# Spatial Reuse Protocol Feature Guide

**Last Updated: November 23, 2007**

This feature guide describes how to configure the Spatial Reuse Protocol (SRP) on supported Cisco Dynamic Packet Transport (DPT) line cards and includes information about the benefits of the feature, supported platforms, related publications, and so on. SRP is the underlying technology used in the Cisco DPT family of products.

**Note** This document was previously called the *Dynamic Packet Transport Feature Guide*.

**Feature History**

| Release | Modification |
|---|---|
| 12.0(6)S | This feature was introduced. |
| 12.0(11)S | Support was added for the 1-Port OC-48c/STM-16c DPT line card.<br>The following commands were introduced:<br>**show srp rate-limit**<br>**srp ips sonet threshold**<br>**srp TX-traffic-rate** |
| 12.0(12)S | The **srp ips sonet protected** command was introduced. |
| 12.0(20)SP | The **show srp transit** command was introduced. |
| 12.0(21)SP | The **show srp failure** command was introduced in Cisco 10720 Internet Routers. |
| 12.0(22)S | The **show srp failure** command was introduced in Cisco 12000 Series Internet Routers. |
| 12.0(23)S | Support was added for the 4-Port OC-48c/STM-16c DPT and the 1-Port OC-192c/STM-64c DPT line cards, and the 2-Port OC-48c/STM-16c POS/DPT uplink card. |
| 12.0(24)S | Support was added for the 4-Port OC-12c/STM-4c DPT ISE line card. |

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| Release | Modification |
|---|---|
| 12.0(26)S | Optical power values are displayed in **show controllers srp** command output for the following line cards:<br>• 4-Port OC-12c/STM-4c DPT ISE<br>• 4-Port OC-48c/STM-16c DPT<br>• 1-Port OC-192c/STM-64c DPT |
| 12.0(27)S | The **srp priority-map transmit** command was enhanced so that you can configure all IP packets on an SRP interface to be queued in the low-priority transmit and transit queues on the following line cards:<br>• 2-Port OC-12c/STM-4c DPT<br>• 1-Port OC-48c/STM-16c DPT<br>• 2-Port OC-48c/STM-16c SRP uplink module<br>• 4-Port OC-48c/STM-16c DPT<br>• 1-Port OC-192c/STM-64c DPT<br>Support was added for the SRP - Layer 3 Fast Notification feature and the **srp fast-convergence** and **debug srp fast-convergence** commands were introduced on Cisco 10700 Series and Cisco 12000 Series Internet Routers. |
| 12.0(30)S | Support for the optional **transceiver** keyword was added to the **show controllers srp** command. |
| 12.0(32)SY | Support was added for SRP on the 2-port OC48/STM16 POS/RPR SPA, the 1-port OC192/STM64 POS/RPR SPA with VSR optics, the 1-port OC192/STM64 POS/RPR with SMLR optics, and the single-height 1-port OC192/STM64 POS/RPR with XFP optics on Cisco 12000 Series Internet Routers. |

**Note** Software images for Cisco 12000 Series Internet Routers have been deferred to Cisco IOS Release 12.0(27)S1.

This document covers the use of the SRP feature. It does not include hardware installation and initial configuration information. Refer to the appropriate line card installation and configuration note for information on how to configure the hardware and prepare it for use with SRP.

This document includes the following sections:

# Feature Overview

The Spatial Reuse Protocol (SRP) is a Cisco-developed MAC-layer protocol, used in conjunction with Cisco's DPT product family. DPT products deliver scalable Internet service, reliable IP-aware optical transport, and simplified network operations. These solutions allow you to scale and distribute your IP services across a reliable optical packet ring infrastructure.

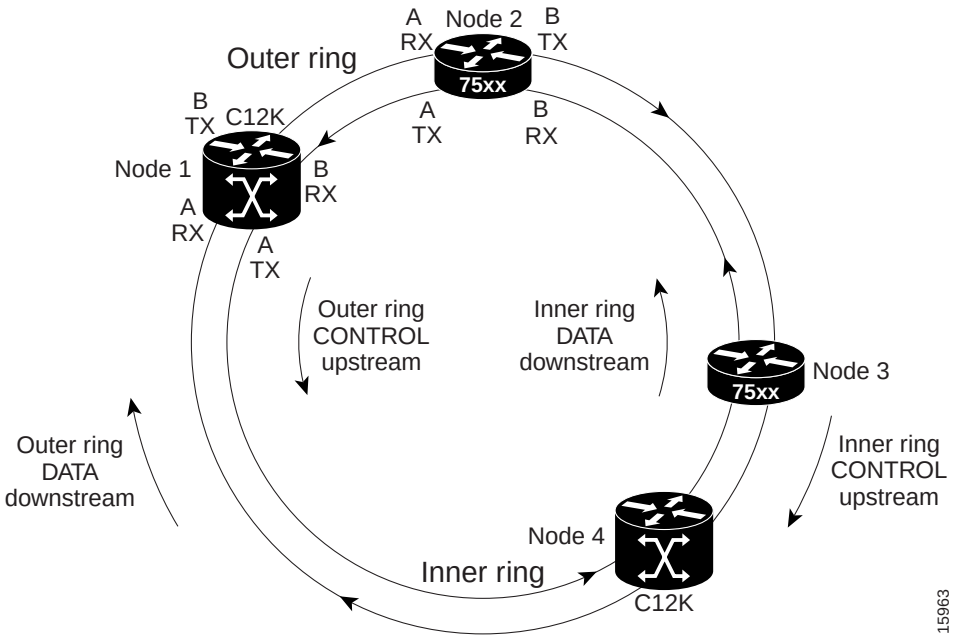
**Note** Throughout the remainder of this publication, the term SRP is used to describe features related to the DPT product family.

Spatial bandwidth reuse is possible due to the packet destination-stripping property of SRP. Older technologies incorporate source stripping, where packets traverse the entire ring until they are removed by the source. Even if the source and destination nodes are next to each other on the ring, packets continue to traverse the entire ring until they return to the source to be removed. SRP provides more efficient use of available bandwidth by having the destination node remove the packet after it is read. This provides more bandwidth for other nodes on the SRP ring.

SRP rings consists of two counterrotating fibers, known as outer and inner rings, both concurrently used to carry data and control packets. SRP uses both explicit control packets and control information piggybacked inside data packets (control packets handle tasks such as keepalives, protection switching, and bandwidth control propagation). Control packets propagate in the opposite direction from the corresponding data packets, ensuring that the data takes the shortest path to its destination. The use of dual fiber-optic rings provides a high level of packet survivability. In the event of a failed node or a fiber cut, data is transmitted over the alternate ring.

SRP rings are media independent and can operate over a variety of underlying technologies, including SONET/SDH, wavelength division multiplexing (WDM), and dark fiber. This ability to run SRP rings over any embedded fiber transport infrastructure provides a path to packet-optimized transport for high-bandwidth IP networks. Figure 1 shows an SRP ring created with OC-12c/STM-4c DPT line cards installed in a Cisco 12000 Series Internet Router and a Cisco 7500 series Router.

*Figure 1 SRP Ring Example*




To distinguish between the two rings, one is referred to as the “inner” ring and the other as the “outer” ring. SRP operates by sending data packets in one direction (downstream) and sending the corresponding control packets in the opposite direction (upstream) on the other fiber. This allows SRP to use both fibers concurrently to maximize bandwidth for packet transport and to accelerate control signal propagation for adaptive bandwidth utilization and for self-healing purposes.

As shown in Figure 1, an SRP node uses SRP side A to receive (RX) outer ring data and transmit (TX) inner ring data. The node uses SRP side B to receive (RX) inner ring data and transmit (TX) outer ring data. Side A on one node connects to Side B on an adjacent SRP node.

# Feature Benefits

- Substantially lower costs by eliminating a layer of SONET/SDH equipment.
- Bandwidth scalability and efficiency with growth opportunities from OC-12c/STM-4c rings up to OC-192c/STM-64c rings.
- Intelligent Protection Switching (IPS) for IP self-healing and restoration and for performance monitoring after a link or node failure.
- Fiber infrastructure flexibility and transparent service extension with port adapters that offer multimode, single-mode intermediate-reach, or single-mode long-reach optics.
- Flexibility to serve as a common technology base for multiple network applications.
- Multiple transport infrastructures that can run over dark fiber, SONET/SDH, WDM, or mixed environments, providing both compatibility with existing equipment and a migration path to handle future growth.
- Enhanced revenue services, including support for multicasting and delay- and jitter-sensitive applications such as voice over IP (VoIP) and video over IP.

- Plug-and-play operations that avoid the extensive configuration and station management requirements of SONET/SDH Fiber Distributed Data Interface (FDDI) rings via automatic procedures such as topology discovery and IPSec.
- Extensive management information via the SONET/SDH Management Information Base (MIB) and MAC-layer source counters for network management and ring traffic engineering.
- Network management integration that eliminates architectures that require two separate network management systems, one for the routers and one for the transport equipment.

# Related Features and Technologies

The Single Ring Recovery (SRR) protocol, an extension that offers additional features to SRP, is also available. For information about how to configure and use the SRR protocol, refer to the *Single Ring Recovery Protocol* publication at http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s16/srr.htm.

# Related Publications

The following is a list of publications that relate to the SRP feature:

- *Cisco 7200 Series Routers Documentation Master Index*

  This web site provides access to the Installation and Configuration guides used with Cisco 7200 Series Internet Routers.

- *Cisco 7500 Series Router Installation and Configuration Guide*

  This document describes the initial hardware installation and procedures for performing the basic system configuration of a Cisco 7500 series router.

- *Cisco 7600 Series Router Hardware Documentation*

  This web site provides access to the Installation and Configuration guides used with Cisco 7600 Series Internet Routers.

- *Cisco IOS Software Documentation for the Cisco 7600 Series Router*

  This web site provides access to the Software Configuration guides used with Cisco 7600 Series Internet Routers.

- *Cisco 10720 Internet Router Installation and Configuration Guide*

  This guide provides hardware installation and basic configuration procedures for the Cisco 10720 Internet Router.

- *Cisco IOS Software Configuration for the Cisco 10720 Internet Router*

  This guide provides hardware installation and basic configuration procedures for the Cisco 10720 Internet Router.

- *Cisco 12000 Series Internet Routers*

  This web site provides access to the Installation and Configuration guides used with Cisco 12000 Series Internet Routers.

- *Dynamic Packet Transport (DPT) Line Card Installation and Configuration*

This document provides hardware installation and configuration notes with instructions for installing, configuring, and troubleshooting Dynamic Packet Transport (DPT) line cards on supported Cisco 12000 Series Internet Routers.

- *Software Configuration Guide for the Cisco 12000 Series Internet Router*

  This document describes the basic configuration of the Cisco 12000 Series Internet Router and configuration and troubleshooting tasks.

- *Single Ring Recovery Protocol*

  This document describes the Single Ring Recovery (SRR) protocol, an extension to the Spatial Reuse Protocol (SRP). The SRR protocol allows Dynamic Packet Transport (DPT) rings to operate over a single fiber.

- *Cisco IOS Release 12.0 Cross-Platform Release Notes* (those that came with your line card)

  This document describes memory requirements and platform-specific information.

- Additional modular configuration and command reference publications:
  - FC: Cisco IOS Release 12.0 Configuration Fundamentals Configuration Guide
  - FR: Cisco IOS Release 12.0 Configuration Fundamentals Command Reference
  - *WC: Cisco IOS Wide-Area Networking Configuration Guide*
  - *WR: Wide-Area Networking Command Reference*
  - *P1C: Network Protocols Configuration Guide, Part 1*
  - *P2C: Network Protocols Configuration Guide, Part 2*
  - *P3C: Network Protocols Configuration Guide, Part 3*
  - *P1R: Network Protocols Command Reference, Part 1*
  - *P2R: Network Protocols Command Reference, Part 2*
  - *P3R: Network Protocols Command Reference, Part 3*
  - *Using Configuration Builder*
  - Internetwork Troubleshooting Handbook
  - Debug Command Reference
  - Cisco IOS Software System Error Messages
  - Cisco IOS Software Command Summary
  - Cisco Management Information Base (MIB) User Quick Reference

See the "Obtaining Documentation" section on page 109 for information on how to obtain Cisco publications.

# Supported Platforms

DPT line cards are supported on the following router platforms:

- Cisco 7200 Series Routers
- Cisco 7500 Series Routers
- Cisco 7600 Series Routers
- Cisco 10700 Series Internet Routers

- Cisco 12000 Series Internet Routers

### Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

# Supported Standards, MIBs, and RFCs

### Standards

No new or modified standards are supported by this feature.

### MIBs

- SONET/SDH MIB
- CISCO-SRP-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 http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml.

### RFCs

- RFC-1595
- Informational RFC-2892

# Prerequisites

The SRP feature requires the following on all supported router platforms:

- A full-fabric router configuration. If you have an existing one-quarter-fabric router configuration and you want to install a DPT line card, you must upgrade to a full-fabric configuration. For details on adding switch fabric cards, refer to the installation and configuration guide for your router.
- One (or two) clock and scheduler cards (CSCs) and three switch fabric cards (SFCs). A configuration with two CSCs is recommended.

**Note** On Cisco 7200 series, Cisco 7500 series, and Cisco 7600 series Routers, you must first enter the **ip cef** command to enable Cisco Express Forwarding (CEF) before you can use a DPT line card.

# Configuration Tasks

Configuration tasks for the SRP feature are presented in the following sections. Each task is identified as either optional or required.


- Assigning an IP Address, page 8
- Configuring the Topology-Timer, page 9

**Note** Cisco recommends that you configure a node before the fibers are connected to it, in order to avoid inserting an incorrectly configured node onto an SRP ring.

The MAC address on each SRP interface has a relationship with the IP address. Even though (in the examples) all DPT line cards are in slot 2 and port 0 in the routers on the network, you can also identify an SRP interface by its unique IP or MAC address. Sample IP and MAC addresses of routers containing DPT line cards that are used in the following configuration tasks are presented in Table 1.

**Caution** Before configuring a MAC address, verify that the MAC address of the node is unique on a given SRP ring.

***Table 1 Router IP and MAC Addresses on a Sample SRP Ring***

| Routers | Nodes | SRP Interface | IP Addresses | MAC Addresses |
|---|---|---|---|---|
| Router1 | Node 1 | 2/0 | 10.1.2.1 | 0012.3456.0001 |
| Router2 | Node 2 | 2/0 | 10.1.2.2 | 0012.3456.0002 |
| Router3 | Node 3 | 2/0 | 10.1.2.3 | 0012.3456.0003 |
| Router4 | Node 4 | 2/0 | 10.1.2.4 | 0012.3456.0004 |
| Router5 | Node 5 | 2/0 | 10.1.2.5 | 0012.3456.0005 |

# Assigning an IP Address

This is a required task. This section explains how to assign an IP address to an SRP interface. Each node on the ring must have an IP address assigned to its SRP interface. To assign an IP address, follow these steps in global configuration mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router1# configure terminal` | Type **configure terminal** to enter global configuration mode. |
| **Step 2** | `Router1(config)# interface srp 2/0` | Specify the SRP interface you want to configure by using the **interface srp** command. The prompt changes to interface configuration mode. |
| **Step 3** | `Router1(config-if)# ip address 10.1.2.1 255.255.255.0` | Enter the **ip address** and **subnet mask** for the SRP interface in interface configuration mode. |

| | Command | Purpose |
|---|---|---|
| **Step 4** | `Router1(config-if)# no shutdown` | Enter the **no shut** command to keep the interface up. |
| **Step 5** | `Router1(config-if)# end` | Type **end** until you return to privileged EXEC mode. |
| **Step 6** | `Router1# show interface srp 2/0` | Use the **show interface** command and specify the SRP interface router slot and port number. |

# Configuring the Topology-Timer

This is a required task. This section explains how to configure the topology-timer on an SRP ring. The **srp topology-timer** interface configuration command and a specified value determine how frequently topology discovery messages are sent around the ring to identify the current nodes on the SRP ring. Topology discovery is always on. The topology discovery frequency is user configurable. The default value is 5 seconds. To configure the topology-timer, enter the following commands, starting in privileged EXEC mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router1# configure terminal` | Type **configure terminal** to enter global configuration mode. |
| **Step 2** | `Router1(config)# interface srp 2/0` | Specify an SRP interface by entering the **interface srp** command. The prompt changes to interface configuration mode. |
| **Step 3** | `Router1(config-if)# srp topology-timer 60`<br>`Router1(config-if)# end` | Confirm the frequency of the topology message timer by entering the **srp topology-timer** command and the value in seconds.<br>Type **end** to return to privileged EXEC mode |
| **Step 4** | `Router1# show srp topology`<br><br>`Topology Map for Interface SRP2/0`<br>`Topology pkt. sent every 60 sec.`<br>`(next pkt. after 2 sec.)`<br><br>`Last received topology pkt. 00:00:02`<br>`Nodes on the ring:4`<br>`Hops (outer ring)  MAC IP Address Wrapped Name`<br>`0  0012.3456.0001 10.1.2.1 No Router1`<br>`1  0012.3456.0002 10.1.2.2 No Router2`<br>`2  0012.3456.0003 10.1.2.3 No Router3`<br>`3  0012.3456.0004 10.1.2.4 No Router4` | Specify the identity of the nodes on the SRP ring by entering the **show srp topology** command. The command output also shows the number of hops between nodes and identifies the nodes that are wrapped. |

**Note** Cisco recommends that the topology-timer value be the same for all nodes on a ring. Therefore, if the topology-timer value is changed on one node, you must configure all other nodes on the ring with the same topology-timer value.

# Configuring SRP Priority-Map Transmit

This is an optional task. This section explains how to configure the minimum SRP priority value that an IP packet must have in order to be queued in the high-priority transmit and transit queues on an SRP interface. IP packets with SRP priority values below the configured value are queued in the low-priority transmit and transit queues.

**Note** The 2-Port OC-12c/STM-4c DPT line card supports the **srp priority-map transmit** command only for sending IP packets to the high- and low-priority transit queues. You cannot configure the transmit queue. All IP packets are sent to the low-priority transmit queue.

Use the **srp priority-map transmit** <*min-srp-pri-value*> interface configuration command, where *min-srp-pri-value* specifies the minimum SRP priority value (in the range of 1 to 7) for packets to be sent to the high-priority queues. To specify that all packets are sent to the low-priority transmit and transit queues, enter 8 for <*min-srp-pri-value*>.

To configure the SRP priority-map, enter the following commands, starting in privileged EXEC mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router1# configure terminal` | Type **configure terminal** to enter global configuration mode. |
| **Step 2** | `Router1(config)# interface srp 2/0` | Specify an SRP interface by entering the **interface srp** command. The prompt changes to interface configuration mode. |
| **Step 3** | `Router1(config-if)# srp priority-map transmit 5`<br>`Router1(config-if)# end` | Enter the **srp priority-map transmit** <*min-srp-pri-value*> command to specify the minimum SRP priority value that an IP packet must have in order to be queued in the high-priority transmit and transit queues. The valid values for <*min-srp-pri-value*> are 1 to 8. |

**Note** The TOS/IP precedence value in the IP header has a platform dependant default mapping with the priority-field in the SRP header. This mapping can also be explicitly configured using modular QOS CLI.

# Configuring SRP Rate-Limit

This is a required task. This section explains how to configure the amount of high- and low-priority traffic being transmitted from the router onto the SRP ring, by using the **srp tx-traffic-rate** interface configuration command. To configure the SRP rate-limit, enter the following commands, starting in privileged EXEC mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router1# configure terminal` | Type **configure terminal** to enter global configuration mode. |
| **Step 2** | `Router1(config)# interface srp 2/0` | Specify an SRP interface by entering the **interface srp** command. The prompt changes to interface configuration mode. |
| **Step 3** | `Router1(config-if)# srp tx-traffic-rate hi 622`<br>`Router1(config-if)# srp tx-traffic-rate low 1866`<br>`Router1(config-if)# end` | To limit the rate of high-priority traffic transmitted on the ring to an average of 622 Mbps (25% line bandwidth), enter the **srp tx-traffic-rate** [**high**\|**low**] <**Mbps**> command. |

# Configuring SRP Layer 3 Fast Notification

This is an optional task. Starting in IOS Release 12.0(27)S, the SRP - Layer 3 Fast Notification feature is supported on Cisco 12000 series Internet Routers and on the Cisco 10720 Internet Router. This feature allows for faster convergence of Layer 3 routing protocols in case of SRP ring events that cause nodes to be dropped from the ring's topology and is enabled by default.

With the Layer 3 Fast Notification feature, changes in a ring's topology map are reported immediately to Layer 3 protocols. The Layer 3 hello and routing update timers are bypassed, resulting in Layer 3 sub-second convergence.

**Note** The SRP - Layer 3 Fast Notification feature applies only to the Open Shortest Path First (OSPF) or Intermediate System-to-Intermediate System (IS-IS) routing protocols.

When the Single Ring Recovery (SRR) protocol is enabled, faster convergence of Layer 3 routing protocols does not occur. The SRR protocol enables an SRP ring to preserve full node connectivity in the event of multiple failures on one of its two counter-rotating rings while the other is failure free. In all other cases, the SRP ring maintains the standard SRP intelligent protection switching (IPS) behavior.

To configure SRP Layer 3 notification, enter the following commands, starting in privileged EXEC mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router1# configure terminal` | Type **configure terminal** to enter global configuration mode. |
| **Step 2** | `Router1(config)# interface srp 1/1` | Specify an SRP interface by entering the **interface srp** command. The prompt changes to interface configuration mode. |
| **Step 3** | `Router1(config-if)# srp fast-convergence` | To enable faster Layer 3 convergence in case of an SRP node failure, enter the **srp fast-convergence** command. |

# Rejecting Packets from a Specific Source Address

This is an optional task. By default, an SRP interface accepts packets from any source. You can configure an SRP interface to reject all packets from a specific source MAC address. This may be useful if there are nodes on the ring that should not communicate.

