MPLS Enhancements to Interfaces MIB

Feature History

Release	Modification
12.0(23)S	This feature was introduced in Cisco IOS Release 12.0(23)S.

This document describes the Multiprotocol Label Switching (MPLS) enhancements to the existing interfaces Management Information Base (MIB) (RFC 2233) to support an MPLS layer. This layer provides counters and statistics specifically for MPLS.

This document includes the following major sections:

Feature Overview

The Interfaces MIB (IF MIB) provides a Simple Network Management Protocol (SNMP) based method for managing interfaces. Each entry in the IF MIB establishes indexing, statistics, and stacking relationships among underlying physical interfaces, subinterfaces, and Layer 2 protocols that exist within Cisco IOS.

The enhancements add an MPLS layer to the IF MIB as a Layer 2 protocol to provide statistics for traffic encapsulated as MPLS on an interface. In this new structure, MPLS-specific data, such as MPLS-encapsulated traffic counters and the MPLS maximum transmission unit (MTU), resides on top of the underlying physical or virtual interface to allow separation from non-MPLS data.

The enhancements also allow you to view indexing, statistics, and stacking relationships using the ifStackTable. MPLS layer interfaces are stacked above the underlying physical or virtual interface that is actually forwarding the MPLS traffic. MPLS traffic engineering tunnels are then stacked above those MPLS layers.

The IF MIB supports several types of interfaces. A virtual interface that provides protocol statistics for MPLS-encapsulated traffic has been added. This new interface is stacked above real Cisco IOS interfaces or subinterfaces, such as Ethernet (et0) or ATM (at1/1.1).

Cisco IOS creates a corresponding MPLS layer above each interface capable of supporting MPLS when the MPLS encapsulation is enabled by issuing the interface configuration command **mpls ip**.

You can also create the interface layer if you enable MPLS traffic engineering (TE) by using the interface command **mpls traffic-eng tunnels**.

Note You must also issue these commands in global configuration mode for MPLS IP and/or MPLS TE to be enabled.

An IF MIB entry is created when you enable either MPLS IP and/or MPLS TE tunnels on an interface; the entry is removed when you disable both MPLS IP and MPLS TE.

MIB Tables

The IF MIB consists of the following tables:

- ifTable—Contains information on each interface in the network. Its definition of an interface includes any sublayers of the internetwork layer of the interface. MPLS interfaces fit into this definition of an interface. Therefore, each MPLS-enabled interface is represented by an entry in the ifTable.
- ifXTable—Contains objects that have been added to the IF MIB as a result of the interface evolution effort or replacements for objects from the original MIB-II ifTable. This table also contains objects that were previously in the ifExtsTable.
- ifStackTable—Contains objects that define the relationships among the sublayers of an interface.
- ifRcvAddressTable—Contains objects that define the media-level addresses received by an interface.

Note There are objects that are not supported by some interface types. The corresponding MPLS layer objects may not be supported if they depend on an unsupported object at the underlying layer.

The notation used in the IF MIB follows the conventions defined in Abstract System Notation One (ASN.1). ASN.1 defines an Open System Interconnection (OSI) language used to describe data types independently from particular computer structures and presentation techniques. Each object in the MIB incorporates a DESCRIPTION field that includes an explanation of the object's meaning and usage, which, together with the other characteristics of the object (SYNTAX, MAX-ACCESS, and INDEX) provides sufficient information for management application development, as well as for documentation and testing.

A network administrator can access the entries (objects) in the IF MIB by means of any SNMP-based network management system (NMS). The network administrator can retrieve information in the IF MIB using standard SNMP **get** and **getnext** operations.

ifTable Objects

Table 1 lists the ifTable objects and their descriptions.

