe-1/2/0 unit 0 family inet address 10.0.0.18/30
set interfaces fe-1/2/0 unit 0 family iso
set interfaces fe-1/2/1 unit 0 description to-R5
set interfaces fe-1/2/1 unit 0 family inet address 10.0.0.25/30
set interfaces fe-1/2/1 unit 0 family iso
set interfaces lo0 unit 0 family inet address 192.168.0.4/32
set interfaces lo0 unit 0 family iso address 49.001.0192.0168.0004.00
set protocols isis interface fe-1/2/0.0 level 1 disable
set protocols isis interface fe-1/2/1.0 level 1 disable
set protocols isis interface lo0.0 level 1 disable
```

Device R5
```
set interfaces fe-1/2/0 unit 0 description to-R3
set interfaces fe-1/2/0 unit 0 family inet address 10.0.0.22/30
set interfaces fe-1/2/0 unit 0 family iso
set interfaces fe-1/2/1 unit 0 description to-R4
set interfaces fe-1/2/1 unit 0 family inet address 10.0.0.26/30
set interfaces fe-1/2/1 unit 0 family iso
set interfaces fe-1/2/2 unit 0 description to-R6
set interfaces fe-1/2/2 unit 0 family inet address 10.0.0.29/30
set interfaces fe-1/2/2 unit 0 family iso
set interfaces fe-1/2/3 unit 0 description to-R7
set interfaces fe-1/2/3 unit 0 family inet address 10.0.0.38/30
set interfaces fe-1/2/3 unit 0 family iso
set interfaces lo0 unit 0 family inet address 192.168.0.5/32
set interfaces lo0 unit 0 family iso address 49.002.0192.0168.0005.00
set protocols isis interface fe-1/2/0.0 level 1 disable
set protocols isis interface fe-1/2/1.0 level 1 disable
set protocols isis interface fe-1/2/2.0 level 2 disable
set protocols isis interface fe-1/2/3.0 level 2 disable
set protocols isis interface lo0.0 level 1 disable
```

Device R6
```
set interfaces fe-1/2/0 unit 0 description to-R5
set interfaces fe-1/2/0 unit 0 family inet address 10.0.0.30/30
set interfaces fe-1/2/0 unit 0 family iso
set interfaces fe-1/2/1 unit 0 description to-R7
set interfaces fe-1/2/1 unit 0 family inet address 10.0.0.33/30
set interfaces fe-1/2/1 unit 0 family iso
set interfaces lo0 unit 0 family inet address 192.168.0.6/32
set interfaces lo0 unit 0 family iso address 49.002.0192.0168.0006.00
```

```
set protocols isis interface fe-1/2/0.0 level 2 disable
set protocols isis interface fe-1/2/1.0 level 2 disable
set protocols isis interface lo0.0 level 2 disable
```

Device R7

```
set interfaces fe-1/2/0 unit 0 description to-R6
set interfaces fe-1/2/0 unit 0 family inet address 10.0.0.34/30
set interfaces fe-1/2/0 unit 0 family iso
set interfaces fe-1/2/1 unit 0 description to-R5
set interfaces fe-1/2/1 unit 0 family inet address 10.0.0.37/30
set interfaces fe-1/2/1 unit 0 family iso
set interfaces lo0 unit 0 family inet address 192.168.0.7/32
set interfaces lo0 unit 0 family iso address 49.002.0192.0168.0007.00
set protocols isis interface fe-1/2/0.0 level 2 disable
set protocols isis interface fe-1/2/1.0 level 2 disable
set protocols isis interface lo0.0 level 2 disable
```

Device S1

```
set interfaces fe-1/2/0 unit 0 family inet address 10.0.0.42/30
set interfaces fe-1/2/0 unit 0 description to-R3
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure multi-level IS-IS:

1. Configure the network interfaces.

   Enable IS-IS on the interfaces by Including the ISO address family on each interface.

   ```
   [edit interfaces]
   user@R5# set fe-1/2/0 unit 0 description to-R3
   user@R5# set fe-1/2/0 unit 0 family inet address 10.0.0.22/30
   user@R5# set fe-1/2/0 unit 0 family iso
   user@R5# set fe-1/2/1 unit 0 description to-R4
   user@R5# set fe-1/2/1 unit 0 family inet address 10.0.0.26/30
   user@R5# set fe-1/2/1 unit 0 family iso
   user@R5# set fe-1/2/2 unit 0 description to-R6
   user@R5# set fe-1/2/2 unit 0 family inet address 10.0.0.29/30
   user@R5# set fe-1/2/2 unit 0 family iso
   user@R5# set fe-1/2/3 unit 0 description to-R7
   user@R5# set fe-1/2/3 unit 0 family inet address 10.0.0.38/30
   user@R5# set fe-1/2/3 unit 0 family iso
   ```

2. Configure two loopback interface addresses.

   One address is for IPv4.

   The other is for the IS-IS area 49.002 so that Device R5 can form adjacencies with the other Level 1 devices in area 49.002. Even though Device R5's NET identifies itself as belonging to the Level 1 area 49.002, its loopback interface is not configured as a Level 1 interface. Doing so would cause the route to Device R5's loopback to be injected into the Level 1 area.

   ```
   [edit interfaces lo0 unit 0]
   user@R5# set family inet address 192.168.0.5/32
   user@R5# set family iso address 49.002.0192.0168.0005.00
   ```

3. Specify the IS-IS level on a per-interface basis.

   Device R5 becomes adjacent to the other routing devices on the same level on each link.

   By default, IS-IS is enabled for IS-IS areas on all interfaces on which the ISO protocol family is enabled (at the **[edit interfaces** *interface-name* **unit** *logical-unit-number***]** hierarchy level). To disable IS-IS at any particular level on an interface, include the **disable** statement.

   Device R5's loopback interface is configured to run Level 2 only. If Level 1 operation were enabled on lo0.0, Device R5 would include its loopback address in its Level 1 link-state PDU, which is incorrect for this example in which the loopback addresses of Level 2 devices must not appear in a Level 1 area.

   Unlike OSPF, you must explicitly list the router's lo0 interface at the **[edit protocols isis]** hierarchy level, because this interface is the source of the router's NET, and therefore must be configured as an IS-IS interface. In IS-IS, the lo0 interface operates in the passive mode by default, which is ideal because adjacency formation can never occur on a virtual interface.

   ```
   [edit protocols isis]
   user@R5# set interface fe-1/2/0.0 level 1 disable
   user@R5# set interface fe-1/2/1.0 level 1 disable
   user@R5# set interface fe-1/2/0.0 level 2 disable
   user@R5# set interface fe-1/2/3.0 level 2 disable
   user@R5# set interface lo0.0 level 1 disable
   ```

Results From configuration mode, confirm your configuration by entering the **show interfaces** and **show protocols** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@R5# show interfaces
fe-1/2/0 {
  unit 0{
    description to-R3;
    family inet {
      address 10.0.0.22/30;
    }
    family iso;
  }
}
fe-1/2/1 {
  unit 0 {
    description to-R4;
    family inet {
      address 10.0.0.26/30;
    }
    family iso;
  }
}
fe-1/2/2 {
  unit 0 {
    description to-R6;
    family inet {
```

```
        address 10.0.0.29/30;
      }
      family iso;
    }
  }
  fe-1/2/3 {
    unit 0 {
      description to-R7;
      family inet {
        address 10.0.0.38/30;
      }
      family iso;
    }
  }
  lo0 {
    unit 0 {
      family inet {
        address 192.168.0.5/32;
      }
      family iso {
        address 49.002.0192.0168.0005.00;
      }
    }
  }
```

```
user@R5# show protocols
isis {
  interface fe-1/2/0.0 {
    level 1 disable;
  }
  interface fe-1/2/1.0 {
    level 1 disable;
  }
  interface fe-1/2/0.0 {
    level 2 disable;
  }
  interface fe-1/2/3.0 {
    level 2 disable;
  }
  interface lo0.0 {
    level 1 disable;
  }
}
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

Confirm that the configuration is working properly.

- Checking Interface-to-Area Associations on page 27
- Verifying IS-IS Adjacencies on page 27
- Examining the IS-IS Database on page 28

Checking Interface-to-Area Associations

Purpose Make sure that the interface-to-area associations are configured as expected.

Action From operational mode, enter the **show isis interface** command.

```
user@R5> show isis interface
IS-IS interface database:
Interface             L CirID Level 1 DR       Level 2 DR       L1/L2 Metric
lo0.0                 3   0x1 Disabled          Passive              0/0
fe-1/2/0.0            2   0x3 Disabled          R5.03               10/10
fe-1/2/1.0            2   0x2 Disabled          R5.02               10/10
fe-1/2/0.0            1   0x1 R6.02         Disabled                10/10
fe-1/2/3.0            1   0x4 R5.04         Disabled                10/10
```

Meaning The output shows that Device R5's interfaces have been correctly configured with the ISO family, and that the interfaces have been placed into the correct levels.

You can also see that Device R5 has elected itself as the designated intermediate system (DIS) on its broadcast-capable IS-IS interfaces.

Verifying IS-IS Adjacencies

Purpose Verify that the expected adjacencies have formed between Device R5 and its IS-IS neighbors.

Action From operational mode, enter the **show isis adjacency detail** command.

```
user@R5> show isis adjacency detail
R3
  Interface: fe-1/2/0.0, Level: 2, State: Up, Expires in 25 secs
  Priority: 64, Up/Down transitions: 1, Last transition: 03:19:31 ago
  Circuit type: 2, Speaks: IP, IPv6, MAC address: 0:5:85:8f:c8:bc
  Topologies: Unicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  LAN id: R5.03, IP addresses: 10.0.0.21

R4
  Interface: fe-1/2/1.0, Level: 2, State: Up, Expires in 24 secs
  Priority: 64, Up/Down transitions: 1, Last transition: 03:19:36 ago
  Circuit type: 2, Speaks: IP, IPv6, MAC address: 0:5:85:8f:c8:bc
  Topologies: Unicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  LAN id: R5.02, IP addresses: 10.0.0.25

R6
  Interface: fe-1/2/0.0, Level: 1, State: Up, Expires in 6 secs
  Priority: 64, Up/Down transitions: 1, Last transition: 03:20:24 ago
  Circuit type: 1, Speaks: IP, IPv6, MAC address: 0:5:85:8f:c8:bd
  Topologies: Unicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  LAN id: R6.02, IP addresses: 10.0.0.30

R7
  Interface: fe-1/2/3.0, Level: 1, State: Up, Expires in 21 secs
  Priority: 64, Up/Down transitions: 1, Last transition: 03:19:29 ago
  Circuit type: 1, Speaks: IP, IPv6, MAC address: 0:5:85:8f:c8:bc
```

```
  Topologies: Unicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  LAN id: R5.04, IP addresses: 10.0.0.37
```

Meaning These results confirm that Device R5 has two Level 2 adjacencies and two Level 1 adjacencies.

Examining the IS-IS Database

Purpose Because Device R5 is a L1/L2 attached router, examine the Level 1 link-state database associated with area 49.002 to confirm that loopback addresses from backbone routers are not being advertised into the Level 1 area.

Action From operational mode, enter the **show isis database detail** command.

```
user@R5> show isis database detail
IS-IS level 1 link-state database:

R5.00-00 Sequence: 0x19, Checksum: 0x7488, Lifetime: 727 secs
   IS neighbor: R5.04                    Metric:       10
   IS neighbor: R6.02                    Metric:       10
   IP prefix: 10.0.0.28/30                   Metric:       10 Internal Up
   IP prefix: 10.0.0.36/30                   Metric:       10 Internal Up

R5.04-00 Sequence: 0x14, Checksum: 0x2668, Lifetime: 821 secs
   IS neighbor: R5.00                    Metric:        0
   IS neighbor: R7.00                    Metric:        0

R6.00-00 Sequence: 0x17, Checksum: 0xa65, Lifetime: 774 secs
   IS neighbor: R6.02                    Metric:       10
   IS neighbor: R7.02                    Metric:       10
   IP prefix: 10.0.0.28/30                   Metric:       10 Internal Up
   IP prefix: 10.0.0.32/30                   Metric:       10 Internal Up
   IP prefix: 192.168.0.6/32                 Metric:        0 Internal Up

R6.02-00 Sequence: 0x13, Checksum: 0xd1c0, Lifetime: 908 secs
   IS neighbor: R5.00                    Metric:        0
   IS neighbor: R6.00                    Metric:        0

R7.00-00 Sequence: 0x17, Checksum: 0xe39, Lifetime: 775 secs
   IS neighbor: R5.04                    Metric:       10
   IS neighbor: R7.02                    Metric:       10
   IP prefix: 10.0.0.32/30                   Metric:       10 Internal Up
   IP prefix: 10.0.0.36/30                   Metric:       10 Internal Up
   IP prefix: 192.168.0.7/32                 Metric:        0 Internal Up

R7.02-00 Sequence: 0x13, Checksum: 0x404d, Lifetime: 966 secs
   IS neighbor: R6.00                    Metric:        0
   IS neighbor: R7.00                    Metric:        0

IS-IS level 2 link-state database:

R3.00-00 Sequence: 0x17, Checksum: 0x5f84, Lifetime: 1085 secs
   IS neighbor: R4.02                    Metric:       10
   IS neighbor: R5.03                    Metric:       10
   IP prefix: 10.0.0.16/30                   Metric:       10 Internal Up
   IP prefix: 10.0.0.20/30                   Metric:       10 Internal Up
   IP prefix: 10.0.0.40/30                   Metric:       10 Internal Up
   IP prefix: 192.168.0.3/32                 Metric:        0 Internal Up
```

```
R4.00-00 Sequence: 0x17, Checksum: 0xab3a, Lifetime: 949 secs
   IS neighbor: R4.02                    Metric:       10
   IS neighbor: R5.02                    Metric:       10
   IP prefix: 10.0.0.16/30                   Metric:       10 Internal Up
   IP prefix: 10.0.0.24/30                   Metric:       10 Internal Up
   IP prefix: 192.168.0.4/32                 Metric:        0 Internal Up

R4.02-00 Sequence: 0x14, Checksum: 0xf2a8, Lifetime: 1022 secs
   IS neighbor: R3.00                    Metric:        0
   IS neighbor: R4.00                    Metric:        0

R5.00-00 Sequence: 0x1f, Checksum: 0x20d7, Lifetime: 821 secs
   IS neighbor: R5.02                    Metric:       10
   IS neighbor: R5.03                    Metric:       10
   IP prefix: 10.0.0.20/30                   Metric:       10 Internal Up
   IP prefix: 10.0.0.24/30                   Metric:       10 Internal Up
   IP prefix: 10.0.0.28/30                   Metric:       10 Internal Up
   IP prefix: 10.0.0.32/30                   Metric:       20 Internal Up
   IP prefix: 10.0.0.36/30                   Metric:       10 Internal Up
   IP prefix: 192.168.0.5/32                 Metric:        0 Internal Up
   IP prefix: 192.168.0.6/32                 Metric:       10 Internal Up
   IP prefix: 192.168.0.7/32                 Metric:       10 Internal Up

R5.02-00 Sequence: 0x14, Checksum: 0x6135, Lifetime: 977 secs
   IS neighbor: R4.00                    Metric:        0
   IS neighbor: R5.00                    Metric:        0

R5.03-00 Sequence: 0x14, Checksum: 0x1483, Lifetime: 1091 secs
   IS neighbor: R3.00                    Metric:        0
   IS neighbor: R5.00                    Metric:        0
```

Meaning This display indicates that Device R5's loopback interface is correctly configured to run Level 2 only. Had Level 1 operation been enabled on lo0.0, Device R5 would have then included its loopback address in its Level 1 link-state PDU.

You can also see that Device R5 has Level 2 link-state PDUs, received from its adjacent neighbors.

Like an OSPF totally stubby area, no backbone (Level 2) or external prefixes are leaked into a Level 1 area, by default. Level 1 prefixes are leaked up into the IS-IS backbone, however, as can be seen in Device R5's Level 2 link-state PDU.

Related Documentation

- *Understanding IS-IS Areas*

Example: Configuring Hitless Authentication Key Rollover for IS-IS

This example shows how to configure hitless authentication key rollover for IS-IS.

Requirements

No special configuration beyond device initialization is required before configuring hitless authentication key rollover for IS-IS.

Overview

Authentication guarantees that only trusted routers participate in routing updates. This keychain authentication method is referred to as hitless because the keys roll over from one to the next without resetting any peering sessions or interrupting the routing protocol. Junos OS supports both RFC 5304, *IS-IS Cryptographic Authentication* and RFC 5310, *IS-IS Generic Cryptographic Authentication*.

This example includes the following statements for configuring the keychain:

- **algorithm**—For each key in the keychain, you can specify an encryption algorithm. The algorithm can be SHA-1 or MD-5.
- **key**—A keychain can have multiple keys. Each key within a keychain must be identified by a unique integer value. The range of valid identifier values is from 0 through 63.
- **key-chain**—For each keychain, you must specify a name. This example defines two keychains: **base-key-global** and **base-key-inter**.
- **options**—For each key in the keychain, you can specify the encoding for the message authentication code:**isis-enhanced** or **basic**. The basic (RFC 5304) operation is enabled by default.

  When you configure the **isis-enhanced** option, Junos OS sends RFC 5310-encoded routing protocol packets and accepts both RFC 5304-encoded and RFC 5310-encoded routing protocol packets that are received from other devices.

  When you configure **basic** (or do not include the **options** statement in the key configuration), Junos OS sends and receives RFC 5304-encoded routing protocols packets, and drops 5310-encoded routing protocol packets that are received from other devices.

  Because this setting is for IS-IS only, the TCP and the BFD protocols ignore the encoding option configured in the key.
- **secret**—For each key in the keychain, you must set a secret password. This password can be entered in either encrypted or plain text format in the **secret** statement. It is always displayed in encrypted format.
- **start-time**—Each key must specify a start time in UTC format. Control gets passed from one key to the next. When a configured start time arrives (based on the routing device's clock), the key with that start time becomes active. Start times are specified in the local time zone for a routing device and must be unique within the key chain.

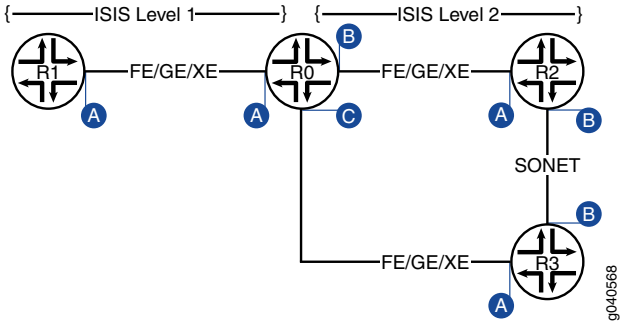
You can apply a keychain globally to all interfaces or more granularly to specific interfaces.

This example includes the following statements for applying the keychain to all interfaces or to particular interfaces:

- **authentication-key-chain**—Enables you to apply a keychain at the global IS-IS level for all Level 1 or all Level 2 interfaces.
- **hello-authentication-key-chain**—Enables you to apply a keychain at the individual IS-IS interface level. The interface configuration overrides the global configuration.

Figure 4 on page 31 shows the topology used in the example.

Figure 4: Hitless Authentication Key Rollover for IS-IS



This example shows the configuration for Router R0.

Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set interfaces ge-0/0/0 unit 0 description "interface A"
set interfaces ge-0/0/0 unit 0 family inet address 10.0.0.1/30
set interfaces ge-0/0/0 unit 0 family iso
set interfaces ge-0/0/0 unit 0 family inet6 address fe80::200:f8ff:fe21:67cf/128
set interfaces ge-0/0/1 unit 0 description "interface B"
set interfaces ge-0/0/1 unit 0 family inet address 10.0.0.5/30
set interfaces ge-0/0/1 unit 0 family iso
set interfaces ge-0/0/1 unit 0 family inet6 address 10FB::C:ABC:1F0C:44DA/128
set interfaces ge-0/0/2 unit 0 description "interface C"
set interfaces ge-0/0/2 unit 0 family inet address 10.0.0.9/30
set interfaces ge-0/0/2 unit 0 family iso
set interfaces ge-0/0/2 unit 0 family inet6 address ff06::c3/128
set security authentication-key-chains key-chain base-key-global key 63 secret
    "$9$jfkqfTQnCpBDiCt"
set security authentication-key-chains key-chain base-key-global key 63 start-time
    "2011-8-6.06:54:00-0700"
set security authentication-key-chains key-chain base-key-global key 63 algorithm
    hmac-sha-1
set security authentication-key-chains key-chain base-key-global key 63 options
    isis-enhanced
set security authentication-key-chains key-chain base-key-inter key 0 secret
    "$9$8sgx7Vws4ZDkWLGD"
```

```
set security authentication-key-chains key-chain base-key-inter key 0 start-time
  "2011-8-6.06:54:00-0700"
set security authentication-key-chains key-chain base-key-inter key 0 algorithm md5
set security authentication-key-chains key-chain base-key-inter key 0 options basic
set protocols isis level 1 authentication-key-chain base-key-global
set protocols isis interface ge-0/0/0.0 level 1 hello-authentication-key-chain
  base-key-inter
```

Step-by-Step Procedure

To configure hitless authentication key rollover for IS-IS:

1. Configure the Router R0 interfaces.

```
[edit interfaces ge-0/0/0 unit 0]
user@R0# set description "interface A"
user@R0# set family inet address 10.0.0.1/30
user@R0# set family iso
user@R0# set family inet6 address fe80::200:f8ff:fe21:67cf/128
[edit interfaces ge-0/0/1 unit 0]
user@R0# set interfaces ge-0/0/1 unit 0 description "interface B"
user@R0# set interfaces ge-0/0/1 unit 0 family inet address 10.0.0.5/30
user@R0# set interfaces ge-0/0/1 unit 0 family iso
user@R0# set interfaces ge-0/0/1 unit 0 family inet6 address
  10FB::C:ABC:1F0C:44DA/128
[edit interfaces ge-0/0/2 unit 0]
user@R0# set description "interface C"
user@R0# set family inet address 10.0.0.9/30
user@R0# set interfaces ge-0/0/2 unit 0 family iso
user@R0# set interfaces ge-0/0/2 unit 0 family inet6 address ff06::c3/128
```

2. Configure one or more authentication keys.

```
[edit security authentication-key-chains key-chain base-key-global]
user@R0# set key 63 secret "$9$jfkqfTQnCpBDiCt"
user@R0# set key 63 start-time "2011-8-6.06:54:00-0700"
user@R0# set key 63 algorithm hmac-sha-1
user@R0# set key 63 options isis-enhanced
[edit security authentication-key-chains key-chain base-key-inter]
user@R0# set key 0 secret "$9$8sgx7Vws4ZDkWLGD"
user@R0# set key 0 start-time "2011-8-6.06:54:00-0700"
user@R0# set key 0 algorithm md5
user@R0# set key 0 options basic
```

3. Apply the base-key-global keychain to all Level 1 IS-IS interfaces on Router R0.

```
[edit protocols isis level 1]
user@R0# set authentication-key-chain base-key-global
```

4. Apply the base-key-inter keychain to the ge-0/0/0.0 interface on Router R0.

```
[edit protocols isis interface ge-0/0/0.0 level 1]
user@R0# set hello-authentication-key-chain base-key-inter
```

5. If you are done configuring the device, commit the configuration.

```
user@R0# commit
```

Results

From configuration mode, confirm your configuration by entering the **show interfaces**, **show protocols**, and **show security** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@R0# show interfaces
ge-0/0/0 {
    unit 0 {
        description "interface A";
        family inet {
            address 10.0.0.1/30;
        }
        family iso;
        family inet6 {
            address fe80::200:f8ff:fe21:67cf/128;
        }
    }
}
ge-0/0/1 {
    unit 0 {
        description "interface B";
        family inet {
            address 10.0.0.5/30;
        }
        family iso;
        family inet6 {
            address 10FB::C:ABC:1F0C:44DA/128;
        }
    }
}
ge-0/0/2 {
    unit 0 {
        description "interface C";
        family inet {
            address 10.0.0.9/30;
        }
        family iso;
        family inet6 {
            address ff06::c3/128;
        }
    }
}
```

```
user@R0# show protocols
isis {
    level 1 authentication-key-chain base-key-global;
    interface ge-0/0/0.0 {
        level 1 hello-authentication-key-chain base-key-inter;
    }
}
```

```
user@R0# show security
authentication-key-chains {
    key-chain base-key-global {
        key 63 {
```

```
            secret "$9$jfkqfTQnCpBDiCt"; ## SECRET-DATA
            start-time "2011-8-6.06:54:00-0700";
            algorithm hmac-sha-1;
            options isis-enhanced;
        }
    }
    key-chain base-key-inter {
        key 0 {
            secret "$9$8sgx7Vws4ZDkWLGD"; ## SECRET-DATA
            start-time "2011-8-6.06:54:00-0700";
            algorithm md5;
            options basic;
        }
    }
}
```

Verification

To verify the configuration, run the following commands:

- show isis authentication
- show security keychain

Related Documentation

- Understanding Hitless Authentication Key Rollover for IS-IS on page 9

Example: Redistributing OSPF Routes into IS-IS

This example shows how to redistribute OSPF routes into an IS-IS network.

Requirements

No special configuration beyond device initialization is required before configuring this example.

Overview

Export policy can be applied to IS-IS to facilitate route redistribution.

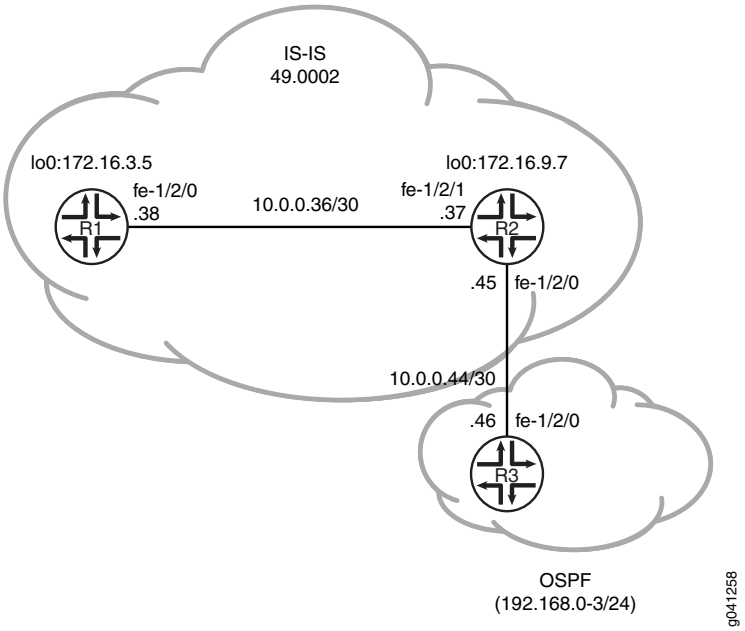
Junos OS does not support the application of import policy for link-state routing protocols like IS-IS because such policies can lead to inconsistent link-state database (LSDB) entries, which in turn can result in routing inconstancies.

In this example, OSPF routes 192.168.0/24 through 192.168.3/24 are redistributed into IS-IS area 49.0002 from Device R2.

In addition, policies are configured to ensure that Device R1 can reach destinations on the 10.0.0.44/30 network, and that Device R3 can reach destinations on the 10.0.0.36/30 network. This enables end-to-end reachability.

Figure 5 on page 35 shows the topology used in this example.

Figure 5: IS-IS Route Redistribution Topology



"CLI Quick Configuration" on page 35 shows the configuration for all of the devices in Figure 5 on page 35. The section "Step-by-Step Procedure" on page 36 describes the steps on Device R2. "Step-by-Step Procedure" on page 37 describes the steps on Device R3.

Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

Device R1

```
set interfaces fe-1/2/0 unit 0 description to-R7
set interfaces fe-1/2/0 unit 0 family inet address 10.0.0.38/30
set interfaces fe-1/2/0 unit 0 family iso
set interfaces lo0 unit 0 family inet address 172.16.3.5/32
set interfaces lo0 unit 0 family iso address 49.0002.0172.0016.0305.00
set protocols isis interface fe-1/2/0.0
set protocols isis interface lo0.0
```

Device R2

```
set interfaces fe-1/2/1 unit 0 description to-R5
set interfaces fe-1/2/1 unit 0 family inet address 10.0.0.37/30
set interfaces fe-1/2/1 unit 0 family iso
set interfaces fe-1/2/0 unit 0 description to-OSPF-network
set interfaces fe-1/2/0 unit 0 family inet address 10.0.0.45/30
```

```
set interfaces lo0 unit 0 family inet address 172.16.9.7/32
set interfaces lo0 unit 0 family iso address 49.0002.0172.0016.0907.00
set protocols isis export ospf-isis
set protocols isis export send-direct-to-isis-neighbors
set protocols isis interface fe-1/2/1.0
set protocols isis interface lo0.0
set protocols ospf export send-direct-to-ospf-neighbors
set protocols ospf area 0.0.0.1 interface fe-1/2/0.0
set protocols ospf area 0.0.0.1 interface lo0.0 passive
set policy-options policy-statement ospf-isis term 1 from protocol ospf
set policy-options policy-statement ospf-isis term 1 from route-filter 192.168.0.0/22
  longer
set policy-options policy-statement ospf-isis term 1 then accept
set policy-options policy-statement send-direct-to-isis-neighbors from protocol direct
set policy-options policy-statement send-direct-to-isis-neighbors from route-filter
  10.0.0.44/30 exact
set policy-options policy-statement send-direct-to-isis-neighbors then accept
set policy-options policy-statement send-direct-to-ospf-neighbors from protocol direct
set policy-options policy-statement send-direct-to-ospf-neighbors from route-filter
  10.0.0.36/30 exact
set policy-options policy-statement send-direct-to-ospf-neighbors then accept
```

Device R3

```
set interfaces fe-1/2/0 unit 0 family inet address 10.0.0.46/30
set interfaces lo0 unit 0 family inet address 192.168.1.1/32
set interfaces lo0 unit 0 family inet address 192.168.2.1/32
set interfaces lo0 unit 0 family inet address 192.168.3.1/32
set interfaces lo0 unit 0 family inet address 192.168.0.1/32
set protocols ospf export ospf
set protocols ospf area 0.0.0.1 interface fe-1/2/0.0
set protocols ospf area 0.0.0.1 interface lo0.0 passive
set policy-options policy-statement ospf term 1 from protocol static
set policy-options policy-statement ospf term 1 then accept
set routing-options static route 192.168.0.0/24 discard
set routing-options static route 192.168.1.0/24 discard
set routing-options static route 192.168.3.0/24 discard
set routing-options static route 192.168.2.0/24 discard
```

Step-by-Step Procedure

To configure Device R2:

1. Configure the network interfaces.

   ```
   [edit interfaces]
   user@R2# set fe-1/2/1 unit 0 description to-R5
   user@R2# set fe-1/2/1 unit 0 family inet address 10.0.0.37/30
   user@R2# set fe-1/2/1 unit 0 family iso
   user@R2# set fe-1/2/0 unit 0 description to-OSPF-network
   user@R2# set fe-1/2/0 unit 0 family inet address 10.0.0.45/30
   user@R2# set lo0 unit 0 family inet address 172.16.9.7/32
   user@R2# set lo0 unit 0 family iso address 49.0002.0172.0016.0907.00
   ```

2. Configure IS-IS on the interface facing Device R1 and the loopback interface.

   ```
   [edit protocols isis]
   user@R2# set interface fe-1/2/1.0
   user@R2# set interface lo0.0
   ```

3. Configure the policy that enables Device R1 to reach the 10.0.0.44/30 network.

```
[edit policy-options policy-statement send-direct-to-isis-neighbors]
user@R2# set from protocol direct
user@R2# set from route-filter 10.0.0.44/30 exact
user@R2# set then accept
```

4. Apply the policy that enables Device R1 to reach the 10.0.0.44/30 network.

```
[edit protocols isis]
user@R2# set export send-direct-to-isis-neighbors
```

5. Configure OSPF on the interfaces.

```
[edit protocols ospf]
user@R2# set area 0.0.0.1 interface fe-1/2/0.0
user@R2# set area 0.0.0.1 interface lo0.0 passive
```

6. Configure the OSPF route redistribution policy.

```
[edit policy-options policy-statement ospf-isis term 1]
user@R2# set from protocol ospf
user@R2# set from route-filter 192.168.0.0/22 longer
user@R2# set then accept
```

7. Apply the OSPF route redistribution policy to the IS-IS instance.

```
[edit protocols isis]
user@R2# set export ospf-isis
```

8. Configure the policy that enables Device R3 to reach the 10.0.0.36/30 network.

```
[edit policy-options policy-statement send-direct-to-ospf-neighbors]
user@R2# set from protocol direct
user@R2# set from route-filter 10.0.0.36/30 exact
user@R2# set then accept
```

9. Apply the policy that enables Device R3 to reach the 10.0.0.36/30 network.

```
[edit protocols ospf]
user@R2# set export send-direct-to-ospf-neighbors
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure multi-level IS-IS:

1. Configure the network interfaces.

   Multiple addresses are configured on the loopback interface to simulate multiple route destinations.