To configure an SRP interface to reject all packets from a specific source MAC address, enter the following commands, starting in privileged EXEC mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router1# configure terminal` | Type **configure terminal** to enter global configuration mode. |
| **Step 2** | `Router1(config)# interface srp 2/0` | Select a specific SRP interface, using the **interface srp** command. |
| **Step 3** | `Router1(config-if)# srp reject 0012.3456.0001` | Configure an SRP interface to discard all packets from a specific node by entering the **srp reject** command and the MAC address of the source node. |
| **Step 4** | `Router1(config-if)# end` | Type **end** until you return to privileged EXEC mode. |
| **Step 5** | `Router1# copy running-config startup-config` | Enter the **copy running-config startup-config** command to write the new configuration to memory. |

# SONET/SDH Configuration Parameters

Table 2 lists the default configuration values of the DPT line card. To modify the configuration parameters, enter the following commands, starting in privileged EXEC mode:

*Table 2 DPT Line Card Default Configuration Values*

| Parameter | Configuration Command | Default Value |
|---|---|---|
| Framing | **srp framing** [**sdh** \| **sonet**] [**a** \| **b**] | SONET |
| SONET overhead | **srp flag** [**c2** *value*] **0** *value*] [**a** \| **b**] | c2 set to 0x16<br>j0 set to 0xCC |
| Clock source[1] | **srp clock-source** [**internal** \| **line** ] [**a** \| **b**] | — |

1. This value varies depending on the DPT line card in use.

To modify SONET/SDH configuration parameters, enter the following commands, starting in privileged EXEC mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router1# configure terminal` | Type **configure terminal** to enter global configuration mode. |
| **Step 2** | `Router1(config)# interface srp 2/0` | Use the **interface srp** command to specify a node. The prompt changes to interface configuration mode. |
| **Step 3** | `Router1(config-if)# srp framing sdh` | To select framing, enter the **srp framing** command. |
| **Step 4** | `Router1(config-if)# srp clock-source line a` | Enter the **srp clock-source** command. |
| **Step 5** | `Router1(config-if)# end` | Type **end** until you return to privileged EXEC mode. |

# SRP IPS Command Options

This is an optional task. This section explains how to use SRP IPS command options to enable or override IPS modes on the SRP ring. There are two SRP IPS modes:

- Automatic SRP IPS modes take effect when the SRP ring detects an event, a fiber cut, or a node failure, and they remain in effect until the default wait-to-restore (WTR) value expires.
- User-configured SRP IPS modes take effect as soon as you enter the commands and remain in effect until they are removed by a user command or overridden by an SRP IPS command with higher priority. You can enter the **no** form of the SRP IPS request to negate an automatic or a user-configured command.

**Note** Before any physical manipulation to the DPT line card, add an **srp ips request forced-switch** to the side of the ring that is to be removed.

For example, you can enter an **srp ips request forced-switch** command to force data traffic to one side of the ring when a DPT line card is removed from a router slot, or in response to an event. Table 3 describes the IPS requests in the order of priority, from higher to lower.

*Table 3 Explanation of SRP IPS Requests*

| SRP IPS Request | Description |
|---|---|
| Forced-switch | Adds a high-priority protection switch wrap on each end of a specified span by entering the user-configured **srp ips request forced-switch** command. |
| Manual-switch | Adds a low-priority protection switch wrap on each end of a specified span by entering the user-configured **srp-ips request manual-switch** command. |

If an automatic or user-configured protection switch is requested for a given span, the node that receives the protection request issues a protection request to the node on the other end of the span using both the short path over the failed span, because the failure may be unidirectional, and the long path around the ring.

As the protection requests travel around the ring, the protection hierarchy is applied. For example, if a high-priority Signal Fail (SF) request enters the ring, it overrides a pre-existing lower-priority Signal Degrade (SD) request. If an event or a user-configured command enters a low-priority request, it is not allowed if a high-priority request is present on the ring.

**Note** An exception is that multiple signal fail and forced-switch requests can coexist on the SRP ring and will bisect the ring if they occur on separate fiber links.

All protection switches are performed bidirectionally and enter wraps at both ends of a span for transmit and receive directions, even if a failure is only unidirectional.

To enter user-configured SRP IPS requests when they are needed, enter the following commands, starting in privileged EXEC mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router1# configure terminal` | Type **configure terminal** to enter global configuration mode. |
| **Step 2** | `Router1(config)# interface srp 2/0` | Enter the **interface srp** command. The prompt changes to interface configuration mode. |
| **Step 3** | `Router1(config-if)# srp ips request manual-switch a` | To enter a manual-switch wrap state, enter the **srp ips request manual-switch** command and specify side A or B. |
| **Step 4** | `Router1(config-if)# srp ips request forced-switch a` | To enter a forced-switch wrap state, enter the **srp ips request forced-switch** command and specify side A or B. |
| **Step 5** | `Router1(config-if)# srp ips wtr-timer 60` | To set a nondefault value of the wait-to-restore timer, enter an **srp ips wait-to-restore timer** command and the value in seconds. |
| **Step 6** | `Router1(config-if)# srp ips timer 60 a` | To set a nondefault value for the frequency of IPS messages, enter the **srp ips timer** command and specify the value in seconds. |

| | Command | Purpose |
|---|---|---|
| **Step 7** | `Router1(config-if)# end` | Type **end** until you return to privileged EXEC mode. |
| **Step 8** | `Router1# show srp ips` | Use the **show srp ips** command to display the status of the SRP IPS requests. |

# Monitoring and Maintaining the SRP Ring

Use the information in the following sections to monitor and maintain the SRP ring:


- Running Loopback Tests on an SRP Ring, page 15
- Using show Commands to Display SRP Ring Configuration, page 18


## Running Loopback Tests on an SRP Ring

When connectivity is not achieved because of a signal failure or degradation, you can use the **srp loopback** interface configuration command to test the node-to-node fiber connection. You can also use the **srp loopback** interface command when fiber or equipment connections are rearranged, or if new connectivity problems arise. Clocking is automatically set when you enter **srp loopback** mode. Clocking returns to the default when you exit **srp loopback** mode.

**Caution** Using the **srp loopback** command disables the entire ring if it is not configured properly.

**Note** A forced-switch on side A causes a wrap on side B. A forced-switch on side B causes a wrap on side A.

The following SRP loopback configuration example is for an SRP ring created with an OC-12c/STM-4c DPT line card

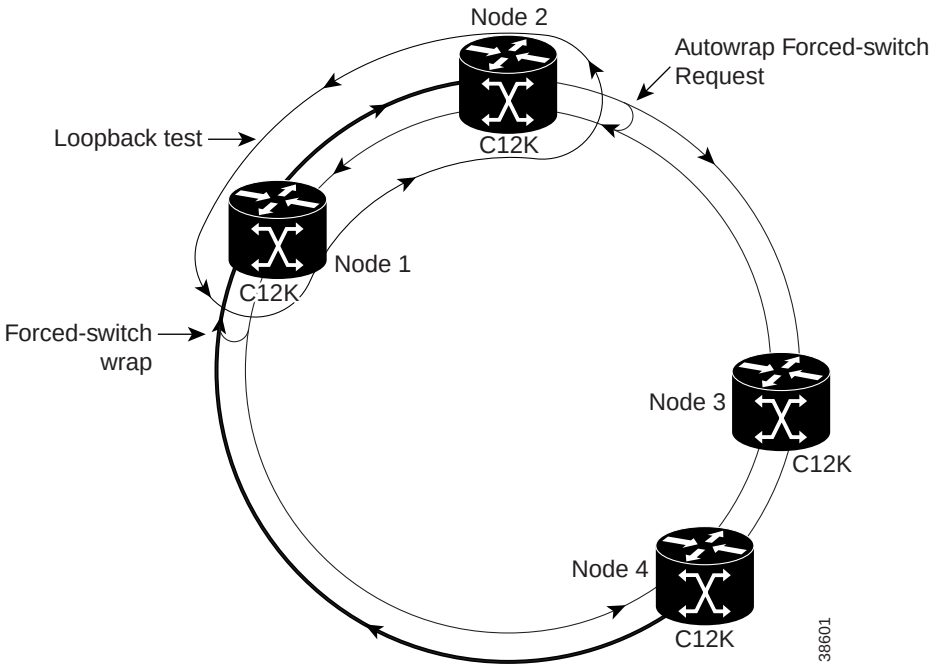
| | Command | Purpose |
|---|---|---|
| **Step 1** | Router# **configure terminal**<br>Router(config)# **interface srp 1/0**<br>Router(config-if)# **ip address 10.0.0.1 255.255.255.0**<br>Router(config-if)# **srp ips request forced-switch a**<br>Router(config-if)# **exit**<br>Router(config)# **interface srp 2/0**<br>Router(config-if)# **ip address 10.0.0.2 255.255.255.0**<br>Router(config-if)# **srp ips request forced-switch b**<br>Router(config-if)# **exit** | Isolate the fiber span by entering an **srp ips forced-switch wrap request** on each node you want to test. For this example, we are adding a forced-switch to Node 1. The forced-switches will redirect traffic on the ring so that packets will reach their destination seamlessly, while you run **srp loopback line** tests on Node 1 and Node 2. |
| **Step 2** | Router(config)# **interface srp 1/0**<br>Router(config-if)# **srp loopback line b**<br>Router(config-if)# **exit**<br>Router(config)# **interface srp 2/0**<br>Router(config-if)# **srp loopback line a**<br>Router(config-if)# **exit** | Enter the **srp loopback line** interface configuration command between the two nodes that have a connectivity problem. |
| **Step 3** | Router(config)# **interface srp 1/0**<br>Router(config-if)# **no srp loopback line b**<br>Router(config-if)# **exit**<br>Router(config)# **interface srp 2/0**<br>Router(config-if)# **no srp loopback line a**<br>Router(config-if)# **exit** | Exit **srp loopback** mode after you verify connectivity. |
| **Step 4** | Router(config)# **interface srp 1/0**<br>Router(config-if)# **ip address 10.0.0.1 255.255.255.0**<br>Router(config-if)# **no srp ips request forced-switch a**<br>Router(config-if)# **exit**<br>Router(config)# **interface srp 2/0**<br>Router(config-if)# **ip address 10.0.0.2 255.255.255.0**<br>Router(config-if)# **no srp ips request forced-switch b**<br>Router(config-if)# **exit** | After you exit **srp loopback** mode, remove the **srp ips forced-switch request** on Node 1 and Node 2. |

The following SRP loopback configuration example is for an SRP ring created with two OC-48c/STM-16c or two OC-192c/STM-64c DPT line cards that use one SRP interface and IP address.

| | Command | Purpose |
|---|---|---|
| **Step 1** | Router# **configure terminal**<br>Router(config)# **interface srp 1/0**<br>Router(config-if)# **ip address 10.0.0.1 255.255.255.0**<br>Router(config-if)# **srp ips request forced-switch a**<br>Router(config-if)# **exit** | Isolate the fiber span by entering an **srp ips forced-switch wrap request** on the node you want to test. For this example, we are adding a forced-switch to Node 1. The forced-switch will redirect traffic on the ring so that packets will reach their destination seamlessly, while you run **srp loopback line** tests between Node 1 and Node 2. |
| **Step 2** | Router(config)# **interface srp 1/0**<br>Router(config-if)# **srp loopback line a**<br>Router(config-if)# **exit** | Enter the **srp loopback line** command between the two nodes that have a connectivity problem. |
| **Step 3** | Router(config)# **interface srp 1/0**<br>Router(config-if)# **no srp loopback line a**<br>Router(config-if)# **exit** | Exit **srp loopback** mode after you verify connectivity. |
| **Step 4** | Router(config)# **interface srp 1/0**<br>Router(config-if)# **ip address 10.0.0.1 255.255.255.0**<br>Router(config-if)# **no srp ips request forced-switch a**<br>Router(config-if)# **exit** | After you exit **srp loopback** mode, remove the **srp ips forced-switch request** on Node 1. |

Figure 2 shows an **srp loopback line** configuration example of an SRP ring.

*Figure 2 SRP Ring in Loopback Mode*




# Using show Commands to Display SRP Ring Configuration

To display information about SRP interfaces on an SRP ring, use the following Cisco IOS software **show** commands in privileged EXEC mode:

| Command | Purpose |
|---|---|
| `Router1# show controllers srp` | Displays the SRP controller that is currently running. |
| `Router1# show interfaces srp` | Displays the status of an DPT line card in a specific router slot and port number. |
| `Router1# show srp` | Displays the status of all the SRP interfaces that are nodes on the SRP ring. |
| `Router1# show srp counters` | Displays a list of the packets counted by the source address on an SRP interface. |
| `Router1# show srp failures` | Displays information about all SRP failures detected on a router in an SRP ring. |
| `Router1# show srp ips` | Displays intelligent protection switch (IPS) information. |
| `Router1# show srp rate-limit` | Displays the current SRP rate-limit configuration for high- and low-priority traffic. |
| `Router1# show srp source-counters` | Displays the total number of packets transmitted and received by a node identified by its unique MAC address. |

| Command | Purpose |
|---|---|
| `Router1# show srp srr` | Displays SRR information for each SRP interface on a router in an SRP ring. |
| `Router1# show srp topology` | Displays the identity of the nodes on the SRP ring. |
| `Router1# show srp transit` | Displays the transit delays (in nanoseconds) between the time that a packet enters the transit buffer and the time it comes back on the ring. (Cisco 10700 Series Internet Routers only.) |

Table 4 explains the terms used in **show** command output.

***Table 4 Show Command Keywords***

| Keyword | Description |
|---|---|
| Hardware address | Provides the MAC address of the SRP interface. |
| Interface | Provides the SRP interface and *slot/port* number. |
| IPS state | Provides wrap information. |
| IPS self-detected requests | Shows whether there is fiber cut or node failure. |
| IPS messages received | Shows the IPS messages received on sides A and B of a node. |
| IPS messages transmitted | Shows the IPS messages transmitted on sides A and B of a node. |
| Protocol address | Provides the Internet protocol address. |
| Node type | Indicates the type of node on the ring. |

# DPT Line Card Configuration Examples

This section describes how to configure DPT line cards and contains the following configuration tasks and other information:



**Note** The procedures in this section use the illustrations of a Cisco 12008 Internet Router to support the descriptions of adding and deleting nodes using the OC-12c/STM-4c DPT line card.

Although the card cages of Cisco 12000 Series Internet Routers differ, the designated use of slots and the process of adding and deleting nodes are basically the same for all Cisco 12000 Series

Internet Routers.

Although the procedures in this section refer to Cisco 12000 Series Internet Routers, you can also perform them on Cisco 7200 Series Routers, Cisco 7500 Series Routers, Cisco 7600 Series Routers, and Cisco 10700 Series Internet Routers.

# Adding a Node to the Ring – Method 1

This section explains how to add Node 5 to a 4-node ring. The examples in this section use OC-12c/STM-4c DPT line cards.

You can insert a new node on a ring without powering down the routers on your network. As long as one connection remains active, data traffic will pass through the fiber from the source node to the destination node, uninterrupted. The new node will be placed between Node 1 and Node 4 on the ring.

The connections between the two existing nodes must be broken to insert the connections to the new node. This intentional break in the ring is handled by Intelligent Protection Switching (IPS).

You can add a node by using one of the following methods:

1. Disconnecting the fiber cables between Node 1 and Node 4 will cause IPS to automatically enter signal-fail wraps on the SRP ring. Signal-fail wraps have the same function as manual-switch wraps. This is the simplest approach, but there will be some data loss while the automatic switching reacts to the change.
2. Using Cisco IOS commands to enter forced-switch wraps on the SRP ring at Node 1 and Node 4, before removing the cables, will prevent loss of data.

**Note** When the ring is in a wrapped state, its traffic-carrying capacity is somewhat reduced. Do not add the extra node when ring bandwidth is fully used.

The following examples show how to add a fifth node to a four-node ring. The nodes are named Router1, Router2, and so on. The additional node, Router5, will be added between Router1 and Router4. Side A of Router5 connects to side B of Router4, and side B of Router5 connects to side A of Router1.

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router5# configure terminal`<br>`Router5(config)# interface srp 2/0`<br>`Router5(config-if)# ip address 10.1.2.5 255.255.255.0`<br>`Router5(config-if)# mac-address 0012.3456.0005`<br>`Router5(config-if)# end` | Type **configure terminal** to enter global configuration mode. Configure the new node by using the **interface srp** command to specify the SRP interface. Then assign an IP address and, if necessary, assign a MAC address.<br>Type **end** until you return to privileged EXEC mode. |
| **Step 2** | `Router1# show srp` | Use the **show srp** command to ensure that the IPS state of the ring is IDLE and that the topology shows four nodes. |

| | Command | Purpose |
|---|---|---|
| **Step 3** | None | Disconnect the fibers on the span where the node is to be added. When the fibers are disconnected, a signal failure will be detected by Nodes 1 and 4, and automatically insert two signal-fail wraps away from the failure between the nodes. |
| **Step 4** | None | Insert Router5 onto the ring by connecting Router5 to Router1. Then connect Router5 to Router4. Router5 will appear on the ring as Node 5, between Nodes 1 and 4. |
| **Step 5** | Router1# **show srp ips** | Use the **show srp ips** command to verify that the signal-fail wraps have disappeared. If the wraps are still present, wait for the default wait-to-restore timer to time out. |
| **Step 6** | Router1# **show srp topology** | Use the **show srp topology** command mode to confirm that the wraps have disappeared and to verify that the new node is part of the ring topology.<br>It takes a few seconds for the new ring topology to become known, so you may have to retry the command a few times. |

The following illustrations use a single DPT line card. Figure 3 and Figure 4 show the physical configuration. Figure 5 and Figure 6 show the logical configuration.

***Figure 3 Four Routers on the SRP Ring (Cisco 12008 Internet Router Shown)***

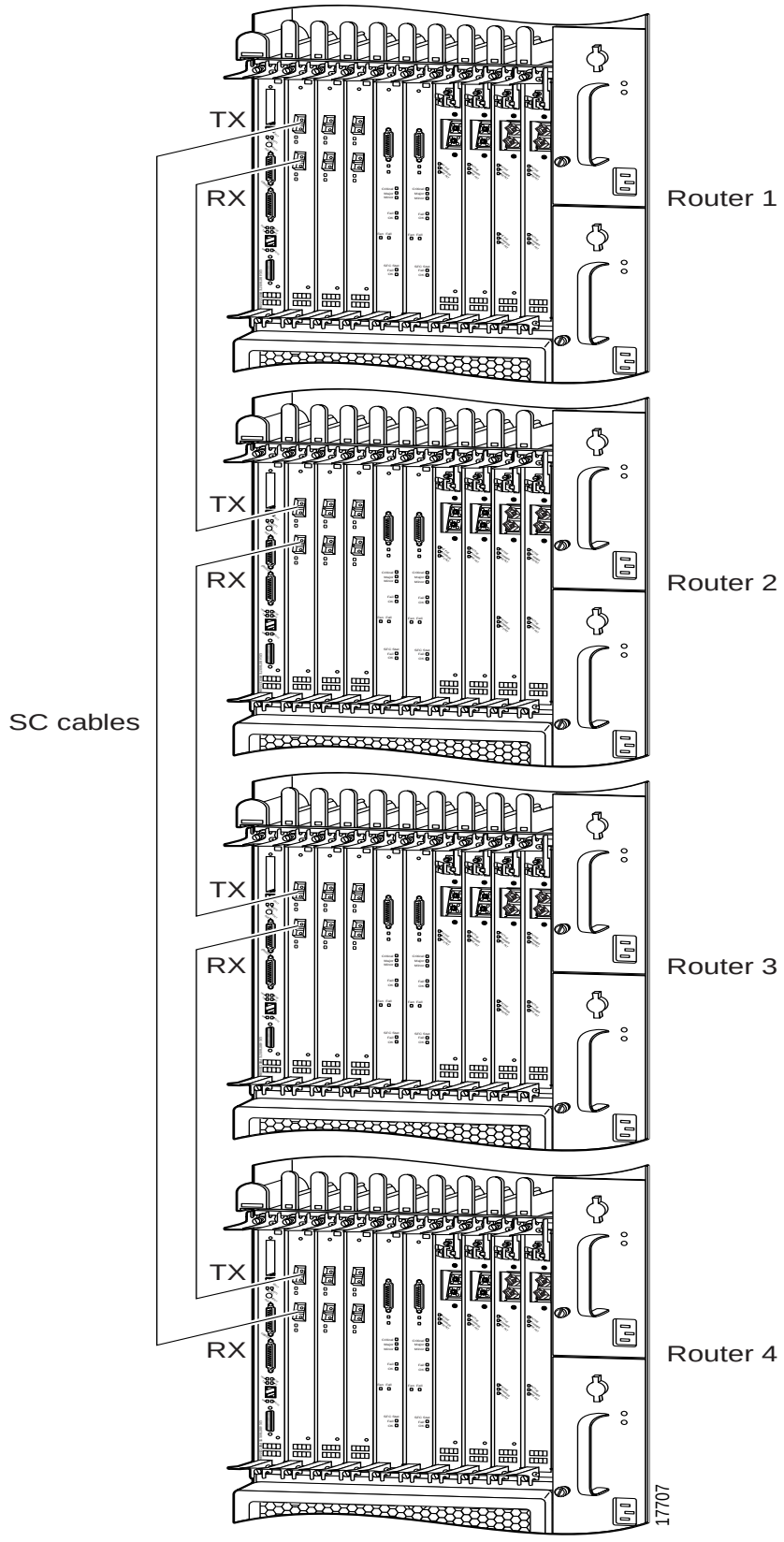


***Figure 4 Adding a Router to the OC-12c/STM-4c SRP Ring (Cisco 12008 Internet Router Shown)***

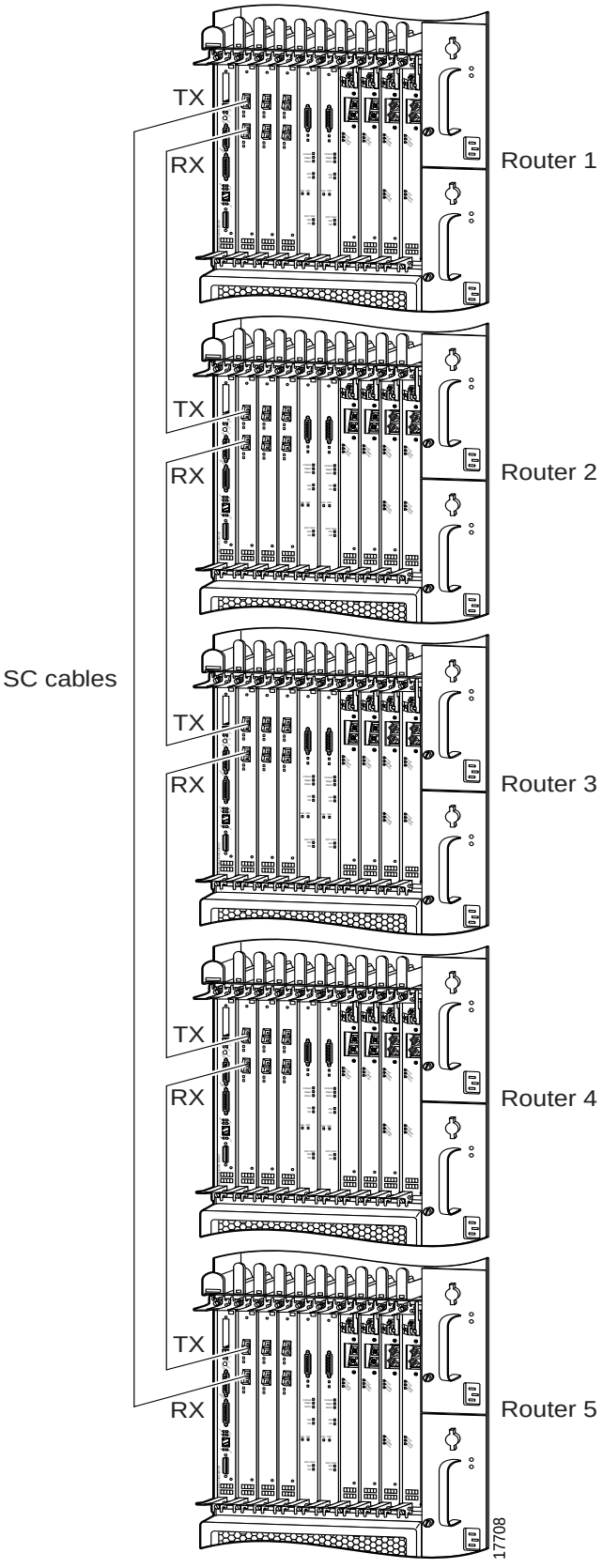


Figure 5 shows a four-node ring before a fifth node is added.

