OSPF Update Packet-Pacing Configurable Timers

Feature History

Release	Modification
12.2(4)T	This feature was introduced.
12.2(4)T3	Support for the Cisco 7500 series was added in Cisco IOS Release 12.2(4)T3.
12.2(8)T	Support for the Cisco 1710, 3631, 3725, 3745, and URM was added in Cisco IOS Release 12.2(8)T.
12.2(8)T1	Support for the Cisco 2691 was added in Cisco IOS Release 12.2(8)T1.
12.2(14)S	This feature was integrated into Cisco IOS Release 12.2(14)S.

This feature module describes the OSPF Update Packet-Pacing Configurable Timers feature. It includes the following sections:

Feature Overview

In rare situations, you might need to change Open Shortest Path First (OSPF) packet-pacing default timers to mitigate CPU or buffer utilization issues associated with flooding very large numbers of link-state advertisements (LSAs). The OSPF Update Packet-Pacing Configurable Timers feature allows you to configure the rate at which OSPF LSA flood pacing, retransmission pacing, and group pacing updates occur.

Configuring OSPF flood pacing timers allows you to control interpacket spacing between consecutive link-state update packets in the OSPF transmission queue. Configuring OSPF retransmission pacing timers allows you to control interpacket spacing between consecutive link-state update packets in the OSPF retransmission queue. Cisco IOS software groups the periodic refresh of LSAs to improve the LSA packing density for the refreshes in large topologies. The group timer controls the interval used for group LSA refreshment; however, this timer does not change the frequency that individual LSAs are refreshed (the default refresh occurs every 30 minutes).

Note The default settings for OSPF packet pacing timers are suitable for the majority of OSPF deployments. You should change the default timers only as a last resort.

Benefits

The OSPF Update Packet-Pacing Configurable Timers feature provides the administrator with a mechanism to control the rate at which LSA updates occur in order to reduce high CPU or buffer utilization that can occur when an area is flooded with a very large number of LSAs.

Restrictions

Do not change the packet pacing timers unless all other options to meet OSPF packet flooding requirements have been exhausted. Specifically, network operators should prefer summarization, stub area usage, queue tuning, and buffer tuning before changing the default timers. Furthermore, there are no guidelines for changing timer values; each OSPF deployment is unique and should be considered on a case-by-case basis. The network operator assumes risks associated with changing the default timer values.

Related Features and Technologies

The OSPF Update Packet-Pacing Configurable Timers feature is an extension of the OSPF routing protocol. For more information about configuring OSPF, packet pacing, area border router (ABR) and autonomous system boundary router (ASBR) summarization, and stub router configuration, 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 Update Packet-Pacing Configurable Timers 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

No new or modified RFCs are supported by this feature.

Configuration Tasks

See the following sections for configuration tasks for the OSPF Update Packet-Pacing Configurable Timers feature. Each task in the list is identified as either required or optional:

- Configuring OSPF Packet-Pacing Timers (required)
- Verifying OSPF Packet-Pacing Timers (optional)

Configuring OSPF Packet-Pacing Timers

To configure a flood packet pacing timer, use the following commands beginning in router 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)# timers pacing flood milliseconds`	Configures a flood packet pacing timer delay (in milliseconds).

To configure a retransmission packet pacing timer, use the following commands beginning in router 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)# timers pacing retransmission milliseconds`	Configures a retransmission packet pacing timer delay (in milliseconds).

To configure a group packet pacing timer, use the following commands beginning in router 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)# timers pacing lsa-group seconds`	Configures an LSA group packet pacing timer delay (in seconds).

