



# OSPF MIB Support of RFC 1850 and Latest Extensions

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The OSPF MIB Support of RFC 1850 and Latest Extensions feature introduces the capability for Simple Network Management Protocol (SNMP) monitoring on the Open Shortest Path First (OSPF) routing protocol. Users have an improved ability to constantly monitor the changing state of an OSPF network by use of MIB objects to gather information relating to protocol parameters and trap notification objects that can signal the occurrence of significant network events such as transition state changes. The protocol information collected by the OSPF MIB objects and trap objects can be used to derive statistics that will help monitor and improve overall network performance.

- [Finding Feature Information, page 1](#)
- [Prerequisites for OSPF MIB Support of RFC 1850 and Latest Extensions, page 2](#)
- [Restrictions for OSPF MIB Support of RFC 1850 and Latest Extensions, page 2](#)
- [Information About OSPF MIB Support of RFC 1850 and Latest Extensions, page 2](#)
- [How to Enable OSPF MIB Support of RFC 1850 and Latest Extensions, page 7](#)
- [Configuration Examples for OSPF MIB Support of RFC 1850 and Latest Extensions, page 12](#)
- [Where to Go Next, page 12](#)
- [Additional References, page 12](#)
- [Feature Information for OSPF MIB Support of RFC 1850 and Latest Extensions, page 13](#)

## Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see 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 at the end of this document.

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](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

## Prerequisites for OSPF MIB Support of RFC 1850 and Latest Extensions

- OSPF must be configured on the router.
- Simple Network Management Protocol (SNMP) must be enabled on the router before notifications (traps) can be configured or before SNMP GET operations can be performed.

## Restrictions for OSPF MIB Support of RFC 1850 and Latest Extensions

For routers that are running Cisco IOS Release 12.0(26)S, 12.2(25)S, 12.2(27)SBC, 12.2(31)SB2 and later releases, the OSPF MIB and CISCO OSPF MIB will be supported only for the first OSPF process (except for MIB objects that are related to virtual links and sham links, and in cases where support for multiple topologies is provided). SNMP traps will be generated for OSPF events that are related to any of the OSPF processes. There is no workaround for this situation.

## Information About OSPF MIB Support of RFC 1850 and Latest Extensions

The following sections contain information about MIB objects standardized as part of RFC 1850 and defined in OSPF-MIB and OSPF-TRAP-MIB. In addition, extensions to RFC 1850 objects are described as defined in the two Cisco private MIBs, CISCO-OSPF-MIB and CISCO-OSPF-TRAP-MIB.

- [OSPF MIB Changes to Support RFC 1850, page 2](#)
- [Benefits of the OSPF MIB, page 6](#)

## OSPF MIB Changes to Support RFC 1850

- [OSPF MIB, page 2](#)
- [OSPF TRAP MIB, page 3](#)
- [CISCO OSPF MIB, page 4](#)
- [CISCO OSPF TRAP MIB, page 5](#)

### OSPF MIB

This section describes the new MIB objects that are provided by RFC 1850 definitions. These OSPF MIB definitions provide additional capacity that is not provided by the standard OSPF MIB that supported the previous RFC 1253. To see a complete set of OSPF MIB objects, see the OSPF-MIB file.

The table below shows the new OSPF-MIB objects that are provided by RFC 1850 definitions. The objects are listed in the order in which they appear within the OSPF-MIB file, per the tables that describe them.

