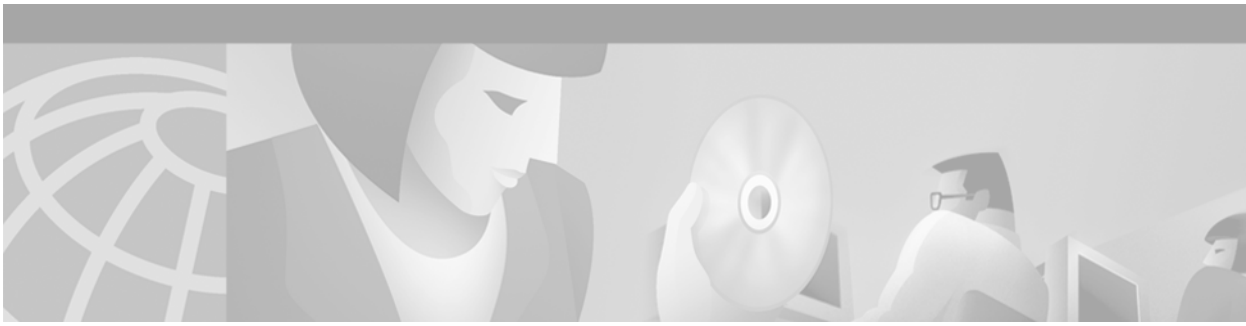

Integrated IS-IS Commands

Use the commands in this chapter to configure and monitor the Intermediate System-to-Intermediate System (IS-IS) protocol. For IS-IS configuration information and examples, refer to the "Configuring Integrated IS-IS" chapter of the *Cisco IOS IP Configuration Guide*.

area-password

To configure the IS-IS area authentication password, use the **area-password** command in router configuration mode. To disable the password, use the **no** form of this command.

area-password *password*

no area-password [*password*]

Syntax Description

password	Password you assign.

Defaults

No area password is defined, and area password authentication is disabled.

Command Modes

Router configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Using the **area-password** command on all routers in an area will prevent unauthorized routers from injecting false routing information into the link-state database.

This password is exchanged as plain text and thus this feature provides only limited security.

This password is inserted in Level 1 (station router level) protocol data unit (PDU) link-state packets (LSPs), complete sequence number PDUs (CSNPs), and partial sequence number PDUs (PSNP).

Examples

The following example assigns an area authentication password:

```
router isis
 area-password angel
```

Related Commands

Command	Description
domain-password	Configures the IS-IS routing domain authentication password.
isis password	Configures the authentication password for an interface.

default-information originate (IS-IS)

To generate a default route into an IS-IS routing domain, use the **default-information originate** command in router configuration mode. To disable this feature, use the **no** form of this command.

default-information originate [**route-map** *map-name*]

no default-information originate [**route-map** *map-name*]

Syntax Description

route-map *map-name*	(Optional) Routing process will generate the default route if the route map is satisfied.

Defaults

This command is disabled by default.

Command Modes

Router configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

If a router configured with this command has a route to 0.0.0.0 in the routing table, IS-IS will originate an advertisement for 0.0.0.0 in its link-state packets (LSPs).

Without a route map, the default is only advertised in Level 2 LSPs. For Level 1 routing, there is another mechanism to find the default route, which is to look for the closest Level 1 or Level 2 router. The closest Level 1 or Level 2 router can be found by looking at the attached-bit (ATT) in Level 1 LSPs.

A route map can be used for two purposes:

- Make the router generate default in its Level 1 LSPs.
- Advertise 0/0 conditionally.

With a **match ip address** *standard-access-list* command, you can specify one or more IP routes that must exist before the router will advertise 0/0.

Examples

The following example forces the software to generate a default external route into an IS-IS domain:

```
router isis
! BGP routes will be distributed into IS-IS
redistribute bgp 120
! access list 2 is applied to outgoing routing updates
distribute-list 2 out
default-information originate
! access list 2 defined as giving access to network 10.105.0.0
access-list 2 permit 10.105.0.0 0.0.255.255
```

Related Commands

Command	Description
redistribute (IP)	Redistributes routes from one routing domain into another routing domain.
show isis database	Displays the IS-IS link-state database.

domain-password

To configure the IS-IS routing domain authentication password, use the **domain-password** command in router configuration mode. To disable a password, use the **no** form of this command.

domain-password *password*

no domain-password [*password*]

Syntax Description

password	Password you assign.

Defaults

No password is specified and no authentication is enabled for exchange of Level 2 routing information.

Command Modes

Router configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This password is exchanged as plain text and thus this feature provides only limited security.

This password is inserted in Level 2 (area router level) protocol data unit (PDU) link-state packets (LSPs), complete sequence number PDUs (CSNPs), and partial sequence number PDUs (PSNPs).

Examples

The following example assigns an authentication password to the routing domain:

```
router isis
 domain-password flower
```

Related Commands

Command	Description
area-password	Configures the IS-IS area authentication password.
isis password	Configures the authentication password for an interface.

hello padding

To reenable IS-IS hello padding at the router level, enter the **hello padding** command in router configuration mode. To disable IS-IS hello padding, use the **no** form of this command.

hello padding

no hello padding

Syntax Description

This command has no arguments or keywords.

Defaults

IS-IS hello padding is enabled.

Command Modes

Router configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.0(5)S	This command was integrated into Cisco IOS Release 12.0(5)S.

Usage Guidelines

Intermediate System-to-Intermediate System (IS-IS) hellos are padded to the full maximum transmission unit (MTU) size. The benefit of padding IS-IS hellos to the full MTU is that it allows for early detection of errors that result from transmission problems with large frames or errors that result from mismatched MTUs on adjacent interfaces.

You can disable hello padding in order to avoid wasting network bandwidth in case the MTU of both interfaces is the same or, in case of translational bridging. While hello padding is disabled, Cisco routers still send the first five IS-IS hellos padded to the full MTU size, in order to maintain the benefits of discovering MTU mismatches.

To disable hello padding for all interfaces on a router for the IS-IS routing process, enter the **no hello padding** command in router configuration mode. To selectively disable hello padding for a specific interface, enter the **no isis hello padding** command in interface configuration mode.

Examples

In the following example the **no hello padding** command is used to turn off hello padding at the router level:

```
Router(config)# router isis
Router(config-router)# no hello padding
Router(config-router)# end
```

The **show clns interfaces** command is entered to show that hello padding has been turned off at router level:

```
Router# show clns interface e0/0

Ethernet0/0 is up, line protocol is up
  Checksums enabled, MTU 1497, Encapsulation SAP
```

```
  ERPDUs enabled, min. interval 10 msec.
  CLNS fast switching enabled
  CLNS SSE switching disabled
  DEC compatibility mode OFF for this interface
  Next ESH/ISH in 4 seconds
  Routing Protocol: IS-IS
    Circuit Type: level-1-2
    Interface number 0x0, local circuit ID 0x1
    Level-1 Metric: 10, Priority: 64, Circuit ID: Router_B.01
    Level-1 IPv6 Metric: 10
    Number of active level-1 adjacencies: 1
    Level-2 Metric: 10, Priority: 64, Circuit ID: Router_B.01
    Level-2 IPv6 Metric: 10
    Number of active level-2 adjacencies: 1
    Next IS-IS LAN Level-1 Hello in 6 seconds
!   No hello padding
    Next IS-IS LAN Level-2 Hello in 2 seconds
!   No hello padding
```

When the **debug isis adj packets** command is entered, the output will show the IS-IS hello protocol data unit (PDU) length when a hello packet has been sent to or received from an IS-IS adjacency. In the following example the IS-IS hello PDU length is 1497:

```
Router# debug isis adj packets e0/0

IS-IS Adjacency related packets debugging is on
Router_A#
*Oct 11 18:04:17.455: ISIS-Adj: Sending L1 LAN IIH on Ethernet0/0, length 55
*Oct 11 18:04:19.075: ISIS-Adj: Rec L2 IIH from aabb.cc00.6600 (Ethernet0/0), cir type
L1L2, cir id 0000.0000.000B.01, length 1497
```

Related Commands

Command	Description
isis hello padding	Reenables IS-IS hello padding at the interface level.
debug isis adj packets	Displays information on all adjacency-related activity such as hello packets sent and received and IS-IS adjacencies going up and down.
show clns interface	Lists the CLNS-specific information about each interface.

hostname dynamic

To enable IS-IS dynamic hostname capability on the router, use the **hostname dynamic** command in router configuration mode. To disable the dynamic hostname feature, use the **no** form of this command.

hostname dynamic

no hostname dynamic

Syntax Description

This command has no arguments or keywords.

Command Default

The dynamic hostname feature is enabled by default.

Command Modes

Router configuration

Command History

Release	Modification
12.0	This command was introduced.
12.0S	This command was integrated into Cisco IOS Release 12.0(S).

Usage Guidelines

In the IS-IS routing domain, the system ID is used to represent each router. The system ID is part of the network entity title (NET) that is configured for each IS-IS router. For example, a router with a configured NET of 49.0001.0023.0003.000a.00 has a system ID of 0023.0003.000a. Router-name-to-system-ID mapping is difficult for network administrators to remember during maintenance and troubleshooting on the routers. Entering the **show isis hostname** command displays the entries in the system-ID-to-router-name mapping table.

The dynamic hostname mechanism uses link-state protocol (LSP) flooding to distribute the router-name-to-system-ID mapping information across the entire network. Every router on the network will try to install the system ID-to-router name mapping information in its routing table.

If a router that has been advertising the dynamic name type, length, value (TLV) on the network suddenly stops the advertisement, the mapping information last received will remain in the dynamic host mapping table for up to one hour, allowing the network administrator to display the entries in the mapping entry during a time when the network experiences problems. Entering the **show isis hostname** command displays the entries in the mapping table.

Note Locally defined mappings are always preferred over dynamicly learned mappings. If you have already configured the **clns host** command to overwrite network advertised name mappings from LSPs, the **clns host** command will take precedence over the dynamic hostname feature.

Examples

The following example changes the hostname from Router to RouterA and assigns the NET 49.0001.0000.0000.000b.00 to RouterA. The dynamic hostname feature is disabled by entering the no **dynamic hostname** command. The dynamic hostname feature is then reeanabled by entering the **dynamic hostname** command.

```
Router> enable
Router# configure terminal
Router(config)# hostname RouterA
RouterA(config)# router isis CompanyA
RouterA(config-router)# net 49.0001.0000.0000.000b.00
RouterA(config-router)# hostname dynamic
RouterA(config-router)# end
```

Entering the **show isis hostname** command displays the dynamic host mapping table. The * symbol signifies that this is the hostname for the local router. The dynamic host mapping table confirms that system ID 0000.0000.000B belongs to a router with the dynamic hostname RouterA. This router is running the IS-IS process named CompanyA.

```
Router# show isis hostname

Level  System ID      Dynamic Hostname    (CompanyA)
     * 0000.0000.000B RouterA
```

Related Commands

Command	Description
clns host	Defines a name-to-NSAP mapping that can then be used with commands that require NSAPs.
hostname	Specifies or modifies the hostname for the network server.
net	Configures an IS-IS NET for a CLNS or IS-IS routing process.
show isis hostname	Displays the entries of the dynamic host mapping table.

ip router isis

To configure an IS-IS routing process for IP on an interface and to attach an area designator to the routing process, use the **ip router isis** command in interface configuration mode. To disable IS-IS for IP, use the **no** form of the command.

ip router isis *area-tag*

no ip router isis *area-tag*

Syntax Description

area-tag	Meaningful name for a routing process. If it is not specified, a null tag is assumed and the process is referenced with a null tag. This name must be unique among all IP or Connectionless Network Service (CLNS) router processes for a given router. Required for multiarea IS-IS configuration. Optional for conventional IS-IS configuration. **Note** Each area in a multiarea configuration should have a nonnull area tag to facilitate identification of the area.