```
[edit interfaces]
user@R3# set fe-1/2/0 unit 0 family inet address 10.0.0.46/30
user@R3# set lo0 unit 0 family inet address 192.168.1.1/32
user@R3# set lo0 unit 0 family inet address 192.168.2.1/32
user@R3# set lo0 unit 0 family inet address 192.168.3.1/32
user@R3# set lo0 unit 0 family inet address 192.168.0.1/32
```

2. Configure static routes to the loopback interface addresses.

   These are the routes that are redistributed into IS-IS.

```
[edit routing-options static]
user@R3# set route 192.168.0.0/24 discard
user@R3# set route 192.168.1.0/24 discard
user@R3# set route 192.168.3.0/24 discard
user@R3# set route 192.168.2.0/24 discard
```

3. Configure OSPF on the interfaces.

```
[edit protocols ospf area 0.0.0.1]
user@R3# set interface fe-1/2/0.0
user@R3# set interface lo0.0 passive
```

4. Configure the OSPF policy to export the static routes.

```
[edit policy-options policy-statement ospf term 1]
user@R3# set from protocol static
user@R3# set then accept
```

5. Apply the OSPF export policy.

```
[edit protocols ospf]
user@R3# set export ospf
```

Results From configuration mode, confirm your configuration by entering the **show interfaces**, **show protocols**, **show policy-options**, and **show routing-options** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

Device R2

```
user@R2# show interfaces
fe-1/2/1 {
    unit 0 {
        description to-R5;
        family inet {
            address 10.0.0.37/30;
        }
        family iso;
    }
}
fe-1/2/0 {
    unit 0 {
        description to-OSPF-network;
        family inet {
            address 10.0.0.45/30;
        }
    }
}
lo0 {
    unit 0 {
        family inet {
            address 172.16.9.7/32;
        }
        family iso {
            address 49.0002.0172.0016.0907.00;
        }
    }
}
```

```
user@R2# show protocols
isis {
    export [ ospf-isis send-direct-to-isis-neighbors ];
    interface fe-1/2/1.0;
    interface lo0.0;
}
ospf {
    export send-direct-to-ospf-neighbors;
    area 0.0.0.1 {
        interface fe-1/2/0.0;
        interface lo0.0 {
            passive;
        }
    }
}
```

```
user@R2# show policy-options
policy-statement ospf-isis {
    term 1 {
        from {
            protocol ospf;
            route-filter 192.168.0.0/22 longer;
        }
        then accept;
    }
}
policy-statement send-direct-to-isis-neighbors {
    from {
        protocol direct;
        route-filter 10.0.0.44/30 exact;
    }
    then accept;
}
policy-statement send-direct-to-ospf-neighbors {
    from {
        protocol direct;
        route-filter 10.0.0.36/30 exact;
    }
    then accept;
}
```

Device R3

```
user@R3# show interfaces
fe-1/2/0 {
    unit 0 {
        family inet {
            address 10.0.0.46/30;
        }
    }
}
lo0 {
    unit 0 {
        family inet {
            address 192.168.1.1/32;
            address 192.168.2.1/32;
            address 192.168.3.1/32;
            address 192.168.0.1/32;
        }
```

```
  }
}

user@R3# show protocols
ospf {
  export ospf;
  area 0.0.0.1 {
    interface fe-1/2/0.0;
    interface lo0.0 {
      passive;
    }
  }
}

user@R3# show policy-options
policy-statement ospf {
  term 1 {
    from protocol static;
    then accept;
  }
}

user@R3# show routing-options
static {
  route 192.168.0.0/24 discard;
  route 192.168.1.0/24 discard;
  route 192.168.3.0/24 discard;
  route 192.168.2.0/24 discard;
}
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

Confirm that the configuration is working properly.

- Verifying OSPF Route Advertisement on page 40
- Verifying Route Redistribution on page 41
- Verifying Connectivity on page 42

Verifying OSPF Route Advertisement

Purpose Make sure that the expected routes are advertised by OSPF.

Action From operational mode on Device R2, enter the **show route protocol ospf** command.

```
user@R2> show route protocol ospf


inet.0: 15 destinations, 15 routes (15 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

192.168.0.0/24     *[OSPF/150] 03:54:21, metric 0, tag 0
                    > to 10.0.0.46 via fe-1/2/0.0
192.168.0.1/32     *[OSPF/10] 03:54:21, metric 1
                    > to 10.0.0.46 via fe-1/2/0.0
```

```
192.168.1.0/24     *[OSPF/150] 03:54:21, metric 0, tag 0
                    > to 10.0.0.46 via fe-1/2/0.0
192.168.1.1/32     *[OSPF/10] 03:54:21, metric 1
                    > to 10.0.0.46 via fe-1/2/0.0
192.168.2.0/24     *[OSPF/150] 03:54:21, metric 0, tag 0
                    > to 10.0.0.46 via fe-1/2/0.0
192.168.2.1/32     *[OSPF/10] 03:54:21, metric 1
                    > to 10.0.0.46 via fe-1/2/0.0
192.168.3.0/24     *[OSPF/150] 03:54:21, metric 0, tag 0
                    > to 10.0.0.46 via fe-1/2/0.0
192.168.3.1/32     *[OSPF/10] 03:54:21, metric 1
                    > to 10.0.0.46 via fe-1/2/0.0
224.0.0.5/32       *[OSPF/10] 03:56:03, metric 1
                          MultiRecv

iso.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
```

Meaning The 192.168/16 routes are advertised by OSPF.

Verifying Route Redistribution

Purpose Make sure that the expected routes are redistributed from OSPF into IS-IS.

Action From operational mode on Device R1, enter the **show route protocol isis** command.

```
user@R1> show route protocol isis


inet.0: 13 destinations, 13 routes (13 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.0.0.44/30       *[IS-IS/160] 03:45:24, metric 20
                    > to 10.0.0.37 via fe-1/2/0.0
172.16.9.7/32      *[IS-IS/15] 03:49:46, metric 10
                    > to 10.0.0.37 via fe-1/2/0.0
192.168.0.0/24     *[IS-IS/160] 03:49:46, metric 10
                    > to 10.0.0.37 via fe-1/2/0.0
192.168.0.1/32     *[IS-IS/160] 03:49:46, metric 11, tag2 1
                    > to 10.0.0.37 via fe-1/2/0.0
192.168.1.0/24     *[IS-IS/160] 03:49:46, metric 10
                    > to 10.0.0.37 via fe-1/2/0.0
192.168.1.1/32     *[IS-IS/160] 03:49:46, metric 11, tag2 1
                    > to 10.0.0.37 via fe-1/2/0.0
192.168.2.0/24     *[IS-IS/160] 03:49:46, metric 10
                    > to 10.0.0.37 via fe-1/2/0.0
192.168.2.1/32     *[IS-IS/160] 03:49:46, metric 11, tag2 1
                    > to 10.0.0.37 via fe-1/2/0.0
192.168.3.0/24     *[IS-IS/160] 03:49:46, metric 10
                    > to 10.0.0.37 via fe-1/2/0.0
192.168.3.1/32     *[IS-IS/160] 03:49:46, metric 11, tag2 1
                    > to 10.0.0.37 via fe-1/2/0.0

iso.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
```

Meaning The 192.168/16 routes are redistributed into IS-IS.

Verifying Connectivity

Purpose Check that Device R1 can reach the destinations on Device R3.

Action From operational mode, enter the **ping** command.

```
user@R1> ping 192.168.1.1
PING 192.168.1.1 (192.168.1.1): 56 data bytes
64 bytes from 192.168.1.1: icmp_seq=0 ttl=63 time=2.089 ms
64 bytes from 192.168.1.1: icmp_seq=1 ttl=63 time=1.270 ms
64 bytes from 192.168.1.1: icmp_seq=2 ttl=63 time=2.135 ms
```

Meaning These results confirm that Device R1 can reach the destinations in the OSPF network.

Related Documentation
- *Understanding Routing Policies*

Example: Configuring BFD for IS-IS

This example describes how to configure the Bidirectional Forwarding Detection (BFD) protocol to detect failures in an IS-IS network.

Requirements

Before you begin, configure IS-IS on both routers. See "Example: Configuring IS-IS" on page 15 for information about the required IS-IS configuration.

This example uses the following hardware and software components:

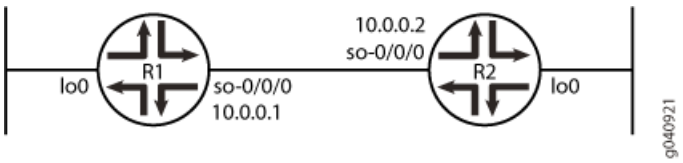
- Junos OS Release 7.3 or later
- M Series, MX Series, and T Series routers

Overview

This example shows two routers connected to each other. A loopback interface is configured on each router. IS-IS and BFD protocols are configured on both routers.

Figure 6 on page 42 shows the sample network.

Figure 6: Configuring BFD for IS-IS



Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

Router R1

```
set protocols isis interface so-0/0/0 bfd-liveness-detection detection-time threshold 5
set protocols isis interface so-0/0/0 bfd-liveness-detection minimum-interval 2
set protocols isis interface so-0/0/0 bfd-liveness-detection minimum-receive-interval 1
set protocols isis interface so-0/0/0 bfd-liveness-detection no-adaptation
set protocols isis interface so-0/0/0 bfd-liveness-detection transmit-interval threshold 3
set protocols isis interface so-0/0/0 bfd-liveness-detection transmit-interval
  minimum-interval 1
set protocols isis interface so-0/0/0 bfd-liveness-detection multiplier 2
set protocols isis interface so-0/0/0 bfd-liveness-detection version automatic
```

Router R2

```
set protocols isis interface so-0/0/0 bfd-liveness-detection detection-time threshold 6
set protocols isis interface so-0/0/0 bfd-liveness-detection minimum-interval 3
set protocols isis interface so-0/0/0 bfd-liveness-detection minimum-receive-interval 1
set protocols isis interface so-0/0/0 bfd-liveness-detection no-adaptation
set protocols isis interface so-0/0/0 bfd-liveness-detection transmit-interval threshold 4
set protocols isis interface so-0/0/0 bfd-liveness-detection transmit-interval
  minimum-interval 1
set protocols isis interface so-0/0/0 bfd-liveness-detection multiplier 2
set protocols isis interface so-0/0/0 bfd-liveness-detection version automatic
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode*.

NOTE: To simply configure BFD for IS-IS, only the **minimum-interval** statement is required. The BFD protocol selects default parameters for all the other configuration statements when you use the **bfd-liveness-detection** statement without specifying any parameters.

NOTE: You can change parameters at any time without stopping or restarting the existing session. BFD automatically adjusts to the new parameter value. However, no changes to BFD parameters take place until the values resynchronize with each BFD peer.

To configure BFD for IS-IS on Routers R1 and R2:

1. Enable BFD failure detection for IS-IS.

```
[edit protocols isis]
user@R1# set interface so-0/0/0 bfd-liveness-detection

[edit protocols isis]
user@R2# set interface so-0/0/0 bfd-liveness-detection
```

2. Configure the threshold for the adaptation of the detection time, which must be greater than the multiplier number multiplied by the minimum interval.

```
[edit protocols isis interface so-0/0/0 bfd-liveness-detection]
user@R1# set detection-time threshold 5

[edit protocols isis interface so-0/0/0 bfd-liveness-detection]
user@R2# set detection-time threshold 6
```

3. Configure the minimum transmit and receive intervals for failure detection.

```
[edit protocols isis interface so-0/0/0 bfd-liveness-detection]
user@R1# set minimum-interval 2

[edit protocols isis interface so-0/0/0 bfd-liveness-detection]
user@R2# set minimum-interval 3
```

4. Configure only the minimum receive interval for failure detection.

```
[edit protocols isis interface so-0/0/0 bfd-liveness-detection]
user@R1# set minimum-receive-interval 1

[edit protocols isis interface so-0/0/0 bfd-liveness-detection]
user@R2# set minimum-receive-interval 1
```

5. Disable BFD adaptation.

```
[edit protocols isis interface so-0/0/0 bfd-liveness-detection]
user@R1# set no-adaptation

[edit protocols isis interface so-0/0/0 bfd-liveness-detection]
user@R2# set no-adaptation
```

6. Configure the threshold for the transmit interval, which must be greater than the minimum transmit interval.

```
[edit protocols isis interface so-0/0/0 bfd-liveness-detection]
user@R1# set transmit-interval threshold 3

[edit protocols isis interface so-0/0/0 bfd-liveness-detection]
user@R2# set transmit-interval threshold 4
```

7. Configure the minimum transmit interval for failure detection.

```
[edit protocols isis interface so-0/0/0 bfd-liveness-detection]
user@R1# set transmit-interval minimum-interval 1

[edit protocols isis interface so-0/0/0 bfd-liveness-detection]
user@R2# set transmit-interval minimum-interval 1
```

8. Configure the multiplier number, which is the number of hello packets not received by the neighbor that causes the originating interface to be declared down.

```
[edit protocols isis interface so-0/0/0 bfd-liveness-detection]
user@R1# set multiplier 2

[edit protocols isis interface so-0/0/0 bfd-liveness-detection]
user@R2# set multiplier 2
```

9. Configure the BFD version used for detection.

   The default is to have the version detected automatically.

   ```
   [edit protocols isis interface so-0/0/0 bfd-liveness-detection]
   user@R1# set version automatic
   ```

   ```
   [edit protocols isis interface so-0/0/0 bfd-liveness-detection]
   user@R2# set version automatic
   ```

Results

From configuration mode, confirm your configuration by issuing the **show protocols isis interface** command. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@R1# show protocols isis interface so-0/0/0

    bfd-liveness-detection {
        version automatic;
        minimum-interval 2;
        minimum-receive-interval 1;
        multiplier 2;
        no-adaptation;
        transmit-interval {
            minimum-interval 1;
            threshold 3;
        }
        detection-time {
            threshold 5;
        }
}
...
```

```
user@R2# show protocols isis interface so-0/0/0

    bfd-liveness-detection {
        version automatic;
        minimum-interval 3;
        minimum-receive-interval 1;
        multiplier 2;
        no-adaptation;
        transmit-interval {
            minimum-interval 1;
            threshold 4;
        }
        detection-time {
            threshold 6;
        }
}
...
```

Verification

Confirm that the configuration is working properly.

Verifying the Connection Between Routers R1 and R2

Purpose Make sure that Routers R1 and R2 are connected to each other.

Action Ping the other router to check the connectivity between the two routers as per the network topology.

```
user@R1> ping 10.0.0.2

PING 10.0.0.2 (10.0.0.2): 56 data bytes
64 bytes from 10.0.0.2: icmp_seq=0 ttl=64 time=1.367 ms
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=1.662 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=1.291 ms
^C
--- 10.0.0.2 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 1.291/1.440/1.662/0.160 ms

user@R2> ping 10.0.0.1

PING 10.0.0.1 (10.0.0.1): 56 data bytes
64 bytes from 10.0.0.1: icmp_seq=0 ttl=64 time=1.287 ms
64 bytes from 10.0.0.1: icmp_seq=1 ttl=64 time=1.310 ms
64 bytes from 10.0.0.1: icmp_seq=2 ttl=64 time=1.289 ms
^C
--- 10.0.0.1 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 1.287/1.295/1.310/0.010 ms
```

Meaning Routers R1 and R2 are connected to each other.

Verifying That IS-IS Is Configured

Purpose Make sure that the IS-IS instance is running on both routers.

Action Use the **show isis database** statement to check if the IS-IS instance is running on both routers, R1 and R2.

```
user@R1> show isis database

IS-IS level 1 link-state database:
LSP ID          Sequence Checksum Lifetime Attributes
R1.00-00        0x4a571   0x30c5     1195 L1 L2
R2.00-00        0x4a586   0x4b7e     1195 L1 L2
R2.02-00        0x330ca1  0x3492     1196 L1 L2
  3 LSPs
```

```
IS-IS level 2 link-state database:
LSP ID         Sequence Checksum Lifetime Attributes
R1.00-00       0x4a856   0x5db0     1194 L1 L2
R2.00-00       0x4a89d   0x149b     1194 L1 L2
R2.02-00       0x1fb2ff  0xd302     1194 L1 L2
  3 LSPs

user@R2> show isis database

IS-IS level 1 link-state database:
LSP ID            Sequence Checksum Lifetime Attributes
R1.00-00          0x4b707   0xcc80     1195 L1 L2
R2.00-00          0x4b71b   0xeb37     1198 L1 L2
R2.02-00          0x33c2ce  0xb52d     1198 L1 L2
  3 LSPs

IS-IS level 2 link-state database:
LSP ID             Sequence Checksum Lifetime Attributes
R1.00-00           0x4b9f2   0xee70     1192 L1 L2
R2.00-00           0x4ba41   0x9862     1197 L1 L2
R2.02-00               0x3   0x6242     1198 L1 L2
  3 LSPs
```

Meaning IS-IS is configured on both routers, R1 and R2.

Verifying That BFD Is onfigured

Purpose Make sure that the BFD instance is running on both routers, R1 and R2.

Action Use the **show bfd session detail** statement to check if BFD instance is running on the routers.

```
user@R1> show bfd session detail
                                                Detect   Transmit
Address                 State     Interface     Time     Interval  Multiplier
10.0.0.2                Up        so-0/0/0     2.000     1.000        2
 Client ISIS R2, TX interval 0.001, RX interval 0.001
 Client ISIS R1, TX interval 0.001, RX interval 0.001
 Session down time 00:00:00, previous up time 00:00:15
 Local diagnostic NbrSignal, remote diagnostic NbrSignal
 Remote state AdminDown, version 1
 Router 3, routing table index 17

1 sessions, 2 clients
Cumulative transmit rate 1.0 pps, cumulative receive rate 1.0 pps

user@R2> show bfd session detail
                                                Detect   Transmit
Address                 State     Interface     Time     Interval  Multiplier
10.0.0.1                Up        so-0/0/0     2.000     1.000        2
 Client ISIS R2, TX interval 0.001, RX interval 0.001
 Session down time 00:00:00, previous up time 00:00:05
 Local diagnostic NbrSignal, remote diagnostic NbrSignal
 Remote state AdminDown, version 1
 Router 2, routing table index 15

1 sessions, 1 clients
Cumulative transmit rate 1.0 pps, cumulative receive rate 1.0 pps
```

Meaning BFD is configured on Routers R1 and R2 for detecting failures in the IS-IS network.

Related Documentation
- *Understanding BFD for IS-IS*

Example: Configuring BFD Authentication for IS-IS

This example shows how to configure BFD authentication for IS-IS.

Requirements

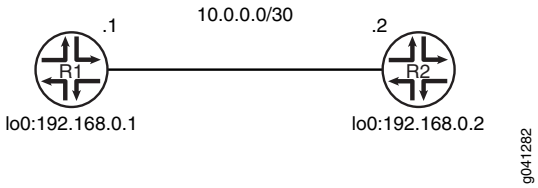
Before you begin, configure IS-IS on both routers. See "Example: Configuring IS-IS" on page 15 for information about the required IS-IS configuration.

Overview

In this example, a BFD authentication keychain is configured with meticulous keyed MD5 authentication.

Figure 7 on page 48 shows the topology used in this example.

Figure 7: IS-IS BFD Authentication Topology



"CLI Quick Configuration" on page 48 shows the configuration for both of the devices in Figure 7 on page 48. The section "Step-by-Step Procedure" on page 49 describes the steps on Device R1.

Configuration

CLI Quick Configuration To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

Device R1

```
set security authentication-key-chains key-chain secret123 description for-isis-bfd
set security authentication-key-chains key-chain secret123 key 1 secret "$9$cW-yrv"
set security authentication-key-chains key-chain secret123 key 1 start-time
   "2012-5-31.13:00:00 -0700"
set security authentication-key-chains key-chain secret123 key 2 secret "$9$m5T3"
```

```
set security authentication-key-chains key-chain secret123 key 2 start-time
  "2013-5-31.13:00:00 -0700"
set security authentication-key-chains key-chain secret123 key 3 secret "$9$mTQn"
set security authentication-key-chains key-chain secret123 key 3 start-time
  "2014-5-31.13:00:00 -0700"
set protocols isis interface ge-1/2/0.0 bfd-liveness-detection minimum-interval 100
set protocols isis interface ge-1/2/0.0 bfd-liveness-detection authentication key-chain
  secret123
set protocols isis interface ge-1/2/0.0 bfd-liveness-detection authentication algorithm
  meticulous-keyed-md5
```

Device R2

```
set security authentication-key-chains key-chain secret123 description for-isis-bfd
set security authentication-key-chains key-chain secret123 key 1 secret "$9$cW-yrv"
set security authentication-key-chains key-chain secret123 key 1 start-time
  "2012-5-31.13:00:00 -0700"
set security authentication-key-chains key-chain secret123 key 2 secret "$9$m5T3"
set security authentication-key-chains key-chain secret123 key 2 start-time
  "2013-5-31.13:00:00 -0700"
set security authentication-key-chains key-chain secret123 key 3 secret "$9$mTQn"
set security authentication-key-chains key-chain secret123 key 3 start-time
  "2014-5-31.13:00:00 -0700"
set protocols isis interface ge-1/2/0.0 bfd-liveness-detection minimum-interval 100
set protocols isis interface ge-1/2/0.0 bfd-liveness-detection authentication key-chain
  secret123
set protocols isis interface ge-1/2/0.0 bfd-liveness-detection authentication algorithm
  meticulous-keyed-md5
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure IS-IS BFD authentication:

1. Configure the authentication keychain.

   ```
   [edit security authentication-key-chains key-chain secret123]
   user@R1# set description for-isis-bfd
   user@R1# set key 1 secret "$9$cW-yrv"
   user@R1# set key 1 start-time "2012-5-31.13:00:00 -0700"
   user@R1# set key 2 secret "$9$m5T3"
   user@R1# set key 2 start-time "2013-5-31.13:00:00 -0700"
   user@R1# set key 3 secret "$9$mTQn"
   user@R1# set key 3 start-time "2014-5-31.13:00:00 -0700"
   ```

2. Enable BFD.

   ```
   [edit protocols isis interface ge-1/2/0.0 bfd-liveness-detection]
   user@R1# set minimum-interval 100
   ```

3. Apply the authentication keychain.

   ```
   [edit protocols isis interface ge-1/2/0.0 bfd-liveness-detection]
   user@R1# set authentication key-chain secret123
   ```

4. Set the authentication type.

   ```
   [edit protocols isis interface ge-1/2/0.0 bfd-liveness-detection]
   user@R1# set authentication algorithm meticulous-keyed-md5
   ```

Results From configuration mode, confirm your configuration by entering the **show protocols** and **show security** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@R1# show protocols
isis {
  interface ge-1/2/0.0 {
    bfd-liveness-detection {
      minimum-interval 100;
      authentication {
        key-chain secret123;
        algorithm meticulous-keyed-md5;
      }
    }
  }
}
```

```
user@R1# show security
authentication-key-chains {
  key-chain secret123 {
    description for-isis-bfd;
    key 1 {
      secret "$9$cW-yrv"; ## SECRET-DATA
      start-time "2012-5-31.13:00:00 -0700";
    }
    key 2 {
      secret "$9$m5T3"; ## SECRET-DATA
      start-time "2013-5-31.13:00:00 -0700";
    }
    key 3 {
      secret "$9$mTQn"; ## SECRET-DATA
      start-time "2014-5-31.13:00:00 -0700";
    }
  }
}
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

Confirm that the configuration is working properly.

Verifying IS-IS BFD Authentication

Purpose Verify the status of IS-IS BFD authentication.

Action From operational mode, enter the **show bfd session extensive** command.

```
user@R1> show bfd session extensive
                                                  Detect   Transmit
Address                 State     Interface       Time     Interval  Multiplier
10.0.0.2                Down      ge-1/2/0.0      0.300     1.000        3
 Client ISIS L1, TX interval 0.100, RX interval 0.100, Authenticate
        keychain secret123, algo meticulous-keyed-md5, mode strict
 Client ISIS L2, TX interval 0.100, RX interval 0.100, Authenticate
        keychain secret123, algo meticulous-keyed-md5, mode strict
```

```
 Session down time 00:35:13, previous up time 00:12:17
 Local diagnostic None, remote diagnostic None
 Remote state Up, version 1
 Logical system 2, routing table index 85
 Min async interval 0.100, min slow interval 1.000
 Adaptive async TX interval 0.100, RX interval 0.100
 Local min TX interval 1.000, minimum RX interval 0.100, multiplier 3
 Remote min TX interval 0.100, min RX interval 0.100, multiplier 3
 Local discriminator 2, remote discriminator 1
 Echo mode disabled/inactive, no-absorb, no-refresh
 Authentication enabled/active, keychain secret123, algo meticulous-keyed-md5,
mode strict
   Session ID: 0x100101

1 sessions, 2 clients
Cumulative transmit rate 1.0 pps, cumulative receive rate 10.0 pps
```

Meaning The output shows that BFD authentication is enabled on IS-IS Level 1 and Level 2.

Related Documentation

- *Configuring BFD Authentication for IS-IS*
- *Example: Configuring BFD for IS-IS*

Example: Configuring IS-IS IPv4 and IPv6 Unicast Topologies

Understanding IS-IS IPv4 and IPv6 Unicast Topologies

You can configure IS-IS to calculate an alternate IPv6 unicast topology, in addition to the normal IPv4 unicast topology, and add the corresponding routes to inet6.0. The IS-IS interface metrics for the IPv4 topology can be configured independently of the IPv6 metrics. You can also selectively disable interfaces from participating in the IPv6 topology while continuing to participate in the IPv4 topology. This enables you to exercise control over the paths that unicast data takes through a network.

A topology is the set of joined nodes. IS-IS evaluates all the paths in a single topology for each IS-IS level and uses the shortest-path-first (SPF) algorithm to determine the best path among all the feasible paths. Topology discovery and SPF calculation is performed in a protocol-neutral fashion because it is done at Layer 2 of the OSI model. If you load the topology with reachability information for a certain protocol (for example, IP), the assumption is that the circuits that are supposed to provide reachability between routing devices can carry the protocol. The SPF algorithm has a per-link orientation, not a per-address family or per-protocol orientation.

Multitopology routing enables you to override this default behavior by enabling a per-address family, per-protocol SPF calculation.

The additional CPU load associated with multiple runs of the SPF algorithm is generally not an issue with the processing power available on today's routing device control planes.

The multitopology extensions alter existing type, length, and value (TLV) tuples by adding a topology ID. Each routing device in a given topology maintains its adjacencies and runs a per-topology SPF calculation.

Example: Configuring IS-IS IPv4 and IPv6 Unicast Topologies

This example shows how to configure IS-IS to calculate an alternate IPv6 unicast topology, in addition to the normal IPv4 unicast topology.

Requirements

No special configuration beyond device initialization is required before configuring this example.

Overview

This example focuses on IPv4 and IPv6 unicast topologies. The IS-IS interface metrics for the IPv4 topology can be configured independently of the IPv6 metrics. You can also selectively disable interfaces from participating in the IPv6 topology while continuing to participate in the IPv4 topology. This enables you to exercise control over the paths that unicast data takes through a network.

To enable an IPv6 unicast topology for IS-IS, include the **ipv6-unicast** statement:

```
isis {
  topologies {
    ipv6-unicast;
  }
}
```

To configure a metric for the IPv6 unicast topology, include the **ipv6-unicast-metric** statement:

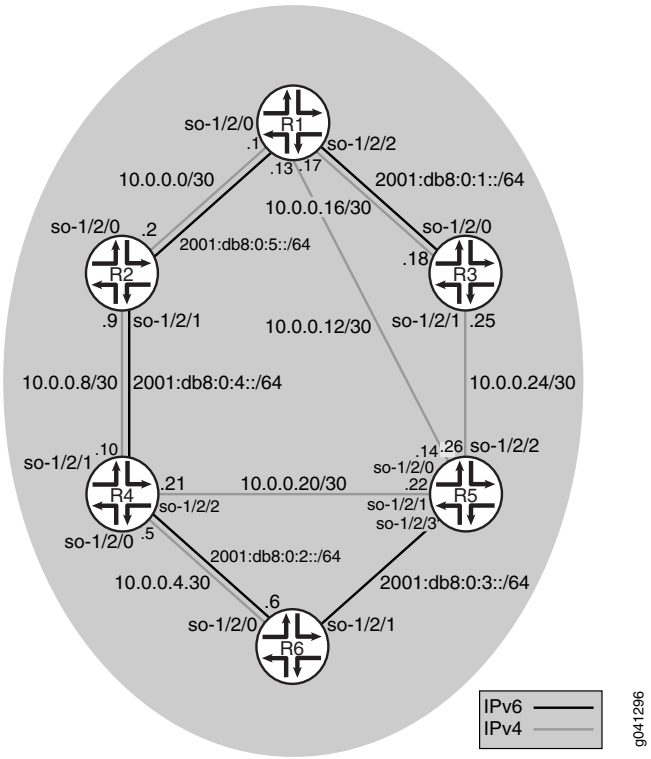
```
isis {
  interface interface-name {
    level level-number {
      ipv6-unicast-metric number;
    }
  }
}
```

To exclude an interface from the IPv6 unicast topologies for IS-IS, include the **no-ipv6-unicast** statement:

```
isis {
  interface interface-name {
    no-ipv6-unicast;
  }
}
```

Figure 8 on page 53 shows the topology used in this example. The black lines indicate link membership in the IPv6 topology. The gray lines indicate membership to the IPv4 topology. Using regular TLVs, it would not be possible to build multiple topologies and run an SPF calculation based on them. The multitopology extensions describe an extension to carry the set of supported protocols in the hello packet. After activating multitopology routing support on a link, the link carries all the topologies that the underlying circuit is able to relay.

Figure 8: IS-IS IPv4 and IPv6 Unicast Topologies



"CLI Quick Configuration" on page 53 shows the configuration for all of the devices in Figure 8 on page 53. The section "Step-by-Step Procedure" on page 55 describes the steps on Device R1.

Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

Device R1

```
set interfaces so-1/2/0 unit 0 family inet address 10.0.0.1/30
set interfaces so-1/2/0 unit 0 family iso
set interfaces so-1/2/0 unit 0 family inet6 address 2001:db8:0:5::/64 eui-64
set interfaces so-1/2/1 unit 0 family inet address 10.0.0.13/30
set interfaces so-1/2/1 unit 0 family iso
set interfaces so-1/2/2 unit 0 family inet address 10.0.0.17/30
set interfaces so-1/2/2 unit 0 family iso
```

```
set interfaces so-1/2/2 unit 0 family inet6 address 2001:db8:0:1::/64 eui-64
set interfaces lo0 unit 0 family inet address 192.168.0.1/32
set interfaces lo0 unit 0 family iso address 49.0002.0192.0168.0001.00
set interfaces lo0 unit 0 family inet6 address 2001:db8::1/128
set protocols isis topologies ipv6-unicast
set protocols isis interface so-1/2/0.0
set protocols isis interface so-1/2/1.0 no-ipv6-unicast
set protocols isis interface so-1/2/2.0
set protocols isis interface lo0.0
```

Device R2