**Table 1**      **New OSPF-MIB Objects**

<b>OSPF-MIB Table</b>	<b>New MIB Objects</b>
OspfAreaEntry table	<ul style="list-style-type: none"> <li>• OspfAreaSummary</li> <li>• OspfAreaStatus</li> </ul>
OspfStubAreaEntry	<ul style="list-style-type: none"> <li>• OspfStubMetricType</li> </ul>
OspfAreaRangeEntry	<ul style="list-style-type: none"> <li>• OspfAreaRangeEffect</li> </ul>
OspfHostEntry	<ul style="list-style-type: none"> <li>• OspfHostAreaID</li> </ul>
OspfIfEntry	<ul style="list-style-type: none"> <li>• OspfIfStatus</li> <li>• OspfIfMulticastForwarding</li> <li>• OspfIfDemand</li> <li>• OspfIfAuthType</li> </ul>
OspfVirtIfEntry	<ul style="list-style-type: none"> <li>• OspfVirtIfAuthType</li> </ul>
OspfNbrEntry	<ul style="list-style-type: none"> <li>• OspfNbmaNbrPermanence</li> <li>• OspfNbrHelloSuppressed</li> </ul>
OspfVirtNbrEntry	<ul style="list-style-type: none"> <li>• OspfVirtNbrHelloSuppressed</li> </ul>
OspfExtLsdbEntry	<ul style="list-style-type: none"> <li>• OspfExtLsdbType</li> <li>• OspfExtLsdbLsid</li> <li>• OspfExtLsdbRouterId</li> <li>• OspfExtLsdbSequence</li> <li>• OspfExtLsdbAge</li> <li>• OspfExtLsdbChecksum</li> <li>• OspfExtLsdbAdvertisement</li> </ul>
OspfAreaAggregateEntry	<ul style="list-style-type: none"> <li>• OspfAreaAggregateAreaID</li> <li>• OspfAreaAggregateLsdbType</li> <li>• OspfAreaAggregateNet</li> <li>• OspfAreaAggregateMask</li> <li>• OspfAreaAggregateStatusospfSetTrap</li> <li>• OspfAreaAggregateEffect</li> </ul>

## OSPF TRAP MIB

This section describes scalar objects and MIB objects that are provided to support FRC 1850.

The following scalar objects are added to OSPF-TRAP-MIB and are listed in the order in which they appear in the OSPF-TRAP-MIB file:

- OspfExtLsdbLimit

- OspfMulticastExtensions
- OspfExitOverflowInterval
- OspfDemandExtensions

The ospfSetTrap control MIB object contains the OSPF trap MIB objects that enable and disable OSPF traps in the IOS CLI. These OSPF trap MIB objects are provided by the RFC 1850 standard OSPF MIB. To learn how to enable and disable the OSPF traps, see the [How to Enable OSPF MIB Support of RFC 1850 and Latest Extensions](#), page 7.

The table below shows the OSPF trap MIB objects, listed in the order in which they appear within the OSPF-TRAP-MIB file.

**Table 2**      **New OSPF-TRAP-MIB Objects**

OSPF Control MIB Object	Trap MIB Objects
ospfSetTrap	<ul style="list-style-type: none"> <li>• ospfIfStateChange</li> <li>• ospfVirtIfStateChange</li> <li>• ospfNbrStateChange</li> <li>• ospfVirtNbrState</li> <li>• ospfIfConfigError</li> <li>• ospfVirtIfConfigError</li> <li>• ospfIfAuthFailure</li> <li>• ospfVirtIfAuthFailure</li> <li>• ospfIfRxBadPacket</li> <li>• ospfVirtIfRxBadPacket</li> <li>• ospfTxRetransmit</li> <li>• ospfVirtIfTxRetransmit</li> <li>• ospfOriginateLsa</li> <li>• ospfMaxAgeLsa</li> </ul>

## CISCO OSPF MIB

This section describes scalar and Cisco-specific OSPF MIB objects that are provided as extensions to support the RFC 1850 OSPF MIB definitions, to provide capability that the standard MIB cannot provide.

The following scalar objects are added to CISCO-OSPF-MIB:

- cospfRFC1583Compatibility
- cospfOpaqueLsaSupport
- cospfOpaqueASLsaCount
- cospfOpaqueASLsaChecksumSum

For each of the following table entries, the new Cisco-specific MIB objects that are provided as extensions to support the RFC 1850 OSPF MIB definitions are listed. To see the complete set of objects for the Cisco-specific OSPF MIB, refer to the CISCO-OSPF-MIB file.

The table below shows the new CISCO-OSPF-MIB objects that are provided by RFC 1850 definitions. The objects are listed in the order in which they appear within the CISCO-OSPF-MIB file, per the tables that describe them.