Table 1 ifTable Objects and Descriptions

Objects	Description
ifIndex	A unique value, greater than zero, for each interface.
ifDescr	A textual string containing information about the MPLS layer. <*underlying interface name*>-mpls layer
ifType	The kind of interface. Additional values for ifType are assigned by the Internet Assigned Numbers Authority (IANA) through updating the syntax of the IANAifType textual convention. MPLS-layer entries are type mpls (166).
ifMtu	The size of the largest MPLS-encapsulated packet that can be sent or received on the interface, specified in octets. By default, this object is the same as the underlying physical or virtual interface, but can be configured by using the **mpls mtu** command.
ifSpeed	An estimate of the interface's current bandwidth in bits per second. This object is the same as the underlying physical or virtual interface; however, it has no MPLS-specific value.
ifPhysAddress	The interface's address at its protocol sublayer. This object is the same as the underlying physical or virtual interface.
ifAdminStatus	The administrative state of the underlying physical or virtual interface. This object is the same as the underlying physical or virtual interface.
ifOperStatus	The operational state of MPLS on the interface. Use the **show mpls interface** command to display this information. **Note** MPLS can be in the up or down state when the underlying physical or virtual interface is up. However, when the underlying physical or virtual interface is down, MPLS is always in the down state.
ifLastChange	The value of sysUpTime when the interface entered its current MPLS-specific operational state.
ifInOctets	The total number of MPLS-encapsulated octets received on the interface.
ifInUcastPkts	The number of MPLS-encapsulated packets received on the underlying physical or virtual interface.

Table 1 ifTable Objects and Descriptions (continued)

Objects	Description
ifInNUcastPkts	The number of packets, delivered by this sublayer to a higher sublayer, which were addressed to a multicast or broadcast address at this sublayer. This object is not supported on the MPLS layer because the event occurs on the underlying physical or virtual interface where it is counted.
ifInDiscards	The number of inbound packets selected to be discarded even though no errors had been detected to prevent delivery to a higher-layer protocol. One reason for discarding such a packet is to free up buffer space. This object is not supported on the MPLS layer because the event occurs on the underlying physical or virtual interface where it is counted.
ifInErrors	The number of inbound packets that contained errors preventing them from being delivered to a higher-layer protocol. This object is not supported on the MPLS layer because the event occurs on the underlying physical or virtual interface where it is counted.
ifInUnknownProtos	The number of packets that were discarded because of an unknown or unsupported protocol received via the interface. This object is not supported on the MPLS layer because the event occurs on the underlying physical or virtual interface where it is counted.
ifOutOctets	The total number of MPLS-encapsulated octets transmitted from the interface.
ifOutUcastPkts	The number of MPLS-encapsulated packets transmitted from the underlying physical or virtual interface.
ifOutNUcastPkts	The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast or broadcast address at this sublayer, including those that were discarded or not sent. This object is not supported on the MPLS layer because the event occurs on the underlying physical or virtual interface where it is counted.
ifOutDiscards	The number of outbound packets selected to be discarded even though no errors had been detected to prevent their transmission. One reason for discarding such a packet is to free up buffer space. This object is not supported on the MPLS layer because the event occurs on the underlying physical or virtual interface where it is counted.

Table 1 ifTable Objects and Descriptions (continued)

Objects	Description
ifOutErrors	The number of outbound packets that could not be transmitted because of errors. This object is not supported on the MPLS layer because the event occurs on the underlying physical or virtual interface where it is counted.
ifOutQLen	The length of the output packet queue (in packets). This object is the same as the underlying physical or virtual interface. It is not supported for MPLS.
ifSpecific	A reference to MIB definitions specific to the particular media being used to recognize the interface. This object is not supported because there is no such reference for MPLS.

ifXTable Objects

Table 2 lists the ifXTable objects and their descriptions.

Note High capacity (HC) objects supported in the IF MIB require SNMPv2c or higher.

Starting in Cisco IOS Release 12.0(31)S, the high-capacity counters for the MPLS layer interfaces of the Interfaces MIB contain 64 bits of counter data. In previous releases, the high capacity counters displayed 32 bits of counter data.

The following MIB objects are affected:

- ifHCInOctets
- ifHCOutOctets
- ifHCInUcastPkts
- ifHCOutUcastPkts

When the 64-bit values are less than the value of 232, the 32-bit and 64-bit values are identical.

After the counter increases to more than 232, the counters are different; the 64-bit value is computed by the following formula:

X * (232) + Y

where:

X is the number of times the 32-bit counter has rolled.

Y is the residual value of the counter after the roll occurred. The Y value equals the 32-bit value.

When the high-capacity counter values are compared to their 32-bit values, there is a period of time that the counter values are not equal. The 64-bit values lag behind the 32-bit values when the counters poll the 32-bit hardware counters and computing the correct counter value. During the polling and computation interval, the following high-capacity counter values counters might be inconsistent.