```
set interfaces so-1/2/0 unit 0 family inet address 10.0.0.2/30
set interfaces so-1/2/0 unit 0 family iso
set interfaces so-1/2/0 unit 0 family inet6 address 2001:db8:0:5::/64 eui-64
set interfaces so-1/2/1 unit 0 family inet address 10.0.0.9/30
set interfaces so-1/2/1 unit 0 family iso
set interfaces so-1/2/1 unit 0 family inet6 address 2001:db8:0:4::/64 eui-64
set interfaces lo0 unit 0 family inet address 192.168.0.2/32
set interfaces lo0 unit 0 family iso address 49.0002.0192.0168.0002.00
set interfaces lo0 unit 0 family inet6 address 2001:db8::2/128
set protocols isis topologies ipv6-unicast
set protocols isis interface so-1/2/0.2
set protocols isis interface so-1/2/1.0
set protocols isis interface lo0.0
```

Device R3

```
set interfaces so-1/2/0 unit 0 family inet address 10.0.0.18/30
set interfaces so-1/2/0 unit 0 family iso
set interfaces so-1/2/0 unit 0 family inet6 address 2001:db8:0:1::/64 eui-64
set interfaces so-1/2/1 unit 0 family inet address 10.0.0.25/30
set interfaces so-1/2/1 unit 0 family iso
set interfaces lo0 unit 0 family inet address 192.168.0.3/32
set interfaces lo0 unit 0 family iso address 49.0002.0192.0168.0003.00
set interfaces lo0 unit 0 family inet6 address 2001:db8::3/128
set protocols isis topologies ipv6-unicast
set protocols isis interface so-1/2/0.0
set protocols isis interface so-1/2/1.0 no-ipv6-unicast
set protocols isis interface lo0.0
```

Device R4

```
set interfaces so-1/2/0 unit 0 family inet address 10.0.0.5/30
set interfaces so-1/2/0 unit 0 family iso
set interfaces so-1/2/0 unit 0 family inet6 address 2001:db8:0:2::/64 eui-64
set interfaces so-1/2/1 unit 0 family inet address 10.0.0.10/30
set interfaces so-1/2/1 unit 0 family iso
set interfaces so-1/2/1 unit 0 family inet6 address 2001:db8:0:1::/64 eui-64
set interfaces so-1/2/2 unit 0 family inet address 10.0.0.21/30
set interfaces so-1/2/2 unit 0 family iso
set interfaces lo0 unit 0 family inet address 192.168.0.4/32
set interfaces lo0 unit 0 family iso address 49.0002.0192.0168.0004.00
set interfaces lo0 unit 0 family inet6 address 2001:db8::4/128
set protocols isis topologies ipv6-unicast
set protocols isis interface so-1/2/0.0
set protocols isis interface so-1/2/1.0
set protocols isis interface so-1/2/2.0 no-ipv6-unicast
set protocols isis interface lo0.0
```

Device R5

```
set interfaces so-1/2/0 unit 0 family inet address 10.0.0.14/30
```

```
set interfaces so-1/2/0 unit 0 family iso
set interfaces so-1/2/1 unit 0 family inet address 10.0.0.22/30
set interfaces so-1/2/1 unit 0 family iso
set interfaces so-1/2/2 unit 0 family inet address 10.0.0.26/30
set interfaces so-1/2/2 unit 0 family iso
set interfaces so-1/2/3 unit 0 family iso
set interfaces so-1/2/3 unit 0 family inet6 address 2001:db8:0:3::/64 eui-64
set interfaces lo0 unit 0 family inet address 192.168.0.5/32
set interfaces lo0 unit 0 family iso address 49.0002.0192.0168.0005.00
set interfaces lo0 unit 0 family inet6 address 2001:db8::5/128
set protocols isis topologies ipv6-unicast
set protocols isis interface so-1/2/0.0 no-ipv6-unicast
set protocols isis interface so-1/2/1.0 no-ipv6-unicast
set protocols isis interface so-1/2/2.0 no-ipv6-unicast
set protocols isis interface so-1/2/3.0
set protocols isis interface lo0.0
```

Device R6

```
set interfaces so-1/2/0 unit 0 family inet address 10.0.0.6/30
set interfaces so-1/2/0 unit 0 family iso
set interfaces so-1/2/0 unit 0 family inet6 address 2001:db8:0:2::/64 eui-64
set interfaces so-1/2/1 unit 0 family iso
set interfaces so-1/2/1 unit 0 family inet6 address 2001:db8:0:3::/64 eui-64
set interfaces lo0 unit 0 family inet address 192.168.0.6/32
set interfaces lo0 unit 0 family iso address 49.0002.0192.0168.0006.00
set interfaces lo0 unit 0 family inet6 address 2001:db8::6/128
set protocols isis topologies ipv6-unicast
set protocols isis interface so-1/2/0.0
set protocols isis interface so-1/2/1.0
set protocols isis interface lo0.0
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure an alternate IPv6 unicast topology:

1. Configure the interfaces.

```
[edit interfaces]
user@R1# set so-1/2/0 unit 0 family inet address 10.0.0.1/30
user@R1# set so-1/2/0 unit 0 family iso
user@R1# set so-1/2/0 unit 0 family inet6 address 2001:db8:0:5::/64 eui-64
user@R1# set so-1/2/1 unit 0 family inet address 10.0.0.13/30
user@R1# set so-1/2/1 unit 0 family iso
user@R1# set so-1/2/2 unit 0 family inet address 10.0.0.17/30
user@R1# set so-1/2/2 unit 0 family iso
user@R1# set so-1/2/2 unit 0 family inet6 address 2001:db8:0:1::/64 eui-64
user@R1# set lo0 unit 0 family inet address 192.168.0.1/32
user@R1# set lo0 unit 0 family iso address 49.0002.0192.0168.0001.00
user@R1# set lo0 unit 0 family inet6 address 2001:db8::1/128
```

2. Enable IS-IS on the interfaces.

```
[edit protocols isis]
user@R1# set interface so-1/2/0.0
user@R1# set interface so-1/2/1.0
```

```
user@R1# set interface so-1/2/2.0
user@R1# set interface lo0.0
```

3. Enable multitopology routing on the IS-IS interfaces.

   The **ipv6-unicast** statement enables multitopology IS-IS routing on all interfaces that have **family iso** and **family inet6** configured and are listed at the **[edit protocols isis interface]** hierarchy level.

   ```
   [edit protocols isis]
   user@R1# set topologies ipv6-unicast
   ```

4. Disable IPv6 unicast support on a given interface.

   If you do not want to run multitopology IS-IS routing for IPv6 on a given interface, you can disable multitopology routing by including the **no-ipv6-unicast** statement in the IS-IS interface configuration.

   ```
   [edit protocols isis]
   user@R1# set interface so-1/2/1.0 no-ipv6-unicast
   ```

Results From configuration mode, confirm your configuration by entering the **show interfaces** and **show protocols** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@R1# show interfaces
so-1/2/0 {
  unit 0 {
    family inet {
      address 10.0.0.1/30;
    }
    family iso;
    family inet6 {
      address 2001:db8:0:5::/64 {
        eui-64;
      }
    }
  }
}
so-1/2/1 {
  unit 0 {
    family inet {
      address 10.0.0.13/30;
    }
    family iso;
  }
}
so-1/2/2 {
  unit 0 {
    family inet {
      address 10.0.0.17/30;
    }
    family iso;
    family inet6 {
      address 2001:db8:0:1::/64 {
        eui-64;
```



```
        }
      }
    }
  }
  lo0 {
    unit 0 {
      family inet {
        address 192.168.0.1/32;
      }
      family iso {
        address 49.0002.0192.0168.0001.00;
      }
      family inet6 {
        address 2001:db8::1/128;
      }
    }
  }

  user@R1# show protocols
  isis {
    topologies ipv6-unicast;
    interface so-1/2/0.0;
    interface so-1/2/1.0 {
      no-ipv6-unicast;
    }
    interface so-1/2/2.0;
    interface lo0.0;
  }
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

Confirm that the configuration is working properly.

- Checking the Topologies on Neighbors on page 57
- Checking the IS-IS SPF Calculations on page 58
- Checking the Tcpdump Output on page 59

Checking the Topologies on Neighbors

Purpose Determine what topologies are supported on neighboring IS-IS devices.

Action From operational mode, enter the **show isis adjacency detail** command.

```
user@R1> show isis adjacency detail

R2
  Interface: so-1/2/0.0, Level: 3, State: Up, Expires in 24 secs
  Priority: 0, Up/Down transitions: 1, Last transition: 05:28:16 ago
  Circuit type: 3, Speaks: IP, IPv6
  Topologies: Unicast, IPV6-Unicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  IP addresses: 10.0.0.2
  IPv6 addresses: fe80::2a0:a514:0:24c

R5
```

```
  Interface: so-1/2/1.0, Level: 3, State: Up, Expires in 21 secs
  Priority: 0, Up/Down transitions: 1, Last transition: 05:27:47 ago
  Circuit type: 3, Speaks: IP, IPv6
  Topologies: Unicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  IP addresses: 10.0.0.14

R3
  Interface: so-1/2/2.0, Level: 3, State: Up, Expires in 22 secs
  Priority: 0, Up/Down transitions: 1, Last transition: 05:27:25 ago
  Circuit type: 3, Speaks: IP, IPv6
  Topologies: Unicast, IPV6-Unicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  IP addresses: 10.0.0.18
  IPv6 addresses: fe80::2a0:a514:0:124c
```

Meaning As expected, the adjacency with Device R5 only supports the IPv4 unicast topology, while the adjacencies with Device R2 and Device R3 support both the IPv4 and IPv6 topologies.

Checking the IS-IS SPF Calculations

Purpose Verify that separate SPF calculations are being run for IPv4 and IPv6.

Action From operational mode, enter the **show isis spf brief** command.

```
user@R1> show isis spf brief
IPV4 Unicast IS-IS level 1 SPF results:
Node             Metric     Interface        NH   Via             SNPA
R6.00        20         so-1/2/1.0      IPV4 R5
R4.00        20         so-1/2/0.0       IPV4 R2
R5.00        10         so-1/2/1.0      IPV4 R5
R3.00        10         so-1/2/2.0      IPV4 R3
R2.00        10         so-1/2/0.0       IPV4 R2
R1.00        0
  6 nodes

IPV4 Unicast IS-IS level 2 SPF results:
Node             Metric     Interface        NH   Via             SNPA
R6.00        20         so-1/2/1.0      IPV4 R5
R4.00        20         so-1/2/0.0       IPV4 R2
R5.00        10         so-1/2/1.0      IPV4 R5
R3.00        10         so-1/2/2.0      IPV4 R3
R2.00        10         so-1/2/0.0       IPV4 R2
R1.00        0
  6 nodes

IPV6 Unicast IS-IS level 1 SPF results:
Node             Metric     Interface        NH   Via             SNPA
R5.00        40         so-1/2/0.0       IPV6 R2
R6.00        30         so-1/2/0.0       IPV6 R2
R4.00        20         so-1/2/0.0       IPV6 R2
R3.00        10         so-1/2/2.0      IPV6 R3
R2.00        10         so-1/2/0.0       IPV6 R2
R1.00        0
  6 nodes

IPV6 Unicast IS-IS level 2 SPF results:
Node             Metric     Interface        NH   Via             SNPA
R5.00        40         so-1/2/0.0       IPV6 R2
R6.00        30         so-1/2/0.0       IPV6 R2
```



```
R4.00        20         so-1/2/0.0       IPV6 R2
R3.00        10         so-1/2/2.0      IPV6 R3
R2.00        10         so-1/2/0.0       IPV6 R2
R1.00        0
  6 nodes
```

Meaning As expected, SPF calculations are being performed for IPv4 and IPv6 topologies.

Checking the Tcpdump Output

Purpose Verify that the link can be a member of both the IPv4 unicast topology and the IPv6 unicast topology.

Action

```
user@R1> monitor traffic detail interface so-1/2/0.0
[...]

15:52:35.719540  In IS-IS, length 82
        p2p IIH, hlen: 20, v: 1, pdu-v: 1, sys-id-len: 6 (0), max-area: 3 (0)
          source-id: 0192.0168.0002, holding time: 27s, Flags: [Level 1, Level
2]
          circuit-id: 0x01, PDU length: 82
            Point-to-point Adjacency State TLV #240, length: 15
              Adjacency State: Up (0)
              Extended Local circuit-ID: 0x00000054
              Neighbor System-ID: 0192.0168.0001
              Neighbor Extended Local circuit-ID: 0x00000043
            Protocols supported TLV #129, length: 2
              NLPID(s): IPv4 (0xcc), IPv6 (0x8e)
            IPv4 Interface address(es) TLV #132, length: 4
              IPv4 interface address: 10.0.0.2
            IPv6 Interface address(es) TLV #232, length: 16
              IPv6 interface address: fe80::2a0:a514:0:24c
            Area address(es) TLV #1, length: 4
              Area address (length: 3): 49.0002
            Restart Signaling TLV #211, length: 3
              Flags [none], Remaining holding time 0s
            Multi Topology TLV #229, length: 4
              IPv4 unicast Topology (0x000), Flags: [none]
              IPv6 unicast Topology (0x002), Flags: [none]
```

Meaning The IS-IS hello (IIH) packet shows that IPv4 and IPv6 are supported. The hello packet lists valid IPv4 and IPv6 addresses, and therefore the routing device can create valid next-hop entries. The supported protocols are listed in the multitopology TLV #229.

Related Documentation

- *Example: Configuring IS-IS Dual Stacking of IPv4 and IPv6 Unicast Addresses*

Example: Configuring IS-IS Multicast Topology

IS-IS Multicast Topologies Overview

Most multicast routing protocols perform a reverse-path forwarding (RPF) check on the source of multicast data packets. If a packet comes in on the interface that is used to send data to the source, the packet is accepted and forwarded to one or more downstream interfaces. Otherwise, the packet is discarded and a notification is sent to the multicast routing protocol running on the interface.

In certain instances, the unicast routing table used for the RPF check is also the table used for forwarding unicast data packets. Thus, unicast and multicast routing are congruent. In other cases, where it is preferred that multicast routing be independent of unicast routing, the multicast routing protocols are configured to perform the RPF check using an alternate unicast routing table inet.2.

You can configure IS-IS to calculate an alternate IPv4 multicast topology, in addition to the normal IPv4 unicast topology, and add the corresponding routes to inet.2. The IS-IS interface metrics for the multicast topology can be configured independently of the unicast metrics. You can also selectively disable interfaces from participating in the multicast topology while continuing to participate in the regular unicast topology. This enables you to exercise control over the paths that multicast data takes through a network so that it is independent of unicast data paths. You can also configure IS-IS to calculate an alternate IPv6 multicast topology, in addition to the normal IPv6 unicast topology.

NOTE: **IS-IS only starts advertising the routes when the interface routes are in inet.2.**

Table 3 on page 60 lists the various IPv4 statements you can use to configure IS-IS topologies.

Table 3: IPv4 Statements

Statement	Description
ipv4-multicast	Enables an alternate IPv4 multicast topology.
ipv4-multicast-metric ***number***	Configures the multicast metric for an alternate IPv4 multicast topology.
no-ipv4-multicast	Excludes an interface from the IPv4 multicast topology.
no-unicast-topology	Excludes an interface from the IPv4 unicast topologies.

Table 4 on page 60 lists the various IPv6 statements you can use to configure IS-IS topologies.

Table 4: IPv6 Statements

Statement	Description
ipv6-multicast	Enables an alternate IPv6 multicast topology.

Table 4: IPv6 Statements *(continued)*

Statement	Description
ipv6-multicast-metric ***number***	Configures the multicast metric for an alternate IPv6 multicast topology.
ipv6-unicast-metric ***number***	Configures the unicast metric for an alternate IPv6 multicast topology.
no-ipv6-multicast	Excludes an interface from the IPv6 multicast topology.
no-ipv6-unicast	Excludes an interface from the IPv6 unicast topologies.

For a list of hierarchy levels at which you can include these statements, see the statement summary sections for these statements.

Example: Configuring IS-IS Multicast Topology

This example shows how to configure a multicast topology for an IS-IS network.

Requirements

Before you begin, configure IS-IS on all routers. See "Example: Configuring IS-IS" on page 15 for information about the required IS-IS configuration.

This example uses the following hardware and software components:

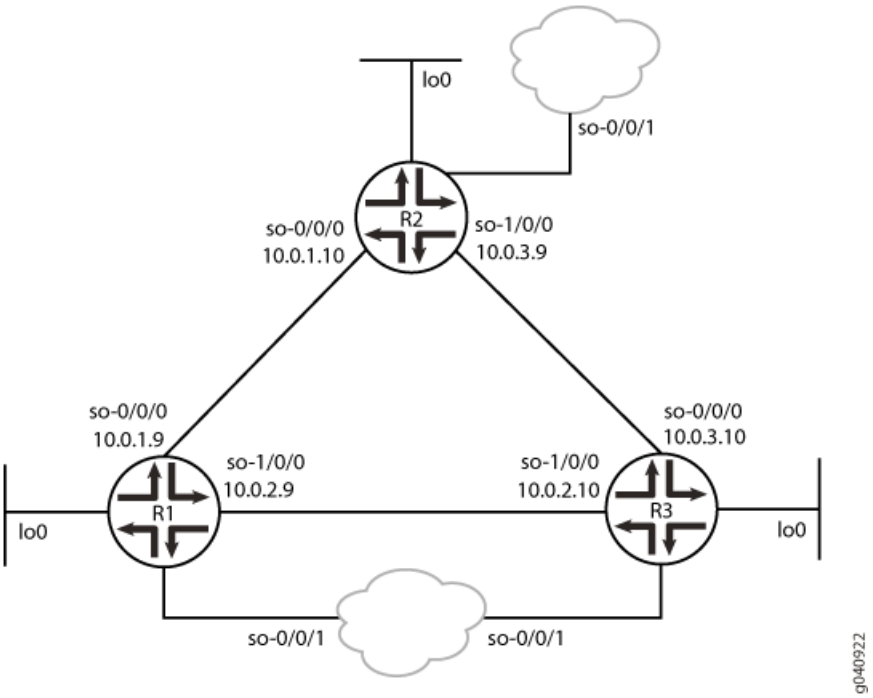
- Junos OS Release 7.3 or later
- M Series, MX Series, and T Series routers

Overview

This example shows an IS-IS multicast topology configuration. Three routers are connected to each other. A loopback interface is configured on each router.

Figure 9 on page 62 shows the sample network.

Figure 9: Configuring IS-IS Multicast Topology



Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

Router R1

```
set protocols isis traceoptions file isis size 5m world-readable
set protocols isis traceoptions flag error
set protocols isis topologies ipv4-multicast
set protocols isis interface so-0/0/0 level 1 metric 15
set protocols isis interface so-0/0/0 level 1 ipv4-multicast-metric 18
set protocols isis interface so-0/0/0 level 2 metric 20
set protocols isis interface so-0/0/0 level 2 ipv4-multicast-metric 14
set protocols isis interface so-1/0/0 level 1 metric 13
set protocols isis interface so-1/0/0 level 1 ipv4-multicast-metric 12
set protocols isis interface so-1/0/0 level 2 metric 29
set protocols isis interface so-1/0/0 level 2 ipv4-multicast-metric 23
set protocols isis interface fxp0.0 disable
```

Router R2

```
set protocols isis traceoptions file isis size 5m world-readable
set protocols isis traceoptions flag error
set protocols isis topologies ipv4-multicast
set protocols isis interface so-0/0/0 level 1 metric 13
set protocols isis interface so-0/0/0 level 1 ipv4-multicast-metric 12
set protocols isis interface so-0/0/0 level 2 metric 29
```

```
set protocols isis interface so-0/0/0 level 2 ipv4-multicast-metric 23
set protocols isis interface so-1/0/0 level 1 metric 14
set protocols isis interface so-1/0/0 level 1 ipv4-multicast-metric 18
set protocols isis interface so-1/0/0 level 2 metric 32
set protocols isis interface so-1/0/0 level 2 ipv4-multicast-metric 26
set protocols isis interface fxp0.0 disable
```

Router R3

```
set protocols isis traceoptions file isis size 5m world-readable
set protocols isis traceoptions flag error
set protocols isis topologies ipv4-multicast
set protocols isis interface so-0/0/0 level 1 metric 19
set protocols isis interface so-0/0/0 level 1 ipv4-multicast-metric 11
set protocols isis interface so-0/0/0 level 2 metric 27
set protocols isis interface so-0/0/0 level 2 ipv4-multicast-metric 21
set protocols isis interface so-1/0/0 level 1 metric 16
set protocols isis interface so-1/0/0 level 1 ipv4-multicast-metric 26
set protocols isis interface so-1/0/0 level 2 metric 30
set protocols isis interface so-1/0/0 level 2 ipv4-multicast-metric 20
set protocols isis interface fxp0.0 disable
```

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure IS-IS multicast topologies:

1. Enable the multicast topology for IS-IS by using the **ipv4-multicast** statement.

   Routers R1, R2, and R3

   ```
   [edit protocols isis]
   user@host# set traceoptions file isis size 5m world-readable
   user@host# set traceoptions flag error
   user@host# set topologies ipv4-multicast
   ```

2. Enable multicast metrics on the first SONET/SDH Interface by using the **ipv4-multicast-metric** statement.

   Router R1

   ```
   [edit protocols isis interface so-0/0/0 ]
   user@R1# set level 1 metric 15
   user@R1# set level 1 ipv4-multicast-metric 18
   user@R1# set level 2 metric 20
   user@R1# set level 2 ipv4-multicast-metric 14
   ```

   Router R2

   ```
   [edit protocols isis interface so-0/0/0]
   user@R2# set level 1 metric 13
   user@R2# set level 1 ipv4-multicast-metric 12
   user@R2# set level 2 metric 29
   user@R2# set level 2 ipv4-multicast-metric 23
   ```

   Router R3

   ```
   [edit protocols isis interface so-0/0/0]
   ```

```
user@R3# set level 1 metric 19
user@R3# set level 1 ipv4-multicast-metric 11
user@R3# set level 2 metric 27
user@R3# set level 2 ipv4-multicast-metric 21
```

3. Enable multicast metrics on a second sonet Interface by using the **ipv4-multicast-metric** statement.

   Router R1

   ```
   [edit protocols isis interface so-1/0/0]
   user@R1# set level 1 metric 13
   user@R1# set level 1 ipv4-multicast-metric 12
   user@R1# set level 2 metric 29
   user@R1# set level 2 ipv4-multicast-metric 23
   ```

   Router R2

   ```
   [edit protocols isis interface so-1/0/0]
   user@R2# set level 1 metric 14
   user@R2# set level 1 ipv4-multicast-metric 18
   user@R2# set level 2 metric 32
   user@R2# set level 2 ipv4-multicast-metric 26
   ```

   Router R3

   ```
   [edit protocols isis interface so-1/0/0]
   user@R3# set level 1 metric 16
   user@R3# set level 1 ipv4-multicast-metric 26
   user@R3# set level 2 metric 30
   user@R3# set level 2 ipv4-multicast-metric 20
   ```

4. Disable the out-of-band management port, fxp0.

   Routers R1, R2, and R3

   ```
   [edit protocols isis]
   user@host# set interface fxp0.0 disable
   ```

5. If you are done configuring the routers, commit the configuration.

   Routers R1, R2, and R3

   ```
   [edit]
   user@host# commit
   ```

Results From configuration mode, confirm your configuration by using the **show protocols isis** statement. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

Router R1

```
user@R1# show protocols isis

traceoptions {
    file isis size 5m world-readable;
    flag error;
}
topologies ipv4-multicast;
interface so-0/0/0 {
    level 1 {
```

```
        metric 15;
        ipv4-multicast-metric 18;
    }
    level 2 {
        metric 20;
        ipv4-multicast-metric 14;
    }
}
interface so-1/0/0 {
    level 1 {
        metric 13;
        ipv4-multicast-metric 12;
    }
    level 2 {
        metric 29;
        ipv4-multicast-metric 23;
    }
}
interface fxp0.0 {
    disable;
}
```

Router R2

```
user@R2# show protocols isis

traceoptions {
    file isis size 5m world-readable;
    flag error;
}
topologies ipv4-multicast;
interface so-0/0/0 {
    level 1 {
        metric 13;
        ipv4-multicast-metric 12;
    }
    level 2 {
        metric 29;
        ipv4-multicast-metric 23;
    }
}
interface so-1/0/0 {
    level 1 {
        metric 14;
        ipv4-multicast-metric 18;
    }
    level 2 {
        metric 32;
        ipv4-multicast-metric 26;
    }
}
interface fxp0.0 {
    disable;
}
```

Router R3

```
user@R3# show protocols isis

traceoptions {
    file isis size 5m world-readable;
    flag error;
```

```
}
topologies ipv4-multicast;
interface so-0/0/0 {
    level 1 {
        metric 19;
        ipv4-multicast-metric 11;
    }
    level 2 {
        metric 27;
        ipv4-multicast-metric 21;
    }
}
interface so-1/0/0 {
    level 1 {
        metric 16;
        ipv4-multicast-metric 26;
    }
    level 2 {
        metric 30;
        ipv4-multicast-metric 20;
    }
}
interface fxp0.0 {
    disable;
}
```

Verification

Confirm that the configuration is working properly.

Verifying the Connection Between Routers R1, R2, and R3

Purpose Make sure that Routers R1, R2, and R3 are connected to each other.

Action Ping the other two routers from any router, to check the connectivity between the three routers as per the network topology.

```
user@R1> ping 10.0.3.9

PING 10.0.3.9 (10.0.3.9): 56 data bytes
64 bytes from 10.0.3.9: icmp_seq=0 ttl=64 time=1.299 ms
64 bytes from 10.0.3.9: icmp_seq=1 ttl=64 time=52.304 ms
64 bytes from 10.0.3.9: icmp_seq=2 ttl=64 time=1.271 ms
64 bytes from 10.0.3.9: icmp_seq=3 ttl=64 time=1.343 ms
64 bytes from 10.0.3.9: icmp_seq=4 ttl=64 time=1.434 ms
64 bytes from 10.0.3.9: icmp_seq=5 ttl=64 time=1.306 ms
^C
--- 10.0.3.9 ping statistics ---
6 packets transmitted, 6 packets received, 0% packet loss
round-trip min/avg/max/stddev = 1.271/9.826/52.304/18.997 ms

user@R1> ping 10.0.3.10
```

```
PING 10.0.3.10 (10.0.3.10): 56 data bytes
64 bytes from 10.0.3.10: icmp_seq=0 ttl=64 time=1.431 ms
64 bytes from 10.0.3.10: icmp_seq=1 ttl=64 time=1.296 ms
64 bytes from 10.0.3.10: icmp_seq=2 ttl=64 time=1.887 ms
^C
--- 10.0.3.10 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 1.296/1.538/1.887/0.253 ms

user@R2> ping 10.0.2.9

PING 10.0.2.9 (10.0.2.9): 56 data bytes
64 bytes from 10.0.2.9: icmp_seq=0 ttl=64 time=1.365 ms
64 bytes from 10.0.2.9: icmp_seq=1 ttl=64 time=1.813 ms
64 bytes from 10.0.2.9: icmp_seq=2 ttl=64 time=1.290 ms
^C
--- 10.0.2.9 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 1.290/1.489/1.813/0.231 ms

user@R2> ping 10.0.2.10

PING 10.0.2.10 (10.0.2.10): 56 data bytes
64 bytes from 10.0.2.10: icmp_seq=0 ttl=63 time=1.318 ms
64 bytes from 10.0.2.10: icmp_seq=1 ttl=63 time=1.394 ms
64 bytes from 10.0.2.10: icmp_seq=2 ttl=63 time=1.366 ms
64 bytes from 10.0.2.10: icmp_seq=3 ttl=63 time=1.305 ms
^C
--- 10.0.2.10 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
round-trip min/avg/max/stddev = 1.305/1.346/1.394/0.036 ms

user@R3> ping 10.0.1.10

PING 10.0.1.10 (10.0.1.10): 56 data bytes
64 bytes from 10.0.1.10: icmp_seq=0 ttl=63 time=1.316 ms
64 bytes from 10.0.1.10: icmp_seq=1 ttl=63 time=1.418 ms
64 bytes from 10.0.1.10: icmp_seq=2 ttl=63 time=1.277 ms
^C
--- 10.0.1.10 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 1.277/1.337/1.418/0.059 ms

user@R3> ping 10.0.1.9

PING 10.0.1.9 (10.0.1.9): 56 data bytes
64 bytes from 10.0.1.9: icmp_seq=0 ttl=64 time=1.381 ms
64 bytes from 10.0.1.9: icmp_seq=1 ttl=64 time=1.499 ms
64 bytes from 10.0.1.9: icmp_seq=2 ttl=64 time=1.300 ms
64 bytes from 10.0.1.9: icmp_seq=3 ttl=64 time=1.397 ms
^C
--- 10.0.1.9 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
round-trip min/avg/max/stddev = 1.300/1.394/1.499/0.071 ms
```

Meaning Routers R1, R2, and R3 have a peer relationship with each other.

Verifying That IS-IS Is Configured

Purpose Make sure that the IS-IS instance is running on Routers R1, R2, and R3, and that they are adjacent to each other.

Action Use the **show isis adjacency detail** command to check the adjacency between the routers.

Router R1

```
user@R1> show isis adjacency detail

R2
  Interface: so-0/0/0, Level: 1, State: Up, Expires in 8 secs
  Priority: 64, Up/Down transitions: 1, Last transition: 2d 19:23:59 ago
  Circuit type: 3, Speaks: IP, MAC address: 0:1b:c0:86:54:bd
  Topologies: IPV4-Multicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  LAN id: R2.02, IP addresses: 10.0.1.10

R2
  Interface: so-0/0/0, Level: 2, State: Up, Expires in 8 secs
  Priority: 64, Up/Down transitions: 1, Last transition: 2d 19:23:58 ago
  Circuit type: 3, Speaks: IP, MAC address: 0:1b:c0:86:54:bd
  Topologies: IPV4-Multicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  LAN id: R2.02, IP addresses: 10.0.1.10

R3
  Interface: so-1/0/0, Level: 1, State: Up, Expires in 7 secs
  Priority: 64, Up/Down transitions: 1, Last transition: 2d 19:24:20 ago
  Circuit type: 3, Speaks: IP, MAC address: 0:1b:c0:86:54:bd
  Topologies: IPV4-Multicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  LAN id: R3.02, IP addresses: 10.0.2.10

R3
  Interface: so-1/0/0, Level: 2, State: Up, Expires in 6 secs
  Priority: 64, Up/Down transitions: 1, Last transition: 2d 19:24:20 ago
  Circuit type: 3, Speaks: IP, MAC address: 0:1b:c0:86:54:bd
  Topologies: IPV4-Multicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  LAN id: R3.02, IP addresses: 10.0.2.10
```

Router R2

```
user@R2> show isis adjacency detail

R1
  Interface: so-0/0/0, Level: 1, State: Up, Expires in 20 secs
  Priority: 64, Up/Down transitions: 1, Last transition: 2d 19:27:50 ago
  Circuit type: 3, Speaks: IP, MAC address: 0:1b:c0:86:54:bc
  Topologies: IPV4-Multicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  LAN id: R2.02, IP addresses: 10.0.1.9

R1
  Interface: so-0/0/0, Level: 2, State: Up, Expires in 26 secs
  Priority: 64, Up/Down transitions: 1, Last transition: 2d 19:27:50 ago
  Circuit type: 3, Speaks: IP, MAC address: 0:1b:c0:86:54:bc
  Topologies: IPV4-Multicast
```



```
  Restart capable: Yes, Adjacency advertisement: Advertise
  LAN id: R2.02, IP addresses: 10.0.1.9

R3
  Interface: so-1/0/0, Level: 1, State: Up, Expires in 8 secs
  Priority: 64, Up/Down transitions: 1, Last transition: 2d 19:27:22 ago
  Circuit type: 3, Speaks: IP, MAC address: 0:1b:c0:86:54:bd
  Topologies: IPV4-Multicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  LAN id: R3.03, IP addresses: 10.0.3.10

R3
  Interface: so-1/0/0, Level: 2, State: Up, Expires in 8 secs
  Priority: 64, Up/Down transitions: 1, Last transition: 2d 19:27:22 ago
  Circuit type: 3, Speaks: IP, MAC address: 0:1b:c0:86:54:bd
  Topologies: IPV4-Multicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  LAN id: R3.03, IP addresses: 10.0.3.10
```

Router R3

```
user@R3> show isis adjacency detail

R2
  Interface: so-0/0/0, Level: 1, State: Up, Expires in 18 secs
  Priority: 64, Up/Down transitions: 1, Last transition: 2d 19:33:09 ago
  Circuit type: 3, Speaks: IP, MAC address: 0:1b:c0:86:54:bc
  Topologies: IPV4-Multicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  LAN id: R3.03, IP addresses: 10.0.3.9

R2
  Interface: so-0/0/0, Level: 2, State: Up, Expires in 22 secs
  Priority: 64, Up/Down transitions: 1, Last transition: 2d 19:33:09 ago
  Circuit type: 3, Speaks: IP, MAC address: 0:1b:c0:86:54:bc
  Topologies: IPV4-Multicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  LAN id: R3.03, IP addresses: 10.0.3.9

R1
  Interface: so-1/0/0, Level: 1, State: Up, Expires in 21 secs
  Priority: 64, Up/Down transitions: 1, Last transition: 2d 19:33:59 ago
  Circuit type: 3, Speaks: IP, MAC address: 0:1b:c0:86:54:bc
  Topologies: IPV4-Multicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  LAN id: R3.02, IP addresses: 10.0.2.9

R1
  Interface: so-1/0/0, Level: 2, State: Up, Expires in 19 secs
  Priority: 64, Up/Down transitions: 1, Last transition: 2d 19:33:59 ago
  Circuit type: 3, Speaks: IP, MAC address: 0:1b:c0:86:54:bc
  Topologies: IPV4-Multicast
  Restart capable: Yes, Adjacency advertisement: Advertise
  LAN id: R3.02, IP addresses: 10.0.2.9
```

Meaning IS-IS is configured on Routers R1, R2, and R3, and they are adjacent to each other.

