OSPF Incremental SPF

The Open Shortest Path First (OSPF) protocol can be configured to use an incremental SPF algorithm for calculating the shortest path first routes. Incremental SPF is more efficient than the full SPF algorithm, thereby allowing OSPF to converge faster on a new routing topology in reaction to a network event.

Feature History for the OSPF Incremental SPF Feature

Release	Modification
12.0(24)S	This feature was introduced.
12.3(2)T	This feature was integrated into Cisco IOS Release 12.3(2)T.
12.2(18)S	This feature was integrated into Cisco IOS Release 12.2(18)S.
12.2(27)SBC	This feature was integrated into Cisco IOS Release 12.2(27)SBC.

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

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Prerequisites for OSPF Incremental SPF

It is presumed that you have OSPF configured in your network.

Information About OSPF Incremental SPF

Before you enable OSPF Incremental SPF, you should understand the concept described in this section.

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Benefits of OSPF Incremental SPF

OSPF uses Dijkstra's SPF algorithm to compute the shortest path tree (SPT). During the computation of the SPT, the shortest path to each node is discovered. The topology tree is used to populate the routing table with routes to IP networks. When changes to a Type-1 or Type-2 link-state advertisement (LSA) occur in an area, the entire SPT is recomputed. In many cases, the entire SPT need not be recomputed because most of the tree remains unchanged. Incremental SPF allows the system to recompute only the affected part of the tree. Recomputing only a portion of the tree rather than the entire tree results in faster OSPF convergence and saves CPU resources. Note that if the change to a Type-1 or Type-2 LSA occurs in the calculating router itself, then the full SPT is performed.

Incremental SPF is scheduled in the same way as the full SPF. Routers enabled with incremental SPF and routers not enabled with incremental SPF can function in the same internetwork.

How to Enable OSPF Incremental SPF

This section contains the following procedure:

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Enabling Incremental SPF

This section describes how to enable incremental SPF.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router ospf** *process-id*
4. **ispf**
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	**router ospf** *process-id* **Example:** `Router(config)# router ospf 1`	Configures an OSPF routing process.
Step 4	**ispf** **Example:** `Router(config-router)# ispf`	Enables incremental SPF.
Step 5	**end** **Example:** `Router(config-router)# end`	Exits router configuration mode.

Configuration Examples for OSPF Incremental SPF

This section contains an example of configuring OSPF incremental SPF:

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Incremental SPF: Example

This example enables incremental SPF:

```
router ospf 1
 ispf
```

Additional References

The following sections provide references related to OSPF Incremental SPF.

Related Documents

Related Topic	Document Title
OSPF commands	"OSPF Commands" chapter in the *Network Protocols Command Reference, Part 1,* Release 12.0
OSPF configuration tasks	"Configuring OSPF " chapter in the *Network Protocols Configuration Guide, Part 1,* Release 12.0

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—

MIBs

MIBs	MIBs Link
None	To obtain lists of supported MIBs by platform and Cisco IOS release, and to download MIB modules, go to the Cisco MIB website on Cisco.com at the following URL: http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

RFCs

RFCs	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
Technical Assistance Center (TAC) home page, containing 30,000 pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/public/support/tac/home.shtml

Command Reference

This section documents the new **ispf** command. All other commands used with this feature are documented in the Cisco IOS Release 12.0 command reference publications.

ispf

To enable incremental shortest path first (SPF), use the **ispf** command in router configuration mode. To disable incremental SPF, use the **no** form of this command.

ispf {**level-1** | **level-2** | **level-1-2**} [*seconds*]

no ispf

Syntax Description

level-1	Enables incremental SPF for Level 1 packets only. The **level-1** keyword applies only when you have enabled Intermediate System-to-Intermediate System (IS-IS).
level-2	Enables incremental SPF for Level 2 packets only. The **level-2** keyword applies only when you have enabled IS-IS.
level-1-2	Enables incremental SPF for Level 1 and Level 2 packets. The **level-1-2** keyword applies only when you have enabled IS-IS.
seconds	(Optional) Number of seconds after configuring this command that incremental SPF is activated. Value can be in the range from 1 to 600. The default value is 120 seconds. The *seconds* argument applies only when you have enabled IS-IS.

Defaults

Incremental SPF is disabled.
seconds: 120

Command Modes

Router configuration

Command History

Release	Modification
12.0(24)S	This command was introduced.
12.3(2)T	This command was integrated into Cisco IOS Release 12.3(2)T.
12.2(18)S	This command was integrated into Cisco IOS Release 12.2(18)S.
12.2(27)SBC	This command was integrated into Cisco IOS Release 12.2(27)SBC.

Usage Guidelines

Intermediate System-to-Intermediate System (IS-IS) and Open Shortest Path First (OSPF) use Dijkstra's SPF algorithm to compute the shortest path tree (SPT). During the computation of the SPT, the shortest path to each node is discovered. The topology tree is used to populate the routing table with routes to IP networks. When changes to a Type 1 or Type 2 link-state advertisement (LSA) occur in an area, the entire SPT is recomputed. In many cases, the entire SPT need not be recomputed because most of the tree remains unchanged. Incremental SPF allows the system to recompute only the affected part of the tree. Recomputing only a portion of the tree rather than the entire tree results in faster OSPF convergence and saves CPU resources. Note that if the change to a Type 1 or Type 2 LSA occurs in the calculating router itself, then the full SPT is performed.

Incremental SPF computes only the steps needed to apply the changes in the network topology diagram. That process requires that the system keep more information about the topology in order to apply the incremental changes. Also, more processing must be done on each node for which the system receives a new link-state packet (LSP). However, incremental SPF typically reduces demand on CPU.

Incremental SPF is scheduled in the same way as the full SPF. Routers enabled with incremental SPF and routers not enabled with incremental SPF can function in the same internetwork.

Incremental SPF works only for IPv4.

Even if incremental SPF is configured, there are some cases where full SPF is executed; for example, periodic SPF, a calculation change for the routing calculation (such as a change in metric, is-type, and so on), the configuration of the **clear ip route** or **clear isis** commands, or adjacency changes.

Examples

The following example enables OSPF incremental SPF:

```
Router(config)# router ospf 1
Router(config-router)# ispf level-1
```

The following examples enables IS-IS incremental SPF for Level 1 and Level 2 packets:

```
Router(config)# router isis
Router(config-router)# ispf level-1-2
```

Cisco IOS Release: Multiple releases (see the Feature History table)