**Note** Only the OC-12c/STM-4c DPT line card supports adding Cisco 7500 series, Cisco 7600 series, and Cisco 7200 series Routers on an SRP ring.

***Figure 5 SRP Ring Topology with Four Nodes***

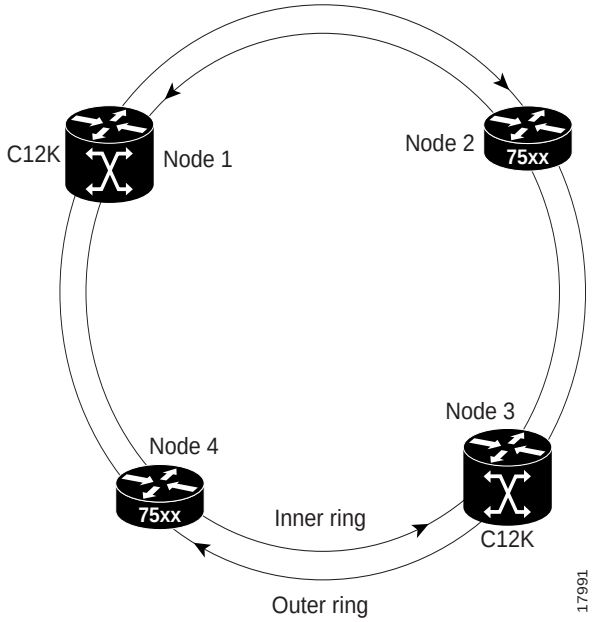
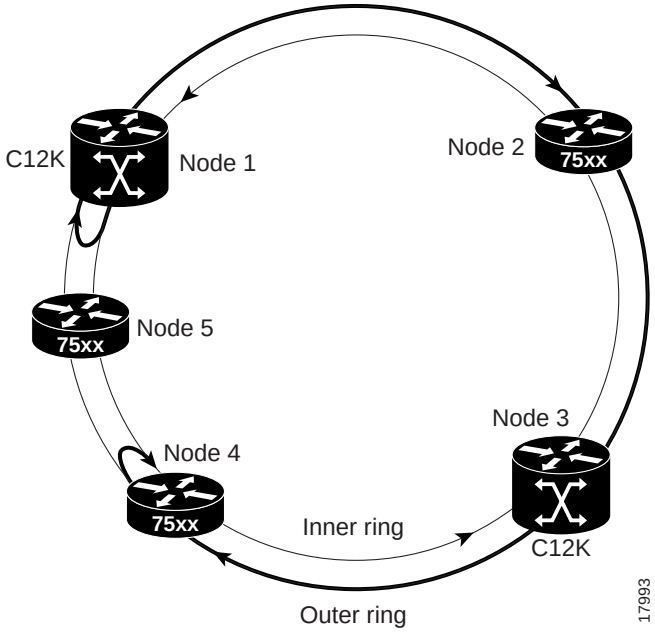



Figure 6 shows a ring with forced-switch wraps entered at Node 1 and Node 4. Node 5 is added to the ring between the forced-switch wraps.

***Figure 6 SRP Ring Topology with a Fifth Node Added to a Wrapped Ring***



Use the **ping** command to verify that you can communicate with an SRP interface on the ring.

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router1# configure terminal`<br>`Router1(config)# interface srp 2/0` | Type **configure terminal** to enter global configuration mode. Specify the new node on the ring by entering **interface srp** command. |
| **Step 2** | `Router1(config-if)# ip address 10.1.2.1 255.255.255.0` | Enter the IP address of the node. |
| **Step 3** | `Router1(config-if)# no shutdown` | Enter the **no shutdown** command to enable the SRP interface. |
| **Step 4** | `Router1# ping 10.1.2.5` | Use the **ping** command in privileged EXEC mode to verify that you can communicate with a new SRP interface on the ring. |
| **Step 5** | `None` | If the ping is successful, continue configuring the new SRP interface. If the ping is unsuccessful, go to the following section, "Adding a Node to the Ring – Method 2." |

# Adding a Node to the Ring – Method 2

This section shows how to add a fifth node to a four-node ring, using Cisco IOS commands that insert forced-switch wraps away from the area on the fiber where the node is being added, to ensure a minimal loss of data traffic. The examples in this section use OC-12c/STM-4c DPT line cards.

For the purpose of this example, Node 5 will be placed between Node 1 and Node 4. Figure 3 and Figure 4 show the physical configuration. Figure 5 and Figure 6 show the logical configuration.

To add a node to a ring, follow the configuration example in this section, enter the following commands, starting in privileged EXEC mode.

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router1# configure terminal` | Type **configure terminal** to enter global configuration mode. |
| **Step 2** | `Router1(config)# interface srp 2/0` | Specify the Node 1 SRP interface by entering the **interface srp** command. |
| **Step 3** | `Router1(config-if)# srp ips request forced-switch a` | Stop data traffic flowing from Node 1 on the fiber that will be disconnected by entering an **srp ips request forced-switch** command to create a wrap next to Node 1 on side A. |

| | Command | Purpose |
|---|---|---|
| **Step 4** | `Router1(config-if)# end` | Type **end** to return to global configuration mode. |
| **Step 5** | `None` | Disconnect the fiber-optic cables connecting Node 1 to Node 4. |
| **Step 6** | `None` | Connect the cables to add the new node while observing the receive (RX) and transmit (TX) cabling relationship. |
| **Step 7** | `Router1(config)# interface srp 2/0` | Specify the Node 1 SRP interface by entering the **interface srp** command. |
| **Step 8** | `Router1(config-if)# no srp ips request forced-switch a` | Remove the wrap on Node 1 by entering the **no srp ips request forced-switch** command. |
| **Step 9** | `Router1(config-if)# end` | Type **end** to return to privileged EXEC mode. |
| **Step 10** | `Router1# show srp topology` | Use the **show srp topology** command to confirm that the wraps have disappeared and the new node is part of the ring topology. (See Figure 6.)<br>It takes a few seconds for the new ring topology to become known, so you may have to retry the command a few times. |

# Deleting a Node from the Ring – Method 1

This section explains how to delete Node 5 that is positioned between Node 1 and Node 4 on the ring. The examples in this section use OC-12c/STM-4c DPT line cards. You must disconnect the cables to break the connection between Node 5 and Nodes 1 and 4. After Node 5 is removed, you must connect Node 1 and Node 4. The intentional break on the ring is handled by the IPS facilities.

There are two ways to delete a node:

- You can just disconnect the existing cables, and IPS will automatically wrap the ring at the two nodes. This is the simplest approach, but there will be some data loss while the automatic switching reacts to the change.
- You can add manual wraps prior to disconnecting the cables to reduce data loss.

**Note** When the ring is in a wrapped state, its traffic-carrying capacity is somewhat reduced. It is not advisable to remove a node when the ring bandwidth is in full use.

The following configuration example shows how to remove a node from a five-node ring. The nodes are named Router1, Router2, and so on. The Router5 node will be removed from its current position between Router1 and Router4. Then side A of Router1 connects to side B of Router4.

To remove a node from a ring, follow the configuration example in this section, starting in privileged EXEC mode.

**Step 1** Ensure that the ring is in the idle state by using the **show srp ips** command.

**Step 2** Disconnect the cables from the router you want to delete from the ring.

**Step 3** When the fibers are disconnected, the ring detects a signal failure and automatically inserts signal fail wraps to direct traffic away from the failure.

**Step 4** Reconnect the cables to the OC-12c/STM-4c DPT line cards that you want on the ring. Be sure to observe the RX and TX cabling relationships.

**Step 5** When the default wait-to-restore timer expires, the wraps will disappear and enable traffic on the ring.

**Step 6** Verify that the topology does not show the deleted node and that the wraps have been removed by using the **show srp topology** command in privileged EXEC mode.

## Deleting a Node from the Ring – Method 2

The following configuration example shows how to remove a node from a ring using forced protection switches to insert wraps on the ring, thereby logically removing the node from the ring prior to physically removing it. The examples in this section use OC-12c/STM-4c DPT line cards.

As in the previous example, you will remove Router5 from its current position between Router1 and Router4. To remove a node from a ring, follow the configuration example in this section, starting in privileged EXEC mode.

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router1# show srp ips` | Enter the **show srp ips** command to ensure that the ring is in an idle state and that no wraps exist. |
| **Step 2** | `Router1# show srp` | Enter the **show srp** command on a neighboring node to verify that Node 5 has disappeared from the SRP ring topology. |
| **Step 3** | `Router1# configure terminal` | Type **configure terminal** to enter global configuration mode on a router adjacent to the one that is to be removed. |
| **Step 4** | `Router1(config)# interface srp 2/0` | Specify the SRP interface of the node by entering the **interface srp** command. |
| **Step 5** | `Router1(config-if)# srp ips request forced-switch a` | Add a wrap next to Node 1 by entering an **srp ips request forced-switch** command. |
| **Step 6** | `Router1(config-if)# end` | Type **end** to return to privileged EXEC mode. |
| **Step 7** | None | Disconnect the RX and TX fibers from Node 5. |
| **Step 8** | None | Reconnect the fibers between Node 4 and Node 1. Be sure to observe the RX and TX cabling conventions. |

| | Command | Purpose |
|---|---|---|
| **Step 9** | `Router1# configure terminal` | Type **configure terminal** to enter global configuration mode. |
| **Step 10** | `Router1(config)# interface srp 2/0` | Specify the Node 1 SRP interface by entering the **interface srp** command. |
| **Step 11** | `Router1(config-if)# no srp ips request forced-switch a` | Remove the wrap created by the forced-switch request on Node 1 by entering the **no srp ips request forced-switch** command. |
| **Step 12** | `Router1(config-if)# exit` | Type **exit** to return to global configuration mode. |
| **Step 13** | `Router1# show srp topology` | Confirm that no wraps exist on Node 1 and Node 4 by entering the **show srp topology** command in privileged EXEC mode. |

# SRP Rings with Mated DPT Line Cards

The OC-48c/STM-16c and OC-192c/STM-64c DPT line cards have a front panel D-type connector. This connector is used to connect a copper coaxial cable that mates two of the same line cards. The copper coaxial cable is referred to as a mate cable.

When you install two line cards that are connected by a mate cable, they create a two-fiber SRP ring with side A and side B. Both line cards are *administratively down* by default. You must use the **hw-module slot** *number* **srp** command to enable the paired line cards as one SRP interface with one IP address. Side A is automatically the far left (or top if horizontally installed) slot of the pair of line cards. For example, if the line cards are installed in slots 4 and 5, you would enter **hw-module slot 4 srp**.

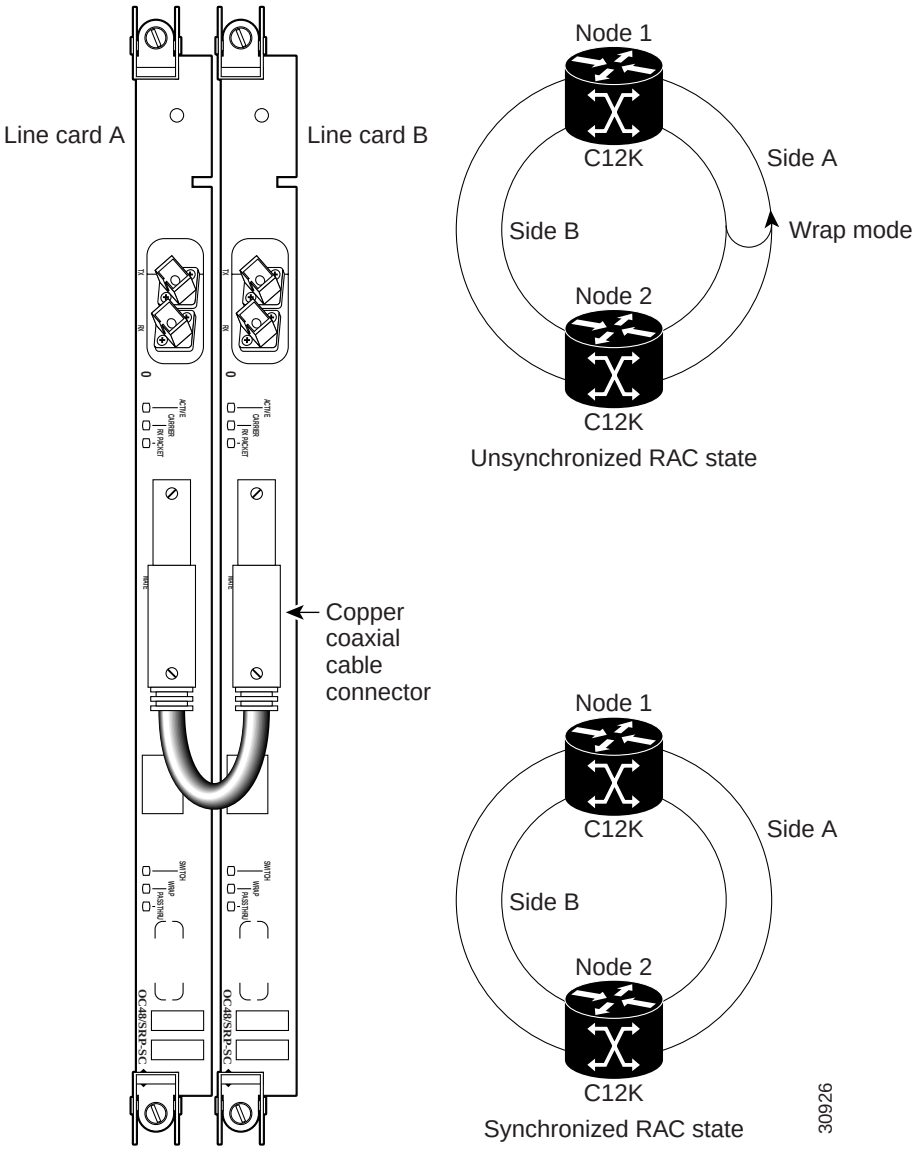
The mate cable facilitates front panel interconnection for pass-through traffic between these line cards.

- When correctly connected, the mate cable synchronizes the Ring Access Controller application-specific integrated circuits (RAC ASICs) on both line cards and creates a two-fiber SRP ring without any wraps. The active (green) Sync LED on the line card indicates that the mate cables are synchronized on each line card.
- When the mate cables are unsynchronized, the line cards indicate a signal fail that automatically creates a two-fiber ring that is in wrapped mode. The Wrap LED is active (green), and the Sync LED is off.
- To troubleshoot an unsynchronized signal fail, reseat the mate cable or replace it. (See Figure 7.)

**Note** The mate cable must be bent into a U shape to connect the two line cards. After it is bent into this shape, do not bend the cable. Never bend one side of the mate cable when you disconnect the cable. Attach and remove both sides of the mate cable as a unit. When you remove the mate cable from both line cards, the system will pick a side (A or B) and automatically enter a wrap on the SRP ring.

Figure 7 shows synchronized and unsynchronized conditions when the mate cable is attached to two 1OC-48c/STM-16c DPT line cards.

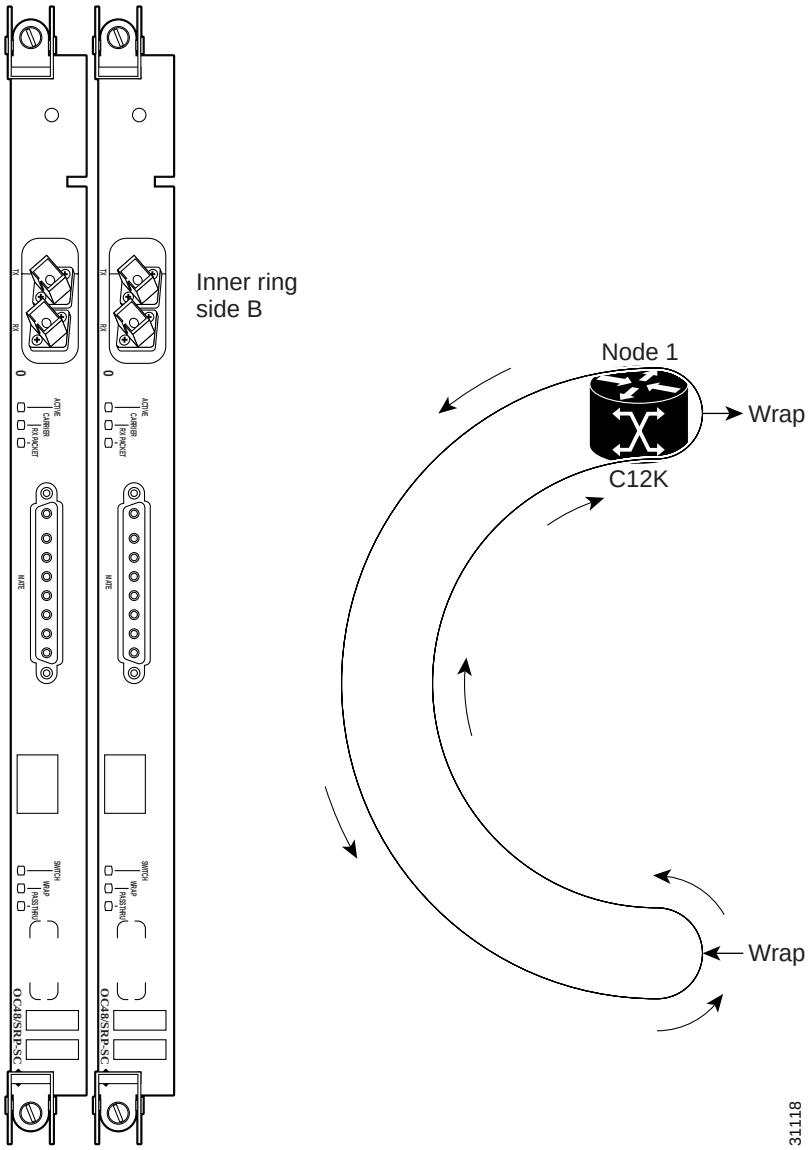
*Figure 7 Two DPT Line Cards with a Mate Cable (OC-48c/STM-16c DPT Line Cards Shown)*




When the two line cards are not connected by the mate cable, the RX and TX fiber is terminated for either the side A or side B direction of the ring, depending on which line card was removed. The IP address and MAC address remain the same on a single-fiber SRP ring.

Figure 8 shows a single-fiber SRP ring with a wrap at each end to pass-through traffic and ensure that all data packets will reach their destination. The Wrap LED on the single (left- or top-most) OC-48c/STM-16c DPT line card remains on until the mate cable is reattached to a pair of line cards. The right OC-48c/STM-16c DPT line card becomes idle.

*Figure 8 Two Unconnected DPT Line Cards and a Single-fiber SRP Ring with Wraps on Each End (OC-48c/STM-16c DPT Line Cards Shown)*



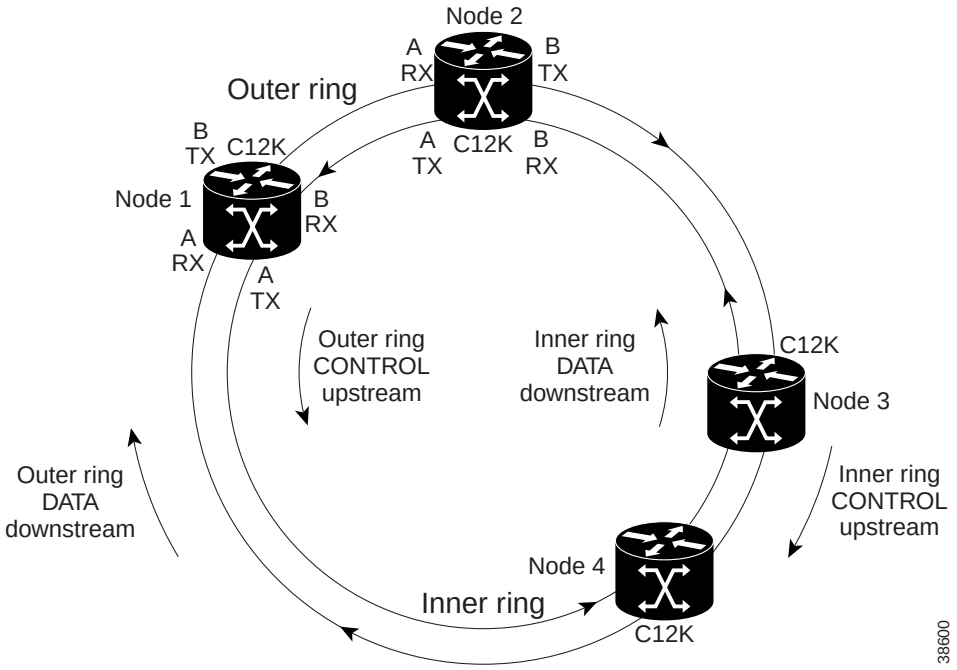

**Note** The active pass-through LED is green on the OC-48c/STM-16c and OC-192c/STM-64c DPT line cards.

On an SRP ring created by two OC-48c/STM-16c or OC-192c/STM-64c DPT line cards, a Cisco 12000 Series Internet Router collects data and passes it to another Cisco 12000 Series Internet Router. On the SRP ring, Cisco 12000 Series Internet Routers aggregate traffic toward other Cisco 12000 Series Internet Routers.

