OSPF Stub Router Advertisement

Feature History

Release	Modification
12.1(8)E	This feature was introduced.
12.0(15)S	This feature was integrated into Cisco IOS Release 12.0(15)S.
12.0(15)SC	This feature was integrated into Cisco IOS Release 12.0(15)SC.
12.0(16)ST	This feature was integrated into Cisco IOS Release 12.0(16)ST.
12.2(4)T	This feature was integrated into Cisco IOS Release 12.2(4)T.
12.2(4)T3	Support for the Cisco 7500 series was added in Cisco IOS Release 12.2(4)T3.
12.2(14)S	This feature was integrated into Cisco IOS Release 12.2(14)S.

This document describes the OSPF Stub Router Advertisement feature. It includes the following sections:

Feature Overview

The OSPF Stub Router Advertisement feature allows you to bring a new router into a network without immediately routing traffic through the new router and allows you to gracefully shut down or reload a router without dropping packets that are destined for other networks. This feature introduces three configuration options that allow you to configure a router that is running the Open Shortest Path First (OSPF) protocol to advertise a maximum or infinite metric to all neighbors.

When any of these three configuration options are enabled on a router, the router will originate link-state advertisements (LSAs) with a maximum metric (LSInfinity: 0xFFFF) through all nonstub links. The advertisement of a maximum metric causes other routers to assign a cost to the new router that is higher than the cost of using an alternate path. Because of the high cost assigned to paths that pass through the new router, other routers will not use a path through the new router as a transit path to forward traffic that is destined for other networks, which allows switching and routing functions to be up and running and routing tables to converge before transit traffic is routed through this router.

Note Directly connected links in a stub network are not affected by the configuration of a maximum or infinite metric because the cost of a stub link is always set to the output interface cost.

Allowing Routing Tables to Converge

Two configuration options introduced by the OSPF Stub Router Advertisement feature allow you to bring a new router into a network without immediately routing traffic through the new router. These configuration options are useful because Interior Gateway Protocols (IGPs) converge very quickly upon a router during startup or after a reload, often before Border Gateway Protocol (BGP) routing tables have completely converged. If neighbor routers forward traffic through a router while that router is building BGP routing tables, packets that have been received for other destinations may be dropped. Advertising a maximum metric during startup will allow routing tables to converge before traffic that is destined for other networks is sent through the router. The following two configuration options enable a router to advertise a maximum metric at startup:

- You can configure a timer to advertise a maximum metric when the router is started or reloaded. When this option is configured, the router will advertise a maximum metric, which forces neighbor routers to select alternate paths until the timer expires. When the timer expires, the router will advertise accurate (normal) metrics, and other routers will send traffic to this router depending on the cost. The configurable range of the timer is from 5 to 86,400 seconds.
- You can configure a router to advertise a maximum metric at startup until BGP routing tables converge or until the default timer expires (600 seconds). Once BGP routing tables converge or the default timer expires, the router will advertise accurate (normal) metrics and other routers will send traffic to this router, depending on the cost.

Configuring a Graceful Shutdown

The third configuration option introduced by the OSPF Stub Router Advertisement feature allows you to gracefully remove a router from the network by advertising a maximum metric through all links, which allows other routers to select alternate paths for transit traffic to follow before the router is shut down. There are many situations where you may need to remove a router from the network. If a router is removed from a network and neighbor routers cannot detect that the physical interface is down, neighbors will need to wait for dead timers to expire before the neighbors will remove the adjacency and routing tables will reconverge. This situation may occur when there is a switch between other routers and the router that is shut down. Packets may be dropped while the neighbor routing tables reconverge.

When this third option is configured, the router advertises a maximum metric, which allows neighbor routers to select alternate paths before the router is shut down. This configuration option could also be used to remove a router that is in a critical condition from the network without affecting traffic that is destined for other networks.

Note You should not save the running configuration of a router when it is configured for a graceful shutdown because the router will continue to advertise a maximum metric after it is reloaded.

Benefits

Improved Stability and Availability

Advertising a maximum metric through all links at startup or during a reload will prevent neighbor routers from using a path through the router as a transit path, thereby reducing the number of packets that are dropped and improving the stability and availability of the network.

Graceful Removal from the Network

Advertising a maximum metric before shutdown allows other routers to select alternate paths before the transit path through a router becomes inaccessible.