Verifying the Configured Multicast Metric Values

Purpose Make sure that the SPF calculations are accurate as per the configured multicast metric values on Routers R1, R2, and R3.

Action Use the **show isis spf results** command to check the SPF calculations for the network.

Router R1

```
user@R1> show isis spf results
...
IPV4 Multicast IS-IS level 1 SPF results:
Node   Metric     Interface      NH   Via   SNPA
R3.03  28         so-1/0/0       IPV4 R3    0:1b:c0:86:54:bd
R2.00  18         so-0/0/0       IPV4 R2    0:1b:c0:86:54:bd
R3.00  17         so-1/0/0       IPV4 R3    0:1b:c0:86:54:bd
R1.00  0
  4 nodes

IPV4 Multicast IS-IS level 2 SPF results:
Node   Metric     Interface      NH   Via   SNPA
R3.03  40         so-0/0/0       IPV4 R2    0:1b:c0:86:54:bd
R3.00  22         so-1/0/0       IPV4 R3    0:1b:c0:86:54:bd
R2.00  14         so-0/0/0       IPV4 R2    0:1b:c0:86:54:bd
R1.00  0
  4 nodes
```

Router R2

```
user@R2> show isis spf results
...
IPV4 Multicast IS-IS level 1 SPF results:
Node   Metric     Interface      NH   Via   SNPA
R3.02  29         so-0/0/0       IPV4 R1    0:1b:c0:86:54:bc
R3.00  18         so-1/0/0       IPV4 R3    0:1b:c0:86:54:bd
R1.00  12         so-0/0/0       IPV4 R1    0:1b:c0:86:54:bc
R2.02  12
R2.00  0
  5 nodes

IPV4 Multicast IS-IS level 2 SPF results:
Node   Metric     Interface      NH   Via   SNPA
R3.02  45         so-0/0/0       IPV4 R1    0:1b:c0:86:54:bc
R3.00  26         so-1/0/0       IPV4 R3    0:1b:c0:86:54:bd
R1.00  23         so-0/0/0       IPV4 R1    0:1b:c0:86:54:bc
R2.02  23
R2.00  0
  5 nodes
```

Router R3

```
user@R3> show isis spf results
...
IPV4 Multicast IS-IS level 1 SPF results:
Node   Metric     Interface      NH   Via   SNPA
R3.02  26
R1.00  23         so-0/0/0       IPV4 R2    0:1b:c0:86:54:bc
R2.02  23         so-0/0/0       IPV4 R2    0:1b:c0:86:54:bc
R2.00  11         so-0/0/0       IPV4 R2    0:1b:c0:86:54:bc
R3.03  11
```



```
R3.00  0
  6 nodes

IPV4 Multicast IS-IS level 2 SPF results:
Node   Metric     Interface      NH   Via   SNPA
R2.02  34         so-1/0/0       IPV4 R1    0:1b:c0:86:54:bc
R2.00  21         so-0/0/0       IPV4 R2    0:1b:c0:86:54:bc
R3.03  21
R1.00  20         so-1/0/0       IPV4 R1    0:1b:c0:86:54:bc
R3.02  20
R3.00  0
  6 nodes
```

Meaning The configured multicast metric values are used in SPF calculations for the IS-IS network.

Verifying the Configuration of the Multicast Topology

Purpose Make sure that the multicast topology is configured on Routers R1, R2, and R3.

Action Use the **show isis database detail** command to verify the multicast topology configuration on the routers.

Router R1

```
user@R1> show isis database detail

IS-IS level 1 link-state database:

R1.00-00 Sequence: 0x142, Checksum: 0xd07, Lifetime: 663 secs
   IPV4 Unicast IS neighbor: R2.02   Metric:       15
   IPV4 Unicast IS neighbor: R3.02   Metric:       15
   IPV4 Multicast IS neighbor: R2.02  Metric:       18
   IPV4 Multicast IS neighbor: R3.02  Metric:       17
   IP IPV4 Unicast prefix: 10.0.1.8/30  Metric:       15 Internal Up
   IP IPV4 Unicast prefix: 10.0.2.8/30  Metric:       15 Internal Up

R2.00-00 Sequence: 0x13f, Checksum: 0xf02b, Lifetime: 883 secs
   IPV4 Unicast IS neighbor: R2.02   Metric:       13
   IPV4 Unicast IS neighbor: R3.03   Metric:       14
   IPV4 Multicast IS neighbor: R2.02  Metric:       12
   IPV4 Multicast IS neighbor: R3.03  Metric:       18
   IP IPV4 Unicast prefix: 10.0.1.8/30  Metric:       13 Internal Up
   IP IPV4 Unicast prefix: 10.0.3.8/30  Metric:       14 Internal Up

R2.02-00 Sequence: 0x13c, Checksum: 0x57e2, Lifetime: 913 secs
   IPV4 Unicast IS neighbor: R1.00   Metric:        0
   IPV4 Unicast IS neighbor: R2.00   Metric:        0

R3.00-00 Sequence: 0x13c, Checksum: 0xc8de, Lifetime: 488 secs
   IPV4 Unicast IS neighbor: R3.02   Metric:       16
   IPV4 Unicast IS neighbor: R3.03   Metric:       19
   IPV4 Multicast IS neighbor: R3.02  Metric:       26
   IPV4 Multicast IS neighbor: R3.03  Metric:       11
   IP IPV4 Unicast prefix: 10.0.2.8/30  Metric:       16 Internal Up
   IP IPV4 Unicast prefix: 10.0.3.8/30  Metric:       19 Internal Up

R3.02-00 Sequence: 0x139, Checksum: 0xfb0e, Lifetime: 625 secs
   IPV4 Unicast IS neighbor: R1.00   Metric:        0
   IPV4 Unicast IS neighbor: R3.00   Metric:        0
```

```
R3.03-00 Sequence: 0x138, Checksum: 0xad56, Lifetime: 714 secs
   IPV4 Unicast IS neighbor: R2.00   Metric:        0
   IPV4 Unicast IS neighbor: R3.00   Metric:        0

IS-IS level 2 link-state database:

R1.00-00 Sequence: 0x142, Checksum: 0x2c7c, Lifetime: 816 secs
   IPV4 Unicast IS neighbor: R2.02   Metric:       20
   IPV4 Unicast IS neighbor: R3.02   Metric:       31
   IPV4 Multicast IS neighbor: R2.02  Metric:       14
   IPV4 Multicast IS neighbor: R3.02  Metric:       22
   IP IPV4 Unicast prefix: 10.0.1.8/30  Metric:       20 Internal Up
   IP IPV4 Unicast prefix: 10.0.2.8/30  Metric:       31 Internal Up
   IP IPV4 Unicast prefix: 10.0.3.8/30  Metric:       29 Internal Up

R2.00-00 Sequence: 0x13f, Checksum: 0x4826, Lifetime: 966 secs
   IPV4 Unicast IS neighbor: R2.02   Metric:       29
   IPV4 Unicast IS neighbor: R3.03   Metric:       32
   IPV4 Multicast IS neighbor: R2.02  Metric:       23
   IPV4 Multicast IS neighbor: R3.03  Metric:       26
   IP IPV4 Unicast prefix: 10.0.1.8/30  Metric:       29 Internal Up
   IP IPV4 Unicast prefix: 10.0.2.8/30  Metric:       28 Internal Up
   IP IPV4 Unicast prefix: 10.0.3.8/30  Metric:       32 Internal Up

R2.02-00 Sequence: 0x13c, Checksum: 0x57e2, Lifetime: 966 secs
   IPV4 Unicast IS neighbor: R1.00   Metric:        0
   IPV4 Unicast IS neighbor: R2.00   Metric:        0

R3.00-00 Sequence: 0x13d, Checksum: 0x1b19, Lifetime: 805 secs
   IPV4 Unicast IS neighbor: R3.02   Metric:       30
   IPV4 Unicast IS neighbor: R3.03   Metric:       27
   IPV4 Multicast IS neighbor: R3.02  Metric:       20
   IPV4 Multicast IS neighbor: R3.03  Metric:       21
   IP IPV4 Unicast prefix: 10.0.1.8/30  Metric:       31 Internal Up
   IP IPV4 Unicast prefix: 10.0.2.8/30  Metric:       30 Internal Up
   IP IPV4 Unicast prefix: 10.0.3.8/30  Metric:       27 Internal Up

R3.02-00 Sequence: 0x139, Checksum: 0xfb0e, Lifetime: 844 secs
   IPV4 Unicast IS neighbor: R1.00   Metric:        0
   IPV4 Unicast IS neighbor: R3.00   Metric:        0

R3.03-00 Sequence: 0x139, Checksum: 0xab57, Lifetime: 844 secs
   IPV4 Unicast IS neighbor: R2.00   Metric:        0
   IPV4 Unicast IS neighbor: R3.00   Metric:        0
```

Router R2

```
user@R2> show isis database detail

IS-IS level 1 link-state database:

R1.00-00 Sequence: 0x142, Checksum: 0xd07, Lifetime: 524 secs
   IPV4 Unicast IS neighbor: R2.02    Metric:       15
   IPV4 Unicast IS neighbor: R3.02    Metric:       15
   IPV4 Multicast IS neighbor: R2.02   Metric:       18
   IPV4 Multicast IS neighbor: R3.02   Metric:       17
   IP IPV4 Unicast prefix: 10.0.1.8/30  Metric:       15 Internal Up
   IP IPV4 Unicast prefix: 10.0.2.8/30  Metric:       15 Internal Up

R2.00-00 Sequence: 0x13f, Checksum: 0xf02b, Lifetime: 748 secs
   IPV4 Unicast IS neighbor: R2.02    Metric:       13
```

```
   IPV4 Unicast IS neighbor: R3.03    Metric:       14
   IPV4 Multicast IS neighbor: R2.02   Metric:       12
   IPV4 Multicast IS neighbor: R3.03   Metric:       18
   IP IPV4 Unicast prefix: 10.0.1.8/30  Metric:       13 Internal Up
   IP IPV4 Unicast prefix: 10.0.3.8/30  Metric:       14 Internal Up

R2.02-00 Sequence: 0x13c, Checksum: 0x57e2, Lifetime: 777 secs
   IPV4 Unicast IS neighbor: R1.00   Metric:        0
   IPV4 Unicast IS neighbor: R2.00   Metric:        0

R3.00-00 Sequence: 0x13d, Checksum: 0xc6df, Lifetime: 1102 secs
   IPV4 Unicast IS neighbor: R3.02    Metric:       16
   IPV4 Unicast IS neighbor: R3.03    Metric:       19
   IPV4 Multicast IS neighbor: R3.02   Metric:       26
   IPV4 Multicast IS neighbor: R3.03   Metric:       11
   IP IPV4 Unicast prefix: 10.0.2.8/30  Metric:       16 Internal Up
   IP IPV4 Unicast prefix: 10.0.3.8/30  Metric:       19 Internal Up

R3.02-00 Sequence: 0x139, Checksum: 0xfb0e, Lifetime: 488 secs
   IPV4 Unicast IS neighbor: R1.00    Metric:        0
   IPV4 Unicast IS neighbor: R3.00    Metric:        0

R3.03-00 Sequence: 0x138, Checksum: 0xad56, Lifetime: 577 secs
   IPV4 Unicast IS neighbor: R2.00    Metric:        0
   IPV4 Unicast IS neighbor: R3.00    Metric:        0

IS-IS level 2 link-state database:

R1.00-00 Sequence: 0x142, Checksum: 0x2c7c, Lifetime: 676 secs
   IPV4 Unicast IS neighbor: R2.02    Metric:       20
   IPV4 Unicast IS neighbor: R3.02    Metric:       31
   IPV4 Multicast IS neighbor: R2.02   Metric:       14
   IPV4 Multicast IS neighbor: R3.02   Metric:       22
   IP IPV4 Unicast prefix: 10.0.1.8/30  Metric:       20 Internal Up
   IP IPV4 Unicast prefix: 10.0.2.8/30  Metric:       31 Internal Up
   IP IPV4 Unicast prefix: 10.0.3.8/30  Metric:       29 Internal Up

R2.00-00 Sequence: 0x13f, Checksum: 0x4826, Lifetime: 831 secs
   IPV4 Unicast IS neighbor: R2.02    Metric:       29
   IPV4 Unicast IS neighbor: R3.03    Metric:       32
   IPV4 Multicast IS neighbor: R2.02   Metric:       23
   IPV4 Multicast IS neighbor: R3.03   Metric:       26
   IP IPV4 Unicast prefix: 10.0.1.8/30  Metric:       29 Internal Up
   IP IPV4 Unicast prefix: 10.0.2.8/30  Metric:       28 Internal Up
   IP IPV4 Unicast prefix: 10.0.3.8/30  Metric:       32 Internal Up

R2.02-00 Sequence: 0x13c, Checksum: 0x57e2, Lifetime: 831 secs
   IPV4 Unicast IS neighbor: R1.00    Metric:        0
   IPV4 Unicast IS neighbor: R2.00    Metric:        0

R3.00-00 Sequence: 0x13d, Checksum: 0x1b19, Lifetime: 667 secs
   IPV4 Unicast IS neighbor: R3.02    Metric:       30
   IPV4 Unicast IS neighbor: R3.03    Metric:       27
   IPV4 Multicast IS neighbor: R3.02   Metric:       20
   IPV4 Multicast IS neighbor: R3.03   Metric:       21
   IP IPV4 Unicast prefix: 10.0.1.8/30  Metric:       31 Internal Up
   IP IPV4 Unicast prefix: 10.0.2.8/30  Metric:       30 Internal Up
   IP IPV4 Unicast prefix: 10.0.3.8/30  Metric:       27 Internal Up

R3.02-00 Sequence: 0x139, Checksum: 0xfb0e, Lifetime: 707 secs
   IPV4 Unicast IS neighbor: R1.00    Metric:        0
```

```
   IPV4 Unicast IS neighbor: R3.00    Metric:        0

R3.03-00 Sequence: 0x139, Checksum: 0xab57, Lifetime: 707 secs
   IPV4 Unicast IS neighbor: R2.00    Metric:        0
   IPV4 Unicast IS neighbor: R3.00    Metric:        0
```

Router R3

```
user@R3> show isis database detail

IS-IS level 1 link-state database:

R1.00-00 Sequence: 0x143, Checksum: 0xb08, Lifetime: 1155 secs
   IPV4 Unicast IS neighbor: R2.02    Metric:       15
   IPV4 Unicast IS neighbor: R3.02    Metric:       15
   IPV4 Multicast IS neighbor: R2.02   Metric:       18
   IPV4 Multicast IS neighbor: R3.02   Metric:       17
   IP IPV4 Unicast prefix: 10.0.1.8/30  Metric:       15 Internal Up
   IP IPV4 Unicast prefix: 10.0.2.8/30  Metric:       15 Internal Up

R2.00-00 Sequence: 0x13f, Checksum: 0xf02b, Lifetime: 687 secs
   IPV4 Unicast IS neighbor: R2.02    Metric:       13
   IPV4 Unicast IS neighbor: R3.03    Metric:       14
   IPV4 Multicast IS neighbor: R2.02   Metric:       12
   IPV4 Multicast IS neighbor: R3.03   Metric:       18
   IP IPV4 Unicast prefix: 10.0.1.8/30  Metric:       13 Internal Up
   IP IPV4 Unicast prefix: 10.0.3.8/30  Metric:       14 Internal Up

R2.02-00 Sequence: 0x13c, Checksum: 0x57e2, Lifetime: 716 secs
   IPV4 Unicast IS neighbor: R1.00   Metric:        0
   IPV4 Unicast IS neighbor: R2.00   Metric:        0

R3.00-00 Sequence: 0x13d, Checksum: 0xc6df, Lifetime: 1044 secs
   IPV4 Unicast IS neighbor: R3.02    Metric:       16
   IPV4 Unicast IS neighbor: R3.03    Metric:       19
   IPV4 Multicast IS neighbor: R3.02   Metric:       26
   IPV4 Multicast IS neighbor: R3.03   Metric:       11
   IP IPV4 Unicast prefix: 10.0.2.8/30  Metric:       16 Internal Up
   IP IPV4 Unicast prefix: 10.0.3.8/30  Metric:       19 Internal Up

R3.02-00 Sequence: 0x139, Checksum: 0xfb0e, Lifetime: 430 secs
   IPV4 Unicast IS neighbor: R1.00    Metric:        0
   IPV4 Unicast IS neighbor: R3.00    Metric:        0

R3.03-00 Sequence: 0x138, Checksum: 0xad56, Lifetime: 519 secs
   IPV4 Unicast IS neighbor: R2.00    Metric:        0
   IPV4 Unicast IS neighbor: R3.00    Metric:        0

IS-IS level 2 link-state database:

R1.00-00 Sequence: 0x142, Checksum: 0x2c7c, Lifetime: 617 secs
   IPV4 Unicast IS neighbor: R2.02    Metric:       20
   IPV4 Unicast IS neighbor: R3.02    Metric:       31
   IPV4 Multicast IS neighbor: R2.02   Metric:       14
   IPV4 Multicast IS neighbor: R3.02   Metric:       22
   IP IPV4 Unicast prefix: 10.0.1.8/30  Metric:       20 Internal Up
   IP IPV4 Unicast prefix: 10.0.2.8/30  Metric:       31 Internal Up
   IP IPV4 Unicast prefix: 10.0.3.8/30  Metric:       29 Internal Up

R2.00-00 Sequence: 0x13f, Checksum: 0x4826, Lifetime: 769 secs
   IPV4 Unicast IS neighbor: R2.02    Metric:       29
   IPV4 Unicast IS neighbor: R3.03    Metric:       32
```



```
   IPV4 Multicast IS neighbor: R2.02   Metric:       23
   IPV4 Multicast IS neighbor: R3.03   Metric:       26
   IP IPV4 Unicast prefix: 10.0.1.8/30  Metric:       29 Internal Up
   IP IPV4 Unicast prefix: 10.0.2.8/30  Metric:       28 Internal Up
   IP IPV4 Unicast prefix: 10.0.3.8/30  Metric:       32 Internal Up

R2.02-00 Sequence: 0x13c, Checksum: 0x57e2, Lifetime: 769 secs
   IPV4 Unicast IS neighbor: R1.00    Metric:        0
   IPV4 Unicast IS neighbor: R2.00    Metric:        0

R3.00-00 Sequence: 0x13d, Checksum: 0x1b19, Lifetime: 610 secs
   IPV4 Unicast IS neighbor: R3.02    Metric:       30
   IPV4 Unicast IS neighbor: R3.03    Metric:       27
   IPV4 Multicast IS neighbor: R3.02   Metric:       20
   IPV4 Multicast IS neighbor: R3.03   Metric:       21
   IP IPV4 Unicast prefix: 10.0.1.8/30  Metric:       31 Internal Up
   IP IPV4 Unicast prefix: 10.0.2.8/30  Metric:       30 Internal Up
   IP IPV4 Unicast prefix: 10.0.3.8/30  Metric:       27 Internal Up

R3.02-00 Sequence: 0x139, Checksum: 0xfb0e, Lifetime: 649 secs
   IPV4 Unicast IS neighbor: R1.00    Metric:        0
   IPV4 Unicast IS neighbor: R3.00    Metric:        0

R3.03-00 Sequence: 0x139, Checksum: 0xab57, Lifetime: 649 secs
   IPV4 Unicast IS neighbor: R2.00    Metric:        0
   IPV4 Unicast IS neighbor: R3.00    Metric:        0
```

Meaning Multicast topology is configured on Routers R1, R2, and R3.

Related Documentation

- *Example: Configuring Multitopology Routing Based on a Multicast Source*
- Example: Configuring IS-IS IPv4 and IPv6 Unicast Topologies on page 51

Example: Configuring IS-IS for CLNS

Understanding IS-IS for CLNS

IS-IS extensions provide the basic interior gateway protocol (IGP) support for collecting intradomain routing information for Connectionless Network Service (CLNS) destinations within a CLNS network. Routers that learn host addresses through End System-to-Intermediate System (ES-IS) can advertise the addresses to other routers (intermediate systems) by using IS-IS.

For more information about IS-IS, see the ISO 10589 standard.

Example: Configuring IS-IS for CLNS

This example shows how to create a routing instance and enable the IS-IS protocol on all interfaces.

Requirements

Before you begin, configure the network interfaces. See the *Junos OS Interfaces Configuration Guide for Security Devices*.

Overview

The configuration instructions in this topic describe how to create a routing instance called aaaa, enable IS-IS on all interfaces, define the BGP export policy name (dist-bgp), family (ISO), and protocol (BGP), and apply the export policy to IS-IS.

Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set routing-instances aaaa protocols isis clns-routing
set routing-instances aaaa protocols isis interface all
set routing-instances aaaa protocols isis no-ipv4-routing no-ipv6-routing
set policy-options policy-statement dist-bgp from family iso protocol bgp
set policy-options policy-statement dist-bgp then accept
set routing-instances aaaa protocols isis export dist-bgp
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure IS-IS for CLNS:

1. Enable CLNS routing.

   ```
   [edit routing-instances aaaa]
   user@host# set protocols isis clns-routing
   ```

2. Enable IS-IS on all interfaces.

   ```
   [edit routing-instances aaaa]
   user@host# set protocols isis interface all
   ```

3. (Optional) Disable IPv4 and IPv6 routing to configure a pure CLNS network.

   ```
   [edit routing-instances aaaa]
   user@host# set protocols isis no-ipv4-routing no-ipv6-routing
   ```

4. Define the BGP export policy name, family, and protocol.

```
[edit policy-options]
user@host# set policy-statement dist-bgp from family iso protocol bgp
```

5. Define the action for the export policy.

```
[edit policy-options]
user@host# set policy-statement dist-bgp then accept
```

6. Apply the export policy to IS-IS.

```
[edit routing-instances aaaa]
user@host# set protocols isis export dist-bgp
```

Results From configuration mode, confirm your configuration by entering the **show routing-instances** and **show policy-options** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@host# show routing-instances
aaaa {
  protocols {
    isis {
      export dist-bgp;
      no-ipv4-routing;
      no-ipv6-routing;
      clns-routing;
      interface all;
    }
user@host# show policy-options
policy-statement dist-bgp {
  from {
    family iso;
    protocol bgp;
  }
  then accept;
}
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

Confirm that the configuration is working properly.

- Verifying the ISO Routes on page 77
- Checking the SPF Calculations on page 78

Verifying the ISO Routes

Purpose Verify that the expected ISO routes are displayed in the IS-IS routing table.

Action From operational mode, enter the show isis route command.

Checking the SPF Calculations

Purpose Display information about IS-IS shortest-path-first (SPF) calculations.

Action From operational mode, enter the **show isis spf** command.

Example: Configuring IS-IS Designated Routers

Understanding IS-IS Designated Routers

A router advertises its priority to become a designated router in its hello packets. On all multiaccess networks (physical networks that support the attachment of more than two routers, such as Ethernet networks), IS-IS uses the advertised priorities to elect a designated router for the network. This router is responsible for sending network link-state advertisements, which describe all the routers attached to the network. These advertisements are flooded throughout a single area. The priority value is meaningful only on a multiaccess network. It has no meaning on a point-to-point interface.

A router's priority for becoming the designated router is indicated by an arbitrary number from 0 through 127, which you configure on the IS-IS interface. The router with the highest priority becomes the designated router for the area (Level 1, Level 2, or both), also configured on the IS-IS interface. If routers in the network have the same priority, then the router with the highest MAC address is elected as the designated router. By default, routers have a priority value of 64.

Example: Configuring Designated Router Election Priority for IS-IS

This example shows how to configure the designated router election priority for IS-IS.

Before you begin:

- Configure network interfaces. See the *Junos OS Interfaces Configuration Guide for Security Devices*.
- Enable IS-IS on the interfaces. See "Example: Configuring IS-IS" on page 15.

In this example, you configure the priority for logical interface ge-0/0/1.0 to be 100 and the level number to be 1. If this interface has the highest priority value, the router becomes the designated router for the Level 1 area.

To configure a designated router election priority for IS-IS:

```
[edit]
user@host# set protocols isis interface ge-0/0/1.0 level 1 priority 100
```

Related Documentation

- *Example: Configuring IS-IS*

Example: Enabling Packet Checksums on IS-IS Interfaces

This example shows how to enable packet checksums for IS-IS interfaces.

Requirements

Before you begin, configure IS-IS on both routers. See "Example: Configuring IS-IS" on page 15 for information about the sample IS-IS configuration.

Overview

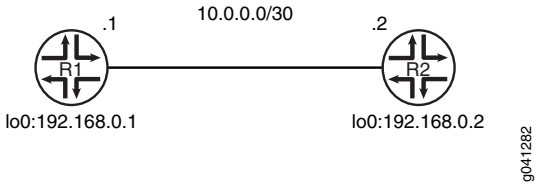
Junos OS supports IS-IS checksums as documented in RFC 3358, *Optional Checksums in Intermediate System to Intermediate System (ISIS)*.

IS-IS protocol data units (PDUs) include link-state PDUs, complete sequence number PDUs (CSNPs), partial sequence number PDUs (PSNPs), and IS-IS hello (IIH) packets. These PDUs can be corrupt due to faulty implementations of Layer 2 hardware or lack of checksums on a specific network technology. Corruption of length or type, length, and value (TLV) fields can lead to the generation of extensive numbers of empty link-state PDUs in the receiving node. Because authentication is not a replacement for a checksum mechanism, you might want to enable the optional checksum TLV on your IS-IS interfaces.

The checksum cannot be enabled with MD5 hello authentication on the same interface.

Figure 10 on page 79 shows the topology used in this example.

Figure 10: IS-IS Checksum Topology



This example describes the steps on Device R1.

Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

Device R1

```
set protocols isis traceoptions file isis
set protocols isis traceoptions flag all
set protocols isis interface fe-1/2/0.1 checksum
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure IS-IS checksums:

1. Enable checksums.

```
[edit protocols isis interface fe-1/2/0.1]
user@R1# set checksum
```

2. (Optional) Enable tracing for tracking checksum operations.

```
[edit protocols isis traceoptions]
user@R1# set file isis
user@R1# set flag all
```

Results

From configuration mode, confirm your configuration by entering the **show protocols** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@R1# show protocols
isis {
    traceoptions {
        file isis;
        flag all;
    }
    interface fe-1/2/0.1 {
        checksum;
    }
}
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

Confirm that the configuration is working properly.

Verifying Checksums

Purpose

Verify that checksums are performed.

Action

From operational mode, enter the **show log isis | match checksum** command.