**Table 3**      **New CISCO-OSPF-MIB Objects**

<b>CISCO-OSPF-MIB Table</b>	<b>New MIB Objects</b>
cospfAreaEntry	<ul style="list-style-type: none"> <li>• cospfOpaqueAreaLsaCount</li> <li>• cospfOpaqueAreaLsaCksumSum</li> <li>• cospfAreaNssaTranslatorRole</li> <li>• cospfAreaNssaTranslatorState</li> <li>• cospfAreaNssaTranslatorEvents</li> </ul>
cospfLsdbEntry	<ul style="list-style-type: none"> <li>• cospfLsdbType</li> <li>• cospfLsdbSequence</li> <li>• cospfLsdbAge</li> <li>• cospfLsdbChecksum</li> <li>• cospfLsdbAdvertisement</li> </ul>
cospfIfEntry	<ul style="list-style-type: none"> <li>• cospfIfLsaCount</li> <li>• cospfIfLsaCksumSum</li> </ul>
cospfVirtIfEntry	<ul style="list-style-type: none"> <li>• cospfVirtIfLsaCount</li> <li>• cospfVirtIfLsaCksumSum</li> </ul>
cospfLocalLsdbEntry	<ul style="list-style-type: none"> <li>• cospfLocalLsdbIpAddress</li> <li>• cospfLocalLsdbAddressLessIf</li> <li>• cospfLocalLsdbType</li> <li>• cospfLocalLsdbLsid</li> <li>• cospfLocalLsdbRouterId</li> <li>• cospfLocalLsdbSequence</li> <li>• cospfLocalLsdbAge</li> <li>• cospfLocalLsdbChecksum</li> <li>• cospfLocalLsdbAdvertisement</li> </ul>
cospfVirtLocalLsdbEntry	<ul style="list-style-type: none"> <li>• cospfVirtLocalLsdbTransitArea</li> <li>• cospfVirtLocalLsdbNeighbor</li> <li>• cospfVirtLocalLsdbType</li> <li>• cospfVirtLocalLsdbLsid</li> <li>• cospfVirtLocalLsdbRouterId</li> <li>• cospfVirtLocalLsdbSequence</li> <li>• cospfVirtLocalLsdbAge</li> <li>• cospfVirtLocalLsdbChecksum</li> <li>• cospfVirtLocalLsdbAdvertisement</li> </ul>

## CISCO OSPF TRAP MIB

The cospfSetTrapMIB object represents trap events in CISCO-OSPF-TRAP-MIB. This is a bit map, where the first bit represents the first trap. The following MIB objects are TRAP events that have been added to

support RFC 1850. To see a complete set of Cisco OSPF Trap MIB objects, see the CISCO-OSPF-TRAP-MIB file.

The table below shows the trap events described within the cospfSetTrap MIB object in the CISCO-OSPF-TRAP-MIB:

**Table 4** *CISCO-OSPF Trap Events*

<b>CISCO-OSPF-TRAP-MIB Trap Events</b>	<b>Trap Event Description</b>
cospfIfConfigError	This trap is generated for mismatched MTU parameter errors that occur when nonvirtual OSPF neighbors are forming adjacencies.
cospfVirtIfConfigError	This trap is generated for mismatched MTU parameter errors when virtual OSPF neighbors are forming adjacencies.
cospfTxRetransmit	This trap is generated in the case of opaque LSAs when packets are sent by a nonvirtual interface. An opaque link-state advertisement (LSA) is used in MPLS traffic engineering to distribute attributes such as capacity and topology of links in a network. The scope of this LSA can be confined to the local network (Type 9, Link-Local), OSPF area (Type 20, Area-Local), or autonomous system (Type 11, AS scope). The information in an opaque LSA can be used by an external application across the OSPF network.
cospfVirtIfTxRetransmit	This trap is generated in the case of opaque LSAs when packets are sent by a virtual interface.
cospfOriginateLsa	This trap is generated when a new opaque LSA is originated by the router when a topology change has occurred.
cospfMaxAgeLsa	The trap is generated in the case of opaque LSAs.
cospfNssaTranslatorStatusChange	The trap is generated if there is a change in the ability of a router to translate OSPF type-7 LSAs into OSPF type-5 LSAs.