Related Features and Technologies

The OSPF Stub Router Advertisement feature is an extension of the OSPF routing protocol. For more information about configuring OSPF and BGP, refer to the Release 12.2 *Cisco IOS IP Routing Configuration Guide* and the *Cisco IOS IP Command Reference, Volume 2 of 3: Routing Protocols*.

Supported Platforms

The OSPF Stub Router Advertisement feature is supported by the following platforms in Cisco IOS Release 12.2(14)S that support OSPF:

- Cisco 7200 series
- Cisco 7400 series
- Cisco 7500 series

Determining Platform Support Through Cisco Feature Navigator

Cisco IOS software is packaged in feature sets that support specific platforms. To get updated information regarding platform support for this feature, access Cisco Feature Navigator. Cisco Feature Navigator dynamically updates the list of supported platforms as new platform support is added for the feature.

Cisco Feature Navigator is a web-based tool that enables you to determine which Cisco IOS software images support a specific set of features and which features are supported in a specific Cisco IOS image. You can search by feature or release. Under the release section, you can compare releases side by side to display both the features unique to each software release and the features in common.

To access Cisco Feature Navigator, you must have an account on Cisco.com. If you have forgotten or lost your account information, send a blank e-mail to cco-locksmith@cisco.com. An automatic check will verify that your e-mail address is registered with Cisco.com. If the check is successful, account details with a new random password will be e-mailed to you. Qualified users can establish an account on Cisco.com by following the directions at http://www.cisco.com/register.

Cisco Feature Navigator is updated regularly when major Cisco IOS software releases and technology releases occur. For the most current information, go to the Cisco Feature Navigator home page at the following URL:

http://www.cisco.com/go/fn

Availability of Cisco IOS Software Images

Platform support for particular Cisco IOS software releases is dependent on the availability of the software images for those platforms. Software images for some platforms may be deferred, delayed, or changed without prior notice. For updated information about platform support and availability of software images for each Cisco IOS software release, refer to the online release notes or, if supported, Cisco Feature Navigator.

Supported Standards, MIBs, and RFCs

Standards

No new or modified standards are supported by this feature.

MIBs

No new or modified MIBs are supported by this feature.

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

- RFC 3137 *OSPF Stub Router Advertisement*

Configuration Tasks

See the following sections for configuration tasks to configure OSPF to advertise a maximum metric. This feature has three different configuration options. All tasks are optional and should be individually configured.

- Configuring Advertisement on Startup (optional)
- Configuring Advertisement Until Routing Tables Converge (optional)
- Configuring Advertisement for a Graceful Shutdown (optional)
- Verifying the Advertisement of a Maximum Metric (optional)

Configuring Advertisement on Startup

To configure a router that is running OSPF to advertise a maximum metric during startup, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# router ospf process-id`	Places the router in router configuration mode and enables an OSPF routing process.
Step 2	`Router(config-router)# max-metric router-lsa on-startup announce-time`	Configures OSPF to advertise a maximum metric during startup for a configured period of time. The *announce-time* argument is a configurable timer that must follow the **on-startup** keyword to be configured. There is no default timer value. The configurable time range is from 5 to 86,400 seconds.

Configuring Advertisement Until Routing Tables Converge

To configure a router that is running OSPF to advertise a maximum metric until BGP routing tables converge, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# router ospf process-id`	Places the router in router configuration mode and enables an OSPF routing process.
Step 2	`Router(config-router)# max-metric router-lsa on-startup wait-for-bgp`	Configures OSPF to advertise a maximum metric until BGP routing tables have converged or until the default timer has expired. The **wait-for-bgp** keyword must follow the **on-startup** keyword to be configured. The default timer value is 600 seconds.

Configuring Advertisement for a Graceful Shutdown

To configure a router that is running OSPF to advertise a maximum metric for a graceful shutdown or removal from the network, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# router ospf process-id`	Places the router in router configuration mode and enables an OSPF routing process.
Step 2	`Router(config-router)# max-metric router-lsa`	Configures OSPF to advertise a maximum metric until the router is shut down.
Step 3	`Router(config-router)# exit`	Exits router configuration mode.

	Command	Purpose
Step 4	`Router(config)# exit`	Exits configuration mode and places the router in privileged EXEC mode.
Step 5	`Router# show ip ospf`	Displays general information about OSPF routing processes. The **show ip ospf** command is entered in order to verify that the **max-metric router-lsa** command has been enabled before the router is shut down or reloaded.