- ifInOctets
- ifOutOctets

- ifInUcastPkts
- ifOutUcastPkts

The inconsistent values can occur if traffic is constantly flowing over an interface and a MIB walk is performed. The 32-bit value is correct at that moment. The 64-bit value lags slightly behind , because of the polling computations needed to generate it. Once traffic stops flowing over the interface, and a polling period has passed, the two counters are identical and correct.

The lag time depends on the following factors:

- The polling interval used by the Interfaces MIB. The less time the polling interval takes, the more accurate the value is.
- The size of the Interfaces MIB. A large MIB takes a long time to walk and might affect the values found at that instant.
- The amount of computations needed to generate the 64-bit value. The number of MPLS-enabled interfaces increases the number of 64-bit counter values that need to be computed.

Table 2 ifXTable Objects and Descriptions

Object	Definition
ifName	The textual name of the underlying physical or virtual interface.
ifInMulticastPkts	The number of packets, which were addressed to a multicast address at this sublayer and delivered by this sublayer to a higher sublayer. This object is not supported because MPLS currently does not support multicast.
ifInBroadcastPkts	The number of packets, which were addressed to a broadcast address at this sublayer and delivered by this sublayer to a higher sublayer. This object is not supported because MPLS currently does not support broadcast.
ifOutMulticastPkts	The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sublayer, including those that were discarded or not sent. This object is not supported because MPLS currently does not support multicast.
ifOutBroadcastPkts	The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a broadcast address at this sublayer, including those that were discarded or not sent. This object is not supported because MPLS currently does not support broadcast.
ifHCInOctets	The total number of MPLS-encapsulated octets received on the interface. This object is a 64-bit version of ifInOctets.
ifHCInUcastPkts	The number of MPLS-encapsulated packets received on the underlying physical or virtual interface. This object is a 64-bit version of ifInUcastPkts.

Table 2 ifXTable Objects and Descriptions (continued)

Object	Definition
ifHCInMulticastPkts	The number of packets, which were addressed to a multicast address at this sublayer and delivered by this sublayer to a higher sublayer. This object is not supported because MPLS currently does not support multicast. This object is a 64-bit version of ifInMulticastPkts.
ifHCInBroadcastPkts	The number of packets, which were addressed to a broadcast address at this sublayer and delivered by this sublayer to a higher sublayer. This object is not supported because MPLS currently does not support broadcast. This object is a 64-bit version of ifInBroadcastPkts.
ifHCOutOctets	The total number of MPLS-encapsulated octets transmitted from the interface. This object is a 64-bit version of ifOutOctets.
ifHCOutUcastPkts	The number of MPLS-encapsulated packets transmitted from the underlying physical or virtual interface. This object is a 64-bit version of ifOutUcastPkts.
ifHCOutMulticastPkts	The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sublayer, including those that were discarded or not sent. This object is not supported because MPLS currently does not support multicast. This object is a 64-bit version of ifOutMulticastPkts.
ifHCOutBroadcastPkts	The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a broadcast address at this sublayer, including those that were discarded or not sent. This object is not supported because MPLS currently does not support broadcast. This object is a 64-bit version of ifOutBroadcastPkts.
ifLinkUpDownTrapEnable	Indicates whether LinkUp/LinkDown traps should be generated for this interface. Link up/down traps are not supported in this release; consequently, this object is set to disabled(2) for MPLS.
ifHighSpeed	An estimate of the interface's current bandwidth in units of 1,000,000 bits per second. This object is the same as the underlying physical or virtual interface; however, it has no MPLS-specific value.

Table 2 ifXTable Objects and Descriptions (continued)

Object	Definition
ifPromiscuousMode	Has a value of false(2) if this interface accepts only packets and frames that are addressed to this station; has a value of true(1) when the station accepts all packets and frames transmitted on the media. This object is the same as the underlying physical or virtual interface.
ifConnectorPresent	Has the value true(1) if the interface sublayer has a physical connector and the value false(2) otherwise. For MPLS, the value is always false(2).
ifAlias	Another name for an interface as specified by a network manager. This object is the same as the underlying physical or virtual interface.
ifCounterDiscontinuityTime	The value of sysUpTime on the most recent occasion at which any one or more of this interface's MPLS-specific counters experienced an interruption in incrementing.

ifStackTable Objects

Table 3 lists the ifStackTable objects and their descriptions.

