MPLS Traffic Engineering--Fast Reroute MIB

The MPLS Traffic Engineering--Fast Reroute MIB provides Simple Network Management Protocol (SNMP)-based network management of the Multiprotocol Label Switching (MPLS) Fast Reroute (FRR) feature in Cisco software.

The Fast Reroute MIB has the following features:

- Notifications can be created and queued.

- Command-line interface (CLI) commands enable notifications, and specify the IP address to where the notifications will be sent.

- The configuration of the notifications can be written into nonvolatile memory.

The MIB includes objects describing features within MPLS FRR, and it includes the following tables:

- cmplsFrrConstTable

- cmplsFrrLogTable

- cmplsFrrFacRouteDBTable

The MIB also includes scalar objects (that is, objects that are not in a table). For more information, see the FRR MIB Scalar Objects, on page 4.

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 at the end of this module.

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.

Prerequisites for the MPLS Traffic Engineering--Fast Reroute MIB

- The network must support the Intermediate System-to-Intermediate System (IS-IS) or Open Shortest Path First (OSPF) protocol.

- The SNMP is installed and enabled on the label switch routers (LSRs).

- MPLS is enabled globally on each LSR.

- Cisco Express Forwarding is enabled on the LSRs.

- Traffic engineering (TE) tunnels are enabled.

- MPLS FRR is enabled on one of the TE tunnels.

- The Resource Reservation Protocol (RSVP) is enabled.

Restrictions for the MPLS Traffic Engineering--Fast Reroute MIB

- The implementation of the FRR MIB is limited to read-only (RO) permission for MIB objects.

- Configuration of the FRR MIB using the SNMP SET command is not supported in Cisco IOS Release 12.2(33)SRA or in prior releases.

- The following tables are not implemented in the specified releases:

  - mplsFrrOne2OnePlrTable--Not implemented in Cisco IOS software.

  - mplsFrrDetourTable--Not implemented in Cisco IOS software.

  - cmplsFrrLogTable--Implemented only in Cisco IOS 12.0S-based releases.

Information About the MPLS Traffic Engineering--Fast Reroute MIB

Feature Design of the MPLS Traffic Engineering--Fast Reroute MIB

The FRR MIB enables standard, SNMP-based network management of FRR in Cisco software. This capability requires that SNMP agent code executes on a designated network management station (NMS) in the network. The NMS serves as the medium for user interaction with the network management objects in the MIB.

The FRR MIB is based on the Internet Engineering Task Force (IETF) draft MIB specification *draft-ietf-mpls-fastreroute-mib-02.txt* . The IETF draft MIB, which undergoes revisions periodically, is evolving toward becoming a standard. The Cisco implementation of the FRR MIB is expected to track the evolution of the IETF draft MIB, and may change accordingly.

Slight differences between the IETF draft MIB and the implementation of FRR within Cisco software require some minor translations between the FRR MIB objects and the internal data structures of Cisco software. These translations are accomplished by the SNMP agent, which runs in the background on the NMS workstation as a low priority process and provides a management interface to Cisco software.

You can use an SNMP agent to access FRR MIB objects using standard SNMP GET operations. All the objects in the FRR MIB follow the conventions defined in the IETF draft MIB.

Functional Structure of the MPLS Traffic Engineering--Fast Reroute MIB

The SNMP agent code supporting the FRR MIB follows the existing model for such code in Cisco software and is, in part, generated by the Cisco tool set, based on the MIB source code. The basis for the generated code is the Cisco version of the FRR MIB CISCO-ietf-frr-mib.

The SNMP agent code, which has a layered structure that is common to MIB support code in Cisco software, consists of the following layers:

- Platform-independent layer--This layer is generated primarily by the MIB development Cisco tool set and incorporates platform- and implementation-independent functions. These functions handle SNMP standard functionality in the context of the specific MIB. This layer handles indexes and range or enumeration value checks for GET, GET-NEXT, and SET SNMP operations. A function is generated for each SNMP table or group of objects. This layer calls into the next layer.

