Configuring Clear Channel SONET Controllers

This module describes the configuration of clear channel SONET controllers.

SONET controller configuration is a prerequisite for configuring Inter-Chassis Stateful Switchover (ICSSO) for Point-to-Point Protocol (PPP) and Multilink PPP (MLPPP), channelized SONET, or serial interfaces on the Cisco ASR 9000 Series Router.

SONET allows you to define optical signals and a synchronous frame structure for multiplexed digital traffic. It is a set of standards defining the rates and formats for optical networks specified in American National Standards Institute (ANSI) T1.105, ANSI T1.106, and ANSI T1.117.

For more information about configuring a channelized SONET controller, see the module.

The commands for configuring the Layer 1 SONET controllers are provided in the *Cisco IOS XR Interface and Hardware Component Command Reference*.

Feature History for Configuring SONET Controllers on Cisco IOS XR Software

Release	Modification
Release 3.9.0	Support for the following SPA was introduced on the Cisco ASR 9000 Series Router: • Cisco 2-Port Channelized OC-12c/DS0 SPA
Release 4.0.0	Support for the following SPAs was introduced on the Cisco ASR 9000 Series Router: • Cisco 1-Port Channelized OC-48/STM-16 SPA • Cisco 1-Port OC-192c/STM-64 POS/RPR XFP SPA • Cisco 2-Port OC-48c/STM-16 POS/RPR SPA • Cisco 8-Port OC-12c/STM-4 POS SPA
Release 4.0.1	Support for the following SPAs was introduced on the Cisco ASR 9000 Series Router: • Cisco 4-Port OC-3c/STM-1 POS SPA • Cisco 8-Port OC-3c/STM-1 POS SPA

Prerequisites for Configuring Clear Channel SONET Controllers

You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Before configuring SONET controllers, be sure that the following tasks and conditions are met:

•

• You have one of the following SPAs installed:

   • Cisco 2-Port Channelized OC-12c/DS0 SPA

   • Cisco 1-Port Channelized OC-48/STM-16 SPA

   • Cisco 4-Port OC-3c/STM-1 POS SPA

   • Cisco 8-Port OC-3c/STM-1 POS SPA

   • Cisco 1-Port OC-192c/STM-64 POS/RPR XFP SPA

   • Cisco 2-Port OC-48c/STM-16 POS/RPR SPA

   • Cisco 8-Port OC-12c/STM-4 POS SPA

• You know how to apply the specify the SONET controller name and instance identifier with the generalized notation *rack/slot/module/port*. The SONET controller name and instance identifier are required with the **controller sonet** command.

Information About Configuring SONET Controllers

To configure SONET controllers, you must understand the following concepts:

SONET Controller Overview

In routers supporting Cisco IOS XR software, the physical ports on certain line cards are called controllers. Before you can configure channelized SONET or a serial interface, you need to configure the SONET controller.

The commands used to configure the physical SONET port are grouped under the SONET controller configuration mode. To get to the SONET controller configuration mode, enter the **controller sonet** command in global configuration mode. You can also preconfigure a SONET controller using the **controller preconfigure sonet** global configuration command.

The router uses SONET controllers for Layer 1 and Layer 2 processing.

Default Configuration Values for SONET Controllers

The table below describes some default configuration parameters that are present on SONET controllers.

