



SNMP for Stateful Switchover

Feature History

Release	Modification
12.0(22)S	This feature was introduced.
12.2(18)S	SSO support was provided for several SNMP MIBs.
12.0(26)S	This feature was integrated into Cisco IOS Release 12.0(26)S.

This document describes the enhancements and modifications made to the Cisco IOS Simple Network Management Protocol (SNMP) infrastructure in order to support stateful switchover (SSO) for Route Processors (RPs). It includes the following sections:

- [Feature Overview, page 1](#)
- [Supported Platforms, page 6](#)
- [Supported Standards, MIBs, and RFCs, page 6](#)
- [Prerequisites, page 7](#)
- [Configuration Tasks, page 7](#)
- [Command Reference, page 8](#)

Feature Overview

The SNMP and stateful switchover feature helps to improve the availability of networks made up of Cisco IOS-based networking devices. Using SSO, a networking device with redundant RPs will continue forwarding traffic, continue operating as a routing protocol peer, and remain manageable under a set of circumstances that ordinarily would cause an interruption in service.

The SSO feature allows one of the processors on the networking device to operate as the active RP, which passes the necessary system, routing, and application state information to the standby RP. Upon switchover, the standby RP quickly assumes the role of active RP. The goal of SNMP network management with SSO functionality is to provide an uninterrupted management interface to the end user during and after a switchover. For more information about the SSO feature, see the [Related Documents](#) section.



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Network Management for SSO

Network management support for SSO is provided through the synchronization of specific SNMP data between the active and standby RPs. From a network management perspective, this synchronization helps to provide an uninterrupted management interface to the network administrator.

**Note**

Synchronization of SNMP data between RPs is available only when the networking device is operating in SSO mode.

Network management services for SSO address a number of issues, which are described in the following sections:

- [Uninterrupted Service, page 2](#)
- [Communication with the NMS, page 2](#)
- [SSO MIB Support, page 3](#)

Uninterrupted Service

When a networking device uses SSO, the network management engine of the standby RP should be indistinguishable from the network management engine of the active RP. A network management system (NMS) should not interpret a switchover to mean that a new device has come up.

The sysUpTime MIB object reports the system uptime. To prevent a switchover from being flagged as a restart, this object is synchronized between the active and the standby RPs. As a result, no coldStart or warmStart traps will be generated as a result of the switchover—the ciscoRFSwactNotif notification is used to signal a switchover.

Communication with the NMS

The following sections describe concepts about communication with the NMS:

- [Counters and Statistics, page 2](#)
- [Switchover Notification, page 3](#)
- [Traps, page 3](#)

Counters and Statistics

The various counters and statistics maintained in the RP are not synchronized because they may change often and the degree of synchronization they require is substantial. They also are not critical to the system operation. Because of this lack of synchronization, counter objects experience a discontinuity after a switchover. The cRFStatusFailoverTime will be the value of sysUpTime when any one or more of the counters experiences a discontinuity.

Switchover Notification

The `ciscoRFSwactNotif` notification informs the NMS about a switchover. This notification provides information regarding the unit ID of the originator of the notification, the newly active redundant unit, the `sysUptime` data, and reason codes for why a switchover has occurred. The NMS can then use the `ciscoRFSwactNotif` notification to resynchronize the counter statistics values, if necessary. For more information, see the “[CISCO-RF-MIB Support](#)” section.

Traps

Only notifications generated on the active RP are sent to the notification destination. None of the notifications generated on the standby RP are sent to the notification destination. Furthermore, notifications might be lost if they were generated on the active RP before a switchover. The NMS should be aware of these constraints.

SSO MIB Support

This section describes the level of synchronization supported by the MIBs Cisco IOS release 12.0(22)S. MIBs that are not listed in this section do not synchronize data between the redundant units. MIB synchronization for SSO only occurs when the system is in SSO mode.