For information about how to enable OSPF MIB traps, see the [How to Enable OSPF MIB Support of RFC 1850 and Latest Extensions](#), page 7.

## Benefits of the OSPF MIB

The OSPF MIBs (OSPF-MIB and OSPF-TRAP-MIB) and Cisco private OSPF MIBs (CISCO-OSPF-MIB and CISCO-OSPF-TRAP-MIB) allow network managers to more effectively monitor the OSPF routing protocol through the addition of new table objects and trap notification objects that previously were not supported by the RFC 1253 OSPF MIB.

New CLI commands have been added to enable SNMP notifications for OSPF MIB support objects, Cisco-specific errors, retransmission and state-change traps. The SNMP notifications are provided for errors and other significant event information for the OSPF network.

## How to Enable OSPF MIB Support of RFC 1850 and Latest Extensions

- [Enabling OSPF MIB Support, page 7](#)
- [Enabling Specific OSPF Traps, page 9](#)
- [Verifying OSPF MIB Traps on the Router, page 11](#)

### Enabling OSPF MIB Support

Before the OSPF MIB Support of RFC 1850 and Latest Extensions feature can be used, the SNMP server for the router must be configured.

#### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **snmp-server community *string1* ro**
4. **snmp-server community *string2* rw**
5. **snmp-server host {*hostname* | *ip-address*} [*vrf vrf-name*] [**traps** | **informs**] [**version** {**1** | **2c** | **3** [**auth** | **noauth** | **priv**]}] *community-string* [**udp-port** *port*] [*notification-type*]**
6. **snmp-server enable traps ospf**
7. **end**

#### DETAILED STEPS

Command or Action	Purpose
<b>Step 1</b> <b>enable</b>  <b>Example:</b> Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b> <b>configure terminal</b>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.

Command or Action	Purpose
<p><b>Step 3</b> <code>snmp-server community string1 ro</code></p> <p><b>Example:</b></p> <pre>Router(config)# snmp-server community public ro</pre>	Enables read access to all objects in the MIB, but does not allow access to the community strings.
<p><b>Step 4</b> <code>snmp-server community string2 rw</code></p> <p><b>Example:</b></p> <pre>Router(config)# snmp-server community private rw</pre>	Enables read and write access to all objects in the MIB, but does not allow access to the community strings.
<p><b>Step 5</b> <code>snmp-server host {hostname   ip-address} [vrf vrf-name] [traps   informs] [version {1   2c   3 [auth   noauth   priv]]] community-string [udp-port port] [notification-type]</code></p> <p><b>Example:</b></p> <pre>Router(config)# snmp-server host 172.20.2.162 version 2c public ospf</pre>	<p>Specifies a recipient (target host) for SNMP notification operations.</p> <ul style="list-style-type: none"> <li>• If no <i>notification-type</i> is specified, all enabled notifications (traps or informs) will be sent to the specified host.</li> <li>• If you want to send only the OSPF notifications to the specified host, you can use the optional <b>ospf</b> keyword as one of the <i>notification-types</i>. (See the example.) Entering the <b>ospf</b> keyword enables the ospfSetTrap trap control MIB object.</li> </ul>
<p><b>Step 6</b> <code>snmp-server enable traps ospf</code></p> <p><b>Example:</b></p> <pre>Router(config)# snmp-server enable traps ospf</pre>	<p>Enables all SNMP notifications defined in the OSPF MIBs.</p> <p><b>Note</b> This step is required only if you wish to enable all OSPF traps. When you enter the <b>no snmp-server enable traps ospf</b> command, all OSPF traps will be disabled.</p>
<p><b>Step 7</b> <code>end</code></p> <p><b>Example:</b></p> <pre>Router(config)# end</pre>	Ends your configuration session and exits global configuration mode.