Table 1: SONET Controller Default Configuration Values

Parameter	Default Value	Configuration File Entry
Reporting of the following alarms for a SONET controller: • Bit 1 (B1) bit error rate (BER) threshold crossing alert (TCA) errors • Bit 2 (B2) BER TCA errors • Signal failure BER errors • Section loss of frame (SLOF) errors • Section loss of signal (SLOS) errors	**enabled**	To disable reporting of any alarms enabled by default, use the **no report** [**b1-tca**	**b2-tca**	**sf-ber**	**slof**	**slos**] command in SONET/SDH configuration mode. To enable reporting of line alarm indication signal (LAIS), line remote defect indication (LRDI), or signal degradation BER errors, use the **report** [**lais**	**lrdi**	**sd-ber**] command in SONET/SDH configuration mode.
Reporting of the following alarms for a SONET path controller: • Bit 3 (B3) BER TCA errors • Path loss of pointer (PLOP) errors	**enabled**	To disable B3 BER TCA or PLOP reporting on the SONET path controller, enter the **no report b3-tca** or **no report plop** command in SONET/SDH path configuration submode. To enable reporting of path alarm indication signal (PAIS), path payload mismatch (PPLM), path remote defect indication (PRDI), or path trace identity mismatch (PTIM) errors, use the **report** [**pais**	**pplm**	**prdi**	**ptim** command in SONET/SDH path configuration submode.
Synchronous payload envelope (SPE) scrambling	**enabled**	To disable SPE scrambling on a SONET controller, enter the **path scrambling disable** command in SONET controller configuration submode.
Keepalive timer	**enabled**	To turn off the keepalive timer, enter the **keepalive disable** command in interface configuration mode.

SONET APS

The automatic protection switching (APS) feature allows switchover of interfaces in the event of failure, and is often required when connecting SONET equipment to telco equipment. APS refers to the mechanism of using a *protect* interface in the SONET network as the backup for *working* interface. When the working interface fails, the protect interface quickly assumes its traffic load. The working interfaces and their protect interfaces make up an *APS group*.

In Cisco IOS XR software, SONET APS configuration defines a working line and a protection line for each redundant line pair. The working line is the primary or preferred line, and communications take place over that line as long as the line remains operative. If a failure occurs on the working line, APS initiates a switchover to the protection line. For proper APS operation between two routers, a working line on one router must also be the working line on the other router, and the same applies to the protection line.

In a SONET APS group, each connection may be bidirectional or unidirectional, and revertive or non-revertive. The same signal payload is sent to the working and protect interfaces. The working and protect interfaces terminate in two different routers.

The protect interface directs the working interface to activate or deactivate in the case of degradation, loss of channel signal, or manual intervention. If communication between the working and protect interfaces is lost, the working router assumes full control of the working interface as if no protect circuit existed.

In an APS group, each line is called a *channel*. In bidirectional mode, the receive and transmit channels are switched as a pair. In unidirectional mode, the transmit and receive channels are switched independently. For example, in bidirectional mode, if the receive channel on the working interface has a loss of channel signal, both the receive and transmit channels are switched.

How to Configure Clear Channel SONET Controllers

This section contains the following procedures:

Configuring a Clear Channel SONET Controller

This task explains how to configure SONET controllers as a prerequisite to configuring POS or serial interfaces.

Before you begin

- You need to have a supported POS SPA or channelized SPA installed in a router that is running the corresponding supported Cisco IOS XR software release.

- If you want to ensure recovery from fiber or equipment failures, then configure SONET APS on the router as describe in the Configuring SONET APS.

SUMMARY STEPS

1. **configure**
2. **controller sonet** *interface-path-id*
3. **clock source** {**internal** | **line**}
4. **line delay trigger** *value*
5. **line delay clear** *value*
6. **framing** {**sdh** | **sonet**}

7. **loopback** {**internal** | **line**}
8. **overhead** {**j0** | **s1s0**} *byte-value*
9. **path** *keyword [values]*
10. **end** or **commit**
11. **show controllers sonet** *interface-path-id*

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**configure** **Example:** RP/0/RSP0/CPU0:router# configure	Enters global configuration mode.
Step 2	**controller sonet** *interface-path-id* **Example:** RP/0/RSP0/CPU0:router(config)# controller sonet 0/1/0/0	Enters SONET controller configuration submode and specifies the SONET controller name and instance identifier with the *rack/slot/module/port* notation.
Step 3	**clock source** {**internal**	**line**} **Example:** RP/0/RSP0/CPU0:router(config-sonet)# clock source internal	Configures the SONET port transmit clock source, where the **internal** keyword sets the internal clock and **line** keyword sets the clock recovered from the line. • Use the **line** keyword whenever clocking is derived from the network. Use the **internal** keyword when two routers are connected back-to-back or over fiber for which no clocking is available. • The **line** clock is the default.
Step 4	**line delay trigger** *value* **Example:** RP/0/RSP0/CPU0:router(config-sonet)# line delay trigger 3000	(Optional) Configures the SONET line delay trigger values, where the trigger values are in the range from 0 through 60000 milliseconds, and the default delay trigger value is 0 milliseconds.
Step 5	**line delay clear** *value* **Example:** RP/0/RSP0/CPU0:router(config-sonet)# line delay clear 4000	(Optional) Configures the amount of time before a SONET line delay trigger alarm is cleared. The range is from 1000 through 180000 milliseconds, and the default is 10 seconds.
Step 6	**framing** {**sdh**	**sonet**} **Example:** RP/0/RSP0/CPU0:router(config-sonet)# framing sonet	(Optional) Configures the controller framing with either the **sdh** keyword for Synchronous Digital Hierarchy (SDH) framing or the **sonet** keyword for SONET framing. SONET framing (**sonet**) is the default.