SSO MIB support has three parts:

- [SNMP Configuration MIBs, page 3](#)
- [Core MIBs, page 3](#)
- [Infrastructure MIBs, page 4](#)
- [CISCO-RF-MIB Support, page 4](#)

SNMP Configuration MIBs

All the objects in the following MIBs that contain SNMP configuration data are synchronized between the active and standby RPs:

- SNMP-FRAMEWORK-MIB
- SNMP-TARGET-MIB
- SNMP-USM-MIB
- SNMP-VACM-MIB
- SNMPv2-MIB

Core MIBs

Core MIBs are as follows:

- ENTITY-MIB—After a switchover, there will be no change in the data reported by the ENTITY-MIB object. This lack of change is result of the `entPhysicalIndex` and its associated objects being synchronized between the active and the standby RPs. The associated objects of the `entPhysicalIndex` are as follows:
 - `entPhysicalAlias`
 - `entPhysicalSerialNum`

- entPhysicalAssetID
- entLastChangeTime
- IF-MIB—The ifIndex is synchronized between the active and standby RPs, along with the ifNumber, ifTableLastChange, ifAdminStatus, ifLinkUpDownTrapEnable, ifAlias, ifLastChange, and ifStackLastChange objects.

Infrastructure MIBs

Infrastructure MIBs are as follows:

- Community MIB
- Notification MIB
- Notification log MIB
- Field-replaceable unit (FRU) control MIB
- CISCO-ENHANCED-MEMPOOL-MIB

CISCO-RF-MIB Support

The CISCO-RF-MIB provides configuration control and status for the redundancy facility (RF) subsystem. The CISCO-RF-MIB has been modified to support SSO functionality. A new cRFHistory subgroup has been added in this release. The subgroup consists of one table (cRFHistorySwitchOverTable) and three objects (cRFHistoryTableMaxLength, cRFHistoryColdStarts, and cRFHistoryStandbyAvailTime), as follows:

- The cRFHistorySwitchOverTable has been added. This new table tracks the history of switchovers that have occurred since system initialization. New objects that have been added as part of this table are as follows:
 - cRFHistoryPrevActiveUnitId—A read-only object that indicates the active RP that went down. The value of this object is the unique ID of the active RP that has gone down. The ID can be the slot ID, the physical or logical entity ID, or a unique ID assigned by the RF.
 - cRFHistoryCurrActiveUnitId—A read-only object that indicates the standby RP that took over as the active RP. The value of this object is the unique ID of the active RP. The ID can be the slot ID, the physical or logical entity ID, or a unique ID assigned by the RF.
 - cRFHistorySwitchOverReason—A read-only object that indicates the reason for the switchover. The reasons for the switchover from the active RP to the standby RP can be any of the following:
 - unsupported—This feature is unsupported.
 - none—No switchover has occurred.
 - notKnown—The reason is unknown.
 - userInitiated—A safe, manual switchover was initiated by the user.
 - userForced—A manual switchover was forced by the user. Preconditions, warnings, and safety checks were ignored.
 - activeUnitFailed—An active RP fault caused an automatic switchover.
 - activeUnitRemoved—The active RP was removed, which caused an automatic switchover.

- `cRFHistorySwactTime`—A read-only object that indicates the date and time the switchover occurred. The value of this object is a time stamp with the date and time the switchover occurred.
- `cRFHistoryTableMaxLength`—A read-write object that indicates the maximum number of entries permissible in the history table. The value of this object is an integer that is more than 0. A value of 0 results in no history being maintained.
- `cRFHistoryColdStarts`—A read-only object that indicates the number of system cold starts including the number of system cold starts due to switchover fault and the number of manual restarts.
- `cRFHistoryStandByAvailTime`—A read-only object that indicates the cumulative time that a standby redundant unit has been available since the last system initialization.

Two objects related to switchover status have been added:

- `cRFStatusFailoverTime`—A read-only object that indicates the `sysUpTime` value when the primary redundant unit took over as active. The value of this object is 0 until the first switchover.
- `cRFStatusPeerStandByEntryTime`—A read-only object that indicates the `sysUpTime` value when the peer redundant unit entered the `standbyHot` state. The value of this object is 0 on system initialization.