Verifying OSPF Packet-Pacing Timers

To verify that OSPF packet pacing has been configured, use the **show ip ospf** privileged EXEC command. The output of the **show ip ospf** command will display the type and delay time of the configurable pacing timers (flood, retransmission, group). The following example output is from the **show ip ospf** command:

```
Router# show ip ospf

  Routing Process "ospf 1" with ID 10.0.0.1 and Domain ID 10.20.0.1
  Supports only single TOS(TOS0) routes
  Supports opaque LSA
  SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
  Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
  LSA group pacing timer 100 secs
  Interface flood pacing timer 55 msecs
  Retransmission pacing timer 100 msecs
  Number of external LSA 0. Checksum Sum 0x0
  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. 2 normal 0 stub 0 nssa
  External flood list length 0
     Area BACKBONE(0)
         Number of interfaces in this area is 2
         Area has message digest authentication
         SPF algorithm executed 4 times
         Area ranges are
         Number of LSA 4. Checksum Sum 0x29BEB
         Number of opaque link LSA 0. Checksum Sum 0x0
         Number of DCbitless LSA 3
         Number of indication LSA 0
         Number of DoNotAge LSA 0
         Flood list length 0
     Area 172.16.26.0
         Number of interfaces in this area is 0
         Area has no authentication
         SPF algorithm executed 1 times
         Area ranges are
            192.168.0.0/16 Passive Advertise
         Number of LSA 1. Checksum Sum 0x44FD
         Number of opaque link LSA 0. Checksum Sum 0x0
         Number of DCbitless LSA 1
         Number of indication LSA 1
         Number of DoNotAge LSA 0
         Flood list length 0
```

Troubleshooting Tips

If the number of OSPF packet retransmissions rapidly increases, increase the value of the packet pacing timers. The number of OSPF packet retransmissions is displayed in the output of the **show ip ospf neighbor** command.

Monitoring and Maintaining OSPF Packet-Pacing Timers

To monitor and maintain OSPF packet-pacing timers, use the following commands in privileged EXEC mode:

Command	Purpose
`Router# show ip ospf`	Displays general information about OSPF routing processes.
`router# show ip ospf neighbor`	Displays OSPF neighbor information on a per-interface basis.
`Router# clear ip ospf redistribution`	Clears route redistribution based on the OSPF routing process ID.

Configuration Examples

This section provides the following configuration examples:

- Flood Pacing Example
- Retransmission Pacing Example
- Group Pacing Example

Flood Pacing Example

The following example configures LSA flood pacing updates to occur in 50-millisecond intervals for OSPF routing process 1:

```
Router(config)# router ospf 1
Router(config-router)# timers pacing flood 50
```

Retransmission Pacing Example

The following example configures LSA flood pacing updates to occur in 100-millisecond intervals for OSPF routing process 1:

```
Router(config)# router ospf 1
Router(config-router)# timers pacing retransmission 100
```

Group Pacing Example

The following example configures OSPF group pacing updates between LSA groups to occur in 75-second intervals for OSPF routing process 1:

```
Router(config)# router ospf 1
Router(config-router)# timers pacing lsa-group 75
```

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 Commands

- **timers pacing flood**
- **timers pacing lsa-group**
- **timers pacing retransmission**

Modified Commands

- **show ip ospf**

timers pacing flood

To configure link-state advertisement (LSA) flood packet pacing, use the **timers pacing flood** command in router configuration mode. To restore the default flood packet pacing value, use the **no** form of this command.

timers pacing flood *milliseconds*

no timers pacing flood

Syntax Description

milliseconds	Time (in milliseconds) at which LSAs in the flooding queue are paced in between updates. The configurable range is from 5 milliseconds to 100 milliseconds. The default value is 33 milliseconds.

Defaults

33 milliseconds

Command Modes

Router configuration

Command History

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

Usage Guidelines

Configuring Open Shortest Path First (OSPF) flood pacing timers allows you to control interpacket spacing between consecutive link-state update packets in the OSPF transmission queue. This command allows you to control the rate at which LSA updates occur so that high CPU or buffer utilization that can occur when an area is flooded with a very large number of LSAs can be reduced.