- Application interface layer--The Cisco tool set generates the function names and template code for MIB objects.

- Application-specific layer--This layer provides the mechanism for retrieving relevant data from the managed application layer. It includes an entry point function for each table. This function calls two other functions; one that searches the TE tunnel database that RSVP maintains for the relevant data according to the indexes, and another function that fills the data into the structure.

- Managed application layer--This layer includes all the structures and mechanisms, and is managed by the MIB.

System Flow of SNMP Protocol Requests and Response Messages

All SNMP protocol requests and response messages are ultimately handled by the SNMP master agent. When such a message is received on a router, the master agent parses the requests and identifies the MIB to which the request refers. The master agent then queries the subagent responsible for the MIB with a GET, GET-NEXT, or SET request. The FRR MIB subagent retrieves the appropriate data, and returns it to the master agent. The master agent is then responsible for returning an SNMP response to the NMS. All queries occur within the IP SNMP Cisco software process, which runs as a low priority task.

FRR MIB Scalar Objects

Scalar objects are objects that are not in tables. A scalar object has one instance (that is, one occurrence).

The table below describes the FRR MIB scalar objects.

Table 1: Scalar Objects

MIB Object	Function
cmplsFrrDetourIncoming	Number of detour link-state packets (LSPs) entering the device. This object returns 0 because cmplsFrrConstProtectionMethod is set to facilityBackup(1).
cmplsFrrDetourOutgoing	Number of detour LSPs leaving the device. This object returns 0 because cmplsFrrConstProtectionMethod is set to facilityBackup(1).
cmplsFrrDetourOriginating	Number of detour LSPs originating from the device. This object returns 0 because cmplsFrrConstProtectionMethod is set to facilityBackup(1).
cmplsFrrSwitchover	Number of tunnels that are being backed up because cmplsFrrConstProtectionMethod is set to facilityBackup(1).
cmplsFrrNumOfConfIfs	Number of MPLS interfaces FRR configured for protection; 0 indicates that LSPs traversing any interface can be protected.
cmplsFrrActProtectedIfs	Number of interfaces FRR is protecting because cmplsFrrConstProtectionMethod is set to facilityBackup(1).
cmplsFrrConfProtectingTuns	Number of backup Fast Reroute-protected tunnels configured because cmplsFrrConstProtectionMethod is set to facilityBackup(1).
cmplsFrrActProtectedTuns	Number of tunnels protected by the Fast Reroute feature. This object returns 0 because cmplsFrrConstProtectionMethod is set to facilityBackup(1).

MIB Object	Function
cmplsFrrActProtectedLSPs	Number of LSPs that FRR is protecting. If cmplsFrrConstProtectionMethod is set to facilityBackup(1), this object returns 0.
cmplsFrrConstProtectionMethod	This object always returns facilityBackup(1) because Cisco software supports only the facility backup protection method.
cmplsFrrNotifsEnabled	A value that indicates whether FRR notifications defined in this MIB are enabled or disabled. This object returns True(1) for enabled, or False(2) for disabled. The default is that notifications are disabled.
cmplsFrrLogTableMaxEntries	Maximum number of entries allowed in the FRR log table.
cmplsFrrLogTableCurrEntries	Current number of entries in the FRR log table. This object always returns 0.
cmplsFrrNotifMaxRate	Maximum interval rate between FRR MIB notifications. This object always returns 0.

FRR MIB Notification Generation Events

Notifications are issued after particular FRR events occur.

When you enable FRR MIB notification functionality by issuing the **snmp-server enable traps mpls fast-reroute** command, FRR events generate notification messages that are sent to a designated NMS in the network to signal the occurrence of specific events in Cisco software.

The FRR MIB objects involved in FRR status transitions and event notifications include cmplsFrrProtected. This message is sent to an NMS if there is a major TE tunnel change (that is, fast rerouting of TE tunnels).

FRR MIB Notification Specification

Notifications are issued after particular FRR events occur.