Defaults

No routing processes are specified.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
12.0(5)T	Multiarea functionality was added, changing the way the *tag* argument (now *area-tag*) is used.

Usage Guidelines

Before the IS-IS routing process is useful, a network entity title (NET) must be assigned with the **net** command and some interfaces must have IS-IS enabled.

If you have IS-IS running and at least one International Organization for Standardization Interior Gateway Routing Protocol (ISO-IGRP) process, the IS-IS process and the ISO-IGRP process cannot both be configured without an area tag. The null tag can be used by only one process. If you run ISO-IGRP and IS-IS, a null tag can be used for IS-IS, but not for ISO-IGRP at the same time. However, each area in an IS-IS multiarea configuration should have a nonnull area tag to facilitate identification of the area.

You can configure only one process to perform Level 2 (interarea) routing. If Level 2 routing is configured on any process, all additional processes are automatically configured as Level 1. You can configure this process to perform intra-area (Level 1) routing at the same time. You can configure up to 29 additional processes as Level 1-only processes. Use the **is-type** command to remove Level 2 routing from a router instance. You can then use the **is-type** command to enable Level 2 routing on some other IS-IS router instance.

An interface cannot be part of more than one area, except in the case where the associated routing process is performing both Level 1 and Level 2 routing. On media such as WAN media where subinterfaces are supported, different subinterfaces could be configured for different areas.

Examples

The following example specifies IS-IS as an IP routing protocol for a process named Finance, and specifies that the Finance process will be routed on Ethernet interface 0 and serial interface 0:

```
router isis Finance
 net 49.0001.aaaa.aaaa.aaaa.00
interface Ethernet 0
 ip router isis Finance
interface serial 0
 ip router isis Finance
```

The following example shows an IS-IS configuration with two Level 1 areas and one Level 1-2 area:

```
ip routing

.
.
.

interface Tunnel529
 ip address 10.0.0.5 255.255.255.0
 ip router isis BB

interface Ethernet1
 ip address 10.1.1.5 255.255.255.0
 ip router isis A3253-01
1
!
interface Ethernet2
 ip address 10.2.2.5 255.255.255.0
 ip router isis A3253-02


.
.
.

! Defaults to "is-type level-1-2"
router isis BB
 net 49.2222.0000.0000.0005.00
!
router isis A3253-01
 net 49.0553.0001.0000.0000.0005.00
 is-type level-1
!
router isis A3253-02
 net 49.0553.0002.0000.0000.0005.00
 is-type level-1
```

Related Commands

Command	Description
is-type	Configures the routing level for an IS-IS routing process.
net	Configures an IS-IS NET for a CLNS routing process.
router isis	Enables the IS-IS routing protocol.

isis circuit-type

To configure the type of adjacency, use the **isis circuit-type** command in interface configuration mode. To reset the circuit type to Level l and Level 2, use the **no** form of this command.

isis circuit-type [**level-1** | **level-1-2** | **level-2-only**]

no isis circuit-type

Syntax Description

level-1	(Optional) Configures a router for Level 1 adjacency only.
level-1-2	(Optional) Configures a router for Level 1 and Level 2 adjacency.
level-2-only	(Optional) Configures a router for Level 2 adjacency only.

Defaults

A Level 1 and Level 2 adjacency is established.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Normally, this command need not be configured. The proper way is to configure a router as a Level 1-only, Level 1-2, or Level 2-only system. Only on routers that are between areas (Level 1-2 routers) should you configure some interfaces to be Level 2-only to prevent wasting bandwidth by sending out unused Level 1 hello packets. Note that on point-to-point interfaces, the Level 1 and Level 2 hellos are in the same packet.

A Level 1 adjacency may be established if there is at least one area address in common between this system and its neighbors. Level 2 adjacencies will never be established over this interface.

A Level 1 and Level 2 adjacency is established if the neighbor is also configured as **level-1-2** and there is at least one area in common. If there is no area in common, a Level 2 adjacency is established. This is the default.

Level 2 adjacencies are established if the other routers are Level 2 or Level 1-2 routers and their interfaces are configured for Level 1-2 or Level 2. Level 1 adjacencies will never be established over this interface.

Examples

In the following example, other routers on Ethernet interface 0 are in the same area. Other routers on Ethernet interface 1 are in other areas, so the router will stop sending Level 1 hellos.

```
interface ethernet 0
ip router isis
interface ethernet 1
 isis circuit-type level-2-only
```

isis csnp-interval

To configure the IS-IS complete sequence number PDUs (CSNPs) interval, use the **isis csnp-interval** command in interface configuration mode. To restore the default value, use the **no** form of this command.

isis csnp-interval *seconds* [**level-1** | **level-2**]

no isis csnp-interval [**level-1** | **level-2**]

Syntax Description

seconds	Interval of time between transmission of CSNPs on multiaccess networks. This interval only applies for the designated router. The default is 10 seconds.
level-1	(Optional) Configures the interval of time between transmission of CSNPs for Level 1 independently.
level-2	(Optional) Configures the interval of time between transmission of CSNPs for Level 2 independently.

Defaults

10 seconds
Level 1 and Level 2

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

It is very unlikely you will need to change the default value of this command.

This command applies only for the designated router (DR) for a specified interface. Only DRs send CSNP packets in order to maintain database synchronization. The CSNP interval can be configured independently for Level 1 and Level 2. Configuring the CSNP interval does not apply to serial point-to-point interfaces. It does apply to WAN connections if the WAN is viewed as a multiaccess meshed network.

For multiaccess WAN interfaces such as ATM, Frame Relay, and X.25, we highly recommend that you configure the nonbroadcast multiaccess (NBMA) cloud as multiple point-to-point subinterfaces. Doing so will make routing much more robust if one or more permanent virtual circuits (PVCs) fails.

The **isis csnp-interval** command on point-to-point subinterfaces should be used only in combination with the IS-IS mesh-group feature.

Examples

The following example configures Ethernet interface 0 for sending CSNPs every 30 seconds:

```
interface ethernet 0
 isis csnp-interval 30 level-1
```

isis display delimiter

To make output from multiarea displays easier to read by specifying the delimiter to use to separate displays of information, use the **isis display delimiter** command in global configuration mode. To disable this output format, use the **no** form of the command.

isis display delimiter [**return** *count* | *character count*]

no isis display delimiter [**return** *count* | *character count*]

Syntax Description

return	(Optional) Delimit with carriage returns.
count	(Optional) Number of carriage returns or length of string to use for the delimiter.
character	(Optional) Character to use for the delimiter string.

Defaults

The **isis display delimiter** command is disabled by default.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use this command to customize display output when the IS-IS multiarea feature is used. The **isis display delimiter** command displays the output from different areas as a string or additional white space.

Examples

The following command causes different areas in multiarea displays (such as **show** command output) to be delimited by a string of dashes (-):

```
isis display delimiter - 14
```

With three IS-IS neighbors configured, this command displays the following output from the **show clns neighbors** command:

```
Router# show clns neighbors
--------------
Area L2BB:
System Id      Interface   SNPA            State  Holdtime  Type Protocol
0000.0000.0009 Tu529       172.21.39.9     Up     25        L1L2 IS-IS
--------------
Area A3253-01:
System Id      Interface   SNPA            State  Holdtime  Type Protocol
0000.0000.0053 Et1         0060.3e58.ccdb  Up     22        L1   IS-IS
0000.0000.0003 Et1         0000.0c03.6944  Up     20        L1   IS-IS
```

```
--------------
Area A3253-02:
System Id      Interface   SNPA            State  Holdtime  Type Protocol
0000.0000.0002 Et2         0000.0c03.6bc5  Up     27        L1   IS-IS
0000.0000.0053 Et2         0060.3e58.ccde  Up     24        L1   IS-IS
```

Related Commands

Command	Description
show clns es-neighbors	Lists the ES neighbors that this router knows.
show clns is-neighbors	Displays IS-IS related information for IS-IS router adjacencies.
show clns neighbors	Displays both ES and IS neighbors.
show clns protocol	Lists the protocol-specific information for each ISO IGRP routing process in the router.
show clns traffic	Lists the CLNS packets this router has seen.
show isis database	Displays the IS-IS link-state database.
show isis routes	Displays the IS-IS Level 1 forwarding table for IS-IS learned routes.
show isis spf-log	Displays how often and why the router has run a full SPF calculation.
show isis topology	Displays a list of all connected routers in all areas.

isis hello padding

To reenable IS-IS hello padding at the interface level, enter the **isis hello padding** command in interface configuration mode. To disable IS-IS hello padding, use the **no** form of this command.

isis hello padding

no isis hello padding

Syntax Description

This command has no arguments or keywords.

Defaults

IS-IS hello padding is enabled.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.0(5)S	This command was integrated into Cisco IOS Release 12.0(5)S.

Usage Guidelines

Intermediate System-to-Intermediate System (IS-IS) hellos are padded to the full maximum transmission unit (MTU) size. The benefit of padding IS-IS hellos to the full MTU is that it allows for early detection of errors that result from transmission problems with large frames or errors that result from mismatched MTUs on adjacent interfaces.

You can disable hello padding in order to avoid wasting network bandwidth in case the MTU of both interfaces is the same or, in case of translational bridging. While hello padding is disabled, Cisco routers still send the first five IS-IS hellos padded to the full MTU size, in order to maintain the benefits of discovering MTU mismatches.

To selectively disable hello padding for a specific interface, enter the **no isis hello padding** command in interface configuration mode. To disable hello padding for all interfaces on a router for the IS-IS routing process, enter the **no hello padding** command in router configuration mode.

Examples

To turn off hello padding at the interface level for the Ethernet interface 0/0, enter the **no isis hello padding** command in interface configuration mode:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface e0/0
Router(config-if)# no isis hello padding
Router(config-if)# end
```

When the **show clns neighbor** command is entered for Ethernet interface 0/0, the output confirms that hello padding has been turned off for both Level 1 and Level 2 circuit types:

```
Router_A# show clns interface e0/0
```

```
Ethernet0/0 is up, line protocol is up
  Checksums enabled, MTU 1497, Encapsulation SAP
  ERPDUs enabled, min. interval 10 msec.
  CLNS fast switching enabled
  CLNS SSE switching disabled
  DEC compatibility mode OFF for this interface
  Next ESH/ISH in 47 seconds
  Routing Protocol: IS-IS
    Circuit Type: level-1-2
    Interface number 0x0, local circuit ID 0x1
    Level-1 Metric: 10, Priority: 64, Circuit ID: Router_B.01
    Level-1 IPv6 Metric: 10
    Number of active level-1 adjacencies: 1
    Level-2 Metric: 10, Priority: 64, Circuit ID: Router_B.01
    Level-2 IPv6 Metric: 10
    Number of active level-2 adjacencies: 1
    Next IS-IS LAN Level-1 Hello in 2 seconds
!   No hello padding
    Next IS-IS LAN Level-2 Hello in 2 seconds
!   No hello padding
```

When the **debug isis adj packets** command is entered, the output will show the IS-IS hello protocol data unit (PDU) length when a hello packet has been sent to or received from an IS-IS adjacency. In the following example the IS-IS hello PDU length is 1497:

```
Router# debug isis adj packets e0/0

IS-IS Adjacency related packets debugging is on
Router#
*Oct 11 18:04:17.455: ISIS-Adj: Sending L1 LAN IIH on Ethernet0/0, length 55
*Oct 11 18:04:19.075: ISIS-Adj: Rec L2 IIH from aabb.cc00.6600 (Ethernet0/0), cir type
L1L2, cir id 0000.0000.000B.01, length 1497
```

Related Commands

Command	Description
hello padding	Reenables IS-IS hello padding at the router level.
debug isis adj packets	Displays information on all adjacency-related activity such as hello packets sent and received and IS-IS adjacencies going up and down.
show clns interface	Lists the CLNS-specific information about each interface.

isis hello-interval

To specify the length of time between hello packets that the Cisco IOS software sends, use the **isis hello-interval** command in interface configuration mode. To restore the default value, use the **no** form of this command.

isis hello-interval {*seconds* | **minimal**} [**level-1** | **level-2**]

no isis hello-interval [**level-1** | **level-2**]

Syntax Description

seconds	An integer value. By default, a value three times the hello interval *seconds* is advertised as the hold time in the hello packets sent. (Change the multiplier of 3 by specifying the **isis hello-multiplier** command.) With smaller hello intervals, topological changes are detected faster, but there is more routing traffic. The default is 10 seconds.
minimal	Causes the system to compute the hello interval based on the hello multiplier (specified by the **isis hello-multiplier** command) so that the resulting hold time is 1 second.
level-1	(Optional) Configures the hello interval for Level 1 independently. Use this on X.25, Switched Multimegabit Data Service (SMDS), and Frame Relay multiaccess networks.
level-2	(Optional) Configures the hello interval for Level 2 independently. Use this on X.25, SMDS, and Frame Relay multiaccess networks.

Defaults

10 seconds
Level 1 and Level 2

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
12.0(5)T	The **minimal** keyword was added.

Usage Guidelines

The hello interval multiplied by the hello multiplier equals the hold time. If the **minimal** keyword is specified, the hold time is 1 second and the system computes the hello interval based on the hello multiplier.

The hello interval can be configured independently for Level 1 and Level 2, except on serial point-to-point interfaces. (Because only a single type of hello packet is sent on serial links, it is independent of Level 1 or Level 2.) The **level-1** and **level-2** keywords are used on X.25, SMDS, and Frame Relay multiaccess networks or LAN interfaces.

A faster hello interval gives faster convergence, but increases bandwidth and CPU usage. It might also add to instability in the network. A slower hello interval saves bandwidth and CPU. Especially when used in combination with a higher hello multiplier, this configuration may increase overall network stability.

It makes more sense to tune the hello interval and hello multiplier on point-to-point interfaces than on LAN interfaces.

Examples

The following example configures serial interface 0 to advertise hello packets every 5 seconds. The router is configured to act as a station router. This configuration will cause more traffic than configuring a longer interval, but topological changes will be detected earlier.

```
interface serial 0
 isis hello-interval 5 level-1
```

Related Commands

Command	Description
isis hello-multiplier	Specifies the number of IS-IS hello packets a neighbor must miss before the router should declare the adjacency as down.

isis hello-multiplier

To specify the number of IS-IS hello packets a neighbor must miss before the router should declare the adjacency as down, use the **isis hello-multiplier** command in interface configuration mode. To restore the default value, use the **no** form of this command.

isis hello-multiplier *multiplier* [**level-1** | **level-2**]

no isis hello-multiplier [**level-1** | **level-2**]

Syntax Description

multiplier	Integer value from 3 to 1000. The advertised hold time in IS-IS hello packets will be set to the hello multiplier times the hello interval. Neighbors will declare an adjacency to this router down after not having received any IS-IS hello packets during the advertised hold time. The hold time (and thus the hello multiplier and the hello interval) can be set on a per-interface basis, and can be different between different routers in one area. Using a smaller hello multiplier will give fast convergence, but can result in more routing instability. Increment the hello multiplier to a larger value to help network stability when needed. Never configure a hello multiplier lower than the default value of 3.
level-1	(Optional) Configures the hello multiplier independently for Level 1 adjacencies.
level-2	(Optional) Configures the hello multiplier independently for Level 2 adjacencies.

Defaults

multiplier: 3
Level 1 and Level 2

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The "holding time" carried in an IS-IS hello packet determines how long a neighbor waits for another hello packet before declaring the neighbor to be down. This time determines how quickly a failed link or neighbor is detected so that routes can be recalculated.

Use the **isis hello-multiplier** command in circumstances where hello packets are lost frequently and IS-IS adjacencies are failing unnecessarily. You can raise the hello multiplier and lower the hello interval (**isis hello-interval** command) correspondingly to make the hello protocol more reliable without increasing the time required to detect a link failure.

On point-to-point links, there is only one hello for both Level 1 and Level 2, so different hello multipliers should be configured only for multiaccess networks such as Ethernet and FDDI. Separate Level 1 and Level 2 hello packets are also sent over nonbroadcast multiaccess (NBMA) networks in multipoint mode, such as X.25, Frame Relay, and ATM. However, we recommend that you run IS-IS over point-to-point subinterfaces over WAN NBMA media.

Examples

In the following example, the network administrator wants to increase network stability by making sure an adjacency will go down only when many (ten) hello packets are missed. The total time to detect link failure is 60 seconds. This configuration will ensure that the network remains stable, even when the link is fully congested.

```
interface serial 1
 ip router isis
 isis hello-interval 6 level-1
 isis hello-multiplier 10 level-1
```

Related Commands

Command	Description
isis hello padding	Specifies the length of time between hello packets that the Cisco IOS software sends.

isis lsp-interval

To configure the time delay between successive IS-IS link-state packet (LSP) transmissions, use the **isis lsp-interval** command in interface configuration mode. To restore the default value, use the **no** form of this command.

isis lsp-interval *milliseconds*

no isis lsp-interval

Syntax Description

milliseconds	Time delay between successive LSPs (in milliseconds).

Defaults

The default time delay is 33 milliseconds.

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

In topologies with a large number of IS-IS neighbors and interfaces, a router may have difficulty with the CPU load imposed by LSP transmission and reception. This command allows the LSP transmission rate (and by implication the reception rate of other systems) to be reduced.

Examples

The following example causes the system to send LSPs every 100 milliseconds (10 packets per second) on serial interface 0:

```
interface serial 0
 isis lsp-interval 100
```

Related Commands

Command	Description
isis retransmit-interval	Configures the time between retransmission of each LSP (IS-IS link-state PDU) over point-to-point links.

isis mesh-group

To optimize link-state packet (LSP) flooding in nonbroadcast multiaccess (NBMA) networks with highly meshed, point-to-point topologies, use the **isis mesh-group** command in interface configuration mode. To remove a subinterface from a mesh group, use the **no** form of this command.

isis mesh-group [*number* | **blocked**]

no isis mesh-group [*number* | **blocked**]

Syntax Description

number	(Optional) A number identifying the mesh group of which this interface is a member.
blocked	(Optional) Specifies that no LSP flooding will take place on this subinterface.

Defaults

The interface performs normal flooding.

Command Modes

Interface configuration

Command History

Release	Modification
12.0	This command was introduced.

Usage Guidelines

LSPs that are first received on subinterfaces that are not part of a mesh group are flooded to all other subinterfaces in the usual way.

LSPs that are first received on subinterfaces that are part of a mesh group are flooded to all interfaces except those in the same mesh group. If the **blocked** keyword is configured on a subinterface, then a newly received LSP is not flooded out over that interface.

To minimize the possibility of incomplete flooding, you should allow unrestricted flooding over at least a minimal set of links in the mesh. Selecting the smallest set of logical links that covers all physical paths results in very low flooding, but less robustness. Ideally, you should select only enough links to ensure that LSP flooding is not detrimental to scaling performance, but enough links to ensure that under most failure scenarios no router will be logically disconnected from the rest of the network. In other words, blocking flooding on all links permits the best scaling performance, but there is no flooding. Permitting flooding on all links results in very poor scaling performance.

Examples

In the following example six interfaces are configured in three mesh groups. LSPs received are handled as follows:

- LSPs received first via ATM 1/0.1 are flooded to all interfaces except ATM 1/0.2 (which is part of the same mesh group) and ATM 1/2.1, which is blocked.
- LSPs received first via ATM 1/1.2 are flooded to all interfaces except ATM 1/1.1 (which is part of the same mesh group) and ATM 1/2.1, which is blocked.
- LSPs received first via ATM 1/2.1 are not ignored, but flooded as usual to all interfaces. LSPs received first via ATM 1/2.2 are flooded to all interfaces, except ATM 1/2.1, which is blocked.

```
interface atm 1/0.1
ip router isis
isis mesh-group 10

interface atm 1/0.2
ip router isis
isis mesh-group 10

interface atm 1/1.1
ip router isis
isis mesh-group 11

interface atm 1/1.2
ip router isis
isis mesh-group 11

interface atm 1/2.1
ip router isis
isis mesh-group blocked

interface atm 1/2.2
ip router isis
```

Related Commands

Command	Description
router isis	Enables the IS-IS routing protocol and specifies an IS-IS process.

isis metric

To configure the value of an Intermediate System-to-Intermediate System (IS-IS) metric, use the **isis metric** command in interface configuration or subinterface mode. To restore the default metric value, use the **no** form of this command.

isis metric {*metric-value* | **maximum}** [**level-1** | **level-2**]

no isis metric {*metric-value* | **maximum}** [**level-1** | **level-2**]

Syntax Description

metric-value	Metric assigned to the link and used to calculate the cost from each other router via the links in the network to other destinations. You can configure this metric for Level 1 or Level 2 routing. The range is from 1to 16777214. The default value is 10.
maximum	Excludes a link or adjacency from the shortest path first (SPF) calculation.
level-1	(Optional) Specifies that this metric should be used only in the SPF calculation for Level 1 (intra-area) routing. If no optional keyword is specified, the metric is enabled on routing Level 1 and Level 2.
level-2	(Optional) Specifies that this metric should be used only in the SPF calculation for Level 2 (interarea) routing. If no optional keyword is specified, the metric is enabled on routing Level 1 and Level 2.

Command Default

The default metric value is set to 10.

Command Modes

Interface configuration
Subinterface configuration

Command History

Release	Modification
10.0	This command was introduced.
12.1	The **maximum** keyword was added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4(13)	The **maximum** keyword was made available under subinterface configuration mode.
12.4(13)T	The **maximum** keyword was made available under subinterface configuration mode.

Usage Guidelines

Specifying the **level-1** or **level-2** keyword resets the metric only for Level 1 or Level 2 routing, respectively.

We highly recommend that you configure metrics on all interfaces. If you do not do so, the IS-IS metrics are similar to hop-count metrics.

It is strongly recommended to use the **metric-style wide** command to configure IS-IS to use the new-style type, length, value (TLV) because TLVs that are used to advertise IPv4 information in link-state packets (LSPs) are defined to use only extended metrics. Cisco IOS software provides support of a 24-bit metric field, the so-called "wide metric." Using the new metric style, link metrics now have a maximum value of 16777214 with a total path metric of 4261412864.

Cisco IOS Release 12.4(13) and 12.4(13)T

Entering the **maximum** keyword will exclude the link from the SPF calculation. If a link is advertised with the maximum link metric, the link will not be considered during the normal SPF calculation. When the link is excluded from the SPF, it will not be advertised for calculating the normal SPF. An example would be a link that is available for traffic engineering, but not for hop-by-hop routing. If a link, such as one that is used for traffic engineering, should not be included in the SPF calculation, enter the **isis metric** command with the **maximum** keyword.

Note The **isis metric maximum** command applies only when the **metric-style wide** command has been entered. The **metric-style wide** command is used to configure IS-IS to use the new-style TLV because TLVs that are used to advertise IPv4 information in link-state packets (LSPs) are defined to use only extended metrics.

Examples

The following example configures serial interface 0 for a link-state metric cost of 15 for Level 1:

```
Router(config)# interface serial 0
Router(config-if)# isis metric 15 level-1
```

The following example sets the IS-IS metric for the link to maximum. SPF will ignore the link for both Level 1 and Level 2 routing because neither the **level-1** keyword nor the **level-2** keyword was entered.