The default settings for OSPF packet pacing timers are suitable for the majority of OSPF deployments. Do not change the packet pacing timers unless all other options to meet OSPF packet flooding requirements have been exhausted. Specifically, network operators should prefer summarization, stub area usage, queue tuning, and buffer tuning before changing the default flood timers. Furthermore, there are no guidelines for changing timer values; each OSPF deployment is unique and should be considered on a case-by-case basis. The network operator assumes risks associated with changing the default flood timer values.

Examples

The following example configures LSA flood packet-pacing updates to occur in 55-millisecond intervals for OSPF routing process 1:

```
Router(config)# router ospf 1
Router(config-router)# timers pacing flood 55
```

Related Commands

Command	Description
show ip ospf	Displays general information about OSPF routing processes.
timers pacing retransmission	Configures LSA retransmission packet pacing.
timers pacing lsa-group	Changes the interval at which OSPF LSAs are collected into a group and refreshed, checksummed, or aged.

timers pacing lsa-group

To change the interval at which Open Shortest Path First (OSPF) link-state advertisements (LSAs) are collected into a group and refreshed, checksummed, or aged, use the **timers pacing lsa-group** command in router configuration mode. To restore the default value, use the **no** form of this command.

timers pacing lsa-group *seconds*

no timers pacing lsa-group

Syntax Description

seconds	Number of seconds in the interval at which LSAs are grouped and refreshed, checksummed, or aged. The range is from 10 to 1800 seconds. The default value is 240 seconds.

Defaults

The default interval for this command is 240 seconds. OSPF LSA group pacing is enabled by default.

Command Modes

Router configuration

Command History

Release	Modification
11.3 AA	This command was introduced.
12.2(4)T	The syntax of this command was changed from **timers lsa-group-pacing** to **timers pacing lsa-group** in 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

This command allows you to control the rate at which LSA updates occur so that high CPU or buffer utilization that can occur when an area is flooded with a very large number of LSAs can be reduced. The default settings for OSPF packet pacing timers are suitable for the majority of OSPF deployments. Do not change the packet pacing timers unless all other options to meet OSPF packet flooding requirements have been exhausted. Specifically, network operators should prefer summarization, stub area usage, queue tuning, and buffer tuning before changing the default flooding timers. Furthermore, there are no guidelines for changing timer values; each OSPF deployment is unique and should be considered on a case-by-case basis. The network operator assumes the risks associated with changing the default timer values.

Cisco IOS software groups the periodic refresh of LSAs to improve the LSA packing density for the refreshes in large topologies. The group timer controls the interval used for group refreshment of LSAs; however, this timer does not change the frequency that individual LSAs are refreshed (the default refresh rate is every 30 minutes).

The duration of the LSA group pacing is inversely proportional to the number of LSAs the router is handling. For example, if you have about 10,000 LSAs, decreasing the pacing interval would benefit you. If you have a very small database (40 to 100 LSAs), increasing the pacing interval to 10 to 20 minutes might benefit you slightly.

Examples

The following example configures OSPF group packet-pacing updates between LSA groups to occur in 60-second intervals for OSPF routing process 1:

```
Router(config)# router ospf 1
Router(config-router)# timers pacing lsa-group 60
```

Related Commands

Command	Description
show ip ospf	Displays general information about OSPF routing processes.
timers pacing flood	Configures LSA flood packet pacing.
timers pacing retransmission	Configures LSA retransmission packet pacing.

timers pacing retransmission

To configure link-state advertisement (LSA) retransmission packet pacing, use the **timers pacing retransmission** command in router configuration mode. To restore the default retransmission packet pacing value, use the **no** form of this command.

timers pacing retransmission *milliseconds*

no timers pacing retransmission

Syntax Description

milliseconds	The time (in milliseconds) at which LSAs in the retransmission queue are paced. The configurable range is from 5 milliseconds to 200 milliseconds. The default value is 66 milliseconds.