	Command or Action	Purpose
Step 7	**loopback** {**internal**	**line**} **Example:** RP/0/RSP0/CPU0:router(config-sonet)# loopback internal	(Optional) Configures the SONET controller for loopback, where the **internal** keyword selects internal (terminal) loopback, or the **line** keyword selects line (facility) loopback.
Step 8	**overhead** {**j0**	**s1s0**} *byte-value* **Example:** RP/0/RSP0/CPU0:router(config-sonet)# overhead s1s0	(Optional) Configures the controller's overhead, where the **j0** keyword specifies the STS identifier (J0/C1) byte, and the **s1s0** keyword specifies bits s1 and s0 of H1 byte. • The default byte value for the **j0** keyword is 0xcc, and the default byte value for the **s1s0** keyword is 0. • The range of valid values for **j0** and **s1s0** is 0 through 255.
Step 9	**path** *keyword [values]* **Example:** RP/0/RSP0/CPU0:router(config-sonet)# path delay trigger 25	(Optional) Configures SONET controller path values. Keyword definitions are as follows: • **ais-shut**—Set sending path alarm indication signal (PAIS) when shut down. • **b3-ber-prdi**—Enable sending of a path-level remote defect indication (PRDI) when the bit error rate (BER) bit interleaved parity (BIP) threshold is exceeded. • **delay clear** *value*—Set the amount of time before a Synchronous Transport Signal (STS) path delay trigger alarm is cleared. Replace the *value* argument with a number in the range from 0 through 180000 milliseconds. The default value is 10 seconds. • **delay trigger** *value* —Set SONET path delay values or delay trigger value. Replace the *value* argument with a number in the range from 0 through 60000 milliseconds. The default value is 0 milliseconds. • **overhead** [**c2** *byte-value*	**j1** *line*] —Set SONET POH byte or bit values. Enter the **c2** keyword to specify STS SPE content (C2) byte, and replace the *byte-value* argument with a number in the range from 0 through 255. Enter the **j1** keyword to configure the SONET path trace (J1) buffer, and replace the *line* argument with the path trace buffer identifier (in ASCII text). • **report** [**b3-tca**	**pais**	**plop**	**pplm**	**prdi**	**ptim**]—Set SONET path alarm reporting. Specifies which alarms are reported and which bit error rate (BER) thresholds will signal an alarm. By default, B3 BER threshold crossing alert (TCA) and path loss of pointer (PLOP) reporting are enabled. Specifying the **pais** keyword sets PAIS reporting status; **pplm** sets path payload

Command or Action	**Purpose**
	mismatch (PPLM) defect reporting status; **prdi** sets path remote defect indication reporting status; and **ptim** sets path trace identity mismatch (PTIM) defect reporting status.
	The **no report b3-tca** and **no report plop** commands in SONET/SDH path configuration submode disable B3 BER TCA and PLOP reporting status, respectively.
	• **scrambling disable**—Disable SPE scrambling. Note that SPE scrambling is enabled by default.
	• **threshold b3-tca** *BER*—Set SONET path BER threshold value. Replace the *BER* argument with a number in the range from 3 through 9. The threshold value is interpreted as a negative exponent of 10 when determining the bit error rate. For example, a value of 5 implies a bit error rate of 10 to the minus 5. The default BER threshold value is 6.
	• **uneq-shut**—Sets sending Unequipped (UNEQ) when shut down.
Step 10	**end** or **commit**	Saves configuration changes.
	Example:	• When you issue the **end** command, the system prompts you to commit changes:
	`RP/0/RSP0/CPU0:router(config-sonet)# end`	
	or	`Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:`
	`RP/0/RSP0/CPU0:router(config-sonet)# commit`	- Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
		- Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
		- Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
		• Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.
Step 11	**show controllers sonet** *interface-path-id*	Verifies the SONET controller configuration.
	Example:	