**Note** OC-48c/STM-16c and OC-192c/STM-64c DPT line cards are not supported on Cisco 7200 Series Routers, Cisco 7500 Series Routers, and Cisco 7600 Series Routers.

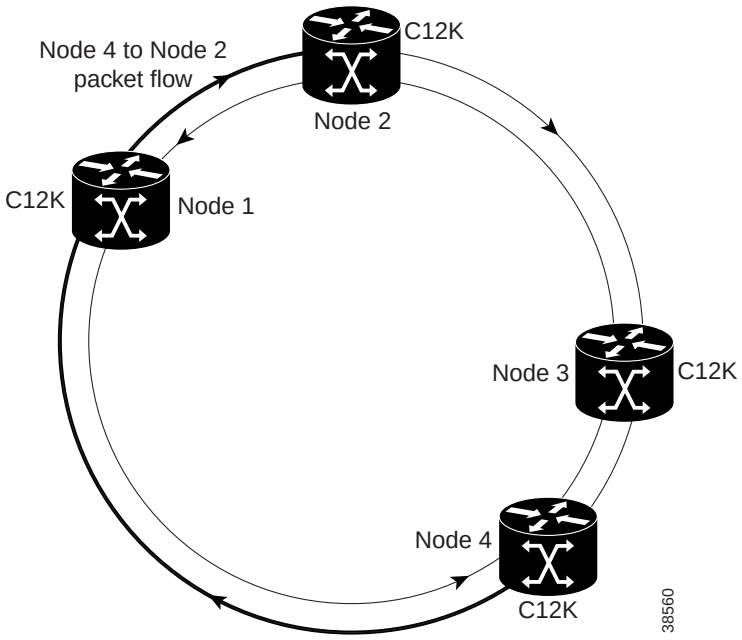
Each time you install two line cards that are connected by a mate cable in a Cisco 12000 Series Internet Router, it appears on the ring as a node with an SRP interface. Each SRP ring is composed of nodes that are interconnected by two fiber rings, which are designated as inner and outer. Traffic flows clockwise on the outer ring and counterclockwise on the inner ring. Side A has outer-ring receive fiber, and side B has inner-ring receive fiber. (See Figure 9.)

***Figure 9 SRP Ring***




In a normal state, data packets flow from Node 4 to Node 2 by taking the short single-hop path shown in Figure 10.

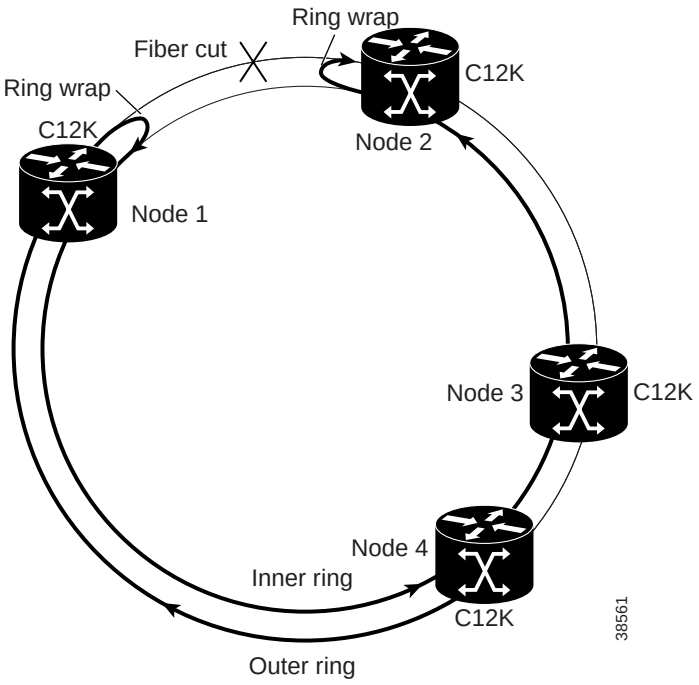
***Figure 10 SRP Ring in a Normal State***




In response to a fiber cut between Node 1 and Node 2, wraps are inserted that direct traffic away from the fiber cut. Wrap mode is initiated when a node or fiber failure occurs on the ring between Node 1 and Node 2. The Wrap LED is active.

Figure 11 shows how IPS allows the ring to recover automatically from node or fiber failures by wrapping away from the failures and routing traffic around the wraps. The nodes adjacent to the failure will wrap the ring onto the alternate fiber. The data packets will take the multihop path from Node 4 to Node 2.

*Figure 11 SRP Ring with a Fiber-Cut in Wrap Mode*




## Configuring Mated DPT Line Cards

When you first install a pair of OC-48c/STM-16c or OC-192c/STM-64c DPT line cards, always ensure that the first line card is inserted into the lowest slot number first. For example, if a pair of 1OC-48c/STM-16c DPT line cards are present in Cisco 12000 Series Internet Router slots 2 and 3, the line card in slot 2 is the first card of the pair (side A) and the line card in slot 3 is the second card (side B).

At installation, the two line cards that are connected by a mate cable are *administratively down*. The following procedures describe how to use the **hw-module slot** *number* **srp** command in privileged EXEC mode to enable the paired line cards as one interface with one IP address. Side A is automatically the left- or top-most slot of the pair of line cards.

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router# show running`<br>`.......`<br>`hw-module slot 4 shutdown`<br>`hw-module slot 5 shutdown` | Enter the **show running configuration** command in privileged EXEC mode to verify that the line cards are administratively down at installation. |
| **Step 2** | `Router# hw-module slot` *number* `srp` | Enter the **hw-module slot** *number* **srp** command to bring up each line card. |
| **Step 3** | `Router# show gsr` | Enter the **show gsr** command to verify that each line card is enabled. |

**Note** Do not use a **shutdown** command before you replace a single line card. When you remove both sides of the mate cable, the line card will automatically enter wrap mode on the remaining line card and create half an SRP ring. (See Figure 7.)

Before you remove both line cards, Cisco recommends that you use the **shutdown** command to disable the SRP interface to prevent anomalies when you reinstall two new or reconfigured line cards. When you shut down an SRP interface, it is designated as *administratively down* in the **show** command display.

## Creating a Ring with Two DPT Line Cards

This section provides procedures on how to create an SRP ring using two line cards that are connected with a mate cable and are installed in a Cisco 12000 Series Internet Router. Follow these steps to create a four-node SRP ring and use Figure 12 and Figure 13 as references.

**Note** These procedures apply to both the OC-48c/STM-16c and the OC-192c/STM-64c DPT line cards.

**Step 1** Install two DPT line cards in a Cisco 12000 Series Internet Router and connect them with a mate cable. The first router with a pair of DPT line cards becomes Node 1, the first SRP interface on the ring.

**Step 2** To add more nodes to the ring, connect the cables on the mated line cards observing the receive (RX) and transmit (TX) cabling relationship, which means that an RX port on one DPT line card must be connected to a TX port on the next DPT line card.

The labels under the fiber connectors identify side A, TX and RX, and side B, TX and RX. Use Figure 12, Figure 13, and Table 5 to create cable connections for a four-node ring with two line cards.

***Figure 12 Creating an SRP Ring Using Two DPT Line Cards (OC-48c/STM-16c Shown)***

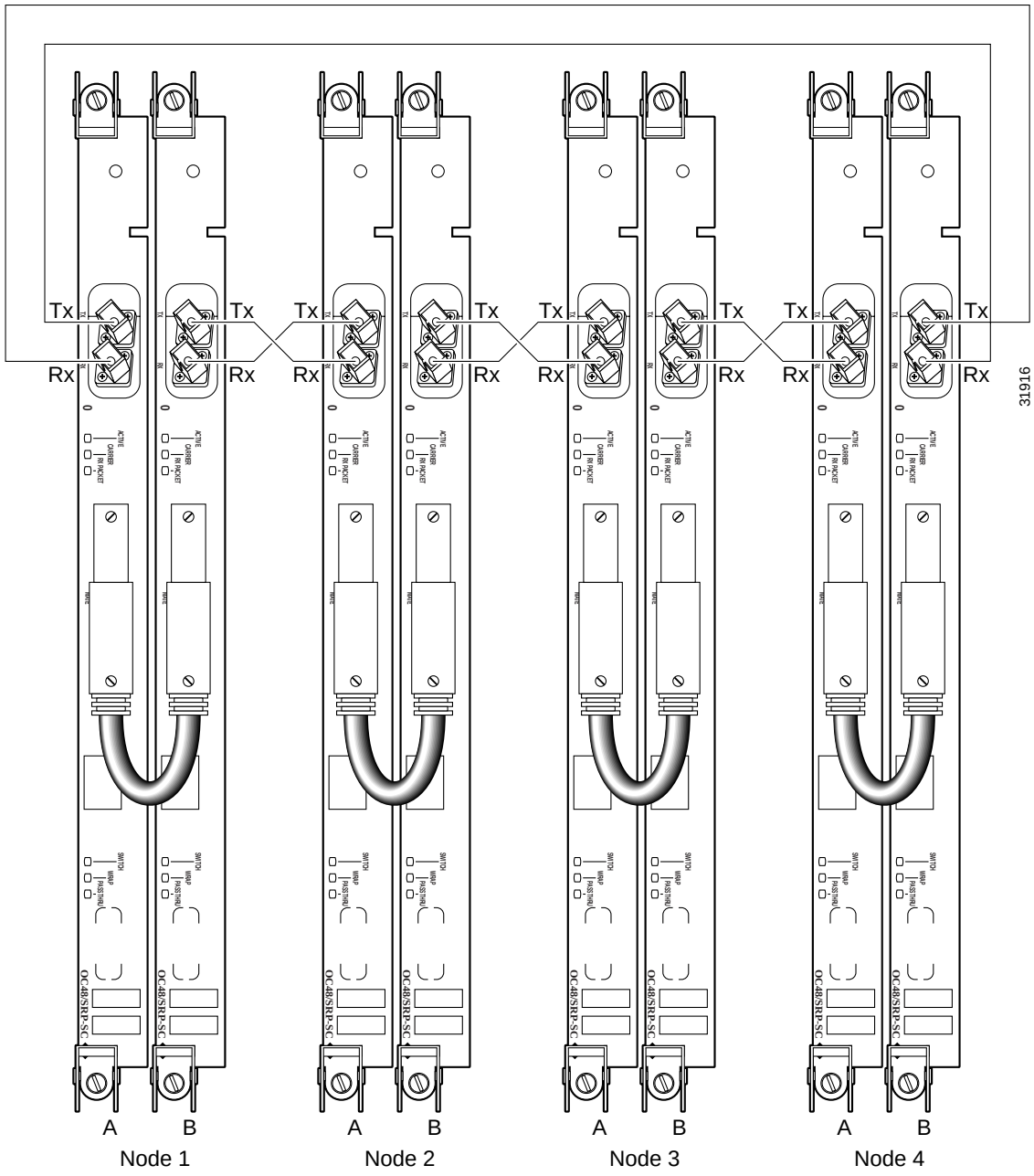


*Figure 13 4-Node SRP Ring*

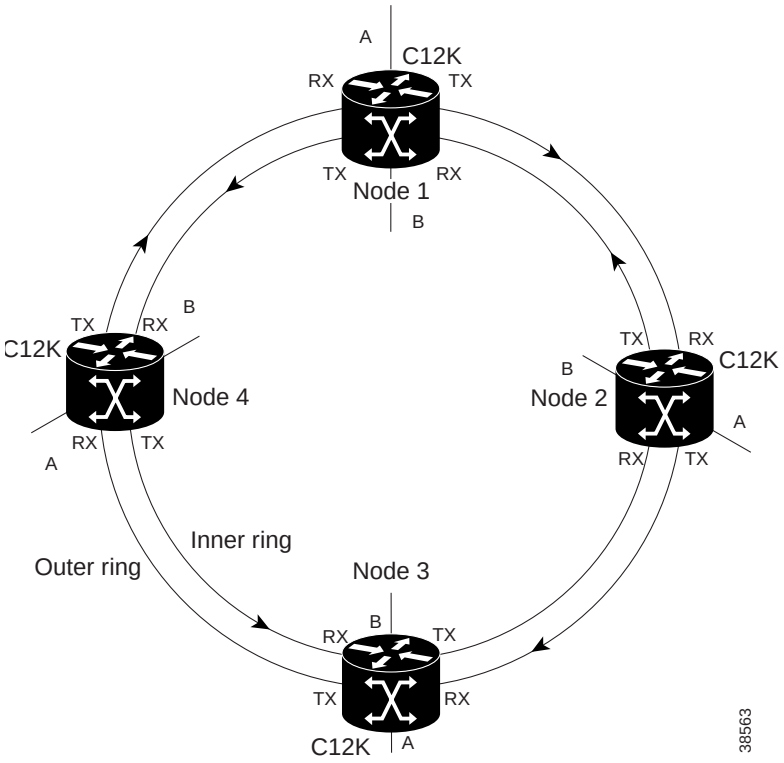



Table 5 lists the cable connections for a 4-node ring.

*Table 5 Cable Connections for 4-Node Ring*

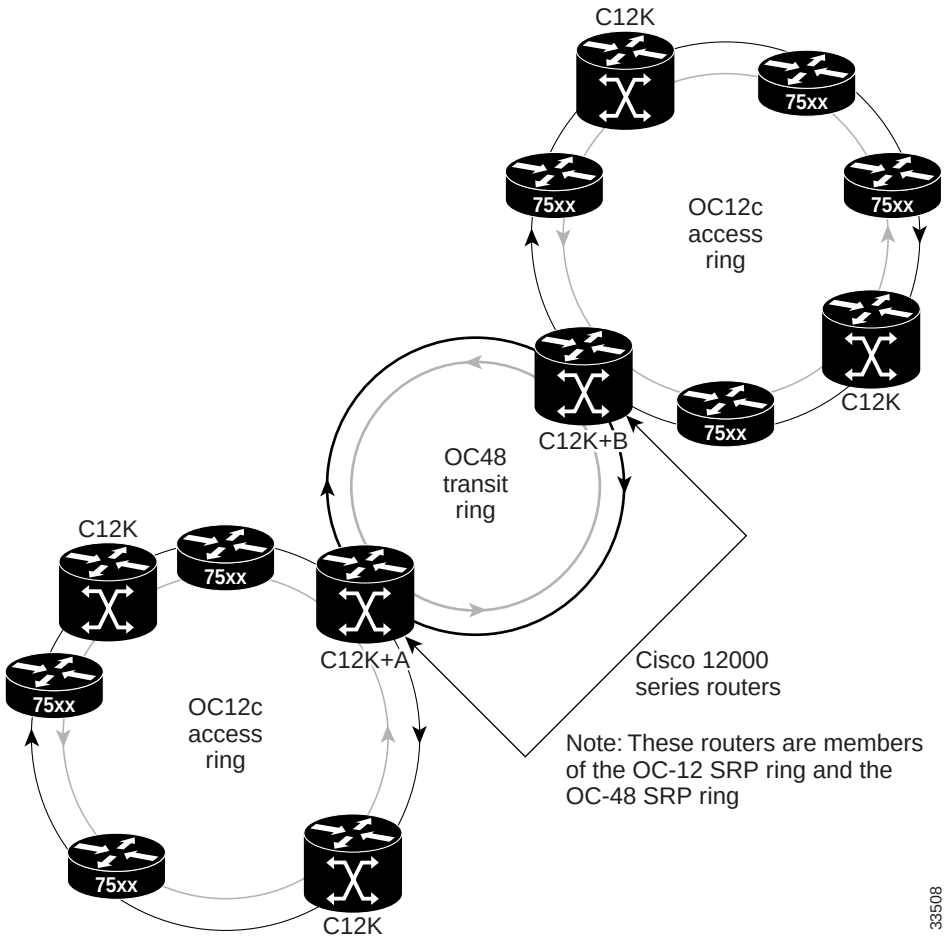
| From Node / Connector | To Node / Connector |
|---|---|
| Node 1 / TX side B | Node 2 / RX side A |
| Node 2 / TX side B | Node 3 / RX side A |
| Node 3 / TX side B | Node 4 / RX side A |
| Node 4 / TX side B | Node 1 / RX side A |
| Node 1 / TX side A | Node 4 / RX side B |
| Node 4 / TX side A | Node 3 / RX side B |
| Node 3 / TX side A | Node 2 / RX side B |
| Node 2 / TX side A | Node 1 / RX side B |

# Creating a Metropolitan-Area Network with SRP Rings

In this example, an OC-48c/STM-16c SRP ring is used to interconnect two OC-12c/STM-4c access rings to form a larger hierarchical SRP ring topology by directly connecting two Cisco 12000 Series Internet Routers together using direct fiber connections without the use of SONET Add/Drop Multiplexers (ADMs). (See Figure 14.)

**Note** Each SRP ring must be on a different subnet.

***Figure 14 Two OC12 SRP Rings Connected to an OC48 SRP Ring***




The following configuration example shows the Cisco IOS commands used to configure SRP rings on the GSR+ A and GSR+ B routers in Figure 14.

## GSR+ A Configuration

```
GSR+A:
Building configuration...
Current configuration:
!
version 12.0
no service pad
service timestamps debug uptime
service timestamps log uptime
service password-encryption
!
hostname GSR+A
!
!
hw-module slot 4 srp
```

```
!
ip subnet-zero
no ip domain-lookup
ip multicast-routing distributed
 ip pim rp-address 10.8.1.20 1
!
interface Loopback0
ip address 10.0.0.1 255.255.255.252
no ip directed-broadcast
!
interface SRP1/0
ip address 10.10.10.1 255.255.255.192
no ip redirects
no ip directed-broadcast
ip pim sparse-mode
ip mroute-cache distributed
load-interval 30
!
interface Ethernet0
ip address 10.100.1.2 255.255.255.0
no ip directed-broadcast
no ip route-cache cef
!
interface SRP4/0
ip address 10.10.20.1 255.255.255.192
no ip redirects
no ip directed-broadcast
ip pim sparse-mode
ip mroute-cache distributed
load-interval 30
 srp topology-timer 1
 srp ips wtr-timer 10
!

router ospf 100
network 10.10.10.0 0.0.0.255 area 1
network 10.10.20.0 0.0.0.255 area 0
network 10.0.0.1 0.0.0.0 area 0

auto-cost reference-bandwidth 2488
!
ip classless
!
```

## GSR B Configuration

```
GSR+B:
Building configuration...
Current configuration:
!
version 12.0
no service pad
service timestamps debug uptime
service timestamps log uptime
service password-encryption
!
hostname GSR+B
!
!
hw-module slot 4 srp
!
ip subnet-zero
```

```
no ip domain-lookup
ip multicast-routing distributed
 ip pim rp-address 10.8.1.20 1
!
interface Loopback0
ip address 10.0.0.2 255.255.255.252
no ip directed-broadcast
!
interface SRP1/0
ip address 10.10.30.1 255.255.255.192
no ip redirects
no ip directed-broadcast
ip pim sparse-mode
ip mroute-cache distributed
load-interval 30
!
interface Ethernet0
ip address 10.100.1.5 255.255.255.0
no ip directed-broadcast
no ip route-cache cef
!
interface SRP4/0
ip address 10.10.20.2 255.255.255.192
no ip redirects
no ip directed-broadcast
ip pim sparse-mode
ip mroute-cache distributed
load-interval 30
 srp topology-timer 1
 srp ips wtr-timer 10
!
router ospf 100

network 10.10.30.0 0.0.0.255 area 2
 network 10.10.20.0 0.0.0.255 area 0
 network 10.0.0.2 0.0.0.0 area 0
auto-cost reference-bandwidth 2488
!
ip classless
```

# Verifying SRP Connections

Use the **show controllers srp** command and look at the path trace information (if no other path-terminating equipment exists). An alarm message is generated if a connection occurs on port A (- port A) or port B (- port B).

# Troubleshooting Tips

- Layer 1 Issues
  - Using the **show controllers srp** command, verify that no SONET errors exist on either side A or side B. If errors are detected, check the dBm levels of the DPT line card. If the dBm levels are lower than the specification (too much power), add attenuation until the readings are correct. A possible reason for a low-level reading is short-distance use with intermediate-range (IR) or long-range (LR) optics. (The ideal dB level is –10 to –15 dBm).

    If the dBm levels are higher than the specification (not enough power), clean all optics and reduce the number of fiber splices or connections (for example, a fiber patch panel). Verify the integrity of the fiber used (no kinks, breaks, or tight coils or bends). If dBm levels are still too high, change to a more powerful optic at the transmission side.
  - Using the **show controllers srp** command, verify that the correct neighbors appear on the proper sides of the ring.
  - Using the **show arp** command, verify that you have a correct Address Resolution Protocol (ARP) table.
  - Using the **srp clock-source** command, verify the clocking methods that are in use. The two modes of clocking for the SRP interface are: internal and line. Internal means that the SRP interface is using its internal clock. Line means that timing is coming from the neighbor on that line. It is acceptable for all line cards to use the internal clock, but this may result in occasional bit interleaved parity (BIP) errors over time. You cannot use the line clocking method with all of the line cards. Ideal clocking is achieved by pairing opposite sides of a connection (one side internal and one side line). The optimal default solution is to clock all side A cards one way and all side B cards the opposite way.
  - Using the **srp shutdown** command, place the DPT line card in pass-through mode. In pass-through mode, the line card acts like an optical regenerator. This mode is activated whenever the interface is placed in shutdown mode, or when the node is not receiving Layer 2 keepalives on either of its sides (in this case, the node is basically isolated). Pass-through mode is useful to isolate which node on the ring is faulty.
- Layer 2 Issues
  - Using the **show srp topology** command, check the last received topology packet entry. It should be 5 seconds maximum (using default settings). If the last received packet value is higher than 5 seconds, topology packets are being lost on the ring. This happens to all nodes on the ring. Check for misconnected fibers (side A to side A or TX to TX, and so forth) using the **show srp** command. A misconnection alarm appears at the top of the **show srp** display. If you see only one alarm (that is, side A connected to side A), then it is the side A neighbor that has a problem. If you see two alarms (side A to A and side B to B), your side is the problem node.
  - Using the **show srp failures** command, verify that no ring wraps are being reported by IPS. Also verify the status of the IDLE, SHORT entry on the IPS messages being transmitted and received. Any status other than IDLE, SHORT indicates that some type of SONET errors are present. If more detailed information is required, use one of the **debug srp** commands.