Each FRR notification has a generic type identifier and an enterprise-specific type identifier for identifying the notification type. The generic type for all FRR notifications is "enterprise Specific" because this is not one of the generic notification types defined for SNMP. The enterprise-specific type is 1 for cmplsFrrProtected.

Each notification contains the following objects from the FRR MIB so that the FRR tunnel can be easily identified:

- cmplsFrrConstNumProtectingTunOnIf
- cmplsFrrConstNumProtectedTunOnIf
- cmplsFrrConstBandwidth

Upon being invoked, the appropriate FRR interface indexes have already been retrieved by existing FRR code. The FRR interfaces are then used to fill in data for the three objects included in the notification.

FRR MIB Notification Monitoring

Notifications are issued after particular FRR events occur.

When FRR MIB notifications are enabled (see the **snmp-server enable traps** command), notification messages relating to specific FRR events within Cisco software are generated and sent to a specified NMS in the network. Any utility that supports SNMPv1 or SNPv2 notifications can receive notification messages.

To monitor FRR MIB notifications, log in to an NMS that supports a utility that displays SNMP notifications, and start the display utility.

MIB Tables in the MPLS Traffic Engineering--Fast Reroute MIB

The FRR MIB consists of the following tables:

The tables access various data structures to obtain information regarding detours, the FRR database, and logging.

cmplsFrrConstTable

cmplsFrrConstTable displays the configuration of an FRR-enabled tunnel and the characteristics of its accompanying backup tunnels. For each protected tunnel, there can be multiple backup tunnels.

The table is indexed by the following:

- cmplsFrrConstIfIndex

- cmplsFrrConstTunnelIndex

- cmplsFrrConstTunnelInstance

The table below describes the MIB objects for cmplsFrrConstTable.

Table 2: cmplsFrrConstTable Objects

MIB Object	Function
cmplsFrrConstIfIndex	Uniquely identifies an interface on which FRR is configured. If an index has a value of 0, the configuration applies to all interfaces on the device on which the FRR feature can operate.
cmplsFrrConstTunnelIndex	Tunnel for which FRR is requested.
cmplsFrrConstTunnelInstance	Tunnel for which FRR is requested. The value always is 0 because only tunnel heads are represented, and tunnel heads have an instance value of 0.
cmplsFrrConstSetupPrio	Setup priority of the backup tunnel.

MIB Object	Function
cmplsFrrConstHoldingPrio	Holding priority of the backup tunnel.
cmplsFrrConstInclAnyAffinity	Attribute bits that must be set for the tunnel to traverse a link.
cmplsFrrConstInclAllAffinity	Attribute bits that must not be set for the tunnel to traverse a link.
cmplsFrrConstExclAllAffinity	A link satisfies the exclude-all constraint only if the link contains none of the administrative groups specified in the constraint.
cmplsFrrConstHopLimit	The maximum number of hops that the backup tunnel can traverse.
cmplsFrrConstBandwidth	The bandwidth of the backup tunnels for this tunnel, in thousands of bits per second (kbps).
cmplsFrrConstRowStatus	Creates, modifies, and deletes a row in this table.

cmplsFrrLogTable

Note cmplsFrrLogTable and the **show mpls traffic-eng fast-reroute log reroutes** command are supported only in Cisco IOS 12.0S-based releases.

cmplsFrrLogTable is indexed by the object cmplsFrrLogIndex. The index corresponds to a log entry in the FRR feature's **show mpls traffic-eng fast-reroute log reroutes** command. That **show** command stores up to 32 entries at a time. If entries are added, the oldest entry is overwritten with new log information.

cmplsFrrLogTable can store up to 32 entries at a time, overwriting older entries as newer ones are added. The index cmplsFrrLogIndex is incremented to give each log table entry of the MIB a unique index value. Therefore, it is possible to have indexes greater than 32 even though only 32 entries are displaying.

The table below describes the MIB objects for cmplsFrrLogTable.