Command or Action	Purpose
`RP/0/RSP0/CPU0:router# show controllers sonet 0/1/0/0`	

Configuring SONET APS

SONET APS offers recovery from fiber (external) or equipment (interface and internal) failures at the SONET line layer. This task explains how to configure basic automatic protection switching (APS) on the router and how to configure more than one protect or working interface on a router by using the **aps group** command.

To verify the configuration or to determine if a switchover has occurred, use the **show aps** command.

Before you begin

Before you configure SONET APS, be sure that you have a supported channelized SPA installed in a router that is running Cisco IOS XR software.

On the Cisco ASR 9000 Series Router, you must have a 2-Port Channelized OC-12c/DS0 SPA installed.

Restrictions

Before you configure SONET APS, consider the following restrictions:

- The POS SPAs on the Cisco ASR 9000 Series Router do not support either single router or multirouter APS.

- The Cisco ASR 9000 Series Router supports multirouter APS on the 2-Port Channelized OC-12/DS0 SPA.

- For proper APS operation between two routers, a working line on one router must also be the working line on the other router, and the same applies to the protection line.

SUMMARY STEPS

1. **configure**
2. **aps group** *number*
3. **channel** {**0** | **1**} **local sonet** *interface*
4. Repeat Step 3 for each channel in the group.
5. **exit**
6. **interface loopback** *number*
7. **ipv4 address** *ip-address mask*
8. **exit**
9. Execute any one the following commands:
   - **interface pos** *interface-path-id*
   - **interface serial** *interface-path-id*
10. **ipv4 address** *ip-address mask*
11. Execute any one the following commands:
    - **pos crc** {**16** | **32**}
    - **crc** {**16** | **32**}

12. **encapsulation** {**frame-relay** | **hdlc** | **ppp**}
13. **keepalive** {*interval* | **disable**}[*retry*]
14. **no shutdown**
15. Repeat Step 9 through Step 13 for each channel in the group.
16. **exit**
17. **controller sonet** *interface-path-id*
18. **ais-shut**
19. **path scrambling disable**
20. **clock source** {**internal** | **line**}
21. Repeat Step 16 through Step 19 for each channel in the group.
22. **end** or **commit**
23. **exit**
24. **exit**
25. **show aps**
26. **show aps group** [*number*]

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**configure** **Example:** RP/0/RSP0/CPU0:router# configure	Enters global configuration mode.
Step 2	**aps group** *number* **Example:** RP/0/RSP0/CPU0:router(config)# aps group 1	Adds an APS group with a specified number and enters APS group configuration mode. • Use the **aps group** command in global configuration mode. • To remove a group, use the **no** form of this command, as in: **no aps group** *number*, where the value range is from 1–255. **Note** - To use the **aps group** command, you must be a member of a user group associated with the proper task IDs for aps commands. - The **aps group** command is used even when a single protect group is configured.
Step 3	**channel** {**0**	**1**} **local sonet** *interface* **Example:**	Creates a channel for the APS group. **0** designates a protect channel, and **1** designates a working channel.

	Command or Action	**Purpose**
	`RP/0/RSP0/CPU0:router(config-aps)# channel 0 local SONET 0/0/0/1`	**Note** • If the protect channel is local, it must be assigned using the **channel** command *before* any of the working channels is assigned.
Step 4	Repeat Step 3 for each channel in the group.	—
Step 5	**exit**	Exits APS group configuration mode and enters global configuration mode.
Step 6	**interface loopback** *number* **Example:** `RP/0/RSP0/CPU0:router(config)# interface loopback 1`	(Optional) Configures a loopback interface if a two-router APS is desired and enters interface configuration mode for a loopback interface. **Note** • In this example, the loopback interface is used as the interconnect.
Step 7	**ipv4 address** *ip-address mask* **Example:** `RP/0/RSP0/CPU0:router(config-if)# ipv4 address 172.18.0.1 255.255.255.224`	Assigns an IPV4 address and subnet mask to the loopback interface.
Step 8	**exit**	Exits interface configuration mode for a loopback interface, and enters global configuration mode.