**Caution** Never use the **debug srp packet** command with traffic running on the ring.

# Command Reference

This section documents only new or modified commands used to configure the Spatial Reuse Protocol on supported DPT line cards.



For information about the debug commands used to troubleshoot an SRP ring, see debug Commands, page 100.

**Note** The command references for the **shutdown**, **srp shutdown**, **srp ips timer**, **srp ips wtr-timer**, and **srp loopback** commands differ for the OC-12c/STM-4c DPT line card, the OC-12c/STM-4c DPT XR-SC line card, and the OC-48c/STM-16c DPT line card.

The OC-12c/STM-4c DPT line card commands specify side A or side B. The OC-48c/STM-16c and OC-192c/STM-64c DPT line card commands do not specify a side.

The OC-48c/STM-16c DPT line card command reference immediately follows the OC-12c/STM-4c DPT line card command reference.

# clear counters srp

To clear the output from the **show srp** and **show srp source-counters** or **show srp counters** commands, use the **clear counters srp** *slot/port* command in privileged EXEC mode.

**clear counters srp** *slot/port*

## Syntax Description

| | |
|---|---|
| *slot/port* | Identifies the router slot and port number for the SRP interface. |

## Defaults

If no interface is specified by a slot/port combination, counters for all SRP interfaces on the router are cleared.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was introduced. |

## Usage Guidelines

This command applies to SRP interfaces only.

## Examples

The following example shows how to use the **clear counters srp** command to make the counts displayed from the **show srp source-counters** command return to zero:

```
Router# show srp source-counters

 Source Address Information for Interface SRP2/0
    0000.0000.0009, index 1, pkt. count 0
    0000.0000.0010, index 2, pkt. count 126
    0000.0000.0011, index 3, pkt. count 0

Router# clear counters srp 2/0
Clear "show interface" counters on this interface [confirm]y
Router#
*Jan  2 20:52:26.621: %CLEAR-5-COUNTERS: Clear counter on interface SRP2/0
```

## Related Commands

| Command | Description |
|---|---|
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |
| **show srp counters** | Displays counters for the packets received, transmitted, and transited on both sides of an SRP node. |
| **show srp source-counters** | Displays the total number of packets received by a node identified by its unique MAC address. |

# show controllers srp

To display the currently running SRP controller, use the **show controllers srp** *slot/port* command in privileged EXEC mode.

**show controllers srp [***slot/port***] [details] [transceiver]**

## Syntax Description

| | |
|---|---|
| *slot/port* | Identifies the router slot and port number for the SRP interface. |
| **details** | Provides additional information about the controller in the output. |
| **transceiver** | Displays the status of the SFP module used in a specified SRP port. |

## Defaults

No default behavior or values.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was introduced. |
| 12.0(26)S | Optical power values are displayed in **show controllers srp** command output for 4-Port OC-12c/STM-4c DPT ISE, 4-Port OC-48c/STM-16c DPT, and 1-Port OC-192c/STM-64c DPT line cards. |
| 12.0(30)S | Support for the optional **transceiver** keyword was added. |

## Usage Guidelines

This command applies to SRP interfaces only.

Starting in IOS Release 12.0(30)S, you can enter the **show controllers srp** *slot/port* **transceiver** command to display additional information on the status of the small form-factor pluggable (SFP) module used in an SRP port.

## Examples

This example shows the output of the **show controllers srp** command for a specified SRP interface.

Note that for a 4-Port OC-12c/STM-4c DPT ISE, 4-Port OC-48c/STM-16c DPT, or 1-Port OC-192c/STM-64c DPT line card, the optical power usage is displayed at the bottom, following the SRP controller configuration:

```
Router1# show controllers srp 3/0
SRP3/0 - Side A (Outer RX, Inner TX)
SECTION
  LOF = 1          LOS    = 1                          BIP(B1) = 0
LINE
  AIS = 1          RDI    = 0          FEBE = 0        BIP(B2) = 0
PATH
  AIS = 1          RDI    = 0          FEBE = 0        BIP(B3) = 0
  LOP = 0          NEWPTR = 0          PSE  = 0        NSE     = 0

Active Defects: SLOF SLOS LAIS PAIS
Active Alarms:  SLOS
```

```
Alarm reporting enabled for: SLOS SLOF PLOP

Framing           : SONET
Rx SONET/SDH bytes: (K1/K2) = 0/0        S1S0 = 0  C2 = 0
Tx SONET/SDH bytes: (K1/K2) = 0/0        S1S0 = 0  C2 = 0x16  J0 = 0x1
Clock source      : Internal
Framer loopback   : None
Path trace buffer : Unstable

BER thresholds:           SF = 10e-3  SD = 10e-6
IPS BER thresholds(B3):   SF = 10e-3  SD = 10e-6
TCA thresholds:           B1 = 10e-6  B2 = 10e-6  B3 = 10e-6
 --More--
Optical Power Monitoring
  Rx optical power: -31 (+/- 2)dBm
  Tx optical power: -13 (+/- 2)dBm

SRP3/0 - Side B (Inner RX, Outer TX)
SECTION
  LOF = 1          LOS    = 1                           BIP(B1) = 0
LINE
  AIS = 1          RDI    = 0          FEBE = 0         BIP(B2) = 0
PATH
  AIS = 1          RDI    = 0          FEBE = 0         BIP(B3) = 0
  LOP = 0          NEWPTR = 0          PSE  = 0         NSE     = 0

Active Defects: SLOF SLOS LAIS PAIS
Active Alarms:  SLOS
Alarm reporting enabled for: SLOS SLOF PLOP

Framing           : SONET
Rx SONET/SDH bytes: (K1/K2) = 0/0        S1S0 = 0  C2 = 0
Tx SONET/SDH bytes: (K1/K2) = 0/0        S1S0 = 0  C2 = 0x16  J0 = 0x1
Clock source      : Internal
Framer loopback   : None
Path trace buffer : Unstable

BER thresholds:           SF = 10e-3  SD = 10e-6
IPS BER thresholds(B3):   SF = 10e-3  SD = 10e-6
TCA thresholds:           B1 = 10e-6  B2 = 10e-6  B3 = 10e-6

Optical Power Monitoring
  Rx optical power: -31 (+/- 2)dBm
  Tx optical power: -12 (+/- 2)dBm
```

The following example shows the output for the **show controllers srp transceiver** command when it is used to check the status of the SFP module used in an SRP port on a Dual Mode IEEE 802.17 RPR/SRP uplink card.

```
Router# show controllers srp 1/1 transceiver

Show Transceiver: Side A
Static information
   ID: SFP transceiver
   Extended ID: 4
   Connector: LC
   SONET compliance: OC48SR
   Gigabit Ethernet compliance: unspecified
   Fibre Channel link length: unspecified
   Fibre Channel transmitter technology: unspecified
   Fibre Channel transmission media: unspecified
   Fibre Channel speed: unspecified
   Encoding: reserved
   Bit Rate: 2500 Mbps
```

```
   Single mode fiber supported length: 2 km
   Upper bit rate limit: unspecified
   Lower bit rate limit: unspecified
   Date code (yyyy/mm/dd): 2004/04/21
   Vendor PN: SCP6828-C5-BNE
   Vendor revision number: D
   Vendor serial number: ECL0817001L

Transceiver status information
   Diagnostics calibration is external
   Temperature 39 (+/-3 Celsius)
   Voltage in transceiver 3231000 uV (+/- 10 mV)
   TX bias 8940 uA (+/- 100uA)
   TX power 320200 nW / -4 dBm (+/- 3dBm)
   RX power 300300 nW / -5 dBm (+/- 3dBm)
No Active Alarms
No Active Warnings

Alarm Thresholds:
                        high                     low
Temperature              96 C                   -44 C
Voltage             4000000 uV                    0 uV
TX bias               70000 uA                    0 uA
TX power            1000000 nW / 0   dBm      50100 nW / -13 dBm
RX power            1008300 nW / 0   dBm   unspecified

Warning Thresholds:
                        high                     low
Temperature              91 C                  - 9 C
Voltage             3600000 uV               3000000 uV
TX bias               60000 uA                    0 uA
TX power             630900 nW / -2  dBm      79400 nW / -11 dBm
RX power            1008300 nW / 0   dBm   unspecified

Show Transceiver: Side B
Static information
   ID: SFP transceiver
   Extended ID: 4
   Connector: LC
   SONET compliance: OC48SR
   Gigabit Ethernet compliance: unspecified
   Fibre Channel link length: unspecified
   Fibre Channel transmitter technology: unspecified
   Fibre Channel transmission media: unspecified
   Fibre Channel speed: unspecified
   Encoding: reserved
   Bit Rate: 2500 Mbps
   Single mode fiber supported length: 2 km
   Upper bit rate limit: unspecified
   Lower bit rate limit: unspecified
   Date code (yyyy/mm/dd): 2004/04/21
   Vendor PN: SCP6828-C5-BNE
   Vendor revision number: D
   Vendor serial number: ECL0817001M

Transceiver status information
   Diagnostics calibration is external
   Temperature 39 (+/-3 Celsius)
   Voltage in transceiver 3230200 uV (+/- 10 mV)
   TX bias 8740 uA (+/- 100uA)
   TX power 287400 nW / -5 dBm (+/- 3dBm)
   RX power 310200 nW / -5 dBm (+/- 3dBm)
No Active Alarms
No Active Warnings
```

```
Alarm Thresholds:
                          high                      low
Temperature                96 C                    -44 C
Voltage                 4000000 uV                   0 uV
TX bias                   70000 uA                   0 uA
TX power                1000000 nW / 0   dBm      50100 nW / -13 dBm
RX power                1008300 nW / 0   dBm   unspecified

Warning Thresholds:
                          high                      low
Temperature                91 C                   - 9 C
Voltage                 3600000 uV                3000000 uV
TX bias                   60000 uA                   0 uA
TX power                 630900 nW / -2  dBm      79400 nW / -11 dBm
RX power                1008300 nW / 0   dBm   unspecified
```

## Related Commands

| Command | Description |
|---|---|
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |
| **show interfaces srp** | Shows interface details such as packet rates. |

# show interfaces srp

To show information about an SRP interface, use the **show interfaces srp** *slot*/*port* command in privileged EXEC mode.

**show interfaces srp** *slot-port* [**accounting | crb** | **fair-queue** | **irb** | **mac-accounting** | **precedence** | **random-detect** | **rate-limit** | **shape**]

## Syntax Descriptions

| | |
|---|---|
| *slot*/*port* | Identifies the router slot and port number for the DPT line card. |
| accounting | (Optional) Displays the number of packets of each protocol type that was sent through the interface. |
| crb | (Optional) Shows interface routing and bridging information. |
| fair-queue | (Optional) Shows interface queueing information. |
| irb | (Optional) Shows integrated routing and bridging information. |
| mac-accounting | (Optional) Shows interface MAC accounting information. |
| precedence | (Optional) Shows interface precedence accounting information. |
| random-detect | (Optional) Shows interface Weighted Random Early Detection (WRED) information. |
| rate-limit | (Optional) Shows interface rate-limit information. |
| shape | (Optional) Shows information about how traffic is shaped on the interface. |

## Defaults

No default behavior or values.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

All of the options are not relevant to SRP interfaces.

## Examples

The following example shows how to examine a specific SRP interface using the **show interfaces srp** *slot*/*port* command:

```
Router# show interfaces srp 2/0
SRP2/0 is up, line protocol is up
  Hardware is SRP over SONET, address is 0012.3456.0001 (bia 0008.200e.5954)
  Internet address is 1.1.1.1/24
  MTU 4470 bytes, BW 2488000 Kbit, DLY 100 usec, rely 255/255, load 1/255
  Encapsulation SRP2,
  Side A: loopback not set
  Side B: loopback not set
     3 nodes on the ring   MAC passthrough not set
```

```
   Side A: not wrapped   IPS local: IDLE       IPS remote: IDLE
   Side B: not wrapped   IPS local: IDLE       IPS remote: IDLE
Last input 00:00:01, output 00:00:00, output hang never
Last clearing of "show interface" counters 00:00:20
Queueing strategy: fifo
Output queue 0/40, 0 drops; input queue 0/75, 0 drops
Side A: 5 minutes output rate 0 bits/sec, 0 packets/sec
        5 minutes input rate 0 bits/sec, 0 packets/sec
Side B: 5 minutes output rate 0 bits/sec, 0 packets/sec
        5 minutes input rate 0 bits/sec, 0 packets/sec
   0 packets input, 0 bytes, 0 no buffer
   Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
   0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
   0 packets output, 0 bytes, 0 underruns
   0 output errors, 0 collisions, 0 interface resets
   0 output buffer failures, 0 output buffers swapped out
   Side A received errors:
      0 input errors, 0 CRC, 0 ignored,
      0 framer runts, 0 framer giants, 0 framer aborts,
      0 mac runts, 0 mac giants, 0 mac aborts
   Side B received errors:
      0 input errors, 0 CRC, 0 ignored,
      0 framer runts, 0 framer giants, 0 framer aborts,
      0 mac runts, 0 mac giants, 0 mac aborts
```

Table 6 describes selected fields from the **show interfaces srp** command output.

***Table 6 show interfaces srp Command Output Fields***

| Field | Description |
|---|---|
| SRP is {up \| down} | Interface is either currently active and inserted into ring (up) or inactive and not inserted (down). |
| SRP is reset | Hardware error has occurred. |
| SRP is initializing | Hardware is up, in the process of inserting the ring. |
| SRP is administratively down | Hardware has been taken down by an administrator. |
| line protocol is {up \| down \| administratively down} | Indicates whether the software processes that handle the line protocol believe the interface is usable (that is, whether keepalives are successful). |
| Hardware | Specifies the hardware type. |
| Internet address | Specifies the Internet address and subnet mask. |
| MTU | Maximum Transmission Unit of the interface. |
| BW | Bandwidth of the interface in kilobits per second. |
| DLY | Delay of the interface in microseconds. |
| rely | Reliability of the interface as a fraction of 255 (255/255 is 100% reliability), calculated as an exponential average over 5 minutes. |
| load | Load on the interface as a fraction of 255 (255/255 is completely saturated), calculated as an exponential average over 5 minutes. |
| Encapsulation | Encapsulation method assigned to interface. |

*Table 6 show interfaces srp Command Output Fields (continued)*

| Field | Description |
|---|---|
| loopback | Indicates if loopback is set or not. |
| Nodes on the ring | Number of nodes visible on the ring through the SRP topology. |
| MAC passthrough | Indicates if the MAC address of the ring controller is set in passthrough mode. If passthrough mode is set, all data received on one side of the MAC address is transmitted on the other side of the MAC address (A->B or B->A) without being passed to the upper layers. In passthrough mode, the node acts as a regeneration controller for data. |
| Side A: {wrapped \| not wrapped} | Indicates if a wrap protection event occurred on this side of the ring. If a wrap is present, any data received that is not destined to this node is wrapped back on the opposite ringlet to try to reach the destination. Data is wrapped back on the opposite ringlet when a protection event has been detected that makes the other side of the node unusable. |
| Side A: IPS local | Indicates if a local protection issue occurred. If IDLE is reported, there is no problem. SF indicates an issue on this side of the node and that the opposite side will be wrapped. |
| Side A: IPS remote | Indicates if a remote protection issue (on the receive neighbor of this side) occurred. If IDLE is reported, there is no problem. SF indicates an issue on the neighbor on this side of the node and that the opposite side will be wrapped. |
| Side B: {wrapped \| not wrapped} | Indicates if a wrap protection event occurred on this side of the ring. If a wrap is present, any data received that is not destined to this node is wrapped back on the opposite ringlet to try to reach the destination. Data is wrapped back on the opposite ringlet when a protection event has been detected that makes the other side of the node unusable. |
| Side B: IPS local | Indicates if a local protection issue occurred. If IDLE is reported, there is no problem. SF indicates an issue on this side of the node and that the opposite side will be wrapped. |
| Side B: IPS remote | Indicates if a remote protection issue (on the receive neighbor of this side) occurred. If IDLE is reported, there is no problem. SF indicates an issue on the neighbor on this side of the node and that the opposite side will be wrapped. |

*Table 6 show interfaces srp Command Output Fields (continued)*

| Field | Description |
|---|---|
| Last input | Number of hours, minutes, and seconds since the last packet was successfully received by an interface. Useful for knowing when a dead interface failed. This counter is updated only when packets are process switched, not when packets are fast switched. |
| output | Number of hours, minutes, and seconds since the last packet was successfully transmitted by an interface. This counter is updated only when packets are process switched, not when packets are fast switched. |
| output hang | Number of hours, minutes, and seconds (or never) since the interface was last reset because of a transmission that took too long. When the number of hours in any of the "last" fields exceeds 24 hours, the number of days and hours is printed. If that field overflows, asterisks are printed. |
| Last clearing | Time at which the counters that measure cumulative statistics (such as number of bytes transmitted and received) shown in this report were last reset to zero. Note that variables that might affect routing (for example, load and reliability) are not cleared when the counters are cleared.<br>*** indicates the elapsed time is too large to be displayed.<br>0:00:00 indicates the counters were cleared more than $2^{31}$ms (and less than $2^{32}$ms) ago. |
| Output queue, drops<br>Input queue, drops | Number of packets in output and input queues. Each number is followed by a slash, the maximum size of the queue, and the number of packets dropped due to a full queue. |
| Five minute input rate,<br>Five minute output rate | Average number of bits and packets transmitted per second in the last 5 minutes.<br>The 5-minute input and output rates should be used only as an approximation of traffic per second during a given 5-minute period. These rates are exponentially weighted averages with a time constant of 5 minutes. A period of four time constants must pass before the average will be within two percent of the instantaneous rate of a uniform stream of traffic over that period. |
| packets input | Total number of error-free packets received by the system. |

*Table 6 show interfaces srp Command Output Fields (continued)*

| Field | Description |
|---|---|
| bytes input | Total number of bytes, including data and MAC encapsulation, in the error free packets received by the system. |
| no buffer | Number of received packets discarded because there was no buffer space in the main system. Compare with ignored count. Broadcast storms on Ethernet networks and bursts of noise on serial lines are often responsible for no input buffer events. |
| broadcasts | Total number of broadcast or multicast packets received by the interface. |
| runts | Number of packets that are discarded because they are smaller than the medium's minimum packet size. |
| giants | Number of packets that are discarded because they exceed the medium's maximum packet size. |
| input errors | Total number of no buffer, runts, giants, CRCs, frame, overrun, ignored, and abort counts. Other input-related errors can also increment the count, so that this sum might not balance with the other counts. |
| CRC | Cyclic redundancy checksum generated by the originating LAN station or far-end device does not match the checksum calculated from the data received. On a LAN, this usually indicates noise or transmission problems on the LAN interface or the LAN bus itself. A high number of CRCs is usually the result of a station transmitting bad data. |
| frame | Number of packets received incorrectly having a CRC error and a noninteger number of octets. |
| overrun | Number of times the serial receiver hardware was unable to hand received data to a hardware buffer because the input rate exceeded the receiver's ability to handle the data. |
| ignored | Number of received packets ignored by the interface because the interface hardware ran low on internal buffers. These buffers are different than the system buffers mentioned previously in the buffer description. Broadcast storms and bursts of noise can cause the ignored count to be increased. |
| abort | Illegal sequence of one bits on a serial interface. This usually indicates a clocking problem between the serial interface and the data link equipment. |

*Table 6 show interfaces srp Command Output Fields (continued)*

| Field | Description |
|---|---|
| packets output | Total number of messages transmitted by the system. |
| bytes output | Total number of bytes, including data and MAC encapsulation, transmitted by the system. |
| underruns | Number of times that the far-end transmitter has been running faster than the near-end router's receiver can handle. This may never be reported on some interfaces. |
| output errors | Sum of all errors that prevented the final transmission of datagrams out of the interface being examined. Note that this may not balance with the sum of the enumerated output errors, as some datagrams may have more than one error, and others may have errors that do not fall into any of the specifically tabulated categories. |
| collisions | Since an SRP Ring cannot have collisions, this statistic is nonzero only if an unusual event occurred when frames were being queued or dequeued by the system software. |
| interface resets | Number of times an interface has been reset. The interface may be reset by the administrator or automatically when an internal error occurs. |
| output buffer failures | Number of no resource errors received on the output. |
| output buffers swapped out | Number of packets swapped to DRAM. |
| Side A received errors: | Number of input errors, CRC, runs, giants, and aborted packets |
| Side B received errors: | Number of input errors, CRC, runs, giants, and aborted frames. |

## Related Commands

| Command | Description |
|---|---|
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |

# show srp

To show the current Intelligent Protocol Switching (IPS), source-counter, and topology status of SRP interfaces on the ring, use the **show srp** *slot*/*port* command in privileged EXEC mode.

**show srp** [*srp slot port*]

## Syntax Description

| | |
|---|---|
| *srp slot*/*port* | (Optional) Identifies the router slot and port number for a specific SRP interface; otherwise, SRP information for all interfaces is shown. |

## Defaults

No default behavior or values.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Examples

The following example produces output that displays the IPS, source-counter, and topology status of the SRP interface by using the **show srp** *slot*/*port* command:

```
Router# show srp 2/0
IPS Information for Interface SRP2/0
 MAC Addresses
   Side A (Outer ring RX) neighbor 0012.3456.0004
   Side B (Inner ring RX) neighbor 0012.3456.0002
   Node MAC address 0012.3456.0001
 IPS State
   Side A not wrapped
   Side B not wrapped
   Side A (Inner ring TX) IPS pkt. sent every 1 sec. (next pkt. after 0 sec.)
   Side B (Outer ring TX) IPS pkt. sent every 1 sec. (next pkt. after 0 sec.)
   IPS WTR period is 60 sec. (timer is inactive)
   Node IPS State IDLE
 IPS Self Detected Requests     IPS Remote Requests
   Side A IDLE                    Side A IDLE
   Side B IDLE                    Side B IDLE
 IPS messages received
   Side A (Outer ring RX) {0012.3456.0002,IDLE,S}, TTL 128
   Side B (Inner ring RX) {0012.3456.0004,IDLE,S}, TTL 128
 IPS messages transmitted
   Side A (Inner ring TX) {0012.3456.0001,IDLE,S}, TTL 128
   Side B (Outer ring TX) {0012.3456.0001,IDLE,S}, TTL 128

 Source Address Information for Interface SRP2/0
    0012.3456.0001, index 1, pkt. count 409847
    0012.3456.0002, index 2, pkt. count 2479330
    0012.3456.0003, index 3, pkt. count 724384
    0012.3456.0004, index 4, pkt. count 1472439
```

```
 Topology Map for Interface SRP2/0
  Topology pkt. sent every 10 sec. (next pkt. after 5 sec.)
  Last received topology pkt. 00:00:04
  Nodes on the ring:4
  Hops (outer ring)      MAC       IP Address      Wrapped Name
      0             0012.3456.0001 10.1.2.1          No    Router1
      1             0012.3456.0002 10.1.2.2          No    Router2
      2             0012.3456.0003 10.1.2.3          No    Router3
      3             0012.3456.0004 10.1.2.4          No    Router4
Router#
```

Table 7 describes selected fields from the **show srp** command output.