```
user@R1> show log isis | match checksum

May 31 16:47:39.513267     sequence 0x49 checksum 0x8e64
May 31 16:47:39.513394     sequence 0x4e checksum 0x34b3
May 31 16:47:39.513517     sequence 0x50 checksum 0x9dcb
May 31 16:47:46.563781     sequence 0x45 checksum 0x7e1a
May 31 16:47:46.563970     sequence 0x46 checksum 0x226d
May 31 16:47:46.564104     sequence 0x52 checksum 0x99cd
May 31 16:47:46.581087     sequence 0x49 checksum 0x8e64
May 31 16:47:46.581222     sequence 0x4e checksum 0x34b3
May 31 16:47:46.581353     sequence 0x50 checksum 0x9dcb
May 31 16:47:55.799090     sequence 0x45 checksum 0x7e1a
May 31 16:47:55.799223     sequence 0x46 checksum 0x226d
```

```
May 31 16:47:55.799347     sequence 0x52 checksum 0x99cd
May 31 16:47:55.818255     sequence 0x49 checksum 0x8e64
May 31 16:47:55.818473     sequence 0x4e checksum 0x34b3
May 31 16:47:55.818606     sequence 0x50 checksum 0x9dcb
May 31 16:48:03.455816     sequence 0x49 checksum 0x8e64
May 31 16:48:03.455973     sequence 0x4e checksum 0x34b3
```

Meaning The output shows that checksum information is captured in the IS-IS trace log file.

Related Documentation

- *Understanding Checksums on IS-IS Interfaces*

PART 3

Configuration Statements and Operational Commands

CHAPTER 4

Configuration Statements

authentication-key (Protocols IS-IS)

Syntax authentication-key *key*;

Hierarchy Level [edit logical-systems *logical-system-name* protocols isis level *level-number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis level *level-number*],
[edit protocols isis level *level-number*],
[edit routing-instances *routing-instance-name* protocols isis level *level-number*]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Authentication key (password). Neighboring routing devices use the password to verify the authenticity of packets sent from this interface. For the key to work, you also must include the **authentication-type** statement.

All routing devices must use the same password. If you are using the Junos OS IS-IS software with another implementation of IS-IS, the other implementation must be configured to use the same password for the domain, the area, and all interfaces adjacent to the Juniper Networks routing device.

Default If you do not include this statement and the **authentication-type** statement, IS-IS authentication is disabled.

Options *key*—Authentication password. The password can be up to 1024 characters long. Characters can include any ASCII strings. If you include spaces, enclose all characters in quotation marks (“ ”).

CAUTION: A simple password for authentication is truncated if it exceeds 254 characters.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Example: Configuring Hitless Authentication Key Rollover for IS-IS*

authentication-key-chain (Protocols IS-IS)

Syntax authentication-key-chain *key-chain-name*;

Hierarchy Level [edit logical-systems *name* protocols isis level *level-number*],
[edit logical-systems *name* routing-instances *instance-name* protocols isis level *level-number*],
[edit protocols isis level *level-number*],
[edit routing-instances *instance-name* protocols isis level *level-number*]

Release Information Statement introduced in Junos OS Release 11.2.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Apply and enable an authentication keychain to the routing device.

Options ***key-chain***—Authentication keychain name. It can be up to 126 characters. Characters can include any ASCII strings. If you include spaces, enclose all characters in quotation marks (“ ”).

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Example: Configuring Hitless Authentication Key Rollover for IS-IS on page 29
- *Example: Configuring Route Authentication for BGP*
- *Example: Configuring BFD Authentication for Static Routes*
- *Configuring the Authentication Key Update Mechanism for BGP and LDP Routing Protocols*
- Understanding Hitless Authentication Key Rollover for IS-IS on page 9

authentication-type (Protocols IS-IS)

Syntax authentication-type *authentication*;

Hierarchy Level [edit logical-systems *logical-system-name* protocols isis level *level-number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis level *level-number*],
[edit protocols isis level *level-number*],
[edit routing-instances *routing-instance-name* protocols isis level *level-number*]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Enable authentication and specify the authentication scheme for IS-IS. If you enable authentication, you must specify a password by including the **authentication-key** statement.

Default If you do not include this statement and the **authentication-key** statement, IS-IS authentication is disabled.

Options ***authentication***—Authentication scheme:

- **md5**—Use HMAC authentication in combination with MD5. HMAC-MD5 authentication is defined in RFC 2104, *HMAC: Keyed-Hashing for Message Authentication*.
- **simple**—Use a simple password for authentication. The password is included in the transmitted packet, making this method of authentication relatively insecure. We recommend that you *not* use this authentication method.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Example: Configuring Hitless Authentication Key Rollover for IS-IS*
- authentication-key on page 87
- no-authentication-check on page 122

bfd-liveness-detection (Protocols IS-IS)

Syntax

```
bfd-liveness-detection {
  authentication {
    algorithm algorithm-name;
    key-chain key-chain-name;
    loose-check;
  }
  detection-time {
    threshold milliseconds;
  }
  minimum-interval milliseconds;
  minimum-receive-interval milliseconds;
  multiplier number;
  no-adaptation;
  transmit-interval {
    minimum-interval milliseconds;
    threshold milliseconds;
  }
  version (1 | automatic);
}
```

Hierarchy Level

[edit logical-systems *logical-system-name* protocols isis interface *interface-name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name*],
[edit protocols isis interface *interface-name*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name*]

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
detection-time threshold and **transmit-interval threshold** options added in Junos OS Release 8.2.
Support for logical systems introduced in Junos OS Release 8.3.
no-adaptation statement introduced in Junos OS Release 9.0.
authentication algorithm, **authentication key-chain**, and **authentication loose-check** options introduced in Junos OS Release 9.6.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description

Configure bidirectional failure detection timers and authentication.

Options

authentication algorithm *algorithm-name* —Configure the algorithm used to authenticate the specified BFD session: **simple-password**, **keyed-md5**, **keyed-sha-1**, **meticulous-keyed-md5**, **meticulous-keyed-sha-1**.

authentication key-chain *key-chain-name*—Associate a security key with the specified BFD session using the name of the security keychain. The name you specify must match one of the keychains configured in the **authentication-key-chains key-chain** statement at the **[edit security]** hierarchy level.

authentication loose-check—(Optional) Configure loose authentication checking on the BFD session. Use only for transitional periods when authentication might not be configured at both ends of the BFD session.

detection-time threshold *milliseconds*—Configure a threshold for the adaptation of the BFD session detection time. When the detection time adapts to a value equal to or greater than the threshold, a single trap and a single system log message are sent.

minimum-interval *milliseconds*—Configure the minimum interval after which the local routing device transmits a hello packet and then expects to receive a reply from the neighbor with which it has established a BFD session. Optionally, instead of using this statement, you can specify the minimum transmit and receive intervals separately using the **transmit-interval minimum-interval** and **minimum-receive-interval** statements.

Range: 1 through 255,000

minimum-receive-interval *milliseconds*—Configure the minimum interval after which the local routing device expects to receive a reply from a neighbor with which it has established a BFD session. Optionally, instead of using this statement, you can configure the minimum receive interval using the **minimum-interval** statement.

Range: 1 through 255,000

multiplier *number*—Configure the number of hello packets not received by a neighbor that causes the originating interface to be declared down.

Range: 1 through 255

Default: 3

no-adaptation—Specify that BFD sessions not adapt to changing network conditions. We recommend that you not disable BFD adaptation unless it is preferable not to have BFD adaptation enabled in your network.

transmit-interval threshold *milliseconds*—Configure the threshold for the adaptation of the BFD session transmit interval. When the transmit interval adapts to a value greater than the threshold, a single trap and a single system message are sent. The interval threshold must be greater than the minimum transmit interval.

Range: 0 through 4,294,967,295 ($2^{32} - 1$)

transmit-interval minimum-interval *milliseconds*—Configure a minimum interval after which the local routing device transmits hello packets to a neighbor. Optionally, instead of using this statement, you can configure the minimum transmit interval using the **minimum-interval** statement.

Range: 1 through 255,000

version—Configure the BFD version to detect: **1** (BFD version 1) or **automatic** (autodetect the BFD version)

Default: **automatic**

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Example: Configuring BFD for IS-IS*
- *Example: Configuring BFD Authentication for IS-IS*

checksum (Protocols IS-IS)

Syntax

```
checksum;
```

Hierarchy Level

[edit logical-systems *logical-system-name* protocols isis interface *interface-name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name*],
[edit protocols isis interface *interface-name*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name*]

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description

Enable checksums for packets on this interface.

Junos OS supports IS-IS checksums as documented in RFC 3358, *Optional Checksums in Intermediate System to Intermediate System (ISIS)*.

The checksum cannot be enabled with MD5 hello authentication on the same interface.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Example: Enabling Packet Checksums on IS-IS Interfaces*

csnp-interval

Syntax csnp-interval (*seconds* | disable);

Hierarchy Level [edit logical-systems *logical-system-name* protocols isis interface *interface-name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name*],
[edit protocols isis interface *interface-name*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name*]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Configure the interval between complete sequence number PDUs (CSNPs) on a LAN interface.

If the routing device is the designated router on a LAN, IS-IS sends CSN packets every 10 seconds. If the routing device is on a point-to-point interface, it sends CSN packets every 5 seconds multiplied by the number of IS-IS adjacencies over point-to-point links, which are in UP state.

To configure the interface not to send any CSNPs, specify the **disable** option.

Default By default, IS-IS sends CSNPs periodically. If the routing device is the designated router on a LAN, IS-IS sends CSNPs every 10 seconds. If the routing device is on a point-to-point interface, it sends CSNPs every 5 seconds multiplied by the number of IS-IS adjacencies over point-to-point links, which are in UP state.

Options **disable**—Do not send CSNPs on this interface.

seconds—Number of seconds between the sending of CSNPs.

Range: 1 through 65,535 seconds

Default: 10 seconds on LAN broadcast links. 5 seconds on point-to-point links.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Example: Configuring the Transmission Frequency for CSNP Packets on IS-IS Interfaces*

disable (Protocols IS-IS)

Syntax disable;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis],
[edit logical-systems *logical-system-name* protocols isis interface *interface-name*],
[edit logical-systems *logical-system-name* protocols isis interface *interface-name* level *level-number*],
[edit logical-systems *logical-system-name* protocols isis traffic-engineering],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name* level *level-number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis traffic-engineering],
[edit protocols isis],
[edit protocols isis interface *interface-name*],
[edit protocols isis interface *interface-name* level *level-number*],
[edit protocols isis traffic-engineering],
[edit routing-instances *routing-instance-name* protocols isis],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name* level *level-number*],
[edit routing-instances *routing-instance-name* protocols isis traffic-engineering]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Disable IS-IS on the routing device, on an interface, or on a level.

At the **[edit protocols isis traffic-engineering]** hierarchy level, disable IS-IS support for traffic engineering.

Enabling IS-IS on an interface (by including the **interface** statement at the **[edit protocols isis]** or the **[edit routing-instances *routing-instance-name* protocols isis]** hierarchy level), disabling it (by including the **disable** statement), and not actually having IS-IS run on an interface (by including the **passive** statement) are mutually exclusive states.

Default IS-IS is enabled for Level 1 and Level 2 routers on all interfaces on which **family iso** is enabled.

IS-IS support for traffic engineering is enabled.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Example: Configuring Multi-Level IS-IS on page 21

- IS-IS Overview on page 3

export (Protocols IS-IS)

Syntax export [*policy-names*];

Hierarchy Level [edit logical-systems *logical-system-name* protocols isis],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis],
[edit protocols isis],
[edit routing-instances *routing-instance-name* protocols isis]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Apply one or more policies to routes being exported from the routing table into IS-IS.

All routing protocols store the routes that they learn in the routing table. The routing table uses this collected route information to determine the active routes to destinations. The routing table then installs the active routes into its forwarding table and exports them into the routing protocols. It is these exported routes that the protocols advertise.

For each protocol, you control which routes the protocol stores in the routing table and which routes the routing table exports into the protocol from the routing table by defining a *routing policy* for that protocol.

NOTE: For IS-IS, you cannot apply routing policies that affect how routes are imported into the routing table; doing so with a link-state protocol can easily lead to an inconsistent topology database.

Options ***policy-names***—Name of one or more policies.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Example: Redistributing OSPF Routes into IS-IS*
- *Example: Configuring an IS-IS Default Route Policy on Logical Systems*

external-preference (Protocols IS-IS)

Syntax external-preference *preference*;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis level *level-number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis level *level-number*],
[edit protocols isis level *level-number*],
[edit routing-instances *routing-instance-name* protocols isis level *level-number*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Configure the preference of external routes.

Options
preference—Preference value.

Range: 0 through 4,294,967,295 ($2^{32} - 1$)

Default: 15 (for Level 1 internal routes), 18 (for Level 2 internal routes), 160 (for Level 1 external routes), 165 (for Level 2 external routes)

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Route Preferences Overview*
- *Example: Redistributing OSPF Routes into IS-IS*
- *Example: Redistributing BGP Routes with a Specific Community Tag into IS-IS*
- preference on page 134

family (Protocols IS-IS)

Syntax

```
family inet {
  shortcuts {
    multicast-rpf-routes;
  }
}
family inet6 {
  shortcuts;
}
```

Hierarchy Level

[edit logical-systems *logical-system-name* protocols isis traffic-engineering],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis traffic-engineering],
[edit protocols isis traffic-engineering],
[edit routing-instances *routing-instance-name* protocols isis traffic-engineering]

Release Information

Statement introduced in Junos OS Release 9.3.
Support for IPv6 for IGP shortcuts introduced in Junos OS Release 9.3.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description

Configure the address family for traffic engineering IS-IS interior gateway protocol (IGP) shortcuts.

Options

inet—IPv4 address family

inet6—IPv6 address family

The remaining statements are explained separately.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

hello-authentication-key

Syntax hello-authentication-key *password*;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis interface *interface-name* level *number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name* level *number*],
[edit protocols isis interface *interface-name* level *number*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name* level *number*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Configure an authentication key (password) for hello packets. Neighboring routing devices use the password to verify the authenticity of packets sent from an interface. For the key to work, you also must include the **hello-authentication-type** statement.

Default By default, hello authentication is not configured on an interface. However, if IS-IS authentication is configured, the hello packets are authenticated using the IS-IS authentication type and password.

Options ***password***—Authentication password. The password can be up to 255 characters. Characters can include any ASCII strings. If you include spaces, enclose all characters in quotation marks (“ ”).

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- authentication-key on page 87
- authentication-type on page 89
- hello-authentication-type on page 100

hello-authentication-key-chain

Syntax hello-authentication-key-chain *key-chain-name*;

Hierarchy Level [edit logical-systems *name* protocols isis interface *interface-name* level *level-number*],
[edit logical-systems *name* routing-instances *instance-name* protocols isis interface *interface-name* level *level-number*],
[edit protocols isis interface *interface-name* level *level-number*],
[edit routing-instances *instance-name* protocols isis interface *interface-name* level *level-number*]

Release Information Statement introduced in Junos OS Release 11.2.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Apply an authentication keychain to the IS-IS interface.

Options ***key-chain-name***—Authentication keychain name. It can be up to 126 characters. Characters can include any ASCII strings. If you include spaces, enclose all characters in quotation marks (“ ”).

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Example: Configuring Hitless Authentication Key Rollover for IS-IS*

hello-authentication-type

Syntax hello-authentication-type (md5 | simple);

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis interface *interface-name* level *number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name* level *number*],
[edit protocols isis interface *interface-name* level *number*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name* level *number*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Enable authentication on an interface for hello packets. If you enable authentication on hello packets, you must specify a password by including the **hello-authentication-key** statement.

You can configure authentication for a given IS-IS level on an interface. On a point-to-point link, if you enable hello authentication for both IS-IS levels, the password configured for Level 1 is used for both levels.

CAUTION: If no authentication is configured for Level 1 on a point-to-point link with both levels enabled, the hello packets are sent without any password, regardless of the Level 2 authentication configurations.

Default By default, hello authentication is not configured on an interface. However, if IS-IS authentication is configured, the hello packets are authenticated using the IS-IS authentication type and password.

Options **md5**—Specifies Message Digest 5 as the packet verification type.

simple—Specifies simple authentication as the packet verification type.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- authentication-key on page 87
- authentication-type on page 89
- hello-authentication-key on page 98

hello-interval (Protocols IS-IS)

Syntax hello-interval *seconds*;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis interface *interface-name* level *level-number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name* level *level-number*],
[edit protocols isis interface *interface-name* level *level-number*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name* level *level-number*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Modify the frequency with which the routing device sends hello packets out of an interface, in seconds.

Routing devices send hello packets at a fixed interval on all interfaces to establish and maintain neighbor relationships. This interval is advertised in the hello interval field in the hello packet.

You can send out hello packets in subsecond intervals. To send out hello packets every 333 milliseconds, set the **hello-interval** value to **1**.

Options *seconds*—Frequency of transmission for hello packets.

Range: 1 through 20,000 seconds

Default: 3 seconds (for designated intermediate system [DIS] routers), 9 seconds (for non-DIS routers)

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- *hold-time*

hello-padding

Syntax hello-padding (adaptive | disable | loose | strict);

Hierarchy Level [edit logical-systems *logical-system-name* protocols isis interface *interface-name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name*],
[edit protocols isis interface *interface-name*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name*]

Release Information Statement introduced in Junos OS Release 8.0.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Configure padding on hello packets to accommodate asymmetrical maximum transfer units (MTUs) from different hosts.

This helps to prevent a premature adjacency Up state when one routing device's MTU does not meet the requirements to establish the adjacency.

As an OSI Layer 2 protocol, IS-IS does not support data fragmentation. Therefore, maximum packet sizes must be established and supported between two routers. During adjacency establishment, the IS-IS protocol makes sure that the link supports a packet size of 1492 bytes by padding outgoing hello packets up to the maximum packet size of 1492 bytes.

This is the default behavior of the Junos OS IS-IS implementation. However, Junos OS provides an option to disable hello padding that can override this behavior.

There are four types of hello padding:

- Adaptive padding—On point-to-point connections, the hello packets are padded from the initial detection of a new neighbor until the neighbor verifies the adjacency as Up in the adjacency state type, length, and value (TLV) tuple. If the neighbor does not support the adjacency state TLV, then padding continues. On LAN connections, padding starts from the initial detection of a new neighbor until there is at least one active adjacency on the interface. Adaptive padding has more overhead than loose padding and is able to detect MTU asymmetry from one side of the connection. This one-sided detection can result in generation of extra link-state PDUs that are flooded throughout the network. Specify the **adaptive** option to configure enough padding to establish an adjacency to neighbors.
- Disabled padding—Padding is disabled on all types of interfaces for all adjacency states. Specify the **disable** option to accommodate interfaces that support less than the default packet size of 1492 bytes.
- Loose padding (the default)—The hello packet is padded from the initial detection of a new neighbor until the adjacency transitions to the Up state. Loose padding might not be able to detect certain situations such as asymmetrical MTUs between the routing devices. Specify the **loose** option to configure enough padding to initialize an adjacency to neighbors.

- Strict padding—Padding is done on all interface types and for all adjacency states, and is continuous. Strict padding has the most overhead. The advantage is that strict padding detects MTU issues on both sides of a link. Specify the **strict** option to configure padding to allow all adjacency states with neighbors.

Options

adaptive—Configure padding until the neighbor adjacency is established and active.

disable—Disable padding on all types of interfaces for all adjacency states.

loose—Configure padding until the state of the adjacency is initialized.

strict—Configure padding for all adjacency states.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Example: Configuring IS-IS*

hold-time (Protocols IS-IS)

Syntax hold-time *seconds*;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis interface *interface-name* level *level-number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name* level *level-number*],
[edit protocols isis interface *interface-name* level *level-number*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name* level *level-number*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Set the length of time a neighbor considers this router to be operative (up) after receiving a hello packet. If the neighbor does not receive another hello packet within the specified time, it marks this routing device as inoperative (down). The hold time itself is advertised in the hello packets.

The hold time specifies how long a neighbor should consider this routing device to be operative without receiving another hello packet. If the neighbor does not receive a hello packet from this routing device within the hold time, it marks the routing device as being unavailable.

For systems configured with graceful routing switchover (GRES) with Graceful Restart, the hold time for Master and Backup Routing Engines should be set to a value higher than 40 seconds. This ensures that adjacencies between the Routing Engine and the neighboring peer 'helper' routers do not time out, stopping graceful restart, and all traffic.

Options ***seconds***—Hold-time value, in seconds.

Range: 3 through 65,535 seconds, or 1 to send out hello packets every 333 milliseconds

Default: 9 seconds (for designated intermediate system [DIS] routers), 27 seconds (for non-DIS routers; three times the default hello interval)

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Configuring Graceful Routing Engine Switchover*
- *Example: Configuring IS-IS*
- *Example: Configuring IS-IS for GRES with Graceful Restart*
- hello-interval on page 101

ignore-attached-bit

Syntax ignore-attached-bit;

Hierarchy Level [edit logical-systems *logical-system-name* protocols isis],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis],
[edit protocols isis],
[edit routing-instances *routing-instance-name* protocols isis]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Ignore the attached bit on IS-IS Level 1 routers. Configuring this statement enables the routing device to ignore the attached bit on incoming Level 1 link-state PDUs. If the attached bit is ignored, no default route, which points to the routing device which has set the attached bit, is installed.

There might be times, such as during a denial-of-service (DoS) attack, that you do not want a Level 1 router to be able to forward traffic based on a default route.

To prevent a routing device from being able to reach interarea destinations, you can prevent the routing device from installing the default route without affecting the status of its IS-IS adjacencies. The **ignore-attached-bit** statement is used to tell the routing device to ignore the presence of the attached bit in Level 1 link-state PDUs, which blocks the installation of the IS-IS default route.

Default The **ignore-attached-bit** statement is disabled by default.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

interface (Protocols IS-IS)

Syntax

```
interface (all | interface-name) {
  disable;
  bfd-liveness-detection {
    authentication {
      algorithm algorithm-name;
      key-chain key-chain-name;
      loose-check;
    }
    detection-time {
      threshold milliseconds;
    }
    minimum-interval milliseconds;
    minimum-receive-interval milliseconds;
    transmit-interval {
      threshold milliseconds;
      minimum-interval milliseconds;
    }
    multiplier number;
  }
  checksum;
  csnp-interval (seconds | disable);
  hello-padding (adaptive | loose | strict);
  ldp-synchronization {
    disable;
    hold-time seconds;
  }
  lsp-interval milliseconds;
  mesh-group (value | blocked);
  no-adjacency-holddown;
  no-ipv4-multicast;
  no-ipv6-multicast;
  no-ipv6-unicast;
  no-unicast-topology;
  passive;
  point-to-point;
  level level-number {
    disable;
    hello-authentication-key key;
    hello-authentication-key-chain key-chain-name;
    hello-authentication-type authentication;
    hello-interval seconds;
    hold-time seconds;
    ipv4-multicast-metric metric;
    ipv6-multicast-metric metric;
    ipv6-unicast-metric metric;
    metric metric;
    passive;
    priority number;
    te-metric metric;
  }
}
```

Hierarchy Level

[edit logical-systems *logical-system-name* protocols isis],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis],
[edit protocols isis],
[edit routing-instances *routing-instance-name* protocols isis]

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description

Configure interface-specific IS-IS properties. To configure more than one interface, include the **interface** statement multiple times.

Enabling IS-IS on an interface (by including the **interface** statement at the **[edit protocols isis]** or the **[edit routing-instances *routing-instance-name* protocols isis]** hierarchy level), disabling it (by including the **disable** statement), and not actually having IS-IS run on an interface (by including the **passive** statement) are mutually exclusive states.

Options

all—Have Junos OS create IS-IS interfaces automatically. If you include this option, disable IS-IS on the management interface (fxp0).

interface-name—Name of an interface. Specify the full interface name, including the physical and logical address components.

The remaining statements are explained separately.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Example: Configuring IS-IS*
- *Example: Configuring Multi-Level IS-IS*

ipv4-multicast

Syntax ipv4-multicast;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis topologies],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis topologies],
[edit protocols isis topologies],
[edit routing-instances *routing-instance-name* protocols isis topologies]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Configure alternate IPv4 multicast topologies.

NOTE: The IS-IS interface metrics for the IPv4 topology can be configured independently of the IPv6 metrics. You can also selectively disable interfaces from participating in the IPv6 topology while continuing to participate in the IPv4 topology. This lets you exercise control over the paths that unicast data takes through a network.

Default Multicast topologies are disabled.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Example: Configuring IS-IS Multicast Topology on page 59

ipv4-multicast-metric

Syntax ipv4-multicast-metric *metric*;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis interface *interface-name* level *level-number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name* level *level-number*],
[edit protocols isis interface *interface-name* level *level-number*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name* level *level-number*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Specify the multicast topology metric value for the level.

Options *metric*—Metric value.
Range: 0 through 16,777,215

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Example: Configuring IS-IS Multicast Topology on page 59

ipv6-multicast

Syntax ipv6-multicast;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis topologies],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis topologies],
[edit protocols isis topologies],
[edit routing-instances *routing-instance-name* protocols isis topologies]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.

Description Configure alternate IPv6 multicast topologies.

Default Multicast topologies are disabled.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Example: Configuring IS-IS Multicast Topology on page 59

ipv6-multicast-metric

Syntax ipv6-multicast-metric *metric*;

Hierarchy Level [edit logical-systems *logical-system-name* protocols isis interface *interface-name* level *level-number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name* level *level-number*],
[edit protocols isis interface *interface-name* level *level-number*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name* level *level-number*]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.

Description Specify the IPv6 alternate multicast topology metric value for the level.

Options ***metric***—Metric value.

Range: 0 through 16,777,215

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Example: Configuring IS-IS Multicast Topology on page 59

ipv6-unicast

Syntax ipv6-unicast;

Hierarchy Level [edit logical-systems *logical-system-name* protocols isis topologies],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis topologies],
[edit protocols isis topologies],
[edit routing-instances *routing-instance-name* protocols isis topologies]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.

Description Configure alternate IPv6 unicast topologies.

This statement causes IS-IS to calculate an alternate IPv6 unicast topology, in addition to the normal IPv4 unicast topology, and add the corresponding routes to inet6.0.

NOTE: The IS-IS interface metrics for the IPv4 topology can be configured independently of the IPv6 metrics. You can also selectively disable interfaces from participating in the IPv6 topology while continuing to participate in the IPv4 topology. This lets you exercise control over the paths that unicast data takes through a network.

Default IPv6 unicast topologies are disabled.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Example: Configuring IS-IS IPv4 and IPv6 Unicast Topologies on page 51

ipv6-unicast-metric

Syntax ipv6-unicast-metric *metric*;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis interface *interface-name* level *level-number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name* level *level-number*],
[edit protocols isis interface *interface-name* level *level-number*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name* level *level-number*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.

Description Specify the IPv6 unicast topology metric value for the level. The IS-IS interface metrics for the IPv4 topology can be configured independently of the IPv6 metrics.

Options *metric*—Metric value.

Range: 0 through 16,777,215

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Example: Configuring IS-IS IPv4 and IPv6 Unicast Topologies on page 51

isis

Syntax isis { ... }

Hierarchy Level [edit logical-systems *logical-system-name* protocols],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols],
[edit protocols],
[edit routing-instances *routing-instance-name* protocols]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Enable IS-IS routing on the routing device or for a routing instance.

The **isis** statement is the one statement you must include in the configuration to run IS-IS on the routing device or in a routing instance.

Default IS-IS is disabled on the routing device.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Example: Configuring IS-IS on page 15
- Example: Configuring Multi-Level IS-IS on page 21

level (Global IS-IS)

Syntax

```
level level-number {
  authentication-key key;
  authentication-key-chain (Protocols IS-IS) key-chain-name;
  authentication-type type;
  disable;
  external-preference preference;
  no-csnp-authentication;
  no-hello-authentication;
  no-psnp-authentication;
  preference preference;
  wide-metrics-only;
}
```

Hierarchy Level

[edit logical-systems *logical-system-name* protocols isis],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis],
[edit protocols isis],
[edit routing-instances *routing-instance-name* protocols isis]

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description

Configure the global-level properties.

You can administratively divide a single AS into smaller groups called areas. You configure each routing device interface to be in an area. Any interface can be in any area. The area address applies to the entire routing device. You cannot specify one interface to be in one area and another interface in a different area. To route between areas, you must have two adjacent Level 2 routers that communicate with each other.

Level 1 routers can only route within their IS-IS area. To send traffic outside their area, Level 1 routers must send packets to the nearest intra-area Level 2 router. A routing device can be a Level 1 router, a Level 2 router, or both. You specify the router level on a per-interface basis, and a routing device becomes adjacent to other routing devices on the same level on that link only.

You can configure one Level 1 routing process and one Level 2 routing process on each interface, and you can configure the two levels differently.

Options

level-number—IS-IS level number.

Values: 1 or 2

The remaining statements are explained separately.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Example: Configuring IS-IS*
- *Example: Configuring Multi-Level IS-IS*

loose-authentication-check

Syntax

loose-authentication-check;

Hierarchy Level

[edit logical-systems *logical-system-name* protocols isis],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis],
[edit protocols isis],
[edit routing-instances *routing-instance-name* protocols isis]

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description

Allow the use of MD5 authentication without requiring network-wide deployment.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Example: Configuring Hitless Authentication Key Rollover for IS-IS*

lsp-interval

Syntax lsp-interval *milliseconds*;

Hierarchy Level [edit logical-systems *logical-system-name* protocols isis interface *interface-name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name*],
[edit protocols isis interface *interface-name*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name*]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Configure the link-state PDU interval time.

By default, the routing device sends one link-state PDU packet out an interface every 100 milliseconds. To disable the transmission of all link-state PDUs, set the interval to 0.

Link-state PDU throttling by use of the **lsp-interval** statement controls the flooding pace to neighboring routing devices in order to not overload them.

Also, consider that control traffic (such as link-state PDUs and related packets) might delay user traffic (information packets) because control traffic always has precedence in terms of scheduling on the routing device interface cards. Unfortunately, the control traffic transmission rate is not decreased on low-bandwidth interfaces, such as DS-0 or fractional T1 and E1 interface. Line control traffic stays the same. On a low-bandwidth circuit that is transmitting 30 full-MTU-sized packets, there is not much bandwidth left over for other types of packets.

Default By default, the routing device sends one link-state PDU out an interface every 100 milliseconds.

Options ***milliseconds***—Number of milliseconds between the sending of link-state PDUs. Specifying a value of 0 blocks all link-state PDU transmission.

Range: 0 through 1000 milliseconds

Default: 100 milliseconds

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Example: Configuring the Transmission Frequency for Link-State PDUs on IS-IS Interfaces*

lsp-lifetime

Syntax lsp-lifetime *seconds*;

Hierarchy Level [edit logical-systems *logical-system-name* protocols isis],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis],
[edit protocols isis],
[edit routing-instances *routing-instance-name* protocols isis]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Specify how long a link-state PDU originating from the routing device should persist in the network. The routing device sends link-state PDUs often enough so that the link-state PDU lifetime never expires.

Because link-state PDUs have a maximum lifetime, they need to be refreshed. Refreshing means that a routing device needs to re-originate its link-state PDUs periodically. The re-origination interval must be less than the link-state PDU's lifetime. For example, if the link-state PDU is valid for 1200 seconds, the routing device needs to refresh the link-state PDU in less than 1200 seconds to avoid removal of the link-state PDU from the link-state database by other routing devices. The recommended maximum link-state PDU origination interval is the lifetime minus 300 seconds. So, in a default environment this would be 900 seconds. In Junos OS, the refresh interval is derived from the lifetime and is equal to the lifetime minus 317 seconds. You can change the lifetime to a higher value to reduce the number of refreshes in the network. (You would rarely want to increase the number of refreshes.) Often theses periodic link-state PDU refreshes are referred to as refresh noise, and network administrators want to reduce this noise as much as possible.

The show isis overview command displays the link-state PDU lifetime.

Default By default, link-state PDUs are maintained in network databases for 1200 seconds (20 minutes) before being considered invalid. This length of time, called the *LSP lifetime*, normally is sufficient to guarantee that link-state PDUs never expire.

Options ***seconds***—link-state PDU lifetime, in seconds.

Range: 350 through 65,535 seconds

Default: 1200 seconds

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Example: Configuring the Transmission Frequency for Link-State PDUs on IS-IS Interfaces*

max-areas

Syntax max-areas *number*;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis]
[edit protocols isis],
[edit routing-instances *routing-instance-name* protocols isis]

Release Information
Statement introduced in Junos OS Release 8.1.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Modify the maximum number of IS-IS areas advertised.

This value is included in the Maximum Address Area field of the IS-IS common PDU header included in all outgoing PDUs.

The maximum number of areas you can advertise is restricted to 36 to ensure that the IIH PDUs have enough space to include other type, length, and value (TLV) fields, such as the Authentication and IPv4 and IPv6 Interface Address TLVs.

Options
number—Maximum number of areas to include in the IS-IS hello (IIH) PDUs and link-state PDUs.

Range: 3 through 36

Default: 3

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- *Example: Configuring Multi-Level IS-IS*

mesh-group (Protocols IS-IS)

Syntax mesh-group (blocked | *value*);

Hierarchy Level [edit logical-systems *logical-system-name* protocols isis interface *interface-name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name*],
[edit protocols isis interface *interface-name*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name*]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Configure an interface to be part of a mesh group, which is a set of fully connected nodes.

A *mesh group* is a set of routing devices that are fully connected. That is, they have a fully meshed topology. When link-state PDUs are being flooded throughout an area, each router within a mesh group receives only a single copy of a link-state PDU instead of receiving one copy from each neighbor, thus minimizing the overhead associated with the flooding of link-state PDUs.

To create a mesh group and designate that an interface be part of the group, assign a mesh-group number to all the routing device interfaces in the group. To prevent an interface in the mesh group from flooding link-state PDUs, configure blocking on that interface.

Options **blocked**—Configure the interface so that it does not flood link-state PDUs.

value—Number that identifies the mesh group.
Range: 1 through 4,294,967,295 (2^{32} – 1; 32 bits are allocated to identify a mesh group)

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- *Example: Configuring Mesh Groups of IS-IS Interfaces*

metric (Protocols IS-IS)

Syntax metric *metric*;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis interface *interface-name* level *level-number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name* level *level-number*],
[edit protocols isis interface *interface-name* level *level-number*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name* level *level-number*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Specify the metric value for the level.

All IS-IS routes have a cost, which is a routing metric that is used in the IS-IS link-state calculation. The cost is an arbitrary, dimensionless integer that can be from 1 through 63, or from 1 through 16,777,215 ($2^{24} - 1$) if you are using wide metrics.

Similar to other routing protocols, IS-IS provides a way of exporting routes from the routing table into the IS-IS network. When a route is exported into the IS-IS network without a specified metric, IS-IS uses default metric values for the route, depending on the protocol that was used to learn the route.

Table 5 on page 120 depicts IS-IS route export metric default values.

Table 5: Default Metric Values for Routes Exported into IS-IS

Protocol Used for Learning the Route	Default Metric Value
Direct	10
Static	Same as reported by the protocol used for exporting the route
Aggregate	10
Generate	10
RIP	Same as reported by the protocol used for exporting the route
OSPF	Same as reported by the protocol used for exporting the route
BGP	10

The default metric values behavior can be customized by using routing policies.

Options ***metric***—Metric value.

Range: 1 through 63, or 1 through 16,777,215 (if you have configured wide metrics)

Default: 10 (for all interfaces except lo0), 0 (for the lo0 interface)

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- *Example: Enabling Wide IS-IS Metrics for Traffic Engineering*
- *te-metric*
- wide-metrics-only on page 146

no-adjacency-holddown

Syntax
no-adjacency-holddown;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis],
[edit protocols isis],
[edit routing-instances *routing-instance-name* protocols isis]

Release Information
Statement introduced in Junos OS Release 8.0.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description
Disable the hold-down timer for IS-IS adjacencies.

A hold-down timer delays the advertising of adjacencies by waiting until a time period has elapsed before labeling adjacencies in the up state. You can disable this hold-down timer, which labels adjacencies up faster. However, disabling the hold-down timer creates more frequent link-state PDU updates and SPF computation.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- hold-time on page 104

no-authentication-check

Syntax no-authentication-check;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis],
[edit protocols isis],
[edit routing-instances *routing-instance-name* protocols isis]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Generate authenticated packets and check the authentication on received packets, but do not reject packets that cannot be authenticated.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- csnp-interval on page 93
- hello-authentication-type on page 100

no-csnp-authentication

Syntax no-csnp-authentication;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis level *level-number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis level *level-number*],
[edit protocols isis level *level-number*],
[edit routing-instances *routing-instance-name* protocols isis level *level-number*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Suppress authentication check on complete sequence number PDU (CSNP) packets.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- csnp-interval on page 93

no-hello-authentication

Syntax no-hello-authentication;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis level *level-number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis level *level-number*],
[edit protocols isis level *level-number*],
[edit routing-instances *routing-instance-name* protocols isis level *level-number*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Suppress authentication check on complete sequence number hello packets.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- hello-authentication-type on page 100

no-ipv4-multicast

Syntax no-ipv4-multicast;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis interface *interface-name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name*],
[edit protocols isis interface *interface-name*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Exclude an interface from IPv4 multicast topologies.

Default Multicast topologies are disabled.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Example: Configuring IS-IS Multicast Topology on page 59

no-ipv4-routing

Syntax no-ipv4-routing;

Hierarchy Level [edit logical-systems *logical-system-name* protocols isis],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis],
[edit protocols isis],
[edit routing-instances *routing-instance-name* protocols isis]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Disable IP version 4 (IPv4) routing.

Disabling IPv4 routing has the following results:

- The routing device does not advertise the network layer protocol identifier (NLPID) for IPv4 in the Junos OS link-state PDU fragment zero.
- The routing device does not advertise any IPv4 prefixes in Junos OS link-state PDUs.
- The routing device does not advertise the NLPID for IPv4 in Junos OS hello packets.
- The routing device does not advertise any IPv4 addresses in Junos OS hello packets.
- The routing device does not calculate any IPv4 routes.

NOTE: Note: Even when **no-ipv4-routing** is configured, an IS-IS traceoptions log can list rejected IPv4 addresses. When a configuration is committed, IS-IS schedules a scan of the routing table to determine whether any routes need to be exported into the IS-IS link state database. The implicit default export policy action is to reject everything. IPv4 addresses from the routing table are examined for export, rejected by the default policy, and the rejections are logged.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Example: Configuring IS-IS IPv4 and IPv6 Unicast Topologies on page 51

no-ipv6-multicast

Syntax no-ipv6-multicast;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis interface *interface-name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name*],
[edit protocols isis interface *interface-name*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.

Description Exclude an interface from the IPv6 multicast topologies.

Default Multicast topologies are disabled.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Example: Configuring IS-IS Multicast Topology on page 59

no-ipv6-routing

Syntax no-ipv6-routing;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis],
[edit protocols isis],
[edit routing-instances *routing-instance-name* protocols isis]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.

Description
Disable IP version 6 (IPv6) routing.

Disabling IPv6 routing has the following results:

- The routing device does not advertise the network layer protocol identifier (NLPID) for IPv6 in the Junos OS link-state PDU fragment zero.
- The routing device does not advertise any IPv6 prefixes in Junos OS link-state PDUs.
- The routing device does not advertise the NLPID for IPv6 in Junos OS hello packets.
- The routing device does not advertise any IPv6 addresses in Junos OS hello packets.
- The routing device does not calculate any IPv6 routes.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Example: Configuring IS-IS IPv4 and IPv6 Unicast Topologies on page 51

no-ipv6-unicast

Syntax no-ipv6-unicast;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis interface *interface-name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name*],
[edit protocols isis interface *interface-name*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.

Description Exclude an interface from the IPv6 unicast topologies. This enables you to exercise control over the paths that unicast data takes through a network.

Default IPv6 unicast topologies are disabled.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Example: Configuring IS-IS IPv4 and IPv6 Unicast Topologies on page 51

no-psnp-authentication

Syntax no-psnp-authentication;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis level *level-number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis level *level-number*],
[edit protocols isis level *level-number*],
[edit routing-instances *routing-instance-name* protocols isis level *level-number*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Suppress authentication check on partial sequence number PDU (PSNP) packets.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Configuring IS-IS Authentication on page 13

no-unicast-topology

Syntax no-unicast-topology;

Hierarchy Level [edit logical-systems *logical-system-name* protocols isis interface *interface-name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name*],
[edit protocols isis interface *interface-name*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name*]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Exclude an interface from the IPv4 unicast topologies.

Default IPv4 unicast topologies are disabled.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Example: Configuring IS-IS Multicast Topology on page 59

overload (Protocols IS-IS)

Syntax