- [What to Do Next, page 8](#)

## What to Do Next

If you did not want to enable all OSPF traps, follow the steps in the following section to selectively enable one or more type of OSPF trap:



## Enabling Specific OSPF Traps

### SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `snmp-server enable traps ospf cisco-specific errors [config-error] [virt-config-error]`
4. `snmp-server enable traps ospf cisco-specific retransmit [packets] [virt-packets]`
5. `snmp-server enable traps ospf cisco-specific state-change [nssa-trans-change] [shamlink-state-change]`
6. `snmp-server enable traps ospf cisco-specific lsa [lsa-maxage] [lsa-originate]`
7. `snmp-server enable traps ospf errors [authentication-failure] [bad-packet] [config-error] [virt-authentication-failure] [virt-config-error]`
8. `snmp-server enable traps ospf lsa [lsa-maxage] [lsa-originate]`
9. `snmp-server enable traps ospf rate-limit seconds trap-number`
10. `snmp-server enable traps ospf retransmit [packets] [virt-packets]`
11. `snmp-server enable traps ospf state-change [if-state-change] [neighbor-state-change] [virtif-state-change] [virtneighbor-state-change]`

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<p><code>enable</code></p> <p><b>Example:</b></p> <pre>Router&gt; enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
Step 2	<p><code>configure terminal</code></p> <p><b>Example:</b></p> <pre>Router# configure terminal</pre>	<p>Enters global configuration mode.</p>
Step 3	<p><code>snmp-server enable traps ospf cisco-specific errors [config-error] [virt-config-error]</code></p> <p><b>Example:</b></p> <pre>Router(config)# snmp-server enable traps ospf cisco-specific errors config-error</pre>	<p>Enables SNMP notifications for Cisco-specific OSPF configuration mismatch errors.</p> <ul style="list-style-type: none"> <li>• Entering the <code>snmp-server enable traps ospf cisco-specific errors</code> command with the optional <code>virt-config-error</code> keyword enables only the SNMP notifications for configuration mismatch errors on virtual interfaces.</li> </ul>

Command or Action	Purpose
<p><b>Step 4</b> <code>snmp-server enable traps ospf cisco-specific retransmit [packets] [virt-packets]</code></p> <p><b>Example:</b></p> <pre>Router(config)# snmp-server enable traps ospf cisco-specific retransmit packets virt-packets</pre>	<p>Enables error traps for Cisco-specific OSPF errors that involve re-sent packets.</p> <ul style="list-style-type: none"> <li>Entering the <b>snmp-server enable traps ospf cisco-specific retransmit</b> command with the optional <b>virt-packets</b> keyword enables only the SNMP notifications for packets that are re-sent on virtual interfaces.</li> </ul>
<p><b>Step 5</b> <code>snmp-server enable traps ospf cisco-specific state-change [nssa-trans-change] [shamlink-state-change]</code></p> <p><b>Example:</b></p> <pre>Router(config)# snmp-server enable traps ospf cisco-specific state-change</pre>	<p>Enables all error traps for Cisco-specific OSPF transition state changes.</p>
<p><b>Step 6</b> <code>snmp-server enable traps ospf cisco-specific lsa [lsa-maxage] [lsa-originate]</code></p> <p><b>Example:</b></p> <pre>Router(config)# snmp-server enable traps ospf cisco-specific lsa</pre>	<p>Enables error traps for opaque LSAs.</p>
<p><b>Step 7</b> <code>snmp-server enable traps ospf errors [authentication-failure] [bad-packet] [config-error] [virt-authentication-failure] [virt-config-error]</code></p> <p><b>Example:</b></p> <pre>Router(config)# snmp-server enable traps ospf errors virt-config-error</pre>	<p>Enables error traps for OSPF configuration errors.</p> <ul style="list-style-type: none"> <li>Entering the <b>snmp-server enable traps ospf errors</b> command with the optional <b>virt-config-error</b> keyword enables only the SNMP notifications for OSPF configuration errors on virtual interfaces.</li> </ul>
<p><b>Step 8</b> <code>snmp-server enable traps ospf lsa [lsa-maxage] [lsa-originate]</code></p> <p><b>Example:</b></p> <pre>Router(config)# snmp-server enable traps ospf lsa</pre>	<p>Enables error traps for OSPF LSA errors.</p>
<p><b>Step 9</b> <code>snmp-server enable traps ospf rate-limit <i>seconds trap-number</i></code></p> <p><b>Example:</b></p> <pre>Router(config)# snmp-server enable traps ospf rate- limit 20 20</pre>	<p>Sets the rate limit for how many SNMP OSPF notifications are sent in each OSPF SNMP notification rate-limit window.</p>