Note You should not save the running configuration of a router when it is configured for a graceful shutdown because the router will continue to advertise a maximum metric after it is reloaded.

Verifying the Advertisement of a Maximum Metric

To verify that the advertisement of a maximum metric has been configured correctly, use the **show ip ospf** or **show ip ospf database** command.

The output of the **show ip ospf** command will display the condition, state, and remaining time delay of the advertisement of a maximum metric, depending on which options were configured with the **max-metric router-lsa** command.

The following sample output is similar to the output that will be displayed when the **on-startup** keyword and *announce-time* argument are configured with the **max-metric router-lsa** command:

```
Router# show ip ospf

Routing Process "ospf 1998" with ID 10.18.134.155
     Supports only single TOS(TOS0) routes
     Supports opaque LSA
     It is an area border and autonomous system boundary router
     Redistributing External Routes from,
        static, includes subnets in redistribution
     Originating router-LSAs with maximum metric, Time remaining: 00:01:18
        Condition: on startup for 300 seconds, State: active
     SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
     Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
     Number of external LSA 7. Checksum Sum 0x47261
     Number of opaque AS LSA 0. Checksum Sum 0x0
     Number of DCbitless external and opaque AS LSA 0
     Number of DoNotAge external and opaque AS LSA 0
     Number of areas in this router is 2. 1 normal 0 stub 1 nssa
     External flood list length 0
        Area BACKBONE(0)
           Number of interfaces in this area is 1
           Area has no authentication
           SPF algorithm executed 3 times
           Area ranges are
           Number of LSA 8. Checksum Sum 0x474AE
           Number of opaque link LSA 0. Checksum Sum 0x0
```

The following sample output is similar to the output that will be displayed when the **on-startup** and **wait-for-bgp** keywords are configured with the **max-metric router-lsa** command:

```
Router# show ip ospf

Routing Process "ospf 1998" with ID 10.18.134.155
     Supports only single TOS(TOS0) routes
     Supports opaque LSA
     It is an area border and autonomous system boundary router
     Redistributing External Routes from,
        static, includes subnets in redistribution
     Originating router-LSAs with maximum metric, Time remaining: 00:01:18
        Condition: on startup while BGP is converging, State: active
     SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
     Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
     Number of external LSA 7. Checksum Sum 0x47261
     Number of opaque AS LSA 0. Checksum Sum 0x0
     Number of DCbitless external and opaque AS LSA 0
     Number of DoNotAge external and opaque AS LSA 0
     Number of areas in this router is 2. 1 normal 0 stub 1 nssa
     External flood list length 0
        Area BACKBONE(0)
           Number of interfaces in this area is 1
           Area has no authentication
           SPF algorithm executed 3 times
           Area ranges are
           Number of LSA 8. Checksum Sum 0x474AE
           Number of opaque link LSA 0. Checksum Sum 0x0
```

The following sample output is similar to the output that will be displayed when the **max-metric router-lsa** command is configured without any keywords or arguments:

```
Router# show ip ospf

Routing Process "ospf 1998" with ID 10.18.134.155
     Supports only single TOS(TOS0) routes
     Supports opaque LSA
     It is an area border and autonomous system boundary router
     Redistributing External Routes from,
        static, includes subnets in redistribution
     Originating router-LSAs with maximum metric
        Condition: always, State: active
     SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
     Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
     Number of external LSA 7. Checksum Sum 0x47261
     Number of opaque AS LSA 0. Checksum Sum 0x0
     Number of DCbitless external and opaque AS LSA 0
     Number of DoNotAge external and opaque AS LSA 0
     Number of areas in this router is 2. 1 normal 0 stub 1 nssa
     External flood list length 0
        Area BACKBONE(0)
           Number of interfaces in this area is 1
           Area has no authentication
           SPF algorithm executed 3 times
           Area ranges are
           Number of LSA 8. Checksum Sum 0x474AE
           Number of opaque link LSA 0. Checksum Sum 0x0
```