Defaults

66 milliseconds

Command Modes

Router configuration

Command History

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

Usage Guidelines

Configuring OSPF retransmission pacing timers allow you to control interpacket spacing between consecutive link-state update packets in the OSPF retransmission queue. This command allows you to control the rate at which LSA updates occur so that high CPU or buffer utilization that can occur when an area is flooded with a very large number of LSAs can be reduced. The default settings for OSPF packet retransmission pacing timers are suitable for the majority of OSPF deployments. Do not change the packet retransmission pacing timers unless all other options to meet OSPF packet flooding requirements have been exhausted. Specifically, network operators should prefer summarization, stub area usage, queue tuning, and buffer tuning before changing the default flooding timers. Furthermore, there are no guidelines for changing timer values; each OSPF deployment is unique and should be considered on a case-by-case basis. The network operator assumes risks associated with changing the default packet retransmission pacing timer values.

Examples

The following example configures LSA flood pacing updates to occur in 55-millisecond intervals for OSPF routing process 1:

```
Router(config)# router ospf 1
Router(config-router)# timers pacing flood 55
```

Related Commands

Command	Description
show ip ospf	Displays general information about OSPF routing processes.
timers pacing flood	Configures LSA flood packet pacing.
timers pacing lsa-group	Changes the interval at which OSPF LSAs are collected into a group and refreshed, checksummed, or aged.

show ip ospf

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

show ip ospf [*process-id*]

Syntax Description

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

Command Modes

privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.
12.2(4)T	This command was modified to show packet pacing timers in the displayed output.
12.2(14)S	Support for displaying packet pacing timers was integrated into Cisco IOS Release 12.2(14)S.

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 201" with ID 10.0.0.1 and Domain ID 10.20.0.1
  Supports only single TOS(TOS0) routes
  Supports opaque LSA
  SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
  Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
  LSA group pacing timer 100 secs
  Interface flood pacing timer 55 msecs
  Retransmission pacing timer 100 msecs
  Number of external LSA 0. Checksum Sum 0x0
  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. 2 normal 0 stub 0 nssa
  External flood list length 0
     Area BACKBONE(0)
         Number of interfaces in this area is 2
         Area has message digest authentication
         SPF algorithm executed 4 times
         Area ranges are
         Number of LSA 4. Checksum Sum 0x29BEB
         Number of opaque link LSA 0. Checksum Sum 0x0
         Number of DCbitless LSA 3
         Number of indication LSA 0
         Number of DoNotAge LSA 0
         Flood list length 0
     Area 172.16.26.0
         Number of interfaces in this area is 0
```

```
Area has no authentication
SPF algorithm executed 1 times
Area ranges are
   192.168.0.0/16 Passive Advertise
Number of LSA 1. Checksum Sum 0x44FD
Number of opaque link LSA 0. Checksum Sum 0x0
Number of DCbitless LSA 1
Number of indication LSA 1
Number of DoNotAge LSA 0
Flood list length 0
```

Table 1 describes the significant fields shown in the display.

Table 1 show ip ospf Field Descriptions

Field	Description
Routing process “ospf 201” with ID 10.0.0.1	Process ID and OSPF router ID.
Supports ...	Number of types of service supported (Type 0 only).
LSA group pacing timer	Configured LSA group pacing timer (in seconds).
Interface flood pacing timer	Configured LSA flood pacing timer (in milliseconds).
Retransmission pacing timer	Configured LSA retransmission pacing timer (in milliseconds).
It is ...	Possible types are internal, area border, or autonomous system boundary.
Summary Link update interval	Specifies summary update interval (in hours:minutes:seconds), and the time until the next update.
External Link update interval	Specifies external update interval (in hours:minutes:seconds), and the time until the 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 hours:minutes:seconds), and the time until the next update.
Link State Age Interval	Specifies the max-aged update deletion interval, and the time until the next database cleanup (in hours:minutes:seconds).