Table 3 ifStackTable Objects and Definitions

Object	Definition
ifStackHigherLayer	The value of ifIndex corresponding to the higher sublayer of the relationship; that is, the sublayer that runs on top of the sublayer identified by the corresponding instance of the ifStackLowerLayer. **Note** Index objects are not accessible in a MIB walk. This value is part of the object identifier (OID) for every object in the ifStackTable.
ifStackLowerLayer	The value of ifIndex corresponding to the lower sublayer of the relationship; that is, the sublayer that runs below the sublayer identified by the corresponding instance of the ifStackHigherLayer. **Note** Index objects are not accessible in a MIB walk. This value is part of the object identifier (OID) for every object in the ifStackTable.
ifStackStatus	Used to create and delete rows in the ifStackTable; status is always active(1) for MPLS.

ifRcvAddressTable Objects

Table 4 lists the ifRcvAddressTable objects and their descriptions.

Note Entries for the MPLS layer do not appear in the ifRcvAddressTable.

Table 4 ifRcvAddressTable Objects and Descriptions

Object	Definition
ifRcvAddressAddress	An address for which the system accepts packets and frames on this entry's interface. **Note** Index objects are not accessible in a MIB walk. This value is part of the object identifier (OID) for every object in the ifRcvAddressTable.
ifRcvAddressStatus	Used to create and delete rows in the ifRcvAddressTable.
ifRcvAddressType	Type of storage used for each entry in the ifRcvAddressTable.

Scalar Objects

The IF MIB supports the following scalar objects:

- ifStackLastChange—The value of sysUpTime at the time of the last change of the entire interface stack. A change of the interface stack is defined to be any creation, deletion, or change in value of any instance of ifStackStatus. If the interface stack has been unchanged since the last reinitialization of the local network management subsystem, then this object contains a zero value.
- ifTableLastChange—The value of sysUpTime at the time of the last creation or deletion of an entry in the ifTable. If the number of entries has been unchanged since the last reinitialization of the local network management subsystem, then this object contains a zero value.

Stacking Relationships for MPLS Layer Interfaces

The ifStackTable within the IF MIB provides a conceptual stacking relationship between the interfaces and subinterfaces represented as entries in the ifTable.

The ifStackTable is indexed like a linked list. Each entry shows a relationship between two interfaces providing the ifIndexes of the upper and the lower interface. The entries chain together to show the entire stacking relationship. Each entry links with one another until the stack terminates with an ifIndex of 0 at the highest and lowest ends of the stack. For example, in Figure 1, the indexes .10.5 show that ifIndex 10 is stacked upon ifIndex 5. There are 0 entries at the highest and lowest ends of the stack; in Figure 1, the indexes .0.15 and 72.0 are the highest and lowest ends of the stack, respectively.

Figure 1 Sample ATM Stacking Relationship in the ifStackTable

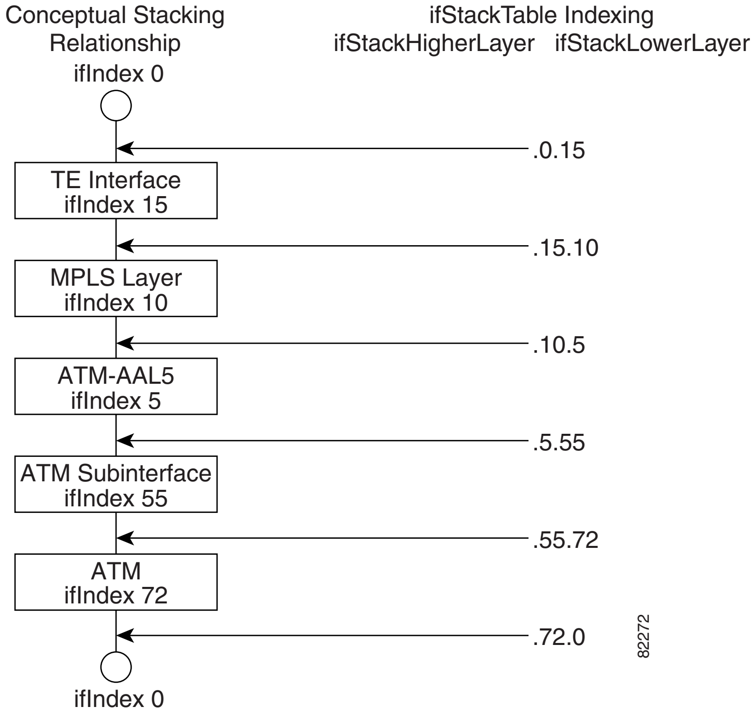


Table 5 describes the indexing of the ifStackTable for the layer relationships shown in Figure 1.

