Customizing IS-IS for Your Network Design

Last Updated: July 19, 2011

This module describes optional tasks that you can perform to customize Intermediate System-to-Intermediate System (IS-IS) for your network design. You can optimize network traffic flow by setting metrics, specifying an IS-IS system type, summarizing addresses, generating a default route, and configuring a global default metric.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Customizing IS-IS for Your Network Design

- Before performing the tasks in this module, you should be familiar with the concepts described in the "Integrated IS-IS Routing Protocol Overview" module.

- You should understand the concept of IP addressing. For more information on IP addressing, see the "Configuring IPv4 Addresses" module of the *Cisco IOS IP Addressing Services Configuration Guide*.
- You should know your network design and how you want traffic to flow through it before configuring IS-IS. Define areas, prepare an addressing plan for the routers (including defining the network entity titles [NETs]), and determine the interfaces that will run Integrated IS-IS.
- IS-IS must be enabled.

Restrictions for Customizing IS-IS for Your Network Design

If you have already configured a metric for a specific interface by entering the **isis metric** command, the metric that has been configured for that specific interface will take precedence over any default set by the **metric** command.

Information About Customizing IS-IS for Your Network Design

You can enhance network traffic flow by configuring IS-IS metric values for Level-1 or Level-2 routing, in order to prioritize traffic through certain paths. You can customize network traffic flow by changing the metric cost for a specified interface. All IS-IS links use the metric of 10 by default. The protocol does not automatically incorporate link attributes such as bandwidth or delay when metric values are assigned. The total cost to a destination is the sum of the costs on all outgoing interfaces along a particular path from the source to the destination. The least-cost paths are preferred.

If you want to configure a global default metric, see the Configuring an IS-IS Default Metric, page 9.

On multi-access networks, IS-IS elects a router to act as a pseudo-node representing the multi-access circuit. The elected router is known as the designated intermediate system (DIS). The DIS issues pseudo-node LSPs listing all of the routers which are reachable on the network. Each router on the network advertises in its non-pseudonode LSPs reachability to the DIS. This reduces the amount of information that needs to be advertised. A DIS is elected for each level that is operating on the network, for example both Level 1 and Level 2. By default, all routers have the same priority for being elected DIS. The MAC address of each router’s interface onto the network is used as the tiebreaker. When all routers have the same priority, the addition or removal of a router onto the network can result in a chance in the DIS. This churn can be prevented by assigning a higher priority to the router which you wish to act as the DIS. Priorities can be configured individually for Level 1 and Level 2. By default the priority is 64. You can configure the priority in the range from 0 to 127.

You can configure a summary address to represent summarized (aggregate) addresses within the IS-IS routing table. This process is called route summarization. Using a summary address can enhance scalability and network stability because it reduces the amount of information that needs to be advertised and reduces the frequency of updates required. For example, a single route flap may not cause the summary advertisement to flap. The disadvantage of using the summary addresses is that routing may be sub-optimal, for example, the path to a specific destination covered by the summary address may be longer than it would have been, had all the individual addresses been advertised. Summary addresses are most commonly used to summarize routes from one Level-one area into the Level-2 subdomain. One summary address can include multiple groups of addresses 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.

In Cisco IOS software, IS-IS has a default metric value of 10 for all active interfaces. If the interface is passive, the default value is zero. Rather than change the metric values for the active interfaces one by one, you can configure a different default metric value to be used by all interfaces. All interfaces that had the original IS-IS default metric 10 will be configured with the new default value. Besides offering the user the

convenience of being able to globally configure the value for all IS-IS interfaces, the feature helps prevent errors that may occur when interfaces are individually configured to change the metric value. For example the user may remove configured metrics from an interface, thereby restoring the default metric value of 10--perhaps unintentionally making that interface a highly preferred one in the network. Such an occurrence on the wrong interface could mean the rerouting of traffic across the network on an undesirable path.

- Enhancing Your IS-IS Network Design at the Interface Level, page 3
- Enhancing Your IS-IS Network Design at the Router Level, page 5

Enhancing Your IS-IS Network Design at the Interface Level

- Setting the IS-IS Link-State Metrics, page 3
- Prioritizing Designated Intermediate Systems for IS-IS, page 4

Setting the IS-IS Link-State Metrics

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type name*
4. **isis metric** *default-metric* [**level-1** | **level-2**]
5. **end**
6. **show isis** [*process-tag*] **database** [**level-1**] [**level-2**] [**l1**] [**l2**] [**detail**] [**lspid**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type name* **Example:** `Router(config)# interface ethernet 0`	Enters interface configuration mode.