***Table 7 show srp Command Output Fields***

| Field | Description |
|---|---|
| IPS Information for Interface SRP2/0 | IPS (Intelligent Protection Switching) identifies the status of an SRP interface on the SRP ring. The IPS field in the **show srp** command output is also produced by the **show srp ips** command output. |
| MAC Addresses<br>Side A (Outer ring RX) neighbor 0012.3456.0002 | MAC address of the next SRP node on the outer ring. |
| MAC Addresses<br>Side B (Inner ring RX) neighbor 0012.3456.0002 | MAC address of the next SRP node on the inner ring. |
| Node MAC address 0012.3456.0001 | MAC address of this SRP node. |
| IPS State | Reports whether or not a wrap exists on side A or side B of the SRP ring. |
| IPS WTR period is 60 seconds (timer is inactive) | Displays the current WTR (Wait to Restore) timer value. If a timer is active, the time remaining before the timer expires will also be given. |
| Node IPS State IDLE | Displays the current IPS state of the node. IDLE is the normal state. Other states are WRAPPED and PASSTHRU. |
| IPS self-detected requests | Indicates any locally generated requests.<br>Indicates any remotely generated requests.<br>Displays local IPS requests, as well as IDLE status. Possible requests include the following:<br>FS — Forced Switch<br>SF — Signal Fail<br>SD — Signal Degrade<br>MS — Manual Switch<br>WTR — Wait to Restore |

*Table 7 show srp Command Output Fields (continued)*

| Field | Description |
|---|---|
| IPS remote requests | Indicates any locally generated requests.<br>Indicates any remotely generated requests.<br>Displays remote IPS requests, as well as IDLE status. Possible requests include the following:<br>FS — Forced Switch<br>SF — Signal Fail<br>SD — Signal Degrade<br>MS — Manual Switch<br>WTR — Wait to Restore |
| IPS messages received | Indicates IPS messages received on side A {0012.3456.0002,IDLE,S}, TTL 128<br>Indicates IPS messages received on side B {0012.3456.0004,IDLE,S}, TTL 128<br>Provides details of the last IPS messages received. Fields within the braces ({}) are the MAC addresses of the sending node and the APS state (IDLE, LO, FS, and so on). It also indicates either a short (S) or long (L) path. |
| IPS messages transmitted | Indicates IPS messages received on side A {0012.3456.0001,IDLE,S}, TTL 128.<br>Indicates IPS messages received on side B {0012.3456.0001,IDLE,S}, TTL 128.<br>Provides details of the last IPS messages transmitted, in the format used for received messages. |
| Source address information for interface SRP2/0 | Provides SRP source-counter information that identifies the SRP interface. This section of the **show srp** command output is also produced by **show srp source-counters** command output. |
| 0012.3456.0001, index 1, packet count 409847 | Displays the initial number of the MAC address of the SRP node whose packets are being counted. The index refers to an internal detail of the SRP implementation and has no operational significance. Packet count indicates that packets from the MAC address are being counted, and the actual count will follow. |
| Topology map for interface SRP2/0 | Displays SRP topology information that identifies the SRP interface. This section of the **show srp** command output is also produced by **show srp topology** command output. |

*Table 7 show srp Command Output Fields (continued)*

| Field | Description |
|---|---|
| Topology packet sent every 10 seconds (next packet after 5 seconds) | Displays the interval between successive topology packets sent from this node and the time until the next one is to be sent (rounded down to the nearest second). |
| Last received topology packet 00:00:04 | Displays the time since the last topology packet was received at this node. |
| Nodes on the ring: 4 | Displays the number of nodes in the current ring topology. |
| Hops | Displays the number of hops to the destination node, beginning with the assumption that the node is traveling on side A. The local node is at hop count zero. |
| MAC | Displays the MAC address of the node. |
| IP Address | Displays the IP address of the SRP interface on the node. If the address is not known, the text string "unknown" will be displayed.<br><br>Note that the IP address information is gathered by the ARP table. When a ring is first established, it is normal for the IP address of a node to remain unknown until some time after the MAC address is known. If the topology continues to display unknown for the IP address after a reasonable length of time, there is probably a problem with address resolution protocol. |
| Wrapped | Indicates whether the SRP ring is wrapped at that node, by either Yes or No. |
| Name | Displays the host name of the router. If the name is not known, this field is left blank.<br><br>Note that the host name is obtained from information that is broadcast on the ring at a slower rate than other topology information. When a ring is first established, it is normal for the host name of a remote node to remain unknown until some time after the MAC address is known. |

**Related Commands**

| Command | Description |
|---|---|
| **show controllers srp** | Displays the current controller configuration on an SRP interface. |
| **show interfaces srp** | Displays the configuration on an SRP interface. |
| **show srp counters** | Displays counters for the packets received, transmitted, and transited on both sides of an SRP node. |
| **show srp failures** | Displays the Intelligent Protection Switching (IPS) status. |
| **show srp source-counters** | Displays the total number of packets received by a node identified by its unique MAC address. |
| **show srp topology** | Identifies the nodes on the Dynamic Packet Transport ring. |

# show srp counters

To display counters for the packets received, transmitted, and transited on both sides of an SRP node, use the **show srp counters** *srp slot/port* command in privileged EXEC mode. The command output displays a subset of the information displayed by the **show srp** command.

**show srp counters** [*srp slot/port*]

## Syntax Description

| | |
|---|---|
| *srp slot/port* | (Optional) Specifies the router slot and port number of a specific SRP interface; otherwise, the command displays information about all SRP interfaces in the router. |

## Defaults

No default behavior or values.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

To clear the counters, use the **clear counters srp** command.

This command applies to SRP interfaces only and reports the per-side counters and rates for various packet paths.

## Examples

The following example shows the output from the **show srp counters** command:

```
Router# show srp counters

 Data Traffic Counters for Interface SRP2/0
   Side A:
   Transit                                Packets               Bytes
     Total Low Priority:                        0                   0
     Total High Priority:                       0                   0
     Total Multicast:                           0                   0
     Total Unicast:                             0                   0
   Host Receive                           Packets               Bytes
     Unicast Low Priority:                      0                   0
     Unicast High Priority:                     0                   0
     Multicast Low Priority:                    0                   0
     Multicast High Priority:                   0                   0
   Total Receive                          Packets               Bytes
     Unicast Low Priority:                      0                   0
     Unicast High Priority:                     0                   0
     Multicast Low Priority:                    0                   0
     Multicast High Priority:                   0                   0
   Host Transmit                          Packets               Bytes
     Unicast Low Priority:                      0                   0
     Unicast High Priority:                     0                   0
```

```
  Multicast Low Priority:                    0                    0
  Multicast High Priority:                   0                    0
Total Transmit                            Packets                Bytes
  Unicast Low Priority:                      0                    0
  Unicast High Priority:                     0                    0
  Multicast Low Priority:                    0                    0
  Multicast High Priority:                   0                    0
Traffic Rate (5 Minutes)             packets/sec             bits/sec
  Transit Low Priority                       0                    0
  Transit High Priority                      0                    0
  Transit Multicast                          0                    0
  Transit Unicast                            0                    0
  Host Receive                               0                    0
  Total Receive                              0                    0
  Host Transmit                              0                    0
  Total Transmit                             0                    0
Received Errors:
  0 input errors, 0 CRC, 0 ignored,
  0 framer runts, 0 framer giants, 0 framer aborts,
  0 mac runts, 0 mac giants, 0 mac ttl strips
Side B:
Transit                                   Packets                Bytes
  Total Low Priority:                        0                    0
  Total High Priority:                       0                    0
  Total Multicast:                           0                    0
  Total Unicast:                             0                    0
Host Receive                              Packets                Bytes
  Unicast Low Priority:                      0                    0
  Unicast High Priority:                     0                    0
  Multicast Low Priority:                    0                    0
  Multicast High Priority:                   0                    0
Total Receive                             Packets                Bytes
  Unicast Low Priority:                      0                    0
  Unicast High Priority:                     0                    0
  Multicast Low Priority:                    2                    0
  Multicast High Priority:                   0                    0
Host Transmit                             Packets                Bytes
  Unicast Low Priority:                      0                    0
  Unicast High Priority:                     0                    0
  Multicast Low Priority:                    0                    0
  Multicast High Priority:                   0                    0
Total Transmit                            Packets                Bytes
  Unicast Low Priority:                      0                    0
  Unicast High Priority:                     0                    0
  Multicast Low Priority:                    0                    0
  Multicast High Priority:                   0                    0
Traffic Rate (5 Minutes)             packets/sec             bits/sec
  Transit Low Priority                       0                    0
  Transit High Priority                      0                    0
  Transit Multicast                          0                    0
  Transit Unicast                            0                    0
  Host Receive                               0                    0
  Total Receive                              0                    0
  Host Transmit                              0                    0
  Total Transmit                             0                    0
Received Errors:
  0 input errors, 0 CRC, 0 ignored,
  0 framer runts, 0 framer giants, 0 framer aborts,
  0 mac runts, 0 mac giants, 0 mac ttl strips
```

Table 8 describes selected fields from the **show srp counters** command output.

*Table 8 show srp counters Command Output Fields*

| Field | Description |
|---|---|
| Side A | Packets received, transmitted, and transited by the MAC address of the next SRP node on the outer ring (side A). |
| Side B | Packets received, transmitted, and transited by the MAC address of the next SRP node on the inner ring (side B). |
| Transit<br>Total Low Priority | Total number of unicast and multicast packets marked as SRP low priority (based on the SRP priority mapping) that transit the router and are counted in the transmit Low Priority counters on the opposite side. |
| Transit<br>Total High Priority | Total number of unicast and multicast packets marked as SRP high priority (based on the SRP priority mapping) that transit the router and are counted in the transmit High Priority counters on the opposite side. |
| Transit<br>Total Multicast | Total number of low and high priority multicast packets that transit the router and are counted in the transmit Multicast counters on the opposite side. |
| Transit<br>Total Unicast | Total number of low and high priority unicast packets that transit the router and are counted in the transmit Unicast counters on the opposite side. |
| Host Receive<br>Unicast Low/High priority | Total number of low and high priority unicast packets received by the router. |
| Host Receive<br>Multicast Low/High priority | Total number of low and high priority multicast packets received by the router. |
| Total Receive<br>Unicast Low/High priority | Total number of low and high priority unicast packets that transit or are received by the router. |
| Total Receive<br>Multicast Low/High priority | Total number of low and high priority multicast packets that transit or are received by the router. |
| Host Transmit<br>Unicast Low/High priority | Total number of low and high priority unicast packets sourced onto the ring by the router. |
| Host Transmit<br>Multicast Low/High priority | Total number of low and high priority multicast packets sourced onto the ring by the router. |
| Total Transmit<br>Unicast Low/High priority | Total number of low and high priority unicast packets received by the opposite side. |
| Total Transmit<br>Multicast Low/High priority | Total number of low and high priority multicast packets received by the opposite side. |

*Table 8 show srp counters Command Output Fields (continued)*

| Field | Description |
|---|---|
| Traffic Rate (5 mins) | Average number of packets and bits transmitted per second during the last 5 minutes.<br>The 5-minute traffic rates should be used only as an approximation of traffic per second during a given 5-minute period. These rates are exponentially weighted averages with a time constant of 5 minutes. A period of four time constants must pass before the average will be within two percent of the instantaneous rate of a uniform stream of traffic over that period. |
| input errors | Total number of no buffer, runts, giants, CRCs, frame, overrun, ignored, and abort counts. Other input-related errors can also increment the count, so that this sum might not balance with the other counts. |
| CRC | Cyclic redundancy checksum generated by the originating LAN station or far-end device does not match the checksum calculated from the data received. On a LAN, this usually indicates noise or transmission problems on the LAN interface or the LAN bus itself. A high number of CRCs is usually the result of a station transmitting bad data. |
| ignored | Number of received packets ignored by the interface because the interface hardware ran low on internal buffers. These buffers are different than the system buffers mentioned previously in the buffer description. Broadcast storms and bursts of noise can cause the ignored count to be increased. |
| framer runts | Number of packets dropped by the framer as runts, that are smaller than 16 bytes. |
| framer giants | Number of packets dropped by the framer as giants, whose size is greater than the MTU. |

*Table 8 show srp counters Command Output Fields (continued)*

| Field | Description |
|---|---|
| framer aborts | Number of packets dropped by the framer due to an error in packet insertion from the SONET frame. Normally a framer abort is caused by a delimiter inserted at the transmit framer that forces the receive framer to drop the packet on reception since it is bad. The delimiter is inserted by the transmit framer when it cannot transmit a packet due to a transmission error. A runt or CRC error may also result. A framer abort can be caused by any of the following:<br>• A bad transmit framer at the neighbor node (upstream)<br>• BIP errors in the SONET frame that cause a false abort delimiter (often due to intermediate equipment failure or clocking issues)<br>• A bad receive framer at this node. |
| mac runts | Packets dropped by the MAC controller as runts, that are smaller than 24 bytes. |
| mac giants | Packets dropped by the MAC controller as giants, whose size is greater than the MTU. |
| mac ttl strips | Packets stripped by the MAC controller when the SRP Time to Live value expires (TTL value is 1 when a packet arrives). These packets are removed from the ring because the TTL value cannot be decreased. As a result, the packet is dropped if it is not destined for the node that strips it. |

## Related Commands

| Command | Description |
|---|---|
| **clear counters srp** | Clears the output from the **show srp** and **show srp source-counters** or **show srp counters** commands. |
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |
| **show srp source-counters** | Displays the total number of packets received by a node identified by its unique MAC address. |

# show srp failures

To display all SRP failures that were detected by the router, use the **show srp failures** *srp slot/port* command in privileged EXEC mode.

**show srp failures** [*srp slot/port*]

## Syntax Description

| | |
|---|---|
| *srp slot/port* | (Optional) Specifies the router slot and port number of a specific SRP interface; otherwise, the command displays information about all SRP interfaces in the router. |

## Defaults

None.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(21)SP | This command was first introduced in Cisco 10720 Internet Routers. |
| 12.0(22)S | This command was first introduced in Cisco 12000 Series Internet Routers. |

## Usage Guidelines

This command applies to SRP interfaces only and reports the SRP failures that were detected by the router.

Use the **show srp failures** command when an SRP interface is wrapped and you want to display information about the cause of the failure. This command displays more detailed information than the **show srp** command.

## Examples

The following example shows how to display the self-detected failures in the SRP interface configured on slot 1 port 1.

```
Router# show srp failures 1/1
 Self Detected Failures Information for Interface SRP1/1
Side A:
                Reported  Debounced  Current  Stable    Debounce
                state     state      state    for(sec)  delay(sec)
HW missing      IDLE      IDLE       IDLE     35909     0
Layer 1         IDLE      IDLE       IDLE     35885     0
MAC Keepalive   IDLE      IDLE       IDLE     35590     10
Link quality    IDLE      IDLE       IDLE     35909     0
Mate interface  IDLE      IDLE       IDLE     35909     10
Side mismatch   IDLE      IDLE       IDLE     35845     5
Result Self Detect = IDLE
```

```
Side B:
                Reported  Debounced  Current  Stable    Debounce
                state     state      state    for(sec)  delay(sec)
HW missing      IDLE      IDLE       IDLE     35910     0
Layer 1         IDLE      IDLE       IDLE     35230     0
MAC Keepalive   IDLE      IDLE       IDLE     35239     10
Link quality    IDLE      IDLE       IDLE     35910     0
Mate interface  IDLE      IDLE       IDLE     35910     10
Side mismatch   IDLE      IDLE       IDLE     35241     5
Result Self Detect = IDLE
Router#
```

Table 9 describes selected fields from the **show srp failures** command output.

***Table 9 show srp failures Command Output Fields***

| Field | Description |
|---|---|
| HW missing | The hardware (for example, a line card) is not installed or is still booting up. |
| Layer 1 | No Section Loss of Signal (SLOS), Section Loss of Frame (SLOF), or Line Alarm Indicator Signal (LAIS). For detailed information about a Layer 1 failure, use **show controllers srp** command. |
| MAC keepalive | The media access controller (MAC) keepalive timer has expired. |
| Link quality | The SONET B3 bit error rate (BER) threshold has been crossed. To configure SRP signal degrade detection and signal fail detection, use the **srp ips sonet protected** command. |
| Mate interface | The external mate cable on a line card interface is missing or malfunctioning. |
| Side mismatch | Side A of the node is connected to side A of the neighbor node, or side B of the node is connected to side B of the neighbor node. |

## Related Commands

| Command | Description |
|---|---|
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |
| **srp ips sonet protected** | Configures SRP signal degrade detection and signal fail detection. |

# show srp ips

To display the Intelligent Protection Switching (IPS) status, use the **show srp ips** *srp slot/port* command in privileged EXEC mode. This command displays a subset of the information displayed by the **show srp** command.

**show srp ips** [*srp slot/port*]

## Syntax Description

| | |
|---|---|
| *srp slot/port* | (Optional) Specifies the router slot and port number of a specific SRP interface; otherwise, the command displays information about all SRP interfaces in the router. |

## Defaults

SRP IPS is on by default and cannot be disabled.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

This command applies to SRP interfaces only.

## Examples

The following example shows how to verify the Intelligent Protection Switching on the ring by using the **show srp ips** command:

```
Router# show srp ips
 IPS Information for Interface SRP1/1
 MAC Addresses
   Side A (Outer ring RX) neighbor 0048.0001.0002
   Side B (Inner ring RX) neighbor 0048.0001.0001
   Node MAC address 0001.64fe.fe80
 IPS State
   Side A not wrapped
   Side B not wrapped
   Side A (Inner ring TX) IPS pkt. sent every 1 sec. (next pkt. after 1 sec.)
   Side B (Outer ring TX) IPS pkt. sent every 1 sec. (next pkt. after 1 sec.)
   inter card bus enabled
   IPS WTR period is 10 sec. (timer is inactive)
   Node IPS State: idle
 IPS Self Detected Requests           IPS Remote Requests
   Side A IDLE                          Side A IDLE
   Side B IDLE                          Side B IDLE
   Side A Failures: none
   Side B Failures: none
 IPS messages received
   Side A (Outer ring RX) {0048.0001.0002,IDLE,SHORT}, TTL 255
   Side B (Inner ring RX) {0048.0001.0001,IDLE,SHORT}, TTL 255
 IPS messages transmitted
   Side A (Inner ring TX) {0001.64fe.fe80,IDLE,SHORT}, TTL 255
```

```
   Side B (Outer ring TX) {0001.64fe.fe80,IDLE,SHORT}, TTL 255
Router#
```

## Related Commands

| Command | Description |
|---|---|
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |
| **show controllers srp** | Displays the current controller configuration on an SRP interface. |
| **show interfaces srp** | Displays the configuration on an SRP interface. |

# show srp rate-limit

To display the current SRP rate-limit configuration for high- and low-priority traffic, use the **show rate-limit srp** *slot*/*port* command in privileged EXEC mode.

**show srp rate-limit srp** [*slot*/*port*]

## Syntax Description

| | |
|---|---|
| *slot*/*port* | (Optional) Specifies the router slot and port number of a specific SRP interface; otherwise, the command displays information about all SRP interfaces in the router. |

## Defaults

No default behavior or values.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(11)S | This command was first introduced. |

## Usage Guidelines

This command applies to SRP interfaces only.

## Examples

The following example shows the output from the **show srp rate-limit srp** *slot*/*port* command.

```
Router# show srp rate-limit srp 2/0
Router#

Rate Limit Information for Interface SRP2/0
Rate limit of high priority outgoing traffic: 622 Mbps
Rate limit of low priority outgoing traffic: 1866 Mbps
Minimum SRP priority value of high priority outgoing/transit traffic: 5
Router#
```

## Related Commands

| Command | Description |
|---|---|
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |

# show srp source-counters

To display the total number of packets received by a node identified by its unique MAC address, use the **show srp source-counters** *srp slot/port* command in privileged EXEC mode. The command output displays a subset of the information displayed by the **show srp** command.

**show srp source-counters** [*srp slot/port*]

## Syntax Description

| | |
|---|---|
| *srp slot/port* | (Optional) Specifies the router slot and port number of a specific SRP interface; otherwise, the command displays information about all SRP interfaces in the router. |

## Defaults

No default behavior or values.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

To clear the counters, use the **clear counters srp** command.

The **show srp source-counters** command is not supported on 10720 Series Internet Routers.

## Examples

The following example shows the output from the **show srp source-counters** command after counting has been switched on for source address 0012.3456.0004:

```
Router# show srp source-counters

Source Address Information for Interface SRP2/0
0012.3456.0004, index 4, pkt. count 1472439
```

## Related Commands

| Command | Description |
|---|---|
| **clear counters srp** | Clears the output from the **show srp** and **show srp source-counters** or **show srp counters** commands. |
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |
| **show srp counters** | Displays counters for the packets received, transmitted, and transited on both sides of an SRP node. |

# show srp topology

To identify the nodes on the ring, use the **show srp topology** *srp slot/port* command in privileged EXEC mode.

**show srp topology** [*srp slot/port*]

## Syntax Description

| | |
|---|---|
| srp *slot/port* | (Optional) Specifies the router slot and port number of a specific SRP interface; otherwise, the command displays information about all SRP interfaces in the router. |

## Defaults

No default behavior or values.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

This command applies to SRP interfaces only.

## Examples

The following example shows the output that identifies SRP interfaces on the ring displayed with the **show srp topology** command:

```
Router# show srp topology

 Topology Map for Interface SRP2/0
  Topology pkt. sent every 10 sec. (next pkt. after 5 sec.)
  Last received topology pkt. 00:00:04
  Nodes on the ring:4
  Hops (outer ring)      MAC       IP Address      Wrapped Name
      0             0012.3456.0001 10.1.2.1          No    Router1
      1             0012.3456.0002 10.1.2.2          No    Router2
      2             0012.3456.0003 10.1.2.3          No    Router3
      3             0012.3456.0004 10.1.2.4          No    Router4
```

## Related Commands

| Command | Description |
|---|---|
| **show controllers srp** | Displays the current controller configuration on an SRP interface. |
| **show interfaces srp** | Displays the configuration on an SRP interface. |
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |

# show srp transit

To display information about traffic buffer delays (minimum, maximum, and average delays) using the time interval specified with the **load-interval** command, use the **show srp transit** command in privileged EXEC mode.