Note The order of the entries in Table 5 may not be the same as that seen in the MIB walk, which has to follow SNMP ordering rules.

Table 5 Layer Relationships

Layer Relationship (in Descending Order)	ifStackHigherLayer/ifStackLowerLayer
TE interface as top layer	.0.15
TE interface stacked upon MPLS layer	.15.10
MPLS layer stacked upon ATM-AAL5	.10.5
ATM-AAL5 layer stacked upon ATM subinterface	.5.55
ATM subinterface stacked upon ATM	.55.72
ATM as bottom layer	.72.0

Stacking Relationships for Traffic Engineering (TE) Tunnels

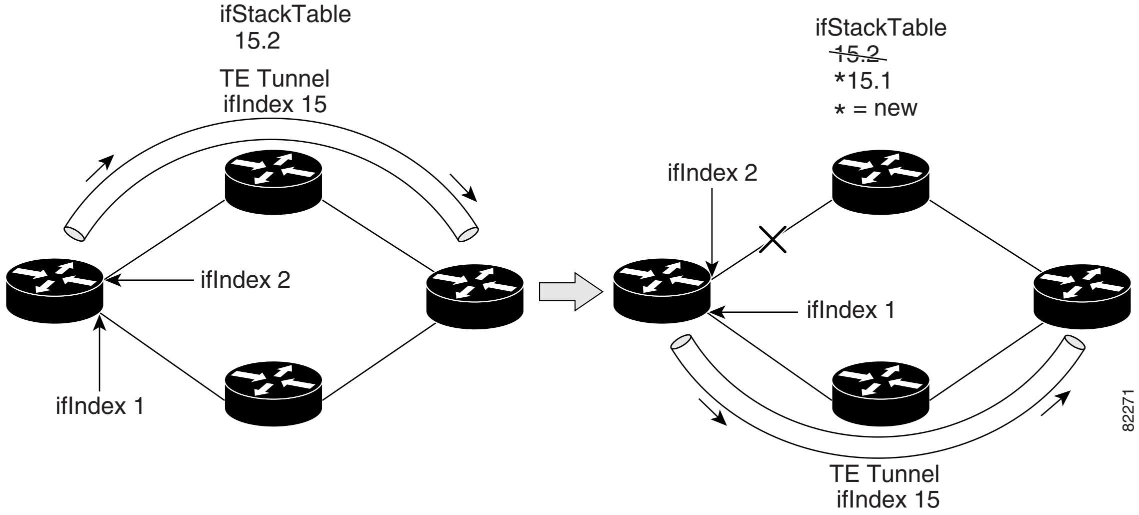
MPLS TE tunnels are represented in Cisco IOS and the IF MIB as virtual interfaces. When properly signaled, TE tunnels pass traffic through MPLS over a physical interface. This process dictates that a TE tunnel is to be stacked on an MPLS layer that is stacked on an underlying interface.

TE tunnels can also change paths in response to different error or network conditions. These changes are instigated by using the RSVP-TE signaling protocol. When a change occurs, a tunnel can switch to a different MPLS interface. If no signaling path exists, no paths will be chosen and thus no MPLS interface will be used.

Because a TE tunnel is represented as an IF MIB ifTable entry, the ifStackTable also contains an entry corresponding to the TE tunnel. If the TE tunnel is successfully signaled, the ifStackTable also contains a link between the tunnel interface as well as one MPLS interface. Note that because it is possible for a TE tunnel to not have a corresponding signaled path, it is thus possible for a TE tunnel's ifStackTable entry to not have a corresponding lower layer. In this case, the lower layer variable contains the value of 0.

Figure 2 shows a TE tunnel before (left) and after (right) being rerouted and the affect on the ifStackTable. When ifIndex 2 fails, the TE tunnel is rerouted through ifIndex1, the 15.2 entry is removed from the ifStackTable, and the 15.1 entry is added.