Step 9	Execute any one the following commands:
	
	   • **interface pos** *interface-path-id*
	   • **interface serial** *interface-path-id*
	
	Example:
	
	`RP/0/RSP0/CPU0:router(config)# interface POS 0/2/0/0`
	`or`
	`RP/0/RSP0/CPU0:router(config)# interface serial 0/1/1/0/0:0`
		Connects the interface for the channel selected in Step 3, and enters interface configuration mode.
		
		For serial interfaces, specifies the complete interface number with the *rack/slot/module/port/T3Num/T1num:instance* notation.

Step 10	**ipv4 address** *ip-address mask* **Example:** `RP/0//CPU0:router(config-if)# ipv4 address 172.18.0.1 255.255.255.224`	Assigns an IPv4 address and subnet mask to the interface.

Step 11	Execute any one the following commands:
	
	   • **pos crc** {**16** | **32**}
	   • **crc** {**16** | **32**}
	
	Example:
		Selects a CRC value for the channel. Enter the **16** keyword to specify 16-bit CRC mode, or enter the **32** keyword to specify 32-bit CRC mode. For POS interfaces, the default CRC is 32. For serial interfaces, the default is 16.

Command or Action	Purpose

`RP/0/RSP0/CPU0:router(config-if)# pos crc 32`
`or`
`RP/0/RSP0/CPU0:router(config-if)# crc 32`	

Step 12 **encapsulation** {**frame-relay** | **hdlc** | **ppp**} **Example:** `RP/0/RSP0/CPU0:router(config-if)# encapsulation ppp`	(Serial interfaces only) Set the Layer 2 encapsulation of an interface.
Step 13 **keepalive** {*interval* | **disable**}[*retry*] **Example:** `RP/0/RSP0/CPU0:router(config-if)# keepalive disable`	Sets the keepalive timer for the channel, where: • *interval*—Number of seconds (from 1 to 30) between keepalive messages. The default is 10. • **disable**—Turns off the keepalive timer. • *retry*—(Optional) Number of keepalive messages (from 1 to 255) that can be sent to a peer without a response before transitioning the link to the down state. The default is 5 for interfaces with PPP encapsulation, and 3 for interfaces with HDLC encapsulation. The **keepalive** command does not apply to interfaces using Frame Relay encapsulation.
Step 14 **no shutdown** **Example:** `RP/0/RSP0/CPU0:router(config-if)# no shutdown`	Removes the shutdown configuration. • The removal of the shutdown configuration removes the forced administrative down on the interface, enabling that interface to move to an up or down state (assuming the parent SONET layer is not configured administratively down).
Step 15 Repeat Step 9 through Step 13 for each channel in the group.	—
Step 16 **exit**	Exits interface configuration mode, and enters global configuration mode.
Step 17 **controller sonet** *interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config)# controller sonet 0/1/0/0`	Enters SONET controller configuration mode and specifies the SONET controller name and instance identifier with the *rack/slot/module/port* notation.
Step 18 **ais-shut** **Example:** `RP/0/RSP0/CPU0:router(config-sonet)# ais-shut`	Configures SONET path values such as alarm indication signal (AIS) at shut down.