```
Router(config)# interface fastethernet 0/0
Router(config-if)# isis metric maximum
```

Cisco IOS Release 12.4(13) and 12.4(13)T

The following example configures the **isis metric maximum** command on Ethernet subinterface 1/1.9.

```
Router(config)# interface Ethernet 1/1.9
Router(config-subif)# isis metric maximum
```

Related Commands

Command	Description
metric-style wide	Configures a router running IS-IS so that it generates and accepts only new-style TLVs.

isis password

To configure the authentication password for an interface, use the **isis password** command in interface configuration mode. To disable authentication for IS-IS, use the **no** form of this command.

isis password *password* [**level-1** | **level-2**]

no isis password [**level-1** | **level-2**]

Syntax Description

password	Authentication password you assign for an interface.
level-1	(Optional) Configures the authentication password for Level 1 independently. For Level 1 routing, the router acts as a station router only.
level-2	(Optional) Configures the authentication password for Level 2 independently. For Level 2 routing, the router acts as an area router only.

Defaults

This command is disabled by default.

If no keyword is specified, the default is Level 1 and Level 2.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command enables you to prevent unauthorized routers from forming adjacencies with this router, and thus protects the network from intruders.

The password is exchanged as plain text and thus provides only limited security.

Different passwords can be assigned for different routing levels using the **level-1** and **level-2** kewords.

Specifying the **level-1** or **level-2** keyword disables the password only for Level 1 or Level 2 routing, respectively.

Examples

The following example configures a password for Ethernet interface 0 at Level 1:

```
interface ethernet 0
 isis password frank level-1
```

isis priority

To configure the priority of designated routers, use the **isis priority** command in interface configuration mode. To reset the default priority, use the **no** form of this command.

isis priority *number-value* [**level-1** | **level-2**]

no isis priority [**level-1** | **level-2**]

Syntax Description

number-value	Sets the priority of a router and is a number from 0 to 127. The default value is 64.
level-1	(Optional) Sets the priority for Level 1 independently.
level-2	(Optional) Sets the priority for Level 2 independently.

Defaults

Priority of 64
Level 1 and Level 2

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Priorities can be configured for Level 1 and Level 2 independently. Specifying the **level-1** or **level-2** keyword resets priority only for Level 1 or Level 2 routing, respectively.

The priority is used to determine which router on a LAN will be the designated router or Designated Intermediate System (DIS). The priorities are advertised in the hello packets. The router with the highest priority will become the DIS.

In IS-IS, there is no backup designated router. Setting the priority to 0 lowers the chance of this system becoming the DIS, but does not prevent it. If a router with a higher priority comes on line, it will take over the role from the current DIS. In the case of equal priorities, the highest MAC address breaks the tie.

Examples

The following example shows Level 1 routing given priority by setting the priority level to 80. This router is now more likely to become the DIS.

```
interface ethernet 0
 isis priority 80 level-1
```

isis retransmit-interval

To configure the amount of time between retransmission of each IS-IS link-state packet (LSP) on a point-to-point link, use the **isis retransmit-interval** command in interface configuration mode. To restore the default value, use the **no** form of this command.

isis retransmit-interval *seconds*

no isis retransmit-interval *seconds*

Syntax Description

seconds	Time (in seconds) between retransmission of each LSP. It is an integer that should be greater than the expected round-trip delay between any two routers on the attached network. The default is 5 seconds.

Defaults

5 seconds

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The setting of the *seconds* argument should be conservative, or needless retransmission will result.

This command has no effect on LAN (multipoint) interfaces. On point-to-point links, the value can be increased to enhance network stability.

Retransmissions occur only when LSPs are dropped. So setting the *seconds* argument to a higher value has little effect on reconvergence. The more neighbors routers have, and the more paths over which LSPs can be flooded, the higher this value can be made.

The value should be higher for serial lines.

Examples

The following example configures serial interface 0 for retransmission of IS-IS LSP, every 60 seconds for a large serial line:

```
interface serial 0
 isis retransmit-interval 60
```

Related Commands

Command	Description
isis lsp-interval	Configures the time delay between successive IS-IS LSP transmissions.
isis retransmit-throttle-interval	Configures the amount of time between retransmissions of any IS-IS LSPs on a point-to-point interface.

isis retransmit-throttle-interval

To configure the amount of time between retransmissions on each IS-IS link-state packet (LSP) on a point-to-point interface, use the **isis retransmit-throttle-interval** command in interface configuration mode. To restore the default value, use the **no** form of this command.

isis retransmit-throttle-interval *milliseconds*

no isis retransmit-throttle-interval

Syntax Description

milliseconds	Minimum delay (in milliseconds) between LSP retransmissions on the interface.

Defaults

The delay is determined by the **isis lsp-interval** command.

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

This command may be useful in very large networks with many LSPs and many interfaces as a way of controlling LSP retransmission traffic. This command controls the rate at which LSPs can be re-sent on the interface.

The **isis retransmit-throttle-interval** command is distinct from the rate at which LSPs are sent on the interface (controlled by the **isis lsp-interval** command) and the period between retransmissions of a single LSP (controlled by the **isis retransmit-interval** command). These commands may all be used in combination to control the offered load of routing traffic from one router to its neighbors.

Examples

The following example configures serial interface 0 to limit the rate of LSP retransmissions to one every 300 milliseconds:

```
interface serial 0
 isis retransmit-throttle-interval 300
```

Related Commands

Command	Description
isis lsp-interval	Configures the time delay between successive IS-IS LSP transmissions.
isis retransmit-interval	Configures the amount of time between retransmission of each IS-IS LSPs over a point-to-point link.

is-type

To configure the routing level for an instance of the IS-IS routing process, use the **is-type** command in router configuration mode. To reset the default value, use the **no** form of this command.

is-type [**level-1** | **level-1-2** | **level-2-only**]

no is-type [**level-1** | **level-1-2** | **level-2-only**]

Syntax Description

level-1	(Optional) Router performs only Level 1 (intra-area) routing. This router learns only about destinations inside its area. Level 2 (interarea) routing is performed by the closest Level 1-2 router.
level-1-2	(Optional) Router performs both Level 1 and Level 2 routing. This router runs two instances of the routing process. It has one link-state packet database (LSDB) for destinations inside the area (Level 1 routing) and runs a shortest path first (SPF) calculation to discover the area topology. It also has another LSDB with link-state packets (LSPs) of all other backbone (Level 2) routers, and runs another SPF calculation to discover the topology of the backbone, and the existence of all other areas.
level-2-only	(Optional) Routing process acts as a Level 2 (interarea) router only. This router is part of the backbone, and does not communicate with Level 1-only routers in its own area.

Defaults

In conventional IS-IS configurations, the router acts as both a Level 1 (intra-area) and a Level 2 (interarea) router.

In multiarea IS-IS configurations, the first instance of the IS-IS routing process configured is by default a Level 1-2 (intra-area and interarea) router. The remaining instances of the IS-IS process configured by default are Level 1 routers.

Command Modes

Router configuration

Command History

Release	Modification
10.3	This command was introduced.
12.0(5)T	This command was modified to include multiarea IS-IS routing.

Usage Guidelines

We highly recommend that you configure the type of IS-IS routing process. If you are configuring multiarea IS-IS, you *must* configure the type of the router, or allow it to be configured by default. By default, the first instance of the IS-IS routing process that you configure using the **router isis** command is a Level 1-2 router.

If only one area is in the network, there is no need to run both Level 1 and Level 2 routing algorithms. If IS-IS is used for Connectionless Network Service (CLNS) routing (and there is only one area), Level 1 only must be used everywhere. If IS-IS is used for IP routing only (and there is only one area), you can run Level 2 only everywhere. Areas you add after the Level 1-2 area exists are by default Level 1 areas.

If the router instance has been configured for Level 1-2 (the default for the first instance of the IS-IS routing process in a Cisco device), you can remove Level 2 (interarea) routing for the area using the **is-type** command. You can also use the **is-type** command to configure Level 2 routing for an area, but it must be the only instance of the IS-IS routing process configured for Level 2 on the Cisco device.

Examples

The following example specifies an area router:

```
router isis
 is-type level-2-only
```

Related Commands

Command	Description
router isis	Enables the IS-IS routing protocol and specifies an IS-IS process.
show clns neighbor areas	Displays information about IS-IS neighbors and the areas to which they belong.

lsp-gen-interval

To customize IS-IS throttling of LSP generation, use the **lsp-gen-interval** command in router configuration mode. To restore default values, use the **no** form of this command.

lsp-gen-interval [level-1 | level-2] *lsp-max-wait* [*lsp-initial-wait lsp-second-wait*]

no lsp-gen-interval

Syntax Description

level-1	(Optional) Apply intervals to Level-1 areas only.
level-2	(Optional) Apply intervals to Level-2 areas only.
lsp-max-wait	Indicates the maximum interval (in seconds) between two consecutive ocurrences of an LSP being generated. The range is 1 to 120 seconds. The default is 5 seconds.
lsp-initial-wait	(Optional) Indicates the initial LSP generation delay (in milliseconds). The range is 1 to 120,000 milliseconds. The default is 50 milliseconds.
lsp-second-wait	(Optional) Indicates the hold time between the first and second LSP generation (in milliseconds). The range is 1 to 120,000 milliseconds. The default is 5000 milliseconds (5 seconds).

Defaults

lsp-max-wait: 5 seconds
lsp-initial-wait: 50 milliseconds
lsp-second-wait: 5000 milliseconds

Command Modes

Router configuration

Command History

Release	Modification
12.1	This command was introduced.

Usage Guidelines

The following description will help you determine whether to change the default values of this command:

- The *lsp-initial-wait* argument indicates the initial wait time (in milliseconds) before generating the first LSP.
- The third argument indicates the amount of time to wait (in milliseconds) between the first and second LSP generation.
- Each subsequent wait interval is twice as long as the previous one until the wait interval reaches the *lsp-max-wait* interval specified, so this value causes the throttling or slowing down of the LSP generation after the initial and second intervals. Once this interval is reached, the wait interval continues at this interval until the network calms down.
- After the network calms down and there are no triggers for 2 times the *lsp-max-wait* interval, fast behavior is restored (the initial wait time).

Notice that the **lsp-gen-interval** command controls the delay between LSPs being *generated*, as opposed to the following related commands:

- The **isis lsp-interval** command sets the delay (in milliseconds) between successive LSPs being *transmitted* (including LSPs generated by another system and forwarded by the local system).
- The **isis retransmit-interval** command sets the amount of time (in seconds) between retransmissions *of the same LSP* on a point-to-point link.
- The **isis retransmit-throttle-interval** command sets the minimum delay (in milliseconds) between retransmitted LSPs on a point-to-point interface.

These commands can be used in combination to control the rate of LSP packets being generated, transmitted, and retransmitted.

Examples

The following example configures intervals for SPF calculations, PRC, and LSP generation:

```
router isis
 spf-interval 5 10 20
 prc-interval 5 10 20
 lsp-gen-interval 2 50 100
```

Related Commands

Command	Description
isis lsp-interval	Sets the time delay between successive IS-IS LSP transmissions.
isis retransmit-interval	Sets the amount of time between retransmission of each IS-IS LSP on a point-to-point link.
isis retransmit-throttle-interval	Sets the minimum delay between retransmissions on each LSP on a point-to-point interface.

lsp-refresh-interval (IS-IS)

To set the link-state packet (LSP) refresh interval, use the **lsp-refresh-interval** command in router configuration mode. To restore the default refresh interval, use the **no** form of this command.

lsp-refresh-interval *seconds*

no lsp-refresh-interval

Syntax Description

seconds	Interval (in seconds) at which LSPs are refreshed.The range is 1 to 65535 seconds. The default value is 900 seconds (15 minutes).

Defaults

900 seconds (15 minutes)

Command Modes

Router configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

The refresh interval determines the rate at which Cisco IOS software periodically transmits in LSPs the route topology information that it originates. This is done to keep the database information from becoming too old.

LSPs must be periodically refreshed before their lifetimes expire. The value set for the **lsp-refresh-interval** command should be less than the value set for the **max-lsp-lifetime** command; otherwise, LSPs will time out before they are refreshed. If you misconfigure the LSP lifetime to be too low compared to the LSP refresh interval, the software will reduce the LSP refresh interval to prevent the LSPs from timing out.

Reducing the refresh interval reduces the amount of time that undetected link state database corruption can persist at the cost of increased link utilization. (This is an extremely unlikely event, however, because there are other safeguards against corruption.) Increasing the interval reduces the link utilization caused by the flooding of refreshed packets (although this utilization is very small).

Examples

The following example configures the IS-IS LSP refresh interval to be 1080 seconds (18 minutes):

```
router isis
 lsp-refresh-interval 1080
```

Related Commands

Command	Description
max-lsp-lifetime (IS-IS)	Sets the maximum time that link-state packets (LSPs) can remain in a router's database without being refreshed.

max-lsp-lifetime (IS-IS)

To set the maximum time that link-state packets (LSPs) can remain in a router's database without being refreshed, use the **max-lsp-lifetime** command in router configuration mode. To restore the default lifetime, use the **no** form of this command.

max-lsp-lifetime *seconds*

no max-lsp-lifetime

Syntax Description

seconds	Lifetime of the LSP in seconds. The range is 1 to 65535 seconds; the default is 1200 seconds (20 minutes).

Defaults

1200 seconds (20 minutes)

Command Modes

Router configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

If the lifetime is exceeded before a refresh LSP arrives, the LSP is dropped from the database.

You might need to adjust the maximum LSP lifetime if you change the LSP refresh interval with the **lsp-refresh-interval** (IP) command. LSPs must be periodically refreshed before their lifetimes expire. The value set for the **lsp-refresh-interval** command should be less than the value set for the **max-lsp-lifetime** command; otherwise, LSPs will time out before they are refreshed. If you misconfigure the LSP lifetime to be too low compared to the LSP refresh interval, the software will reduce the LSP refresh interval to prevent the LSPs from timing out.

You might prefer higher values for each command in order to reduce control traffic, at the expense of holding stale LSPs from a crashed or unreachable router in the database longer (thus wasting memory) or increasing the risk of undetected bad LSPs staying active (very rare).

Examples

The following example configures an LSP lifetime of 40 minutes:

```
router isis
 max-lsp-lifetime 2400
```

Related Commands

Command	Description
lsp-refresh-interval (IS-IS)	Sets the link-state packet (LSP) refresh interval.

net

To configure an IS-IS network entity title (NET) for a Connectionless Network Service (CLNS) routing process, use the **net** command in router configuration mode. To remove a NET, use the **no** form of this command.

net *network-entity-title*

no net *network-entity-title*

Syntax Description

network-entity-title	NET that specifies the area address and the system ID for a CLNS routing process. This argument can be either an address or a name.

Defaults

No NET is configured and the CLNS process will not start. A NET is mandatory.

Command Modes

Router configuration

Command History

Release	Modification
10.0	This command was introduced.
12.0(5)T	This command was modified to include multiarea IS-IS routing.

Usage Guidelines

Under most circumstances, one and only one NET must be configured.

A NET is a network service access point (NSAP) where the last byte is always zero. On a Cisco router running IS-IS, a NET can be 8 to 20 bytes. The last byte is always the n-selector and must be zero.

The six bytes directly in front of the n-selector are the system ID. The system ID length is a fixed size and cannot be changed. The system ID must be unique throughout each area (Level 1) and throughout the backbone (Level 2).

All bytes in front of the system ID are the area ID.

Even when IS-IS is used to perform IP routing only (no CLNS routing enabled), a NET must still be configured to define the router system ID and area ID.

A maximum of three NETs per router are allowed. In rare circumstances, it is possible to configure two or three NETs. In such a case, the area this router is in will have three area addresses. There will still be only one area, but it will have an additional maximum of three area addresses.

Configuring multiple NETs can be temporarily useful in the case of network reconfiguration where multiple areas are merged, or where one area is split into additional areas. Multiple area addresses enable you to renumber an area individually as needed.

If you are configuring multiarea IS-IS, the area ID must be unique, but the system ID portion of the NET must be the same for all IS-IS routing process instances.

Examples

The following example configures a router with system ID 0000.0c11.1111.00 and area ID 47.0004.004d.0001:

```
router isis CHESNUT
 net 47.0004.004d.0001.0001.0c11.1111.00
```

The following example shows three IS-IS routing processes with three areas configured. Each area has a unique identifier, but the system ID is the same for all areas.

```
clns routing

.
.
.

interface Tunnel529
 ip address 10.0.0.5 255.255.255.0
 ip router isis BB
 clns router isis BB

interface Ethernet1
 ip address 10.1.1.5 255.255.255.0
 ip router isis A3253-01
 clns router isis A3253-01
!
interface Ethernet2
 ip address 10.2.2.5 255.255.255.0
 ip router isis A3253-02
 clns router isis A3253-02

.
.
.

router isis BB                          ! Defaults to "is-type level-1-2"
 net 49.2222.0000.0000.0005.00
!
router isis A3253-01
 net 49.0553.0001.0000.0000.0005.00
 is-type level-1
!
router isis A3253-02
 net 49.0553.0002.0000.0000.0005.00
 is-type level-1
```

Related Commands

Command	Description
is-type	Configures the routing level for an instance of the IS-IS routing process.
router isis	Enables the IS-IS routing protocol and specifies an IS-IS process.

partition avoidance

To cause an IS-IS Level 1-2 border router to stop advertising the Level 1 area prefix into the Level 2 backbone when full connectivity is lost between the border router, all adjacent Level 1 routers, and end hosts, use the **partition avoidance** command in router configuration mode. To disable this output format, use the **no** form of the command.

partition avoidance *area-tag*

no partition avoidance *area-tag*

Syntax Description

area-tag	Meaningful name for a routing process. If it is not specified, a null tag is assumed and the process is referenced with a null tag. This name must be unique among all IP or Connectionless Network Service Protocol (CLNS) router processes for a given router. Required for multiarea IS-IS configuration. Optional for conventional IS-IS configuration.

Defaults

This command is disabled by default.

Command Modes

Router configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

When the **partition avoidance** command is enabled, a multiarea router withdraws a Level 1 area prefix from the Level 2 backbone when it no longer has any active adjacencies to that Level 1 area. This withdrawal prevents the Level 1 area from appearing to be partitioned within the Level 2 backbone.

In International Standards Organization (ISO) CLNS networks using a redundant topology, it is possible for an area to become “partitioned” when full connectivity is lost between a Level 1-2 border router, all adjacent Level 1 routers, and end hosts. In such a case, multiple Level 1-2 border routers advertise the Level 1 area prefix into the backbone area, even though any one router can reach only a subset of the end hosts in the Level 1 area.

When enabled, the **partition avoidance** command prevents this partitioning by causing the border router to stop advertising the Level 1 area prefix into the Level 2 backbone. This command displays the output from different areas as a string or additional white space.

Other cases of connectivity loss within the Level 1 area itself are not detected or corrected by the border router, and this command will have no effect.

Examples

The following example causes the routing process named Finance to stop advertising the prefix for the area named area1 when the router no longer has any active adjacencies to area1:

```
router isis Finance
 partition avoidance area1
```

Related Commands

Command	Description
is-type	Configures the routing level for an instance of the IS-IS routing process.
router isis	Enables the IS-IS routing protocol and specifies an IS-IS process.

prc-interval

To customize IS-IS throttling of partial route calculations (PRC), use the **prc-interval** command in router configuration mode. To restore default values, use the **no** form of this command.

prc-interval *prc-max-wait* [*prc-initial-wait prc-second-wait*]

no prc-interval

Syntax Description

prc-max-wait	Indicates the maximum interval (in seconds) between two consecutive PRC calculations. Value range is 1 to 120 seconds. The default is 5 seconds.
prc-initial-wait	(Optional) Indicates the initial PRC calculation delay (in milliseconds) after a topology change. The range is 1 to 120,000 milliseconds. The default is 2000 milliseconds.
prc-second-wait	(Optional) Indicates the hold time between the first and second PRC calculation (in milliseconds). The range is 1 to 120,000 milliseconds. The default is 5000 milliseconds (5 seconds).

Defaults

prc-max-wait: 5 seconds
prc-initial-wait: 2000 milliseconds
prc-second-wait: 5000 milliseconds

Command Modes

Router configuration

Command History

Release	Modification
12.1	This command was introduced.

Usage Guidelines

PRC is the software's process of calculating routes without performing an SPF calculation. This is possible when the topology of the routing system itself has not changed, but a change is detected in the information announced by a particular IS or when it is necessary to attempt to reinstall such routes in the RIB.

The following description will help you determine whether to change the default values of this command:

- The *prc-initial-wait* argument indicates the initial wait time (in milliseconds) before generating the first LSP.
- The *prc-second-wait* argument indicates the amount of time to wait (in milliseconds) between the first and second LSP generation.
- Each subsequent wait interval is twice as long as the previous one until the wait interval reaches the *prc-max-wait* interval specified, so this value causes the throttling or slowing down of the PRC calculation after the initial and second intervals. Once this interval is reached, the wait interval continues at this interval until the network calms down.

- After the network calms down and there are no triggers for 2 times the *prc-max-wait* interval, fast behavior is restored (the initial wait time).

Examples

The following example configures intervals for SPF calculations, PRC, and LSP generation:

```
router isis
 spf-interval 5 10 20
 prc-interval 5 10 20
 lsp-gen-interval 2 50 100
```

router isis

To enable the Intermediate System-to-Intermediate System (IS-IS) routing protocol and to specify an IS-IS process, use the **router isis** command in global configuration mode. To disable IS-IS routing, use the **no** form of this command.

router isis *area-tag*

no router isis *area-tag*

Syntax Description

area-tag	Meaningful name for a routing process. If it is not specified, a null tag is assumed and the process is referenced with a null tag. This name must be unique among all IP or Connectionless Network Service (CLNS) router processes for a given router. Required for multiarea IS-IS configuration. Optional for conventional IS-IS configuration.

Defaults

This command is disabled by default.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.
12.0(5)T	Multiarea functionality was added, changing the way the *tag* argument (now *area-tag*) is used.

Usage Guidelines

This command is used to enable routing for an area. An appropriate network entity title (NET) must be configured to specify the area address of the area and system ID of the router. Routing must be enabled on one or more interfaces before adjacencies may be established and dynamic routing is possible.

If you have IS-IS running and at least one International Standards Organization Interior Gateway Routing Protocol (ISO-IGRP) process, the IS-IS process and the ISO-IGRP process cannot both be configured without an area tag. The null tag can be used by only one process. If you run ISO-IGRP and IS-IS, a null tag can be used for IS-IS, but not for ISO-IGRP at the same time. However, each area in an IS-IS multiarea configuration should have a nonnull area tag to facilitate identification of the area.

You can configure only one IS-IS routing process to perform Level 2 (interarea) routing. You can configure this process to perform Level 1 (intra-area) routing at the same time. You can configure up to 29 additional processes as Level 1-only processes. If Level 2 routing is configured on any process, all additional processes are automatically configured as Level 1.

An interface cannot be part of more than one area, except in the case where the associated routing process is performing both Level 1 and Level 2 routing. On media such as WAN media where subinterfaces are supported, different subinterfaces could be configured for different areas.

If Level 2 routing is not desired for a given area, use the **is-type** command to remove Level 2. Level 2 routing can then be enabled on some other router instance.

Explicit redistribution between IS-IS instances is prohibited (prevented by the parser). In other words, you cannot issue a **redistribute isis** *area-tag* command in the context of another IS-IS router instance (**router isis** *area-tag*). Redistribution from any other routing protocol into a particular area is possible, and is configured per router instance, as in Cisco IOS software Release 12.0, using the **redistribute** and **route map** commands. By default, redistribution is into Level 2.

If multiple Level 1 areas are defined, the Target Address Resolution Protocol (TARP) behaves in the following way:

- The locally assigned target identifier gets the network service access point (NSAP) of the Level 2 area, if present.
- If only Level 1 areas are configured, the router uses the NSAP of the first active Level 1 area as shown in the configuration at the time of TARP configuration ("tarp run"). (Level 1 areas are sorted alphanumerically by tag name, with capital letters coming before lowercase letters. For example, AREA-1 precedes AREA-2, which precedes area-1.) Note that the target identifier NSAP could change following a reload if a new Level 1 area is added to the configuration after TARP is running.
- The router continues to process all Type 1 and 2 protocol data units (PDUs) that are for this router. Type 1 PDUs are processed locally if the specified target identifier is in the local target identifier cache. If not, they are "propagated" (routed) to all interfaces in the *same* Level 1 area. (The same area is defined as the area configured on the input interface.)
- Type 2 PDUs are processed locally if the specified target identifier is in the local target identifier cache. If not, they are propagated via all interfaces (all Level 1 or Level 2 areas) with TARP enabled. If the source of the PDU is from a different area, the information is also added to the local target identifier cache. Type 2 PDUs are propagated via all static adjacencies.
- Type 4 PDUs (for changes originated locally) are propagated to all Level 1 and Level 2 areas (because internally they are treated as "Level 1-2").
- Type 3 and 5 PDUs continue to be routed.
- Type 1 PDUs are propagated only via Level 1 static adjacencies if the static NSAP is in one of the Level 1 areas in this router.

After you enter the **router isis** command, you can enter the maximum number of paths. There can be from 1 to 32 paths.

Examples

The following example configures IS-IS for IP routing, with system ID 0000.0000.0002 and area ID 01.0001, and enables IS-IS to form adjacencies on Ethernet interface 0 and serial interface 0. The IP prefix assigned to Ethernet interface 0 will be advertised to other IS-IS routers.

```
router isis tag1
 net 01.0001.0000.0000.0002
 is-type level-1
!
interface ethernet 0
 ip address 10.1.1.1 255.255.255.0
 ip router isis
!
interface serial 0
 ip unnumbered ethernet0
 ip router isis
```

The following example starts IS-IS routing with the optional *area-tag* argument, where CISCO is the value for the *area-tag* argument:

```
router isis CISCO
```

The following example specifies IS-IS as an IP routing protocol for a process named Finance, and specifies that the Finance process will be routed on Ethernet interface 0 and serial interface 0:

```
router isis Finance
 net 49.0001.aaaa.aaaa.aaaa.00
interface Ethernet 0
 ip router isis Finance
interface serial 0
 ip router isis Finance
```

The following example shows usage of the **maximum-paths** option:

```
router isis
maximum-paths?
20
```

Related Commands

Command	Description
clns router isis	Enables IS-IS routing for ISO CLNS on an interface and attaches an area designator to the routing process.
ip router isis	Configures an IS-IS routing process for IP on an interface and attaches an area designator to the routing process.
net	Configures an IS-IS NET for the routing process.
redistribute (IP)	Redistribute routes from one routing domain into another routing domain.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another.

set-attached-bit

To specify constraints for when a Level 1 - Level 2 (L1L2) router should set its attached-bit, use the **set-attached-bit route-map** command in router configuration mode. To disable this function, use the **no** form of this command.

set-attached-bit route-map *map-tag*

no set-attached-bit route-map *map-tag*

Syntax Description

route-map *map-tag*	(Required) Identifier of a configured route map. If the specified route map is matched, the router continues to set its attached-bit.

Defaults

This command is disabled by default.

Command Modes

Router configuration

Command History

Release	Modification
12.2	This command was introduced.
12.2(4)B	This command was integrated into Cisco IOS Release 12.2(4)B.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.

Usage Guidelines

In the current IS-IS implementation, as specified in ISO 10589, L1L2 routers set their Level 1 (L1) link-state packet (LSP) attached-bit when they see other areas in their own domain, or see other domains. However, in some network topologies, adjacent L1L2 routers in different areas may lose connectivity to the Level 2 (L2) backbone. Level 1 (L1) routers may then send traffic destined outside of the area or domain to L1L2 routers that may not have such connectivity.

To allow more control over the attached-bit setting for L1L2 routers, enter the **set-attached-bit** command in router configuration mode. The route map can specify one or more CLNS routes. If at least one of the match address route-map clauses matches a route in the L2 CLNS routing table, and if all other requirements for setting the attached-bit are met, the L1L2 router will continue to set the attached-bit in its L1 LSP. If the requirements are not met or no match address route-map clauses match a route in the L2 CLNS routing table, the attached-bit will not be set.

Note Wildcarded matches are not supported. For each route-map statement, an exact route lookup of the specified route will be performed. The first matched route will have other match statements applied.

Examples

In the following example, the attached-bit will stay set when the router matches 49.00aa in the L2 CLNS routing table.

```
clns filter-set L2_backbone_connectivity permit 49.00aa
route-map check-for-L2_backbone_connectivity
 match clns address L2_backbone_connectivity
router isis
 set-attached-bit route-map check-for-L2_backbone_connectivity
end
show clns route 49.00aa

Known via "isis", distance 110, metric 30, Dynamic Entry
Routing Descriptor Blocks:
 via tr2, Serial0
   isis, route metric is 30, route version is 58
```

Related Commands

Command	Description
route-map	Defines the conditions for redistributing routes from one routing protocol into another.
show clns route	Displays one or all of the destinations to which a router knows how to route CLNS packets.

set-overload-bit

To configure the router to signal other routers not to use it as an intermediate hop in their shortest path first (SPF) calculations, use the **set-overload-bit** command in router configuration mode. To remove the designation, use the **no** form of this command.

set-overload-bit [**on-startup** {*seconds* | **wait-for-bgp**}] [**suppress** {[**interlevel**] [**external**]}]

no set-overload-bit

Syntax Description

on-startup	(Optional) Sets the overload bit upon the system starting up. The overload bit remains set for the number of *seconds* configured or until BGP has converged, depending on the subsequent argument or keyword specified.
seconds	(Optional) When the **on-startup** keyword is configured, causes the overload bit to be set upon system startup and remain set for this number of seconds.
wait-for-bgp	(Optional) When the **on-startup** keyword is configured, causes the overload bit to be set upon system startup and remain set until BGP has converged. If BGP does not signal IS-IS that it is converged, IS-IS will turn off the overload bit after 10 minutes.
suppress	(Optional) Causes the type of prefix identified by the subsequent keyword or keywords to be suppressed.
interlevel	(Optional) When the **suppress** keyword is configured, prevents the IP prefixes learned from another IS-IS level from being advertised.
external	(Optional) When the **suppress** keyword is configured, prevents the IP prefixes learned from other protocols from being advertised.

Defaults

The overload bit is not set.

Command Modes

Router configuration

Command History

Release	Modification
11.2	This command was introduced.
11.3(2)	The **on-startup** keyword and the *seconds* argument were added.
12.0(7)S	The **wait-for-bgp** keyword was added.
12.1(9)	The **wait-for-bgp** keyword was added.
12.2(2)	The **wait-for-bgp** keyword was added.
12.0(21)ST	The **suppress**, **interlevel**, and **external** keywords were added.
12.2(8)	The **suppress**, **interlevel**, and **external** keywords were added.

Usage Guidelines

This command forces the router to set the overload bit (also known as the hippity bit) in its nonpseudonode link-state packets (LSPs). Normally, the setting of the overload bit is allowed only when a router runs into problems. For example, when a router is experiencing a memory shortage, it might be that the link-state database is not complete, resulting in an incomplete or inaccurate routing table. By setting the overload bit in its LSPs, other routers can ignore the unreliable router in their SPF calculations until the router has recovered from its problems.

The result will be that no paths through this router are seen by other routers in the IS-IS area. However, IP and Connectionless Network Service (CLNS) prefixes directly connected to this router will still be reachable.

This command can be useful when you want to connect a router to an IS-IS network but do not want real traffic flowing through it under any circumstances. Examples situations are as follows:

- A test router in the lab, connected to a production network.
- A router configured as an LSP flooding server, for example, on a nonbroadcast multiaccess (NBMA) network, in combination with the mesh group feature.
- A router that is aggregating virtual circuits (VCs) used only for network management. In this case, the network management stations must be on a network directly connected to the router with the **set-overload-bit** command configured.

Unless you specify the **on-startup** keyword, this command sets the overload bit immediately.

In addition to setting the overload bit, you might want to suppress certain types of IP prefix advertisements from LSPs. For example, allowing IP prefix propagation between Level 1 and Level 2 effectively makes a node a transit node for IP traffic, which might be undesirable. The **suppress** keyword used with the **interlevel** or **external** keyword (or both) accomplishes that suppression while the overload bit is set.

Examples

The following example sets the overload bit upon startup and until BGP has converged, and suppresses redistribution between IS-IS levels and suppresses redistribution from external routing protocols while the overload bit is set:

```
interface Ethernet0
 ip address 10.1.1.1 255.255.255.0
 ip router isis
router isis
 net 49.0001.0000.0000.0001.00
 set-overload-bit on-startup wait-for-bgp suppress interlevel external
router bgp 100
```

show isis database

To display the IS-IS link-state database, use the **show isis database** command in EXEC mode.

show isis *area-tag* **database** [**level-1**] [**level-2**] [**l1**] [**l2**] [**detail**] [**lspid**]

Syntax Description

area-tag	Meaningful name for a routing process. This name must be unique among all IP or Connectionless Network Service (CLNS) router processes for a given router. If an area tag is not specified, a null tag is assumed and the process is referenced with a null tag. If an area tag is specified, output is limited to the specified area. Required for multiarea IS-IS configuration. Optional for conventional IS-IS configuration.
level-1	(Optional) Displays the IS-IS link-state database for Level 1.
level-2	(Optional) Displays the IS-IS link-state database for Level 2.
l1	(Optional) Abbreviation for the **level-1** option.
l2	(Optional) Abbreviation for the **level-2** option.
detail	(Optional) When specified, the contents of each link-state packet (LSP) are displayed. Otherwise, a summary display is provided.
lspid	(Optional) Link-state protocol data unit (PDU) identifier. When specified, the contents of a single LSP are displayed by its ID number.

Command Modes

EXEC

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Each of the options for this command can be entered in an arbitrary string within the same command entry. For example, the following are both valid command specifications and provide the same output: **show isis database detail l2** and **show isis database l2 detail**.

Examples

The following is sample output from the **show isis database** command when it is specified with no options or as **show isis database l1 l2**:

```
Router# show isis database

IS-IS Level-1 Link State Database
LSPID                 LSP Seq Num    LSP Checksum  LSP Holdtime  ATT/P/OL
0000.0C00.0C35.00-00  0x0000000C     0x5696        792           0/0/0
0000.0C00.40AF.00-00* 0x00000009     0x8452        1077          1/0/0
0000.0C00.62E6.00-00  0x0000000A     0x38E7        383           0/0/0
0000.0C00.62E6.03-00  0x00000006     0x82BC        384           0/0/0
0800.2B16.24EA.00-00  0x00001D9F     0x8864        1188          1/0/0
0800.2B16.24EA.01-00  0x00001E36     0x0935        1198          1/0/0

IS-IS Level-2 Link State Database
LSPID                 LSP Seq Num    LSP Checksum  LSP Holdtime  ATT/P/OL
0000.0C00.0C35.03-00  0x00000005     0x04C8        792           0/0/0
0000.0C00.3E51.00-00  0x00000007     0xAF96        758           0/0/0
0000.0C00.40AF.00-00* 0x0000000A     0x3AA9        1077          0/0/0
```

Table 25 describes the significant fields shown in the display.

Table 25 show isis database Field Descriptions

Field	Description
LSPID	The LSP identifier. The first six octets form the system ID of the router that originated the LSP. The next octet is the pseudonode ID. When this byte is zero, the LSP describes links from the system. When it is nonzero, the LSP is a so-called nonpseudonode LSP. This is similar to a router link-state advertisement (LSA) in Open Shortest Path First (OSPF). The LSP will describe the state of the originating router. For each LAN, the designated router for that LAN will create and flood a pseudonode LSP, describing all systems attached to that LAN. The last octet is the LSP number. If there is more data than can fit in a single LSP, the LSP will be divided into multiple LSP fragments. Each fragment will have a different LSP number. An asterisk (*) indicates that the LSP was originated by the system on which this command is issued.
LSP Seq Num	Sequence number for the LSP that allows other systems to determine if they have received the latest information from the source.
LSP Checksum	Checksum of the entire LSP packet.
LSP Holdtime	Amount of time the LSP remains valid (in seconds). An LSP hold time of zero indicates that this LSP was purged and is being removed from the link-state database (LSDB) of all routers. The value indicates how long the purged LSP will stay in the LSDB before being completely removed.
ATT	The Attach bit. This indicates that the router is also a Level 2 router, and it can reach other areas. Level 1-only routers and Level 1-2 routers that have lost connection to other Level 2 routers will use the attach bit to find the closest Level 2 router. They will point a default route to the closest Level 2 router.

Table 25 show isis database Field Descriptions (continued)

Field	Description
P	The P bit. Detects if the IS is area partition repair capable. Cisco and other vendors do not support area partition repair.
OL	The Overload bit. Determines if the IS is congested. If the Overload bit is set, other routers will not use this system as a transit router when calculating routers. Only packets for destinations directly connected to the overloaded router will be sent to this router.

The following is sample output from the **show isis database detail** command:

```
Router# show isis database detail

IS-IS Level-1 Link State Database
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime  ATT/P/OL
0000.0C00.0C35.00-00  0x0000000C   0x5696        325           0/0/0
  Area Address: 47.0004.004D.0001
  Area Address: 39.0001
  Metric: 10   IS 0000.0C00.62E6.03
  Metric: 0    ES 0000.0C00.0C35
 --More--
0000.0C00.40AF.00-00* 0x00000009   0x8452        608           1/0/0
  Area Address: 47.0004.004D.0001
  Metric: 10   IS 0800.2B16.24EA.01
  Metric: 10   IS 0000.0C00.62E6.03
  Metric: 0    ES 0000.0C00.40AF

IS-IS Level-2 Link State Database
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime  ATT/P/OL
0000.0C00.0C35.03-00  0x00000005   0x04C8        317           0/0/0
  Metric: 0    IS 0000.0C00.0C35.00
 --More--
0000.0C00.3E51.00-00  0x00000009   0xAB98        1182          0/0/0
  Area Address: 39.0004
  Metric: 10   IS 0000.0C00.40AF.00
  Metric: 10   IS 0000.0C00.3E51.05
```

As the output shows, in addition to the information displayed with the **show isis database** command, the **show isis database detail** command displays the contents of each LSP.

Table 26 describes the significant fields shown in the display.

Table 26 show isis database detail Field Descriptions

Field	Description
Area Address:	Reachable area addresses from the router. For Level 1 LSPs, these are the area addresses configured manually on the originating router. For Level 2 LSPs, these are all the area addresses for the area to which this route belongs.
Metric:	IS-IS metric for the cost of the adjacency between the originating router and the advertised neighbor, or the metric of the cost to get from the advertising router to the advertised destination (which can be an IP address, an end system [ES], or a CLNS prefix).

The following is additional sample output from the **show isis database detail** command.This is a Level 2 LSP. The area address 39.0001 is the address of the area in which the router resides.

```
Router# show isis database detail l2

IS-IS Level-2 Link State Database
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime  ATT/P/OL
0000.0C00.1111.00-00* 0x00000006   0x4DB3        1194          0/0/0
  Area Address: 39.0001
  NLPID:        0x81 0xCC
  IP Address:  160.89.64.17
  Metric: 10   IS 0000.0C00.1111.09
  Metric: 10   IS 0000.0C00.1111.08
  Metric: 10   IP 172.16.65.0 255.255.255.0
  Metric: 10   IP 172.16.64.0 255.255.255.0
  Metric: 0    IP-External 10.0.0.0 255.0.0.0
```

Table 27 describes the significant field shown in the display.

Table 27 show isis database detail Field Descriptions Displaying IP Addresses

Field	Description
Various addresses	The IP entries are the directly connected IP subnets the router is advertising (with associated metrics). The IP-External entry is a redistribute route.

show isis hostname

To display the router-name-to-system-ID mapping table entries for an Intermediate System-to-Intermediate System (IS-IS) router, use the **show isis hostname** command in privileged EXEC mode.

show isis hostname

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0	This command was introduced.
12.0S	This command was integrated into Cisco IOS Release 12.0(S).

Usage Guidelines

In the IS-IS routing domain, the system ID is used to represent each router. The system ID is part of the network entity title (NET) that is configured for each IS-IS router. For example, a router with a configured NET of 49.0001.0023.0003.000a.00 has a system ID of 0023.0003.000a. Router-name-to-system-ID mapping is difficult for network administrators to remember during maintenance and troubleshooting on the routers. Entering the **show isis hostname** command displays the entries in the router-name-to-system-ID mapping table.

If the dynamic hostname feature has not been disabled by entering the **no dynamic hostname** command, the mapping will consist of a dynamic host mapping table. However, if the **clns host** command has been entered to create a mapping between the router name and the system ID, this locally defined mapping will take precedence over the dynamicly learned one from the dynamic hostname feature.

Examples

The following example changes the hostname to RouterA and assigns the NET 49.0001.0000.0000.000b.00 to RouterA.

```
Router> enable
Router# configure terminal
Router(config)# hostname RouterA
RouterA(config)# router isis CompanyA
RouterA(config-router)# net 49.0001.0000.0000.000b.00
RouterA(config-router)# hostname dynamic
RouterA(config-router)# end
```

Entering the **show isis hostname** command displays the dynamic host mapping table. The dynamic host mapping table displays the router-name-to-system-ID mapping table entries for Router-b, Router-c and for the local router named Router-a. The command output shows that the local router is running the IS-IS process named CompanyA. The table also shows that the neighbor router Router-b is a Level-1 router, and its hostname is advertised by the Level-1 (L1) link-state protocol (LSP). Router-b is a

Level-2 router and its hostname is advertised by the L2 LSP. The * symbol that appears under Level for the local router Router-a signifies that this is the router-name-to-system-ID mapping information for the local router.

```
Router-a# show isis hostname

Level  System ID      Dynamic Hostname    (CompanyA)
   1   3333.3333.333b Router-b
   2   3131.3131.313b Router-c
   *   3232.3232.323b Router-a
```

Related Commands

Command	Description
clns host	Defines a name-to-NSAP mapping that can then be used with commands that require NSAPs.
hostname	Specifies or modifies the hostname for the network server.
hostname dynamic	Enables dynamic hostname capability.
net	Configures an IS-IS NET for a CLNS or IS-IS routing process.

show isis lsp-log

To display the Level 1 and Level 2 Intermediate System-to-Intermediate System (IS-IS) link-state packet (LSP) log of the interfaces that triggered the new LSP, use the **show isis lsp-log** command in EXEC mode.

show isis lsp-log

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
12.0	This command was introduced.

Examples

The following is sample output from the **show isis lsp-log** command:

```
Router# show isis lsp-log

   Level 1 LSP log
  When       Count      Interface   Triggers
07:05:18        3                  CONFIG NEWADJ DIS
07:05:13        2       Ethernet0  NEWADJ DIS
07:04:43        1                  ATTACHFLAG
07:01:38        2       Ethernet0  IPUP
07:01:33        2       Loopback0  CONFIG
07:01:24        1       Ethernet0  DELADJ
07:01:17        2       Ethernet0  DIS ES
07:01:02        1       Ethernet0  NEWADJ
07:00:57        2       Ethernet0  NEWADJ DIS


   Level 2 LSP log
  When       Count      Interface   Triggers
07:05:24        2                  CONFIG NEWADJ
07:05:23        1       Ethernet0  NEWADJ
07:05:18        1       Ethernet0  DIS
07:05:00        1         Serial0  NEWADJ
07:01:44        2       Ethernet0  IPUP
07:01:39        3       Loopback0  CONFIG DELADJ
07:01:30        1       Ethernet0  DELADJ
07:01:25        1         Serial0  NEWADJ
07:00:56        1                  IPIA
07:00:47        2                  AREASET IPIA
```

Table 28 describes the fields shown in the display.

Table 28 show isis lsp-log Field Descriptions

Field	Description
When	Time elapsed since the LSP was generated.
Count	Number of events that took place at this time.
Interface	Interface that caused the LSP regeneration.
Triggers	Event that triggered the LSP to be flooded. Possible triggers for an LSP are as follows: • AREASET—Active area set changed. • ATTACHFLAG—Attached bit changed state. • CLEAR—Some form of manual **clear** command was issued. • CONFIG—Any configuration change. • DELADJ—Adjacency went down. • DIS—DIS changed or pseudonode changed. • ES—End System adjacency changed. • HIPPITY—LSPDB overload bit changed state. • IF_DOWN—Needs a new LSP. • IP_DEF_ORIG—Default information originate changed. • IPDOWN—Directly connected IP prefix down. • IP_EXTERNAL—Redistributed IP route appeared or gone. • IPIA—Interarea IP route appeared or gone. • IPUP—Directly connected IP prefix up. • NEWADJ—New adjacency came up. • REDIST—Redistributed level-2 CLNS route changed. • RRR_INFO—RRR bandwidth resource information.

show isis spf-log

To display how often and why the router has run a full shortest path first (SPF) calculation, use the **show isis spf-log** user command in EXEC mode.

show isis *area-tag* **spf-log**

Syntax Description

area-tag	Meaningful name for a routing process. This name must be unique among all IP or Connectionless Network Service (CLNS) router processes for a given router. If an area tag is not specified, a null tag is assumed and the process is referenced with a null tag. If an area tag is specified, output is limited to the specified area. Required for multiarea IS-IS configuration. Optional for conventional IS-IS configuration.

Command Modes

EXEC

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following is sample output from the **show isis spf-log** command:

```
Router# show isis spf-log

                  Level 1 SPF log
When   Duration  Nodes  Count     Last trigger LSP   Triggers
00:15:46    3124     40      1          milles.00-00  TLVCODE
00:15:24    3216     41      5          milles.00-00  TLVCODE NEWLSP
00:15:19    3096     41      1          deurze.00-00  TLVCODE
00:14:54    3004     41      2          milles.00-00  ATTACHFLAG LSPHEADER
00:14:49    3384     41      1          milles.00-01  TLVCODE
00:14:23    2932     41      3          milles.00-00  TLVCODE
00:05:18    3140     41      1                        PERIODIC
00:03:54    3144     41      1          milles.01-00  TLVCODE
00:03:49    2908     41      1          milles.01-00  TLVCODE
00:03:28    3148     41      3           bakel.00-00  TLVCODE TLVCONTENT
00:03:15    3054     41      1          milles.00-00  TLVCODE
00:02:53    2958     41      1          mortel.00-00  TLVCODE
00:02:48    3632     41      2          milles.00-00  NEWADJ TLVCODE
00:02:23    2988     41      1          milles.00-01  TLVCODE
00:02:18    3016     41      1          gemert.00-00  TLVCODE
00:02:14    2932     41      1           bakel.00-00  TLVCONTENT
00:02:09    2988     41      2           bakel.00-00  TLVCONTENT
00:01:54    3228     41      1          milles.00-00  TLVCODE
00:01:38    3120     41      3            rips.03-00  TLVCONTENT
```

Table 29 describes the significant fields shown in the display.

Table 29 show isis spf-log Field Descriptions

Field	Description
When	How long ago (in hours: minutes: seconds) a full SPF calculation occurred. The last 20 occurrences are logged.
Duration	Number of milliseconds required to complete this SPF run. Elapsed time is wall clock time, not CPU time.
Nodes	Number of routers and pseudonodes (LANs) that make up the topology calculated in this SPF run.
Count	Number of events that triggered this SPF run. When there is a topology change, often multiple link-state packets (LSPs) are received in a short time. A router waits 5 seconds before running a full SPF run, so it can include all new information. This count denotes the number of events (such as receiving new LSPs) that occurred while the router was waiting its 5 seconds before running full SPF.
Last trigger LSP	Whenever a full SPF calculation is triggered by the arrival of a new LSP, the router stores the LSP ID. The LSP ID can provide a clue as to the source of routing instability in an area. If multiple LSPs are causing an SPF run, only the LSP ID of the last received LSP is remembered.
Triggers	A list of all reasons that triggered a full SPF calculation. For a list of possible triggers, see Table 30.

Table 30 lists possible triggers of a full SPF calculation.

Table 30 Possible Triggers of Full SPF Calculation

Trigger	Description
ATTACHFLAG	This router is now attached to the Level 2 backbone or it has just lost contact to the Level 2 backbone.
ADMINDIST	Another administrative distance was configured for the IS-IS process on this router.
AREASET	Set of learned area addresses in this area changed.
BACKUPOVFL	An IP prefix disappeared. The router knows there is another way to reach that prefix but has not stored that backup route. The only way to find the alternative route is through a full SPF run.
DBCHANGED	A **clear isis *** command was issued on this router.
IPBACKUP	An IP route disappeared, which was not learned via IS-IS, but via another protocol with better administrative distance. IS-IS will run a full SPF to install an IS-IS route for the disappeared IP prefix.
IPQUERY	A **clear ip route** command was issued on this router.
LSPEXPIRED	Some LSP in the link-state database (LSDB) has expired.
LSPHEADER	ATT/P/OL bits or is-type in an LSP header changed.
NEWADJ	This router has created a new adjacency to another router.
NEWAREA	A new area (via NET) was configured on this router.

Table 30 Possible Triggers of Full SPF Calculation (continued)

Trigger	Description
NEWLEVEL	A new level (via is-type) was configured on this router.
NEWLSP	A new router or pseudonode appeared in the topology.
NEWMETRIC	A new metric was configured on an interface of this router.
NEWSYSID	A new system ID (via network entity title (NET)) was configured on this router.
PERIODIC	Typically, every 15 minutes a router runs a periodic full SPF calculation.
RTCLEARED	A **clear clns route** command was issued on this router.
TLVCODE	TLV code mismatch, indicating that different TLVs are included in the newest version of an LSP.
TLVCONTENT	TLV contents changed. This normally indicates that an adjacency somewhere in the area has come up or gone down. Look at the “Last trigger LSP” column to get an indication of where the instability may have occurred.

show isis topology

To display a list of all connected routers in all areas, use the **show isis topology** command in EXEC mode.

show isis *area-tag* **topology** [**level-1**] [**level-2**] [*host-nsap*]

Syntax Description

area-tag	Meaningful name for a routing process. This name must be unique among all IP or Connectionless Network Service (CLNS) router processes for a given router. If an area tag is not specified, a null tag is assumed and the process is referenced with a null tag. If an area tag is specified, output is limited to the specified area. Required for multiarea IS-IS configuration. Optional for conventional IS-IS configuration.
level-1	(Optional) Paths to all Level 1 routers in the area or areas in which this router resides. The abbreviated keyword **l1** may be used in place of **level-1**.
level-2	(Optional) Paths to all Level 2 routers in the domain. The abbreviated keyword **l2** may be used in place of **level-2**.
host-nsap	(Optional) Host name or network service access point (NSAP) of a router for which you would like to check reachability.

Command Modes

EXEC

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.1	The **level-1** and **level-2** keywords and the *host-nsap* argument were added.

Usage Guidelines

Use the **show isis topology** EXEC command to verify the presence and connectivity between all routers in all areas.

Examples

The following is sample output from the **show isis topology** command:

```
Router# show isis topology

IS-IS paths to level-1 routers
System Id       Metric  Next-Hop        Interface       SNPA
Router_A        --
Router_B        10      Router_B        Et0             00e0.b064.46ec
```

```
IS-IS paths to level-2 routers
System Id       Metric  Next-Hop        Interface       SNPA
Router_A        --
Router_B        10      Router_B        Et0             00e0.b064.46ec
Router_C        20      Router_B        Et0             00e0.b064.46ec
                        Router_D        Se0             DLCI 100
                        Router_D        Se1             *HDLC*
Router_D        10      Router_D        Se0             DLCI 100
                        Router_D        Se1             *HDLC*
```

Table 31 describes the fields shown in the display.

Table 31 show isis topology Field Descriptions

Field	Description
System Id	Identification value of the system listed in the Level 1 or Level 2 forwarding table.
Metric	IS-IS metric for the route.
Next-Hop	System ID of best-cost next-hop to listed address.
Interface	Interface through which the next-hop system is known.
SNPA	Subnetwork point of attachment (MAC address) of next-hop.

Related Commands

Command	Description
show clns es-neighbors	Lists the ES neighbors that this router knows.
show clns is-neighbors	Displays IS-IS related information for IS-IS router adjacencies.
show clns neighbors	Displays both ES and IS neighbors.
show clns neighbor areas	Displays information about IS-IS neighbors and the areas to which they belong.
show clns route	Displays one or all of the destinations to which the router knows how to route CLNS packets.

spf-interval

To customize IS-IS throttling of shortest path first (SPF) calculations, use the **spf-interval** command in router configuration mode. To restore default values, use the **no** form of this command.

spf-interval [level-1 | level-2] *spf-max-wait* [*spf-initial-wait spf-second-wait*]

no spf-interval

Syntax Description

level-1	(Optional) Apply intervals to Level-1 areas only.
level-2	(Optional) Apply intervals to Level-2 areas only.
spf-max-wait	Indicates the maximum interval (in seconds) between two consecutive SPF calculations. The range is 1 to 120 seconds. The default is 10 seconds.
spf-initial-wait	(Optional) Indicates the initial SPF calculation delay (in milliseconds) after a topology change. The range is 1 to 120,000 milliseconds. The default is 5500 milliseconds (5.5 seconds).
spf-second-wait	(Optional) Indicates the hold time between the first and second SPF calculation (in milliseconds). The range is 1 to 120,000 milliseconds. The default is 5500 milliseconds (5.5 seconds).

Defaults

spf-max-wait: 10 seconds
spf-initial-wait: 5500 milliseconds
spf-second-wait: 5500 milliseconds

Command Modes

Router configuration

Command History

Release	Modification
12.1	This command was introduced.

Usage Guidelines

The following description will help you determine whether to change the default values of this command:

- The *spf-initial-wait* argument indicates the initial wait time (in milliseconds) before the first SPF calculation.
- The *spf-second-wait* argument indicates the amount of time to wait (in milliseconds) between the first and second SPF calculation.
- Each subsequent wait interval is twice as long as the previous one until the wait interval reaches the *spf-max-wait* interval specified, so this value causes the throttling or slowing down of the SPF calculations after the initial and second intervals. Once this interval is reached, the wait interval continues at this interval until the network calms down.
- After the network calms down and there are no triggers for 2 times the *spf-max-wait* interval, fast behavior is restored (the initial wait time).

SPF throttling is not a dampening mechanism; that is, SPF throttling does not prevent SPF calculations or mark any route, interface, or router as down. SPF throttling simply increases the intervals between SPF calculations.

Examples

The following example configures intervals for SPF calculations, PRC, and LSP generation:

```
router isis
 spf-interval 5 10 20
 prc-interval 5 10 20
 lsp-gen-interval 2 50 100
```

summary-address (IS-IS)

To create aggregate addresses for IS-IS, use the **summary-address** command in router configuration mode. To restore the default, use the **no** form of this command.

summary-address *address mask* {**level-1** | **level-1-2** | **level-2**}

no summary-address *address mask* {**level-1** | **level-1-2** | **level-2**}

Syntax Description

address	Summary address designated for a range of addresses.
mask	IP subnet mask used for the summary route.
level-1	Only routes redistributed into Level 1 are summarized with the configured address and mask value.
level-1-2	Summary routes are applied when redistributing routes into Level 1 and Level 2 IS-IS, and when Level 2 IS-IS advertises Level 1 routes as reachable in its area.
level-2	Routes learned by Level 1 routing are summarized into the Level 2 backbone with the configured address and mask value. Redistributed routes into Level 2 IS-IS will be summarized also.

Defaults

All redistributed routes are advertised individually.

Command Modes

Router configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Multiple groups of addresses can be summarized for a given level. Routes learned from other routing protocols can also be summarized. The metric used to advertise the summary is the smallest metric of all the more specific routes. This command helps reduce the size of the routing table.

This command also reduces the size of the link-state packets (LSPs) and thus the link-state database (LSDB). It also helps stability because a summary advertisement is depending on many more specific routes. A single route flap does not cause the summary advertisement to flap in most cases.

The drawback of summary addresses is that other routes might have less information to calculate the most optimal routing table for all individual destinations.

Examples

The following example redistributes Routing Information Protocol (RIP) routes into IS-IS. In a RIP network, there are IP routes for 10.1.1, 10.1.2, 10.1.3, 10.1.4, and so on. This example advertises only 10.1.0.0 into the IS-IS Level 1 link-state PDU.

```
router isis
net 01.0000.0000.0001.00
redistribute rip level-1 metric 40
summary-address 10.1.0.0 255.255.0.0 level-1
```