```
overload {
  advertise-high-metrics;
  allow-route-leaking;
  timeout seconds;
}
```

Hierarchy Level

[edit logical-systems *logical-system-name* protocols isis],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis],
[edit protocols isis],
[edit routing-instances *routing-instance-name* protocols isis]

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description

Configure the local routing device so that it appears to be overloaded. This statement causes the routing device to continue participating in IS-IS routing, but prevents it from being used for transit traffic. Traffic destined to immediately attached subnets continues to transit the routing device.

You can also advertise maximum link metrics in network layer reachability information (NLRI) instead of setting the overload bit.

You configure or disable overload mode in IS-IS with or without a timeout. Without a timeout, overload mode is set until it is explicitly deleted from the configuration. With a timeout, overload mode is set if the time elapsed since the IS-IS instance started is less than the specified timeout.

A timer is started for the difference between the timeout and the time elapsed since the instance started. If the time elapsed after the IS-IS instance is enabled is less than the specified timeout, overload mode is set. When the timer expires, overload mode is cleared. In overload mode, the routing device IS-IS advertisements are originated with the overload bit set. This causes the transit traffic to take paths around the routing device. However, the overloaded routing device's own links are still accessible.

The value of the overload bit depends on these three scenarios:

1. When the overload bit has already been set to a given value and the routing process is restarted: Link-state PDUs are regenerated with the overload bit cleared.
2. When the overload bit is reset to a lesser value while the routing process is running: Link-state PDUs are regenerated with the overload bit cleared.
3. When the overload bit is reset to a greater value while the routing process is running: Link-state PDUs are regenerated with the overload bit set to the difference between the old and new value.

In overload mode, the routing device advertisement is originated with all the transit routing device links (except stub) set to a metric of 0xFFFF. The stub routing device links are advertised with the actual cost of the interfaces corresponding to the stub. This causes the transit traffic to avoid the overloaded routing device and take paths around the routing device.

To understand the reason for setting the overload bit, consider that BGP converges slowly. It is not very good at detecting that a neighbor is down because it has slow-paced keepalive timers. Once the BGP neighbor is determined to be down, it can take up to 2 minutes for a BGP router to declare the neighbor down. IS-IS is much quicker. IS-IS only takes 10-30 seconds to detect absent peers. It is the slowness of BGP, more precisely the slowness of internal BGP (IBGP), that necessitates the use of the overload bit. IS-IS and BGP routing are mutually dependent on each other. If both do not converge at the same time, traffic is dropped without notification (black holed).

You might want to configure the routing device so that it appears to be overloaded when you are restarting routing on the device. Setting the overload bit for a fixed amount of time right after a restart of the routing protocol process (rpd) ensures that the router does not receive transit traffic while the routing protocols (especially IBGP) are still converging.

Setting the overload bit is useful when performing hardware or software maintenance work on a routing device. After the maintenance work, clear the overload bit to carry on forwarding transit traffic. Manual clearing of the overload bit is not always possible. What is needed is an automated way of clearing the overload bit after some amount of time. Most networks use a time value of 300 seconds. This 5-minute value provides a good balance, allowing time to bring up even large internal IBGP meshes, while still relatively quick.

Another appropriate application for setting for the overload bit is on dedicated devices such as BGP route reflectors, which are intentionally not meant to carry any transit traffic. In this case, you would not use the timer.

You can verify that the overload bit is set by running the **show isis database** command.

Options

advertise-high-metrics—Advertise maximum link metrics in NLRIs instead of setting the overload bit.

The **advertise-high-metric** setting is only valid while the routing device is in overload mode. When **advertise-high-metric** is configured, IS-IS does not set the overload bit. Rather, it sets the metric to 63 or 16,777,214, depending whether wide metrics are enabled. This allows the overloaded routing device to be used for transit as a last resort.

An L1-L2 router in overload mode stops leaking route information between L1 and L2 levels and clears its attached bit. This is also true when **advertise-high-metrics** is configured.

allow-route-leaking—Enable leaking of route information into the network even if the overload bit is set.

NOTE: **The allow-route-leaking option does not work if the routing device is in dynamic overload mode. Dynamic overload can occur if the device has exceeded its resource limits, such as the prefix limit.**

timeout *seconds*—Number of seconds at which the overloading is reset.

Range: 60 through 1800 seconds

Default: 0 seconds

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Example: Configuring IS-IS*

passive (Protocols IS-IS)

Syntax passive;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis interface *interface-name*],
[edit logical-systems *logical-system-name* protocols isis interface *interface-name* level *level-number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name* level *level-number*],
[edit protocols isis interface *interface-name*],
[edit protocols isis interface *interface-name* level *level-number*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name* level *level-number*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Advertise the direct interface addresses on an interface or into a level on the interface without actually running IS-IS on that interface or level.

This statement effectively prevents IS-IS from running on the interface. To enable IS-IS on an interface, include the **interface** statement at the **[edit protocols isis]** or the **[edit routing-instances *routing-instance-name* protocols isis]** hierarchy level. To disable it, include the **disable** statement at those hierarchy levels. The three states—enabling, disabling, or not running IS-IS on an interface—are mutually exclusive.

NOTE: Configuring IS-IS on a loopback interface automatically renders it as a passive interface, irrespective of whether the passive statement was used in the configuration of the interface.

If neither passive mode nor the **family iso** option is configured on the IS-IS interface, then the routing device treats the interface as not being operational, and no direct IPv4/IPv6 routes are exported into IS-IS. (You configure the **family iso** option at the **[edit interfaces *interface-name* unit *logical-unit-number*]** hierarchy level.)

Default By default, IS-IS must be configured on an interface or a level for direct interface addresses to be advertised into that level.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Example: Configuring Multi-Level IS-IS on page 21

- *disable*

point-to-point

Syntax point-to-point;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis interface *interface-name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name*],
[edit protocols isis interface *interface-name*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Configure an IS-IS interface to behave like a point-to-point connection.

You can use the **point-to-point** statement to configure a LAN interface to act like a point-to-point interface for IS-IS. You do not need an unnumbered LAN interface, and it has no effect if configured on an interface that is already point-to-point.

The **point-to-point** statement affects only IS-IS protocol procedures on that interface. All other protocols continue to treat the interface as a LAN interface. Only two IS-IS routing devices can be connected to the LAN interface, and both must be configured as point-to-point.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- IS-IS Overview on page 3
- Understanding IS-IS Designated Routers on page 78
- *Example: Configuring Synchronization Between IS-IS and LDP*

preference (Protocols IS-IS)

Syntax preference *preference*;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis level *level-number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis level *level-number*],
[edit protocols isis level *level-number*],
[edit routing-instances *routing-instance-name* protocols isis level *level-number*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Configure the preference of internal routes.

Route preferences (also known as administrative distances) are used to select which route is installed in the forwarding table when several protocols calculate routes to the same destination. The route with the lowest preference value is selected.

To change the preference values, include the **preference** statement (for internal routes) or the **external-preference** statement.

Options *preference*—Preference value.

Range: 0 through 4,294,967,295 ($2^{32} - 1$)

Default: 15 (for Level 1 internal routes), 18 (for Level 2 internal routes), 160 (for Level 1 external routes), 165 (for Level 2 external routes)

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Route Preferences Overview*
- *Example: Redistributing OSPF Routes into IS-IS*
- *Example: Redistributing BGP Routes with a Specific Community Tag into IS-IS*
- external-preference on page 96

prefix-export-limit (Protocols IS-IS)

Syntax prefix-export-limit *number*;

Hierarchy Level [edit logical-systems *logical-system-name* protocols isis level *level-number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis level *level-number*],
[edit protocols isis level *level-number*],
[edit routing-instances *routing-instance-name* protocols isis level *level-number*]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Configure a limit to the number of prefixes exported into IS-IS.

By default, there is no limit to the number of prefixes that can be exported into IS-IS. To configure a limit to the number of prefixes that can be exported into IS-IS, include the **prefix-export-limit** statement. The **prefix-export-limit** statement protects the rest of the network from a malicious policy by applying a threshold filter for exported routes.

The number of prefixes depends on the size of your network. Good design advice is to set it to double the total number of IS-IS Level 1 and Level 2 routing devices in your network.

If the number of prefixes exported into IS-IS exceeds the configured limit, the overload bit is set and the overload state is reached. When other routers detect that this bit is set, they do not use this routing device for transit traffic, but they do use it for packets destined to the overloaded routing device's directly connected networks and IP prefixes. The overload state can be cleared by using the clear isis overload command.

The show isis overview command displays the prefix export limit when it is configured.

Options ***number***—Prefix limit.

Range: 0 through 4,294,967,295 ($2^{32} - 1$)

Default: None

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Example: Redistributing BGP Routes with a Specific Community Tag into IS-IS*
- *Example: Redistributing OSPF Routes into IS-IS*

priority (Protocols IS-IS)

Syntax priority *number*;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis interface *interface-name* level *level-number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis interface *interface-name* level *level-number*],
[edit protocols isis interface *interface-name* level *level-number*],
[edit routing-instances *routing-instance-name* protocols isis interface *interface-name* level *level-number*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Configure the interface's priority for becoming the designated router. The interface with the highest priority value becomes that level's designated router.

The priority value is meaningful only on a multiaccess network. It has no meaning on a point-to-point interface.

A routing device advertises its priority to become a designated router in its hello packets. On all multiaccess networks, IS-IS uses the advertised priorities to elect a designated router for the network. This routing device is responsible for sending network link-state advertisements, which describe all the routing devices attached to the network. These advertisements are flooded throughout a single area.

A routing device's priority for becoming the designated router is indicated by an arbitrary number from 0 through 127. Routing devices with a higher value are more likely to become the designated router.

Options *number*—Priority value.

Range: 0 through 127

Default: 64

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Example: Configuring IS-IS Designated Routers on page 78

reference-bandwidth (Protocols IS-IS)

Syntax reference-bandwidth *reference-bandwidth*;

Hierarchy Level [edit logical-systems *logical-system-name* protocols isis],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis],
[edit protocols isis],
[edit routing-instances *routing-instance-name* protocols isis]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Optimize routing based on bandwidth by setting the reference bandwidth used in calculating the default interface cost.

All IS-IS interfaces have a cost, which is a routing metric that is used in the IS-IS link-state calculation. Routes with lower total path metrics are preferred over those with higher path metrics. When there are several equal-cost routes to a destination, traffic is distributed equally among them.

The cost of a route is described by a single dimensionless metric that is determined using the following formula:

```
cost = reference-bandwidth/bandwidth
```

For example, if you set the reference bandwidth to 1 Gbps (that is, ***reference-bandwidth*** is set to 1,000,000,000), a 100-Mbps interface has a routing metric of 10.

All IS-IS interfaces have a cost, which is a routing metric that is used in the IS-IS link-state calculation. Routes with lower total path metrics are preferred over those with higher path metrics.

Options ***reference-bandwidth***—Reference bandwidth value in bits per second.

Range: 9600 through 1,000,000,000,000 bps

Default: None

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Example: Configuring IS-IS*
- http://www.juniper.net/us/en/training/certification/JNCIP_studyguide.pdf

rib-group (Protocols IS-IS)

Syntax

```
rib-group {
    inet group-name;
    inet6 group-name;
}
```

Hierarchy Level

[edit logical-systems *logical-system-name* protocols isis],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis],
[edit protocols isis],
[edit routing-instances *routing-instance-name* protocols isis]

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description

Install routes learned from IS-IS routing instances into routing tables in the IS-IS routing table group. You can install IPv4 routes or IPv6 routes.

Support for IPv6 routing table groups in IS-IS enables IPv6 routes that are learned from IS-IS routing instances to be installed into other routing tables defined in an IS-IS routing table group.

Options

group-name—Name of the routing table group.

inet—Install IPv4 IS-IS routes.

inet6—Install IPv6 IS-IS routes.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Example: Exporting Specific Routes from One Routing Table Into Another Routing Table*
- *Example: Importing Direct and Static Routes Into a Routing Instance*
- *Understanding Multiprotocol BGP*

topologies (Protocols IS-IS)

Syntax

```
topologies {
  ipv4-multicast;
  ipv6-multicast;
  ipv6-unicast;
}
```

Hierarchy Level

[edit logical-systems *logical-system-name* protocols isis],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis],
[edit protocols isis],
[edit routing-instances *routing-instance-name* protocols isis]

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description

Configure alternate IS-IS topologies.

The remaining statements are explained separately.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Example: Configuring IS-IS IPv4 and IPv6 Unicast Topologies on page 51
- Example: Configuring IS-IS Multicast Topology on page 59

traceoptions (Protocols IS-IS)

Syntax

```
traceoptions {
  file name <size size> <files number> <world-readable | no-world-readable>;
  flag flag <flag-modifier> <disable>;
}
```

Hierarchy Level

[edit logical-systems *logical-system-name* protocols isis],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis],
[edit protocols isis],
[edit routing-instances *routing-instance-name* protocols isis]

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description

Configure IS-IS protocol-level tracing options. To specify more than one tracing operation, include multiple **flag** statements.

NOTE: The **traceoptions** statement is not supported on QFabric systems.

Default

The default IS-IS protocol-level tracing options are those inherited from the routing protocols **traceoptions** statement included at the **[edit routing-options]** hierarchy level.

Options

disable—(Optional) Disable the tracing operation. You can use this option to disable a single operation when you have defined a broad group of tracing operations, such as **all**.

file *name*—Name of the file to receive the output of the tracing operation. Enclose the name within quotation marks (" "). All files are placed in the directory **/var/log**. We recommend that you place IS-IS tracing output in the file **isis-log**.

files *number*—(Optional) Maximum number of trace files. When a trace file named ***trace-file*** reaches its maximum size, it is renamed ***trace-file*.0**, then ***trace-file*.1**, and so on, until the maximum number of trace files is reached. Then, the oldest trace file is overwritten.

If you specify a maximum number of files, you also must specify a maximum file size with the **size** option.

Range: 2 through 1000 files

Default: 10 files

flag *flag*—Tracing operation to perform. To specify more than one flag, include multiple **flag** statements.

IS-IS Protocol-Specific Tracing Flags

- **csn**—Complete sequence number PDU (CSNP) packets
- **error**—Errored IS-IS packets
- **graceful-restart**—Graceful restart operation
- **hello**—Hello packets
- **ldp-synchronization**—Synchronization between IS-IS and LDP
- **lsp**—Link-state PDUs
- **lsp-generation**—Link-state PDU generation packets
- **packets**—All IS-IS protocol packets
- **psn**—Partial sequence number PDU (PSNP) packets
- **spf**—Shortest-path-first calculations

Global Tracing Flags

- **all**—All tracing operations
- **general**—A combination of the **normal** and **route** trace operations
- **normal**—All normal operations, including adjacency changes

Default: If you do not specify this option, only unusual or abnormal operations are traced.

- **policy**—Policy operations and actions
- **route**—Routing table changes
- **state**—State transitions
- **task**—Routing protocol task processing
- **timer**—Routing protocol timer processing

flag-modifier—(Optional) Modifier for the tracing flag. You can specify one or more of these modifiers:

- **detail**—Provide detailed trace information.
- **receive**—Trace the packets being received.
- **send**—Trace the packets being transmitted.

no-world-readable—(Optional) Prevent any user from reading the log file.

size *size*—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). When a trace file named ***trace-file*** reaches this size, it is renamed ***trace-file*.0**. When the ***trace-file*** again reaches its maximum size, ***trace-file*.0** is renamed ***trace-file*.1** and ***trace-file*** is renamed ***trace-file*.0**. This renaming scheme continues until the maximum number of trace files is reached. Then, the oldest trace file is overwritten. Note that if you specify a maximum file size, you also must specify a maximum number of trace files with the **files** option.

Syntax: ***x*k** to specify KB, ***x*m** to specify MB, or ***x*g** to specify GB

Range: 10 KB through the maximum file size supported on your system

Default: 128 KB

world-readable—(Optional) Allow any user to read the log file.

Required Privilege Level

routing and trace—To view this statement in the configuration.
routing-control and trace-control—To add this statement to the configuration.

Related Documentation

- *Example: Configuring the Transmission Frequency for CSNPs on IS-IS Interfaces*
- *Example: Configuring the Transmission Frequency for Link-State PDUs on IS-IS Interfaces*
- *Example: Enabling Packet Checksums on IS-IS Interfaces*

traffic-engineering (Protocols IS-IS)

Syntax

```
traffic-engineering {
  disable;
  credibility-protocol-preference;
  family inet {
    shortcuts {
      multicast-rpf-routes;
    }
  }
  family inet6 {
    shortcuts;
  }
  multipath {
    lsp-equal-cost;
  }
}
```

Hierarchy Level [edit logical-systems *logical-system-name* protocols isis],
[edit protocols isis]

Release Information Statement introduced before Junos OS Release 7.4.
Support for the **family** statement introduced in Junos OS Release 9.3.
Support for the **credibility-protocol-preference** statement introduced in Junos OS Release 9.4.
Support for the **multipath** statement introduced in Junos OS Release 9.6.
Support for the **lsp-equal-cost** statement introduced in Junos OS Release 9.6.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Configure traffic engineering properties for IS-IS.

IS-IS always performs shortest-path-first (SPF) calculations to determine next hops. For prefixes reachable through a particular next hop, IS-IS places that next hop for that prefix in the inet.0 routing table. In addition, for routers running MPLS, IS-IS installs the prefix for IPv4 routes in the inet.3 routing table as well. The inet.3 table, which is present on the ingress router, contains the host address of each MPLS label-switched path (LSP) egress router. BGP uses this routing table to resolve next-hop addresses.

If you enable IS-IS traffic engineering shortcuts and if there is a label-switched path to a point along the path to that prefix, IS-IS installs the prefix in the inet.3 routing table and uses the LSP as a next hop. The net result is that for BGP egress routers for which there is no LSP, BGP automatically uses an LSP along the path to reach the egress router.

In Junos OS Release 9.3 and later, IS-IS traffic engineering shortcuts support IPv6 routes. LSPs to be used for shortcuts continue to be signaled using IPv4. However, by default, shortcut routes calculated through IPv6 routes are added to the inet6.3 routing table. The default behavior is for only BGP to use LSPs in its calculations. If you configure MPLS so that both BGP and interior gateway protocols use LSPs for forwarding traffic, shortcut routes calculated through IPv6 are added to the inet6.0 routing table. IS-IS ensures that the IPv6 routes running over the IPv4 MPLS LSP are correctly de-encapsulated at the

tunnel egress by pushing an extra IPv6 explicit null label between the IPv6 payload and the IPv4 transport label.

RSVP LSPs with a higher preference than IS-IS routes are not considered during the computation of traffic engineering shortcuts.

To configure IS-IS so that it uses LSPs as shortcuts when installing information in the inet.3 or inet6.3 routing table, include the following statements:

```
family inet {
  shortcuts {
    multicast-rpf-routes;
  }
}
family inet6 {
  shortcuts;
}
```

For IPv4 traffic, include the **inet** statement. For IPv6 traffic, include the **inet6** statement.

To configure load balancing across multiple LSPs, include the **multipath** statement.

When traffic engineering shortcuts are used, RSVP first looks at the **metric2** value, which is derived from the IGP cost. After this, RSVP considers the LSP metric value. So, if a certain path changes for an LSP and the cost changes, not all LSPs are used to load-balance the network.

When a route with an improved metric is added to the IS-IS internal routing table, IS-IS flushes all next-hop information (including LSP next-hop information) for a route. This is undesirable, because certain equal-cost multipath (ECMP) combinations can be lost during route calculation. To override this default behavior for load balancing, include the **lsp-equal-cost** statement to retain the equal cost path information in the routing table.

```
multipath {
  lsp-equal-cost;
}
```

Because the inet.3 routing table is present only on ingress routers, you can configure LSP shortcuts only on these routers.

Default IS-IS traffic engineering support is enabled.

By default, IS-IS supports traffic engineering by exchanging basic information with the traffic engineering database. To disable this support, and to disable IS-IS shortcuts if they are configured, include the **disable** statement.

Options

credibility-protocol-preference—Specify that IS-IS should use the configured protocol preference for IGP routes to determine the traffic engineering database credibility value. By default, the traffic engineering database prefers IS-IS routes even when the routes of another IGP are configured with a lower, that is, more preferred value. Use this statement to override this default behavior.

The traffic engineering database assigns a credibility value to each IGP and prefers the routes of the IGP with the highest credibility value. In Junos OS Release 9.4 and later, you can configure IS-IS to take protocol preference into account to determine the traffic engineering database credibility value. When protocol preference is used to determine the credibility value, IS-IS routes are not automatically preferred by the traffic engineering database, depending on your configuration. For example, OSPF routes have a default preference value of 10, whereas IS-IS Level 1 routes have a default preference value of 15. When protocol preference is enabled, the credibility value is determined by deducting the protocol preference value from a base value of 512. Using default protocol preference values, OSPF has a credibility value of 502, whereas IS-IS has a credibility value of 497. Because the traffic engineering database prefers IGP routes with the highest credibility value, OSPF routes are now preferred.

NOTE: This feature is also supported for OSPFv2.

lsp-equal-cost—Configure LSPs to be retained as equal cost paths for load balancing when a better path metric is found during the IS-IS internal routing table calculation. When a route with an improved metric is added to the IS-IS internal routing table, IS-IS flushes all next-hop information (including LSP next-hop information) for a route. This is undesirable, because certain equal-cost multipath (ECMP) combinations can be lost during route calculation. To override this default IS-IS behavior, include the **lsp-equal-cost** statement for load balancing, so that the equal cost path information is retained in the routing table.

multipath—Enable load balancing for multiple LSPs.

The remaining statements are explained separately.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- *Example: Enabling OSPF Traffic Engineering Support*
- *Example: Enabling IS-IS Traffic Engineering Support*
- *traffic-engineering (OSPF)*

wide-metrics-only

Syntax wide-metrics-only;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols isis level *level-number*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols isis level *level-number*],
[edit protocols isis level *level-number*],
[edit routing-instances *routing-instance-name* protocols isis level *level-number*]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Configure IS-IS to generate metric values greater than 63 on a per IS-IS level basis.

Normally, IS-IS metrics can have values up to 63, and IS-IS generates two type, length, and value (TLV) tuples, one for an IS-IS adjacency and the second for an IP prefix. To allow IS-IS to support traffic engineering, a second pair of TLVs has been added to IS-IS, one for IP prefixes and the second for IS-IS adjacency and traffic engineering information. With these TLVs, IS-IS metrics can have values up to 16,777,215 ($2^{24} - 1$).

To configure IS-IS to generate only the new pair of TLVs and thus to allow the wider range of metric values, include the **wide-metrics-only** statement.

Default By default, Junos OS supports the sending and receiving of wide metrics. Junos OS allows a maximum metric value of 63 and generates both pairs of TLVs.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- *Example: Enabling Wide IS-IS Metrics for Traffic Engineering*
- *te-metric*

CHAPTER 5

Operational Commands

- clear isis adjacency
- clear isis database
- clear isis overload
- clear isis statistics
- show isis adjacency
- show isis authentication
- show isis database
- show isis hostname
- show isis interface
- show isis overview
- show isis route
- show isis statistics

clear isis adjacency

List of Syntax
Syntax on page 148
Syntax (EX Series Switches and QFX Series) on page 148

Syntax
clear isis adjacency
<instance *instance-name*>
<interface *interface-name*>
<logical-system (all | *logical-system-name*)>
<*neighbor*>

Syntax (EX Series Switches and QFX Series)
clear isis adjacency
<instance *instance-name*>
<interface *interface-name*>
<*neighbor*>

Release Information
Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.

Description
Remove entries from the IS-IS adjacency database.

Options
none—Remove all entries from the adjacency database.

instance *instance-name*—(Optional) Clear all adjacencies for the specified routing instance only.

interface *interface-name*—(Optional) Clear all adjacencies for the specified interface only.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

neighbor—(Optional) Clear adjacencies for the specified neighbor only.

Required Privilege Level
clear

Related Documentation
- show isis adjacency on page 156

List of Sample Output
clear isis adjacency on page 148

Output Fields
See show isis adjacency for an explanation of output fields.

Sample Output

clear isis adjacency

The following sample output displays IS-IS adjacency database information before and after the **clear isis adjacency** command is entered:

```
user@host> show isis adjacency
IS-IS adjacency database:
Interface     System         L State       Hold (secs) SNPA
so-1/0/0.0    karakul        3 Up                    26
```

```
so-1/1/3.0    1921.6800.5080 3 Up                    23
so-5/0/0.0    1921.6800.5080 3 Up                    19

user@host> clear isis adjacency karakul

user@host> show isis adjacency
IS-IS adjacency database:
Interface     System         L State        Hold (secs) SNPA
so-1/0/0.0    karakul        3 Initializing          26
so-1/1/3.0    1921.6800.5080 3 Up                    24
so-5/0/0.0    1921.6800.5080 3 Up                    21
```

clear isis database

List of Syntax
Syntax on page 150
Syntax (EX Series Switches and QFX Series) on page 150

Syntax
clear isis database
<*entries*>
<instance *instance-name*>
<logical-system (all | *logical-system-name*)>

Syntax (EX Series Switches and QFX Series)
clear isis database
<*entries*>
<instance *instance-name*>

Release Information
Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
Command introduced in Junos OS Release 12.1 for the QFX Series.
Command introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description
Remove the entries from the IS-IS link-state database, which contains prefixes and topology information.

Options
none—Remove all entries from the IS-IS link-state database for all routing instances.

entries—(Optional) Name of the database entry.

instance *instance-name*—(Optional) Clear all entries for the specified routing instance.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

Required Privilege Level
clear

Related Documentation
- show isis database on page 162

List of Sample Output
clear isis database on page 150

Output Fields
See show isis database for an explanation of output fields.

Sample Output

clear isis database

The following sample output displays IS-IS link-state database information before and after the **clear isis database** command is entered:

```
user@host> show isis database
IS-IS level 1 link-state database:
LSP ID                 Sequence Checksum Lifetime (secs)
crater.00-00               0x12   0x84dd            1139
  1 LSPs
IS-IS level 2 link-state database:
```

```
LSP ID                  Sequence Checksum Lifetime (secs)
crater.00-00                0x19   0xe92c             1134
badlands.00-00              0x16   0x1454              985
carlsbad.00-00              0x33   0x220b             1015
ranier.00-00                0x2e   0xfc31             1007
1921.6800.5066.00-00        0x11   0x7313              566
1921.6800.5067.00-00        0x14   0xd9d4              939
  6 LSPs

user@host> clear isis database

user@host> show isis database
IS-IS level 1 link-state database:
LSP ID                  Sequence Checksum Lifetime (secs)

IS-IS level 2 link-state database:
LSP ID                  Sequence Checksum Lifetime (secs)
```

clear isis overload

List of Syntax
Syntax on page 152
Syntax (EX Series Switches and QFX Series) on page 152

Syntax
clear isis overload
<instance *instance-name*>
<logical-system (all | *logical-system-name*)>

Syntax (EX Series Switches and QFX Series)
clear isis overload
<instance *instance-name*>

Release Information
Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
Command introduced in Junos OS Release 12.1 for the QFX Series.
Command introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description
Reset the IS-IS dynamic overload bit. This command can appear to not work, continuing to display **overload** after execution. The bit is reset only if the root cause is corrected by configuration remotely or locally.

When other routers detect that the overload bit is set, they do not use this routing device for transit traffic, but they do use it for packets destined to the overloaded routing device's directly connected networks and IP prefixes.

Options
none—Reset the IS-IS dynamic overload bit.

instance *instance-name*—(Optional) Reset the IS-IS dynamic overload bit for the specified routing instance.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

Required Privilege Level
clear

Related Documentation
- show isis database on page 162

List of Sample Output
clear isis overload on page 152

Output Fields
See show isis database for an explanation of output fields.

Sample Output

clear isis overload

The following sample output displays IS-IS database information before and after the **clear isis overload** command is entered:

```
user@host> show isis database
```

```
IS-IS level 1 link-state database:
LSP ID                  Sequence Checksum Lifetime Attributes
pro3-c.00-00                 0x4   0x10db     1185 L1 L2 Overload