The output of the **show ip ospf database** command will display information about OSPF LSAs and indicate if the router is announcing maximum cost links. The following sample output is similar to the output that will be displayed when any form of the **max-metric router-lsa** command is configured:

```
Router# show ip ospf database

       Exception Flag: Announcing maximum link costs
       LS age: 68
       Options: (No TOS-capability, DC)
       LS Type: Router Links
       Link State ID: 172.18.134.155
       Advertising Router: 172.18.134.155
       LS Seq Number: 80000002
       Checksum: 0x175D
       Length: 60
       Area Border Router
       AS Boundary Router
       Number of Links: 3

         Link connected to: a Transit Network
         (Link ID) Designated Router address: 192.168.1.11
         (Link Data) Router Interface address: 192.168.1.14
          Number of TOS metrics: 0
            TOS 0 Metrics: 65535 (metric used for local calculation: 10)

         Link connected to: a Transit Network
         (Link ID) Designated Router address: 10.1.145.11
         (Link Data) Router Interface address: 10.1.145.14
          Number of TOS metrics: 0
            TOS 0 Metrics: 65535 (metric used for local calculation: 10)

         Link connected to: a Stub Network
         (Link ID) Network/subnet number: 10.11.12.0
         (Link Data) Network Mask: 255.255.255.0
          Number of TOS metrics: 0
            TOS 0 Metrics: 1
```

Monitoring and Maintaining OSPF Stub Router Advertisement

To monitor and maintain the advertisement of a maximum metric, use the following EXEC commands:

Command	Purpose
`Router# show ip ospf`	Displays general information about OSPF routing processes and provides information about the configuration settings and status of the OSPF Stub Router Advertisement feature.
`Router# show ip ospf database router`	Displays information about router LSAs, and indicates if a router is announcing maximum link costs.

Configuration Examples

This section provides the following configuration examples:

- Advertisement on Startup Example
- Advertisement Until Routing Tables Converge Example
- Graceful Shutdown Example

Advertisement on Startup Example

In the following example, a router that is running OSPF is configured to advertise a maximum metric at startup for 300 seconds:

```
Router(config)# router ospf 100
 Router(config-router)# max-metric router-lsa on-startup 300
```

Advertisement Until Routing Tables Converge Example

In the following example, a router that is running OSPF is configured to advertise a maximum metric until BGP routing tables converge or until the default timer expires (600 seconds):

```
Router(config)# router ospf 100
 Router(config-router)# max-metric router-lsa on-startup wait-for-bgp
```

Graceful Shutdown Example

In the following example, a router that is running OSPF is configured to advertise a maximum metric until the router is shut down:

```
Router(config)# router ospf 100
 Router(config-router)# max-metric router-lsa
 Router(config-router)# exit
 Router(config)# exit
 Router# show ip ospf
```

Command Reference

This section documents new and modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.2 command reference publications.

New Command

- **max-metric router-lsa**

Modified Command

- **show ip ospf**

max-metric router-lsa

To configure a router that is running the Open Shortest Path First (OSPF) protocol to advertise a maximum metric so that other routers do not prefer the router as an intermediate hop in their shortest path first (SPF) calculations, use the **max-metric router-lsa** command in router configuration mode. To disable the advertisement of a maximum metric, use the **no** form of this command.

max-metric router-lsa [**on-startup** {*announce-time* | **wait-for-bgp**}]

no max-metric router-lsa [**on-startup** {*announce-time* | **wait-for-bgp**}]

Syntax Description

on-startup (optional)	Configures the router to advertise a maximum metric at startup.
announce-time (optional)	Advertises a maximum metric for the specified time interval. The configurable range is from 5 to 86,400 seconds. There is no default timer value for this configuration option.
wait-for-bgp (optional)	Advertises a maximum metric until Border Gateway Protocol (BGP) routing tables have converged or the default timer has expired. The default timer is 600 seconds.

Defaults

Router link-state advertisements (LSAs) are originated with normal link metrics.

Command Modes

Router configuration

Command History

Release	Modification
12.0(15)S	This command was introduced.
12.0(16)ST	This command was integrated into Cisco IOS Release 12.0(16)ST.
12.2(4)T	This command was integrated into Cisco IOS Release 12.2(4)T.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.

Usage Guidelines

Enabling the **max-metric router-lsa** command will cause a router to originate LSAs with a maximum metric (LSInfinity: 0xFFFF) through all nonstub links, which allows BGP routing tables to converge without attracting transit traffic (if there are not alternate lower cost paths around the router). The router will advertise accurate (normal) metrics after the configured or default timers expire or after BGP sends a notification that routing tables have converged.

Note Directly connected links in a stub network are not affected by the configuration of a maximum or infinite metric because the cost of a stub link is always set to the output interface cost.