Command or Action	Purpose
Step 4 **isis metric** *default-metric* [**level-1** | **level-2**] **Example:** `Router(config-if)# isis metric 15 level-1`	Configures the metric for an interface. **Note** We highly recommend that you configure the metrics on all interfaces. If you do not do so, all links will have the same cost and the cost to reach any node in the network will be logically equivalent to the number of hops.
Step 5 **end** **Example:** `Router(config-if)# end`	Exits interface configuration mode and returns to privileged EXEC mode.
Step 6 **show isis** [*process-tag*] **database** [**level-1**] [**level-2**] [**l1**] [**l2**] [**detail**] [**lspid**] **Example:** `Router# show isis database detail`	(Optional) Displays the IS-IS link-state database. • To display information about each LSP and the link-state database, enter the **detail** keyword.

Prioritizing Designated Intermediate Systems for IS-IS

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type name*
4. **isis priority** *number-value* [**level-1** | **level-2**]
5. **end**
6. **show clns interface** *type number*

DETAILED STEPS

Command or Action	Purpose
Step 1 **enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type name* **Example:** `Router(config)# interface ethernet 0/3`	Enters interface configuration mode.
Step 4	**isis priority** *number-value* [**level-1** | **level-2**] **Example:** `Router(config-if)# ip priority 2 level-1`	Configures the priority used in designated router election.
Step 5	**end** **Example:** `Router(config-if)# end`	Exits interface configuration mode and returns to privileged EXEC mode.
Step 6	**show clns interface** *type number* **Example:** `Router# show clns interface ethernet 0/3`	(Optional) Displays CLNS-specific information about the the interfaces running IS-IS. • The command output will display the DIS for both Level 1 and Level 2.

Enhancing Your IS-IS Network Design at the Router Level

Limiting Level 1 and Level 2 Operations on the IS-IS Router

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router isis**
4. **is-type** [**level-1** | **level-1-2** | **level-2-only**]
5. **end**
6. **show isis** [**ipv6**] [*] **topology**[**level-1**] [**level-2**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**router isis** **Example:** `Router(config)# router isis`	Enables IS-IS as an IP routing protocol. • Enters router configuration mode.
Step 4	**is-type** [**level-1**	**level-1-2**	**level-2-only**] **Example:** `Router(config-router)# is-type level-1`	Configures the routing level for an instance of the IS-IS routing process. • By default Cisco IOS software enables both Level 1 and Level 2 operations on IS-IS routers. Specifying routers to act as Level 1, Level 2, or Level 1 and 2 can streamline your network design.
Step 5	**end** **Example:** `Router(config-router)# end`	Exits router configuration mode and returns to privileged EXEC mode.

Command or Action	Purpose
Step 6 **show isis** [**ipv6**] [*] **topology**[**level-1**] [**level-2**] **Example:** `Router# show isis topology level-1`	(Optional) Displays a list of all connected routers in all areas. • To confirm paths to all Level 1 or Level 2 routers in the area or areas in which this router resides, enter the **level-1** or **level-2** keywords, respectively.

Example

The following example shows output from the **show isis topology** command for a router within a dual CLNS-IP network. In this example, because neither the **level-1** nor **level-2** optional keywords were entered, information is displayed for both Level 1 and Level 2 routers.

```
Router# show isis topology
Tag L2BB:
IS-IS paths to level-2 routers
System Id       Metric  Next-Hop        Interface       SNPA
0000.0000.0005  --
0000.0000.0009  10      0000.0000.0009  Tu529           *Tunnel*
0000.0000.0017  20      0000.0000.0009  Tu529           *Tunnel*
0000.0000.0053  30      0000.0000.0009  Tu529           *Tunnel*
0000.0000.0068  20      0000.0000.0009  Tu529           *Tunnel*
Tag A3253-01:
IS-IS paths to level-1 routers
System Id       Metric  Next-Hop        Interface       SNPA
0000.0000.0003  10      0000.0000.0003  Et1             0000.0c03.6944
0000.0000.0005  --
0000.0000.0053  10      0000.0000.0053  Et1             0060.3e58.ccdb
```