Table 3: cmplsFrrLogTable Objects

MIB Object	Function
cmplsFrrLogIndex	Number of the FRR event.
cmplsFrrLogEventTime	Number of milliseconds that elapsed from bootstrap time to the time that the event occurred.
cmplsFrrLogInterface	Identifies the interface that was affected by this FRR event. The value can be set to 0 if mplsFrrConstProtectionMethod is set to oneToOneBackup(0).
cmplsFrrLogEventType	The type of FRR event that occurred. The object returns Protected or Other.

MIB Object	Function
cmplsFrrLogEventDuration	Duration of the event, in milliseconds.
cmplsFrrLogEventReasonString	Implementation-specific explanation of the event. The object returns interface down event or interface other event.

cmplsFrrFacRouteDBTable

The following indexes specify which interface and tunnel are being protected by the FRR feature:

- cmplsFrrFacRouteProtectedIfIndex
- cmplsFrrFacRouteProtectedTunIndex

The following indexes specify the backup tunnel that provides protection to the protected tunnel:

- cmplsFrrFacRouteProtectedIfIndex
- cmplsFrrFacRouteProtectingTunIndex
- cmplsFrrFacRouteProtectedTunIndex
- cmplsFrrFacRouteProtectedTunInstance
- cmplsFrrFacRouteProtectedTunIngressLSRId
- cmplsFrrFacRouteProtectedTunEgressLSRId

This version of the MIB will attempt to leverage the work already done for the MPLS TE MIB because it contains similar lookup functions for TE tunnels.

The table below describes the MIB objects for cmplsFrrFacRouteDBTable.

Table 4: cmplsFrrFacRouteDBTable Objects

MIB Object	Function
cmplsFrrFacRouteProtectedIfIndex	Interface configured for FRR protection.
cmplsFrrFacRouteProtectingTunIndex	The tunnel number of the protecting (backup) tunnel.
cmplsFrrFacRouteProtectedTunIndex	The mplsTunnelEntry primary index for the tunnel head interface designated to protect the interface specified in mplsFrrFacRouteIfProtIdx (and all the tunnels using this interface).
cmplsFrrFacRouteProtectedTunInstance	An mplsTunnelEntry that is being protected by FRR. An instance uniquely identifies a tunnel.
cmplsFrrFacRouteProtectedTunIngressLSRId	Inbound label for the backup LSR.
cmplsFrrFacRouteProtectedTunEgressLSRId	Outbound label for the backup LSR.

MIB Object	Function
cmplsFrrFacRouteProtectedTunStatus	State of the protected tunnel. Valid values are: • active--Tunnel label has been placed in the Label Forwarding Information Base (LFIB) and is ready to be applied to incoming packets. • ready--Tunnel's label entry has been created, but is not in the LFIB. • partial--Tunnel's label entry has not been fully created.
cmplsFrrFacRouteProtectingTunResvBw	Amount of bandwidth, in megabytes per second, that is reserved by the backup tunnel.
cmplsFrrFacRouteProtectingTunProtectionType	Type of protection: 0 designates link protection; 1 designates node protection.

How to Configure the MPLS Traffic Engineering--Fast Reroute MIB

Enabling the SNMP Agent for FRR MIB Notifications

SUMMARY STEPS

1. **enable**
2. **show running-config**
3. **configure terminal**
4. **snmp-server community** *string* [**view** *view-name*] [**ro**] [*access-list-number*]
5. **snmp-server enable traps mpls fast-reroute protected**
6. **end**
7. **write memory**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**show running-config** **Example:** Router# show running-config	Displays the running configuration of the router to determine if an SNMP agent is already running on the device. If no SNMP information is displayed, continue with the next step. If any SNMP information is displayed, you can modify or change the information.
Step 3	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 4	**snmp-server community** *string* [**view** *view-name*] [**ro**] [*access-list-number*] **Example:** Router(config)# snmp-server community public ro	Configures read-only (ro) SNMP community strings for the FRR MIB.
Step 5	**snmp-server enable traps mpls fast-reroute protected** **Example:** Router(config)# snmp-server enable traps mpls fast-reroute protected	Enables Fast Reroute traps.
Step 6	**end** **Example:** Router(config)# end	Exits to privileged EXEC mode.
Step 7	**write memory** **Example:** Router# write memory	Writes the modified SNMP configuration into NVRAM of the router, permanently saving the SNMP settings.