**show srp transit** [**srp** *slot*/*port*]

## Syntax Description

| | |
|---|---|
| *srp slot*/*port* | (Optional) Identifies the router slot and port number of an SRP interface.<br>• Slot 0 is the main board midplane card.<br>• Slot 1 is the uplink card (for example, OC-48 SRP).<br>• Slot 2 is the access card (Fast Ethernet). |

## Defaults

No default behavior or values.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(20)SP | This command was first introduced. |

## Usage Guidelines

Use this command to display the transit buffer delays for high- and low-priority traffic collected using the currently configured load interval.

The transit buffer delay is the number of nanoseconds that it takes for a packet to enter the transit buffer and come back out on the ring. This command allows you to observe the amount of packet latency experienced by traffic on the ring. This information is particularly useful when the ring is congested.

To change the amount of time used to load data and collect delay statistics, use the **load-interval** command in interface configuration mode.

## Examples

The following example shows how to display the buffer transit delays calculated for the SRP interface on port 1 on the line card in slot 1 using a load interval of 5 minutes.

```
router# show srp transit
Transit Buffer Delay Counters for Interface SRP1/1
   Side A:
   Transit Delay (5 Minutes)             Nanoseconds
     Low TB Min Delay:                           700
     Low TB Avg Delay:                           770
     Low TB Max Delay:                           820
     High TB Min Delay:                            0
     High TB Avg Delay:                            0
     High TB Max Delay:                            0
   Side B:
   Transit Delay (5 Minutes)             Nanoseconds
     Low TB Min Delay:                           780
```

```
Low TB Avg Delay:                       790
Low TB Max Delay:                       820
High TB Min Delay:                      580
High TB Avg Delay:                      613
High TB Max Delay:                      660
```

**Related Commands**

| Command | Description |
|---|---|
| **load-interval** | Sets the time (in seconds) used to gather data for computing load statistics. |

# shutdown

To disable an interface, use the **shutdown** interface configuration command. To restart a disabled interface, use the **no** form of this command.

**shutdown**
**no shutdown**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Enabled

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 10.0 | This command was first introduced. |
| 12.0(6)S | This command invokes the pass-through mode on the SRP ring. |

## Usage Guidelines

The **shutdown** command disables all functions on the specified interface. On SRP interfaces, the **shutdown** command causes the interface to go into pass-through mode, logically removing it from the ring.

This command also marks the SRP interface as unavailable. To verify if an interface is disabled, use the **show interface srp** *slot*/*port* command in privileged EXEC mode. An SRP interface that received the **shutdown** command is shown as *administratively down* in the command output.

## Examples

The following example disables SRP interface 2/0:

```
Router(config)# interface srp 2/0
Router(config-if)# shutdown
Router(config-if)#
```

The following example enables SRP interface 2/0:

```
Router(config)# interface srp 2/0
Router(config-if)# no shutdown
```

## Related Commands

| Command | Description |
|---|---|
| **show interfaces srp** | Shows the status of SRP interfaces on the router. |

# srp clock-source

To configure the clock source, use the **srp clock-source** interface configuration command. Use the **no** form of this command to restore the default **srp clock-source**.

**srp clock-source** [*line* | *internal*] [**a** | **b**]
**no srp clock-source** [*line* | *internal*] [**a** | **b**]

## Syntax Description

| | |
|---|---|
| *line* | Specifies the clock source as line. Used when connecting a router to SONET/SDH ADM. |
| *internal* | Specifies the clock source as internal. Used when connecting between two routers over dark fiber or over a Wavelength Division Multiplexing (WDM) system. |
| **a** | Specifies the clock source on side A of the router. |
| **b** | Specifies the clock source on side B of the router. |

## Defaults

**srp clock-source** [*line* | *internal*] [**a** | **b**]

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

This command applies to SRP interfaces only.

When you configure a connection between two Cisco 10700 Series Internet Routers, you can configure the SRP interfaces for clock source as follows:

- You can set both interfaces to *internal*. This is the default setting and is recommended for optimal clocking.
- You cannot set both SRP interfaces to *line*. This is not supported.
- You can configure the SRP interface on one side of the connection as *internal* and the SRP interface on the other side as *line*. This is available for installations in which line timing is desirable, such as Add/Drop Multiplexer (ADM) and Wavelength Division Multiplexing (WDM).

## Examples

The following is an example of how to use the **srp clock-source** command to select *line* as a clock source on side A:

```
Router# configure terminal
Router(config)# interface srp 2/0
Router(config-if)# srp clock-source line a
Router(config-if)#
```

## Related Commands

| Command | Description |
|---|---|
| **show controllers srp** | Shows the current clock source, in addition to other information. |

# srp fast-convergence

To enable faster Layer 3 convergence in case of an SRP node failure, use the **srp fast-convergence** interface configuration command. Use the **no** form of this command to disable Layer 3 fast notification on an SRP interface.

**srp fast-convergence**
**no srp fast-convergence**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Faster convergence of Layer 3 routing protocols in case of node failure is enabled by default.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(27)S | This command was first introduced on Cisco 12000 series Internet Routers and on the Cisco 10720 Internet Router. |

## Usage Guidelines

Starting in IOS Release 12.0(27)S, the SRP - Layer 3 Fast Notification feature is supported on Cisco 12000 series Internet Routers and on the Cisco 10720 Internet Router. This feature enables faster convergence of Layer 3 routing protocols in case of SRP ring events that cause nodes to be dropped from the ring's topology.

The Layer 3 Fast Notification feature is triggered only as a result of a wrap event or a pass-through event, when a change in the SRP ring topology indicates that a node should be dropped from the ring. The Layer 3 Fast Notification feature is not triggered when an SRP node joins the ring.

**Note** A wrap event that triggers faster convergence of Layer 3 routing protocols and results from a signal failure on both sides of an SRP node is supported in Spatial Reuse Protocol Version 1.0 and Version 2.0. A pass-through event is supported only in Spatial Reuse Protocol Version 2.0 at OC-48 or higher speeds.

In IOS Release 12.0(26)S and earlier releases, a node failure in an SRP ring causes ring wrap to occur around the failed node. Traffic flow from other nodes in the ring to the failed node continues, even if there is an alternative path, until the Internal Gateway Protocol (IGP) reconverges. The traffic is interrupted for seconds because the SRP node failure is transparent to Layer 3 protocols and IP convergence takes the normal time based on routing updates.

With the Layer 3 Fast Notification feature, changes in an SRP ring's topology map are reported immediately to Layer 3 protocols. The Layer 3 hello and routing update timers are bypassed, resulting in Layer 3 sub-second convergence.

**Note** The SRP - Layer 3 Fast Notification feature applies only to the Open Shortest Path First (OSPF) or Intermediate System-to-Intermediate System (IS-IS) routing protocols.

When the Single Ring Recovery (SRR) protocol is enabled, faster convergence of Layer 3 routing protocols does not occur. The SRR protocol enables an SRP ring to preserve full node connectivity in the event of multiple failures on one of its two counter-rotating rings while the other is failure free. In all other cases, the SRP ring maintains the standard SRP intelligent protection switching (IPS) behavior.

Layer 3 routing protocols do not reconverge for every ring protection event, but only as a result of ring protection events that indicate that a node should be dropped from the ring. Although topology packets perform the same function, Layer 3 convergence occurs much slower.

OSPF and ISIS use various timers to control how fast a topology change is sent and propagated across an SRP ring and how fast routing computation is performed when a change in topology is received. It is recommended that you tune the OSPF and ISIS timers in your network according to your network complexity and convergence requirements.

## Examples

The following example shows how to enable fast Layer 3 convergence in case of node failure and the immediate notification to Layer 3 OSPF and IS-IS protocols:

```
Router# configure terminal
Router(config)# interface srp 1/1
Router(config-if)# srp fast-convergence
```

## Related Commands

| Command | Description |
|---|---|
| **show controllers srp** | Shows the current clock source, in addition to other information. |

# srp flag

To specify SONET/SDH overhead values for the frame header, use the **srp flag** interface configuration command. Use the **no** form of this command to restore the default SRP flag.

**srp flag** [**c2** | **j0**] *value* [**a** | **b**]
**no srp flag** [**c2** | **j0**] *value* [**a** | **b**]

## Syntax Description

| | |
|---|---|
| **c2** *value* | Path signal label byte. |
| **j0** *value* | Section trace byte. For interoperability with some SDH equipment in Japan, use the value 0x1. |
| **a** | The side of a node that has outer ring receive fiber is identified as side A. |
| **b** | The side of a node that has inner ring receive fiber is identified as side B. |

## Defaults

The default value of the c2 byte is 0x16. The default value of the j0 byte is 0x01.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

This command applies to SRP interfaces only.

## Examples

The following example shows how to use the **srp flag** command to specify the SONET/SDH overhead values on an SRP interface:

```
Router# configure terminal
Router(config)# interface srp 2/0
Router(config-if)# srp flag j0 0x1
Router(config-if)#
```

## Related Commands

| Command | Description |
|---|---|
| **srp framing** | Specifies framing for the packet header and trailer to ensure synchronization and error control. |

# srp framing

To specify framing for the packet header and trailer to ensure synchronization and error control, use the **srp framing** interface configuration command. Use the **no** form of this command to restore the default value for srp framing.

**srp framing** [**sdh** | **sonet**] [**a** | **b**]
**no srp framing** [**a** | **b**]

## Syntax Description

| | |
|---|---|
| **sdh** | Selects SDH framing and sets the value of the s1s0 bits to 2. |
| **sonet** | Selects SONET framing and sets the value of the s1s0 bits to 0. |
| **a** | The side of a node that has outer ring receive fiber is identified as side A. |
| **b** | The side of a node that has inner ring receive fiber is identified as side B. |

## Defaults

The default framing is SONET with the s1s0 bits set to 0.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

There are two types of framing: SONET and SDH. SONET is the North American standard, while SDH is the European standard. Like clocking, you can configure framing independently for each side of the node.

The value of the s1s0 bits is fixed according to the framing type you configure with the **srp framing** command:

- When you configure SONET framing, the value of the s1s0 bits is set to 0.
- When you configure SDH framing, the value of the s1s0 bits is set to 2.

This command applies to SRP interfaces only.

## Examples

The following example allows you to set framing to SDH by using the **srp framing** command:

```
Router# configure terminal
Router(config)# interface srp 2/0
Router(config-if)# srp framing sdh
```

## Related Commands

| Command | Description |
|---|---|
| **srp flag** | Specifies SONET/SDH overhead values. |

# srp ips request forced-switch

To initiate a forced-switch wrap on a ring, use an **srp ips request forced-switch** interface configuration command. Use the **no** form of this command to remove the wrap.

**srp ips request forced-switch** [**a** | **b**]
**no srp ips request forced-switch** [**a** | **b**]

## Syntax Description

| | |
|---|---|
| **a** | The side of a node that has outer ring receive fiber is identified as side A. |
| **b** | The side of a node that has inner ring receive fiber is identified as side B. |

## Defaults

**srp ips request forced-switch** [**a** | **b**]

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

This command applies to SRP interfaces only.

## Examples

The following example shows how to insert a forced-switch wrap on side A of the interface by entering the **srp ips request forced-switch a** command:

```
Router# configure terminal
Router(config)# interface srp2/0
Router(config-if)# srp ips request forced-switch a
Router(config-if)#
```

**Related Commands**

| Command | Description |
|---|---|
| **srp ips request manual-switch** | Inserts a manual-switch wrap on the ring. |
| **srp ips wtr-timer** | User-configurable wait-to-restore interval that determines how long a wrap remains on the fiber after the original cause of the wrap is removed. |
| **srp shutdown** | Provides alternative form of **srp ips request forced-switch** command. |
| **show interfaces srp** | Displays current IPS wrap state, along with other information. |
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |
| **show srp failures** | Displays current IPS wrap state, along with other information. |

# srp ips request manual-switch

To insert a manual-switch wrap on the ring fiber, use an **srp ips request manual-switch** interface configuration command. Use the **no** form of the command to remove the wrap.

**srp ips request manual-switch** [**a** | **b**]
**no srp ips request manual-switch** [**a** | **b**]

## Syntax Description

| | |
|---|---|
| **a** | The side of a node that has outer ring receive fiber is identified as side A. |
| **b** | The side of a node that has inner ring receive fiber is identified as side B. |

## Defaults

**srp ips request manual-switch** [**a** | **b**]

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

This command applies to SRP interfaces only.

**Note** The **srp ips request manual-switch** command is applied to the SRP interface, but may be overridden by higher-priority events. If such cases, the manual switch is discarded. The manual switch is not saved to running-config and will not persist across reloads.

## Examples

The following example shows how to enter a manual-switch wrap on side B of the interface by using the **srp ips request manual-switch b** command:

```
Router# configure terminal
Router(config)# interface srp2/0
Router(config-if)# srp ips request manual-switch b
Router(config-if)#
```

**Related Commands**

| Command | Description |
|---|---|
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |
| **show srp failures** | Displays current IPS wrap state, along with other information. |
| **show interfaces srp** | Displays current IPS wrap state, along with other information. |
| **srp ips request forced-switch** | Inserts a forced-switch request wrap on side A or B through a user-configured command. |
| **srp ips wtr-timer** | An automatic or user-configurable wait-to-restore interval that determines how long a wrap remains on the fiber after the original cause of the wrap is removed. |

# srp ips sonet protected

Use the **srp ips sonet protected** interface configuration command to place a 100-millisecond delay (in L2 keepalive wrapping) when the ring side is connected to a protected add/drop multiplexer (ADM) network. This provides the ADM with enough time to protect itself in case of an L1 failure, without causing an L2 wrap.

**srp ips sonet protected** [**a** | **b**]
**no srp ips sonet protected** [**a** | **b**]

## Syntax Description

| | |
|---|---|
| **a** | The side of a node that has outer ring receive fiber is identified as side A. |
| **b** | The side of a node that has inner ring receive fiber is identified as side B. |

## Defaults

**no srp ips sonet protected** [**a** | **b**]

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(12)S | This command was first introduced. |

## Usage Guidelines

This command applies to SRP interfaces only.

## Examples

The following example shows how to set the **srp ips sonet protected** command:

```
Router# configure terminal
Router(config)# interface srp 2/0
Router(config-if)# srp ips sonet protected
```

## Related Commands

| Command | Description |
|---|---|
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |
| **show srp failures** | Displays current IPS timers, along with other information. |
| **srp ips wtr-timer** | A user-configurable wait-to-restore interval that determines how long a wrap remains after a trigger to an automatic request, such as signal fail, has disappeared. |

# srp ips sonet threshold

To configure SRP signal degrade detection and signal fail detection, use the **srp ips sonet threshold** interface configuration command. When detected, an SRP signal degradation will trigger the appropriate IPS protection switch. Use the **no** form of this command to restore the default value.

**srp ips sonet threshold [sd-ber | sf-ber] <3-9> [a | b]**
**no srp ips sonet threshold [sd-ber | sf-ber] <3-9> [a | b]**

## Syntax Description

| | |
|---|---|
| **sd-ber** | Sets the IPS Signal Degrade BER threshold. |
| **sf-ber** | Sets the IPS Signal Fail BER threshold. |
| **< *3–9*>** | Bit error rate (10 to the minus n) |
| **a** | The side of a node that has outer ring receive fiber is identified as side A. |
| **b** | The side of a node that has inner ring receive fiber is identified as side B. |

## Defaults

**no srp ips sonet threshold [sd-ber | sf-ber] <*3-9*> [a | b]**

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(11)S | This command was first introduced. |

## Usage Guidelines

This command applies to SRP interfaces only.

## Examples

The following example shows how to set the **srp ips sonet threshold** command to 3 seconds on side A:

```
Router# configure terminal
Router(config)# interface srp 2/0
Router(config-if)# srp ips sonet threshold sd-ber 3 a
Router(config-if)#
```

## Related Commands

| Command | Description |
|---|---|
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |
| **show srp failures** | Displays current IPS timers, along with other information. |
| **srp ips wtr-timer** | A user-configurable wait-to-restore interval that determines how long a wrap remains after a trigger to an automatic request, such as signal fail, has disappeared. |

# srp ips timer

To control the frequency of the transmission of ips requests, use the **srp ips timer** interface configuration command. Use the **no** form of this command to restore the default value.

**srp ips timer** <*value*> [**a** | **b**]
**no srp ips timer** [**a** | **b**]

## Syntax Description

| | |
|---|---|
| *value* | 1 to 60 seconds. |
| **a** | The side of a node that has outer ring receive fiber is identified as side A. |
| **b** | The side of a node that has inner ring receive fiber is identified as side B. |

## Defaults

The default setting of the IPS timer is 1 second.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

This command applies to SRP interfaces only. If a node (side A or side B) is not specified in the command, the IPS timer value is applied to both sides.

## Examples

The following example shows how to set the **srp ips timer** command to 5 seconds on side A:

```
Router# configure terminal
Router(config)# interface srp 2/0
Router(config-if)# srp ips timer 5 a
Router(config-if)#
```

## Related Commands

| Command | Description |
|---|---|
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |
| **show srp failures** | Displays current IPS timers, along with other information. |
| **srp ips wtr-timer** | User-configurable wait-to-restore interval that determines how long a wrap remains after a trigger to an automatic request, such as signal fail, disappears. |

# srp ips wtr-timer

To change the srp ips wait-to-restore timer from its default value, use the **srp ips wtr-timer** interface configuration command. Use the **no** form of this command to restore the default value.

**srp ips wtr-timer** <*value*>
**no srp ips wtr-timer**

## Syntax Description

| | |
|---|---|
| *value* | 10 to 600 seconds |

## Defaults

60 seconds

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

When the cause of a wrap is removed, the wrap remains in place for a length of time determined by the SRP wait-to-restore timer. This mechanism prevents oscillations on the SRP ring. It is recommended that you configure the **srp ips wrt-timer** value to the same setting on all nodes on a ring. This means that if you modify the **srp ips wrt-timer** value on one node, you must reconfigure all other nodes on the ring with the same wait-to-restore timer setting.

## Examples

The following example shows how to use the **srp ips wtr-timer** command to change the SRP IPS wtr-timer to 10 seconds on SRP interface 2/0:

```
Router# configure terminal
Router(config)# interface srp 2/0
Router(config-if)# srp ips wtr-timer 10
Router(config-if)# end
```

## Related Commands

| Command | Description |
|---|---|
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |
| **show srp failures** | Displays current IPS timers, along with other information. |
| **srp ips timer** | Controls the frequency of the transmission of SRP IPS packets. |

# srp loopback

To configure the framer into loopback mode, use the **srp loopback** interface configuration command. Use the **no** form of this command to restore the default value.

**srp loopback** [*internal* | *line*] [**a** | **b**]
**no srp loopback** [*internal* | *line*] [**a** | **b**]

## Syntax Description

| | |
|---|---|
| *internal* | Internal (framer) loopback. |
| *line* | Loopback line data. |
| **a** | The side of a node that has outer ring receive fiber is identified as side A. |
| **b** | The side of a node that has inner ring receive fiber is identified as side B. |

## Defaults

No loopbacks in place.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

Using the **srp loopback** command breaks connectivity. This command is used mostly during the initial setup of the SONET link (such as a node-to-node fiber connection), or when general connectivity is not clearly and obviously achieved. You can also use the **srp loopback** command when fiber or equipment connections are rearranged, or if new connectivity problems arise. If a node (side A or side B) is not specified in the command, the loopback value is applied to both sides.

## Examples

The following example shows how to enter the **srp loopback** command on side A:

```
Router# configure terminal
Router(config)# interface srp 2/0
Router(config-if)# srp loopback line a
Router(config-if)#
```

## Related Commands

| Command | Description |
|---|---|
| **show controllers srp** | Displays current loopback modes along with other information. |

# srp priority-map transmit

To configure the minimum SRP priority value that an IP packet must have in order to be queued in the high-priority transmit and transit queues, use the **srp priority-map transmit** command in interface configuration mode. IP packets with SRP priority values below the configured value are queued in the low-priority transmit and transit queues. Use the **no** form of this command to remove the configured SRP priority value.

**srp priority-map transmit** <*min-srp-pri-value*>
**no srp priority-map transmit** <*min-srp-pri-value*>

## Syntax Description

| | |
|---|---|
| *min-srp-pri-value* | Minimum SRP priority value required for packets to be sent to the high-priority queues. Valid values are from 1 to 8 where:<br>• 1 to 7 specify the minimum SRP priority value required for the high-priority transmit and transit queues.<br>• 8 specifies that all packets are sent to the low-priority transmit and transit queues. |

**Note** The TOS/IP precedence value in the IP header has a platform dependant default mapping with the priority-field in the SRP header. This mapping can also be explicitly configured using modular QOS CLI.

## Defaults

IP packets with minimum SRP priority of 6 are queued in the high-priority transmit and transit queues.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |
| 12.0(27)S | The **srp priority-map transmit** command was enhanced so that you can configure all IP packets on an SRP interface to be queued in the low-priority transmit and transit queues. |

## Usage Guidelines

Use this command to control which IP packets are queued in the high- and low-priority queues for transmitting traffic to the SRP ring and transiting traffic to adjacent nodes.

Starting in IOS Release 12.0(27)S, you can specify that all IP packets on a supported SRP interface are sent to the low-priority queues by entering 8 for the *min-srp-pri-value*. This feature is supported only on the following DPT line cards:

- 2-Port OC-12c/STM-4c DPT
- 1-Port OC-48c/STM-16c DPT
- 2-Port OC-48c/STM-16c SRP uplink module

- 4-Port OC-48c/STM-16c DPT
- 1-Port OC-192c/STM-64c DPT

**Note** The 2-Port OC-12c/STM-4c DPT line card supports the **srp priority-map transmit** command only for sending IP packets to the high- and low-priority transit queues. You cannot configure the transmit queue. All IP packets are sent to the low-priority transmit queue.