Summarizing Address Ranges in the IS-IS Routing Table

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router isis**
4. **summary-address** *address mask* {**level-1** | **level-1-2** | **level-2**}[**tag** *tag-number*] [**metric** *metric-value*]
5. **end**
6. **show isis database verbose**

DETAILED STEPS

Command or Action	Purpose
Step 1 **enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**router isis** **Example:** `Router(config)# router isis`	Enables IS-IS as an IP routing protocol. • Enters router configuration mode.
Step 4	**summary-address** *address mask* {**level-1** | **level-1-2** | **level-2**}[**tag** *tag-number*] [**metric** *metric-value*] **Example:** `Router(config-router)# summary-address 10.1.0.0 255.255.0.0 level-2`	Creates aggregate addresses for IS-IS. **Note** 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.
Step 5	**end** **Example:** `Router(config-router)# end`	Exits router configuration mode and returns to privileged EXEC mode.
Step 6	**show isis database verbose** **Example:** `Router# show isis database verbose`	(Optional) Displays detailed information about the IS-IS database.

Generating an IS-IS Default Route

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router isis**
4. **default-information originate** [**route-map** *map-name*]
5. **end**
6. **show ip route**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**router isis** **Example:** `Router(config)# router isis`	Enables IS-IS as an IP routing protocol. • Enters router configuration mode.
Step 4	**default-information originate** [**route-map** *map-name*] **Example:** `Router(config-router)# default-information originate`	Generates a default route into an IS-IS routing domain. • Use the route map to identify the level into which the default route is to be announced, whether a particular non-default prefix must be reachable, etc.
Step 5	**end** **Example:** `Router(config-router)# end`	Exits router configuration mode and returns to privileged EXEC mode.
Step 6	**show ip route** **Example:** `Router# show ip route`	(Optional) Displays the current state of the routing table.

Configuring an IS-IS Default Metric

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router isis**
4. **metric** *default-value* [**level-1** | **level-2**]
5. **end**
6. **show clns interface** [*type number*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**router isis** **Example:** `Router(config)# router isis 1`	Enables IS-IS as an IP routing protocol. • Enters router configuration mode.
Step 4	**metric** *default-value* [**level-1**	**level-2**] **Example:** `Router(config-router)# metric 25 level-2`	Globally sets a new default metric value for all IS-IS interfaces. • The value 25 shown in the example will apply only to Level 2 IS-IS interfaces. If you do not enter the **level-1** or **level-2** keyword, the metric will be applied to both Level 1 and Level 2 IS-IS interfaces.
Step 5	**end** **Example:** `Router(config-router)# end`	Exits router configuration mode and returns to privileged EXEC mode.

	Command or Action	Purpose
Step 6	**show clns interface** [*type number*] **Example:** `Router# show clns interface`	(Optional) Displays the CLNS-specific information about each interface. • Enter this command if you want to verify the IS-IS global default metric that is set for the interface.

Configuration Examples for Customizing IS-IS for Your Network Design

Example Configuring a Global Default Metric for IPv4

The following configuration example for an IS-IS routing process called area1 sets a global default metric of 111 for the IS-IS interfaces:

```
interface Ethernet3/1
 ip address 172.16.10.2 255.255.0.0
 ip router isis area1
 no ip route-cache
 duplex half
!
interface Ethernet3/2
 ip address 192.168.242.2 255.255.255.0
 ip router isis area1
 no ip route-cache
 duplex half
router isis area1
 net 01.0000.0309.1234.00
 metric-style wide
 metric 111
```