  1 LSPs
IS-IS level 2 link-state database:
LSP ID                  Sequence Checksum Lifetime Attributes
pro3-c.00-00                 0x5   0x429f     1185 L1 L2 Overload


pro2-a.00-00                0x91e   0x2589      874 L1 L2
pro2-a.02-00                  0x1    0xcbc      874 L1 L2
  3 LSPs
```

```
user@host> clear isis overload
```

```
user@host> show isis database
IS-IS level 1 link-state database:
LSP ID                  Sequence Checksum Lifetime Attributes
pro3-c.00-00                 0xa   0x429e     1183 L1 L2
  1 LSPs

IS-IS level 2 link-state database:
LSP ID                  Sequence Checksum Lifetime Attributes
pro3-c.00-00                 0xc   0x9c39     1183 L1 L2
pro2-a.00-00                0x91e   0x2589      783 L1 L2
pro2-a.02-00                  0x1    0xcbc      783 L1 L2
  3 LSPs
```

clear isis statistics

List of Syntax
Syntax on page 154
Syntax (EX Series Switches and QFX Series) on page 154

Syntax
clear isis statistics
<instance *instance-name*>
<logical-system (all | *logical-system-name*)>

Syntax (EX Series Switches and QFX Series)
clear isis statistics
<instance *instance-name*>

Release Information
Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
Command introduced in Junos OS Release 12.1 for the QFX Series.
Command introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description
Set statistics about IS-IS traffic to zero.

Options
none—Set IS-IS traffic statistics to zero for all routing instances.

instance *instance-name*—(Optional) Set IS-IS traffic statistics to zero for the specified routing instance only.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

Required Privilege Level
view

Related Documentation
- show isis statistics on page 187

List of Sample Output
clear isis statistics on page 154

Output Fields
See show isis statistics for an explanation of output fields.

Sample Output

clear isis statistics

The following sample output displays IS-IS statistics before and after the **clear isis statistics** command is entered:

```
user@host> show isis statistics
IS-IS statistics for merino:

PDU type     Received  Processed      Drops       Sent     Rexmit
LSP             12793      12793          0       8666        719
IIH            116751     116751          0     118834          0
CSNP           203956     203956          0     204080          0
PSNP             7356       7350          6       8635          0
Unknown             0          0          0          0          0
```

```
Totals         340856     340850          6     340215        719

Total packets received: 340856 Sent: 340934

SNP queue length:           0 Drops:          0
LSP queue length:           0 Drops:          0

SPF runs:                1064
Fragments rebuilt:       1087
LSP regenerations:        436
Purges initiated:           0
```

```
user@host> clear isis statistics
```

```
user@host> show isis statistics
IS-IS statistics for merino:

PDU type     Received  Processed      Drops       Sent     Rexmit
LSP                 0          0          0          0          0
IIH                 3          3          0          3          0
CSNP                2          2          0          4          0
PSNP                0          0          0          0          0
Unknown             0          0          0          0          0
Totals              5          5          0          7          0

Total packets received: 5 Sent: 7

SNP queue length:           0 Drops:          0
LSP queue length:           0 Drops:          0

SPF runs:                   0
Fragments rebuilt:          0
LSP regenerations:          0
Purges initiated:           0
```

show isis adjacency

List of Syntax
Syntax on page 156
Syntax (EX Series Switches and QFX Series) on page 156

Syntax
show isis adjacency
<system-id>
<brief | detail | extensive>
<instance *instance-name*>
<logical-system (all | *logical-system-name*)>

Syntax (EX Series Switches and QFX Series)
show isis adjacency
<system-id>
<brief | detail | extensive>
<instance *instance-name*>

Release Information
Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
Command introduced in Junos OS Release 12.1 for the QFX Series.
Command introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description
Display information about IS-IS neighbors.

Options
none—Display standard information about IS-IS neighbors for all routing instances.

system id—(Optional) Display information about IS-IS neighbors for the specified intermediate system.

brief | detail | extensive—(Optional) Display standard information about IS-IS neighbors with the specified level of output.

instance *instance-name*—(Optional) Display information about IS-IS neighbors for the specified routing instance.

logical-system (all | *logical-system-name*)—(Optional) Display information about IS-IS neighbors for all logical systems or for a particular logical system.

Required Privilege Level
view

Related Documentation
- clear isis adjacency on page 148

List of Sample Output
show isis adjacency on page 158
show isis adjacency brief on page 158
show isis adjacency detail on page 159
show isis adjacency extensive on page 159

Output Fields
Table 6 on page 157 describes the output fields for the **show isis adjacency** command. Output fields are listed in the approximate order in which they appear.

Table 6: show isis adjacency Output Fields

Field Name	Field Description	Level of Output
Interface	Interface through which the neighbor is reachable.	All levels
System	System identifier (**sysid**), displayed as a name, if possible.	**brief**
L or Level	Level: • **1**—Level 1 only • **2**—Level 2 only • **3**—Level 1 and Level 2 An exclamation point (**!**) preceding the level number indicates that the adjacency is missing an IP address.	All levels
State	State of the adjacency: **Up**, **Down**, **New**, **One-way**, **Initializing**, or **Rejected**.	All levels
Hold (secs)	Remaining hold time of the adjacency.	**brief**
SNPA	Subnetwork point of attachment (MAC address of the next hop).	**brief**
Expires in	How long until the adjacency expires, in seconds.	**detail**
Priority	Priority to become the designated intermediate system.	**detail extensive**
Up/Down transitions	Count of adjacency status changes from **Up** to **Down** or from **Down** to **Up**.	**detail**
Last transition	Time of the last **Up/Down** transition.	**detail**
Circuit type	Bit mask of levels on this interface: **1**=Level 1 router; **2**=Level 2 router; **3**=both Level 1 and Level 2 router.	**detail**
Speaks	Protocols supported by this neighbor.	**detail extensive**
MAC address	MAC address of the interface.	**detail extensive**
Topologies	Supported topologies.	**detail extensive**
Restart capable	Whether a neighbor is capable of graceful restart: **Yes** or **No**.	**detail extensive**
Adjacency advertisement: Advertise	This routing device has signaled to advertise this interface to its neighbors in their link-state PDUs.	**detail extensive**
Adjacency advertisement: Suppress	This neighbor has signaled not to advertise the interface in the routing device's outbound link-state PDUs.	**detail extensive**
IP addresses	IP address of this neighbor.	**detail extensive**

Table 6: show isis adjacency Output Fields *(continued)*

Field Name	Field Description	Level of Output

Transition log	List of recent transitions, including:
	• **When**—Time at which an IS-IS adjacency transition occurred.
	• **State**—Current state of the IS-IS adjacency (**up**, **down**, or **rejected**).
	  • **Up**—Adjacency is up and operational.
	  • **Down**—Adjacency is down and not available.
	  • **Rejected**—Adjacency has been rejected.
	• **Event**—Type of transition that occurred.
	  • **Seenself**—Possible routing loop has been detected.
	  • **Interface down**—IS-IS interface has gone down and is no longer available.
	  • **Error**—Adjacency error.
	• **Down reason**—Reason that an IS-IS adjacency is down:
	  • **3-Way Handshake Failed**—Connection establishment failed.
	  • **Address Mismatch**—Address mismatch caused link failure.
	  • **Aged Out**—Link expired.
	  • **ISO Area Mismatch**—IS-IS area mismatch caused link failure.
	  • **Bad Hello**—Unacceptable hello message caused link failure.
	  • **BFD Session Down**—Bidirectional failure detection caused link failure.
	  • **Interface Disabled**—IS-IS interface is disabled.
	  • **Interface Down**—IS-IS interface is unavailable.
	  • **Interface Level Disabled**—IS-IS level is disabled.
	  • **Level Changed**—IS-IS level has changed on the adjacency.
	  • **Level Mismatch**—Levels on adjacency are not compatible.
	  • **MPLS LSP Down**—Label-switched path (LSP) is unavailable.
	  • **MT Topology Changed**—IS-IS topology has changed.
	  • **MT Topology Mismatch**—IS-IS topology is mismatched.
	  • **Remote System ID Changed**—Adjacency peer system ID changed.
	  • **Protocol Shutdown**—IS-IS protocol is disabled.
	  • **CLI Command**—Adjacency brought down by user.
	  • **Unknown**—Unknown.
		extensive

Sample Output

show isis adjacency

```
user@host> show isis adjacency
Interface             System         L State       Hold (secs) SNPA
at-2/3/0.0            ranier         3  Up                 23
```

show isis adjacency brief

The output for the **show isis adjacency brief** command is identical to that for the **show isis adjacency** command. For sample output, see show isis adjacency on page 158.

show isis adjacency detail

```
user@host> show isis adjacency detail
ranier
  Interface: at-2/3/0.0, Level: 3, State: Up, Expires in 21 secs
  Priority: 0, Up/Down transitions: 1, Last transition: 00:01:09 ago
  Circuit type: 3, Speaks: IP, IPv6
  Topologies: Unicast
  Restart capable: Yes
  IP addresses: 11.1.1.2
```

show isis adjacency extensive

```
user@host> show isis adjacency extensive
ranier
  Interface: at-2/3/0.0, Level: 3, State: Up, Expires in 22 secs
  Priority: 0, Up/Down transitions: 1, Last transition: 00:01:16 ago
  Circuit type: 3, Speaks: IP, IPv6
  Topologies: Unicast
  Restart capable: Yes
  IP addresses: 11.1.1.2
  Transition log:
  When                  State        Event           Down reason
  Wed Nov  8 21:24:25   Up           Seenself
```

show isis authentication

List of Syntax
Syntax on page 160
Syntax (EX Series Switches and QFX Series) on page 160

Syntax
show isis authentication
<instance *instance-name*>
<logical-system (all | *logical-system-name*)>

Syntax (EX Series Switches and QFX Series)
show isis authentication
<instance *instance-name*>

Release Information
Command introduced in Junos OS Release 7.5.
Command introduced in Junos OS Release 9.0 for EX Series switches.
Support for hitless authentication key rollover introduced in Junos OS Release 11.2.
Command introduced in Junos OS Release 12.1 for the QFX Series.
Command introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description
Display information about IS-IS authentication.

Options
none—Display information about IS-IS authentication.

instance *instance-name*—(Optional) Display IS-IS authentication for the specified routing instance.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

Required Privilege Level
view

List of Sample Output
show isis authentication on page 161
show isis authentication (With Hitless Authentication Key Rollover Configured) on page 161

Output Fields
Table 7 on page 160 describes the output fields for the **show isis authentication** command. Output fields are listed in the approximate order in which they appear.

Table 7: show isis authentication Output Fields

Field Name	Field Description
Interface	Interface name.
Level	IS-IS level.
IIH Auth	IS-IS Hello (IIH) packet authentication type. Displays the name of the active keychain if hitless authentication key rollover is configured.
CSN Auth	Complete sequence number authentication type.

Table 7: show isis authentication Output Fields *(continued)*

Field Name	Field Description
PSN Auth	Partial sequence number authentication type.
L1 LSP Authentication	Layer 1 link-state PDU authentication type.
L2 LSP Authentication	Layer 2 link-state PDU authentication type.

Sample Output

show isis authentication

```
user@host> show isis authentication
Interface             Level IIH Auth  CSN Auth  PSN Auth
at-2/3/0.0            1     Simple    Simple    Simple
                      2     MD5       MD5       MD5

L1 LSP Authentication: Simple
L2 LSP Authentication: MD5
```

show isis authentication (With Hitless Authentication Key Rollover Configured)

```
user@host> show isis authentication
Interface             Level IIH Auth  CSN Auth  PSN Auth
so-0/1/3.0            2     hakrhello MD5       MD5

L2 LSP Authentication: MD5
```

show isis database

List of Syntax
Syntax on page 162
Syntax (EX Series Switches and QFX Series) on page 162

Syntax
show isis database
<system-id>
<brief | detail | extensive>
<instance *instance-name*>
<level (1 | 2)>
<logical-system (all | *logical-system-name*)>

Syntax (EX Series Switches and QFX Series)
show isis database
<system-id>
<brief | detail | extensive>
<level (1 | 2)>
<instance *instance-name*>

Release Information
Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
Command introduced in Junos OS Release 12.1 for the QFX Series.
Command introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description
Display the entries in the IS-IS link-state database, which contains data about PDU packets.

Options
none—Display standard information about IS-IS link-state database entries for all routing instances.

system id—(Optional) Display IS-IS link-state database entries for the specified intermediate system.

brief | detail | extensive—(Optional) Display the specified level of output.

instance *instance-name*—(Optional) Display IS-IS link-state database entries for the specified routing instance.

level (1 | 2)—(Optional) Display IS-IS link-state database entries for the specified IS-IS level.

logical-system (all | *logical-system-name*)—(Optional) Display standard information about IS-IS link-state database entries for all logical systems or for a particular logical system.

Required Privilege Level
view

Related Documentation
- clear isis database on page 150

List of Sample Output
show isis database on page 164
show isis database brief on page 165

show isis database detail on page 165
show isis database extensive on page 165

Output Fields Table 8 on page 163 describes the output fields for the **show isis database** command. Output fields are listed in the approximate order in which they appear. Fields that contain internal IS-IS information useful only in troubleshooting obscure problems are not described in the table. For more details about these fields, contact your customer support representative.

Table 8: show isis database Output Fields

Field Name	Field Description	Level of Output
Interface name	Name of the interface on which the link-state PDU has been received; always **IS-IS** for this command.	All levels
level	Level of intermediate system: • **1**—Intermediate system routes within an area; when the destination is outside an area, it routes toward a Level 2 system. • **2**—Intermediate system routes between areas and toward other ASs.	All levels
LSP ID	Link-state PDU identifier.	All levels
Sequence	Sequence number of the link-state PDU.	All levels
Checksum	Checksum value of the link-state PDU.	All levels
Lifetime (secs)	Remaining lifetime of the link-state PDU, in seconds.	All levels
Attributes	Attributes of the specified database: **L1**, **L2**, **Overload**, or **Attached** (L1 only).	none **brief**
# LSPs	Total number of link-state PDUs in the specified link-state database.	none **brief**
IP prefix	Prefix advertised by this link-state PDU.	**detail extensive**
IS neighbor	IS-IS neighbor of the advertising system.	**detail extensive**
ES neighbor	(J Series routers only) An ES-IS neighbor of the advertising system.	**detail extensive**
IP prefix	IPv4 prefix advertised by this link-state PDU.	**detail extensive**
V6 prefix	IPv6 prefix advertised by this link-state PDU.	**detail extensive**
Metric	Metric of the prefix or neighbor.	**detail extensive**
Header	• **LSP ID**—Link state PDU identifier of the header. • **Length**—Header length. • **Allocated Length**—Amount of length available for the header. • **Router ID**—Address of the local routing device. • **Remaining Lifetime**—Remaining lifetime of the link-state PDU, in seconds.	**extensive**

Table 8: show isis database Output Fields *(continued)*

Field Name	Field Description	Level of Output
Packet	• **LSP ID**—The identifier for the link-state PDU. • **Length**—Packet length. • **Lifetime**—Remaining lifetime, in seconds. • **Checksum**—The checksum of the link-state PDU. • **Sequence**—The sequence number of the link-state PDU. Every time the link-state PDU is updated, this number increments. • **Attributes**—Packet attributes. • **NLPID**—Network layer protocol identifier. • **Fixed length**—Specifies the set length for the packet.	**extensive**
TLVs	• **Area Address**—Area addresses that the routing device can reach. • **Speaks**—Supported routing protocols. • **IP router id**—ID of the routing device (usually the IP address). • **IP address**—IPv4 address. • **Hostname**—Assigned name of the routing device. • **IP prefix**—IP prefix of the routing device. • **Metric**—IS-IS metric that measures the cost of the adjacency between the originating routing device and the advertised routing device. • **IP extended prefix**—Extended IP prefix of the routing device. • **IS neighbor**—Directly attached neighbor's name and metric. • **IS extended neighbor**—Directly attached neighbor's name, metric, IP address, local interface index, and remote interface index. The interface indexes enable Junos OS to support unnumbered extensions for IS-IS, as described in RFC 4205.	**extensive**

Sample Output

show isis database

```
user@host> show isis database
IS-IS level 1 link-state database:
LSP ID                 Sequence Checksum Lifetime Attributes
kobuk.00-00                 0x3   0x3167     1057 L1 L2
camaro.00-00                0x5   0x770e     1091 L1 L2
ranier.00-00                0x4   0xaa95     1091 L1 L2
glacier.00-00               0x4   0x206f     1089 L1 L2
glacier.02-00               0x1   0xd141     1089 L1 L2
badlands.00-00              0x3   0x87a2     1093 L1 L2
  6 LSPs

IS-IS level 2 link-state database:
LSP ID                 Sequence Checksum Lifetime Attributes
kobuk.00-00                 0x6   0x8d6b     1096 L1 L2
camaro.00-00                0x9   0x877b     1101 L1 L2
ranier.00-00                0x8   0x855d     1103 L1 L2
glacier.00-00               0x7   0xf892     1098 L1 L2
glacier.02-00               0x1   0xd141     1089 L1 L2
badlands.00-00              0x6    0x562     1105 L1 L2
  6 LSPs
```

show isis database brief

The output for the **show isis database brief** command is identical to that for the **show isis database** command. For sample output, see show isis database on page 164.

show isis database detail

```
user@host> show isis database logical-system CE3 sisira.00-00 detail

IS-IS level 1 link-state database:

sisira.00-00 Sequence: 0x11, Checksum: 0x10fc, Lifetime: 975 secs
   IS neighbor: hemantha-CE3.02               Metric:       10
   ES neighbor: 0015.0015.0015                Metric:       10 Down
   ES neighbor: 0025.0025.0025                Metric:       10 Down
   ES neighbor: 0030.0030.0030                Metric:       10 Down
   ES neighbor: 0040.0040.0040                Metric:       10 Down
   ES neighbor: sisira                        Metric:        0
   IP prefix: 1.0.0.0/24                      Metric:       10 External Down
   IP prefix: 3.0.0.0/24                      Metric:       10 External Down
   IP prefix: 4.0.0.0/24                      Metric:       10 External Down
   IP prefix: 5.0.0.0/24                      Metric:       10 Internal Up
   IP prefix: 15.15.15.15/32                  Metric:       10 External Down
   IP prefix: 25.25.25.25/32                  Metric:       10 External Down
   IP prefix: 30.30.30.30/32                  Metric:       10 External Down
   IP prefix: 40.40.40.40/32                  Metric:       10 External Down
   IP prefix: 60.60.60.60/32                  Metric:        0 Internal Up

IS-IS level 2 link-state database:

sisira.00-00 Sequence: 0x13, Checksum: 0x69ac, Lifetime: 993 secs
   IS neighbor: hemantha-CE3.02               Metric:       10
   IP prefix: 1.0.0.0/24                      Metric:       10 External Down
   IP prefix: 3.0.0.0/24                      Metric:       10 External Down
   IP prefix: 4.0.0.0/24                      Metric:       10 External Down
   IP prefix: 5.0.0.0/24                      Metric:       10 Internal Up
   IP prefix: 15.15.15.15/32                  Metric:       10 External Down
   IP prefix: 25.25.25.25/32                  Metric:       10 External Down
   IP prefix: 30.30.30.30/32                  Metric:       10 External Down
   IP prefix: 40.40.40.40/32                  Metric:       10 External Down
   IP prefix: 50.50.50.50/32                  Metric:       10 Internal Up
   IP prefix: 60.60.60.60/32                  Metric:        0 Internal Up
   ISO prefix: 60.0006.80ff.f800.0000.0108.0001.0015.0015.0015/152
                                              Metric:       10 External Down
   ISO prefix: 60.0006.80ff.f800.0000.0108.0001.0025.0025.0025/152
                                              Metric:       10 External Down
   ISO prefix: 60.0006.80ff.f800.0000.0108.0001.0030.0030.0030/152
                                              Metric:       10 External Down
   ISO prefix: 60.0006.80ff.f800.0000.0108.0001.0040.0040.0040/152
                                              Metric:       10 External Down
   ISO prefix: 60.0006.80ff.f800.0000.0108.0001.0060.0060.0060/152
                                              Metric:        0 Internal Up
```

show isis database extensive

```
user@host> show isis database extensive

IS-IS level 1 link-state database:

Router-A.00-00 Sequence: 0x1, Checksum: 0xf75c, Lifetime: 1116 secs
```

```
    IP prefix: 192.168.0.1/32                  Metric:        0 Internal Up

  Header: LSP ID: Router-A.00-00, Length: 85 bytes
    Allocated length: 1492 bytes, Router ID: 192.168.0.1
    Remaining lifetime: 1116 secs, Level: 1, Interface: 0
    Estimated free bytes: 1353, Actual free bytes: 1407
    Aging timer expires in: 1116 secs
    Protocols: IP, IPv6

  Packet: LSP ID: Router-A.00-00, Length: 85 bytes, Lifetime : 1200 secs
    Checksum: 0xf75c, Sequence: 0x1, Attributes: 0x3 <L1 L2>
    NLPID: 0x83, Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
    Packet type: 18, Packet version: 1, Max area: 0

  TLVs:
    Area address: 49.0002 (3)
    LSP Buffer Size: 1492
    Speaks: IP
    Speaks: IPV6
    IP router id: 192.168.0.1
    IP address: 192.168.0.1
    Hostname: Router-A
    IP prefix: 192.168.0.1/32, Internal, Metric: default 0, Up
    IP extended prefix: 192.168.0.1/32 metric 0 up
  No queued transmissions

IS-IS level 2 link-state database:

Router-A.00-00 Sequence: 0x5, Checksum: 0x3196, Lifetime: 1158 secs
   IS neighbor: Router-B.02                      Metric:       10
     Two-way fragment: Router-B.02-00, Two-way first fragment: Router-B.02-00
   IS neighbor: Router-E.02                      Metric:       10
     Two-way fragment: Router-E.02-00, Two-way first fragment: Router-E.02-00
   IP prefix: 10.0.0.0/30                    Metric:       10 Internal Up
   IP prefix: 10.0.0.4/30                    Metric:       10 Internal Up
   IP prefix: 192.168.0.1/32                 Metric:        0 Internal Up

  Header: LSP ID: Router-A.00-00, Length: 208 bytes
    Allocated length: 1492 bytes, Router ID: 192.168.0.1
    Remaining lifetime: 1158 secs, Level: 2, Interface: 0
    Estimated free bytes: 1233, Actual free bytes: 1284
    Aging timer expires in: 1158 secs
    Protocols: IP, IPv6

  Packet: LSP ID: Router-A.00-00, Length: 208 bytes, Lifetime : 1198 secs
    Checksum: 0x3196, Sequence: 0x5, Attributes: 0x3 <L1 L2>
    NLPID: 0x83, Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
    Packet type: 20, Packet version: 1, Max area: 0

  TLVs:
    Area address: 49.0002 (3)
    LSP Buffer Size: 1492
    Speaks: IP
    Speaks: IPV6
    IP router id: 192.168.0.1
    IP address: 192.168.0.1
    Hostname: Router-A
    IP prefix: 192.168.0.1/32, Internal, Metric: default 0, Up
    IP prefix: 10.0.0.4/30, Internal, Metric: default 10, Up
    IP prefix: 10.0.0.0/30, Internal, Metric: default 10, Up
    IP extended prefix: 192.168.0.1/32 metric 0 up
```

```
    IP extended prefix: 10.0.0.4/30 metric 10 up
    IP extended prefix: 10.0.0.0/30 metric 10 up
    IS neighbor: Router-E.02, Internal, Metric: default 10
    IS neighbor: Router-B.02, Internal, Metric: default 10
    IS extended neighbor: Router-E.02, Metric: default 10
      IP address: 10.0.0.1
      Local interface index: 101, Remote interface index: 0
    IS extended neighbor: Router-B.02, Metric: default 10
      IP address: 10.0.0.5
      Local interface index: 102, Remote interface index: 0
  No queued transmissions

Router-B.00-00 Sequence: 0x5, Checksum: 0xf8f, Lifetime: 1183 secs
   IS neighbor: Router-B.02                      Metric:       10
     Two-way fragment: Router-B.02-00, Two-way first fragment: Router-B.02-00
   IS neighbor: Router-C.02                      Metric:       10
     Two-way fragment: Router-C.02-00, Two-way first fragment: Router-C.02-00
   IP prefix: 10.0.0.4/30                    Metric:       10 Internal Up
   IP prefix: 10.0.0.8/30                    Metric:       10 Internal Up
   IP prefix: 192.168.0.2/32                 Metric:        0 Internal Up

  Header: LSP ID: Router-B.00-00, Length: 208 bytes
    Allocated length: 284 bytes, Router ID: 192.168.0.2
    Remaining lifetime: 1183 secs, Level: 2, Interface: 102
    Estimated free bytes: 114, Actual free bytes: 76
    Aging timer expires in: 1183 secs
    Protocols: IP, IPv6

  Packet: LSP ID: Router-B.00-00, Length: 208 bytes, Lifetime : 1196 secs
    Checksum: 0xf8f, Sequence: 0x5, Attributes: 0x3 <L1 L2>
    NLPID: 0x83, Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
    Packet type: 20, Packet version: 1, Max area: 0

  TLVs:
    Area address: 49.0002 (3)
    LSP Buffer Size: 1492
    Speaks: IP
    Speaks: IPV6
    IP router id: 192.168.0.2
    IP address: 192.168.0.2
    Hostname: Router-B
    IP prefix: 192.168.0.2/32, Internal, Metric: default 0, Up
    IP prefix: 10.0.0.4/30, Internal, Metric: default 10, Up
    IP prefix: 10.0.0.8/30, Internal, Metric: default 10, Up
    IP extended prefix: 192.168.0.2/32 metric 0 up
    IP extended prefix: 10.0.0.4/30 metric 10 up
    IP extended prefix: 10.0.0.8/30 metric 10 up
    IS neighbor: Router-B.02, Internal, Metric: default 10
    IS neighbor: Router-C.02, Internal, Metric: default 10
    IS extended neighbor: Router-B.02, Metric: default 10
      IP address: 10.0.0.6
      Local interface index: 108, Remote interface index: 0
    IS extended neighbor: Router-C.02, Metric: default 10
      IP address: 10.0.0.9
      Local interface index: 109, Remote interface index: 0
  No queued transmissions

Router-B.02-00 Sequence: 0x1, Checksum: 0x3c7c, Lifetime: 1156 secs
   IS neighbor: Router-A.00                      Metric:        0
     Two-way fragment: Router-A.00-00, Two-way first fragment: Router-A.00-00
   IS neighbor: Router-B.00                      Metric:        0
```

```
    Two-way fragment: Router-B.00-00, Two-way first fragment: Router-B.00-00

  Header: LSP ID: Router-B.02-00, Length: 76 bytes
    Allocated length: 284 bytes, Router ID: 0.0.0.0
    Remaining lifetime: 1156 secs, Level: 2, Interface: 102
    Estimated free bytes: 208, Actual free bytes: 208
    Aging timer expires in: 1156 secs

  Packet: LSP ID: Router-B.02-00, Length: 76 bytes, Lifetime : 1196 secs
    Checksum: 0x3c7c, Sequence: 0x1, Attributes: 0x3 <L1 L2>
    NLPID: 0x83, Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
    Packet type: 20, Packet version: 1, Max area: 0

  TLVs:
    IS neighbor: Router-B.00, Internal, Metric: default 0
    IS neighbor: Router-A.00, Internal, Metric: default 0
    IS extended neighbor: Router-B.00, Metric: default 0
    IS extended neighbor: Router-A.00, Metric: default 0
  No queued transmissions

Router-C.00-00 Sequence: 0x5, Checksum: 0x255b, Lifetime: 1182 secs
   IS neighbor: Router-C.02                      Metric:       10
     Two-way fragment: Router-C.02-00, Two-way first fragment: Router-C.02-00
   IS neighbor: Router-D.03                      Metric:       10
     Two-way fragment: Router-D.03-00, Two-way first fragment: Router-D.03-00
   IP prefix: 10.0.0.8/30                    Metric:       10 Internal Up
   IP prefix: 10.0.0.12/30                   Metric:       10 Internal Up
   IP prefix: 192.168.0.3/32                 Metric:        0 Internal Up

  Header: LSP ID: Router-C.00-00, Length: 208 bytes
    Allocated length: 284 bytes, Router ID: 192.168.0.3
    Remaining lifetime: 1182 secs, Level: 2, Interface: 102
    Estimated free bytes: 114, Actual free bytes: 76
    Aging timer expires in: 1182 secs
    Protocols: IP, IPv6

  Packet: LSP ID: Router-C.00-00, Length: 208 bytes, Lifetime : 1196 secs
    Checksum: 0x255b, Sequence: 0x5, Attributes: 0x3 <L1 L2>
    NLPID: 0x83, Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
    Packet type: 20, Packet version: 1, Max area: 0

  TLVs:
    Area address: 49.0002 (3)
    LSP Buffer Size: 1492
    Speaks: IP
    Speaks: IPV6
    IP router id: 192.168.0.3
    IP address: 192.168.0.3
    Hostname: Router-C
    IP prefix: 192.168.0.3/32, Internal, Metric: default 0, Up
    IP prefix: 10.0.0.8/30, Internal, Metric: default 10, Up
    IP prefix: 10.0.0.12/30, Internal, Metric: default 10, Up
    IP extended prefix: 192.168.0.3/32 metric 0 up
    IP extended prefix: 10.0.0.8/30 metric 10 up
    IP extended prefix: 10.0.0.12/30 metric 10 up
    IS neighbor: Router-C.02, Internal, Metric: default 10
    IS neighbor: Router-D.03, Internal, Metric: default 10
    IS extended neighbor: Router-C.02, Metric: default 10
      IP address: 10.0.0.10
      Local interface index: 105, Remote interface index: 0
    IS extended neighbor: Router-D.03, Metric: default 10
```

```
      IP address: 10.0.0.13
      Local interface index: 106, Remote interface index: 0
  No queued transmissions

Router-C.02-00 Sequence: 0x1, Checksum: 0xaa09, Lifetime: 1181 secs
   IS neighbor: Router-B.00                      Metric:        0
     Two-way fragment: Router-B.00-00, Two-way first fragment: Router-B.00-00
   IS neighbor: Router-C.00                      Metric:        0
     Two-way fragment: Router-C.00-00, Two-way first fragment: Router-C.00-00

  Header: LSP ID: Router-C.02-00, Length: 76 bytes
    Allocated length: 284 bytes, Router ID: 0.0.0.0
    Remaining lifetime: 1181 secs, Level: 2, Interface: 102
    Estimated free bytes: 208, Actual free bytes: 208
    Aging timer expires in: 1181 secs

  Packet: LSP ID: Router-C.02-00, Length: 76 bytes, Lifetime : 1194 secs
    Checksum: 0xaa09, Sequence: 0x1, Attributes: 0x3 <L1 L2>
    NLPID: 0x83, Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
    Packet type: 20, Packet version: 1, Max area: 0

  TLVs:
    IS neighbor: Router-C.00, Internal, Metric: default 0
    IS neighbor: Router-B.00, Internal, Metric: default 0
    IS extended neighbor: Router-C.00, Metric: default 0
    IS extended neighbor: Router-B.00, Metric: default 0
  No queued transmissions

Router-D.00-00 Sequence: 0x4, Checksum: 0x8ab7, Lifetime: 1180 secs
   IS neighbor: Router-D.02                      Metric:       10
     Two-way fragment: Router-D.02-00, Two-way first fragment: Router-D.02-00
   IS neighbor: Router-D.03                      Metric:       10
     Two-way fragment: Router-D.03-00, Two-way first fragment: Router-D.03-00
   IP prefix: 10.0.0.12/30                   Metric:       10 Internal Up
   IP prefix: 10.0.0.20/30                   Metric:       10 Internal Up
   IP prefix: 192.168.0.4/32                 Metric:        0 Internal Up

  Header: LSP ID: Router-D.00-00, Length: 208 bytes
    Allocated length: 284 bytes, Router ID: 192.168.0.4
    Remaining lifetime: 1180 secs, Level: 2, Interface: 102
    Estimated free bytes: 114, Actual free bytes: 76
    Aging timer expires in: 1180 secs
    Protocols: IP, IPv6