## Examples

The following example shows that IP packets with priority values of 5 to 7 will be queued in the high-priority transmit and transit queues on the specified SRP interface. IP packets with priority values of 1 to 4 will be queued in the low-priority transmit and transit queues.

```
Router# configure terminal
Router(config)# interface srp 2/0
Router(config-if)# srp priority-map transmit 5
Router(config-if)# end
```

## Related Commands

| Command | Description |
|---|---|
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |

# srp reject

To force the SRP interface to reject packets sent to it by a specified source MAC address, use the **srp reject** interface configuration command. Use the **no** form of this command to restore the default value.

**srp reject** [**H.H.H**]
**no srp reject** [**H.H.H**]

## Syntax Description

| | |
|---|---|
| H.H.H | Specifies the 48-bit MAC address for the node whose packets are to be rejected. |

## Defaults

**no srp reject** [**H.H.H**]

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

This command applies to SRP interfaces only. If the SRP interface is instructed to reject packets by source address, this will be shown by the **show srp** and **show srp source-counters** commands.

## Examples

The following example shows how to use the **srp reject** command to configure an SRP interface to reject any packets from source MAC address 0012.3456.0001:

```
Router# configure terminal
Router(config)# interface srp 2/0
Router(config-if)# srp reject 0012.3456.0001
Router(config-if)# end
```

## Related Commands

| Command | Description |
|---|---|
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |
| **show srp source-counters** | Displays the total number of packets received by a node identified by its unique MAC address. |

# srp report

To enable reporting of selected alarms, use the **srp report** interface configuration command. Use the **no** form of this command to restore the default value.

**srp report** [**b1-tca** | **b2-tca** | **b3-tca** | **lais** | **lrdi** | **pais** | **plop** | **prdi** | **sd-ber** | **sf-ber** | **slof** | **slos**] [**a** | **b**]
**no srp report** [**b1-tca** | **b2-tca** | **b3-tca** | **lais** | **lrdi** | **pais** | **plop** | **prdi** | **sd-ber** | **sf-ber** | **slof** | **slos**] [**a** | **b**]

## Syntax Description

| | |
|---|---|
| **b1-tca** | Reports B1 bit error rate (BER) threshold-crossing alarm errors. |
| **b2-tca** | Reports B2 BER threshold-crossing alarm errors. |
| **b3-tca** | Reports B3 BER threshold-crossing alarm errors. |
| **lais** | Reports line alarm indication signal errors. |
| **lrdi** | Reports line remote defect indication errors. |
| **pais** | Reports path alarm indication signal errors. |
| **plop** | Reports path loss of pointer errors. |
| **prdi** | Reports path remote defect indication errors. |
| **sd-ber** | Reports LBIP BER in excess of signal degradation threshold. |
| **sf-ber** | Reports LBIP BER in excess of signal failure threshold. |
| **slof** | Reports section loss of frame errors. |
| **slos** | Reports section loss of signal errors. |
| **a** | The side of a node that has outer ring receive fiber is identified as side A. |
| **b** | The side of a node that has inner ring receive fiber is identified as side B. |

## Defaults

Reporting enabled for section loss of signal (SLOS), section loss of frame (SLOF), and path loss of pointer (PLOP) errors.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was introduced. |

## Usage Guidelines

To determine which alarms are reported on the SRP interface, use the **show controllers srp** command.

## Examples

The following example shows how to use the **srp report** command to enable reports for the SD-BER and LAIS alarms on an SRP interface:

```
Router# configure terminal
Router(config)# interface srp 2/0
Router(config-if)# srp report sd-ber
Router(config-if)# srp report lais
Router(config-if)#
```

## Related Commands

| Command | Description |
|---|---|
| **show controllers srp** | Displays conditions to be reported, along with other information. |

# srp shutdown

To shut down an interface by entering a forced switch, use the **srp shutdown** interface configuration command. Use the **no** form of this command to remove the forced-switch wrap near the interface.

**srp shutdown** [**a** | **b**]
**no srp shutdown** [**a** | **b**]

## Syntax Description

| | |
|---|---|
| **a** | The side of a node that has outer ring receive fiber is identified as side A. |
| **b** | The side of a node that has inner ring receive fiber is identified as side B. |

## Defaults

**srp shutdown [a | b]**

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

This **srp shutdown** command is an abbreviated form of the **srp ips request forced-switch** interface configuration command that enters a forced-switch request and inserts a wrap on a ring. Use the **no** form of this command to remove the wrap on the ring. The long form, **srp ips request forced-switch**, will appear in the show command output.

**Note** The **srp shutdown** command differs from the **shutdown** command in the following manner: **srp shutdown** inserts a forced-switch wrap on a ring, while **shutdown** invokes the pass-through mode, logically removing the interface from the ring.

## Examples

The following example shows how to enter an **srp shutdown** request on side A of an SRP interface:

```
Router# configure terminal
Router(config)# interface srp 2/0
Router(config-if)# srp shutdown a
Router(config-if)#
```

**Related Commands**

| Command | Description |
|---|---|
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |
| **show srp failures** | Displays current IPS wrap state along with other information. |
| **show interfaces srp** | Displays current IPS wrap state along with other information. |
| **srp ips request forced-switch** | This command is an alternate form of **srp shutdown**. |

# srp threshold

To set the BER threshold values of the specified alarms for a SRP interface, use the **srp threshold** interface configuration command. Use the **no** form of this command to restore the default value.

**srp threshold** [**b1-tca** | **b2-tca** | **b3-tca** | **sd-ber** | **sf-ber**] <*3-9*> [**a** | **b**]
**no srp threshold** [**b1-tca** | **b2-tca** | **b3-tca** | **sd-ber** | **sf-ber**] <*3-9*> [**a** | **b**]

## Syntax Description

| | |
|---|---|
| **b1-tca** | Specifies the B1 bit error rate (BER) threshold-crossing alarm. |
| **b2-tca** | Specifies the B2 BER threshold-crossing alarm. |
| **b3-tca** | Specifies the B3 BER threshold-crossing alarm. |
| **sd-ber** | Sets the signal degrade BER threshold. |
| **sf-ber** | Sets the signal failure BER threshold. |
| **rate** | Specifies the bit error rate from 3 to 9 (10-n). The default is 6 for all thresholds, except for the **sf-ber**, where the default is 3, (10e-3). |
| **a** | The side of the node that has outer ring receive fiber is identified as side A. |
| **b** | The side of the node that has inner ring receive fiber is identified as side B. |

## Defaults

The default is 6 (10e-6) for all thresholds except for **sf-ber**, where the default is 3 (10e-3).

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

This command applies to SRP interfaces only. If a node (side A or side B) is not specified in the command, the threshold value is applied to both sides.

## Examples

The following example shows how to set the **srp threshold** values on side A of an SRP interface:

```
Router# configure terminal
Router(config)# interface srp 3/0
Router(config-if)# srp threshold sd-ber 8 a
Router(config-if)# srp threshold b1_tca 4 a
Router(config-if)# end
Router#
```

**Related Commands**

| Command | Description |
|---|---|
| **show controllers srp** | Shows current alarm thresholds, along with other information. |
| **srp report** | Controls reporting of selected alarms. |

# srp topology-timer

To specify the frequency of the topology timer, use the **srp topology-timer** interface configuration command. Use the **no** form of this command to restore the default value.

**srp topology-timer** <*value*>
**no srp topology-timer**

## Syntax Description

| | |
|---|---|
| *value* | 1 to 600 seconds. |

## Defaults

The default value for the topology timer is 10 seconds.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

The **srp topology-timer** interface configuration command and a specified value determine how frequently topology discovery messages are sent around the ring to identify the current nodes on the SRP ring. It is recommended that you configure the same **srp topology-timer** value on all nodes on an SRP ring. This means that if you modify the topology timer setting on one node, you must reconfigure all other nodes on the ring with the same topology timer value.

## Examples

The following example shows how to set the frequency for how often SRP topology packets are sent around the ring to identify the nodes:

```
Router# configure terminal
Router(config)# interface srp 2/0
Router(config-if)# srp topology-timer 100
Router(config-if)#
```

## Related Commands

| Command | Description |
|---|---|
| **show srp** | Displays information about SRP interfaces on the ring, including MAC addresses of neighboring nodes, IPS status, source-counters, and topology map. |
| **show srp topology** | Displays current topology and topology timer, along with other information. |

# srp TX-traffic-rate

To configure the amount of high- and low-priority traffic being transmitted from the router onto the SRP ring, use the **srp TX-traffic-rate** interface configuration command. Use the **no** form of this command to remove the TX traffic rate from the configuration.

**srp TX-traffic-rate [high | low]** <*Mbps*>
**no srp TX-traffic-rate [high | low]** <*Mbps*>

## Syntax Description

| | |
|---|---|
| *Mbps* | Average rate in Mbps. OC-48 DPT line card values must be in increments of 1 Mbps in the range of 1 to 2488. The range for OC-192 DPT line cards is in the range of 1 to 9952. |

## Defaults

By default, **TX-traffic-rate** is disabled on low priority and set to 20 Mbps for high priority.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(11)S | This command was first introduced. |

## Usage Guidelines

Use this command to control the amount of high- and low-priority traffic a node can transmit onto the SRP ring. This command does not control the amount of transit traffic on the ring; that is controlled by the SRP fairness algorithm.

**Note** High-priority traffic in transit on the ring is not controlled by the SRP fairness algorithm. It is recommended that the TX traffic rate for high-priority traffic not be disabled in order to prevent high-priority traffic transmitted from one node on the ring from starving traffic transmitted by other nodes on the SRP ring.

## Examples

The following example limits the rate of high-priority traffic transmitted on the ring to an average rate of 622 Mbps (25 percent line bandwidth), and the low-priority traffic transmitted on the ring to an average rate of 1866 Mbps (75 percent line bandwidth):

```
Router# configure terminal
Router(config)# interface srp 2/0
Router(config-if)# srp rate-limit hi 622
Router(config-if)# srp rate-limit low 1866
Router(config-if)# end
Router#
```

## Related Commands

None

# debug Commands

Use the following **debug srp** commands if you recognize configuration problems that need debugging, such as loss of packets, cyclic redundancy check (CRC) errors, card resets, alarms, and so on. This section describes the following debug commands:

# debug srp fast-convergence

To activate troubleshooting information for fast convergence events (when SRP ring events indicate that nodes should be dropped from the ring's topology), use the **debug srp fast-convergence** command in privileged EXEC mode.

[**no**] **debug srp fast-convergence**

## Syntax Description

| | |
|---|---|
| **debug srp fast-convergence** | Displays information about SRP ring events and the nodes that may be dropped from a ring's topology. |

## Defaults

**no debug srp fast-convergence**

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(27)S | This command was first introduced. |

## Usage Guidelines

This command applies to the Layer 3 Fast Notification feature. This feature enables faster convergence of Layer 3 routing protocols in case of SRP ring events that cause nodes to be dropped from the ring's topology.

The Layer 3 Fast Notification feature is triggered only as a result of a wrap event or a pass-through event, when a change in the SRP ring topology indicates that a node should be dropped from the ring. The Layer 3 Fast Notification feature is not triggered when an SRP node joins the ring.

**Note** A wrap event that triggers faster convergence of Layer 3 routing protocols and results from a signal failure on both sides of an SRP node is supported in Spatial Reuse Protocol Version 1.0 and Version 2.0. A pass-through event is supported only in Spatial Reuse Protocol Version 2.0 at OC-48 or higher speeds.

When the Single Ring Recovery (SRR) protocol is enabled, faster convergence of Layer 3 routing protocols does not occur. The SRR protocol enables an SRP ring to preserve full node connectivity in the event of multiple failures on one of its two counter-rotating rings while the other is failure free. In all other cases, the SRP ring maintains the standard SRP intelligent protection switching (IPS) behavior.

## Examples

The following example shows how to display information about the SRP ring events that indicate that an SRP node may be dropped from the ring's topology:

```
Router# debug srp fast-convergence
Router# 02:25:53: srp_input: Neighbor status packet received
02:25:53:   mac(0003.0003.0003), neighbor(0001.0001.0001), wrap(No), ringid(1), ips req(0)
```

When you enable debugging for fast convergence events with the **debug srp fast-convergence** command, the current neighbor map is displayed for the SRP node when you enter the **show srp topology** command:

```
Router# show srp topology
Hops    Node           Side-A         Side-B         Wrapped    IPS     Ring ID
0       aaaa.5555.2222 aaaa.5555.1111 aaaa.5555.3333     No     0       0
1       aaaa.5555.3333 aaaa.5555.2222 aaaa.5555.1111     No     0       0
2       aaaa.5555.1111 aaaa.5555.3333 aaaa.5555.2222     No     0       0
```

## Related Commands

| Command | Description |
|---|---|
| **debug srp topology** | Examines ring topology information. |

# debug srp ips

To debug an SRP interface on the ring, use the **debug srp ips** command in privileged EXEC mode.

[**no**] **debug srp ips**

## Syntax Description

| | |
|---|---|
| **debug srp ips** | Displays IPS request messages. |

## Defaults

**no debug srp ips**

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

This command applies to SRP interfaces only.

## Examples

The following example shows how to enter the debug mode to debug an SRP interface:

```
Router# debug srp ips
```

## Related Commands

| Command | Description |
|---|---|
| **debug srp protocol error** | Displays SRP interface protocol errors and error statistics. |
| **debug srp packet** | Debugs information on a specific SRP packet. |
| **debug srp periodic activity** | Debugs a specific periodic activity. |
| **debug srp topology** | Examines ring topology information. |

# debug srp nodename

To display node name packets by the source MAC address, use the **debug srp nodename** command in privileged EXEC mode.

[**no**] **debug srp nodename**

## Syntax Description

| | |
|---|---|
| **debug srp nodename** | Checks the nodename in the packet header information. |

## Defaults

**no debug srp nodename**

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

This command applies to SRP interfaces only.

## Examples

The following example shows how to debug a specific periodic activity on an SRP interface:

```
Router# debug srp nodename
SRP node name debugging is on
Router#
*May  9 08:28:39:srp_process_node_name_packet SRP4/0, len 27, 0048.1100.0002, M2305B
*May  9 08:28:39:srp_forward_node_name_packet:SRP4/0, len 27, 0048.1100.0002, M2305B
*May  9 08:28:39:srp_glean_node_name:SRP4/0, len 27 src 0048.1100.0002 data M2305B
*May  9 08:28:48:srp_process_node_name_packet SRP4/0, len 27, 0048.3300.0001, M2307A
*May  9 08:28:48:srp_passthrough_node_name_packet:SRP4/0, len 27, 0048.3300.0001, M2307A
*May  9 08:28:48:srp_process_node_name_packet SRP4/0, len 27, 0048.3300.0001, M2307A
*May  9 08:28:48:srp_forward_node_name_packet:SRP4/0, len 27, 0048.3300.0001, M2307A
*May  9 08:28:48:srp_glean_node_name:SRP4/0, len 27 src 0048.3300.0001 data M2307A
```

## Related Commands

| Command | Description |
|---|---|
| **debug srp topology** | Examines ring topology information. |

# debug srp packet

To display information about how to debug a specific SRP packet, use the **debug srp packet** command in privileged EXEC mode and specify the MAC address of the SRP interface.

[**no**] **debug srp packet**

## Syntax Description

| | |
|---|---|
| **debug srp packet** | Repeat every packet received by SRP node. |

## Defaults

**no debug srp packet**

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

This command applies to SRP interfaces only.

**Note** Only use this command under a light traffic load. If there is a full line rate, this command will overload the logging interface.

## Examples

The following example enters debug mode to debug information on a specific packet on an SRP interface:

```
Router# debug srp packet
Router#
```

## Related Commands

| Command | Description |
|---|---|
| **debug srp protocol error** | Displays SRP interface protocol errors and error statistics. |
| **debug srp periodic activity** | Debugs a specific periodic activity. |
| **debug srp topology** | Examines ring topology information. |

# debug srp periodic activity

To debug a specific periodic activity, use the **debug srp periodic activity** command in privileged EXEC mode.

[**no**] **debug srp periodic activity**

## Syntax Description

| | |
|---|---|
| **debug srp periodic activity** | Checks the frequency of IPS requests and topology messages. |

## Defaults

**no debug srp periodic activity**

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

This command applies to SRP interfaces only.

## Examples

The following example shows how to debug a specific periodic activity on an SRP interface:

```
Router# debug srp periodic activity
Router#
```

## Related Commands

| Command | Description |
|---|---|
| **debug srp protocol error** | Displays interface protocol errors and error statistics. |
| **debug srp periodic activity** | Debugs a specific periodic activity. |
| **debug srp topology** | Examines ring topology information. |

# debug srp protocol error

To display SRP interface protocol errors and error statistics, use the **debug srp protocol error** command in **show interface srp** *slot*/*port* command in privileged EXEC mode.

[**no**] **debug srp protocol error**

## Syntax Description

| | |
|---|---|
| **debug srp protocol error** | Displays errors from all SRP interfaces on the ring. |

## Defaults

**no debug srp protocol error**

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Usage Guidelines

The **debug srp protocol error** command generates the following output:

- Lack of memory when attempting to originate packets
- SRP version mismatches
- Time To Live (TTL) problems. TTL problems should not affect the normal operation of the ring.
- Checksum failures
- Incorrectly sized topology packets
- Incorrect packet type
- Internal software errors

## Examples

The following example shows how to use the **debug srp protocol error** command to list error statistics on an SRP interface:

```
Router# debug srp protocol error
Router#
```

## Related Commands

| Command | Description |
|---|---|
| **debug srp packet** | Debugs information on a specific SRP packet. |
| **debug srp periodic activity** | Debugs a specific periodic activity. |
| **debug srp topology** | Examines ring topology information. |

# debug srp topology

To examine ring topology information, use the **debug srp topology** command in privileged EXEC mode.

[**no**] **debug srp topology**

## Syntax Description

| | |
|---|---|
| **debug srp topology** | Provides information on topology messages that identify nodes on the ring. |

## Defaults

**no debug srp topology**

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(6)S | This command was first introduced. |

## Examples

The following example shows how to examine the topology information on an SRP interface:

```
Router# debug srp topology
Router#
```

## Related Commands

| Command | Description |
|---|---|
| **debug srp protocol error** | Displays SRP interface protocol errors and error statistics. |
| **debug srp periodic activity** | Debugs a specific periodic activity. |
| **debug srp topology** | Examines ring topology information. |

# Obtaining Documentation

These sections explain how to obtain documentation from Cisco Systems.

## World Wide Web

You can access the most current Cisco documentation on the World Wide Web at this URL:

http://www.cisco.com

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http://www.cisco.com/public/countries_languages.shtml

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Attn: Document Resource Connection
170 West Tasman Drive
San Jose, CA 95134-9883

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# Obtaining Technical Assistance

| Description | Link |
|---|---|
| Technical Assistance Center (TAC) home page, containing 30,000 pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content. | http://www.cisco.com/public/support/tac/home.shtml |

# Glossary

The following terms and acronyms are used in reference to DPT line cards:

**Add/Drop Internet Multiplexer (ADM)**—Device used to add or drop virtual channels from SONET/SDH lines into physical tributaries.

**Address Resolution Protocol (ARP)**—Internet protocol used to map an IP address to a MAC address. Defined in RFC 826.

**Average rate**—Maximum long-term average rate of conforming traffic.

**Bit Interleaved Parity (BIP)**—Method used to monitor errors on a link. A check bit or word is sent in the link overhead for the previous block or frame. Bit errors in the payload then can be detected and reported as maintenance information.

**Committed Access Rate (CAR)**—Quality of Service (QoS) feature that performs rate limiting and packet classification.

**Conform action**—Action to take on packets below the rate allowed by the rate limit.

**Dynamic Packet Transport (DPT)**—DPT technology creates dual, counterrotating fiber rings. Both fibers are used concurrently to transport both data and control traffic, and use Intelligent Protection Switching (IPS) that provides proactive performance monitoring, event detection, and rapid self-healing, and restores IP service after fiber facility or node failures. Also called SRP.

**Exceed action**—Action to take on packets above the rate allowed by the rate limit.

**Excess burst size**—Bytes allowed in a burst before all packets will exceed the rate limit.

**Intelligent Protection Switching (IPS)**—Ability of the SRP ring to recover from fiber cuts and node failures by “wrapping” traffic onto the alternate fiber.

**Link Control Protocol (LCP)**—Establishes, configures, and tests data-link connections for use by Point-to-Point Protocol.

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

**Normal burst size**—Bytes allowed in a burst before some packets will exceed the rate limit. Larger bursts are more likely to exceed the rate limit.

**Rate limit**—Traffic descriptor defined by the average rate, normal burst size, and excess burst size.

**Rate policy**—The rate limit, conform actions, and exceed actions that apply to traffic matching a certain criteria.

**Signal degrade**—Enters automatic protection switch wraps on a span when it is invoked by a media signal degrade, such as an excessive bit error rate.

**Signal fail**—Enters automatic protection switch wraps on a span when it is invoked by a media signal failure or SRP keepalive failure. The signal fail protection switch wrap remains in effect until the event is repaired.

**Synchronous Digital Hierarchy (SDH)**—European standard that defines a set of rate and format standards that are transmitted using optical signals over fiber. SDH is similar to SONET, with a basic SDH rate of 155.52 Mbps, designated at STM-1.

**Synchronous Optical Network (SONET)**—High-speed synchronous network specification developed by Bellcore and designed to run on optical fiber. STS-1 is the basic building block of SONET. Approved as an international standard in 1988.

**Synchronous Payload Envelope (SPE)**—The payload portion of the SONET frame into which the octet-oriented user data is mapped. Octet boundaries are aligned with the SPE octet boundaries.

**Spatial Reuse Protocol (SRP)**—Layer 2 Media Access Control (MAC) protocol that is media-independent, but the initial SRP implementation is over SONET/SDH. SRP runs over a dual-ring network topology and is characterized by shared media, statistical multiplexing, global fairness, bandwidth allocation, and spatial reuse. Also called DPT.

**Synchronous Transport Module level 1 (STM-1)**—One of a number of SDH formats that specifies the frame structure for the 155.52-Mbps lines used to carry packets.

**Synchronous Transport Module level N (STM-N)**—SDH multiplexing measure, where N indicates the number of 155.52-Mbps channels.

**Synchronous Transport Signal /Synchronous Transport Module (STS-Nc/STM-Nc)**—Lowercase c after N indicates that N channels are concatenated into one logical channel with a bandwidth of N multiplied by the appropriate rate for SONET/SDH. For SONET, N is defined as having values 3, 12, 48, and 192. For SDH, the legal values are 1, 4, and 16.

**Wait-to-restore (WTR)**—Invokes a waiting period after the working channel meets the restoration criteria after a signal fail or signal degrade condition disappears. The wait-to-restore period prevents protection switch oscillations.