The **max-metric router-lsa** command is useful in the following situations:

- Reloading a router. After a router is reloaded, Interior Gateway Protocols (IGPs) converge very quickly, and other routers may try to forward traffic through the newly reloaded router. If the router is still building BGP routing tables, packets destined for other networks that the router has not learned through BGP may be dropped. In the case of an Internet backbone router, a large number of packets may be dropped.
- Introducing a router into a network without routing traffic through it. You may want to connect a router to an OSPF network but not want real traffic flowing through the router if there are better alternate paths. If there are no alternate paths, then this router would still accept transit traffic as before.
- Gracefully removing a router from a network. This feature allows you to gracefully remove a router from the network by advertising a maximum metric through all links, which allows other routers to select alternate paths for transit traffic to follow before the router is shut down.

Note You should not save the running configuration of a router when it is configured for a graceful shutdown because the router will continue to advertise a maximum metric after it is reloaded.

Note In older OSPF implementations (RFC 1247 and earlier implementations), the router link costs in received LSAs with a metric of LSInfinity are not used during SPF calculations, which means that no transit traffic will be sent to the routers originating these LSAs.

Examples

The following example configures a router that is running OSPF to advertise a maximum metric for 100 seconds:

```
Router(config)# router ospf 100
 Router(config-router)# max-metric router-lsa on-startup 100
```

The following example configures a router to advertise a maximum metric until BGP routing tables converge or until the default timer expires (600 seconds):

```
Router(config)# router ospf 100
 Router(config-router)# max-metric router-lsa on-startup wait-for-bgp
```

The following example configures a router that is running OSPF to advertise a maximum metric until the router shuts down:

```
Router(config)# router ospf 100
 Router(config-router)# max-metric router-lsa
 Router(config-router)# exit
 Router(config)# exit
 Router# show ip ospf
```

Related Commands

Command	Description
show ip ospf	Displays general information about OSPF routing processes.
show ip ospf database	Displays lists of information related to the OSPF database for a specific router.

show ip ospf

To display general information about Open Shortest Path First (OSPF) routing processes, use the **show ip ospf** command in EXEC mode.

show ip ospf [*process-id*]

Syntax Description

process-id	(Optional) OSPF routing process ID. If this argument is included, only information for the specified routing process is included.

Command Modes

EXEC

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following is sample output from the **show ip ospf** command when entered without a specific OSPF process ID:

```
Router# show ip ospf

Routing Process "ospf 200" with ID 10.18.134.155
     Supports only single TOS(TOS0) routes
     Supports opaque LSA
     It is an area border and autonomous system boundary router
     Redistributing External Routes from,
        static, includes subnets in redistribution
      Originating router-LSAs with maximum metric, Time remaining: 00:01:18
        Condition: on startup for 300 seconds, State: active
     SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
     Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
     Number of external LSA 7. Checksum Sum 0x47261
     Number of opaque AS LSA 0. Checksum Sum 0x0
     Number of DCbitless external and opaque AS LSA 0
     Number of DoNotAge external and opaque AS LSA 0
     Number of areas in this router is 2. 1 normal 0 stub 1 nssa
     External flood list length 0
        Area BACKBONE(0)
           Number of interfaces in this area is 1
           Area has no authentication
           SPF algorithm executed 3 times
           Area ranges are
           Number of LSA 8. Checksum Sum 0x474AE

           Number of opaque link LSA 0. Checksum Sum 0x0
```

Table 1 describes the significant fields shown in the display.

Table 1 show ip ospf Field Descriptions

Field	Description
Routing process "ospf 200" with ID 10.18.134.155	Process ID and OSPF router ID.
Supports ...	Number of types of service supported (Type 0 only).
It is ...	Possible types are internal, area border, or autonomous system boundary.
Originating router LSAs ...	Specifies the configured type of unreachable metric that is advertised. Possible types are: • with maximum metric (Condition: always, State: active) • with maximum metric, Time remaining *hh:mm:ss* (Condition: on startup for *number* seconds, State: active) • with maximum metric, Time remaining *hh:mm:ss* (Condition: on startup while BGP is converging, State: active)
Summary Link update interval	Specifies summary update interval in hh:mm:ss, and time until next update.
External Link update interval	Specifies external update interval in hh:mm:ss, and time until next update.
Redistributing External Routes from	Lists of redistributed routes, by protocol.
Number of areas	Number of areas in router, area addresses, and so on.
Link State Update Interval	Specifies router and network link-state update interval in hh:mm:ss, and time until next update.
Link State Age Interval	Specifies max-aged update deletion interval, and time until next database cleanup, in hh:mm:ss.