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.

- Finding Feature Information, on page 1
- Information About OSPF Stub Router Advertisement, on page 1
- How to Configure OSPF Stub Router Advertisement, on page 3
- Configuration Examples of OSPF Stub Router Advertisement, on page 7
- Additional References, on page 8
- Feature Information for OSPF Stub Router Advertisement, on page 9

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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.

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.

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.
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**

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

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Router(config)# router ospf process-id</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Router(config-router)# max-metric router-lsa on-startup wait-for-bgp</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Router(config)# router ospf process-id</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Router(config-router)# max-metric router-lsa</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Router(config-router)# end</td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Router# show ip ospf</td>
</tr>
</tbody>
</table>

Used 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

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` 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` 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 DO Bladeless 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
```
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 SPF's 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
Monitoring and Maintaining OSPF Stub Router Advertisement

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Router# <code>show ip ospf</code></td>
<td>Displays general information about OSPF routing processes and provides information about the configuration settings and status of the OSPF Stub Router Advertisement feature.</td>
</tr>
<tr>
<td>Router# <code>show ip ospf database router</code></td>
<td>Displays information about router LSAs, and indicates if a router is announcing maximum link costs.</td>
</tr>
</tbody>
</table>

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

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

Standards and RFCs

<table>
<thead>
<tr>
<th>Standard/RFC</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFC 5286</td>
<td>Basic Specification for IP Fast Reroute: Loop-Free Alternates</td>
</tr>
</tbody>
</table>

Technical Assistance

<table>
<thead>
<tr>
<th>Description</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td><a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a></td>
</tr>
</tbody>
</table>
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

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