  Packet: LSP ID: Router-D.00-00, Length: 208 bytes, Lifetime : 1192 secs
    Checksum: 0x8ab7, Sequence: 0x4, Attributes: 0x3 <L1 L2>
    NLPID: 0x83, Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
    Packet type: 20, Packet version: 1, Max area: 0

  TLVs:
    Area address: 49.0002 (3)
    LSP Buffer Size: 1492
    Speaks: IP
    Speaks: IPV6
    IP router id: 192.168.0.4
    IP address: 192.168.0.4
    Hostname: Router-D
    IP prefix: 192.168.0.4/32, Internal, Metric: default 0, Up
    IP prefix: 10.0.0.12/30, Internal, Metric: default 10, Up
    IP prefix: 10.0.0.20/30, Internal, Metric: default 10, Up
    IP extended prefix: 192.168.0.4/32 metric 0 up
```

```
    IP extended prefix: 10.0.0.12/30 metric 10 up
    IP extended prefix: 10.0.0.20/30 metric 10 up
    IS neighbor: Router-D.02, Internal, Metric: default 10
    IS neighbor: Router-D.03, Internal, Metric: default 10
    IS extended neighbor: Router-D.02, Metric: default 10
      IP address: 10.0.0.22
      Local interface index: 115, Remote interface index: 0
    IS extended neighbor: Router-D.03, Metric: default 10
      IP address: 10.0.0.14
      Local interface index: 114, Remote interface index: 0
  No queued transmissions

Router-D.02-00 Sequence: 0x1, Checksum: 0xebbc, Lifetime: 1128 secs
   IS neighbor: Router-D.00                      Metric:        0
     Two-way fragment: Router-D.00-00, Two-way first fragment: Router-D.00-00
   IS neighbor: Router-F.00                      Metric:        0
     Two-way fragment: Router-F.00-00, Two-way first fragment: Router-F.00-00

  Header: LSP ID: Router-D.02-00, Length: 76 bytes
    Allocated length: 284 bytes, Router ID: 0.0.0.0
    Remaining lifetime: 1128 secs, Level: 2, Interface: 101
    Estimated free bytes: 208, Actual free bytes: 208
    Aging timer expires in: 1128 secs

  Packet: LSP ID: Router-D.02-00, Length: 76 bytes, Lifetime : 1160 secs
    Checksum: 0xebbc, Sequence: 0x1, Attributes: 0x3 <L1 L2>
    NLPID: 0x83, Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
    Packet type: 20, Packet version: 1, Max area: 0

  TLVs:
    IS neighbor: Router-D.00, Internal, Metric: default 0
    IS neighbor: Router-F.00, Internal, Metric: default 0
    IS extended neighbor: Router-D.00, Metric: default 0
    IS extended neighbor: Router-F.00, Metric: default 0
  No queued transmissions

Router-D.03-00 Sequence: 0x1, Checksum: 0x129b, Lifetime: 1180 secs
   IS neighbor: Router-C.00                      Metric:        0
     Two-way fragment: Router-C.00-00, Two-way first fragment: Router-C.00-00
   IS neighbor: Router-D.00                      Metric:        0
     Two-way fragment: Router-D.00-00, Two-way first fragment: Router-D.00-00

  Header: LSP ID: Router-D.03-00, Length: 76 bytes
    Allocated length: 284 bytes, Router ID: 0.0.0.0
    Remaining lifetime: 1180 secs, Level: 2, Interface: 101
    Estimated free bytes: 208, Actual free bytes: 208
    Aging timer expires in: 1180 secs

  Packet: LSP ID: Router-D.03-00, Length: 76 bytes, Lifetime : 1192 secs
    Checksum: 0x129b, Sequence: 0x1, Attributes: 0x3 <L1 L2>
    NLPID: 0x83, Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
    Packet type: 20, Packet version: 1, Max area: 0

  TLVs:
    IS neighbor: Router-D.00, Internal, Metric: default 0
    IS neighbor: Router-C.00, Internal, Metric: default 0
    IS extended neighbor: Router-D.00, Metric: default 0
    IS extended neighbor: Router-C.00, Metric: default 0
  No queued transmissions

Router-E.00-00 Sequence: 0x4, Checksum: 0x9da9, Lifetime: 1155 secs
```

```
    IS neighbor: Router-E.02                      Metric:       10
      Two-way fragment: Router-E.02-00, Two-way first fragment: Router-E.02-00
    IS neighbor: Router-F.02                      Metric:       20
      Two-way fragment: Router-F.02-00, Two-way first fragment: Router-F.02-00
    IP prefix: 10.0.0.0/30                    Metric:       10 Internal Up
    IP prefix: 10.0.0.16/30                   Metric:       20 Internal Up
    IP prefix: 192.168.0.5/32                 Metric:        0 Internal Up

  Header: LSP ID: Router-E.00-00, Length: 208 bytes
    Allocated length: 284 bytes, Router ID: 192.168.0.5
    Remaining lifetime: 1155 secs, Level: 2, Interface: 101
    Estimated free bytes: 114, Actual free bytes: 76
    Aging timer expires in: 1155 secs
    Protocols: IP, IPv6

  Packet: LSP ID: Router-E.00-00, Length: 208 bytes, Lifetime : 1185 secs
    Checksum: 0x9da9, Sequence: 0x4, Attributes: 0x3 <L1 L2>
    NLPID: 0x83, Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
    Packet type: 20, Packet version: 1, Max area: 0

  TLVs:
    Area address: 49.0002 (3)
    LSP Buffer Size: 1492
    Speaks: IP
    Speaks: IPV6
    IP router id: 192.168.0.5
    IP address: 192.168.0.5
    Hostname: Router-E
    IP prefix: 192.168.0.5/32, Internal, Metric: default 0, Up
    IP prefix: 10.0.0.16/30, Internal, Metric: default 20, Up
    IP prefix: 10.0.0.0/30, Internal, Metric: default 10, Up
    IP extended prefix: 192.168.0.5/32 metric 0 up
    IP extended prefix: 10.0.0.16/30 metric 20 up
    IP extended prefix: 10.0.0.0/30 metric 10 up
    IS neighbor: Router-E.02, Internal, Metric: default 10
    IS neighbor: Router-F.02, Internal, Metric: default 20
    IS extended neighbor: Router-E.02, Metric: default 10
      IP address: 10.0.0.2
      Local interface index: 112, Remote interface index: 0
    IS extended neighbor: Router-F.02, Metric: default 20
      IP address: 10.0.0.17
      Local interface index: 111, Remote interface index: 0
  No queued transmissions

Router-E.02-00 Sequence: 0x1, Checksum: 0xb4fa, Lifetime: 1130 secs
   IS neighbor: Router-A.00                      Metric:        0
     Two-way fragment: Router-A.00-00, Two-way first fragment: Router-A.00-00
    IS neighbor: Router-E.00                      Metric:        0
     Two-way fragment: Router-E.00-00, Two-way first fragment: Router-E.00-00

  Header: LSP ID: Router-E.02-00, Length: 76 bytes
    Allocated length: 284 bytes, Router ID: 0.0.0.0
    Remaining lifetime: 1130 secs, Level: 2, Interface: 101
    Estimated free bytes: 208, Actual free bytes: 208
    Aging timer expires in: 1130 secs

  Packet: LSP ID: Router-E.02-00, Length: 76 bytes, Lifetime : 1161 secs
    Checksum: 0xb4fa, Sequence: 0x1, Attributes: 0x3 <L1 L2>
    NLPID: 0x83, Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
    Packet type: 20, Packet version: 1, Max area: 0
```

```
  TLVs:
    IS neighbor: Router-E.00, Internal, Metric: default 0
    IS neighbor: Router-A.00, Internal, Metric: default 0
    IS extended neighbor: Router-E.00, Metric: default 0
    IS extended neighbor: Router-A.00, Metric: default 0
  No queued transmissions

Router-F.00-00 Sequence: 0x5, Checksum: 0x94bd, Lifetime: 1153 secs
   IS neighbor: Router-D.02                      Metric:       10
     Two-way fragment: Router-D.02-00, Two-way first fragment: Router-D.02-00
   IS neighbor: Router-F.02                      Metric:       10
     Two-way fragment: Router-F.02-00, Two-way first fragment: Router-F.02-00
   IP prefix: 10.0.0.16/30                   Metric:       10 Internal Up
   IP prefix: 10.0.0.20/30                   Metric:       10 Internal Up
   IP prefix: 192.168.0.6/32                 Metric:        0 Internal Up

  Header: LSP ID: Router-F.00-00, Length: 208 bytes
    Allocated length: 284 bytes, Router ID: 192.168.0.6
    Remaining lifetime: 1153 secs, Level: 2, Interface: 101
    Estimated free bytes: 76, Actual free bytes: 76
    Aging timer expires in: 1153 secs
    Protocols: IP, IPv6

  Packet: LSP ID: Router-F.00-00, Length: 208 bytes, Lifetime : 1183 secs
    Checksum: 0x94bd, Sequence: 0x5, Attributes: 0x3 <L1 L2>
    NLPID: 0x83, Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
    Packet type: 20, Packet version: 1, Max area: 0

  TLVs:
    Area address: 49.0002 (3)
    LSP Buffer Size: 1492
    Speaks: IP
    Speaks: IPV6
    IP router id: 192.168.0.6
    IP address: 192.168.0.6
    Hostname: Router-F
    IP prefix: 192.168.0.6/32, Internal, Metric: default 0, Up
    IP prefix: 10.0.0.16/30, Internal, Metric: default 10, Up
    IP prefix: 10.0.0.20/30, Internal, Metric: default 10, Up
    IP extended prefix: 192.168.0.6/32 metric 0 up
    IP extended prefix: 10.0.0.16/30 metric 10 up
    IP extended prefix: 10.0.0.20/30 metric 10 up
    IS neighbor: Router-D.02, Internal, Metric: default 10
    IS neighbor: Router-F.02, Internal, Metric: default 10
    IS extended neighbor: Router-D.02, Metric: default 10
      IP address: 10.0.0.21
      Local interface index: 94, Remote interface index: 0
    IS extended neighbor: Router-F.02, Metric: default 10
      IP address: 10.0.0.18
      Local interface index: 93, Remote interface index: 0
  No queued transmissions

Router-F.02-00 Sequence: 0x1, Checksum: 0xf5ae, Lifetime: 1153 secs
   IS neighbor: Router-E.00                      Metric:        0
     Two-way fragment: Router-E.00-00, Two-way first fragment: Router-E.00-00
   IS neighbor: Router-F.00                      Metric:        0
     Two-way fragment: Router-F.00-00, Two-way first fragment: Router-F.00-00

  Header: LSP ID: Router-F.02-00, Length: 76 bytes
    Allocated length: 284 bytes, Router ID: 0.0.0.0
    Remaining lifetime: 1153 secs, Level: 2, Interface: 101
```

```
  Estimated free bytes: 208, Actual free bytes: 208
  Aging timer expires in: 1153 secs

Packet: LSP ID: Router-F.02-00, Length: 76 bytes, Lifetime : 1183 secs
  Checksum: 0xf5ae, Sequence: 0x1, Attributes: 0x3 <L1 L2>
  NLPID: 0x83, Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
  Packet type: 20, Packet version: 1, Max area: 0

TLVs:
  IS neighbor: Router-F.00, Internal, Metric: default 0
  IS neighbor: Router-E.00, Internal, Metric: default 0
  IS extended neighbor: Router-F.00, Metric: default 0
  IS extended neighbor: Router-E.00, Metric: default 0
No queued transmissions
```

show isis hostname

List of Syntax
Syntax on page 174
Syntax (EX Series Switches and QFX Series) on page 174

Syntax
show isis hostname
<logical-system (all | *logical-system-name*)>

Syntax (EX Series Switches and QFX Series)
show isis hostname

Release Information
Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
Command introduced in Junos OS Release 12.1 for the QFX Series.
Command introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description
Display IS-IS hostname database information.

This command displays the system ID-to-name cache. The output shows if the mapping has been learned by receipt of a Hostname TLV #137 (type dynamic) configured in Junos OS with the **set system host-name** command, or a static mapping defined in Junos OS with the **set system static-host-mapping *hostname* sysid** command (type static). The local router always has its type set to static even if **static-host-mapping** is not configured.

Options
none—Display IS-IS hostname database information.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

Required Privilege Level
view

List of Sample Output
show isis hostname on page 175

Output Fields
Table 9 on page 174 describes the output fields for the **show isis hostname** command. Output fields are listed in the approximate order in which they appear.

Table 9: show isis hostname Output Fields

Field Name	Field Description
System Id	System identifier mapped to the hostname.
Hostname	Hostname mapped to the system identifier.
Type	Type of mapping between system identifier and hostname. • **Dynamic**—Hostname mapping determined as described in RFC 2763, *Dynamic Hostname Exchange Mechanism for IS-IS*. • **Static**—Hostname mapping configured by user.

Sample Output

show isis hostname

```
user@host> show isis hostname
   IS-IS hostname database:
   System Id      Hostname                                          Type
   1921.6800.4201 isis1                                             Dynamic
   1921.6800.4202 isis2                                             Static
   1921.6800.4203 isis3                                             Dynamic
```

show isis interface

List of Syntax
Syntax on page 176
Syntax (EX Series Switches and QFX Series) on page 176

Syntax
show isis interface
<brief | detail | extensive>
<*interface-name*>
<logical-system (all | *logical-system-name*)>

Syntax (EX Series Switches and QFX Series)
show isis interface
<brief | detail | extensive>
<*interface-name*>

Release Information
Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
Command introduced in Junos OS Release 12.1 for the QFX Series.
Command introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description
Display status information about IS-IS-enabled interfaces.

NOTE: If the configured metric for an IS-IS level is above 63, and the **wide-metrics-only** statement is not configured, the **show isis interface detail** command and the **show isis interface extensive** command display 63 as the metric value for that level. Configure the **wide-metrics-only** statement to generate metric values greater than 63 on a per IS-IS level basis.

The **show isis interface** command displays the configured metric value for an IS-IS level irrespective of whether is configured or not.

Options
none—Display standard information about all IS-IS-enabled interfaces.

brief | detail | extensive—(Optional) Display the specified level of output.

interface-name—(Optional) Display information about the specified interface only.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

Required Privilege Level
view

Related Documentation
- *Example: Enabling Wide IS-IS Metrics for Traffic Engineering*

List of Sample Output
show isis interface on page 178
show isis interface brief on page 179
show isis interface detail on page 179
show isis interface extensive on page 179

Output Fields Table 10 on page 177 describes the output fields for the **show isis interface** command. Output fields are listed in the approximate order in which they appear.

Table 10: show isis interface Output Fields

Field Name	Field Description	Level of Output
interface-name	Name of the interface.	**detail**
Designated router	Routing device selected by other routers that is responsible for sending link-state advertisements that describe the network. Used only on broadcast networks.	**detail**
Index	Interface index assigned by the Junos OS kernel.	**detail**
State	Internal implementation information.	**detail**
Circuit id	Circuit identifier.	**detail**
Circuit type	Circuit type: • **1**—Level 1 only • **2**—Level 2 only • **3**—Level 1 and Level 2	**detail**
LSP interval	Interval between link-state PDUs sent from the interface.	**detail**
CSNP interval	Interval between complete sequence number PDUs sent from the interface.	**detail extensive**
Sysid	System identifier.	**detail**
Interface	Interface through which the adjacency is made.	none **brief**
L or Level	Level: • **1**—Level 1 only • **2**—Level 2 only • **3**—Level 1 and Level 2 NOTE: The default IS-IS level on loopback interfaces are always same as the IS-IS level configured on other IS-IS interfaces in a router. You can also configure IS-IS level on loopback interfaces per your requirement.	All levels
CirID	Circuit identifier.	none **brief**
Level 1 DR	Level 1 designated intermediate system.	none **brief**
Level 2 DR	Level 2 designated intermediate system.	none **brief**
L1/L2 Metric	Interface's metric for Level 1 and Level 2. If there is no information, the metric is **0**.	none **brief**

Table 10: show isis interface Output Fields *(continued)*

Field Name	Field Description	Level of Output
Adjacency advertisement: Advertise	This routing device has signaled to advertise this interface to its neighbors in their label-switched paths (LSPs).	**detail extensive**
Adjacency advertisement: Suppress	This neighbor has signaled not to advertise this interface in the routing device's outbound LSPs.	**detail extensive**
Adjacencies	Number of adjacencies established on this interface.	**detail**
Priority	Priority value for this interface.	**detail**
Metric	Metric value for this interface.	**detail**
Hello(s) / Hello Interval	Interface's hello interval.	**detail extensive**
Hold(s) / Hold Time	Interface's hold time.	**detail extensive**
Designated Router	Router responsible for sending network link-state advertisements, which describe all the routing devices attached to the network.	**detail**
Hello padding	Type of hello padding: • **Adaptive**—On point-to-point connections, the hello packets are padded from the initial detection of a new neighbor until the neighbor verifies the adjacency as Up in the adjacency state TLV. If the neighbor does not support the adjacency state TLV, then padding continues. On LAN connections, padding starts from the initial detection of a new neighbor until there is at least one active adjacency on the interface. • **Loose**—(Default) The hello packet is padded from the initial detection of a new neighbor until the adjacency transitions to the Up state. • **Strict**—Padding is performed on all interface types and for all adjacency states, and is continuous.	**extensive**
LDP sync state	Current LDP synchronization state: **in sync**, **in holddown**, or **not supported**.	**extensive**
reason	Reason for being in the LDP sync state.	**extensive**
config holdtime	Configured value of the hold timer.	**extensive**
remaining	If the state is not in sync and the hold time is not infinity, then this field displays the remaining hold time in seconds.	**extensive**

Sample Output

show isis interface

```
user@host> show isis interface
```

```
IS-IS interface database:
Interface             L CirID Level 1 DR        Level 2 DR        L1/L2 Metric
at-2/3/0.0            3   0x1 Point to Point    Point to Point         10/10
lo0.0                 3   0x1 Passive           Passive                 0/0
```

show isis interface brief

The output for the **show isis interface brief** command is identical to that for the **show isis interface** command. For sample output, see show isis interface on page 178.

show isis interface detail

```
user@host> show isis interface detail
IS-IS interface database:
at-2/3/0.0
  Index: 66, State: 0x6, Circuit id: 0x1, Circuit type: 3
  LSP interval: 100 ms, CSNP interval: 5 s
  Level Adjacencies Priority Metric Hello (s) Hold (s) Designated Router
    1             1       64     10     9.000       27
    2             1       64     10     9.000       27
lo0.0
  Index: 64, State: 0x6, Circuit id: 0x1, Circuit type: 0
  LSP interval: 100 ms, CSNP interval: disabled
  Adjacency advertisement: Advertise
  Protection Type: Node Link, No eligible Backup
  Level Adjacencies Priority Metric Hello (s) Hold (s) Designated Router
    1             0       64      0 Passive
    2             0       64      0 Passive
```

show isis interface extensive

```
user@host> show isis interface extensive
IS-IS interface database:
xe-6/1/0.0
  Index: 75, State: 0x6, Circuit id: 0x1, Circuit type: 2
  LSP interval: 100 ms, CSNP interval: 10 s, Loose Hello padding
  Adjacency advertisement: Advertise
  Level 1
    Adjacencies: 0, Priority: 64, Metric: 10
    Disabled
  Level 2
    Adjacencies: 1, Priority: 64, Metric: 10
    Hello Interval: 20.000 s, Hold Time: 60 s
    Designated Router: nemean.03
```

show isis overview

Syntax
show isis overview
<instance *instance-name*>
<**logical-system (all | *logical-system-name*)**>

Syntax (EX Series Switches and QFX Series)
show isis overview
<instance *instance-name*>

Release Information
Command introduced in Junos OS Release 8.5.
Command introduced in Junos OS Release 9.0 for EX Series switches.
Command introduced in Junos OS Release 12.1 for the QFX Series.
Command introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description
Display IS-IS overview information.

Options
none—Display standard overview information about IS-IS for all routing instances.

instance *instance-name*—(Optional) Display overview information for the specified routing instance.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

Required Privilege Level
view

List of Sample Output
show isis overview on page 182

Output Fields
Table 11 on page 180 lists the output fields for the **show isis overview** command. Output fields are listed in the approximate order in which they appear.

Table 11: show isis overview Output Fields

Field Name	Field Description
Instance	IS-IS routing intance.
Router ID	Router ID of the routing device.
Adjacency holddown	Adjacency holddown capability: **enabled** or **disabled**.
Maximum Areas	Maximum number of IS-IS areas advertised by the routing device.
LSP life time	Lifetime of the link-state PDU, in seconds.
Attached bit evaluation	Attached bit capability: **enabled** or **disabled**.
SPF delay	Delay before performing consecutive shortest-path-first (SPF) calculations.

Table 11: show isis overview Output Fields *(continued)*

Field Name	Field Description
SPF holddown	Delay before performing additional SPF calculations after the maximum number of consecutive SPF calculations is reached.
SPF rapid runs	Maximum number of SPF calculations that can be performed in succession before the holddown timer begins.
Overload bit at startup is set	Overload bit capability is enabled.
Overload high metrics	Overload high metrics capability: **enabled** or **disabled**.
Overload timeout	Time period after which overload is reset and the time that remains before the timer is set to expire.
Traffic engineering	Traffic engineering capability: **enabled** or **disabled**.
Restart	Graceful restart capability: **enabled** or **disabled**.
Restart duration	Time period for complete reacquisition of IS-IS neighbors.
Helper mode	Graceful restart helper capability: **enabled** or **disabled**.
Level	IS-IS level: • **1**—Level 1 information • **2**—Level 2 information
IPv4 is enabled	IP Protocol version 4 capability is enabled.
IPv6 is enabled	IP Protocol version 6 capability is enabled.
CLNS is enabled	(J Series routers only) OSI CLNP capability is enabled.
Internal route preference	Preference value of internal routes.
External route preference	Preference value of external routes.
Prefix export limit	Number of prefixes allowed to be exported, as configured by the prefix-export-limit statement.
Prefix export count	Number of prefixes exported.
Wide area metrics are enabled	Wide area metrics capability is enabled.
Narrow metrics are enabled	Narrow metrics capability is enabled.

Sample Output

show isis overview

```
user@host> show isis overview
Instance: master
  Router ID: 10.255.107.183
  Adjacency holddown: disabled
  Maximum Areas: 3
  LSP life time: 1200
  Attached bit evaluation: enabled
  SPF delay: 200 msec, SPF holddown: 5000 msec, SPF rapid runs: 3
  IPv4 is enabled, IPv6 is enabled
  Traffic engineering: enabled
  Restart: Disabled
    Helper mode: Enabled
  Level 1
    Internal route preference: 15
    External route preference: 160
    Wide metrics are enabled, Narrow metrics are enabled
  Level 2
    Internal route preference: 18
    External route preference: 165
    Prefix export limit: 5, Prefix export count: 5
    Wide metrics are enabled
```

show isis route

List of Syntax
Syntax on page 183
Syntax (EX Series Switches and QFX Series) on page 183

Syntax

show isis route
<*destination*>
<inet | inet6>
<instance *instance-name*>
<logical-system (all | *logical-system-name*)>
<topology (ipv4-multicast | ipv6-multicast | ipv6-unicast | unicast)>

Syntax (EX Series Switches and QFX Series)

show isis route
<*destination*>
<inet | inet6>
<instance *instance-name*>
<topology (ipv4-multicast | ipv6-multicast | ipv6-unicast | unicast)>

Release Information

Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
Command introduced in Junos OS Release 12.1 for the QFX Series.
Command introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description

Display the routes in the IS-IS routing table.

Options

none—Display all routes in the IS-IS routing table for all supported address families for all routing instances.

destination—(Optional) Destination address for the route.

inet | inet6—(Optional) Display inet (IPv4) or inet6 (IPv6) routes, respectively.

instance *instance-name*—(Optional) Display routes for the specified routing instance only.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

topology (ipv4-multicast | ipv6-multicast | ipv6-unicast | unicast)—(Optional) Display routes for the specified topology only, or use unicast to display information, if available, for both IPv4 and IPv6 unicast topologies.

Required Privilege Level

view

List of Sample Output

show isis route logical-system on page 184
show isis route (CLNS) on page 184
show isis route on page 185

Output Fields

Table 12 on page 184 describes the output fields for the **show isis route** command. Output fields are listed in the approximate order in which they appear.

Table 12: show isis route Output Fields

Field Name	Field Description
Current version	Number of the current version of the IS-IS routing table.
L1	Version of Level 1 SPF that was run.
L2	Version of Level 2 SPF that was run.
Prefix	Destination of the route.
L	IS-IS level: • **1**—Level 1 only • **2**—Level 2 only • **3**—Level 1 and Level 2
Version	Version of SPF that generated the route.
Metric	Metric value associated with the route.
Type	Metric type: **int** (internal) or **ext** (external).
Interface	Interface to the next hop.
Via	System identifier of the next hop, displayed as a name if possible.
ISO Routes	ISO routing table entries.
snpa	MAC address.

Sample Output

show isis route logical-system

```
user@host> show isis route logical-system ls1
IS-IS routing table            Current version: L1: 8 L2: 11
Prefix             L Version Metric Type Interface    Via
10.9.7.0/30        2      11     20 int  gr-0/2/0.0   h
10.9.201.1/32      2      11     60 int  gr-0/2/0.0   h
IPV6 Unicast IS-IS routing table            Current version: L1: 9 L2: 11
Prefix             L Version Metric Type Interface    Via
8009:3::a09:3200/126 2      11     20 int gr-0/2/0.0  h
```

show isis route (CLNS)

```
user@host> show isis route
IS-IS routing table            Current version: L1: 10 L2: 8
IPv4/IPv6 Routes
Prefix             L Version   Metric Type Interface    Via
0.0.0.0/0          1      10       10 int  fe-0/0/1.0   ISIS.0
ISO Routes
Prefix  L   Version   Metric Type Interface    Via    snpa
```

```
0/0
        1        10       10 int  fe-0/0/1.0   isis.0 0:12:0:34:0:56
47.0005.80ff.f800.0000.0108.0001/104
        1        10        0 int
47.0005.80ff.f800.0000.0108.0001.1921.6800.4001/152
        1        10       10 int  fe-0/0/1.0 isis.0 0:12:0:34:0:56
47.0005.80ff.f800.0000.0108.0001.1921.6800.4002/152
        1        10       20 int  fe-0/0/1.0 isis.0 0:12:0:34:0:56
47.0005.80ff.f800.0000.0108.0002/104
        1        10        0 int
47.0005.80ff.f800.0000.0108.0002.1921.6800.4001/152
        1        10       10 int  fe-0/0/1.0 isis.0 0:12:0:34:0:56
```

show isis route

```
user@host> show isis route

IS-IS routing table            Current version: L1: 4 L2: 13
IPv4/IPv6 Routes
----------------
Prefix                  L   Version  Metric Type Interface       NH   Via
10.255.71.52/32         2      13       10   int  ae0.0           IPV4 camaro

10.255.71.238/32        2      13       20   int  so-6/0/0.0      IPV4 olympic

                                             as0.0           IPV4 glacier

10.255.71.239/32        2      13       20   int  so-6/0/0.0      IPV4 olympic

                                             ae0.0           IPV4 camaro

10.255.71.242/32        2      13       10   int  as0.0           IPV4 glacier

10.255.71.243/32        2      13       10   int  so-6/0/0.0      IPV4 olympic

12.13.0.0/30            2      13       20   int  so-6/0/0.0      IPV4 olympic

12.15.0.0/30            2      13       20   int  so-6/0/0.0      IPV4 olympic

13.15.0.0/30            2      13       30   int  ae0.0           IPV4 camaro

                                             so-6/0/0.0      IPV4 olympic

                                             as0.0           IPV4 glacier

13.16.0.0/30            2      13       25   int  as0.0           IPV4 glacier

14.15.0.0/30            2      13       20   int  ae0.0           IPV4 camaro

192.2.1.0/30            2      13       30   int  so-6/0/0.0      IPV4 olympic

                                             as0.0           IPV4 glacier

1eee::/64               2      13       30   int  so-6/0/0.0      IPV6 olympic

                                             as0.0           IPV6 glacier

abcd::10:255:71:52/128  2      13       10   int  ae0.0           IPV6 camaro

abcd::10:255:71:238/128 2      13       20   int  so-6/0/0.0      IPV6 olympic
```

```
                                                    as0.0           IPV6 glacier
abcd::10:255:71:239/128  2      13       20   int   so-6/0/0.0      IPV6 olympic
                                                    ae0.0           IPV6 camaro
abcd::10:255:71:242/128  2      13       10   int   as0.0           IPV6 glacier
abcd::10:255:71:243/128  2      13       10   int   so-6/0/0.0      IPV6 olympic
```

show isis statistics

List of Syntax
Syntax on page 187
Syntax (EX Series Switches and QFX Series) on page 187

Syntax
show isis statistics
<instance *instance-name*>
<logical-system (all | *logical-system-name*)>

Syntax (EX Series Switches and QFX Series)
show isis statistics
<instance *instance-name*>

Release Information
Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
Command introduced in Junos OS Release 12.1 for the QFX Series.
Command introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description
Display statistics about IS-IS traffic.

Options
none—Display IS-IS traffic statistics for all routing instances.

instance *instance-name*—(Optional) Display statistics for the specified routing instance.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

Required Privilege Level
view

Related Documentation
- clear isis statistics on page 154

List of Sample Output
show isis statistics on page 189

Output Fields
Table 13 on page 188 describes the output fields for the **show isis statistics** command. Output fields are listed in the approximate order in which they appear.

Table 13: show isis statistics Output Fields

Field Name	Field Description
PDU type	PDU type: • **CSNP**—Complete sequence number PDUs contain a complete list of all link-state PDUs in the IS-IS database. CSNPs are sent periodically on all links, and the receiving systems use the information in the CSNP to update and synchronize their link-state PDU databases. The designated router multicasts CSNPs on broadcast links in place of sending explicit acknowledgments for each link-state PDU. • **IIH**—IS-IS hello packets are broadcast to discover the identity of neighboring IS-IS systems and to determine whether the neighbors are Level 1 or Level 2 intermediate systems. • **LSP**—Link-state PDUs contain information about the state of adjacencies to neighboring IS-IS systems. Link-state PDUs are flooded periodically throughout an area. • **PSNP**—Partial sequence number PDUs are sent multicast by a receiver when it detects that it is missing a link-state PDU (when its link-state PDU database is out of date). The receiver sends a PSNP to the system that transmitted the CSNP, effectively requesting that the missing link-state PDU be transmitted. That routing device, in turn, forwards the missing link-state PDU to the requesting routing device. • **Unknown**—The PDU type is unknown.
Received	Number of PDUs received since IS-IS started or since the statistics were set to zero.
Processed	Number of PDUs received less the number dropped.
Drops	Number of PDUs dropped.
Sent	Number of PDUs transmitted since IS-IS started or since the statistics were set to zero.
Rexmit	Number of PDUs retransmitted since IS-IS started or since the statistics were set to zero.
Total packets received/sent	Total number of PDUs received and transmitted since IS-IS started or since the statistics were set to zero.
SNP queue length	Number of CSPN and PSNP packets currently waiting in the queue for processing. This value is almost always **0**.
LSP queue length	Number of link-state PDUs waiting in the queue for processing. This value is almost always **0**.
SPF runs	Number of shortest-path-first (SPF) calculations that have been performed. If this number is incrementing rapidly, it indicates that the network is unstable.
Fragments rebuilt	Number of link-state PDU fragments that the local system has computed.
LSP regenerations	Number of link-state PDUs that have been regenerated. A link-state PDU is regenerated when it is nearing the end of its lifetime and it has not changed.
Purges initiated	Number of purges that the system initiated. A purge is initiated if the software decides that a link-state PDU must be removed from the network.

Sample Output

show isis statistics

```
user@host> show isis statistics
IS-IS statistics for merino:

PDU type     Received  Processed      Drops       Sent     Rexmit
LSP             12227      12227          0       8184        683
IIH            113808     113808          0     115817          0
CSNP           198868     198868          0     198934          0
PSNP             6985       6979          6       8274          0
Unknown             0          0          0          0          0
Totals         331888     331882          6     331209        683

Total packets received: 331888 Sent: 331892

SNP queue length:           0 Drops:          0
LSP queue length:           0 Drops:          0

SPF runs:                1014
Fragments rebuilt:       1038
LSP regenerations:        425
Purges initiated:           0
```