Reducing Failure Detection Times in IS-IS Networks

Last Updated: October 22, 2011

This module describes how to customize IS-IS configuration to help you achieve fast convergence in your network. This module describes how to configure Bidirectional Failure Detection (BFD) and how to perform other tasks to optimize how a router that runs IS-IS detects link failures and topology changes, sends important topology change updates to its neighbors, and reacts to the topology change updates that it receives from its neighbors, in order to increase network performance.

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 Reducing Failure Detection Times in IS-IS Networks

Before performing the tasks in this module, you should be familiar with the concepts described in the "Overview of IS-IS Fast Convergence" module.

Information About Reducing Failure Detection Times in IS-IS Networks

You can customize your IS-IS network to reduce the amount of time it takes for network failures to be discovered. When failures are detected more quickly, networks can react to them sooner and alternate paths can be selected more quickly, speeding up network convergence.

You can enable BFD support for routing protocols at the router level to enable BFD support globally for all interfaces or you can configure BFD on a per-interface basis at the interface level.

For Cisco IOS XE Release 2.1 and later releases, you must configure BFD support for one or more of the following routing protocols: BGP, IS-IS, and OSPF.

IS-IS is a registered protocol with BFD and will receive forwarding path detection failure messages from BFD. There are two methods for enabling BFD support for IS-IS:

- You can enable BFD for all of the interfaces for which IS-IS is routing by using the **bfd all-interfaces** command in router configuration mode. You can then disable BFD for one or more of those interfaces using the **isis bfd disable** command in interface configuration mode.
- You can enable BFD for a subset of the interfaces for which IS-IS is routing by using the **isis bfd** command in interface configuration mode.

IP event dampening introduces a configurable exponential delay mechanism to suppress the effects of excessive interface flapping events on routing protocols and routing tables in the network. This feature allows the network operator to configure a router to automatically identify and selectively dampen a local interface that is flapping, removing it from the network until it becomes stable again. Thus, the network becomes more stable, with a faster convergence time.

BFD is a detection protocol designed to provide fast forwarding path failure detection times for all media types, encapsulations, topologies, and routing protocols. In addition to fast forwarding path failure detection, BFD provides a consistent failure detection method for network administrators. Because the network administrator can use BFD to detect forwarding path failures at a uniform rate, rather than the variable rates for different routing protocol hello mechanisms, network profiling and planning will be easier, and reconvergence time will be consistent and predictable.

For complete information about the BFD feature, see the following documentation:

- "Bidirectional Forwarding Detection"

Tuning hello parameters should be considered only when the link type does not offer fast enough link failure detection. The standard default values for the hello interval and hello multiplier are 10 seconds and 3 seconds. Therefore, the multiplier times the interval will give a default hold-time of 30 seconds.

Configuring a point-to-point adjacency over a broadcast media can improve convergence times of a customer's network because it prevents the system from electing a designated router (DR), prevents flooding from using CSNPs for database synchronization, and simplifies shortest path first (SPF) computations.

How to Reduce Failure Detection Times in IS-IS Networks

Using Bidirectional Forwarding Failure Detection to Decrease Failure Detection Times

Configuring BFD Session Parameters on the Interface

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **bfd interval** *milliseconds* **min_rx** *milliseconds* **multiplier** *interval-multiplier*
5. **end**

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 number* **Example:** `Router(config)# interface GigabitEthernet 6/0/0`	Enters interface configuration mode.

	Command or Action	Purpose
Step 4	**bfd interval** *milliseconds* **min_rx** *milliseconds* **multiplier** *interval-multiplier* **Example:** Router(config-if)# bfd interval 50 min_rx 50 multiplier 5	Enables BFD on the interface.
Step 5	**end** **Example:** Router(config-if)# end	Exits interface configuration mode.

Configuring BFD Support for IS-IS

Prerequisites

- IS-IS must be running on all participating routers.
- The baseline parameters for BFD sessions on the interfaces that you want to run BFD sessions to BFD neighbors over must be configured. See the Configuring BFD Session Parameters on the Interface, page 3 for more information.

Configuring BFD Support for IS-IS for All Interfaces

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router isis** *area-tag*
4. **bfd all-interfaces**
5. **exit**
6. **interface** *type number*
7. **isis bfd** [**disable**]
8. **end**
9. **show bfd neighbors** [**details**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**router isis** *area-tag* **Example:** Router(config)# router isis tag1	Specifies an IS-IS process and enters router configuration mode.
Step 4	**bfd all-interfaces** **Example:** Router(config-router)# bfd all-interfaces	Enables BFD globally on all interfaces associated with the IS-IS routing process.
Step 5	**exit** **Example:** Router(config-router)# exit	(Optional) Returns the router to global configuration mode. Enter this command only if you want to follow Step 6 and Step 7 to disable BFD for one or more interfaces.
Step 6	**interface** *type number* **Example:** Router(config)# interface gigabitethernet 6/0/0	(Optional) Enters interface configuration mode.
Step 7	**isis bfd** [**disable**] **Example:** Router(config-if)# isis bfd	Enables or disables BFD on a per-interface basis for one or more interfaces associated with the IS-IS routing process. **Note** You should use the **disable** keyword only if you enabled BFD on all of the interfaces that IS-IS is associated with using the **bfd all-interfaces** command in router configuration mode.