	Command or Action	**Purpose**
Step 19	**path scrambling disable** **Example:** RP/0/RSP0/CPU0:router(config-sonet)# path scrambling disable	(Optional) Disables synchronous payload envelope (SPE) scrambling. **Note** • SPE scrambling is enabled by default.
Step 20	**clock source** {**internal**	**line**} **Example:** RP/0/RSP0/CPU0:router(config-sonet)# clock source internal	Configures the SONET port TX clock source, where the **internal** keyword sets the internal clock and the **line** keyword sets the clock recovered from the line. • Use the **line** keyword whenever clocking is derived from the network; use the **internal** keyword when two routers are connected back-to-back or over fiber for which no clocking is available. • The line clock (**line**) is the default.
Step 21	Repeat Step 16 through Step 19 for each channel in the group.	—
Step 22	**end** or **commit** **Example:** RP/0/RSP0/CPU0:router(config-sonet)# end or RP/0/RSP0/CPU0:router(config-sonet)# commit	Saves configuration changes. • When you issue the **end** command, the system prompts you to commit changes: Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]: - Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode. - Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes. - Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes. • Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.
Step 23	**exit**	Exits SONET controller configuration mode, and enters global configuration mode.
Step 24	**exit**	Exits global configuration mode, and enters EXEC mode.
Step 25	**show aps** **Example:**	(Optional) Displays the operational status for all configured SONET APS groups.

	Command or Action	Purpose
	`RP/0/RSP0/CPU0:router# show aps`	
Step 26	**show aps group** [*number*] **Example:** `RP/0/RSP0/CPU0:router# show aps group 3`	(Optional) Displays the operational status for configured SONET APS groups. **Note** • The **show aps group** command is more useful than the **show aps** command when multiple groups are defined.

Configuring a Hold-off Timer to Prevent Fast Reroute from Being Triggered

When APS is configured on a router, it does not offer protection for tunnels; because of this limitation, fast reroute (FRR) still remains the protection mechanism for Multiprotocol Label Switching (MPLS) traffic-engineering.

When APS is configured in a SONET core network, an alarm might be generated toward a router downstream. If the router downstream is configured with FRR, you may want to configure a hold-off timer at the SONET level to prevent FRR from being triggered while the CORE network is doing a restoration. Perform this task to configure the delay.

Before you begin

Configure SONET APS, as describe in the *Configuring SONET APS* section.

SUMMARY STEPS

1. **configure**
2. **controller sonet** *interface-path-id*
3. **line delay trigger** *value* or **path delay trigger** *value*
4. **end** or **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.
Step 2	**controller sonet** *interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config)# controller sonet 0/6/0/0`	Enters SONET configuration mode.
Step 3	**line delay trigger** *value* or **path delay trigger** *value* **Example:**	Configures SONET port delay trigger values in milliseconds.

	Command or Action	Purpose
	RP/0/RSP0/CPU0:router(config-sonet)# line delay trigger 250 or RP/0/RSP0/CPU0:router(config-sonet)# path delay trigger 300	• Tip The commands in Step 2 and Step 3 can be combined in one command string and entered from global configuration mode like this: **controller sonet** *r/s/m/p* **line delay trigger** or **controller sonet** *r/s/m/p* **path delay trigger**.
Step 4	**end** or **commit** **Example:** RP/0/RSP0/CPU0:router(config-sonet)# end or RP/0/RSP0/CPU0:router(config-sonet)# commit	Saves configuration changes. • When you issue the **end** command, the system prompts you to commit changes: Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]: - Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode. - Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes. - Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes. • Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Configuration Examples for SONET Controllers

This section contains the following examples:

SONET Controller Configuration: Example

The following example shows the commands and output generated when you are performing the configuration of a SONET controllers following the steps outlined in the *Configuring a Clear Channel SONET Controller* section. This example shows the usage of every optional command, along with listings of options within commands where relevant. An actual configuration may or may not include all these commands.

```
configure
controller sonet 0/1/0/0
 ais-shut
 clock source internal
 framing sonet
 loopback internal
Loopback is a traffic-effecting operation
 overhead s1s0 1
```

```
path ais-shut
path delay trigger 0
path overhead j1 line l1
path report pais
path scrambling disable
path threshold b3-tca 6
path uneq-shut
report pais
threshold b2-tca 4
commit
```

SONET APS Group Configuration: Example

The following example shows SONET Remote (two routers) APS configuration.

```
RP/0/0/CPU0:router(config)# aps group 1
 channel 0 local SONET 0/0/0/1
 channel 1 remote 172.18.69.123
 signalling sonet
 commit
show aps
show aps group 3
RP/0/0/CPU0:router(config)#
```