Intermediate System-to-Intermediate System (IS-IS) Support for Graceful Restart (GR) and Non-Stop Routing (NSR)

Last updated: June 2008

Summary

The Intermediate System-to-Intermediate System (IS-IS) routing protocol provides support for both Graceful Restart (GR) and Non Stop Routing (NSR) on a variety of Cisco platforms. Graceful Restart (also known as Non Stop Forwarding) and NSR are two different mechanisms that prevent routing protocol re-convergence during a processor switchover. Cisco IOS Software supports IS-IS GR and NSR across a wide range of platforms from the Cisco Catalyst 4500 Series Switch to the Cisco 12000 Series Router.

Overview

Traditionally, when a networking device restarts, all routing peers associated with that device detect that the device has gone down and routes from that peer are removed. The session is re-established when the device completes the restart. This transition results in removal and re-insertion of routes, which could spread across multiple routing domains. This was required because of the inability of the restarting device to forward traffic during the reload period.

Today, dual processor systems which support Stateful Switch Over (SSO) or In-Service Software Upgrades (ISSU) can continue to forward traffic, while restarting the control plane on the second processor. In this case, route removal and insertion caused by routing protocol restarts is no longer necessary, no longer creating unnecessary routing instabilities, which are detrimental to the overall network performance. Graceful Restart and Non Stop Routing suppress routing changes on peers to SSO-enabled devices during processor switchover events (SSO or ISSU), reducing network instability and downtime.

GR and NSR, when coupled with SSO, provide the foundation for fast recovery from a processor failure and allow the use of In Service Software Upgrade to perform software upgrades with little downtime. SSO is necessary to handle other non routing protocol related items needed for the router to operate following a switchover. These include syncing the complete router configuration, Cisco Express Forwarding (CEF) forwarding entries and other needed information, to the standby processor.

Graceful Restart and Non Stop Routing both allow for the forwarding of data packets to continue along known routes while the routing protocol information is being restored (in the case of Graceful Restart) or refreshed (in the case of Non Stop Routing) following a processor switchover.

When Graceful Restart is used, there is no need for an initial negotiation of GR capabilities with IS-IS, unlike with some other protocols such as Border Gateway Protocol (BGP). GR aware routers include the Restart TLV in their hellos at all times. The restarting router therefore knows which neighbors are and which are not capable of supporting GR helper mode upon receipt of the first hello PDU following restart. Neighbors of the restarting router who do not support IS-IS GR helper

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mode do not include the restart TLV in their hellos. When the restarting router receives hellos from such neighbors, it knows that restart is not supported and initiates the adjacency normally. Otherwise, when a switchover occurs, the peer will continue to forward data to the switching over router as instructed by the GR process, even though the peering relationship needs to be rebuilt. Essentially, the peer router will give the switching over router a “grace” period to re-establish the neighbor relationship, while continuing to forward traffic to the routes from that peer. The Cisco IS-IS Graceful Restart implementation is based upon to RFC 3847, the IETF standard that ensures vendor interoperability.

When Non Stop Routing is used, peer networking devices have no knowledge of any event on the switching over router. All information needed to continue the routing protocol peering state is transferred to the standby processor, so it can continue immediately upon a switchover.

The following table shows the Cisco IOS Software releases in which IS-IS Graceful Restart and NSR were first introduced by platform:

Table 1.

Platform	Support Starts with:
Cisco 12000	Release 12.0(22)S
Cisco 10000	Release 12.0(22)S, Release 12.2(27)SBB
Cisco 7600	Release12.2(18)SXD, Release 12.2(33)SRA
Cisco ASR1000	IOS XE Rel 2.1
Cisco Catalyst 6500	Release 12.2(18)SXD
Cisco Catalyst 4500	Release 12.2(31)SG

Configuration

Configuring both IS-IS Graceful Restart and NSR may be a little confusing. They both use the **nsf** command in router configuration IS-IS mode. The **nsf** command has two keywords, **cisco** and **ietf**. The keyword **cisco** indicates NSR, while **ietf** indicates Graceful Restart.

Examples

To configure IS-IS Non Stop Routing:

```
Router# configure terminal
Router(config)# router isis [tag]
Router(config-router)# nsf cisco
```

To configure IS-IS Graceful Restart:

```
Router# configure terminal
Router(config)# router isis [tag]
Router(config-router)# nsf ietf
```

There are also several timers that may optional be configured. For details please see the Software Configuration Guide for your platform and release. (For example if you are configuring Release12.2SR on a Cisco 7600 see http://www.cisco.com/en/US/docs/routers/7600/ios/12.2SXF/configuration/guide/nsfsso.html#wp1122415.

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Printed in USA C78-484478-00 06/08

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