Benefits

SNMP network management with SSO functionality ensures an uninterrupted management interface to the end user. The network administrator can differentiate a switchover from a system restart based on the notification type (for example, `ciscoRFSwactNotif` for switchover and `coldStart` or `warmStart` for system restarts). Uninterrupted service also includes synchronizing the SNMP configuration and data from core MIBs such as IF-MIB and ENTITY-MIB to the standby RP.

Restrictions

Counter and Statistics

Statistics and counter values will not be synchronized from the active to the standby RP.

MIB Limitations

No MIBs other than the ones mentioned in the “MIB Support” section are synchronized between the active and the standby RPs.

Possible Failure of SNMP Requests

SNMP requests might fail during the switchover process, that is, while the standby RP is taking over as the active RP. Data in the unsynchronized MIBs may be out of synchronization, and the information in these MIBs might be lost on a switchover.

Related Documents

- *Stateful Switchover for the Cisco 7500 Series Routers*, Cisco IOS Release 12.0(22)S feature module
- *Stateful Switchover for the Cisco 10000 Series Routers*, Cisco IOS Release 12.0(22)S feature module

- *Stateful Switchover for the Cisco 12000 Series Routers*, Cisco IOS Release 12.0(22)S feature module
- The “Configuring SNMP Support” chapter of *Cisco IOS Configuration Fundamentals Configuration Guide*, Release 12.2
- The “SNMP Commands” chapter of *Cisco IOS Configuration Fundamentals Command Reference*, Release 12.2

Supported Platforms

Determining Platform Support Through Cisco Feature Navigator

Cisco IOS software is packaged in feature sets that are supported on specific platforms. To obtain updated information about 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. In the release section, you can compare releases side by side to display both the features unique to each software release and the features that releases have 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.

For further information on supported platforms for IPv6, refer to Product Bulletin No. 1975:

http://www.cisco.com/warp/public/cc/pd/rt/2600/prodlit/1975_pp.htm

Supported Standards, MIBs, and RFCs

Standards

No new or modified standards are supported by this feature.

MIBs

The following MIBs are supported with SSO in regard to state maintenance across a switchover:

- CISCO-RF-MIB—This MIB has been modified for this release. The MIB contains several new MIB objects.
- ENTITY-MIB
- IF-MIB
- SNMP-FRAMEWORK-MIB
- SNMP-TARGET-MIB
- SNMP-USM-MIB
- SNMP-VACM-MIB
- SNMPv2-MIB

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

- RFC 1907, *Management Information Base for Version 2 of the Simple Network Management Protocol*
- RFC 2233, *The Interfaces Group MIB Using SMIV2*
- RFC 2571, *An Architecture for Describing SNMP Management Frameworks*
- RFC 2573, *SNMP Applications*
- RFC 2574, *User-Based Security Model (USM) for Version 3 of the Simple Network Management Protocol (SNMPv3)*
- RFC 2575, *View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)*
- RFC 2737, *Entity MIB*

Prerequisites

The router must be in SSO mode.

Configuration Tasks

To configure the router to run in SSO mode, refer to the documents listed in the “Related Documents” section for your specific platform. For further information on configuring SNMP support, refer to the “Configuring SNMP Support” chapter of *Cisco IOS Configuration Fundamentals Configuration Guide*, Release 12.2.

Verifying SSO

To verify that the router is running in SSO mode, refer to the documents listed in the “Related Documents” section for your specific platform.

Troubleshooting Tips

- Use the **show redundancy switchover history** command to see the switchover history.
- Use the **debug snmp sync** command to debug SNMP synchronization and faults in synchronization.

Configuration Examples

For SSO configuration examples, refer to the documents listed in the “Related Documents” section for your specific platform.

