OSPF Shortest Path First Throttling

The OSPF Shortest Path First Throttling feature makes it possible to configure shortest path first (SPF) scheduling in millisecond intervals and to potentially delay SPF calculations during network instability. SPF is scheduled to calculate the Shortest Path Tree (SPT) when there is a change in topology. One SPF run may include multiple topology change events.

The interval at which the SPF calculations occur is chosen dynamically and is based on the frequency of topology changes in the network. The chosen interval is within the boundary of the user-specified value ranges. If the network topology is unstable, SPF throttling calculates SPF scheduling intervals to be longer until the topology becomes stable.

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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 SPF Throttling

SPF calculations occur at the interval set by the timers throttle spf command. The wait interval indicates the amount of time to wait until the next SPF calculation occurs. Each wait interval after that calculation is twice as long as the previous one until the wait interval reaches the maximum wait time specified.

The SPF timing can be better explained using an example. In this example the start interval is set at 5 milliseconds (ms), the wait interval at 1000 milliseconds, and the maximum wait time is set at 90,000 milliseconds.
timers throttle spf 5 1000 90000

The figure below shows the intervals at which the SPF calculations occur so long as at least one topology change event is received in a given wait interval.

*Figure 1: SPF Calculation Intervals Set by the timers throttle spf Command*

Notice that the wait interval between SPF calculations doubles when at least one topology change event is received during the previous wait interval. Once the maximum wait time is reached, the wait interval remains the same until the topology stabilizes and no event is received in that interval.

If the first topology change event is received after the current wait interval, the SPF calculation is delayed by the amount of time specified as the start interval. The subsequent wait intervals continue to follow the dynamic pattern.

If the first topology change event occurs after the maximum wait interval begins, the SPF calculation is again scheduled at the start interval and subsequent wait intervals are reset according the parameters specified in the `timers throttle spf` command. Notice in the figure below that a topology change event was received after the start of the maximum wait time interval and that the SPF intervals have been reset.

*Figure 2: Timer Intervals Reset After a Topology Change Event*

How to Configure OSPF SPF Throttling

Configuring OSPF SPF Throttling

**SUMMARY STEPS**

1. enable
2. configure terminal
3. router ospf  process-id
4. timers throttle spf  spf-start spf-hold spf-max-wait
5. end
**DETAILED STEPS**

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<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
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| 1    | enable            | Enables higher privilege levels, such as privileged EXEC mode.  
  **Example:**  
  Router> enable  
  - Enter your password if prompted. |
| 2    | configure terminal| Enters global configuration mode.  
  **Example:**  
  Router# configure terminal |
| 3    | router ospf process-id | Configures an OSPF routing process.  
  **Example:**  
  Router(config)# router ospf 1 |
| 4    | timers throttle spf spf-start spf-hold spf-max-wait | Sets OSPF throttling timers.  
  **Example:**  
  Router(config-router)# timers throttle spf 10 4800 90000 |
| 5    | end               | Exits configuration mode.  
  **Example:**  
  Router(config-router)# end |

**Verifying SPF Throttle Values**

To verify SPF throttle timer values, use the `show ip ospf` command. The values are displayed in the lines that begin, "Initial SPF schedule delay..." "Minimum hold time between two consecutive SPF's...," and "Maximum wait time between two consecutive SPF's..."

**Example:**

```plaintext
Router# show ip ospf  
Routing Process "ospf 1" with ID 10.10.10.2 and Domain ID 0.0.0.1  
Supports only single TOS(TOS0) routes  
Supports opaque LSA  
It is an autonomous system boundary router  
Redistributing External Routes from,  
  static, includes subnets in redistribution  
Initial SPF schedule delay 5 msecs  
Minimum hold time between two consecutive SPF's 1000 msecs  
Maximum wait time between two consecutive SPF's 90000 msecs  
Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs  
LSA group pacing timer 240 secs  
Interface flood pacing timer 33 msecs  
Retransmission pacing timer 66 msecs  
Number of external LSA 4. Checksum Sum 0x17445  
Number of opaque AS LSA 0. Checksum Sum 0x0  
Number of DCbitless external and opaque AS LSA 0
```
Configuration Example for OSPF SPF Throttling

Example Throttle Timers

This example shows a router configured with the start, hold, and maximum interval values for the timers throttle spf command set at 5, 1,000, and 90,000 milliseconds, respectively.

```plaintext
router ospf 1
  router-id 10.10.10.2
  log-adjacency-changes
timers throttle spf 5 1000 90000
redistribute static subnets
  network 21.21.21.0 0.0.0.255 area 0
  network 22.22.22.0 0.0.0.255 area 00
```

Additional References

The following sections provide references related to OSPF Shortest Path First Throttling.

### Related Documents

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<thead>
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<th>Related Topic</th>
<th>Document Title</th>
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<tbody>
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<td>Configuring OSPF</td>
<td>&quot;Configuring OSPF&quot;</td>
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<tr>
<td>OSPF commands</td>
<td>Cisco IOS IP Routing: OSPF Command Reference</td>
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<td>Cisco IOS master command list, all releases</td>
<td>Cisco IOS Master Command List, All Releases</td>
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### Standards

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MIBs

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<th>MIBs Link</th>
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<td>No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.</td>
<td>To locate and download MIBs for selected platforms, Cisco IOS XE releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a></td>
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RFCs

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Technical Assistance

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<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>
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Feature Information for OSPF Shortest Path First Throttling

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.
The OSPF Shortest Path First Throttling feature makes it possible to configure SPF scheduling in millisecond intervals and to potentially delay shortest path first (SPF) calculations during network instability. SPF is scheduled to calculate the Shortest Path Tree (SPT) when there is a change in topology.

The following commands are introduced or modified in the feature documented in this module:

- `timer spf-interval`
- `timers throttle spf`

<table>
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<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
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| OSPF Shortest Path First Throttling  | Cisco IOS XE Release 2.1 | The OSPF Shortest Path First Throttling feature makes it possible to configure SPF scheduling in millisecond intervals and to potentially delay shortest path first (SPF) calculations during network instability. SPF is scheduled to calculate the Shortest Path Tree (SPT) when there is a change in topology. The following commands are introduced or modified in the feature documented in this module:  
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