Figure 2 Sample TE Tunnel Stacking Relationship



MPLS Label Switching Router MIB Enhancements

All of the ifIndex references in the MPLS-LSR-MIB tables have changed from the ifIndex of the underlying physical or virtual interface to the ifIndex of the MPLS layer.

Table 6 shows the specific changes.

Table 6 MPLS-LSR-MIB ifIndex Objects Enhanced

Table	ifIndex
MPLS interface configuration table (mplsInterfaceConfTable)	mplsInterfaceConfIndex
MPLS in-segment table (mplsInSegmentTable)	mplsInSegmentIfIndex
MPLS cross-connect table (mplsXCTable)	mplsInSegmentIfIndex
MPLS out-segment table (mplsOutSegmentTable)	mplsOutSegmentIfIndex

The following objects from the mplsInterfaceConfTable are affected:

- mplsInterfaceOutPackets—Count only MPLS-encapsulated packets
- mplsInterfaceInPackets—Count only MPLS-encapsulated packets

Benefits

Improved Accounting Capability

By viewing the MPLS layer, you get MPLS-encapsulated traffic counters that do not include non-MPLS encapsulated traffic (for example, IP packets). Therefore, the counters are more useful for MPLS-related statistics.

TE Tunnel Interfaces

For TE tunnel interfaces, the stacking relationship reflects the current underlying MPLS interface that is in use and dynamically changes as TE tunnels reoptimize and reroute.

MPLS-Specific Information

The MPLS layer shows MPLS-specific information including the following:

- If MPLS is enabled
- MPLS counters
- MPLS MTU
- MPLS operational status

Restrictions

- Link up and link down traps for the MPLS layer are not supported in this release.
- Write capability using the SNMP SET command is not supported for the MPLS layer in this release.
- Some counters, including discard and multicast, increment on the underlying physical layer; therefore, they equal 0 because they never reach the MPLS layer.

Related Documents

Cisco Documentation

For information on configuring SNMP using Cisco IOS software, see the following documents:

- *Cisco IOS Release 12.0 Configuration Fundamentals Configuration Guide*
- *Cisco IOS Release 12.0 Configuration Fundamentals Command Reference*
- *MPLS Label Switching Router MIB,* Cisco IOS Release 12.0(14)ST feature module

Other Documentation

- "*Multiprotocol Label Switching (MPLS) Label Switch Router (LSR) Management Information Base*," Internet draft, January 2002 [draft-ietf-mpls-lsr-mib-08.txt]; Srinivasan, C., Viswanathan, A., and Nadeau, T.D.

For information on using SNMP MIB features, see the appropriate documentation for your network management system.

Supported Platforms

- Cisco 7200 series
- Cisco 7500 series
- Cisco 12000 series

Determining Platform Support Through Cisco Feature Navigator

Cisco IOS software is packaged in feature sets that are supported on 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 found at this URL:

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

Interfaces Group MIB (IF MIB)

To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:

http://tools.cisco.com/ITDIT/MIBS/servlet/index

If Cisco MIB Locator does not support the MIB information that you need, you can also obtain a list of supported MIBs and download MIBs from the Cisco MIBs page at the following URL:

http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

To access Cisco MIB Locator, 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 found at this URL:

http://www.cisco.com/register

RFCs

- RFC 2233, *The Interfaces Group MIB using SMIv2*
- RFC 1229, *Extensions to the Generic-Interface MIB*
- RFC 1213, *Management Information Base for Network Management of TCP/IP-based internets: MIB-II*
- RFC 1157, *A Simple Network Management Protocol (SNMP)*
- RFC 1156, *Management Information Base for Network Management of TCP/IP-based internets*

Prerequisites

The MPLS Enhancements to Interfaces MIB feature requires the following:

- SNMP installed and enabled on the label switching routers (LSRs)
- MPLS enabled on the LSRs
- MPLS IP enabled on an interface or an MPLS TE tunnel enabled on an interface

Configuration Tasks

See the following sections for configuration tasks for the MPLS Enhancements to Interfaces MIB feature. Each task in the list is identified as either optional or required.