In the following example, the **show clns interface** command confirms that the IS-IS IPv4 interface metric for both Level 1 and Level 2 interfaces is assigned the new default metric value 111:

```
Router# show clns interface
Ethernet3/1 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 39 seconds
  Routing Protocol: IS-IS
    Circuit Type: level-1-2
    Interface number 0x0, local circuit ID 0x1
    Level-1 Metric: 111, Priority: 64, Circuit ID: mekong.01
    Level-1 IPv6 Metric: 10
    Number of active level-1 adjacencies: 0
    Level-2 Metric: 111, Priority: 64, Circuit ID: mekong.01
    Level-2 IPv6 Metric: 10
    Number of active level-2 adjacencies: 0
    Next IS-IS LAN Level-1 Hello in 922 milliseconds
    Next IS-IS LAN Level-2 Hello in 1 seconds
Ethernet3/2 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 20 seconds
  Routing Protocol: IS-IS
    Circuit Type: level-1-2
    Interface number 0x1, local circuit ID 0x2
    Level-1 Metric: 111, Priority: 64, Circuit ID: mekong.02
    Level-1 IPv6 Metric: 10
    Number of active level-1 adjacencies: 1
    Level-2 Metric: 111, Priority: 64, Circuit ID: mekong.02
    Level-2 IPv6 Metric: 10
    Number of active level-2 adjacencies: 1
    Next IS-IS LAN Level-1 Hello in 2 seconds
    Next IS-IS LAN Level-2 Hello in 1 seconds
```

In the following example, the **isis metric** command is entered so that it will assign a metric value of 10. The metric value that is set with the **isis metric** command for Ethernet interface 3/1 will take precedence over the metric value that was previously set with the **metric** command.

```
interface Ethernet3/1
 ip address 172.30.10.2 255.255.0.0
 ip router isis area1
 no ip route-cache
 duplex half
 isis metric 10
!
interface Ethernet3/2
 ip address 192.168.224.2 255.255.255.0
 ip router isis area1
 no ip route-cache
 duplex half
router isis area1
 net 01.0000.0309.1234.00
 metric-style wide
 metric 111
```

When the **show clns interface**command is entered, the router output confirms that the interface has an assigned IS-IS IPv4 metric value of 10:

```
Router# show clns interface
Ethernet3/1 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 53 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: mekong.01
    Level-1 IPv6 Metric: 10
    Number of active level-1 adjacencies: 0
    Level-2 Metric: 10, Priority: 64, Circuit ID: mekong.01
    Level-2 IPv6 Metric: 10
    Number of active level-2 adjacencies: 0
    Next IS-IS LAN Level-1 Hello in 4 seconds
    Next IS-IS LAN Level-2 Hello in 4 seconds
Ethernet3/2 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 30 seconds
  Routing Protocol: IS-IS
    Circuit Type: level-1-2
    Interface number 0x1, local circuit ID 0x2
```

```
Level-1 Metric: 111, Priority: 64, Circuit ID: mekong.02
Level-1 IPv6 Metric: 10
Number of active level-1 adjacencies: 1
Level-2 Metric: 111, Priority: 64, Circuit ID: mekong.02
Level-2 IPv6 Metric: 10
Number of active level-2 adjacencies: 1
Next IS-IS LAN Level-1 Hello in 2 seconds
Next IS-IS LAN Level-2 Hello in 922 milliseconds
```

Where to Go Next

- To customize IS-IS for achieving fast convergence and scalability, see the "Overview of IS-IS Fast Convergence" module.
- To enhance IS-IS network security, see the "Enhancing Security in an IS-IS Network" module.

Additional References

Related Documents

Related Topic	Document Title
IS-IS commands: complete command syntax, command mode, defaults, command history, usage guidelines, and examples	*Cisco IOS IP Routing: ISIS Command Reference*
Overview of Integrated IS-IS conceptual information with links to all the individual IS-IS modules	"Integrated IS-IS Routing Protocol Overview" module
Configuring IPv6	"Implementing IPv6 Addressing and Basic Connectivity" module in the *Cisco IOS IPv6 Configuration Guide*
Configuring the IS-IS protocol for IPv6 networks	"Implementing IS-IS for IPv6" module in the *Cisco IOS IPv6 Configuration Guide*

RFCs

RFCs	Title
RFC 1195	http://www.ietf.org/rfc/rfc1195.txt Use of OSI IS-IS for Routing in TCP/IP and Dual Environments

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Customizing IS-IS for Your Network Design

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1 Feature Information for Customizing IS-IS for Your Network Design

Feature Name	Releases	Feature Information
Integrated IS-IS Global Default Metric	12.0(27)S 12.2(25)S 12.3(4)T	The Integrated IS-IS Global Default Metric feature allows you to change the global IS-IS default metric for interfaces so that you need not change the metric values for the interfaces one by one. All interfaces that had the original IS-IS default metric 10 will be configured with the new global default value.

and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.