



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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Information About OSPF SPF Throttling

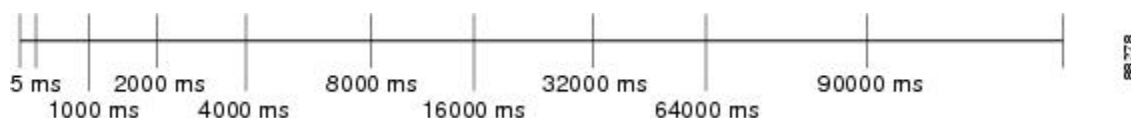
SPF calculations occur at the interval set by the **timers throttle spf** command. The wait interval indicates the amount of time to wait until the next SPF calculation occurs. Each wait interval after that calculation is twice as long as the previous one until the wait interval reaches the maximum wait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

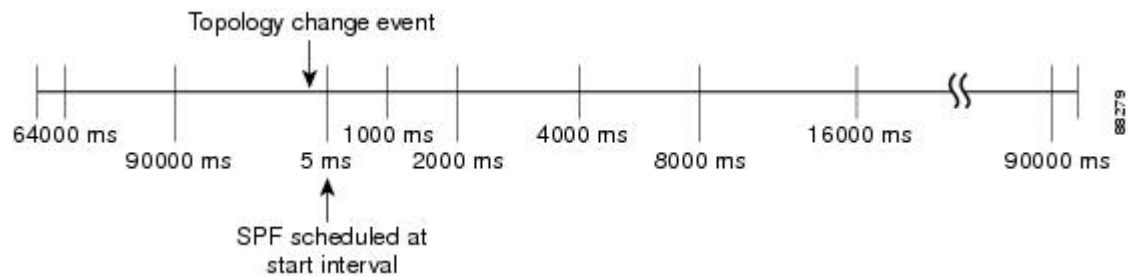


Notice that the wait interval between SPF calculations doubles when at least one topology change event is received during the previous wait interval. Once the maximum wait time is reached, the wait interval remains the same until the topology stabilizes and no event is received in that interval.

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

Procedure

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables higher privilege levels, such as privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	configure terminal Example: <pre>Router# configure terminal</pre>	Enters global configuration mode.
Step 3	router ospf process-id Example: <pre>Router(config)# router ospf 1</pre>	Configures an OSPF routing process.
Step 4	timers throttle spf spf-start spf-hold spf-max-wait Example: <pre>Router(config-router)# timers throttle spf 10 4800 90000</pre>	Sets OSPF throttling timers.
Step 5	end Example: <pre>Router(config-router)# end</pre>	Exits configuration mode.

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...", and "Maximum wait time between two consecutive SPF..."

```
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 SPFs 1000 msecs
Maximum wait time between two consecutive SPFs 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
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
External flood list length 0
Area BACKBONE(0)
    Number of interfaces in this area is 2
    Area has no authentication
    SPF algorithm last executed 19:11:15.140 ago
    SPF algorithm executed 28 times
```

```
Area ranges are
Number of LSA 4. Checksum Sum 0x2C1D4
Number of opaque link LSA 0. Checksum Sum 0x0
Number of DCbitless LSA 0
Number of indication LSA 0
Number of DoNotAge LSA 0
Flood list length 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.

```
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

Related Topic	Document Title
Configuring OSPF	"Configuring OSPF"
OSPF commands	<i>Cisco IOS IP Routing: OSPF Command Reference</i>
Cisco IOS master command list, all releases	Cisco IOS Master Command List, All Releases

Standards

Standards	Title
None	--

MIBs

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

RFCs

RFCs	Title
None	--

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 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.

Table 1: Feature Information for OSPF Shortest Path First Throttling

Feature Name	Releases	Feature Information
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: • timer spf-interval • timers throttle spf

Table 2: Feature Information for OSPF Shortest Path First Throttling

Feature Name	Releases	Feature Information
OSPF Shortest Path First Throttling	Cisco IOS XE Release 17.4	This feature was introduced.