	Command or Action	Purpose
<b>Step 10</b>	<b>snmp-server enable traps ospf retransmit [packets] [virt-packets]</b>  <b>Example:</b>  Router(config)# snmp-server enable traps ospf retransmit	Enables SNMP OSPF notifications for re-sent packets.
<b>Step 11</b>	<b>snmp-server enable traps ospf state-change [if-state-change] [neighbor-state-change] [virtif-state-change] [virtneighbor-state-change]</b>  <b>Example:</b>  Router(config)# snmp-server enable traps ospf state-change	Enables SNMP OSPF notifications for OSPF transition state changes.

## Verifying OSPF MIB Traps on the Router

### SUMMARY STEPS

1. enable
2. show running-config [options]

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b>  Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>show running-config [options]</b>  <b>Example:</b>  Router# show running-config   include traps	Displays the contents of the currently running configuration file and includes information about enabled traps. <ul style="list-style-type: none"> <li>• Verifies which traps are enabled.</li> </ul>

# Configuration Examples for OSPF MIB Support of RFC 1850 and Latest Extensions

- [Example Enabling and Verifying OSPF MIB Support Traps, page 12](#)

## Example Enabling and Verifying OSPF MIB Support Traps

The following example enables all OSPF traps.

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# snmp-server enable traps ospf
Router(config)# end
```

The **show running-config** command is entered to verify that the traps are enabled:

```
Router# show running-config | include traps
snmp-server enable traps ospf
```

## Where to Go Next

For more information about SNMP and SNMP operations, see the "Configuring SNMP Support" chapter of the *Cisco IOS Configuration Fundamentals and Network Management Configuration Guide*, Release 12.2.

## Additional References

The following sections provide references related to the OSPF MIB Support of RFC 1850 and Latest Extensions feature.

### Related Documents

Related Topic	Document Title
SNMP commands	<i>Cisco IOS Configuration Fundamentals and Network Management Command Reference</i>

### Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

**MIB**

MIB	MIBs Link
<ul style="list-style-type: none"> <li>• CISCO-OSPF-MIB</li> <li>• CISCO-OSPF-TRAP-MIB</li> <li>• OSPF-MIB</li> <li>• OSPF-TRAP-MIB</li> </ul>	<p>To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:</p> <p><a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a></p>

**RFC**

RFC	Title
RFC 1850	<i>OSPF MIB Support</i>

**Technical Assistance**

Description	Link
<p>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.</p>	<p><a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a></p>

## Feature Information for OSPF MIB Support of RFC 1850 and Latest Extensions

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](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

**Table 5**      **Feature Information for OSPF MIB Support of RFC 1850 and Latest Extensions**

Feature Name	Releases	Feature Information
OSPF MIB Support of RFC 1850 and Latest Extensions	12.0(26)S 12.3(4)T 12.2(25)S 12.2(27)SBC 12.2(31)SB2	OSPF MIB Support of RFC 1850 and Latest Extensions feature introduces the capability for Simple Network Management Protocol (SNMP) monitoring on the Open Shortest Path First (OSPF) routing protocol. Users have an improved ability to constantly monitor the changing state of an OSPF network by use of MIB objects to gather information relating to protocol parameters and trap notification objects that can signal the occurrence of significant network events such as transition state changes. The protocol information collected by the OSPF MIB objects and trap objects can be used to derive statistics that will help monitor and improve overall network performance.

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