Enabling Cisco Express Forwarding

SUMMARY STEPS

1. **enable**
2. **configure teminal**
3. **ip cef distributed**
4. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure teminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip cef distributed** **Example:** `Router(config)# ip cef distributed`	Enables distributed Cisco Express Forwarding.
Step 4	**end** **Example:** `Router(config)# end`	Exits to privileged EXEC mode.

Enabling TE Tunnels

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip cef**
4. **mpls traffic-eng tunnels**
5. **interface** *typeslot*/*port*
6. **mpls traffic-eng tunnels**
7. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip cef** **Example:** `Router(config)# ip cef`	Enables standard Cisco Express Forwarding operations.
Step 4	**mpls traffic-eng tunnels** **Example:** `Router(config)# mpls traffic-eng tunnels`	Enables the MPLS TE tunnel feature on a device.
Step 5	**interface** *typeslot*/*port* **Example:** `Router(config)# interface POS1/0`	Specifies the interface and enters interface configuration mode.

	Command or Action	**Purpose**
Step 6	**mpls traffic-eng tunnels** **Example:** Router(config-if)# mpls traffic-eng tunnels	Enables the MPLS TE tunnel feature on an interface.
Step 7	**end** **Example:** Router(config-if)# end	Returns to privileged EXEC mode.

Enabling MPLS FRR on Each TE Tunnel

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *typeslot/port*
4. **tunnel mode mpls traffic-eng**
5. **tunnel mpls traffic-eng fast-reroute**
6. **end**

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**interface** *typeslot/port* **Example:** Router(config)# interface POS1/0	Specifies the interface and enters interface configuration mode.

	Command or Action	Purpose
Step 4	**tunnel mode mpls traffic-eng** **Example:** `Router(config-if)# tunnel mode mpls traffic-eng`	Sets the mode of a tunnel to MPLS for traffic engineering.
Step 5	**tunnel mpls traffic-eng fast-reroute** **Example:** `Router(config-if)# tunnel mpls traffic-eng fast-reroute`	Enables Fast Reroute on the TE tunnel being protected.
Step 6	**end** **Example:** `Router(config-if)# end`	Exits to privileged EXEC mode.

Enabling a Backup Tunnel on an Interface

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *typeslot*/*port*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	**Purpose**
Step 3	**interface** *typeslot/port* **Example:** `Router(config)# interface POS1/0`	Specifies the interface and enters interface configuration mode.

Configuration Examples for the MPLS Traffic Engineering--Fast Reroute MIB

Enabling an SNMP Agent on a Host NMS Example

The following example shows how to enable an SNMP agent on the host NMS:

```
enable
 show running-config
 configure terminal
 snmp-server community public ro
 snmp-server enable traps mpls fast-reroute protected
 end
 write memory
```

Enabling Cisco Express Forwarding Example

The following example shows how to enable Cisco Express Forwarding:

```
enable
 configure terminal
 ip cef distributed
 end
```

Enabling TE Tunnels Example

The following example shows how to enable traffic engineering tunnels:

```
enable
 configure terminal
 ip cef
 mpls traffic-eng tunnels
 interface Ethernet1/0
 mpls traffic-eng tunnels
 end
```

Enabling MPLS FRR on Each TE Tunnel Example

The following example shows how to enable MPLS Fast Reroute on each TE tunnel:

```
enable
 configure terminal
 interface POS1/0
 tunnel mode mpls traffic-eng
 tunnel mpls traffic-eng fast-reroute
 end
```