- Enabling the SNMP Agent (required)
- Verifying That the SNMP Agent Has Been Enabled (optional)

Enabling the SNMP Agent

The SNMP agent for the IF MIB is disabled by default. To enable the SNMP agent, perform the following steps:

:

	Command	Purpose
Step 1	`Prompt#` **`telnet xxx.xxx.xxx.xxx`**	Accesses the router identified by the specified IP address (represented by *xxx.xxx.xxx.xxx*) through a Telnet session.
Step 2	`Router#` **`enable`**	Enters privileged mode.

	Command	Purpose
Step 3	`Router# show running-configuration`	Displays the running configuration so that you can determine if an SNMP agent is already running. If no SNMP information is displayed, continue with the steps below. If any SNMP commands are listed, you can modify them or leave them as they are.
Step 4	`Router# configure terminal`	Enters configuration mode.
Step 5	`Router(config)# snmp-server community xxxxxx RO`	Enables the read-only community string, where *xxxxxx* is the read-only community string.
Step 6	`Router(config)# exit`	Exits configuration mode and returns to the main prompt.
Step 7	`Router# write memory`	Writes the modified configuration to nonvolatile memory (NVRAM) so that the settings stay permanently.

Verifying That the SNMP Agent Has Been Enabled

To verify that the SNMP agent has been enabled, perform the following steps:

Step 1 Access the router through a Telnet session:

```
Prompt# telnet xxx.xxx.xxx.xxx
```

where *xxx.xxx.xxx.xxx* represents the IP address of the target device.

Step 2 Enter privileged mode:

```
Router# enable
```

Step 3 Display the running configuration and look for SNMP information:

```
Router# show running-configuration
...
...
snmp-server community public RO
```

If you see any snmp-server statements, SNMP has been enabled on the router.

Configuration Examples

The following example shows how to enable an SNMP agent:

```
Router# configure terminal

Router(config)# snmp-server community
```

In the following example, SNMPv1 and SNMPv2C are enabled. The configuration permits any SNMP manager to access all objects with read-only permissions using the community string public.

```
Router(config)# snmp-server community public
```

In the following example, read-only access is allowed for all objects to members of access list 4 that specify the comaccess community string. No other SNMP managers have access to any objects.

```
Router(config)# snmp-server community comaccess ro 4
```

Command Reference

This section documents new or modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.0, 12.1, and 12.2 command reference publications.

- snmp-server community

snmp-server community

To configure read-only or read/write Simple Network Management Protocol (SNMP) community strings, use the **snmp-server community** command in global configuration mode. To change the community string to its default value, use the **no** form of this command.

snmp-server community *string* [**view** *view-name*] [**ro** | **rw**] [*number*]

no snmp-server community *string*

Syntax Description

string	Community string of 1 to 32 alphanumeric characters. The community string acts like a password and permits access to the SNMP protocol. No blank character spaces are allowed.
view *view-name*	(Optional) Name of a previously defined view. The view defines the objects available to the community.
ro	(Optional) Configures read-only access. Authorized management stations can only retrieve MIB objects.
rw	(Optional) Configures read/write access. Authorized management stations can retrieve and modify MIB objects.
number	(Optional) Integer from 1 to 99 that specifies an access list of IP addresses that are allowed to use the community string to gain access to the SNMPv1 agent.

Defaults

The default value of the read/write parameter is read-only (**ro**). The default value of the read-only community string is public, and the default value of the read/write community string is private.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.
12.0(14)ST	This command was integrated into Cisco IOS Release 12.0(14)ST.
12.2(2)T	This command was integrated into Cisco IOS Release 12.2(2)T.
12.0(23)S	This command was integrated into Cisco IOS Release 12.0(23)S.

Usage Guidelines

The **no snmp-server** command disables both versions of SNMP (SNMPv1 and SNMPv2).

The first **snmp-server** command that you enter enables both versions of SNMP.

Examples

In this example, the read/write community string is set to newstring:

```
Router(config)# snmp-server community newstring rw
```

In the following example, the string comaccess is assigned to SNMPv1, allowing read-only access. IP access list 4 is enabled to use the community string:

```
Router(config)# snmp-server community comaccess ro 4
```

In the following example, the string mgr is assigned to SNMPv1, allowing read/write access to the objects in the restricted view:

```
Router(config)# snmp-server community mgr view restricted rw
```

In the following example, the community comaccess is removed:

```
Router(config)# no snmp-server community comaccess
```

In the following example, both versions of SNMP are disabled:

```
Router(config)# no snmp-server
```

Related Commands

Command	Description
snmp-server enable traps	Enables the router to send SNMP traps.
snmp-server host	Specifies the recipient of an SNMP trap operation.

