



OSPF Stub Router Advertisement

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.

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Information About OSPF Stub Router Advertisement

OSPF Stub Router Advertisement Functionality

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.

Maximum Metric Allows 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.

Maximum Metric Allows Graceful Shutdown of a Router

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 of OSPF Stub Router Advertisement

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.

How to Configure OSPF Stub Router Advertisement

The following tasks 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

SUMMARY STEPS

1. Router(config)# **router ospf process-id**
2. Router(config-router)# **max-metric router-lsa on-startup announce-time**

DETAILED STEPS

Procedure		
	Command or Action	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 <i>announce-time</i> 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

SUMMARY STEPS

1. Router(config)# **router ospf process-id**
2. Router(config-router)# **max-metric router-lsa on-startup wait-for-bgp**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	Router(config)# router ospf <i>process-id</i>	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

SUMMARY STEPS

1. Router(config)# **router ospf***process-id*
2. Router(config-router)# **max-metric router-lsa**
3. Router(config-router)# **end**
4. Router# **show ip ospf**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	Router(config)# router ospf <i>process-id</i>	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)# end	Ends configuration mode and places the router in privileged EXEC mode.
Step 4	Router# show ip ospf	Displays general information about OSPF routing processes. • Use the show ip ospf command to verify that the max-metric router-lsa command has been enabled before the router is shut down or reloaded.

What to do next

Note Do 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

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 of OSPF Stub Router Advertisement

Example Advertisement on Startup

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
```

Example Advertisement Until Routing Tables Converge

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
```

Example Graceful Shutdown

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)# end
Router# show ip ospf

```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
OSPF commands: complete command syntax, command mode, defaults, command history, usage guidelines, and examples	<i>Cisco IOS IP Routing: OSPF Command Reference</i>
Configuring OSPF	“Configuring OSPF” in the <i>IP Routing: OSPF Configuration Guide</i> .
OSPFv2 loop-free alternate fast reroute	“OSPFv2 Loop-Free Alternate Fast Reroute” in the <i>IP Routing: OSPF Configuration Guide</i>

Standards and RFCs

Standard/RFC	Title
RFC 5286	<i>Basic Specification for IP Fast Reroute: Loop-Free Alternates</i>

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 OSPF Stub Router Advertisement

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 OSPF Stub Router Advertisement

Feature Name	Releases	Feature Information
OSPF Stub Router Advertisement	Cisco IOS XE Release 2.1	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. The following commands are introduced or modified in the feature documented in this module: • max-metric router-lsa • show ip ospf

Table 2: Feature Information for OSPF Stub Router Advertisement

Feature Name	Releases	Feature Information
OSPF Stub Router Advertisement	Cisco IOS XE Release 17.4	This feature was introduced.