	Command or Action	Purpose
Step 8	**end** **Example:** `Router(config-if)# end`	Returns the router to privileged EXEC mode.
Step 9	**show bfd neighbors** [**details**] **Example:** `Router# show bfd neighbors details`	Displays information that can be used to verify if the BFD neighbor is active and displays the routing protocols that BFD has registered.

Configuring BFD Support for IS-IS for One or More Interfaces

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **isis bfd** [**disable**]
5. **end**
6. **show bfd neighbors** [**details**]

DETAILED STEPS

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

	Command or Action	Purpose
Step 3	**interface** *type number* **Example:** Router(config)# interface gigabitethernet 6/0/0	Enters interface configuration mode.
Step 4	**isis bfd** [**disable**] **Example:** Router(config-if)# isis bfd	Enables or disables BFD on a per-interface basis for one or more interfaces associated with the IS-IS routing process. **Note** You should use the **disable** keyword only if you enabled BFD on all of the interfaces that IS-IS is associated with using the **bfd all-interfaces** command in router configuration mode.
Step 5	**end** **Example:** Router(config-if)# end	Returns the router to privileged EXEC mode.
Step 6	**show bfd neighbors** [**details**] **Example:** Router# show bfd neighbors details	Displays information that can help verify if the BFD neighbor is active and displays the routing protocols that BFD has registered.

Using IP Event Dampening to Decrease Failure Detection Times

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **dampening** [*half-life-period reuse-threshold*] [*suppress-threshold max-suppress-time* [*restart-penalty*]]
5. **end**
6. **show dampening interface**
7. **show interface dampening**

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 number* **Example:** Router(config)# interface GigabitEthernet 0/1/0	Enters interface configuration mode.
Step 4	**dampening** [*half-life-period reuse-threshold*] [*suppress-threshold max-suppress-time* [*restart-penalty*]] **Example:** Router(config-if)# dampening	Enables interface dampening. • Entering the **dampening** command without any keywords or arguments enables interface dampening with the default configuration parameters. **Note** The default values for the *half-life-period*, *reuse-threshold*, *suppress-threshold*, *max-suppress-time*, and *restart-penalty* arguments are 5, 1000, 2000, 20, and 2000, respectively. • When the timer for the *restart-penalty* argument is manually configured, the values must be manually entered for all arguments.
Step 5	**end** **Example:** Router(config-if)# end	Exits interface configuration mode and returns to privileged EXEC mode.
Step 6	**show dampening interface** **Example:** Router# show dampening interface	Displays a summary of dampened interfaces.

Command or Action	Purpose
Step 7 **show interface dampening** **Example:** `Router# show interface dampening`	Displays dampened interfaces on the local router.

Tuning IS-IS Hello Parameters to Decrease Link Failure Detection Times

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **isis hello-interval** {*seconds* | **minimal**} [**level-1** | **level-2**]
5. **isis hello-multiplier** *multiplier* [**level-1** | **level-2**]
6. **end**

DETAILED STEPS

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

Step 3 **interface** *type number*
 	
Example:
 	
`Router(config)# interface`
`GigabitEthernet 0/1/0`
	Configures an interface type and enters interface configuration mode.

	Command or Action	Purpose
Step 4	**isis hello-interval** {*seconds* | **minimal**} [**level-1** | **level-2**] **Example:** Router(config-if)# isis hello-interval 5 level-1	Specifies the length of time between the sending of IS-IS hello PDUs. • The default value is 10. 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 PDU is sent on serial links, it is independent of Level 1 or Level 2.) The level-1 and level-2 keywords are used on SMDS and Frame Relay multiaccess networks or LAN interfaces. **Note** A faster hello interval gives faster convergence, but increases bandwidth and CPU usage. It might also add to instability in the network, due to false failure detection events. 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, but has typical slower network convergence as a consequence.
Step 5	**isis hello-multiplier** *multiplier* [**level-1** | **level-2**] **Example:** Router(config-if)# isis hello-multiplier 6 level-1	Specifies the number of IS-IS hello PDUs a neighbor must miss before the router should declare the adjacency as down. • The default value is 3. A multiplier value of 1 is very aggressive--we recommend a value of at least 2.
Step 6	**end** **Example:** Router(config-if)# end	Returns to privileged EXEC mode.

Configuring an IS-IS Point-to-Point Adjacency over Broadcast Media to Reduce Link Failure Detection Times

Note   We recommend that you perform this task only for IS-IS networks that consist of only two networking devices connected to broadcast media. Such networks are usually configured as a point-to-point link rather than a broadcast link. In this case, it is recommended to follow this task to decrease the link failure detection time.

Having a multipoint interface instead of the point-to-point interfaces will cause the creation of a pseudonode on the network. The addition of the pseudonode means that the router must retain information about it. To decrease the size of the topology database of the router, thereby reducing the memory requirement of the router and increasing the efficiency of the SPF calculation since there is one less node involved, configure point-to-point interfaces when possible.