Glossary

Asynchronous Transfer Mode—See ATM.

ATM—Asynchronous Transfer Mode. The international standard for cell relay in which multiple service types (such as voice, video, or data) are conveyed in fixed-length (53-byte) cells. Fixed-length cells allow cell processing to occur in hardware, thereby reducing transit delays. ATM is designed to take advantage of high-speed transmission media, such as E3, SONET, and T3.

ATM adaptation layer—See ATM-AAL5**.**

ATM-AAL5—ATM adaptation layer 5. One of four AALs recommended by the ITU-T. AAL5 supports connection-oriented variable bit rate (VBR) services and is used predominantly for the transfer of classical IP over ATM and LAN emulation (LANE) traffic. AAL5 uses simple and efficient AAL (SEAL) and is the least complex of the current AAL recommendations. It offers low bandwidth overhead and simpler processing requirements in exchange for reduced bandwidth capacity and error-recovery capability.

encapsulation—Wrapping of data in a particular protocol header. For example, Ethernet data is wrapped in a specific Ethernet header before network transit. Also, when bridging dissimilar networks, the entire frame from one network is simply placed in the header used by the data link layer protocol of the other network.

IETF—Internet Engineering Task Force. A task force (consisting of more than 80 working groups) that is developing standards for the Internet and the IP suite of protocols.

interface—The boundary between adjacent layers of the ISO model.

Internet Engineering Task Force—See IETF.

label—A short, fixed-length identifier that is used to determine the forwarding of a packet.

label switching—A term used to describe the forwarding of IP (or other network layer) packets using a label swapping algorithm based on network layer routing algorithms. The forwarding of these packets uses the exact match algorithm and rewrites the label.

label switching router—See LSR.

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

Management Information Base—See MIB.

maximum transmission unit—See MTU.

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

MPLS—Multiprotocol Label Switching. MPLS is a method for forwarding packets (frames) through a network. It enables routers at the edge of a network to apply labels to packets (frames). ATM switches or existing routers in the network core can switch packets according to the labels with minimal lookup overhead.

MPLS interface—An interface on which MPLS traffic is enabled.

MTU—Maximum transmission unit. Maximum packet size, in bytes, that a particular interface can handle.

Multiprotocol Label Switching—See MPLS.

network management system—See NMS.

NMS—Network management system. System responsible for managing at least part of a network. An NMS is generally a reasonably powerful and well-equipped computer, such as an engineering workstation. NMSs communicate with agents to help keep track of network statistics and resources.

Object identifier—See OID.

OID—Object identifier. Values are defined in specific MIB modules. The Event MIB allows you or an NMS to watch over specified objects and to set event triggers based on existence, threshold, and Boolean tests. An event occurs when a trigger is fired; this means that a specified test on an object returns a value of true. To create a trigger, you or an NMS configures a trigger entry in the mteTriggerTable of the Event MIB. This trigger entry specifies the OID of the object to be watched. For each trigger entry type, corresponding tables (existence, threshold, and Boolean tables) are populated with the information required for carrying out the test. The MIB can be configured so that when triggers are activated (fired) either an SNMP Set is performed, a notification is sent out to the interested host, or both.

Simple Network Management Protocol—See SNMP.

SNMP—Simple Network Management Protocol. Management protocol used almost exclusively in TCP/IP networks. SNMP provides a means for monitoring and controlling network devices, and for managing configurations, statistics collection, performance, and security.

traffic engineering tunnel—A label-switched tunnel that is used for traffic engineering. Such a tunnel is set up through means other than normal Layer 3 routing; it is used to direct traffic over a path different from the one that Layer 3 routing could cause the tunnel to take.

trap—A message sent by an SNMP agent to a network management station, console, or terminal, indicating that a significant event occurred. Traps are less reliable than notification requests, because the receiver does not send an acknowledgment when it receives a trap. The sender cannot determine if the trap was received.

tunnel—A secure communication path between two peers, such as routers.