Command Reference

This section documents modified commands. All other commands used with this feature are documented in the Cisco IOS high availability stateful switchover publications for various releases.

- [debug snmp sync](#)
- [show redundancy](#)
- [show redundancy](#)

debug snmp sync

To debug Simple Network Management Protocol (SNMP) synchronization and faults in synchronization, use the **debug snmp sync** command in privileged EXEC mode. To disable the display of debugging output, use the **no** form of this command.

debug snmp sync

no debug snmp sync

Syntax Description This command has no arguments or keywords.

Defaults Disabled

Command Modes Privileged EXEC

Command History	Release	Modification
	12.0(22)S	This command was introduced.
	12.2(18)S	The command was integrated into Cisco IOS Release 12.2(18)S.
	12.0(26)S	This command was integrated into Cisco IOS Release 12.0(26)S.

Usage Guidelines The **debug snmp sync** command can be used to debug SNMP synchronization and faults in synchronization. The standby Route Processor (RP) may sometimes reset as a result of synchronization faults. If the fault occurs when SNMP activities such as SNMP sets are in progress, enter the **debug snmp sync** command to identify whether a synchronization fault caused the reset.

SNMP synchronizations (dynamic and bulk) are performed only if the router is configured to be in stateful switchover (SSO) mode.

Examples The following example enables debugging of SNMP synchronization activity:

```
router> debug snmp sync
```

Related Commands	Command	Description
	debug snmp packets	Displays information about every SNMP packet sent or received by the networking device.
	mode	Configures the redundancy mode of operation.

show redundancy

To display the current redundancy mode, use the **show redundancy** command in privileged EXEC mode.

show redundancy [**clients** | **counters** | **history** | **states** | **switchover**]

Cisco 12000 Series Internet Routers

show redundancy [**all** | **arbitration** | **clients** | **counters** | **history** | **negotiation** | **switchover** | **standby-cpu** | **states** | **trace** | **trace all**]

Syntax Description

all	(Optional) Displays all of the redundancy mode output.
arbitration	(Optional) Displays details of the Redundancy Facility (RF) arbitration scheme.
clients	(Optional) Displays the RF client list
counters	(Optional) Displays the RF operational counters.
history	(Optional) Displays the RF history.
negotiation	(Optional) Displays details of the RF negotiation.
standby-cpu	(Optional) Displays details of the current standby device.
states	(Optional) Displays the RF states.
switchover	(Optional) Displays switchover history information.
trace	(Optional) Displays a trace of the main events for the redundancy finite state machine.
trace all	(Optional) Displays all basic and latest event traces.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.2 GS	This command was introduced.
12.0(16)ST	This command was modified to show information on Route Processor Redundancy (RPR).
12.0(22)S	This command was modified to add the switchover keyword on Cisco 12000, 10000, and 7500 series Internet routers.
12.2(18)S	The command was integrated into Cisco IOS Release 12.2(18)S.
12.0(26)S	This command was integrated into Cisco IOS Release 12.0(26)S.

Usage Guidelines

Use this command to display the redundancy of a Cisco IOS series Internet routers.

Examples

The following example shows redundancy switchover history information:

```
router# show redundancy switchover history
```

```

Index      Prev Active      Curr Active      Swact Reason      Swact Time
1          1                0                unsupported        8:03:52 UTC Thu
Nov 29 2001
2          0                1                unsupported        08:07:00 UTC Thu
Nov 29 2001

```

Table 1 describes the significant fields shown in the display.

Table 1 *show redundancy Field Descriptions*

Field	Description
Prev Active	Slot number of the previously active unit.
Curr Active	Slot number of the currently active unit.
Swact Reason	Reason for the switchover.
Swact Time	The date and time the switchover occurred.

Related Commands

Command	Description
clear redundancy history	Clears the redundancy event history log.
mode	Configures the redundancy mode of operation.
redundancy	Enters redundancy mode.
redundancy force-switchover	Switches control of a router from the active to the standby RP.

■ show redundancy