>

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *interface-type interface-number*
4. **isis network point-to-point**
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables higher privilege levels, such as privileged EXEC mode. Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *interface-type interface-number* **Example:** `Router(config)# interface gigabitethernet 4/0/0`	Configures an interface type and enters interface configuration mode.

	Command or Action	Purpose
Step 4	**isis network point-to-point** **Example:** Router(config-if)# isis network point-to-point	Configures a network of only two networking devices that use broadcast media and the integrated IS-IS routing protocol to function as a point-to-point link instead of a broadcast link.
Step 5	**end** **Example:** Router(config-if)# end	Returns to privileged EXEC mode.

Monitoring IS-IS Network Convergence Time

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **isis display delimiter** [**return** *count* | **character** *count*]
4. **exit**
5. **show isis database** [**level-1**] [**level-2**] [**l1**] [**l2**] [**detail**] [**lspid**]
6. **show isis** [*area-tag*] **routes**
7. **show isis spf-log**
8. **show isis** [*process-tag*] **topology**

DETAILED STEPS

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

	Command or Action	Purpose
Step 3	**isis display delimiter** [**return** *count* | **character** *count*] **Example:** `Router(config)# isis display delimiter return 2`	Makes output from multiarea displays easier to read by specifying the delimiter to use to separate displays of information.
Step 4	**exit** **Example:** `Router(config)# exit`	Returns to privileged EXEC mode.
Step 5	**show isis database** [**level-1**] [**level-2**] [**l1**] [**l2**] [**detail**] [**lspid**] **Example:** `Router# show isis database detail`	Displays the IS-IS link-state database.
Step 6	**show isis** [*area-tag*] **routes** **Example:** `Router# show isis financetag routes`	Displays the IS-IS Level 1 forwarding table for IS-IS learned routes.
Step 7	**show isis spf-log** **Example:** `Router# show isis spf-log`	Displays how often and why the router has run a full SPF calculation.
Step 8	**show isis** [*process-tag*] **topology** **Example:** `Router# show isis financetag topology`	Displays a list of all connected routers in all areas. • If a process tag is specified, output is limited to the specified routing process. When "null" is specified for the process tag, output is displayed only for the router process that has no tag specified. If a process tag is not specified, output is displayed for all processes.

Configuration Examples for Reducing Failure Detection Times in IS-IS Networks

Example Configuring IS-IS to Achieve Fast Convergence by Reducing Failure Detection Times

The following example configures Gigabit Ethernet interface 0/0/0 to use IP event dampening, setting the half life to 30 seconds, the reuse threshold to 1500, the suppress threshold to 10,000, and the maximum suppress time to 120 seconds. The IS-IS hello parameters have also been tuned for more rapid failure detection

```
enable
configure terminal
interface GigabitEthernet 0/0/0
 dampening 30 1500 10000 120
 isis hello-interval minimal
 isis hello-multiplier 2
```

Where to Go Next

To configure additional features to improve IS-IS network convergence times, complete the optional tasks in one or more of the following modules:

- "Setting Best Practice Parameters for IS-IS Fast Convergence"
- "Reducing Alternate-Path Calculation Times in IS-IS Networks"

Additional References

The following sections provide references related to reducing failure detection times in IS-IS networks.

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 Cisco IS-IS conceptual information with links to all the individual IS-IS modules	"Overview of IS-IS Fast Convergence"
Cisco IOS master command list, all releases	Cisco IOS Master Command List, All Releases

Standards

Standard	Title
No new or modified standards are supported, and support for existing standards has not been modified.	--

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

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

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Feature Information for Reducing Failure Detection Times in IS-IS Networks

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 Reducing Failure Detection Times in IS-IS Networks*

Feature Name	Software Releases	Feature Information
Integrated IS-IS Point-to-Point Adjacency over Broadcast Media	Cisco IOS XE Release 2.1	When a network consists of only two networking devices connected to broadcast media and uses the integrated IS-IS protocol, it is better for the system to handle the link as a point-to-point link instead of as a broadcast link. This feature introduces a new command to make IS-IS behave as a point-to-point link between the networking devices. In Cisco IOS XE Release 2.1 this feature was introduced on the Cisco ASR 1000 Series Routers. The following commands were modified by this feature: **isis network point-to-point**.
IS-IS Support for BFD over IPv4	Cisco IOS XE Release 2.1	BFD is a detection protocol designed to provide fast forwarding path failure detection times for all media types, encapsulations, topologies, and routing protocols. In addition to fast forwarding path failure detection, BFD provides a consistent failure detection method for network administrators. Because the network administrator can use BFD to detect forwarding path failures at a uniform rate, rather than the variable rates for different routing protocol hello mechanisms, network profiling and planning will be easier, and reconvergence time will be consistent and predictable. This feature was introduced on the Cisco ASR 1000 Series Aggregation Services Routers. The following commands were modified by this feature: **bfd all-interfaces**, **bfd interval**, **isis bfd**, **router isis**, **show bfd neighbors.**