Enabling a Backup Tunnel on an Interface Example

The following example shows how to enable a backup tunnel on an interface:

```
enable
 configure terminal
 interface POS1/0
 mpls traffic-eng backup-path tunnel1
 end
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
Description of commands associated with MPLS and MPLS applications	*Multiprotocol Label Switching Command Reference*
SNMP agent support for the MPLS Traffic Engineering MIB	MPLS Traffic Engineering MIB
Fast Reroute	MPLS Traffic Engineering: Fast Reroute Link and Node Protection

Standards

Standard	Title
MPLS-FRR-MIB	*draft-ietf-mpls-fastreroute-mib-02.txt*

MIBs

MIB	MIBs Link
MPLS Traffic Engineering (TE) MIB	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

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

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 MPLS Traffic Engineering--Fast Reroute MIB

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 5: Feature Information for MPLS Traffic Engineering--Fast Reroute MIB

Feature Name	Releases	Feature Information
MPLS Traffic Engineering--Fast Reroute MIB	12.0(10)ST 12.0(16)ST 12.0(22)S 12.0(26)S 12.2(33)SRA 12.2(33)SXH 12.4(20)T 15.3(2)S	The MPLS Traffic Engineering--Fast Reroute MIB provides SNMP-based network management of the Multiprotocol Label Switching (MPLS) Fast Reroute (FRR) feature in Cisco IOS software. In 12.0(10)ST, the Fast Reroute link protection feature was introduced. In 12.0(16)ST, link protection for Cisco series 7200 and 7500 platforms was added. In 12.0(22)S, Fast Reroute enhancements, including node protection, were added. In 12.0(26)S, support for the IETF MIB *draft-ietf-mpls-fastreroute-mib-02.txt,* which provides network management for the FRR feature, was added. In 12.2(33)SRA, support for cmplsFrrLogTableCurrEntries and cmplsFrrNotifMaxRate was added. The cmplsFrrLogTable is not supported. In 12.2(33)SXH, support was added. In 12.4(20)T, support was added. In 15.3(2)S, this feature was integrated.

Glossary

Cisco Express Forwarding --An advanced Layer 3 IP switching technology. Cisco Express Forwarding optimizes network performance and scalability for networks with large and dynamic traffic patterns.

index --A method of uniquely identifying a tunnel.

instance --An occurrence. An object can have one or more instances.

IS-IS --Intermediate System-to-Intermediate System. IS-IS is an OSI link-state hierarchical routing protocol based on DECnet Phase V routing where intermediate system (IS) routers exchange routing information based on a single metric to determine network topology.

label --A short, fixed-length data construct that tells switching nodes how to forward data (packets or cells).

LFIB --Label Forwarding Information Base. The data structure for storing information about incoming and outgoing tags (labels) and associated equivalent packets suitable for labeling.

LSR --label switching router. A device that forwards MPLS packets based on the value of a fixed-length label encapsulated in each packet.

MIB --Management Information Base. A database of network management information that is used and maintained by a network management protocol such as Simple Network Management Protocol (SNMP). The value of a MIB object can be changed or retrieved by using SNMP commands, usually through a network management system. MIB objects are organized in a tree structure that includes public (standard) and private (proprietary) branches.

NMS --network management station. A powerful, well-equipped computer (typically an engineering workstation) that is used by a network administrator to communicate with other devices in the network. An NMS is typically used to manage network resources, gather statistics, and perform a variety of network administration and configuration tasks.

notification --A message sent by a Simple Network Management Protocol (SNMP) agent to a network management station, console, or terminal to indicate that a significant event within Cisco software has occurred.

object --A variable that has a specific instance associated with it.

OSPF --Open Shortest Path First. Link-state, hierarchical Interior Gateway Protocol (IGP) routing algorithm proposed as a successor to Routing Information Protocol (RIP) in the Internet community. OSPF features include least-cost routing, multipath routing, and load balancing.

RSVP --Resource Reservation Protocol. Protocol for reserving network resources to provide quality of service (QoS) guarantees to application flows.

scalar object--Objects that are not instances. A scalar object has one instance.

SNMP --Simple Network Management Protocol. A network management protocol used almost exclusively in TCP/IP networks. SNMP provides a means to monitor and control network devices, manage configurations, collect statistics, monitor performance, and ensure network security.

SNMP agent--A managed node or device. The router that has the MIB implementation on it.